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CONTENTS

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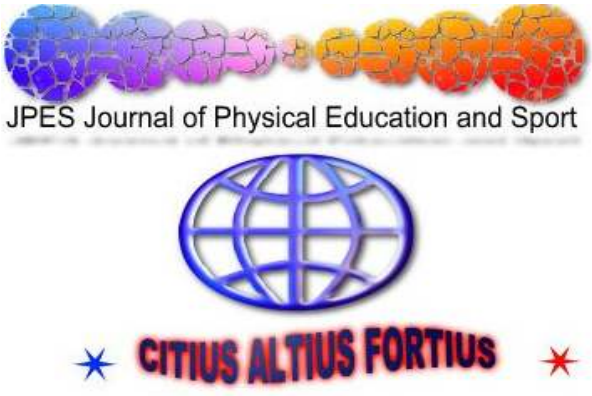

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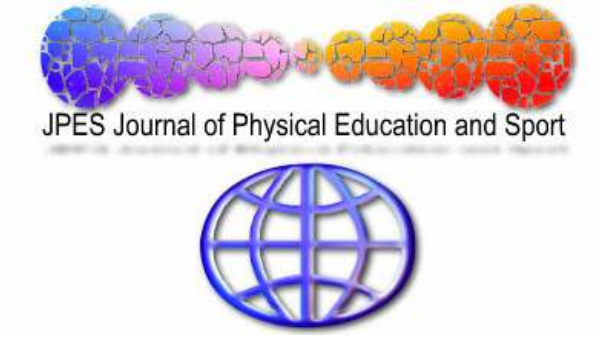

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ORIGINAL RESEARCH

SUCCESS RATES OF UNDERHAND AND OVERHAND FREE-THROWS AS NOVEL SKILLS

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ABSTRACT

In the pursuit of scoring as many points as possible during basketball competitions, most effective free-throw shooting techniques were explored. This study sought to determine whether the underhand or overhand basketball free-throw shooting style was naturally more prone to success than the other. Total participants (N=29) were 15 male and 14 female undergraduate students, who were at least 18 years of age (average age was 23.98) with no prior basketball shooting experience. Through a counterbalanced design, each participant shot 25 underhand free-throws on one day and 25 overhand free-throws on a different day. No significant differences between the number of successful overhand and underhand shots were observed for attempts 1-13 when compared to attempts 14-25. Males averaged .57 more successful attempts overhand than underhand. Females averaged .33 less successful attempts overhand than underhand.

Overall, as a group, the performance of both underhand and overhand shooting was positively correlated (.28), representing a trend suggesting that if a participant shot well underhand they also shot well overhand, indicating that it is unlikely that either the overhand or underhand shooting style is more naturally more prone to success than the other; hence, free-throw shooting success may be more dependent on repetition than style.

Keywords: trajectory, backspin, arc, NCAA, angle of release

INTRODUCTION AND REVIEW OF LITERATURE

The overhand free-throw shooting style, historically, has been the predominant basketball free-throw shooting style of choice. Nearly unheard of today is an alternative approach to overhand free-throw shooting – the underhand style – which may have been used most frequently in the 1950s when it was believed that as many as 10% of basketball players used it (Modesti, 1997).

Few measures in sport have remained as consistent over the years as the success percentages of men's and women's free-throw shooting (Branch, 2009). Since the 1960s the success rates of National Collegiate Athletic Association (NCAA) Division I men's free-throw shooting has remained remarkably consistent, hovering around 69.0%, never dropping below 67.0%, and never rising above 70.0% (Branch, 2009; National Collegiate Athletic Association, 2010a). Women's Division I free-throw averages have also been consistent since record keeping began in 1981, ranging from 67.2% to 70.5% over 29 seasons through 2010 (National Collegiate Athletic Association [NCAA] 2010b). More recently, over the past 10 years women's Division I success rates have been extremely consistent ranging from a low of 68.49% to 69.04% (NCAA, 2010b).

From an individual standpoint the best free-throw shooters succeed at rates surpassing 90%. At the top of the all time NCAA free-throw leaders list is former Missouri State player Blake Ahearn who, during the 2003-04 season, made 117 of 120 free-throws for a 97.5% success rate ("Single Season Leaders," 2010).

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Free-throw shooters are expected to succeed, in general because the free-throw is considered to be a "simple" shot (Edwards, 2009). Making it one of the easiest shots in basketball is the absence of a defender when the free-throw shot is taken (Okubo & Hubbard, 2006). The absence of a defender allows the free-throw shooter time to relax and concentrate before shooting (Brancazio, 1981). Reilly (2006) acknowledged the perceived simplicity of free-throw shooting by expressing his disbelief at athletes who cannot make free-throws.

Despite the perceived simplicity of the free-throw, not all players are effective free-throw shooters. Syracuse University's Arinze-Onuaku stands out as one of the worst with his 37 successes out of 124 shots for 29.8% during the 2008-09 season (Young, 2010).

Regardless of the acknowledgement that making free-throws is often the critical difference in a game (Roth, 2007), examples of players, at any level, attempting to improve their free-throw shooting by switching from the overhand to underhand style are scarce. In fact, no examples were found in which college level players consistently used the underhand style.

While playing in the National Basketball Association's (NBA's) professional league, however, Rick Barry achieved a 90% free-throw success rate, while shooting underhand, over the course of his career (Rosen, 2009). Barry led the NBA in free-throw percentage during the 1977-1978, 1978-1979, and 1979-1980 seasons (Regular Season Records, 2010). Interestingly, though, few players have chosen to adopt the underhand style that proved to be extraordinarily successful for Barry.

A literature search revealed the perceived benefits of the underhand free-throw style and reasons why players most often elect not to use the underhand style but rather prefer the traditional overhand style. Skills necessary for effective free-throw shooting, regardless of style, are included. And, the following techniques specific for successful use of the underhand free-throw shooting style are discussed: arc, velocity, backspin, and balanced and angle of release.

Support for the Underhand Style

Despite the near dearth of basketball players using the underhand free-throw shooting style, Edwards (2009) claimed that its positive results are undeniable. By switching to the underhand free-throw, according to Rosen (2009), poor free-throw shooters could improve by 20% in a week. Further support for the underhand free-throw came from Brancazio (as cited in Rist, 2008) who asserted that from a physics (i.e., biomechanics) standpoint, if all players used the underhand style there would be a dramatic increase in success rates.

Masculinity and Unwillingness to Change

Players, in general, are unwilling to change their free-throw shooting style (from overhand to underhand), which Modesti (1997) refers to as "unfortunate." The less than masculine stigma associated with the underhand style is a reason why even the poorest free-throw shooters are unwilling to switch over to the underhand style (Modesti, 1997; Reilly, 2006; Rosen, 2009). Modesti (1997) interviewed several prominent players and coaches from various levels of men's basketball, all affirming that the less than masculine stigma associated with the underhand free-throw is an impediment to its progress. Reinforcing the non-masculine stigma associated with the underhand style is the ego of players and the ribbing taken from others directed at those who might be considering using it (Edwards, 2009).

On the other hand, Rosen (2009) suggested that poor free-throw shooters in the NBA try using the underhand style, as it could not be any more embarrassing than the dismal percentages they currently shoot using the overhand style. Rosen also pointed out that if the underhand free-throw was good enough for Rick Barry, it should be good enough for players who shoot dismal percentages.

A rare exception to those players resisting the switch from overhand to underhand was former NBA great Wilt Chamberlin, who in his best year only shot 61% and in his worst shot a meager 42% (Libby, 1977). Through Chamberlin's self-analysis, the one handed (overhand) style caused him to shoot too flat and too hard (Libby, 1977). After switching to the underhand style, Chamberlin switched back because in his words, it made him feel like a sissy (Reilly, 2006).

Effective Free-Throw Shooting – Overhand or Underhand

Successful free-throw shooting depends on a relationship of factors that determine the ball's path toward the rim. Height of release, angle of release, speed of release, and spin of the basketball are factors considered crucial for successful free-throws (Brancazio, 1984; Embse & Engebretsen, 1996; Okubu & Hubbard, 2006; Southard & Miracle, 1993). Furthermore, biomechanically sound techniques that are reproducible are necessary for shooting success (Hudson, 1985). Consistency of such techniques can be developed through the repetition of shooting and through drills (Branch, 2009; Tran & Silverberg, 2008). In fact, consistent release angle and backspin were found to be two important outcomes of sound shooting techniques (Brancazio, 1984; Okubu & Hubbard, 2006). A minimum release angle of between 45 to 52 degrees makes for an optimal trajectory (Brancazio, 1984). Backspin, and especially higher levels of backspin, was found to increase the

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likelihood of a successful shot (Okubu & Hubbard, 2006). There is an inverse relationship between the height of the arc and backspin velocity: as arc height increases, less backspin is necessary. A back spinning basketball decreases the speed and energy of the ball after contact with the rim allowing for a "softer" shot more likely to drop in the rim (Brancazio, 1981).

Effective Free-Throw Shooting – The Underhand Style

Techniques specific to the underhand free-throw are believed to contribute to its success. According to Edwards (2009), the simplicity of the underhand free-throw and its compact nature establishes conditions for accuracy. In addition, a larger variety of release combinations characteristic of the underhand free-throw style have been reported to be an advantage (Okubu & Hubbard, 2006). Modesti (1997) cited four factors as advantageous to the underhand free-throw style: the ball goes up softer, both hands on the ball improve aim, fewer variables in the shooting motion make for consistency, and the more relaxed motion helps eliminate fatigue as a factor during both game and practice conditions. More specifically, and from a biomechanical standpoint, the literature supports the following techniques as contributors to underhand free-throw success: the high arc, i.e., "softer shot," (Hudson, 1985), high velocity backspin, high release point, and balanced release, i.e., "more relaxed motion," (Curtis, 2000; Tran & Silverberg, 2008).

Arc of the underhand style. A high arc of the path of the ball is necessary for successful free-throw shooting (Hudson, 1985; Rist, 2008) and can be reached when the ball is released at an angle greater than 45 degrees (Brancazio, 1984). Furthermore, free-throws are considerably less sensitive to errors (soft shot) at a 52 degree release angle (Tran & Silverberg, 2008). In other words as the release angle increases, the arc of the path of the ball also increases. As a result, two advantageous outcomes occur. First, the velocity of the ball has a greater vertical component than horizontal component as the ball falls toward the rim. The result is a ball that tends to bounce more vertically than horizontally on a missed shot that hits the rim. The potential for a successful free-throw after an initial miss that bounces up vertically from the rim gives the ball a second chance to fall through the rim on its descent.

Secondly, a higher arc with a more vertical angle of trajectory is preferable over a low arched line drive trajectory (Brancazio, 1984) and will also increase the cross-sectional target area of the rim, i.e., makes the rim bigger, (Okubu & Hubbard, 2006). As a result, the margin for error is smaller with a lower release angle than with a higher release angle. Thus, it is better to err on the side of too much arc than too little (Brancazio, 1981; Brancazio, 1984). On the other hand, as the ball travels on an increasingly horizontal trajectory, the cross-sectional area of the rim decreases. In other words, a flat shot has a lower margin for error (Brancazio, 1981). In addition moderate or minimal velocity on the point of release might best be used in combination with a high arc (Hudson, 1985).

Release angle and velocity of the underhand style. Some players are poor free-throw shooters because they release the ball at the wrong angle (Gablonsky & Lang, 2005). As a result of the motion of the body during an underhand shot, where the ball is lowered near the ground (between the legs) and lifted through a large range of motion until release, it is more likely that the shooter can release the ball with a more accurate angle and initial velocity using the underhand style (Okubu & Hubbard, 2006). The range of motion associated with the underhand style will result in a more vertical release angle, typically greater than 45 degrees.

A minimal speed angle is the best launching angle (Brancazio, 1981). The margin for error in speed is greatest when the shot is launched at a release point leading to as high an angle as possible (Brancazio, 1984). In addition, based on the impulse-momentum relationship a greater range of motion increases the time that the projecting force is applied, resulting in less force required to achieve the appropriate velocity. With less force required, the shooter's movements can be more controlled, and more attention can be focused on accuracy (Fitts, 1954/1992).

Backspin of the underhand style. The ability of the underhand free-throw to create backspin is a contributing factor to underhand free-throw success (Curtis, 2000; Tran & Silverberg, 2008; Rist, 2008). The result of backspin is a decrease of horizontal velocity after impact with the rim, which can work with the arc of the path of the ball to create a "softer" shot. In free-throw shooting, backspin is said to "deaden" the motion of the basketball after it bounces off the rim, causing the ball to stay closer to the rim, which increases the probability of a successful shot (Brancazio, 1981). If the ball makes contact with the upper surface of the rim during a free-throw attempt, the effect of backspin will reduce the speed and energy after hitting the rim, increasing the chance that the ball will fall through the rim (Brancazio, 1981). When the spin of the ball, however, deviates from a backspin (i.e., includes some sidespin), and initially strikes the rim (as opposed to a swish shot) it is less likely to bounce through the rim as a successful shot. A ball with sideways spin that hits a surface will veer sharply to the left or right depending on the spin direction (Brancazio, 1981). Rosen (2009) used the term "soft ball" to describe the underhand style because it turns virtually every near miss into a make; and Reilly (2006) stated that the underhand free-throw is so soft that a lot more shots are successful.

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Balanced release of the underhand style. A balanced release of the underhand style results in a more consistent shot. For example, the bilateral motions of the legs and hands, allow the ball to be more easily controlled during the underhand style, preventing lateral deviations (Okubu & Hubbard, 2006). So long as the elbows are kept in (balanced approach) the underhand style provides better stability than the overhand (Rist, 2008). When comparing overhand and underhand styles, Steiger (as cited in Rist, 2008) pointed out that an overall higher probability for error exists for overhand shooting, including the ball rolling off one side of the hand; whereas when shooting underhand, enhanced stability is provided because the ball is being held by both hands. An imbalance of grip strength of one hand, however, could result in a misaligned underhand release and the subsequent off-center path of trajectory of the ball toward the rim. Successful shots require trajectories that do not deviate too far to the left or right of the center of the rim (Brancazio, 1981).

The purpose of this study was to determine whether one basketball shooting style (underhand or overhand) was naturally more prone to success than the other. It was presumed that the overhand style is a one-handed shot that requires more ipsilateral (same side) movement patterns that are less balanced and requires more individual wrist strength from the shooting/dominant hand; whereas, the underhand style is one that requires more bilateral (two sided) movement patterns that are more balanced and requires less wrist strength.

METHODS

Participants

The total participants (*N*=29), consisted of 15 men and 14 women. Prior to data collection, the study was granted approval by the researchers' Institutional Review Board, ensuring for anonymity of the participants. All participants were undergraduates attending a four year college and were required to be at least 18 years of age. The study was delimited to participants with no free-throw shooting experience. In addition, all participants had less than one year of basketball experience. For descriptive purposes, information related to general fitness habits was obtained from subjects based on their responses to survey questions regarding the frequency and duration of exercise sessions per week. Prior to data collection, the study was granted approval by the researchers' Institutional Review Board.

Procedures

Data was collected using a counterbalanced design consisting of two shooting sessions per participant. Each participant shot 25 free-throws using the underhand style and 25 free-throws using the overhand style. Participant shooting sessions were each conducted on different days to help prevent fatigue from influencing the success rate of shots attempted during the second shooting session. The interval between the first and second shooting session was at least 24 hours. Men used an NCAA regulation men's basketball (circumference of 29.5 to 30 inches) and women used an NCAA regulation women's basketball (circumference of 28.5 to 29 inches).

Prior to shooting, measures of strength and fitness were obtained from each participant. A hand held dynamometer (Jamar/model 5030J1) was used to measure grip strength (kg). Measurements were obtained as each participant held the dynamometer with the arm fully extended and the shoulder at approximately 45 degrees of abduction. Grip strength was measured for the dominant and non-dominant hands. Participants were instructed to squeeze the dynamometer with a maximal effort.

A shooting script describing proper shooting techniques to be used for both the overhand and underhand style was read to each participant prior to his/her shooting trial. The underhand style shooting script included the following shooting techniques:
Position your feet comfortably, shoulder width apart.
Grip the ball with your hands placed evenly on the sides of the basketball.
Bend your knees and lower the ball between your knees.
Elevate your body and shoot the ball, while following through.
The overhand style shooting script included the following shooting techniques:
Position your feet comfortably, shoulder width apart.
Place your shooting hand underneath the ball with your guide hand on or near the side of the ball.
Bend your knees, lowering your body.
Elevate your body and release the ball with your shooting hand while following through.

RESULTS

Participants' average age was 23.98 years (*SD*=6.75). The average age of the males was 24.5 years (*n*=14, *SD*=6.92). Females' average age was 23.4 years (*n*=15, *SD*=6.77). Participants averaged 4.27 exercise sessions per week. Of the 29 participants, 28 exercised 31 minutes or more per week, and were considered active. Furthermore, 11 participants exercised 60 or more minutes per week, and one exercised less than 15 minutes per week.

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No significant differences were found between dominant (*M*=41.12, *SD*=10.92) and non dominant (*M*=40.47, *SD*=11.89) grip strength across males and across females. Similarly, no significant differences were found between dominant (*M*=49.64, *SD*=7.87) and non dominant (*M*=49.57, *SD*=9.87) grip strength of males, nor between dominant (*M*=33.54, *SD*=6.43) and non dominant (*M*=32.18, *SD*=5.80) grip strength of females. In fact, significant correlations were found between dominant and non dominant grip strength among males (*r*=.87, *p*=.000) and among females (*r*=.95, *p*=.000). Significant differences were found between the dominant hand grip strength of males (*M*=49.64, *SD*=7.87) and females (*M*=33.17, *SD*=6.36); (*F*=38.71, *p*=.000). Significant differences also were found between the non dominant hand grip strength of males (*M*=49.57, *SD*=9.87 and females (*M*=31.97, *SD*=5.65); (*F*=35.40, *p*=.000).

To examine the relationship between grip strength and shooting success, Pearson correlation was used. No significant correlation was found between grip strength of the dominant hand and underhand performance (*r*=.03) nor overhand performance (*r*=.06). Similarly, no significant correlation was found between grip strength of the non dominant hand and underhand performance (*r*=-.01) nor overhand performance (*r*=.04).

Regardless of gender, no significant differences were found between the number of successful shots using underhand (*M*=6.24, *SD*= 3.28) and overhand (*M*=6.34, *SD*=2.97) styles. Similarly, no significant differences were found for shooting success of males between the underhand (*M*=6.50, *SD*= 3.82) and overhand (*M*=7.07, *SD*=2.95) styles; nor for shooting success of females between the underhand (*M*=6.0, *SD*= 2.80) and overhand (*M*=5.67, *SD*=2.92) styles. In addition, no significant correlation between grip strength of the dominant hand and the underhand performance (*r*=.02) or the overhand performance (*r*=.06) was found.

Finally, there was no significant difference across males and females between the number of successful underhand shots for attempts 1-13 (*M*=3.41, *SD*=1.78) when compared to the number of successful underhand shots for attempts14-25 (*M*=3.15, *SD*=1.70). Similarly, there was no significant difference between the number of successful overhand shots for attempts 1-13 (*M*=3.31, *SD*=1.85) when compared to the numbers of successful overhand shots for attempts14-25 (*M*=3.10, *SD*=1.68). And similarly, when comparing successful shots between attempts 1-13 and 14-25 among males and females separately, no significant differences were found.

DISCUSSION

Overhand/Underhand Success

As an overall group, regardless of gender, no significant differences were found between underhand and overhand shooting performance. Also as a group, the performance of both underhand and overhand styles were positively correlated (r=.28). This trend suggests that if a participant shot well underhand they also shot well overhand, indicating that it is likely that neither the overhand or underhand shooting style is naturally more prone to success than the other.

Strength. Regarding dominant and non dominant grip strength, no statistical differences were observed among all participants, regardless of gender; nor were statistical differences observed between dominant and non-dominant grip strength among men or among women. The active participation in exercise sessions among all but one participant may explain the aforementioned finding. Yet, as would generally be expected, grip strength of both the dominant and non dominant hands of males was observed to be greater than for females' dominant and non-dominant hands. This greater grip strength of males, suggests that males would have a greater success rate than females when shooting overhand, which, in fact was found to be the case in this study but not to any degree of significance.

However, by virtue of the fact that all participants' shots reached the rim during the shooting trials it is likely that the grip strength of participants was great enough to support the minimum velocity and shooting angle necessary to not only travel the 15' distance to the rim but do so with a velocity and angle allowing for the maximum potential for success. The amount of force needed to launch the 15-foot free-throw at a 54 degree angle is only 2% greater than the minimum force (at 49 degrees) needed to cover the 15-foot distance (Brancazio, 1984).

Therefore, males' greater dominant and non-dominant hand grip strengths, when compared to females' dominant and non-dominant grip strength, may not be a factor leading to greater successes by males. In fact, the means and standard deviations of shooting success show no significant differences between the underhand and overhand performance, regardless of gender.

Distance. Coppedge (1967) also found that at the free-throw shooting distance of 15 feet, greater grip strength was not an indicator of success. However, at a shooting distance of 25 feet it was found that participants with greater grip strength experienced greater shooting success (Coppedge, 1967). Thus, as the distance is increased beyond 15 or 20 feet, significant differences in performance may be found between successes of participants with greater grip strength when compared to those with lesser grip strength. If the distance is increased beyond 15 or 20 feet, then the underhand style may be more successful then the overhand style for those with lesser grip strength. However, the underhand style's apparent effectiveness for distances beyond 15

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feet is generally impractical because most any shot beyond 15 feet would be considered a jump shot, which is attempted during live game situations, making it virtually impossible to release without being blocked by a defender.

Balance of strength. The magnitude of grip strength, at least beyond a minimum threshold, may not be as much of a contributing factor for underhand free-throw shooting success as is the balance of grip strength between the dominant and non dominant hand. The underhand shooting style requires each hand to be placed on a side of the basketball prior to a simultaneous two hand release. An imbalance of strength, favoring either hand, could potentially cause the ball to drift off center from the rim, creating a misalignment between the path of the ball and the rim, or cause sidespin, decreasing the likelihood of success. Furthermore, a sidespin might result from an imbalance of dominant and non dominant hand grip strength, causing, according to Brancazio, (1981), the ball to veer sharply to the left or right after it hits the rim, contributing to a missed shot. In this study, regarding the underhand style, an "on-center" straight forward path of the ball traveling toward the rim was supported because an imbalance of strength was not found to exist, as no significant differences in grip strength were found when comparing dominant and non-dominant hands of participants.

Repetition. Repetition may contribute more to free-throw shooting success than the style of shooting. Given that neither the underhand or overhand free-throw shooting style was shown to be more naturally prone to success, success may be more dependent on repetition than style. The importance of emphasizing repetition is consistent with the views of Branch (2009), and Tran and Silverberg (2008) who pointed out that consistent development of sound shooting techniques are developed through repetition. Aspiring basketball players should select one of the styles and commit to it by striving to achieve shooting success through multiple practice repetitions. However, athletes with lesser grip strength, i.e., youth, may experience success more quickly with the underhand style.

Fatigue/Learning Effect

In this study, no significant differences between the number of successful overhand and underhand shots were observed for attempts 1-13 when compared to attempts 14-25, which may indicate that acute muscle fatigue did not have an effect on successful attempts. The aforementioned findings are consistent with the findings in a study by Looney, Spray and Castelli (1996) in which split shooting trial procedures were also used. Looney et al. (1996) also found that learning or fatigue did not severely affect free-throw shooting accuracy. One might have hypothesized that novice shooters would have improved during the second half of the shooting sequence (attempts 13-25); however, the data in this study did not indicate that fatigue or learning affected the number of successful shots. On the other hand, although beyond the scope of our study, it is possible that a learning effect could have been attenuated by fatigue, or that a learning effect may have required more than the 25 shots recorded in our experiment.

Among men and among women, differences between underhand and overhand shooting success existed but were not significantly different. It was observed that males averaged .57 more successful attempts overhand than underhand; whereas, females averaged .33 less successful attempts overhand than underhand. When comparing the success rates of the men's and women's overhand shots, a trend for higher success rates for men (3.6%) was found. If extrapolated to larger numbers of shots, the number of overhand success by the men becomes apparent when compared to females. If males and females were to attempt 1000 overhand shots, males would make approximately 36 more shots than females.

Furthermore, if fatigue increases with attempts or in the later stages of games, differences in overhand success rates could be exacerbated. The effects could have real ramifications in game situations because it was found by Kozar, Vaughn, Whitfield, Lord, and Dye (1994) that during the last five minutes of basketball games, free-throws constitute 35% of the points scored. The trend of slightly higher success rates of the men's overhand style when compared to women's overhand style may, again, be attributed to greater grip strengths of the male dominant hand when compared to the females' dominant hand. Thus it might be suggested that an underhand free-throw style by females could make up for the slightly greater success rates achieved by the men when using he overhand style.

INSIGHTS AND RECOMMENDATIONS

Although each free-throw shooting style is learned at approximately the same rate, a trend in this study suggests that males might be more apt to succeed when using the overhand style and females might be more apt to succeed when using the underhand style.

Beyond a minimum level, additional upper body strength is unnecessary to achieve success using either free-throw shooting style. Players with low levels of physical strength, however, are more apt to experience success using the underhand style. Whereas, a balance of upper body strength appears to be preferable for players using the underhand style, those with an imbalance of upper body strength may experience more success with the overhand style.

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A coach's primary challenge might not be the instruction of the underhand free-throw but rather his/her ability to persuade a player to switch over from the traditional overhand style. Additional challenges might lie in the fact that there is a lack of experts who can teach the underhand free-throw shooting skill from an experience standpoint.

Moreover, the general perception of the underhand free-throw is that it is an unacceptable form of free-throw shooting, which could lead to hypercriticism unless the success rate is well beyond success rate averages of the overhand style.

Players should continue with the style they have been using unless their success rate is abysmal. The definition of abysmal may vary, but anyone whose overhand success rate is less than 50% should consider switching to the underhand style. In the final analysis, players will be best served by selecting either style, and practice it through multiple repetitions.

FURTHER RESEARCH

Despite the fact that a correlation between grip strength and successful free-throw shooting was not revealed in novices, further research might be conducted to determine a minimal grip strength threshold necessary to achieve successful free-throw shooting. Studying a youth population would likely result in lower grip strength recordings than in our young adult population. Lower (youth) grip strength recordings might show a significant drop in successful free-throw shooting when compared to higher (young adult) grip strength recordings. The same research design should be implemented while increasing the number of shot attempts per participant from 25 to upwards to 1000. Finally, similar studies should be conducted with skilled players at various levels (e.g., youth, high school, etc.).

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ORIGINAL RESEARCH

THE UTILITY OF CONTINUOUS GLUCOSE MONITORING IN EXERCISE AND HEALTH SCIENCE

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Abstract

Continuous glucose monitoring (CGM) is an evolving technology which provides information about the direction, magnitude, duration, frequency, and causes of fluctuations in blood glucose levels. This review summarises the rationale for ambulatory continuous glucose monitoring in the exercise sciences, the current literature to date, and potential future directions of research. It is concluded that CGM data collected during exercise/physical activity related trials would facilitate the improvement of glucoregulatory exercise programmes and development of more appropriate evidence based physical activity guidelines for glycaemic control.

Keywords: blood glucose, glycaemic regulation, physical activity, exercise.

Introduction

A sedentary lifestyle is considered an important modifiable risk factor for type 2 diabetes. It is well established that physical activity reduces the risk of developing insulin resistance and glucose intolerance [1], although the 'dose' a function of intensity, frequency, and duration, of activity required for optimal protection continues to be debated [2]. Current guidelines [3] suggest that to improve glycaemic control at least 150 min per week of moderate-intensity aerobic physical activity (40–60% of VO_{2max} or 50–70% of HR_{max}) and/or at least 90 min per week of vigorous aerobic exercise (60% of VO_{2max} or 70% of HR_{max}) is required.

A comprehensive review of prospective studies published between the years 1990 and 2000 concluded that the reduction in the risk of type 2 diabetes associated with a physically active, compared with a sedentary, lifestyle is 30–50% [4]. Further, the participation in regular physical activity may slow the initiation and progression of type 2 diabetes; via the amelioration of the effects of increased body mass, insulin sensitivity, glycaemic control, blood pressure, lipid profile, fibrinolysis, endothelial function, and inflammatory defence systems [2].

The effect of exercise upon glucose metabolism is well documented; exercise is known to increase the rate of glycogen uptake into the surrounding skeletal muscle [3]. Likewise blood glucose response to exercise has been well documented in diabetics; numerous experimental studies having observed tighter glycaemic control [5]. The greater proportion of research conducted upon blood glucose response to exercise is of a long-term experimental design, detailing chronic adaptations to exercise in diabetics. However recent developments have enabled clinicians and exercise scientists to reliably monitor plasma and/or interstitial glucose concentrations in an ambulatory and continuous fashion [6].

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Continuous Glucose Monitoring

Continuous glucose monitoring (CGM) has emerged as a tool for patients with type 1 diabetes mellitus to help maintain euglycaemia (normal glycaemic control). The monitors provide information on ambulatory, postprandial and/or nocturnal glucose excursions [7]. In contrast to intermittent self-monitoring of blood glucose, usually via finger stick devices (SMBG), CGM systems (e.g., Guardian® RT by Minimed) allow glucose levels to be measured continuously from a small electrode inserted into the interstitial fluid under the skin. A transmitter sends information wirelessly to a monitor that displays current glucose readings and stores the data for viewing and downloading to a personal computer [8]. Alternatively newer models such as the MiniMed iPro® CGMS (CGMS iPro, Medtronic, Northridge, USA) have a digital recorder attached to the electrode sensor, which stores data onboard negating the need for an LCD monitor display, see Figure 1 below.

Figure 1. The iPro® CGMS, pictured with sensor (in grey) and digital recorder (in white). The sensor is inserted below the skin, into the abdomen [10].

CGM provides information about the direction, magnitude, duration, frequency, and causes of fluctuations in blood glucose levels. Compared with traditional glucose monitoring (defined as three to four blood glucose measurements per day) CGM provides much greater insight (measurements at a 5 minute resolution) into blood glucose levels throughout the day [9]. Figure 2 shows the high resolution of data which CGM can provide.

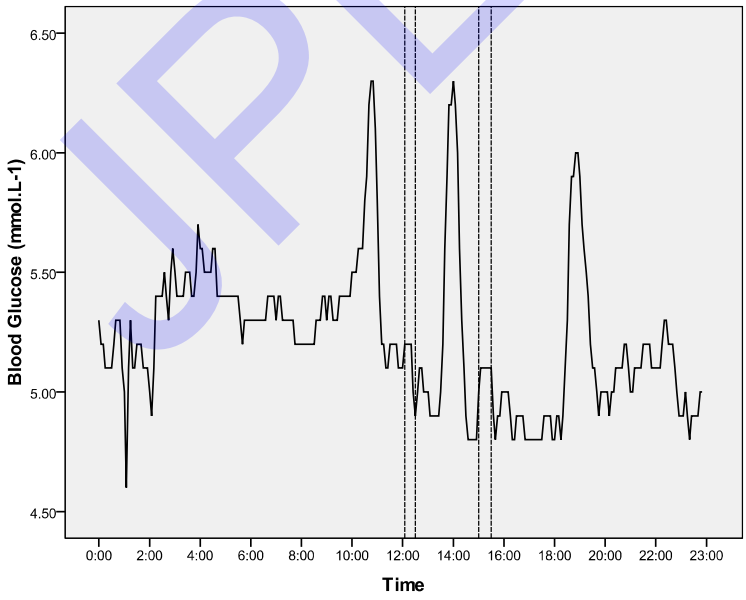

Figure 2. Twenty-four hour CGM blood glucose profile for a 22 year old non-diabetic male. The dashed lines represent times of exercise bouts, and the prominent spikes are meal times. [10].

The advent of CGM technology has facilitated the management of diabetes by providing acute blood glucose trends and the ability to detect extreme fluctuations in glucose concentrations that would previously go undetected using conventional measures [11]. The availability of such high resolution data provides clear rationale for investigating the pattern of blood glucose response to physical activity and or exercise.

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For exercise scientists and health practioners alike, this is an exciting field, but as yet one in which many questions remain unanswered. There is a growing body of research beginning to use CGM systems, the majority of which has charted normative glycaemic characteristics in diabetics, with little data available in apparently healthy non-diabetic populations. Several large controlled clinical trials have demonstrated that CGM has successfully aided in glucose control and insulin therapy adjustment [5]. Out of five randomised control trials that have used HbA1c (glycated haemoglobin) as an outcome measure of mortality and morbidity related to diabetes, four utilised CGM to monitor glucose levels, in particular to detect unrecognised hypoglycaemic events. In the four studies which employed CGM compared with standard monitoring, this was associated with significant improvements in mean HbA1c levels [12-16].

There are a small number of studies to date that have used CGM for therapeutic adjustment. For example, Schaepelynck-Belicar et al. [17] reported the findings of a nonrandomized, uncontrolled trial of a 72 hour course of CGM. CGM was used to determine rational adjustments in insulin therapy in 12 type 1 diabetic participants. Changes involved alterations of the dosage in three participants, insulin type in seven participants, the number of daily injections in five participants, and the delivery technology (from insulin injection to pump therapy) in one subject. A two month follow-up demonstrated a significant reduction of glycaemic excursions in eight participants and a decrease in the mean HbA1c from 10.3 to 8.75% ($p < 0.05$). The findings of this study add weight to the efficacy of CGM as a key tool in diabetic management, and its future promise in clinical interventions [9]

The availability of such high resolution data, allows an understanding of extremely acute periods of glucose excursion such as postprandial hyperglycaemia. This was highlighted by Praet et al. [6] who assessed the level of 24 hour glycaemic control in eleven male patients with Type II diabetes and 11 normoglycaemic controls who participated in a 24 hour CGM trial under standardized dietary and physical activity conditions. Alongside, finger stick glucose measures were recorded. The results showed that CGM is far more sensitive to acute glucose changes in daily life than traditional finger stick methods. This is highly important when taking into account the vascular damage caused by postprandial hyperglycaemia, given that the traditional methods may miss some periods of hyperglycaemia.

Why do we need Continuous Glucose Monitoring?

Optimal glycaemic control is defined by the American Diabetes Association (ADA) as a glycated haemoglobin (HbA1C) value of < 7.0% for a population, or as close to 6.0% as possible without unacceptable risk of hypoglycaemia for an individual [18]. The regulation of blood glucose for a diabetic individual can be an elusive task, despite the efforts of the patient to monitor and manage therapeutic intervention i.e. insulin dose. This may be difficult as blood glucose levels are influenced by a wide variety of variables which are often in flux, such as diet, insulin dosage, stress, physical activity, and the rate of nutrient absorption. Traditional blood glucose meters provide a small snapshot of blood glucose at a given moment, with no indication of whether the value is moving up or down, thus modulation of behaviour in response to a finger stick blood glucose value is often an educated guess [19].

For example increasing insulin dosage in response to an elevated finger stick blood glucose value following vigorous intensity exercise (a feed forward mechanism stimulates increased hepatic glucose production during vigorous exercise) could trigger a period of hypoglycaemia if in fact blood glucose was actually declining despite at that time point being relatively high. The real-time data provided by CGM allows for optimal therapeutic intervention to be administered, as the direction of blood glucose trends following food intake or exercise can be observed by the patient or clinician [19].

Continuous Glucose Monitoring during Exercise

Of the extant literature, three studies have charted acute blood glucose response to exercise using CGM. As established prior, exercise improves glycaemic control. Information attained from CGM could be used to identify exercise- or diet induced changes in glucose tolerance and provides a useful source of additional information for healthcare professionals to formulate evidence based exercise programmes to alter the glycaemic profiles of individuals with type 2 diabetes [20].

Macdonald et al. [21] aimed to determine the efficacy of CGM during moderate intensity exercise. CGM was used to monitor the changes in whole day glucose profiles in individuals with and without type 2 diabetes. Six obese individuals (type 2 diabetics) and four age matched non-diabetic controls were monitored for 3 days. Participants cycled for 1 hour on day 2 at ~ 90% of lactate threshold, venous blood was drawn for sampling every 10 minutes. As a result of the cycling intervention there were significant improvements in glycaemic control in the diabetic group compared to control ($p < 0.001$). Indeed it was concluded that CGM was able to demonstrate that a period of moderate exercise improved whole-day glycaemic control in obese individuals with type 2 diabetics, compared to controls.

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It was however recommended that CGM should only be used as an adjunct and not as an alternative when examining the changes in glucose values during exercise in individuals with and without type 2 diabetes [21]. However with the current development of more accurate devices, CGM should be embraced by exercise scientists; real time data will allow an understanding of the acute blood glucose response to a range of exercise modes, across differing exercise intensities, and between differing populations and ages.

Similarly a pilot study [11] aimed to determine the efficacy of using a CGM system (Guardian® RT, Minimed, Northridge, CA) to detect blood glucose excursions associated with exercise and Late onset hyperglycaemia (LOH) after exercise in individuals with type 1 diabetes. Five participants with type 1 diabetes were monitored before, during, and after a 60 minute vigorous spin class using the Guardian RT® CGM (48 hour in total). The Guardian RT® monitor was found to be effective in identifying all participants' glycaemic excursions over the 48 hour surveillance period. A strong correlation ($rr = 0.89$, $p < 0.001$) was found between conventional self-monitoring of blood glucose and Guardian RT® data.

Preliminary data has shown that different patterns of physical activity, may impact upon acute blood glucose regulation [10]. In a single participant case study one physically active non-diabetic male (age: 22 y; mass: 71.5 kg; height: 181 cm) underwent 7 days CGM, performing 3 trial conditions: a sedentary control (< 2500 steps, pedometer controlled), a continuous vigorous exercise condition (2 x 30 min treadmill running at 70% HR_{max}), and a lifestyle-embedded physical activity condition (100 min fractionalized moderate activity). Diet was standardised and physical activity levels were monitored via accelerometry throughout.

Results showed a significant difference of -0.24 $mmol.L^{-1}$ in twenty-four hour mean glucose levels between the sedentary and continuous condition ($p = 0.00$), and a significant difference of -0.038 $mmol.L^{-1}$ in twenty-four hour mean glucose levels between the sedentary and lifestyle embedded physical activity condition ($p = 0.004$). Descriptive results displayed a post exercise decrease in glucose levels (2 hours pre- 6 hours post (5.3 – 5.1 $mmol.L^{-1}$)) with a carryover effect for the following day (reduced mean glucose 24 hours pre-post (5.5 ± 0.5 - 5.2 ± 0.3 $mmol.L^{-1}$)) in the continuous exercise condition. Whilst from a case study, these findings illustrate that both continuous vigorous exercise and lifestyle activity bouts have a beneficial effect upon whole day glucose regulation compared to a sedentary control, with tighter glycaemic variation observed in the continuous vigorous exercise condition. Importantly continuous vigorous exercise reduces and maintains mean glucose levels for the acute period of 6 hours post exercise and promotes a carry over effect for the ensuing 24 hours [10]. Clearly these findings are not generalisable to the wider population, however the predominant message here is that CGM can be employed to investigate intermittent lifestyle related physical activity, which previous traditional methods of blood glucose sampling could not measure.

Saliently there are few studies that have employed CGM within exercise protocols. Moderate exercise may aid in the control of blood glucose, and reduce the number of hyperglycaemic excursions in both diabetic and non-diabetic individuals. However, very little is known regarding the dose-response relationship between physical activity and acute blood glucose response determined via CGM, and the influence this may have on long term measures of glycaemic control such as HbA1c.

Accuracy of Continuous Glucose Monitoring

The findings of studies employing CGM must be quantified in relation to measurement error. To date the accuracy of CGM devices has shown to be acceptable, the mean absolute difference between sensor and blood glucose meter values is normally reported as between 1.3 and 2.6 $mmol.L^{-1}$, likely reflecting the biological time delay (approximately 5 minutes) between interstitial and blood glucose concentrations [22, 23].

The International Organization for Standardization (ISO) state that standards for accuracy of point blood glucose tests require that a CGM blood glucose value be within ± 20% of a reference criterion value. The DirectNEt study [24] used the ISO standards to determine the accuracy of the CGMS over a range of glucose excursions in 78 children with type 1 diabetes. It was observed that the performance of the CGMS was acceptable. The CGMS glucose values were ~ 3% lower than the reference glucose values (median relative difference = −3%, $p < 0.001$). The median relative absolute difference (RAD) was 12% and the ISO criteria were met by 72% of all paired values. Accuracy varied with the glucose level, being greater at higher glucose levels than lower glucose levels ($p < 0.001$). For 556 paired glucose values where the reference value was >240 $mg.dL^{-1}$, the median RAD was 10% and 77% of pairs met the ISO criteria whereas for the 176 pairs where the reference value was ≤70 $mg.dL^{-1,}$ the median RAD was 20% and 66% of pairs met the ISO criteria. This study suggests that the performance of CGM is greatest in the euglycaemia and/or hyperglycaemic range [24].

More recent research has shown that the monitors show strong agreement compared with venous blood concentrations, with approximately 80% accuracy system over a five day period being reported in some CGM models [25]. The accuracy of CGM devices in exercise protocols is limited; Macdonald et al. [21] showed that the number of data points outside of the 95% confidence intervals was < 5% in both groups, suggesting that there is a good level of agreement between venous blood glucose and CGM values during exercise. Future studies

employing CGM in exercise related studies should assess and report the agreement between CGM and reference blood glucose samples.

Future Directions

Clearly there is great potential for the employment of CGM in exercise related trials. In particular a number of questions remain unanswered that, could be elucidated upon using CGM devices. For example: 1) what is the minimum intensity required to achieve improved glycaemic regulation? 2) What pattern of activity should be prescribed? 3) Should the activity be continuous or fractionalized into shorter bouts? These are just a few of the answered questions. Thus there is salient justification for the need to further understand the prophylactic benefit of physical activity upon glycaemic regulation as to identify the most effective exercise therapy.

Conclusions

CGM devices show acceptable accuracy but to date are not fully evaluated during exercise parameters. The use of CGM during exercise may support the development of guidelines for individuals engaging in various types and intensities of exercise. Data collected during such studies would facilitate the improvement of glucoregulatory exercise programmes and development of more appropriate evidence based physical activity guidelines.

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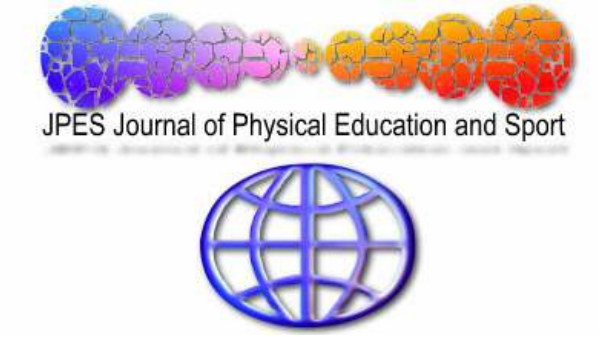

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ORIGINAL RESEARCH

THE EFFECT OF A STRETCH-SHORTENING CYCLE FATIGUE TEST ON THE DYNAMIC CHARACTERISTICS OF LOWER LIMBS IN ADULT MEN AND PRE-PUBESCENT BOYS.

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Abstract
Purpose: The present study focused on the acute effect differences between children and adults after a stretch shortening cycle fatigue test on drop jump performance.
Method: Eleven pre-pubescent boys (10,2 ± 0,7 y old) and eleven adult men (24,3 ± 3,3 y old) performed a stretch shortening cycle fatigue test (SSFT,10 sets /10 repetitions, with 30 sec interval between sets). Before and after fatigue test, maximal isometric torque, drop jump (DJ), contact time and ground reaction forces (GRF) were evaluated. Fatigue perceives and feel of pain were evaluated immediately after fatigue as well.
Results: After fatigue MVC and DJ significantly decreased in both groups but this decrease was higher in adults. Contact time and GRF were increased in both groups but in a higher extend in adults. Fatigue perception and the feeling of pain were also higher in adults.
Conclusion: In this research, the SSFT resulted in acute reduction of the performance of both age groups but more in adults. The higher performance reduction in adults could be attributed possibly both in neuromuscular, metabolic and inflammatory factors.
Keywords: Pre-pubescent boys, adults, fatigue, stretch shortening cycle, pain,

Introduction

The physical muscular activity usually requires the involvement of the stretch-shortening cycle mechanism. The importance of this cycle is based on the store and release of the elastic energy which potentiates finally the concentric action of the selected task (Asmussen, 1956). Relevant studies also showed that after a SSCF protocol, both jumping and strength performance decreased dramatically (Horita et al., 2003; Marginson et al., 2005). This decrease has an acute and long term effect. The acute effect was attributed both in metabolic and inflammatory mechanisms (Nicol et al., 2003) while the long term effect (lasting 1-7days) was caused mainly by the inflammatory process and the muscle structure deformation. (Hough 1902, Armstrong et al., 1991, Byrne et al., 2004, Clarkson & Sayers 1999). During this long term fatigue phase, a pain appeared the so called "Delayed muscle soreness" (DOMS). However, the effect of SSCF has not been well studied in children.

It has been reported that children presented lower fatigability than adults during maximal efforts including strength (Halin et al., 2003, Armatas et al., 2010, (Zafeiridis et al., 2005, 2009, Paraschos et al., 2007) and maximal dynamic efforts (Hebestreit et al., 1993). This was attributed to the fact that after such fatigue test children presented a lower, accumulation of muscle metabolites (Ratel et al., 2006) and decrease in agonist activity (Halin et al., 2003, Paraschos et al., 2007). Moreover, recovery was faster in all cases in children (Armatas et al., 2010, Zafeiridis et al., 2005, 2009, Paraschos et al., 2007, Hatzikotoulas et al., 2009) because children present faster phosphocreatine (PCr) resynthesis (Ratel et al., 2008), higher oxidative capacity (Kaczor et al., 2005) and more effective acid-base regulation (Ratel et al., 2002) .

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Only two studies investigated the SSCF in children (Marginson et al., 2005, Streckis et al., 2005) giving conflicting results. Marginson et al., (2005) reported higher fatigability in adults, while Streckis et al., (2007) reported equal fatigability for both adults and children. From this point of you it would be interesting this issue to be re-examined.

Thus the purpose of this research was to examine the acute effect of SSC fatigue test in the performance of children and adults.

METHODS

Participants

Eleven pre-pubescent and eleven healthy male adults volunteered to participate in this study. Their anthropometric characteristics are written in Table 1. All participants were informed about the scientific procedure and they gave written informed consent including children's parents. Additionally, all the participants completed health questionnaires to screen for any potential health risk.

These who had no neurological problems or injured lower limbs were finally selected for the experiment.

The biological level was 1 for children and 5 for adults according to Tanner's criteria (1962).

Table 1: Anthropometric characteristics of participants (mean ± SD).

Age Group	Age (yr)	Height (cm)	Body Mass (Kg)	Body Fat %	Biological level of maturation
Pre pubescent	10,2 ± 0,7	147 ± 8	40 ± 7	**17 ± 5**	**1**
Adults	24,3 ± 3,3	181 ± 5	81 ± 7	**17 ± 4**	**5**

Instruments

Bertec 4060 force plate (60 x 125cm) was used for the estimation of the jumping height, GRF and contact time. The isometric torque of knee extensor was evaluated in a dynamometer (Cybex Norm). For the anthropometric measurements an anthropometer, electronic scale and caliper were used.

Test and fatigue procedure

Body fat was estimated according to Slaughter et al., (1988). Subjects visit our lab and were informed verbally about the procedure. Afterwards, their anthropometric data were evaluated and they performed a warming up which included running on a treadmill in a self selected rate, warming up exercises and finally, submaximal and maximal jumps.

Drop jump height was evaluated before and after fatigue. For this purpose the subjects performed three maximal drop heights for familiarization from 30cm height. Finally, they also performed three maximal drop jumps and the highest jump was selected for further evaluation. The jumping height was calculated according to Komi & Bosco (1978) recommendations and was based on flight time. During drop height the instruction was to "jump as high as possible" with the hands kept on the waist. The contact time and GRF were evaluated as well.

For MVC evaluation the isolation of knee extensors was secured by the specific instructions of Cybex Norm Manual with knee joint fixed at 70° on knee flexion (0^o knee joint in full extension). The MVC evaluation was performed according to Armatas et al., (1010) protocol. Briefly, the subjects performed initially submaximal isometric contractions and finally three maximal isometric ones. The best trial was selected for evaluation.

Fatigue protocol was consisted by ten sets of ten consecutively maximal vertical jumps. Between sets a 30 seconds rest period was applied. Participants stood with feet shoulder width apart and hands on hips. They were also asked to jump as high as possible and verbal encouragement was given. The fatigue perceive was estimated using a 20 degree Borg scale.

The feeling of pain was performed by palpation using a ten scale questionnaire according to Marginson et al., (2005). Jumping height and dynamic data were expressed as a percentage of baseline values for further analysis.

Statistical analysis

Mean values and standard deviations of the dependent variables were evaluated. A Two-Way Analysis of variance with repeated measures (2x2 ANOVA) was used for the statistical analysis of the data before and exactly after the fatigue protocol in both groups. Post hoc scheffe tests were used to follow up significant results. The level of significance was set at $p<0.05$ (*) in all tests.

RESULTS

Borg scale showed that both age groups were affected from the fatigue protocol but the level of fatigue differed as it appears in figure 1. Adults estimated their attitudinal weariness about 18,2 (±2,07) in mean values whereas the pre-pubescent boys reported only 13,7 (±1,55) perceived exhaustion ($t21= 5,77$ $P< 0,001$).

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Regarding the feeling of pain it was higher in adults compared to children (2,62±1.01 vs 4,1±1.4 for children and adults respectively p<0.01).

The absolute values were presented in table 1.

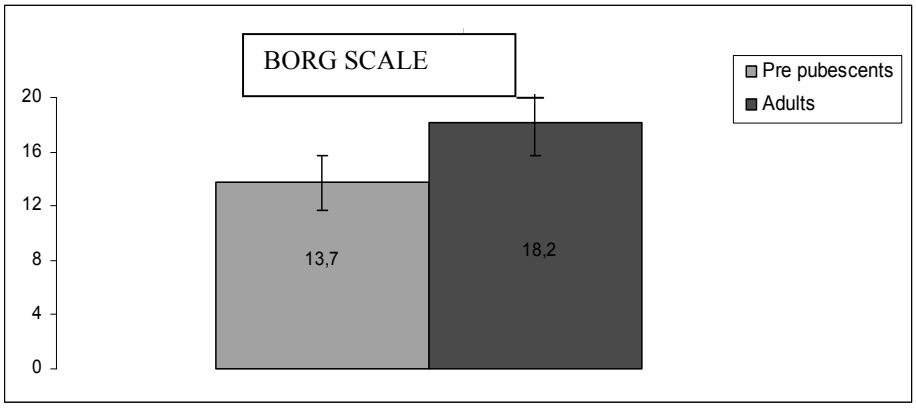

Figure 1: Record of perceived exhaustion for the pre-pubescent boys and adults. 20grade scale (Borg scale).

Isometric torque performance: There were group x time interaction for knee extensors torque (Cybex) $F_{(1,20)}$ = 56,541, p< 0,001. Post hoc analysis revealed that adults were fatigued more immediately after the fatigue protocol in comparison to initial values ($F_{(1,10)}$ = 899,385 p < 0,001). Additionally, knee extensors torque was also decreased in pre-pubescent boys, but in a lower level ($F_{(1,10)}$ = 683,397 p< 0,001).

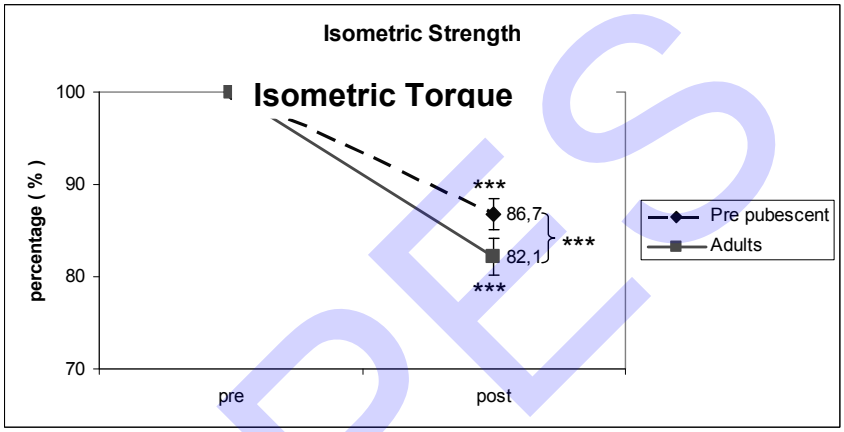

Figure 2: Record of knee extensors isometric torque performance pre and post fatigue exercise in pre-pubescent boys and adults.

Jumping height performance: There were group x time interaction for relative drop jump height $F_{(1,20)}$ = 43,217 p< 0,001) (fig 2). Post hoc analysis showed that the reduction in height performance was greater in adults ($F_{(1,10)}$ = 255,922 p< 0,001) than in pre-pubescent boys ($F_{(1,10)}$ = 95,879 p< 0,001) immediately after the fatigue protocol.

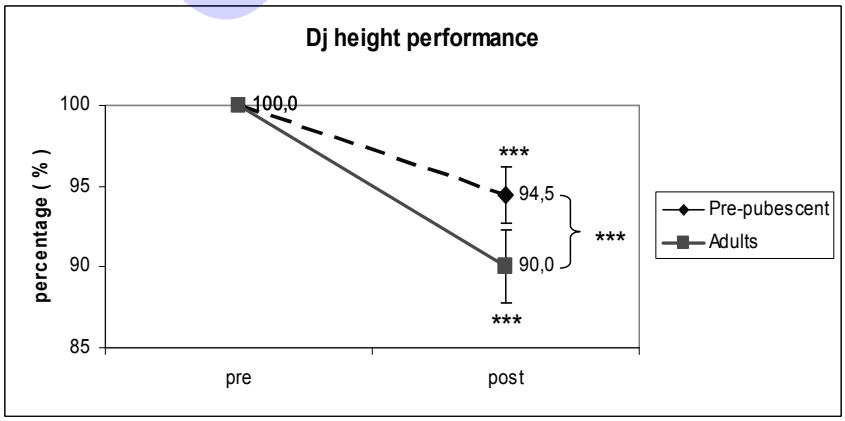

Figure 3: Record of height performance pre and post fatigue exercise in pre-pubescent boys and adults.

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Ground reaction force: There were group x time interaction for GRF $F_{(1,20)} = 12,648$ $p< 0,01$. Post hoc analysis revealed that adults exerted greater vertical force during landing face immediately after the fatigue protocol in comparison to initial values $F_{(1,10)} = 31,517$ $p< 0,001$). It was also showed that pre-pubescent, increased their GRF but this increase was lower than adults ($F_{(1,10)} = 14,409$ $p< 0,01$).

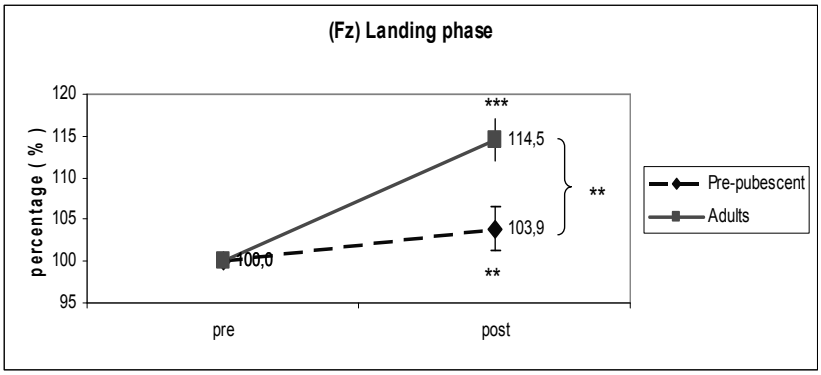

Figure 4: Record of ground reaction forces during landing phase pre and post fatigue exercise in pre-pubescent boys and adults.

Contact time: There were group x time interaction for contact time $F_{(1,20)} = 32,215$ $p< 0,001$. Post hoc analysis showed that contact time increased 5,7% in adults after the fatigue protocol $F_{(1,10)} = 162,511$ $p< 0,001$. In pre-pubescent an increase also observed but it was lower compared to adults (3,2% $F_{(1,10)} = 61,111$. $p<0,01$).

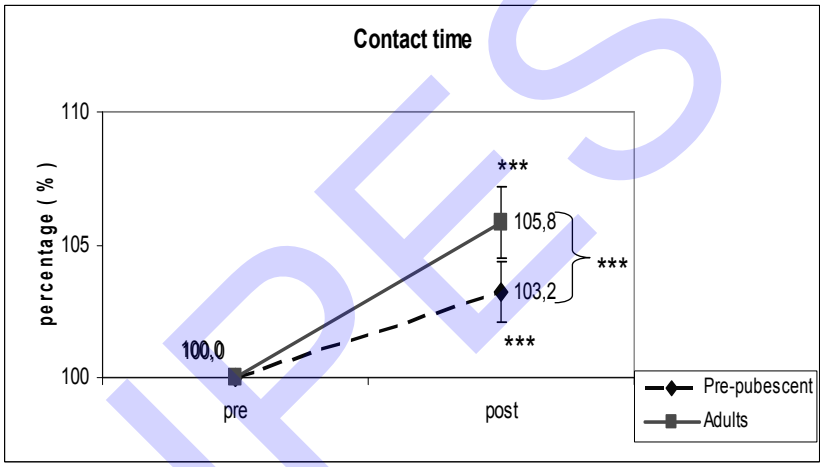

Figure 5 : Record of contact time pre and post fatigue exercise in pre-pubescent boys and adults

TABLE 1: Changes in drop jump performance, ground reaction force (landing and push off phase), ground contact time and perceived weariness immediately after the fatigue SSC protocol in pre-pubescent boys and adults.

	Pre-pubescent boys		**Adults**	
	Pre test	After test	Pre test	After test
Borg scale		13,7		18,2
Jumping performance (m)	0,231	0,218***	0,362	0,326***
F(z) landing phase[a]	2,27	2,36**	1,99	2,28***
Contact time (msec)	544	562***	499	529***
Isometric strength[b]	0,28	0,24***	0,36	0,29***

* ** *** Significantly different from before fatigue at p<0,05 (*), p<0,01 (**), p<0,001 (***)
[a]Expressed as ground reaction force/body weight
[b]Expressed as Nm/body weight

Journal of Physical Education and Sport Vol 27, no 2, June, 2010
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Discussion

The main finding of the current study was that the applied stretch shortening fatigue test caused a significant decrease in performance both for children and adults. The MVC and DJ were decreased more in adults. The increase in contact time and GRF were higher in adults. The fatigues perceive and the feelings of the pain were higher in adults.

The obtained results concerning MVC and DJ are supported by Marginson's et al., (2005) findings and are contrasting to Streckis et al., (2005) who did not find differences between age groups. These differences between the obtained results and Streckis' et al., (2005) findings could be attributed to the different protocols used. In Streckis' et al., (2005) protocol, 100 jumps were performed with 20sec interval between them a fact which was not probably sufficient to cause substantial fatigue. The fact that children were less fatigued could be based also on Borg scale findings where the perceived fatigue was higher in adults. Higher fatigue perceive was also observed in adults compared to children in previous studies supporting the obtained results as well (Armatas et al., 2010) but for first time is presented after a SSCF protocol in children. The possible mechanisms which could explain the obtained results could be the higher metabolites accumulation and the effect of inflammatory process in adults since they possess higher distribution of fast muscle fibers and have stiffer tendon (Marginson et al., 2005). The obtained results regarding the feeling of pain can support this assumption.

The present study showed that there was an increase in ground reaction force in both groups but this increase was higher in adults. These data are in contrast to previous studies (Streckis et al., 2005) which did not find any differences between children and adults. No other available data from previous studies exist on this issue. Generally speaking ground reaction force increase after fatigue has been previously reported in adults in SSCF (Komi, 2000; Kuitunen et al., 2002) and in generally indicates a loss in neuromuscular coordination (Nicol et al., 2003;1996). The obtained results indicate that this neuromuscular control decrease was higher in adults.

An increase in contact time was observed after the fatigue test which is a typical characteristic for previously used SSCF protocols (Gollhofer et al., 1987; Horita et al., 1996; Komi 2000, Proske & Morgan 2001). It indicates a total reduction in muscle function and especially in eccentric phase (Regueme et al., 2005; Avela et al., 1998; Horita et al., 2003). The stretch shortening cycle fatigue protocol probably caused a reduction of knee stiffness, which is also verified in research of Kuitunen et al., (2002). The reduction of joint stiffness makes muscle tendon complex more compliant leading to a higher flexion of lower limb which consequently caused an elongation of the contact time. The obtained results also indicate that possibly the reduction in muscle tendon stiffness was higher in adults (Arampatzis et al., 2001; Kuitunen et al., 2005).

Conclusion

The basic conclusion indicate that the application of the certain SSC fatigue test causes significant decrease of performance both in children and adults but the fatigue occurrence is higher in adults. This higher decrease in adults could be atributed simultaneously in neuromuscular, metabolic and inflammatory factors.

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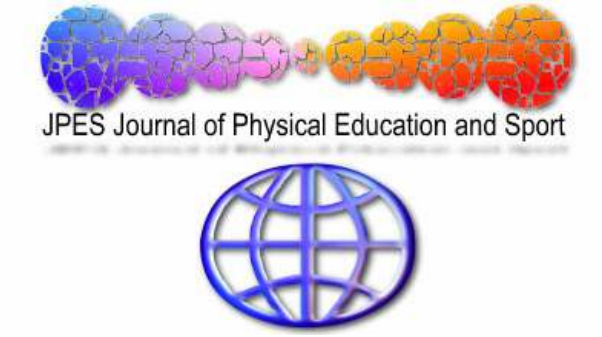

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ORIGINAL RESEARCH

DOPING IN FRANCE (1960-2000) : AMERICAN AND EASTERN BLOC INFLUENCES

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In the beginning of the 20th century, sports consisted in a minimum amount of physical activity. It was generally considered as dangerous and unhealthy because it encouraged people to push their limits too far. The medical profession used to advise teenagers against doing any sport, for fear that they would become too tired and, as a result, their bodies would not develop properly (Arnaud, 1980; Defrance, 2003). Nevertheless, during this period, some doctors became interested in sports. Some were former sportsmen, others had worked for the army (Pociello, 1999) which was involved in research to improve the physical skills of their soldiers. They observed that the body was a wonderful product of nature. Those doctors took photos to decompose the movements of the body and to understand how it worked. Hobberman (1992) showed that there was a radical change in the 30's when physicians began to work with sportsmen. It would also become the case in France, but later, after the Second World War. In the 50's, the context completely changed. The first reason is that the medical profession started to promote physical and sports activities to build up the exhausted and damaged bodies of French people, due to lack of food during and after the war. They asked the French Ministry of Youth and Sports for the creation of medical centres specialised in sports. In the beginning of the 60's, sports doctors wanted to take care of high level sportsmen. Because, for them, practising sports was indeed healthy, Doctor Encausse (1962) emphasizes the advantages of doing some sport " *Physical and sports education is absolutely both virile and morally essential to the rational upbringing of young people* ". Pr. Vacher (1969) underlined that the practice must be moderate to achieve positive effects on health. For that, the medical profession had to supervise physical education. "*It requires serious efforts, a considerable physical outlet, and progressive training. It must be watched, medically controlled, especially in the case of official competitions*" (Dr Encausse, 1962).

During this period, we can observe the appearance of a new medical paradigm. Before, doctors who looked after sportsmen were clinical practitioners. They examined their patients in their surgeries only when those were already injured or sick. In the fifties, this model was predominant in the lectures on trauma in international medical symposiums. In the beginning of the sixties, another model appeared. It can be observed by studying the Sport Medicine International Federation symposiums : the fifty or so talks on trauma in the 50's were replaced by hundreds of talks on sports training and the physiology of effort (Brissonneau, 2003). The new majority consisted predominantly in talks on sports training by doctors from the Eastern Socialist Bloc (Brissonneau, 2003). The subjects concerned the physiology of effort or training planning patterns for the most part. The concept of "health" changed when it departed from a clinical approach, which involved curing diseases, to a scientifical, medical approach aimed at keeping people healthy while being competitive. Research implied putting the bodies of sportsmen on high technology machines to examine their performance levels. The new approach was determined rationally and scientifically! " To be in good health" meant to be able to achieve high performances thanks to an efficient cardiovascular system. We can see this paradigmatic evolution with, in

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1977, the sidelining of the old medical bosses of the surgeries of the National Sports Centres, to make room for physiological physicians working in proper medical research department.

The second reason for which the context changed is that, in 1958, General De Gaulle became the President of the French republic. In the context of the Cold War, he favoured policies aimed at restoring the greatness of France on the international scene. Such was the case in politics, economics and in sports too. France had to have champions, like the USA and the USSR. The latter countries had different models: the open sports structures of the American universities which recruited the best sportsmen, or the closed sports structures such as in the German Democratic Republic (GDR) where the best talents were gathered in one place (Passevant, 1972). A state sports policy was created in France by the then Minister of Youth and Sports, Maurice Herzog. This was a real change which put forward a policy of state governed sports (Loret, 2008) similar to that of the Eastern Bloc. The French sports management adopted a pyramidal structure. On the base, hundreds of sports clubs discovered potential young champions who were then trained in state structures by professional trainers.

The best ones would then go on to continue their training in National Sport Centres. Maurice Herzog developed the role and number of National Techniques Directors whose mission was to create a rational politics, to develop the number of sport members and the level of excellence within the Olympic federations (Fleuriel, 2004). He created the district and regional technique advisers whose job was to help the sports clubs develop and discover young talents. These champions were gathered in closed Institutions, similar to Coffman's "Total Institutions" (1979), where everything was designed to help the champions achieve the best possible performances. The best dieticians, trainers, teachers, physiotherapists and doctors were put at their disposal. The school timetables were organised around their training. The National Sport Centre was soon to be created, specifically for the best champions, in a forest in Paris. In 1974, the Ministry of Youth and Sports would also create special sections in some secondary schools, devoted to the intensive practice of a sport while following a normal academic syllabus: the "Sport-Etudes" Sections. Young people gifted in sports and potential champions, could study in those special sections.

The third reason for the change in the approach of high level sports training from an empirical model to a scientific one, results from the numerous contacts with the physiologists whose reference was the GDR and soviet models (Zartsiorsky, Mendveiev, Platonov for example). This introduction, aims at showing how the sports model of the Eastern Bloc fascinated French politicians, physicians and trainers. It represented the epitome of a rational, scientific approach which optimized the chances of success. In the article we shall study the testimonies of several sportsmen who have used doping (2 athletes, 4 cyclists) in which they talk about their lives (Bertaux, 1997), their careers (Hughes, 1997), and we shall observe how they received the official standards on sports, health and ethics, and what they made of them in their daily practices. Those testimonies do not aim at describing ideal-typical careers but rather processes. We will see through two sports (amateur athletics and professional cycling) how our French empirical model has been constituted by a rational, scientific model to which a scientific doping model is added**,** first the American model, then that of the Eastern Bloc. It was all the more prevalent as it was promoted by a new medical care for sportsmen, the physiology of effort.

USA, the American way of life or the winning model

In the beginning of the 60's, the use of anabolic steroids became common in high-level sports, especially in the sports which require physical strength (Dimeo, 2007). In 1965, Alain, had been training for a few years and was one of the best sportsmen in France. He favoured power training, from the beginning, and strongly believed in it. Contrary to other throwers at the time in France, for him, strength was an important element in his performance. That year, he completed his engineering degree with some professional work experience in Canada. He then called a famous American thrower trainer, who was in one of the best American Universities, in California. The latter immediately offered him to come and train on campus with some of the best world international throwers. He did not have to pay the very expensive university fees because of his contribution to the international fame of the University, and he benefited from a student grant from the French Ministry of Youth and Sports for his accommodation expenses. During the first months of the academic year, he was surprised to see that some throwers stopped training for several weeks in order to prepare for their exams and then resumed training and were soon extremely strong, after a few weeks training only. One of his best friends, a national thrower, told him about the powerful results one could get with Dianabol (anabolic steroids). So, he decided to speak with their coach who was in favour of taking Dianabol and advised him to go and see the doctor of the campus. The latter prescribed him low doses of Dianabol which, according to the doctor, would help him train and which would not be dangerous for his health. The doctor explained that this product was good for people who had just undergone surgery and needed to increase their muscular mass. " *So, it was ideal for sportsmen who needed to develop their muscles* " Alain said. The throwers freely recommended this product because it was not considered as cheating : it was a training technique, like any other, in accordance to the Olympic logic: to be the "Fastest, highest and strongest". He quickly got results and he put on eight kilos which allowed him to beat his best performance yet, in body-building movements and in his different throws. Alain

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gave us a photography of himself when he came back to France and won shot put and discus during the French championship. His body was sculptural, tanned ; he wore Ray Bans, the icon of the Californian dream! Some national French throwers confirmed; for them, he was (thanks to doping) the epitome of the American model : a winner. From this moment on, the use of anabolic steroids increased among the different throwers in France. At the same time, French athletes discovered how common the use of these products was among the American and soviet athletes during the Olympics games in 1968 in Mexico, and 1972, in München (Dimeo, 2007) and during international matches.

With Alain, the model was a combination of both the American and soviet models. It combined both an empirical and a scientific approach. Indeed, throwers tended to confuse body mass and strength. Therefore, they did everything to become bigger. I interviewed some French national shot put throwers; they explained how, in national training camps, they used to weigh themselves before and after each meal. They gobbled up vast quantities of food to put on weight, which is also the purpose of taking Dianabol. Before meals, or time off, athletes would offer steroid pills to each other, in the same way that smokers offer cigarettes. They thought that those pharmacological products were no more than super vitamins, which was confirmed by medical advertisements.

In the 50's and the 60's, the only international model was the American one. During the 70's and the 80's, with the support of the French State, the French Ministry of Youth and Sports' reference model became that of the communist countries which successfully took over from that of the USA. The exchanges of knowledge were numerous; the best trainers and effort physiologists were invited to symposiums by the French National Sports Centres and the best French athletes often visited the different Eastern European countries.

Sports training model reference : a departure from the American model, to adopt the model of the Eastern Bloc.

Michel was one of the best French international throwers. He trained two to three times a week, enough to become a junior French champion. When he was nineteen - national military service was compulsory in France, and he joined a military sports centre, in the southern suburb of Paris. There, he discovered high level sports training: its pleasures and its obligations. So he passed from an ordinary social world to an "extra-ordinary" world (Papin, 2000), high level sports, a kind of bubble disconnected from social reality. All his life was centred on a single purpose: achieving the best possible performance. It governed his sleep, food, recovery, friends and lovers. Everything was made to optimize his training, records and competitive results. Inside this extra-ordinary world, standards were very different. During the first months, he trained with a high-level group of sportsmen who experienced some difficulties in accepting him. The other throwers were sceptical. They were laughing behind his back and calling him names such as "doped head". However, he did not understand what they meant. During that winter, he discovered a new, hard way of training; his trainer modelled the USSR trainers. He often went to the medical centres of the National Sport Centres to have his injuries looked after and get help for his extreme tiredness. He passed different medical tests to regulate his trainings loads. Fortunately, he improved the record of France several times throughout the spring season, before important international competitions. It was on the occasion of a doping test that he discovered what « doping » really meant. The results were negative, which arose suspicion. The technical national director decided to allow him to take part in an international competition. There, he was confronted to the best world throwers, and the issue of doping. He saw some body sizes, morphologies which were impossible to achieve with a natural way of training. The issue of doping was much discussed among the French as well as the foreign athletes. Furthermore, some weeks later, a finalist thrower was tested positive. The following year, he took part in a competition in which he did as well as a Czechoslovak thrower. Some weeks later, in difficult climatic conditions, he lost against him, by many meters. Having returned to France, in his club, he spoke about it with his training friends who smiled : « *Yes, you need to understand, in the Eastern Bloc, there are people who use products, anabolic steroids, it's normal, don't worry, continue your training (laughter). We can't do anything about it, it's just the way it is. Furthermore, don't change, it would be bad for your health !* ». So, he decided to speak to his trainer. The latter gave him some newspaper articles in which some international throwers talked about their daily use of doping. This information raised many questions : what was the point of training, why was doping legal in the Eastern Bloc, why were there anti doping tests in France ? All these questions resulted in his decision to experiment with doping, and once he had made up his mind, his experiences were numerous and varied. On the one hand, he knew how easy it was to buy products in ordinary chemists. « *You could find small knickknack : testosterone, Andractime, creams, fantastic products! You could cover your body with cream and yet test negative* ». He also bought some products from a bodybuilder friend in his power training gym. Furthermore, the latter gave him information: dosage to be strictly followed, « to be in the clear » in the anti-doping tests. He took Prodion, then Pantestone (testosterone) but he did not improve his body building records. He asked around him, in his club, in national training camps, for advice about doping, its use and dosage, to elaborate a coherent pharmacology-

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training plan, learning by essays and error. He understood that, as for his training, he had to adopt a scientific approach.

The thrower confusedly felt that doping was in keeping with the logic of high level sports achievement : pharmacology was just another technique to master. The last phase of his evolution process happened in a training camp in the Eastern Bloc. One of his competitors invited him to his club where he could meet both a national trainer and some international throwers. The atmosphere was nice and, even if he did not speak their language, they all tried to communicate and share experiences : " *That evening, we drank beers, or vodka. And one young athlete asked me how far I could throw. He appeared not to believe my answer and asked me whether I had to take drugs to achieve such results. I did not want to argue so I confessed that I did take drugs. He then believed me.*"

The following day, the young athlete opened his toilet bag and showed him its content. "*There were so many drugs : testosterone, anabolics, stimulants, even a cardiac accelerator. He used five different drugs every day."* Some days later, they walked past a pharmacy. He suggested they should enter and buy anabolic steroids, which they got very easily, over the counter. We notice that for the "Insiders" (Becker, 1985) - those who live in the extra-ordinary high level world of sports -, using anabolic steroids was not cheating, it was an element of their job. Sports colleagues helped each others to do their jobs, as professionals. It was what the media would discover in 1998, with the Festina Affair (Duret, Trabal, 2001), where 95% of the cyclist "Peloton" was found to be using doping which they casually would give one another.

Our French thrower also questioned the Russian athlete about the anti doping tests. He answered that he knew how to go round them. Doping was a part of his training, so were tests . We can observe how Michel slowly understood, as he interacted with the best athletes and effort physicians, that in order to win he had to adopt a global scientific approach. The accumulated testimonies of the international French wrestlers (who were at the same time competing in the Eastern Bloc countries) described the omnipresence of the research physicians in the sports structures during the competitions. At any time, they could help the sportsmen within the framework of their performances. This new technical model for a global scientific approach was a far cry from the empiricism which still reigned, more or less undisturbed, in France (Roger, 2006).

This article will now focus on a different approach in cycling, for two reasons. It is a professional sport and France is the world professional high level reference. The training approaches changed after the internationalization of this sport in the mid 80's. We also passed from the US model to the Eastern Bloc model, even more quickly.

Another approach, that of the French cyclists (1960-1980) : dabbling into drugs

Between the 60's and the 80's, cycling was practised on each side by the Iron Curtain. Except for the "Race of the Future" across Europe, the contacts between Western and Eastern cyclists were rare because cyclists were professionals in the Western Bloc whereas they were amateurs in the Eastern Bloc. The sponsors, the best competitions and the money were all to be found in France. You could earn a living with cycling.

The French cyclists (the Italians and Spaniards too) used drugs to overcome fatigue, most of the time, they used stimulants. They discovered them when they signed up their employment contracts. As the training loads grew heavier, they were advised by their peers on how to manage the difficulties. Learning about drugs was empirical; cyclists tried teaching by essays and errors, to determine what was best for them. The transmission of knowledge was done by word of mouth: "*You feel your way around, you find out how to train in the most suitable way for you. The culture of cycling requires looking around for information. You teach yourself. I also learnt from older, more experienced cyclists !"* (Patrick, 1970's). So, they did not know how to control when they could afford to be tired and when they simply had to be at their fittest. As a consequence they did not select their competitive objectives: they tried to win every race. Sometimes, when they did not feel good, or felt tired, a sports leader or a peer would provide them with a stimulant and would explain how to use it : " *You find protection from the wind by staying behind the other cyclists for an hour and, ten kilometres before the finishing line, as you ride up the hill, you take the pill*" (Christian, 1970's). So, Christian developed his own technique with the use of stimulants. Certain beginners would use the products too early, or at the wrong moment, and they finished the race with difficulty because the effects of the product would diminish. After the Tour de France (in July), came the season of the "criterion races" in August. They were round trips competitions on smaller roads within a city. The spectators paid to see the competition. The cyclists saw it as a show in which the final result was decided in advance. It was a kind of party, the runners met in a festive atmosphere, after the very exhausting Tour de France. They did not drink alcohol, considered bad for their health and their performance, but they shared stimulants (amphetamines, cocaine, **etc.**) to unwind!

A rational approach: the American model completed by that of the Eastern Bloc

At the end of 70's, the Tour de France became a declining competition. Felix Levitan, its director, wanted to boost the interest in the Tour, and for that purpose he wanted to find new heroes to look up to in this

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particular competition. He therefore went to the USA, for two reasons, first to evaluate the possibility of developing the market for the sale of bicycles (Louy, 1986), and to evaluate the excellence of American cyclists. Some years later, the entrepreneur Bernard Tapie, wanted to develop his own brand of cycling gear "Look". He hired an American champion, Greg Lemond who soon won some international races in Europe. He won The Tour de France as a member of Bernard Tapie's team, in 1986. He brought with him a new rational, scientific model. « *In Europe, the trainers didn't understand me. They wanted me to follow their outdated, twenty-year old training methods. I read books about physiology; I favoured the quality of my training over the quantity which was the dominant method adopted by the others. I had a particular conception of what it was to be a professional. In Europe, to be a professional meant training all day long, as much as was humanly possible. For me, it meant to be organized in the best possible way : to write down my objectives and think about how to reach them. I created a new system, on my own, nobody could help or advise me*". 1989, was the year of the fall of the Berlin Wall, and many Olympic cyclists of the former Eastern Bloc became available to the international professional market. They were cyclists who had trained very hard and whose salaries were much lower than those of Western Europe. In 1990, they constituted 5% of the "peloton". They brought the scientific sports approaches of both the former USSR and East Germany: a full training plan (physical, medical) focusing on one or two objectives. At the same time, new entrepreneurs became sponsors, bringing more money and greater expectations with regards to results. They all wanted to be largely represented in the Tour de France which was becoming the third most watched sports event in the world. The benefits of world advertising, resulting from having one's own team at the Tour, were incredibly advantageous. Each cyclist would define his one or two objectives, necessarily including the Tour de France. Their tiredness and trainings had to be predictable and managed, in order to be successful on "the Day". For that, the team of professionals supporting cyclists needed to be broader. A new generation of professionals was hired who were not directly connected to the world of cycling; among those the most important actors were effort physiologists, and scientific physicians. Thanks to scientific instruments, doctors could investigate bodies more thoroughly and determine which parts needed to be trained. Training became very precise. Interacting with this new kind of physicians, cyclists accumulated a large number of scientific information and, in particular on products, some of which they already knew about, and others they did not. They already used steroids and then started using peptide hormones. As for the training loads plans, the products were different according to the season: "*Anabolic steroids used for quantitative training loads in winter and peptide hormones to improve fitness, just before going for your objectives*" (Philippe, 1990's). Over a short period, to optimize the effects of the product, "*You adopt a pyramid like pattern. For example on a Monday, I would take half a pill, on the following Tuesday and Wednesday a whole pill, and on Thursday two pills. Then, I would decrease the amount of pill intake* " (Jean, 1990's). Christian decided to do everything to win, he went to Italy to experience a total scientific approach. He stayed there several times, in training camps, where he followed a model in which many parameters (biological, physiological, psychological) were taken into consideration**.** So, each day, he would receive directives in which training loads were equated with the exact quantities of products. Many times a week, he would have lactates and blood tests. A Few weeks later, he scored a world performance.

Conclusion

From the 60's, in the context of the Cold war, we can observe an increased demand for results in sports in France. The uncertainty of the performance in sports was no longer tolerated. So, the first available model to improve the French situation in sports was the American model, due both to the recent relationship established with America after the war and to the fact that it was the only sports winning model. It brought a certain rationality in its training methods. French sportsmen accumulated training information from sports newspapers or discussions during or after international competitions. Few sportsmen, such as Alain, had the opportunity to go and train in the best world sports training centres, in American Universities (plane tickets were expensive!). But, a new sports approach was adopted by the French Government, because they did not want to leave anything to chance**.** They chose the model of the Eastern Bloc, with the USSR as leaders. This model could be observed, at the international level, at the end of the 50's, and won a huge amount of medals in the 60's. It would reach a climax in the German Democratic Republic with the establishment of a high-level sports and doping state policy, which was to be revealed to the world later (Berendonk, 1992; Spitzer, 2003). The consequence was the adoption of the sports structures training references and scientific knowledge of the Eastern Bloc. Their impact was important because they developed the image of the "performing body" by whichever means necessary. With the increasingly heavy training loads resulting from this hard training, the pharmacopoeia became a necessity.

But through those cases studied, in athletics and cycling, we can observe a different evolution depending on the sports. The different degrees of closeness between a given sport federation and the Ministry of Youth and Sports is an element of explanation for these disparities. The French Athletics federation, which depends entirely on the Ministry of Youth and Sports for money, had no choice but to adopt and undergo the reorganization of the sports structures in the 60's. So, the French athletes were given the Eastern Bloc model as a reference which was promoted by the Ministry of Youth and Sports, through its national trainers and the training

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camps in the eastern socialist countries. As for professional cycling, it depended on the national private sector for money and therefore their training model was empirical. They were advised by former cyclists who had become trainers. They would change their approach in the 80's with the arrival of new international sponsors with important financial support. Their model then became the same as that of their sponsors: the American model. The new private cyclist structures took advantage of the Fall of the Berlin Wall to employ former socialist world leading cyclists at low cost. They brought with them their scientific approach. So, cycling passed, later than athletics, from an empirical drug using model to a scientific doping approach. They followed the same process but in a much shorter time sequence. To complete this analysis, we must underline that effort physiologists who started to work with cyclists in the 80's were already active in athletics some ten years before (see the cases of Ferrari and Conconi in Italy for example). Secondly, this varied proximity with the Ministry of Youth and Sports explains the fact that the Olympic Games ethics is more important for the athletes who train with national trainers and state representatives. The information about doping did not circulate so easily and it was difficult to elaborate doping techniques. We met with more difficulties when interviewing athletes, than cyclists. The reason is that athletes are torn between the ethics of the Olympic Games and the Olympic logic which is "fastest, highest and strongest". Cycling is a professional sport which depended a little on the Ministry of Youth and Sports between the 60's and the 80's. The ethics was to do the best job possible and doping was merely a technique to do one's best. The arrival of new sponsors leaded to the arrival of new professionals who brought a new performance approach. Since the international Festina scandal, in 1998, in France, the French government has adopted an intermediate model : the Eastern Bloc technique model, which is more than ever present, but the former USSR and GDR drugs approaches have become illegal and trespassers are prosecuted (Brissonneau, Ohl, 2010). And through a constant and hard anti doping policy, the French Ministry of Youth and Sports has imposed its rules to professional cycling. If we analyze the situation in terms of results, these two sports have never had such poor results as in the last ten years, but it is difficult to establish a direct link between these recent bad results and the new French approach !

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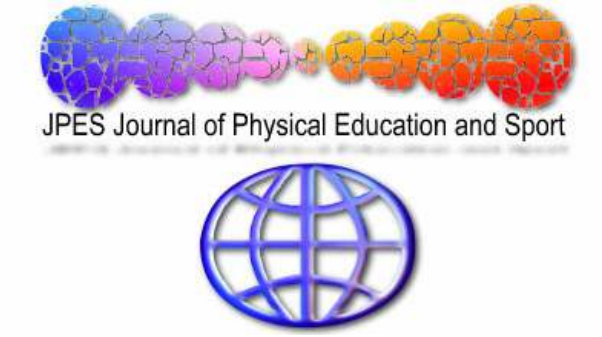

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ORIGINAL RESEARCH

THE EFFECTS OF A STRETCH-SHORTENING CYCLE FATIGUE PROTOCOL ON KNEE KINEMATICS DURING RUNNING IN UNTRAINED CHILDREN

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ABSTRACT

The purpose of the current study was to examine the effects of an intensive stretch shortening-cycle **(SSC)** protocol (100 plyometric jumps) on knee kinematics during running on a treadmill in healthy children using 3D kinematics. Twelve healthy and untrained children volunteered. Their mean ± age, height and weight was 10,1±0,5 years, 142± 6,1 cm and 37 ±4,6kg, respectively. Muscle damage of lower extremities was caused by 100 maximal intensity plyometric jumps performed as 10 sets of 10 continuous jumps with a 30 second rest period between sets. Muscle damage indicators [delayed onset muscle soreness (DOMS), knee-joint flexion/extension angles during running on a treadmill (speed at 2.8 m/s)] were assessed pre-, 0h, 24h, 48h and 72h post exercise. Kinematic data were captured at 100 Hz using a six-camera 3D motion analysis system (VICON 612). Repeated measures one-way ANOVA with five levels were utilised for the parameters. All muscle damage indicators revealed significant changes post- compared to pre-exercise data *($p<0.05$)*. Kinematic analysis revealed that the 100 plyometric jumps decreased knee-joint angles at different phases of stance (impact, support, push-off phase). These changes were more evident just after (0h) the protocol and 48h after this, and remained till 72h post at a great extent *($p<0.05$)*. Lastly, children suffered from delayed muscle soreness on their thigh muscles which remained only 24 hours after this *($p<0.05$)*. Muscle damage causes alterations in treadmill running in knee kinematics of untrained children probable due to differentiation of their central nervous system running strategy.

Key words: kinematics, knee joint, muscle damage, running

INTRODUCTION

Muscular fatigue is defined as the reduction in the force-generating capacity of the neuromuscular system that occurs during sustained activity (Bigland-Ritchie et al. 1983) and is affected by many factors, such as the contraction type and intensity, the joint type, gender and age (Hakkinen, 1983; Clark et al., 2003; Halin et al., 2003; Hatzikotoulas et al. 2004). Although muscle fatigue has been extensively examined in adults and in common contractions (isokinetic, isometric steady on a cybex apparatus, only a few studies are available concerning children response to fatigue during intense fatiguing contractions arising from continuous jumping situation including the stretch-shortening cycle phenomenon. Stretch –shortening cycle (SSC) - type fatigue can

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lead to muscle damage and is associated with acute (post) and prolonged (1, 2 and 3 day) symptoms. Muscle damage induced by such type of exercise (SSC) in humans frequently occurs after unaccustomed exercise, particularly if the exercise involves a large amount of eccentric contractions (Byrne et al. 2004; Nosaka et al. 2002). Brown et al (1997) who examined six female and two male, who performed a bout of 50 maximum voluntary eccentric contractions of the knee extensors of a single leg, found indirect evidence of exercise induced muscle damage suggesting that myofibre disruption caused by the eccentric muscle contractions. Similarly, Mavrovouniotis et al. (2002), observed increased muscle tissue damage in adolescent volleyball players. The symptoms of SSC fatigue protocols have well been examined in functional demands such as jumping, lower extremities torque or even feel of muscle soreness and biochemistry alterations, but limited research is available regarding running. (Marginson et al. 2005; Paschalis et al. 2007; Clarkson 2002; 1992; Komi, 2000; Novachech, 1995).

The effects of a SSC protocol and subsequent muscle damage on running could be reflected in lower extremities kinematics and be responsible for a different running strategy. A different running strategy could lead to perturbations and increase the risk of musculoskeletal injury. Only a recent study examined the effects of muscle damage on running biomechanics but an isokinetic eccentric exercise and not a SSC protocol was employed (Paschalis et al. 2007) and this focused only on adult population. Therefore, the purpose of this study was to investigate the effects of an intensive exercise protocol including 100 intermittent plyometric jumps on particular kinematic parameters in treadmill running, both at acute and prolonged level, in untrained children.

MATERIAL AND METHODS

Subjects and experimental procedure

Experiments were performed on 12 healthy children 9-12years of age without any history of neurological or orthopaedic disease. All of them were male students, occasionally participating in various recreational activities. The characteristics of participants are presented in table 1.

All subjects wore gym shoes in all the experimental visits. Participants visited the laboratory venue on four different timing periods. The first was reserved for familiarisation with the assessment instruments as well as for the baseline and post-protocol measurements (running treadmill) and the experiment procedures (execution of 100 plyometric jumps). At the following three days (24, 48 and 72 hours post protocol) the same data were collected.

Muscle damage of lower extremities was caused by 100 maximal intensity plyometric jumps performed as 10 sets of 10 continuous jumps. Participants stood with feet shoulder apart and hands on hips. Assuming this posture, they were asked to jump as high as possible on each jump after a preparatory downward eccentric movement, to a knee bend of 90˚, which was performed as fast as possible (Lazaridis et al., 2010; 2006). Each set of 10 jumps was separated by a 30 seconds rest period. All jumps of the protocol were performed on a 0.6x0.6 Bertec force plate (Type 4060, Bertec Corporation, Columbus, OH) collecting at 1000 Hz, which served as a landing area.

Assessments-Data collection

Muscle indicator

For the evaluations of delayed onset muscle soreness (DOMS), each participant palpated his muscle belly and the distal region of the vastus medialis, vastus lateralis and rectus femoris in a seated position with the muscles relaxed. Perceived soreness was then rated on a scale ranging from 1 (normal) to 10 (very sore). This method and scale has been previously documented by other investigators (Clarkson et al., 1992; 2002; Zaggelidou et al., 2009)

Running kinematics

Running was performed on a treadmill set at 2.8 m/s, graded at 0%. Kinematic data were obtained using a six-camera optoelectronic system (VICON 612 M3, Oxford Metrics, UK), sampling at 100 Hz. Sixteen reflective markers (14 mm spheres) were placed at anatomical bony landmarks of each lower extremity (posterior superior iliac spine, anterior superior iliac spine, lateral thigh, femoral epicondyle, lateral tibia, lateral malleolus, calcaneus, 5th metatarsal head, and the dorsum of the foot). The static and dynamic calibration for the motion analysis system was assessed by the same investigator according to the manufacturer recommendations before each data collection session. Trajectories were filtered with the generalized cross validated splines (Woltring et al. 1986). All trajectories were filtered using the generalized cross-validated splines technique as reported by Woltring. Prior to the kinematic evaluation, each participant was recorded in the standing position, which was used as reference for joint movement. 10 continuous steps (after a 20sec. period for start) were analysed and averaged for every participant of its right side. The study of biomechanical variables focused on the knee extension/ flexion across all the four parts of a running cycle (impact, support, pushing, swing phases).

All the parameters mentioned were measured before exercise protocol and immediately after, 24 h, 48 h and 72 h after this.

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Table 1. Characteristics of adult participants

	Children
Characteristics	
Subjects	12
Sex	Male
Age (years)	10,1± 0,5
Body weight (kg)	37 ± 4,6
Height (cm)	142 ± 6,1
% of Body Fat	17,3 ± 3.5

Statistical analysis

The results are presented as mean and standard deviation (mean± SD). Repeated measures one-way ANOVA with five levels (pre-exercise, immediately post exercise, 24, 48 and 72 hours post exercise) were utilised for indirect muscle indicators. The significance level was set at $P < 0.05$. The Statistical Package for Social Sciences (SPSS 16 Inc., Chicago, IL) was used for the analysis.

RESULTS

In the case of DOMS, values found to elevate just after the protocol and present their peak value at 24 hours post exercise [$P < 0.01$ (Figure 1)]. These values remained higher compared to baseline even 48 hours post exercise.

Regarding knee kinematics during running, there was a significant knee joint angle decrement almost in the entire stride during running and mainly at the swing phase of it [*P<0.05* (Table 2)]. These alterations presented their statistical significance compared to baseline data at 24h post exercise and to a lesser extend at 48 and 72h after that.

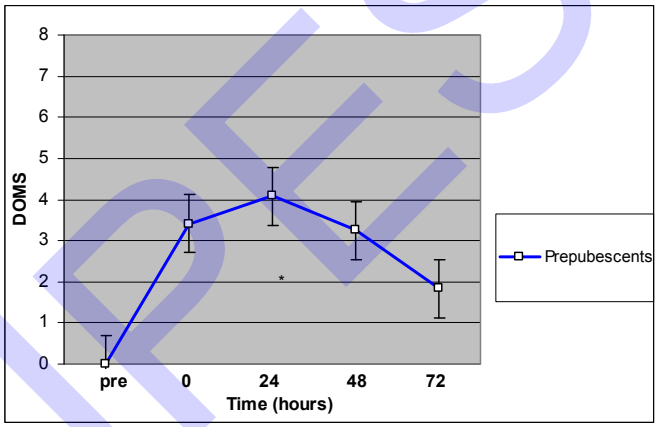

Figure 1. Delayed onset muscle soreness in children

Table 2. Knee joint angles (deg) during running in children.
Data are means ±SD.

Running (n=12)					
	Baseline	**Acute (0h)**	**24h**	**48h**	**72h**
Knee (impact)	10± 3	9± 2*	8± 4*	11± 3	11± 2
Knee (support)	41± 5	36± 4**	39± 5*	40± 5	40± 6
Knee (pushing)	18± 2	17±3	14± 5*	13± 5**	18± 4
Knee (swing)	76± 8	76 ± 7	72± 8*	74± 6*	76± 8

Journal of Physical Education and Sport Vol 27, no 2, June, 2010
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DISCUSSION

The purpose of this study was to investigate the effects of an intensive SSC protocol including plyometric jumps on knee kinematics during running in untrained children. The main finding was that muscle damage significantly altered the knee joint angle during the stance and swing phases of treadmill running. In fact, our participants failed to flex adequate their knee-joint mostly in the swing phase of running at a steady speed (2,8 m/s) and that occurred more evidently 24 h after the protocol. The sense of muscle pain may be responsible for this alteration (Paschalis et al. 2005;Child et al. 1998). In addition to this, this strategy or inability of knee flexion may be an attempt to increase knee stability following fatigue as a neuromuscular protective mechanism and to prevent from further damage. The above finding comes in accordance with that of a recent similar study (Paschalis et al. 2007) but to mention that focused on adult participants. In their attempt to fulfil the exercise protocol following fatigue, probably presented a self-protection strategy in order to run onto the treadmill on a relatively high speed (2.8m/s), which was for most of them an unaccustomed exercise and especially after unaccustomed fatigue caused by the 100 jumps. Lastly, participants suffered from delayed muscle soreness on their thigh muscles but this peaked 24h after that and 48 and 72hours after the protocol the values presented decrement. Concerning this aspect, the low values of muscle soreness presented in children are attributed to either muscular and/or neural mechanisms (Ratel et al. 2003; Jansson, 1996; Bar, 1995; Gaitanos et al. 1993). Children, in fact, seemed to be fatigue resistant and this is obvious by their quick and acute recovery from the protocol and across the following re-assessments (48 and 72 after protocol). Further investigation is required on running kinematics probably with the use of electromyography around the knee joint in order to shed light on the total behaviour of the knee musculature after exercises which cause neuromuscular fatigue and muscle damage.

CONCLUSION

Muscle damage causes alterations in treadmill running in knee kinematics of untrained children probable due to differentiation of their central nervous system running strategy. These alterations remained till 24h after protocol. Children suffered from delayed muscle soreness on their thigh muscles which remained only 24 hours after this and then returned to baseline data. Future research should investigate mechanisms for the reduced severity of symptoms of exercise-induced muscle damage in boys compared with adults. This study gives evidence that children are fatigue resistant to an intensive protocol of plyometric jumps. This should not be omitted when there are designed training protocols for children. The speed of recovery from the 100 plyometric jumps exhiibited by the boys supports the use of plyometric training methods in boys.

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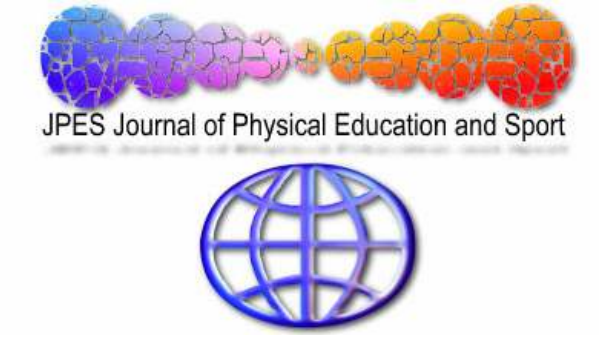

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ORIGINAL RESEARCH

THE EFFECT OF SPORT COMPETITION ON SALIVARY STEROIDS IN AMATEUR FEMALE KARATE ATHLETES

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Abstract

The purpose of present study was to investigate the impact of repeated competition on salivary cortisol and DHEA-S in amateur women karate athletes. We recruited 20 young elite female karate fighters [height 158 ± 7 cm (mean ± S.D.), weight 59.5 ± 10.9 kg, age 21.1 ± 3.0 years], who were placed first till fourth in the Iranian championship tournament. Five ml of unstimulated whole saliva was collected 30-min before and 5-min after first and last match in competition and analyzed for cortisol and DHEA-S concentrations. The results showed that participation in competition resulted in significantly increased saliva cortisol level ($p < 0.05$). The concentration of salivary cortisol increased throughout the competition ($p < 0.05$). Although the concentration of cortisol was decreased after a final competition, it was higher than resting values ($p < 0.05$). The concentration of salivary DHEA-S was not affected by competition ($p > 0.05$). Significant differences in salivary steroids were not different between winners and losers ($p > 0.05$). The results of present study show that salivary cortisol concentration is a suitable index for showing competing stress.

Key words: Cortisol; DHEA-S; Saliva; Karate; Women.

Introduction

Success in competition requires well-adapted physiological and psychological capacities to minimize the disruption of homeostasis and affect optimal decision making. Game sports which requires concurrently high levels of physical attributes and concentration, such as karate, are won and lost if either of these capacities are not operating optimally. The extent of physical and mental stress experienced during a game can be detected by the hormonal responses to competition. The scientific literature indicates that androgens and cortisol are the most sensitive hormones to these stresses and reveal the differences in their concentrations before, during and after participation [3,14]. With this in mind, it seems sensible that the hormonal responses to

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competition in winners and losers will be different, particularly prior to exercise. In the last three decades researchers have reported the increase in testosterone concentration in winners and the decrease its concentration in losers few hours after the competition and vice versa [6]. Others have reported no significant changes in blood testosterone [1,7,15,16]. Also, being the actual winner in competition may not be the main mediator of the hormonal response; perception of being winner may indeed change the testosterone concentration. Level of experience and ability (elite vs. non-elite) [10] and gender are the other effective factors [1] which alter the stress and androgenic hormone responses to competition. In women the concentration of testosterone is derived from dehydroepiandrosterone sulfate (DHEA-S) secreted in response to active hormonal axis in response to peripheral events such as fear and stress [14]. Therefore the purpose of the present study was to investigate the effect of participation in a first significant event on salivary cortisol and DHEA-S in amateur karateka women, and then compare the responses of the above-mentioned hormones between winners and losers.

Material and method

Subjects

All of the athletes in a national karate tournament were invited to participate in the study. During the first morning of competition, subjects were asked to fill a medical questionnaire and the aims and procedures of the study were described to subjects carefully and consent granted in writing. After the end of competition, data were collected from women who were the placed first to fourth in each of five weight categories. In total, 20 women [mean age 21.1 ± 3.0 year (mean ± SD), height 158.1 ± 7.3 cm and weight 59.5 ± 10.9 kg] who win the tournament (first until fourth place-getter) in the 50, 55, 60, 65 and >65 weight categories were selected as subjects. None of these subjects reported hormonal disorder, or use of any drug during the study, and all of them report normal menstrual cycle.

Competition

The karate competition from which subjects were recruited for the present study was a national competition for women in full contact style with five weight categories. Before each competition subjects use non-contact karate techniques for their warm up. Competition started at 8:30 a.m. and the duration of each bout was three minutes. The total competition duration was related to the number of persons that taking part in each weight category. The data collection sequence was showed in Figure 1.

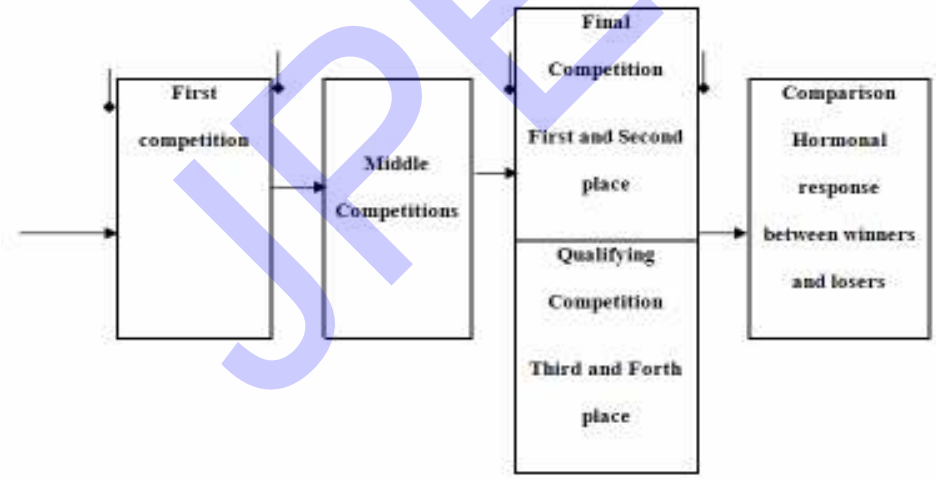

Figure 1. The experimental design of the study (Indicating saliva sampling). *Arrows* (↓) indicated where saliva samples were drawn

Saliva sampling and assaying

Before saliva sampling, the subjects rinsed out their mouths in order to remove any substances that may affect the hormonal measurements. The subjects were asked to drink 100 ml water to avoid dehydration, and then five ml unstimulated whole saliva was collected half an hour before and five minutes after the first and last bouts of competition. Subjects were instructed to allow saliva to dribble into the collecting tubes unaided by spitting. All saliva collections were taken whilst subjects were seated leaned forward with their heads down. Samples were transported in ice to the laboratory and were kept frozen at -20°C until use. On the day of testing,

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all samples were centrifuged at 3000 rpm for 10 min to remove mucins. The clear sample was transported into appropriate testing wells or tubes. Salivary cortisol and DHEA-S concentrations were measured by enzyme linked immunosorbant assay (ELISA). The kit for cortisol and DHEA-S were obtained from RADIM (Pomezia, Italy; sensitivity 5 ng/ml), and DRG Diagnostics (DRG Diagnostics, Germany; sensitivity 0.8 ng/ml) respectively. All assays were carried out in duplicate. Quality controls were included in all series of determination. All hormone samples were tested in the same series to avoid any variations between assays.

Statistical analyses

The normal distribution of all the data was confirmed by k-s test. Changes in salivary cortisol and DHEA-S concentration were compared using repeated-measures ANOVA and Greenhouse-Geiser epsilon (ε) used for correction of P values. Paired T-test with Boneferroni correction was done for additional post-hoc analyses. For comparing concentration of salivary hormones in winners and losers after the final match competition, independent samples *t*-test was used. An alpha level of 0.05 was used to determine statistical significance. All statistical analyses were performed using the SPSS program for Windows, version 15.0.

Results

Participating in karate competitions can change salivary cortisol concentration significantly ($F(3,57) = 8.05$, $p \leq 0.001$, $\epsilon = 0.851$, $\mu 2 = 0.298$). Paired *t*-testing showed that salivary cortisol concentration increased significantly before the final match in comparison to resting value. Although after the final match cortisol concentration decreased somewhat, it was also significantly higher than resting concentrations (Figure 2, panel A). Moreover, participation in competition did not alter the saliva concentration of DHEA-S ($F(3,57) = 1.21$, $p \leq 0.312$, $\varepsilon = 0.872$, $\mu 2 = 0.60$ (Figure 2, panel B). Comparison of salivary samples between winners and losers after final or qualifying matches showed that there were no significant differences for cortisol and DHEA-S concentrations ($p > 0.05$) (Figure 3 panel A and B).

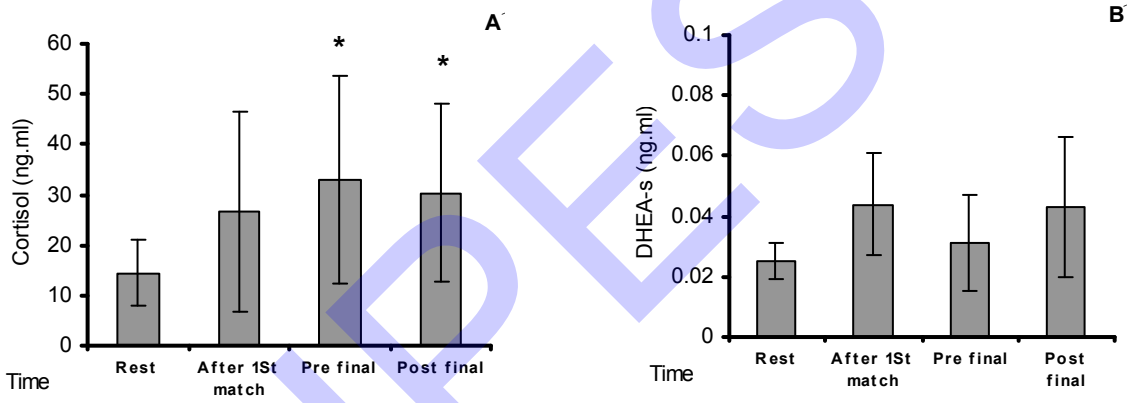

Figure 2. Concentrations of saliva cortisol (ng/ml)(A) and DHEA-S (ng/ml) (B) at rest, after 1st match, pre and post final match.* Denotes statistical differences from Rest. Values are mean±Std.

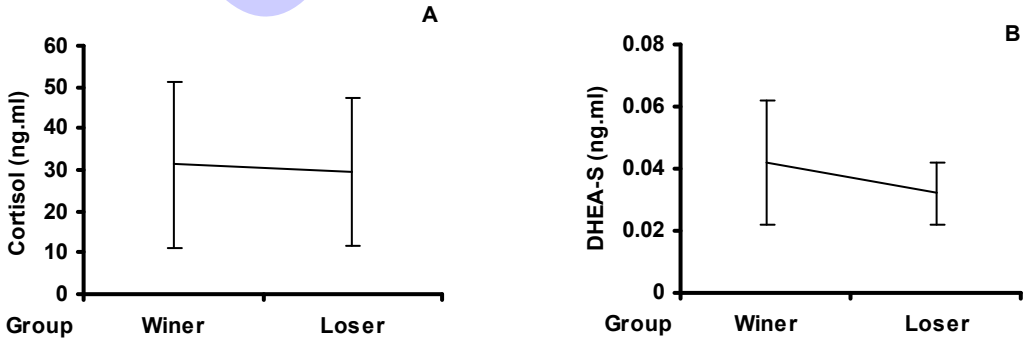

Figure 3. Concentrations of saliva Cortisol (ng/ml) (A) and DHEA-S (ng/ml) (B) in winners and losers. Values are mean ± SD.

Journal of Physical Education and Sport Vol 27, no 2, June, 2010
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Discussion

The main result of this study was that participation in karate competition significantly alters the saliva cortisol concentration in women. Saliva cortisol concentration increased before final match as compared to resting values and remained high until competition finished. Whilst perhaps not surprising, we believe this to be the first description of the stress hormone response to women karate players before and during competition.

Important stimuli of cortisol secretion are blood glucose concentrations and exercise intensity. The former was undoubtedly high given the nature of the competition. Anaerobic exercise metabolites such as lactate, decrease of pH, and hypoxia are stimuli of hypothalamus-pituitary- adrenal axis. In the present study in each phase of the three minute match anaerobic energy system was likely dominant. It seems that subjects tolerated high physical stress and the intensity of exercise exceeded the threshold of cortisol secretion. We had no measure of the blood glucose concentrations, but it is likely that this was not low as has been shown in prolonged constant intensity exercise [11]. By nature of competition, participants not only experienced physical stress but they also likely experienced a high level of psychological stress. Another important stimulus for cortisol secretion is mental stress. Whilst some exercises such as shooting induce low physical stress, cortisol concentrations are elevated [8]. Deinzer et al (1997) were test the effect of three free jumps on cortisol secretion and a noteworthy observation was that cortisol concentrations decreased after the 3rd jump that was due to the accustomedness of subjects of jumping stress [21]. This suggests that experience in a stressful environment, such as competition experience, can alter the stress response.

We tested the hypothesis that the stress hormone response to competition would be different in women of different levels of ability; measured by their success in the event. This however did not change, probably because for these women, they were all naïve to regional (higher level) competition and so all experienced similar preparatory mental stresses. The present study showed that a DHEA-S concentration was not different at any point of competition and between winners and losers. DHEA-S is a precursor hormone for androgens that change to male sex hormones in the adrenal glands. As such, it is the main modulator for biosynthesis of androgens and estrogens in human sex glands and adrenal glands. However physiologic levels of testosterone are very low in females and in present study the saliva concentrations was measured; in this body fluid, concentrations are very low. However, as adrenal concentrations of androgens are similar in both sexes, in the present study DHEA-S was measured instead of testosterone. Filaire and co-workers [5] reported that saliva DHEA-S is a more suitable index than testosterone for indicating the androgenic response to training in females. However, others did not report a significant difference in saliva DHEA-S concentrations after volleyball and handball competitions in female athletes [4]. Our results are similar to the results of above studies. Together, results indicated that the cortisol response to competition is different from the androgen response. Previous studies have indicated that winners have higher concentrations of testosterone than losers [7,13]. The mechanisms of these differences between winners and losers is not clearly defined, but there is an important theory that social status coould plays a role [9,12]. In this study the competition didn't have any prize for the winners and this could have impacted upon the perceived effects on social status. Thus, perhaps winning or losing in this competition was not important. Much more research needs to be performed in this area, particularly in women. Finally, the attitude of players and the importance of competition for them cannot be underestimated. It could be possible that the players were more interested in competing alone and did not have a strong motivation for winning.

Conclusion

The results of this study indicated that participation in karate competition can change saliva cortisol concentration in women but it does have a significant effect on salivary DHEA-S concentrations. This suggests that glucocorticoids are more sensitive to competition compared with the androgenic response; but that the saliva cortisol concentration is a suitable index for define competitive stress.

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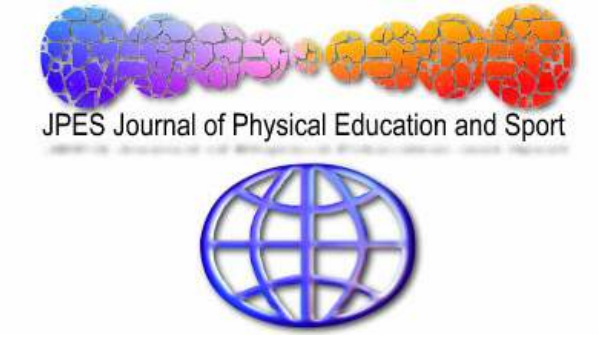

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ORIGINAL RESEARCH

ANALYSIS OF SOME ELEMENTS OF COMPLEXITY OF MOVEMENT ACTIVITIES

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Abstract
The aim of the study is to develop a classification of motor activities and sports that will be useful to researchers who either directly or indirectly deal with the subject areas relating to human motion analysis. This need is due to the complexity of the phenomenon of motor activities and sports. It calls for the study of those characteristics that identify the different motor activities in order to simplify and understand in greater detail this phenomenon.
The research was carried out through a theoretical-argumentative approach and was based on a review of the literature relating to the classification of motor activities and sports.
Through a classification that takes into account several specific variables such as conditional, temporal and spatial aspects, a theoretical framework has been created for studies aimed at investigating motor activities and sports.
Key words: Motor activities – Sport classification – skill

Introduction

The complexity of motor activities and sports requires the study of the elements that not only characterize them but also give a simpler and greater understanding of the phenomenon. The reason for this orientation is determined by the desire to help those who either directly or indirectly deal with the subject areas relating to the analysis of human movement and motor activities in general. An attempt to simplify makes it possible to classify motor activities. A comprehensive classification can provide a good understanding in the methods used in a particular movement activity as well as the opportunity to develop research projects that may be useful in developing such methods.
Movement activities, given the variety and complexity of their forms, are considered a complex system that is generally regarded and classified according to:

- specific purposes;
- environment where it is practiced;
- the type of participation;
- the type of choice of commitment and practice.

The complexity of this phenomenon requires further evaluation and analysis related to space, distances, equipment, as well as quantitative and qualitative performance characteristics.

[1] **Rodolfo Vastola** has edited the analysis of research and the literary review.
[2] **Carmen Palumbo** has edited the introduction and methodological aspects.
[3] **Maurio Sibilio** Scientific Director of the Article

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The aim of the research is to analyze movement activities and develop a possible classification targeted at studies that take into account:

- the quantitative and qualitative parameters;
- the technical features and performance,
- the distances;
- the equipment used.

Methodology

The research was carried out through a theoretical-argumentative approach and was based on a review of the current literature on the classifications of motor activities and sport. Elements from previous classifications as well as additional categories and subcategories of quantitative and qualitative parameters that will satisfy the aim of the research were highlighted.

Results

Movement activities can be analyzed according to:

- the type of performance;
- the type of space and distance between the athletes;
- the characteristics of the equipment used and the way they are used;
- the structural characteristics of the performance required;
- the quantitative characteristics of the performance required;
- the quality characteristics of the performance required;.

Motor activities and sports **according to the type of performance** can be analyzed in relation to *the prevailing impact of energy processes that determine the operating performance* (Bellotti et al., 1978) and can be classified into:

a. *Alactic-acid or power sports movement activities* (Dal Monte, 1977), when the type of performance required by the motor activity or sport includes a priority commitment of the anaerobic energy system ATP-Pcr,
b. *Predominantly lactic acid movement activities* (Dal Monte, 1977), when the physical effort is such to assume the use of the anaerobic glycolytic energy system (Wilmore H.J., Costill D.L., 2008). These movement activities provide an extension of the average maximum effort. It should be noted that some sports are characterized by the repetition of actions or gestures, with the energy resources, in this case, initially coming from the anaerobic system ATP-Pcre in continuous activity from the anaerobic glycolytic energy system (Altimari, J.et al.2007). These include most motor activities and sports.
c. *Predominantly aerobic movement activities*, when physical activity is over an extended period of time and low-intensity, using mainly aerobic energy mechanisms. These include all those activities with minimum workloads and prolonged over time, such as walking or running at low intensity (Helgerud, J. et al. 2007) . Dal Monte develops a subdivision defining anaerobic-aerobic systems, predominantly alternating aerobic and aerobic.

Movement activities, **according to the type of spaces and distances between people during the motor action** can be classified into:

a. *Distance movement activities*, corresponding to motor activities in which there is no contact between athletes. These include jogging, spinning, etc.
b. *Distance sports* are those sports where the athletes compete without there being any direct contact between them. (tennis, volleyball, archery, etc.).
c. *Direct contact movement activities*, corresponding to motor activities and sports where competition involves physical contact between athletes. These may correspond to different free games, games with a not encoded ball etc.

c.1) Contact sports *can be classified into the following subcategories*:

- Disciplines with contact for attack and defence purposes, in which the contact is intended to help execute actions to obtain a final result that correspond to protective or offensive movements. These include boxing, wrestling, martial arts, etc..
- Disciplines where contact has the aim of facilitating tactical tasks, in which case the contact is intended to facilitate the actions of attack and defence as well as the success of an athletic movement, to protect actions of the game, to disturb the time of execution. These include football, basketball, handball, water polo, rugby, etc..

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d) *Indirect contact movement activities*, corresponding to motor activities and sports that involve contact between athletes who compete through the use of equipment. These include free games where a piece of equipment is used or passed.

d.1) Indirect contact sports *can be classified into the following subcategories*:

- Disciplines with indirect contact for attack and defence, in which the contact is contested by the athlete through the piece of equipment and is designed to execute actions relevant to the final result. These include fencing, kendo, etc..
- Disciplines with indirect contact for tactics or strategy, in which the contact is through pieces of equipment and is designed to facilitate the actions of attack or defence to either protect or disrupt the game when executing a movement. These include football, basketball, etc..

Movement activities **according to the characteristics of the equipment and their use**, can be classified into:

a. *Movement activities with large pieces of equipment*, (C. Scotton, 2003) are the motor activities and sports that require the athlete to use pieces of equipment to carry out the motor action, with it not being possible to change the position of the piece of equipment. Examples of motor activities with large pieces of equipment are all movement activities carried out in the gym such as on the wall-bars or using pieces of equipment like the beam, pole, etc..

Sports with large pieces of equipment can be classified into:

- Prehension activities, in which the athlete grasps the piece of equipment and moves on it. These include gymnastics, with the horse, rings, parallel-bars, etc..
- Sliding activities in which the athlete establishes contact with the piece of equipment which he moves on and realizes the athletic movement, sliding. In these sports the large piece of equipment which is fundamental to the sport is the area in which the athlete moves, and must have specific characteristics. The ice-rink, the ski field, the skating-rink are such pieces of equipment where the athlete performs the technical activities required for the specific sport (skating, skiing, rollerblading, windsurfing , etc.).
- Thrust activities, in which the athlete exerts pressure through the piece of equipment that allows the creation of an athletic movement. These include the vault and the floor in gymnastics, climbing on artificial walls, etc..

b. *Movement activities with small pieces of equipment*, including the motor activities and sports that require the athlete to move the piece of equipment. Motor activities with small pieces of equipment are all those non-sporting activities that use these aids to make it possible to characterize and practice it. Small pieces of equipment used in sports may be used for most of these activities.

Sporting activities with small pieces of equipment can be classified into:

- ✓ **Activity with throwing equipment**, which includes the catching and throwing of a piece of equipment. These include basketball, shot-put, discus, javelin, handball, baseball, polo, etc;
- ✓ **Activity with direct striking equipment**, which requires that the athlete directly hits the piece of equipment in order to throw or direct it. These include volleyball, soccer, etc.;
- ✓ **Activities with equipment directed with other striking equipment**, which involves the use of a piece of equipment by the athlete to hit and direct another piece of equipment. Examples include tennis, cricket, polo, golf, shooting;
- ✓ **Activity with indirect striking equipment**, involving the use by the athlete of a piece of equipment to strike an opponent. These include fencing, kendo etc.;
- ✓ **Activity with precision equipment**, which involves the use by the athlete of a piece of equipment to carry out specific actions, aimed at directing other pieces of equipment toward a target. Examples are archery, rifle shooting, etc.;
- ✓ **Activity with thrust equipment**, which involves that the athlete in realising the athletic movement is pushed when using the piece of equipment. Examples include canoeing, rowing, pole-vaulting, etc..

Movement activities, **according to the structural characteristics of the performance required** can be classified into:

a. *Principally cyclical activities* (Scotton C., 2003), characterized by visually recognizable movements that are repeated at low, medium and high frequency during the entire competition, whose effectiveness can be evaluated using the parameters of:

- time, corresponding to the number of cycles of movement achieved in an established time period;
- space, corresponding to the number of cycles completed over a preset distance;
- effectiveness, corresponding to the maximum ratio between the characteristics of the subject, performance power and execution. Examples in sport are the movements for running, swimming, etc..

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b. *Principally combinatorial activities* (Scotton C., 1983), characterized by the combination of different motor movements necessary for the execution, whose effectiveness can be evaluated using the following parameters:
   - functionality of the various movements for the final result of the execution;
   - time of completion of the motor combination;
   - distance travelled through the combination of movements.

Examples are the floor exercise in gymnastics, synchronized swimming, the triple jump, etc..

Movement activities, according to **the quantitative characteristics of the performance required** can be classified into:

- ✓ *Activities to execute a single movement* (Schidmt R.A., Lee T.D., 2005), corresponding to those activities whose performance is the execution of a single movement or gesture. In sports, these include the initial phase of archery, shot-put, etc..
- ✓ *Single execution of a motor combination activities* (Farrell, JE, 1975), consist of those activities whose performance consists of different linked movements. In sports, these include the approach in the high jump, the run-up in the triple jump, etc..
- ✓ *Repeated execution of the same movement activities* (Aune, T.K. et al. 2008), corresponding to those activities where the performance involves repeating the same movement or unique link between repetitions of the same movement. In sport, there are several examples, a series of the same blows in boxing, the pedal in cycling, the strokes in swimming, etc..

- ✓ *Single execution of repetition of various movements activities*, (Schidmt R.A.,Wrisberg C.A.., 2008), corresponding to those activities in which the moment of execution involves the link between the repetition of different movements. In sports, the examples include a continuous series of repeated, different blows in boxing, the pedal in cycling under different conditions (standing and sitting), etc..

Movement activities **according to the quality characteristics of the performance required** can be classified into:

- ✓ *Low expected demand activities* (Schidmt R.A.,Wrisberg C.A.., 2008),, characterized by execution forms subject to a low percentage of variability of the responses. These movement activities in a performance may be subject to a small number of problematic situations which are highly predictable using a small number of variables on which to build. A perfect example is sprinting, which can be linked to the execution variability of the start, the frequency of the race, the width of the stride, acceleration and thrust.
- ✓ *High expected demand and high execution variability activities* (Schidmt R.A.,Wrisberg C.A.., 2008), characterized by the large number of variables required by the problematic situations whose characteristics require the use of combined motor skills, integrated and targeted to the specific problem to be solved. Examples are the movements from the games of football, basketball, etc..
- ✓ *High reproductive demand activities* (Schidmt R.A.,Wrisberg C.A.., 2008),, characterized by low variability execution, with the characteristics requiring to accurately reproduce actions that have already been executed. The variability may depend on execution error or differences of reproductive movements, both positively and negatively. An example is springboard or platform diving.

Discussions and conclusions.

The need to collocate the activities into macro-categories allows the users to have immediate information on the common characteristics of that group as well as possible differences with groups that have similarities in order to avoid the problems generated by the wide variety and complexity that characterizes systemic motor activities and sports.

Through a classification that takes into account several specific variables such as conditional, temporal and spatial aspects, a theoretical framework has been created for studies aimed at investigating motor activities and sports.

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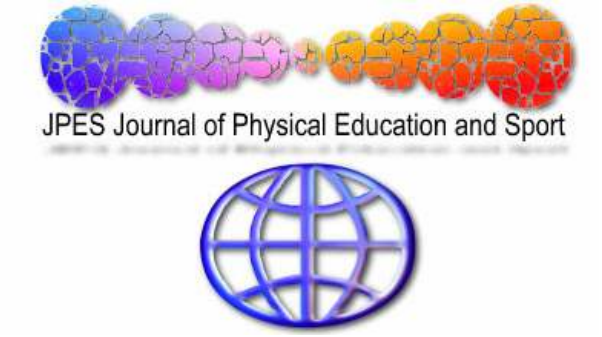

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ORIGINAL RESEARCH

DYNAMICS OF TECHNICAL ELEMENTS TEACHING WIHIN A TRAINING MEZZO-CYCLE IN WOMEN'S ARTISTIC GYMNASTICS

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Abstract: The paper is meant to point out the contents of the technical elements teaching at different apparatus within a training mezzo-cycle in women's artistic gymnastics. With this aim in view, we have considered that the efficient use of the preparatory exercises during the training sessions will emphasize the dynamics of the technical elements teaching at various apparatus in women's artistic gymnastics.
Key words: *stages, technical elements, gymnastics, teaching.*

This set of problems determined us to conduct a study within the School Sports Club no.2 of Bucharest, „Obor" Gym; our subjects were 4 girl gymnasts of 12 to 14 years old, juniors of 3rd and 4th level, multiple national champions at different apparatus.

The results of the study emphasize the stages of the technical elements teaching at different apparatus in conformity with the training level of each gymnast separately and the objectives of the training mezzo-cycle.

These results demonstrate that each girl gymnast has a certain level of training and the efficient use of the teaching methods contributed to the more efficient assimilation of the technical elements at different apparatus. Thus, the individualized use of the preparatory exercises depending on the gymnasts' training level has as result the continuity of learning the technical elements at different apparatus in women's artistic gymnastics.

Introduction

At the present moment, the artistic gymnastics has reached a very high training level. Also, after each Olympic Games edition, the International Federation and the Technical Commission change the requirements of the apparatus exercises contents by means of the Code of Points; they modify the elements difficulty and the specific penalizations at apparatus too (FIG, 2009).

The purpose of the paper is to emphasize the contents of the technical elements teaching at different apparatus in women's artistic gymnastics, along a training mezzo-cycle.

Paper Hypothesis

We consider that the efficient utilization of the preparatory exercises during the training sessions will lead to the outlining of the technical elements teaching dynamics at different apparatus in women's artistic gymnastics.

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Theoretical- methodical aspects of the teaching in women's artistic gymnastics.

The rich and various contents of the artistic gymnastics are characterized by the high technical level. Each movement has a special technique, so all movements must be learned. Some of them have a simpler structure, other are technically more complex and have a high difficulty level, requiring some specific skills. The technical training in gymnastics should be treated with a particular attention; each new element to be learned should be based on the already correct previously assimilated knowledge (Vieru N., 1997).

The process of teaching the gymnastics technical elements is a system of successive actions from the teacher's (coach's) and the athlete's part. The performance of some correct tasks in a successive manner, in an appointed time creates the possibility to divide into stages the whole learning process: *stage of initial learning, thorough study, consolidation and improvement*. (Grigore V., 2003).

Depending on the learning stage, the whole system of training methods and procedures– as a training process – is used in the gymnastics motor learning. The methods and procedures are used depending on the female gymnast's technical and physical training level, on the technical element structure and difficulty level and on the learning stage. An important factor of the learning process in the artistic gymnastics is the transfer, which can be considered the superior stage of the learning (Potop V., 2008).

Contents of the study

The premise of our study is that the preparatory exercises individualized use during the training stage will lead to the continuity of the training at uneven parallel bars and to the successful participation in events.

This topic has lead to the organization of a case study at the School Sports Club no.2 of Bucharest, with a group of 4 junior female gymnasts of 3rd and 4th level, whose training progresses were reviewed.

The study was carried out along a period of 4 micro-cycles, including a mezzo-cycle for the preparation of the training period basic stage (16.XI.2009- 11.XII.2009).

The contents of the study carrying out show the goals and the means of the training mezzo and micro-cycles within the technical training at different apparatus during the preparatory period.

Table no.1. Teaching of Tzukahara vault with backward tucked salto

Contents of the means		
Stage - **Initial**	Stage - **Consolidation**	Stage - **Improvement**
- Handspring with 180° twisting and landing on stacked mats - 15x -Rotating on corbett springboard with back landing on mat (preparatory exercise) - 15x	- Tzukahara vault – landing in pit, with help – 15x - Tzukahara vault – landing in pit, without help - 10x	- Tzukahara vault with landing on „hard" surface, with help - 10x - Tzukahara vault with landing on „hard" surface, without help – 5x
Group of vaults and code: 3.10 Graphic symbol:  , Value of difficulty : 4.00 points		

Figure no.1. Tzukahara vault with backward tucked salto

In table no.1 and figure no.1 are shown the methods to learn the Tzukahara vault with backwards tucked salto; the stages and means used during the training are pointed out.

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Table no.2. Learning of the double backward tucked salto dismount from uneven parallel bars

Contents of the means		
Stage - **Initial**	Stage - **Consolidation**	Stage - **Improvement**
Uneven parallel bars *- pit: with help* - Handstand balance with double salto -2x; - Back giant , double salto dismount -3x - Two giants , double salto dismount -5x	*Competition uneven parallel bars: assisted* - Two giants , double salto dismount -5x	*-Exercises with help / assisted* Lower bar: Handstand straightening, two free circles, circle on soles, jump on the upper bar, two giants, double salto dismount -5x - *Integral exercises without help / assisted* Upper bar: Handstand straightening, handstands balance with 180º twisting, handstand straightening, handstand balance, free circle, stretching, under-balance on the upper bar, handstand backwards balance stretching, two back giants, double backward tucked salto dismount - 5x
Element code: 6.205 Graphic symbol: , Value of difficulty: B- 0.2 points.		

Figure no.2. Dismount through back giant, double backward tucked salto, with and without help (N.L)

In table no.2 and figure no.2 are introduced the learning methods of the double backward tucked salto dismount from the uneven parallel bars, pointing out the stages and the means used during the training.

Table no.3. Learning of forward „Danilova" on the beam
Free (aerial) walkover fwd, landing on one or both feet

Contents of the means		
Stage - **Initial**	Stage - **Consolidation**	Stage - **Improvement**
Floor: - Free walkover fwd (Danilova) -5x *Low beam:* - Free walkover fwd -10x	*Balance beam :* - Free walkover fwd (Danilova) with „mat"-with help-10x - Free walkover fwd (Danilova) without help -5x	„ – „ – „ – „ – „ – „ – „
Element code: 5.410 Graphic symbol: , Value of difficulty: D- 0.4 points		

Table no.3 and figure no.3 introduce the methods to learn the free walkover fwd (Danilova) on the balance beam, pointing out the stages and the means used during the training.

Figure nr.3. Forward walkover on floor and on balance beam (BR)

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Table no.4. Learning of the acrobatic line „Backward flick-flak rotation *backward walkover with 540° turn* linked to *forward tucked salto*"

Contents of the means		
Stage - **Initial**	Stage - **Consolidation**	Stage - **Improvement**
- Flick rotation backward walkover-1x - Flick rotation backward walkover with 360º turn -2x - Flick rotation backward walkover with 540º turn-3x - Flick rotation backward walkover with 540º turn linked to forward tucked salto -3x	- Flick rotation backward walkover with 540º turn-3x - Flick rotation backward walkover with 540º turn linked to tucked forward salto-3x - Rotation backward walkover-1x - Rotation backward walkover with 360º turn -2x - Rotation backward walkover with 540º turn-3x - Rotation backward walkover with 540º turn linked to tucked forward salto -3x	„ – „ – „ – „ – „ – „ – „
Element code: 5.301+ 4.101 Graphic symbol: , Value of difficulty: C+A , 0.3pct. + 0.1pct.		

Figure no.3.Rotation backward walkover with 540° turning

Table no.4 and figure no.4 introduce the methods to learn the „ Backward flick-flak rotation *backward walkover with 540° turn* linked to *forward tucked salto"*, pointing out the stages and the means used during the training.

During this preparatory period, the training objectives did not aim at the improvement of the technical elements; it was only at the uneven parallel bars that we have tried to reach this level, as the uneven parallel bars are a more „difficult" apparatus and it is good to use more complex exercises during the training too; such exercises can contribute to the increase of the specific endurance and to the learning of some new elements of higher difficulty.

Methods of research

- *Method of bibliographic study* – it was meant to provide the theoretical documentation of the paper;
- *Method of observation* – it was used all along the study carrying out, in training sessions and events as well;
- *Experimental method* – meant to confirm or to invalidate the study hypotheses;
- *Statistical-mathematical method and graphical method,* using the most usual statistical indices: arithmetic mean – X, deviation of the mean – Am, standard deviation –S, coefficient of variability – Cv%, correlation – r Spearman and correlation significance – t.

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Results of the study and their interpretation

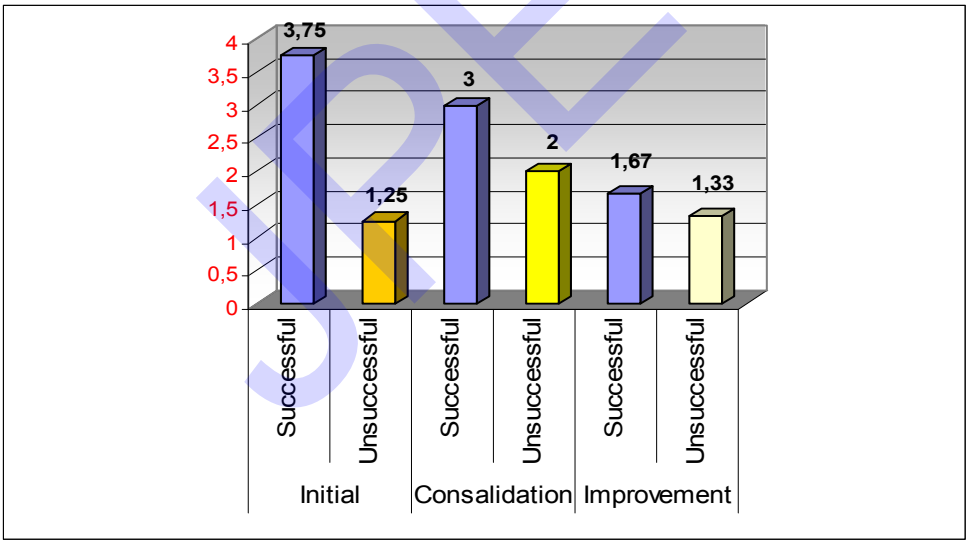
Table no.5. Dynamics of double backward tucked salto dismount teaching at uneven parallel bars

Full name	Initial		Consolidation		Improvement	
	Successful	Unsuccessful	Successful	Unsuccessful	Successful	Unsuccessful
Ş.C.	3	2	2	3	1	2
T.C.	4	1	3	2	2	1
B.R.	5	0	4	1	2	1
N.L.	3	2	3	2	-	-
Statistical indices						
X	**3.75**	**1.25**	**3.00**	**2.00**	**1.67**	**1.33**
Am	0.75	0.44	0.50	0.50	0.44	0.44
S	0.83	0.47	0.47	0.71	0.47	0.47
Cv%	22.11	28.28	23.57	35.36	28.28	35.36

Table no.6. Teaching stages correlation with the reps number

r - Spearman t- Student		Initial		Consolidation		Improvement	
		Successful	Unsuccessful	Successful	Unsuccessful	Successful	Unsuccessful
Initial	Successful			0.85 2.28		0.90 2.92	
	Unsuccessful				0.85 2.28		0.10 0.14
Consolidation	Successful					0.55 0.93	
	Unsuccessful						0.55 0.93

In the tables no.5 and 6 are shown the results of the statistical-mathematical indices calculation for the double backward tucked salto dismount learning dynamics at uneven parallel bars; the stages and the assessment are pointed out. The observation of the girl gymnasts' progresses shows that during the improvement stage the girl gymnast N.L. has no grade as she was in the initial learning stage and she did not succeed to go through all learning stages.



Graph no.1. Dynamics of the double backwards tucked salto landing from uneven parallel bars

The results of the calculations point out that during the initial stage, 3.75 points are successful and 1,25 points unsuccessful out of 5 attempts, having a low homogeneity. Regarding the correlation of the *learning stages with the number of reps, insignificant differences between stages are visible,* excepting the correlation of the initial stage with the improvement stage, which has significant values at p-0.05; $t_{critical}$ is 2.92 at the unilateral test significance threshold.

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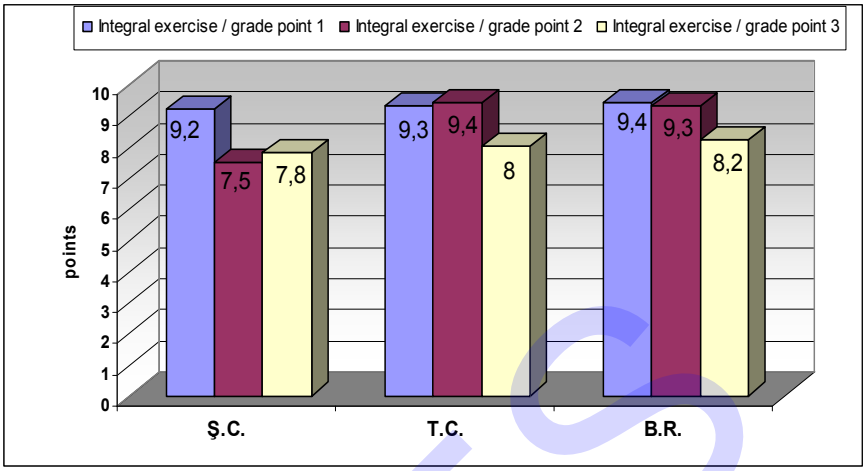
Table no.7. Improvement of the double backward tucked salto landing from uneven parallel bars

Full name	Integral exercise / grade points		
	1	2	3
Ş.C.	9.2	7.5	7.8
T.C.	9.3	9.4	8.0
B.R.	9.4	9.3	8.2
Statistical Indices			
X	9.30	8.73	8.00
Am	0.07	0.82	0.13
S	0.08	0.87	0.16
Cv%	0.88	10.0	2.04



Graph no.2. Improvement of the double backward tucked salto landing from uneven parallel bars

Table no.7 and graph no.2 show the results of the improvement of the *double backwards tucked salto landing from uneven parallel bars,* pointing out the executions of the girl gymnasts in the 3 integral exercises, where at the first attempt is obtained an average score of 9.30 pct, a decrease of the average score by 0.57 points at the second execution and a decrease by 1.30 points at the third execution. These poorer results render evident the fact that the girl gymnasts do not master well this element yet within the integral exercise and that they still need a greater number of training sessions.

Conclusions

In order to provide an efficient technical training it is important that the number of attempts and the passage from a preparatory exercise to another one is made depending on the technical correctness of the gymnasts' individual possibilities and attempts; in proportion as a certain exercise is learnt, the number of reps is gradually reduced and another exercise, more complex, will be aimed at.

The results of the study emphasize the stages of the technical elements learning at various apparatus depending on each girl gymnast's training level and on the objectives of the training mezzo-cycle.

These results prove that each girl gymnast has a certain training level and the efficient use of the teaching methodology contributes to the more efficient learning of the technical elements at different apparatus.

The selection of the more efficient means during the training sessions renders evident the dynamics of the technical elements learning at different apparatus. The individualized use of the preparatory exercises depending on the girl gymnasts' training level leads to the continuity of the technical elements learning at different apparatus in women's artistic gymnastics.

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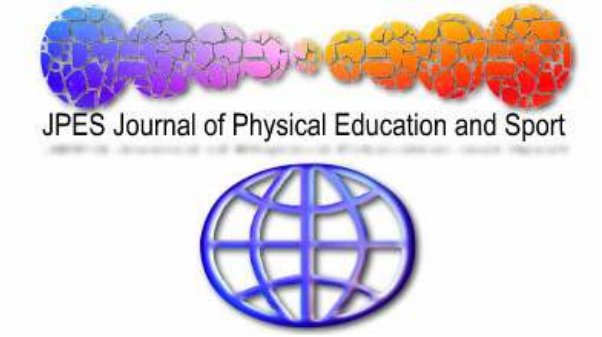

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ORIGINAL RESEARCH

THE EFFECT OF SURYANAMASKAR YOGASANA ON MUSCULAR ENDURANCE AND FLEXIBILITY AMONG INTERCOLLEGE YOGINIS

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Abstract
Study aim: To assess the effects of suryanamaskar yogasana on muscular endurance and flexibility. **Material and methods:** Thirty randomly selected female students aged 17-25 years volunteered to participate in the study. They were randomly assigned into two groups: A (experimental) and B (control). The subjects were subjected to a six week suryanamaskar yogasana training programme. The difference in the mean of each group for selected variable was tested for the significance of difference by "t" test. The level of significance was set at 0.05.
Results: The muscular endurance and flexibility significantly improved in group A compared with the control one. **Conclusions:** Suryanamaskar asana may be recommended to improve muscular endurance and flexibility.
Keywords: Suryanamaskar – Yogasana - Muscular Endurance – Flexibility - Yoginis

INTRODUCTION

India has a rich tradition of yogic practices. Now-a-days yoga, the ancient practice of postures, breathing and meditation is gaining a lot of attention from health care Professionals. With increasing scientific research in yoga, its therapeutic aspects are also being explored. Suryanamaskar – the salutation to the god sun is also a part of Indian traditional yogic practices. Each cycle of suryanamaskar is a sequence of certain 'asanas' performed along with pranayama' The nomenclature 'suryanamaskar' is composed of two terms 'surya' (meaning 'the sun god') and 'namaskar' (connoting obeisance). Both the words have their roots in Sanskrit. Surya Namaskara is a series of 12 physical postures made up of a variety of forward and backward bends. The sequence of asanas is such that each asana is complimentary to the next. During Suryanamaskar, muscles of the entire body experience stretch and pressure alternately and therefore it is said to give more benefits with less expenditure of time. The series of movements stretch the spinal column and massage, tone and stimulate vital organs through alternately flexing the body forwards and backwards. While performing surya namaskar the breathing exercise (pranayam) gives more oxygen to your lungs. The rhythm of breathing becomes heavy with vitality. Each breath becomes deep and clear. It carries more oxygen to the parts of your body. Surya namaskar has a deep effect in detoxifying the organs through copius oxygenation and has a deeper relaxing effect. It reduces stress, rejuvenates us and improves circulation and as a result this study was undertaken to find out the effects of suryanamaskar yogasana on muscular endurance and flexibility.

MATERIAL AND METHODS

Subjects: Thirty randomly selected female students of the DAV Institute of Engineering and Technology, Jalandhar (Punjab, India), aged 17 – 25 years, volunteered to participate in the study. They were randomly assigned into two groups: A (experimental) and B (control). The subjects from Group A were subjected to a 6-week suryanamaskar *asana* training programme. This lasted 6 weeks and consisted of daily sessions, lasting 90 min each, which included 12 positions: Mountain pose (Parvatasana), Raised Arms Pose (Hastha

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uthanasana), Hand to Foot Pose (Padahastanasana), Equestrian Pose (Aswa sanchalanasana), Salute with eight limbs (Ashtanga namskar), Serpent pose (Bhujangasana) and Prayer pose (Pranamasana). (Fig. 1).

Methodology: The sit-up test was used to measure the muscular endurance of the abdominals and hip-flexors and the sit and reach test used to measure the lower back and hamstring flexibility. The sit-up test consists of maximum number of sit ups performed in one (1) minute is recorded. Alternatively, the test may be performed at a set tempo, and the maximum number of total sit-ups is recorded. For this method, a metronome was set at the desired tempo. The sit and reach test involves stretching out to touch the toes or beyond with extended arms from a sitting position. The score is in inches reached on a yard stick with 15 inches being at the toes.

The between-group differences were assessed using the Student's *t*-test for dependent data. The level of $p \leq 0.05$ was considered significant.

Fig. 1. The 12 steps of Suryanamaskar

RESULTS

The study was conducted to find out the effects of suryanamaskar yogasana on muscular endurance and flexibility among intercollege yoginis. The statistical analysis of data collected on thirty (N=30) subjects. For

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each of the chosen variable, the results pertaining to significant difference, if any, between experimental and control groups were assessed by "t" test and are presented in following tables:

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	32.5333	36.2000
95% CI for the mean	29.7973 to 35.2693	33.9244 to 38.4756
Variance	24.4095	16.8857
Standard deviation	4.9406	4.1092
Standard error of the mean	1.2757	1.0610
Mean difference		3.6667
Standard deviation		1.7995
95% CI		2.6702 to 4.6632
Test statistic t		**7.892**
Degrees of Freedom (DF)		14
Two-tailed probability		P<0.0001

Table 1.. Muscular Endurance of Experimental Group Paired Samples t-Test

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	33.3333	33.2000
95% CI for the mean	30.6312 to 36.0355	30.7753 to 35.6247
Variance	23.8095	19.1714
Standard deviation	4.8795	4.3785
Standard error of the mean	1.2599	1.1305
Mean difference	-0.1333	
Standard deviation	2.2949	
95% CI	-1.4042 to 1.1376	
Test statistic t	**-0.225**	
Degrees of Freedom (DF)	14	
Two-tailed probability	P=0.8252	

Table 2. Muscular Endurance of Control Group Paired Samples t-Test

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	32.5333	4.9046	1.2757	**7.892**
Experimental (Post-test)	15	36.2000	4.1092	1.0610	
Control (Pre-test)	**15**	**33.3333**	**4.8795**	**1.2599**	**-0.225**
Control (Post-test)	**15**	**33.2000**	**4.3785**	**1.1305**	

Table 3. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) of Muscular Endurance of Experimental and Control Group

Table-3 shows that the mean of muscular endurance of pretest of experimental group and posttest of experimental group was 32.5333 and 36.2000 respectively, whereas the mean of muscular endurance of pretest of control and posttest of control group was 33.3333 and 33.2000. The "t" value in case of experimental group was 7.892 and for control group it was -0.225. Since cal. t (=7.892) > tab t .05 (14) (=2.145), Ho (null hypothesis) is rejected at 0.05 level of significance. Thus it may be concluded that six week training program of Suryanamaskar yogasana showed significant improvement in muscular endurance. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in (Fig. 2).

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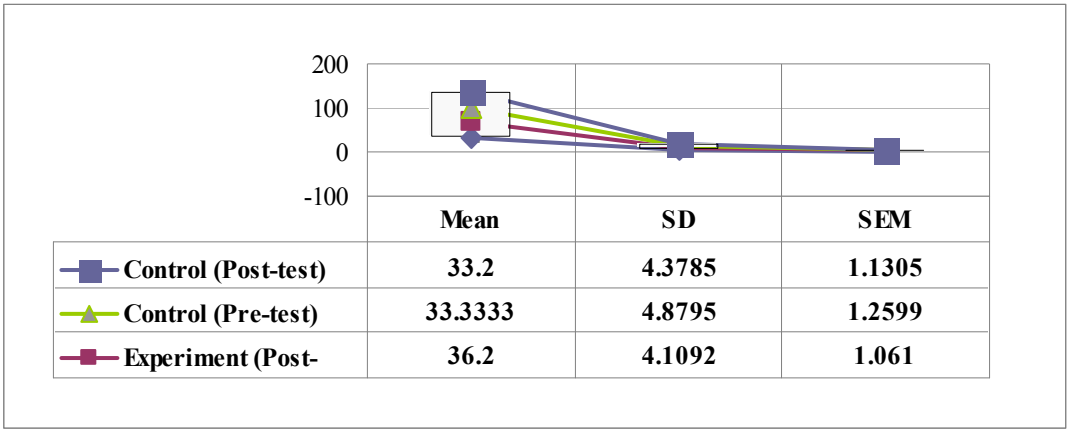

	Mean	SD	SEM
Control (Post-test)	33.2	4.3785	1.1305
Control (Pre-test)	33.3333	4.8795	1.2599
Experiment (Post-	36.2	4.1092	1.061

Fig. 2. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) Of Muscular Endurance of Experimental and Control Group

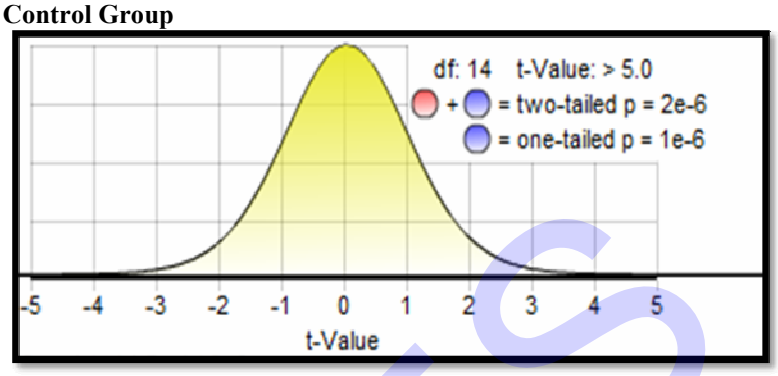

Fig. 3. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Experimental Group of Muscular Endurance

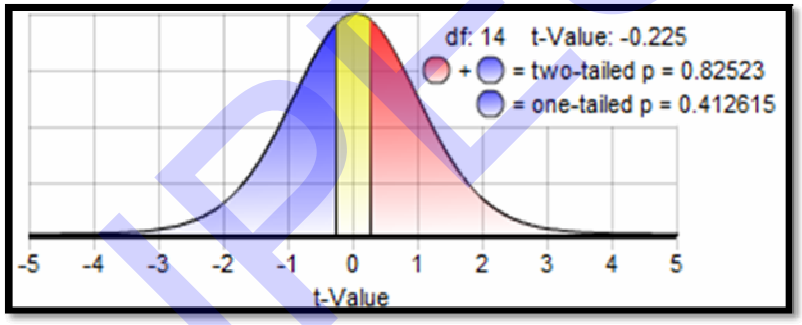

Fig. 4. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Control Group of Muscular Endurance

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	4.6667	5.7333
95% CI for the mean	3.8382 to 5.4951	4.8840 to 6.5827
Variance	2.2381	2.3524
Standard deviation	1.4960	1.5337
Standard error of the mean	0.3863	0.3960
Mean difference		1.0667
Standard deviation		1.0998
95% CI		0.4576 to 1.6757
Test statistic t		**3.756**
Degrees of Freedom (DF)		14
Two-tailed probability		P=0.0021

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Table 4. Flexibility of Experimental Group Paired Samples t-Test

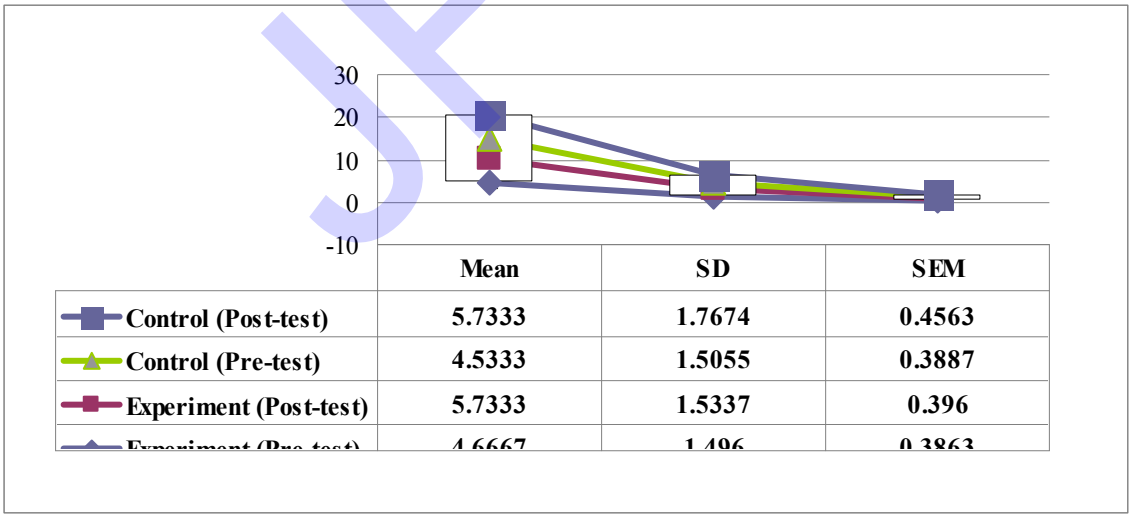
	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	4.5333	4.4667
95% CI for the mean	3.6996 to 5.3671	3.4879 to 5.4454
Variance	2.2667	3.1238
Standard deviation	1.5055	1.7674
Standard error of the mean	0.3887	0.4563
Mean difference		-0.06667
Standard deviation		1.1629
95% CI		-0.7107 to 0.5773
Test statistic t		**-0.222**
Degrees of Freedom (DF)		14
Two-tailed probability		P=0.8275

Table 5. Flexibility of Control Group Paired Samples t-Test

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	4.6667	1.4960	0.3863	**3.756**
Experimental (Post-test)	15	5.7333	1.5337	0.3960	
Control (Pre-test)	**15**	**4.5333**	**1.5055**	**0.3887**	**-0.222**
Control (Post-test)	**15**	**4.4667**	**1.7674**	**0.4563**	

Table 6. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) Flexibility of Experimental and Control Group

Table-6 shows that the mean of flexibility of pretest of experimental group and post test of experimental group was 4.6667 and 5.7333 respectively, whereas the mean of flexibility of pretest of control and posttest of control group was 4.5333 and 4.4667. The "t" value in case of experimental group was 3.756 and for control group it was 0.222. Since cal. t (=3.756)> tab t .05 (14) (=2.145), Ho (null hypothesis) is rejected at .05 level of significance. Thus it may be concluded that six week training program of suryanamaskar yogasana leads to significant improvement in flexibility. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in (Fig. 5).



	Mean	SD	SEM
Control (Post-test)	5.7333	1.7674	0.4563
Control (Pre-test)	4.5333	1.5055	0.3887
Experiment (Post-test)	5.7333	1.5337	0.396
Experiment (Pre-test)	4.6667	1.496	0.3863

Fig. 5. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) of Flexibility Volume of Experimental and Control Group

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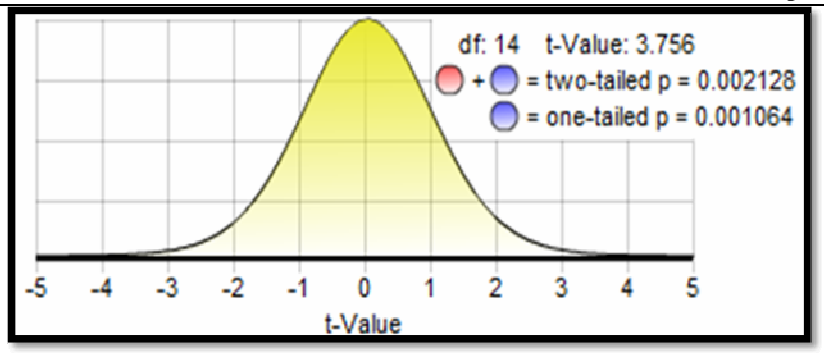

Fig. 6. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Experimental Group of Flexibility

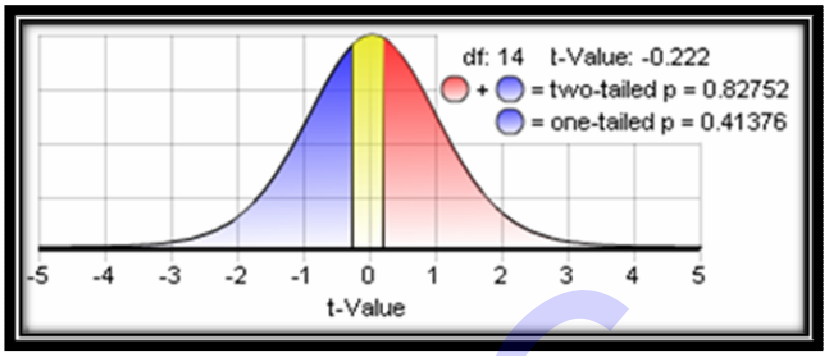

Fig. 7. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Control Group of Flexibility

DISCUSSION

From the results it is evident that the six week Suryanamaskar yogasana training programme has shown a significant improvement in muscular endurance and flexibility among intercollege yoginis. The results have shown a significant improvement in muscular endurance. The findings are supported by the study conducted by Alisha Bauman titled "Is yoga enough to keep you fit?" which concluded that statistically significant improvement indicates better respiratory endurance after regular practice of Suryanamaskar. It also confirmed the increase in VO2 max by yoga training. The study is also supported by Makwana K., Khirwadkar N. and Gupta H.C. who presented a paper titled "Effects of short term yoga practice on ventilatory function tests" which stated that regular yogic practices strengthen the respiratory muscles. Nayar H.S. and Mathur R.M also carried out a study titled "Effects of yogic exercises on human physical efficiency" which also stated that practice of Suryanamaskar increases the excursions of diaphragm and lungs as well as thoracic compliance. The results have also shown a significant improvement in flexibility. It is supported by the study of by Marieke Van Puymbroeck, Laura L. Payne and Pei-Chun Hsieh in a study titled "A Phase I Feasibility Study of Yoga on the Physical Health and Coping of Informal Caregivers" which concluded that that an 8-week Hatha yoga program for informal caregivers has the potential to increase the coping ability, strength, flexibility and endurance of informal caregivers.

CONCLUSION

Summing up, the 6-week training programme of suryanamaskar asanas had significant effect on muscular endurance and flexibility. Thus, such training may be recommended to improve physical fitness-based performance.

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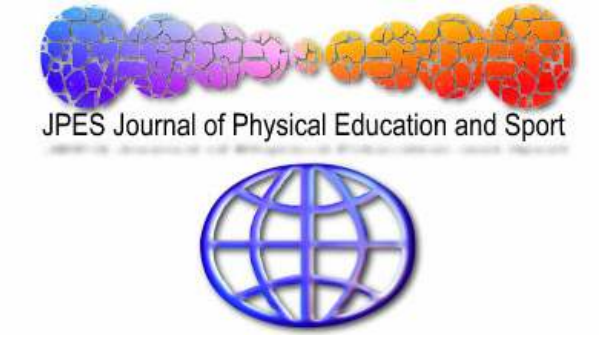

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ORIGINAL RESEARCH

USING WHOLE BODY VIBRATION TO IMPROVE JUMP ABILITY IN YOUNG RECREATIONAL SPORTMEN

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ABSTRACT

The whole body vibrations (WBV) it is nowadays one of the most widely used methods for improving the explosive strength. In this study, 12 subjects participating in recreational physical activity were allocated to a 5 sets of 60 s training, using a frequency of 30 Hz, an amplitude of 2.5 mm. and a isometric position (110 ° bending knees) on a Galileo Fitness ® (Novotech, Germany) platform. The results showed an increase in SJ (+1.76 ± 4.05 cm) and CMJ (+1.10 ± 3.20 cm) in the post-test conducted just after the vibration. The values of the post-test performed 30 minutes after the squat jump remained above the ones of pre-test but just below the ones of the immediate post-test (+0.42 ± 4.43 cm). By contrast the values in the counter movement jump drop below the pre-test ones (-0.12 ± 2.45 cm). Based on these data it seems that when the frequency is not high it is necessary to use a greater amplitude in order to achieve the desired effects. The effect achieved after the vibration is transient, not remaining after 30 minutes.

KEYWORDS: Whole body vibrations (WBV), Counter-Movement Jump (CMJ), Squat jump (SJ), Explosive Strength.

Introduction

Whole body vibration (WBV) is nowadays one of the main lines of research due to the multiple possible effects on the body (Cardinale and Bosco, 2003). Some studies have shown how the exposure to low amplitude and high frequency vibration can improve strength, balance and hormonal profile (Cardinale y Bosco, 2003; Kvorning et al., 2006).

The WBV methodology needs to define the characteristics of the vibration, so, it is necessary to define the frequency, amplitude, duration and magnitude used (Luo, McNamara and Moran, 2005). The frequencies used for these exercises ranging from 15 to 44 Hz, while the amplitudes between 3 to 10 mm. The acceleration values ranging from 3.5 to 15 g. With regard to the duration, short exposures, for example 4 to 5 min divided into sets of 1 min with the same rest period between series, are enough to improve muscle strength (Rittweger et al., 2000). With the increments in the length of vibration, the fatigue can appear faster and become more important.

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Longer exposures with this device may trigger the inhibitory feedback (e.g. Golgi complex) or reduce the sensitivity of muscle spindles. In general, people are using intermitent programs for no more than 30 min.
In this way the aim of the study is to know the acute and residual effect (after 30 min.) of one bout with WBV on the explosive strenght assesed by jump test such as counter movement jump (CMJ) and Squat jump (SJ)

Materials and methods

Subjects

Table 1: Descriptive data

GROUP 1	N	Minimun	Maximun	Mean	SD
Age (years)	12	18,00	36,00	22,90	5,06
Weight (Kg)	12	57,30	90,70	72,39	9,46
Height (m)	12	1,65	1,84	1,73	0,06
BMI (kg/m^2)	12	21,05	30,66	24,03	2,63

Procedures

All subjects in the study were invited to three pre-test sessions. The data were correlated in order to obtain the reliability of the (r> 0.85) and we take the third pre-test as baseline. After each intervention one post-test was carried out, analyzing the same parameters in order to identify possible variations between both test. The assesment it was performed just after the vibration and after 30 min in order to determine the residual effect. With regard to the protocol it was used the Galileo Fitness® platform (Novotech, Germany), with a frecuency of 30 Hz and an amplitude of 2.5 mm. The gravity obtained was 9.1 g. The subject remained standing on the platform adopting an isometric position with 110 degrees flexion on the knees. The duration of vibration used for this study was 5 sets of 60 s with another 60 s rest between series.

Every subject performed three CMJ and another three SJ in accordance with the protocol proposed by Cronin & Mali (2000). Each jump was recorded with precision of 0.1 cm. The rest time was 30 s between two consecutive jumps. If the difference between jump's height was more than 5% another attempt was done. The best of the three attemps was recorded. All the jumps were performed on a Ergo Tester ® contact platform (Globus, Italy).

Results

Table 2: Comparation between the data obtained drom the jump's acute effect after the test

Paired analysis		N	Mean	SD	Mean difference	SD	Sig
Pair 1	HSJpre3 (cm)	12	26,13	4,33	+1,76	4,05	0,20
	HSJpostAG1 (cm)	12	27,89	4,63			
Pair 2	HCMJpre3 (cm)	12	34,05	5,38	+1,10	3,20	0,31
	HCMJpostAG1 (cm)	12	35,15	5,15			

HSJpre3: Jump height in SJ from pre-test; HSJpostAG1: Jump height in SJ just after the test; HCMJpre3: Jump height in CMJ from pre-test; HCMJpostAG1: Jump height in CMJ just after the test.

Table 3: Comparation of the data obtained from the residual effect after the jump with the pre-test

GROUP 1		N	Mean	SD	Mean Difference	SD	Sig
Pair 1	HSJpre3 (cm)	12	26,13	4,33	+0,42	4,43	0,77
	HSJpost301 (cm)	12	26,55	4,23			
Pair 2	HCMJpre3 (cm)	12	34,05	5,38	-0,12	2,45	0,88
	HCMJpost301 (cm)	12	33,93	4,93			

HSJpre3: Jump height in SJ from pre-test; HSJpost301: Jump heiht in SJ 30 min after the test; HCMJpre3: Jump heght with CMJ in pre-test; HCMJpost301: Jump height with CMJ 30 min after the test.

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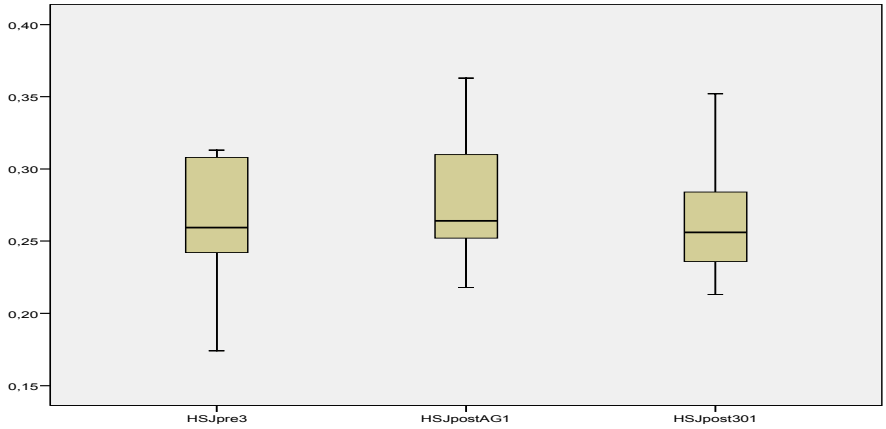

Figure 1. Squat jump height in pre-, post-, and 30 min. after the test
HSJpre3: SJ height in pre-test; HSJpostAG1: SJ height just after test; HSJpost301: SJ height 30 min after the test.

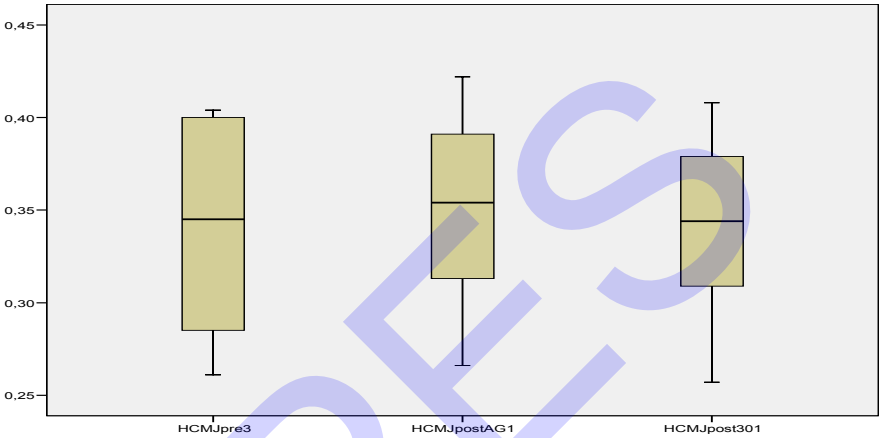

Figure 2. Counter movement jump height in pre-, post--, and 30 min. after the test
HCMJpre3: CMJ height in pre-test; HCMJpostAG1: CMJ height just after test; HCMJpost301: CMJ height 30 min after the test.

Discussion

SJ and CMJ are often used as an index of the explosive strength in the lower limb (Keogh, Weber and Dalton, 2003). Although our results showed a lack of significant effect, we found increments in both test (6.74% and 3.23% in SJ and CMJ height, respectively). Those results are in the line of other previously published (Torvinen et al., 2002a; De Silva et al., 2006; Martínez et al., 2007). Moreover, Cardinale y Lim (2003) studied the effect of WBV on SJ and CMJ jumps in 15 young people participating in recreational sports who underwent a protocol with a 4 mm amplitude and 40 Hz. Data from post-test were lower than those obtained in the pre-test. While the decline observed in SJ was not statistically significant (- 4%, $p = 0.07$) the one in CMJ it was (- 3.8%, $p < 0001$).

It seems therefore, that when the vibration does not produce fatigue and is of short duration it can produce an increase of nervous system signals and facilitate the strength generation (Cardinale and Bosco, 2003). On the other side, when we apply a stressful stimulus it can cause fatigue and then reduce the strength generation. The results suggest that when the frequency is 30 Hz we need a greater amplitude in order to get acute significant improvements in jump ability, whereas when the frequency in greater, it is necessary to use a lower amplitude in order to avoid muscle fatigue.

Regarding the residual effect, some authors suggest that the vibration effect seems to be transitional on the muscle performance (Torvinen et al., 2002). These authors found in their studies that the higher increments founds 2 min after the CMJ were not present 60 min after them (Torvinen et al, 2002). In our case, the residual effect was measured at 30 min, showing an increment for SJ (1.61%) with regard to the pre-test, although just

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6.74% was found in the immediate post-test. The CMJ drop below the pre-test level (- 0.35%). Similar results were observed by several authors (Torvinen et al., 2002; Cormier et al., 2006)

Showed results let us to go further in the study of WBV. In this way, we have seen when the frecuency is not high the amplitude have to be increased in orther to improve the explosive strength. In this way, the improvements found were not maintained after 30 min, so it can be said that the WBV effect is just transitory.

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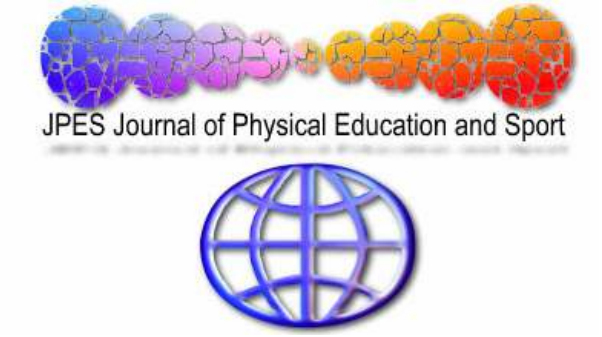

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ORIGINAL RESEARCH

STUDY ON THE EFFECTS OF AQUATIC VS. DRY LAND COMBINED CONTRACTIONS ON MUSCLE STRENGTH FOR THE STUDENTS IN PHYSICAL EDUCATION AND SPORT

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Abstract:

Researchers in our country have examined only the dry land effects of combined contractions on muscle strength. Thus, there was conducted a study during an academic year (October 2008 - May 2009), which aimed to develop and experiment some training programs through schemes of aquatic and dry land combined contractions, and test of 5 power indicators on 24 students - boys second year in the Faculty of Physical Education and Sport of Pitesti, aged 18-20 years who were selected voluntarily and divided into two experimental groups (aquatic n = 12 experimental group and dry land n = 12 control group) to compare the results of muscle strength development. The same training, testing facilities and methods were used for each assessment and lesson. Each lesson took between 65-70 minutes, three days a week. Tests were performed using Quatro Jump Kistler platform, Bosco Protocol Version 1.0.9.2., and provided information about both jump height and power and data on neuro-motor ability (fast fibers), volunteer effort, fatigue, the stretching effect or muscle elasticity. The results of the experiment showed that the experimental group improved their power indices compared with control group, which used the same dry land-adapted programs, with a value between: 2.47 and 8.47%.

Keywords: *muscle strength, aquatic, dry land, programs*

Introduction

Aquatic exercises popularity is growing. Aquatic exercises have been used initially as a means of recovering injured athletes. Sports medicine experts found that floating in water, water resistance and therapeutic massage help accelerate the healing process. Water, acting as a giant pillow, decreases muscle and tendon fatigue and protects joints. Working in water using only water resistance is in our favor because it minimizes the risk of injuries usually occurred during exercises performed on land due to impact with hard surfaces (classical fitness room floor). Water pressure acts as a muscle massage, helping the elimination of lactic acid accumulated in muscles.Water resistance is much higher than the air; aquatic exercises engage several muscles and also are more difficult to achieve. Due to unstable environment water exercises require participation of all muscle groups in an attempt to maintain our position in the water. Bodies "lose" weight in water, have an apparent weight that can be adjusted continuously up to floating (to create conditions of weightlessness).

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Benefits of aquatic activities are both internal and external, short and long term. Various studies have shown that all body systems benefit from doing regular exercises in water: circulatory, cardio- respiratory and musculoskeletal system. All musculoskeletal aspects of physical training can be improved by aquatic exercises.

Due to water resistance, both muscles are working in a pair while the body is stretched and expanded. During exercises on land, only the agonist is working.

As an environment exercise, water is 6 to 15 times more resistant than air. Strength improves any movement in any direction when the body is submerged in water. Studies indicate that water resistance property, possibly facilitates the development of muscle force and resistance to inactive participants, while maintaining strength in competitive athletes. (Krawitz, 1997).

The therapeutic effects of water have been appreciated since ancient times by ancient civilizations like Greeks, Romans, Babylonians and Egyptians. Dry land exercises have shown negative effects as well: vertebrae compaction, hernias, bone and cartilage disorders, tachycardia, etc.

They are caused by the high intensity exercises on the one hand, and the shortcomings of people's training, on the other hand. Thus, doctors and trainers had to find a "softer" means to mitigate such possible damage. Water creates a "non-impact environment," as stated by Politino, McCormick and Jeffery in 1995, producing a small request to muscles, bones and connective tissue compared with land-based activities. Water also provides buoyancy that reduces weight, anyway, movement in water increases resistance, as concluded by Sova in 1992 and Troup and Berger in 1994. Training in the aquatic environment allows individuals to train almost all body muscles and joints simultaneously, while it dissipates heat better than air. (Case, 1997; Ruoti, Troup and Berger 1994). Any movement at any speed, in any direction slows down due to water resistance.

Balan V, in 2007, stated that "water is acting on the submerged body through hydrostatic pressure, which acts on the body as long as it is sunk on all sides."

Because water is denser than air, the muscles work harder in water than in air or soil. Water is, in effect, a natural weight training machine, which can be instantly adjusted: the harder it pushes, pulls and strikes in water the more resistance it encounters.

On land, such resistance (opposition) can increase body temperature. But water dissipates heat faster than air, so water freshness keeps the body cool and fresh, as if massaged.

Previous studies supported the introduction of water activities in training programs to increase muscle strength (Weinstein, LB 1986, Martin MM 1992, Binkley HM 1996, White, T. and Smith, BS 1999), while reducing fever - muscle pain (Woods D.A , 1989). Beasly (1988) said that "the main advantage of water activities is the effect of buoyancy and water resistance of the body, as it has a minimum application on joints and muscles." It is an area that was not explored enough thus requiring investigations on the results regarding muscle strength, that it may have if we apply training programs based on the combination of muscle contractions in water.

Research Assumptions

Combining the various schemes of muscle contraction has been a constant preoccupation of specialized authors whose studies have shown the usefulness of various combinations with a view to achieve a more complex training. The preparatory muscle training can be improved, one direction being the combination of contraction schemes which are specified and approched by famous experts (Cometti G., 2005, etc.) in materials of outstanding importance.

The assessment of the materials shows that using combinations of contraction schemes is better than using each scheme separately.

Following the research carried out on land to detect the best combination of contraction schemes, on subjects of 13-14 years and 16-18 years respectively, we found out that among the six contraction combinations, the isometric-plyometric pair best contributed qualitatively and quantitatively to a greater muscle training for both upper and lower limbs.

Comparison of changes on plyometric training performance on land and water was made only for a short period of eight - twelve weeks.

Training in water allows individuals to train almost all the muscles and joints of the body simultaneously, while it dissipates heat better than air. (Case, 1997; Ruoti, Troup and Berger 1994). Politino & Co (1995) reveals that water produces resistance in all directions, 12 times more compared to the activity on land. For these reasons, conducting exercises in water may be more appropriate than using them on land as regards strength development.

Combining contraction schemes in water, plyometric – concentric for lower limbs and concentric - eccentric for upper limbs in subjects of 18-20 years has not been analyzed yet.

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Research purpose

This research aims to optimize muscle training through the development and enhancement of programs using a combination of contraction schemes for students (18-20 years) in the field of physical education and sports in water.

Research hypothesis

Increasing the strength indicator by using specific exercises based on contraction combination requires their harmonious combination with methods and means specific to aquatic environment. Therefore, using aquatic muscle training programs can obtain conclusive results on the development of strength in comparison with those performed on land.

The research importance

This paper examines the effects of a "new" form of muscle training (in the aquatic environment) through contraction combination, which can cause physical adaptation such as muscle strength development.

Material and methods

The experiment used the following research methods: measurement and testing method, educational experiment, statistical-mathematical method of data processing, comparative analysis and graphical method. Six samples were selected to assess muscle training : Squat Jump and Squat Jump with additional weight equal to body weight (SJ and SJbw) which shows the Bosco index, Countermovement Jump (CMJ), Bent Leg Jump Continuous Reference (CJbref) Continous Jump Straight Legs (CJs) and Continous Jump Bent Legs (CJb 30s) for the lower limbs through which we evaluated the level of training and progress of the experimental and control groups according to the means used in the preparation. To assess the sport students' muscle strength of the lower limbs we used the testing method through Bosco protocol applied to **Kistler Quattro Jump 9290AD** force platform measurement. Data were analyzed using Microsoft Excel, 2003.

To test the research hypothesis, dependent variables were first compared using paired t test for each group (experimental and control) to determine whether there are differences between muscle training in the aquatic environment and force training on land. We used unpaired t test to examine comparative developments of somatic, functional and motric indicators in experimental and control groups, both in initial and final testing.

The experiment was conducted inside the Olympic Basin in Pitesti, the sample experimental group consisting of 12 second year students (18-20 years) at the Faculty of Physical Education and Sport of Pitesti. The control group was represented by 12 second year students, at the Faculty of Physical Education and Sport of Pitesti, who worked in the fitness room inside the faculty. The pedagogical experiment conducted during an academic year (October 2008 - May 2009) consisted in the application of muscle training programs through combined contraction schemes in water on an experimental group and we compared the results with a control group who worked on land following the same adapted programs.

Periodization of Muscle training in the aquatic environment

The annual cycle of muscle training in the aquatic environment is divided into four main periods: initial period, passing period, peak period, and active rest period.

These training periods were divided into smaller structures (mesocycles, microcycles) that had specific objectives derived from the general objectives of the annual plan.

During the academic year 2008-2009, there were 95 training sessions, which meant 105.75 hours of muscle training in the aquatic environment.

In order to meet objectives regarding muscle preparation in water we combined contraction schemes, namely the concentric-plyometric combination for the lower limbs.

Results

The six tests that were performed using the measurement platform of Kistler Quatro Jump Bosco Protocol Version 1.0.9.2. force, gave us information about both jump height and power and data on neuromotor recruitment capacity (fast fibers), volunteer effort, fatigue, stretching or muscle elasticity.

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Statistical-mathematical analysis of the power indicators in water and on land.

Table 1. Dynamics of power indicator evolution in the lower limb muscle in initial-final testing – experimental group

Nr	Name and First name	Bosco Index %		CMJ Power W/kg		Cjbref Power W/kg		CJs W/kg		CJb 30s Power W/kg	
		TI	TF	TI	TF	TI	TF	TI	TF	TI	TF
1.	Boştinaru Dragoş	45.5	47.8	22.3	24.5	21.2	23.1	41.1	42.7	20.2	22.1
2.	Burciu Eduard	33.1	40.7	27.5	30.1	22.1	23.4	43.5	45.5	20.6	23.7
3.	Burhan Valentin	37.4	43.1	27.8	30.2	22.4	24	37.5	40.8	19	22.8
4.	Călin Gabi	37.2	42.5	23.1	24.9	22.2	25.8	45.3	46.9	19.7	21
5.	Firicel Ionuţ	41.1	45.2	21.8	23.7	23.3	25.4	29.4	34.8	19	21.9
6.	Iordache Vlad	35.1	45.4	27.1	30.6	27.4	28.5	45.6	49.6	19.4	23.7
7.	Mihăilă Marius	37.2	52.1	22.6	22.7	24.3	26.2	38.1	43.7	19.1	22.4
8.	Pleşa Alexandru	38.1	43.1	24.7	25.4	23.2	25.7	35.3	40	17.9	21.2
9.	Sârbu Mihai	37.5	40.6	25.7	28.7	24.4	28.5	41.2	44	21.7	22.2
10	Stănescu Liviu	29.4	45.3	28.5	30.9	25.2	28.8	45.5	48.4	22.7	26
11	Veselu Ovidiu	38.2	43.5	28.5	30.1	27.1	28.8	36.9	41.1	21.1	24.5
12	Vlad Andrei	47.3	51.8	24.7	25.6	25.9	28.5	50	56.9	20	24.7
	x	38.09	45.09	25.35	27.28	24.05	26.39	40.78	44.53	20.03	23.01
	S	4.86	3.79	2.50	3.07	2.01	2.18	5.65	5.60	1.32	1.52
	Cv	12.77	8.41	9.87	11.27	8.38	8.26	13.85	12.58	6.63	6.60
	t test calculated		**5,468**		**6,785**		**8,318**		**7,692**		**8,564**
			<0.001		**<0.001**		**<0.001**		**<0.001**		**<0.001**

Evolution of power factor jump in the experiment group (Table 1.)

Bosco Index- During the experiment, the experimental group average value on this indicator increased from 38.09 in initial testing to 45.09 in final testing with a significant difference of 7, critical t value = 2.179 <t calculated = 5.468, p <0.001. The null hypothesis is rejected. Homogeneity of results remains very good, CV = 12.77% in initial testing and 8.41% in final testing.

Power in Counter Movement Jump (PCMJ) - this indicator average increased from 25.35 in initial testing to 27.28 in final testing with a difference of 1.93 causing a significant change, critical t value= 2.179 <t calculated = 6.785, p <0.001. The null hypothesis is rejected. Performance hemogeneity remains very good Cv = 9.87% in initial testing to 11.27% in final testing.

Power in Continuous Jump with Bent Legs Reference (PCJbref) - Experimental group average values increased from 24.05 in initial testing to 26.39 in final testing with a significant difference of 2.34, critical t value = 2.179 <t calculated = 8.318, p <0.001. The null hypothesis is rejected. Homogeneity of results remains very good, Cv = 8.38% in initial testing to 8.26% in final testing.

Power in Continuous Jump with Straight Legs (PCJs) - experimental group average values for PCJs indicator increased from 40.78 in initial testing to 44.53 in final testing with a significant difference of 3.75, t critical values = 2.179 <t calculated = 7.692, p <0.001. The null hypothesis is rejected. Homogeneity of results remains good, CV = 13.85% to 12.58% in initial and final testing.

Power in Continuous Jump with Bent Legs (PCJb 30 s) – experimental group average values for PCJ 30s indicator increased from 20,03 in initial testing to 23,01 in final testing with a significant difference of 2,98, critical t value = 2,179 < **t calculated** = 8,564, **p < 0,001**. Null hypothesis is rejected. Homogeneity of results remains good, Cv = 6,63 % in initial testing and decreases to 6,60 % in final testing.

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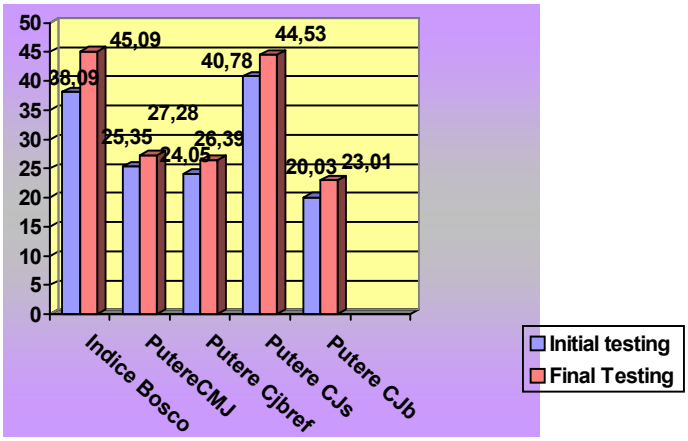

Figure 1. Dynamics of power indicator evolution in the lower limb muscle in initial-final testing – experimental group

Putere CJb – CJb Power
CJs Power
Cjbref Power
CMJ Power
Bosco Index

Table 2. Dynamics of power indicator evolution in the lower limb muscle in initial-final testing –control group

Nr	NAME AND FIRST NAME	Bosco index %		CMJ Power W/kg		Cjbref Power W/kg		CJs Power W/kg		CJb 30s Power W/kg	
		TI	TF	TI	TF	TI	TF	TI	TF	TI	TF
1.	B.A.	41.8	41.9	20.4	20.9	20.2	20.8	39.3	40.5	18.5	18.7
2.	N.E.	34.6	34.2	25.6	26.3	21.3	22	40.2	40.9	19.9	20
3.	R.D.	35.4	35.8	27.3	27.7	22.5	22.6	36.7	36.3	19.8	20.3
4.	B.I.	38.3	39.1	22.9	23.2	20.6	21.5	43.4	43.9	19.4	19.8
5.	U.A	39.2	39.8	21.9	22.2	20.5	20.6	30.5	30	18.1	18.6
6.	P.C.	34.8	34.5	26.8	27.2	26.5	26	43	44.1	19.1	20.7
7.	A.I.	36	36.7	21.8	21.3	21.8	22.3	37.3	37.9	18.7	19
8.	S.R.	37.7	38.6	24.1	24.5	23.9	23.7	34.8	35	17	17.7
9.	L.A.	37.2	37.3	24.2	24.5	23.8	23.9	40.6	40.7	20.3	20.6
10	G.V.	30.1	31.9	26.7	26.4	24.2	25.8	41.7	41.2	21.9	21.4
11	C.I.	37.8	37	27.8	28	26.9	26.6	37	37.7	20.4	20
12	D.R.	43.9	44.7	25	25.6	24.9	25.6	45.9	46.3	19.8	20.1
	x	37.23	37.6	24.54	24.81	23.09	23.45	39.2	39.54	19.40	19.74
	S	3.56	3.50	2.41	2.46	2.30	2.13	4.22	4.47	1.26	1.04
	Cv	9.56	9.31	9.82	9.93	9.96	9.08	10.76	11.32	6.49	5.31
	t calculated		**1,934**		**2,747**		**2,103**		**2,038**		**2,172**
	Critical t value		**>0.05**		**<0.05**		**>0.05**		**>0.05**		**> 0.05**

Evolution of power factor jump in the control group (Table 2)
Bosco Index – During the experiment the control group average values on this indicator increased from 37.23 in initial testing to 37.6 in final testing with an insignificant difference of 0.37, critical t value = 2.179 <t calculated = 1.934, p> .05. The null hypothesis is accepted. Homogeneity of results remains very good, Cv = 9.56% in initial testing to 9.31% in final testing.

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Power in Counter Movement Jump (PCMJ) - this indicator averages increase from 24.54 in initial testing to 24.81 i final testing with a difference of 0.27 causing an significant change, critical t value = 2.179 <t calculated = 2.474, p <0.05. Null hypothesis is rejected. Performance homogeneity remains very good Cv = 9.82% to 9.93% in initial testing and 9.93 in final testing.

Power in Continuous jump with Bent Legs Reference (PCJbref) - control group averages increased from 23.09 in initial testing to 23.45 in final testing with an insignificant difference of 0.36, critical t value = 2.179> t calculated = 2.103, p> .05. Null hypothesis is accepted.

Homogeneity of results remains very good Cv= 9.96% in initial testing and 9.08% in final testing.

Power in Continuous Jump with Straight Legs (PCJs) - control group averages increase from 39.2 in initial testing to 39.54 in final testing with an insignificant difference of 0.34, critical t value = 2.179> t calculated = 2.038, p> .05. Null hypothesis is accepted. Homogeneity of results remains very good Cv = 10.76% in initial testing and 11.32% in final testing.

Power in Continuous Jump with Bent Legs (PCJb 30s) - control group average increased from 19.40 in initial testing to 19.74 in final testing with a insignificant difference of 0 ,34, critical t value= 2.179> t calculated = 2.172, p> .05. Null hypothesis is accepted. Homogeneity of results remains very good CV = 6.49% in initial testing and 5.31% in final testing.

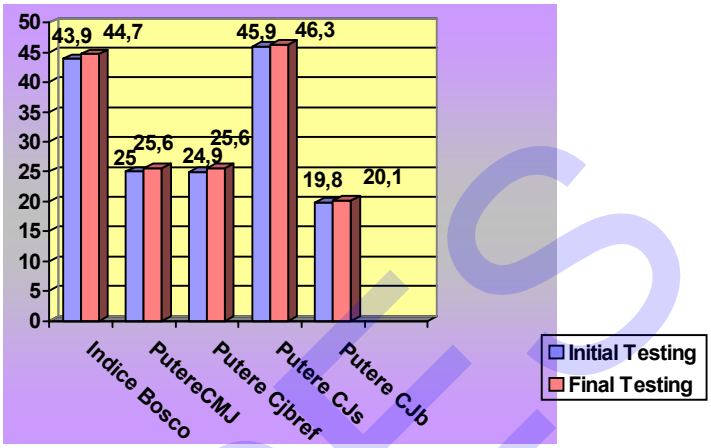

Figure 2. Dynamics of power indicator evolution in the lower limb in control group

Conclusions:

1. Earlier research in our country, have examined only the land effects of combined contraction schemes regarding strength development.

2.Due to unstable water environment and its resistance, aquatic exercises involve all muscle groups in an attempt to maintain the vertical position of the body, and the execution speed is fast and explosive, all of which are an effective way to develop strength.

3. Using muscle training programs in the aquatic environment, we have obtained efficient results regarding the power indicator for the experimental group. Data on lower limbs power assessment through Bosco Protocol applied on the measurement platform of Kistler Quatro Jump Bosco Protocol Version 1.0.9.2 form were as follows:

- Bosco index - shows a significant difference of 7 (before = 38.09, after = 45.09). This rejects the null hypothesis and accepts alternative hypothesis. (Table 1).
- Power in Counter Movement Jump (PCMJ) - shows a difference of 1.93 causing a significant change (before = 25.35, after = 27.28).
- Power in **Continuous Jump with Bent Legs Reference (PCJbref)** - presents a significant difference of 2.34 (before = 24.05 after = 26.39). This assumption rejects null hypothesis and accepts alternative hypothesis (Table 1).
- Power in **Continuous Jump with Straight Legs (PCJs)** - presents a significant difference of 3.75 (before = 40.78, after= 44.53). This rejects null hypothesis and accepts alternative hypothesis (Table 1).
- Power in **Continuous Jump with Bent Legs (PCJb 30 sec)** - presents a significant difference of 2.98 (before = 20.03, after = 23.01). This rejects null hypothesis and accepts alternative hypothesis (Table 1).

4.Given the comparative analysis of motric indicators evolution in experimental and control groups - initial testing indicates that all the five dynamic indicators of experimental group compared to the control group had

significant differences for significance level p <0.05, at the beginning of the experiment which shows the original homogeneity of the two samples.

5. After using aquatic training programs, the experimental group improved their power indices compared with control group, which used the same land-adapted programs, with a value between: 2.47 and 8.47%. This rejects the null hypothesis and accepts the alternative hypothesis.

Comparative evolution of experimental and control groups in final testing

Table. 3

	Control group	Experimental group	Difference	t - calculated	p – significance level
Bosco Index %	37.625	45.09167	8,47	**5.008294**	**p < 0,001**
CMJ Power W/kg	24.81667	27.28333	2,47	**2.167624**	**p < 0,05**
Cjbref Power W/kg	23.45	26.39167	2,93	**3.34283**	**p < 0,01**
CJs Power W/kg	39.54167	44.53333	4,99	**2.410562**	**p < 0,05**
CJb 30s Power W/kg	19.74167	23.01667	3,27	**6.143967**	**p < 0,001**

It appears that the experimental group had significant increases in all five dynamic indicators, compared to control group, for the significance level p <0.001 (two indicators), p <0.01, (one indicator) and p <0.05 (two indicators), which demonstrates the superior means used by the experimental group.

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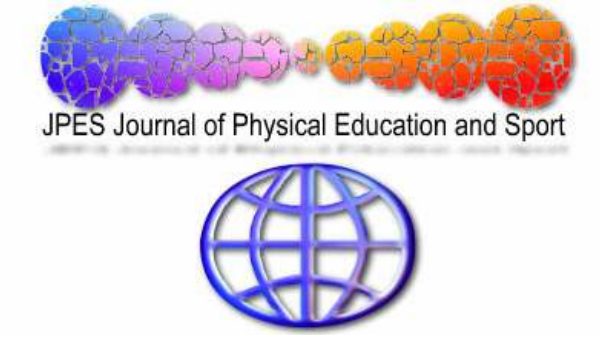

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ORIGINAL RESEARCH

RESEARCH CONCERNING THE MOTIVATION'S QUATIFICATION FOR PERFORMANCE ATHLETES

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Summary*:* Motivation in sport performance is a key factor in achieving sporting performance, without which the athletes wouldn't be determined to face the sports training effort to refine the pshyhomotric capabilities. At the basis of motivation may be its own internal or external factors. International class athletes are characterized by a high performance motivation.

Key-Words*:* athletics, quantify, motivation, performance**.**

Introduction

The issue of the psychological training in performance athletic training, in Romania, has recently come out. Now, when the recorded sportive results are very good, we consider that the psychological training can get new valences and prospects and become a challenge in order to optimize the sportive performance.

The specialty literature considers that human performance can be explained as a multiplicative factor of the motivation and possibilities/abilities, P= f(M x A), [Bologa, M., 1994, p. 119 – 125].

In performance sport, motivation can have positive or negative effects over the athlete's behavior, depending in a large measure on the organization and management way of the whole sportive training process. Motivation is one of the important factors of the sportive performance. It can be named a sportive performance source.

The research's purpose is to elaborate, test and validate some instruments for motivation's evaluation on three components of motivation structure: valence (V), expectation (E) and instruments (I), all of these emphasizing the global motivation force (GMF) of the performance athletes and motivation instruments (MI), in order to optimize the psychological training and to make it efficient by achieving the optimum motivation level, a source of performance attitudes by aware directing or self-control.

Objective: working out a study concerning the identification of quantification instruments (GMF) and their components and their validation; elaborating the items for the evaluation of the motivation's valence, the motivation's expectation and the motivation's instruments; working out a questionnaire for the checking and conceptual …. of the settled items; the analysis of the inquiry's results and the elaboration of the study's conclusions concerning motivation quantification.

The research's hypothesis

1. We consider that in performance sport we can quantify the motivation level of the athletes by establishing/objectivation of GMF that can emphasize the essential sizes of motivation: valence, an emotional size (it expresses the appeal or rejection); expectation, the subjective possibility to obtain a result.

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2. The establishment of the two levels of the motivation of performance athletes, the intrinsic and extrinsic level and, at the same time, the establishment of MI with the help of motivation valence and motivation instruments (that can express the degree a valence can or can't be reached at by self effort), sustain the scientific directing of the optimum motivation level for demonstrating the maximum performance level (performance maximum) in objective events, if in psychological training of athletes it is used a didactic strategy focused on objectives concerning the motivation directing.

Research methods

- Bibliographic study method (documentation method);
- Questionnaire method;
- Mathematics – Statistics method;
- Graphic method for results

The research's subjects and research organization:

In our research, we used athletes (males and females), participants in Track and Field University National Championship (indoor), 2009. For our research we drew up three questionnaires, each of them containing 14 items, motivation factors that observe the bifactorial concept (Herzeberg), 7 intrinsic factors and 7 extrinsic factors: the evaluation questionnaire of the motivation valence, the evaluation questionnaire of the motivation expectation and the evaluation questionnaire of the motivation instruments.

We established the questionnaires items by processing some models presented previously by Bologa, M., 1999 and Mihailescu, L., 2007 (tables 1, 2).

Table 1. Intrinsic motivation factors

No.	MOTIVATION ITEMS
1.	The contents of the sportive activity: training, contests, cantonaments
2.	Chance of utilization and development of the sportive capacities in a creative way
3.	Passion for the practised sport
4.	The level of sportive endeavor: promotions in superior categories, group selections
5.	The tendency of personal affirmation: integration and hierarchical promotion in the team
6.	The performance need: to be the best, to win
7.	Failure fear: failing, losing, injuries, opponents.

Table 2. Extrinsic motivation factors

No.	MOTIVATION ITEMS
1.	The sportive activity standards: rules, statutes, regulations
2.	The material advantages and facilities: bonus, prizes, dwelling, official trips
3.	The special climate: family, club, audience, trainers, press, radio-TV
4.	The social prestige of the athlete, practiced sport, club and trainer
5.	The management style applied by the trainer, club, administration
6.	The realation between sport and school: the possibility to be a performance athlete and a pupil
7.	The material conditions: instalations, equipment, material base, program - schedule

In order to quantify and evaluate the infrastructural level of motivation and its global structural level we gave to each of the three answers the following score:

Table 3. The score of the answers

Answers				
Score		3	2	1
Motivation instruments	Valence	very important	Medium importance	Insignificant
	Expectation	Always suits the expectations	Sometimes suits the expectations	Doesn't suit the expectations at all
	Instrumentality	Totally depends on you	Depends on you and others	Totally depends on others

According to this score, we calculated the infrastructural level of motivation by establishing the size of each factors of motivation, defined previously. After that we quantified the GMF and M.I. the quantification was calculated by the non-differential utilization of the answers for the content and context factors, according to Dunnett's formula, 1972.

- GMF = V x E
- M I = V x I

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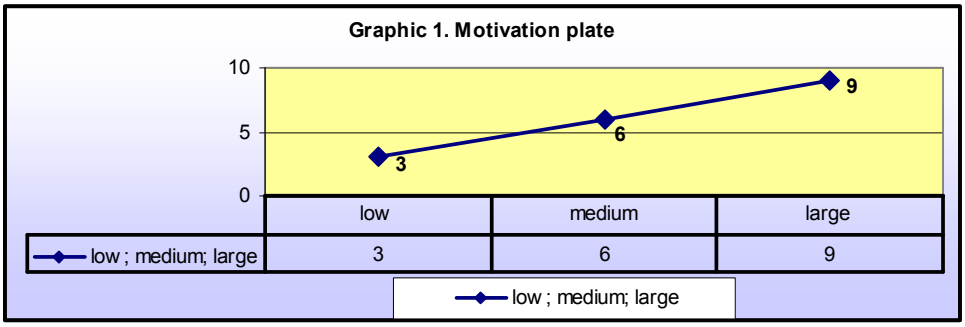
The graphic of the data for GMF is presented using the motivation plate (graphic 1), established on the base of the sources given to the answers and the contents of the establishment formula of GMF.



The analysis and interpretation of the research's results

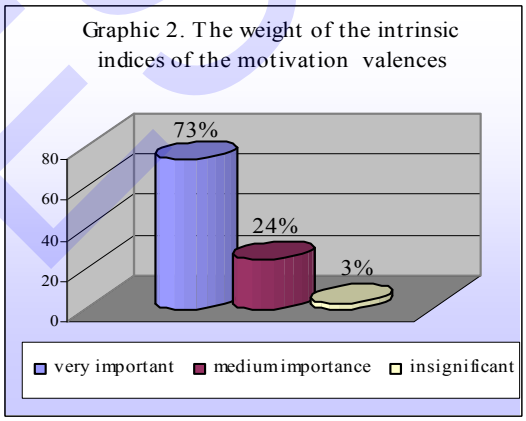
By processing the questionnaires we established the valence and weight of the intrinsic and extrinsic indices of the structural elements of motivation for athletes, participants in Track and Field University Nation Championship (TFUNC – indoor, 2009). The value of the motivation indices is presented in tables as motivation factors, and the weight of the motivation indices is presented in the below graphics.

The analysis and interpretation of the answers to the evaluation questionnaire of motivation valence

From graphic 2, we see that the seven questions that correspond to intrinsic motivation, 73 % of the subject chose the first variant of answer, 24 % the second and 3 % the third. This shows that the athletes pay a lot of attention to the intrinsic factors of the motivation valence.

Table 4. The valences of intrinsic indices of the motivation valences

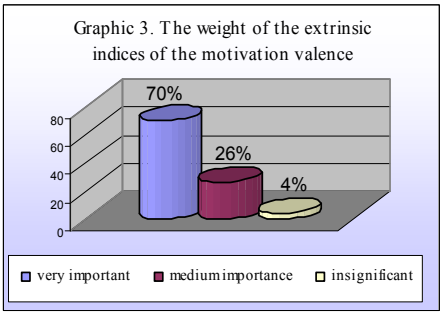
Questions no.	Subjects no.			Points no.			
	3	2	1	3	2	1	Average of answers
1	86	12	2	258	24	2	2.84
2	61	37	2	183	74	2	2.59
3	66	31	3	198	62	3	2.63
4	66	27	7	198	54	7	2.59
5	52	40	8	156	80	8	2.44
6	81	16	3	243	32	3	2.78
7	25	55	20	75	110	20	2.05



As it concerns the extrinsic factors of the motivation valence, the processed date were recorded in the following table. From the graphic 3, we can see that 70 % of the subjects chose the first variant of answer, 26 % the second and 4 % the third. This shows that the athletes are highly motivated in the sportive activity by the extrinsic factors of the motivation valences, too (material advantages, social climate, material conditions, etc.).

Table 5. The values of the extrinsic indices of motivation valence

Questions no.	Subjects no.			Points no.			
	3	2	1	3	2	1	Average of answers
8	44	46	10	132	92	10	2.34
9	73	21	6	219	42	6	2.77
10	60	29	11	180	58	11	2.49
11	51	43	6	153	86	6	2.45
12	65	26	9	195	52	9	2.56
13	48	40	12	144	80	12	2.36
14	67	22	11	201	44	11	2.56



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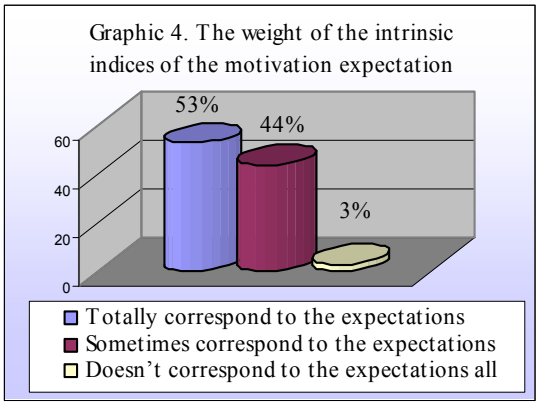
The analysis and interpretation of the answers to the evaluation questionnaire of motivation expectation

Graphic 4, shows that 53% of the subjects say that the difficulty of the aimed objectives, the affirmation possibility, the intensity of needs, the chance of improvement of self capacities and the contents of the sportive activity are in total concordance with the athletes' expectations, 44 % consider that these intrinsic factors sometimes correspond to their expectations and 3 % say that these factors never correspond to their expectations.

Table. 6. The values of the intrinsic indices of the motivation expectation

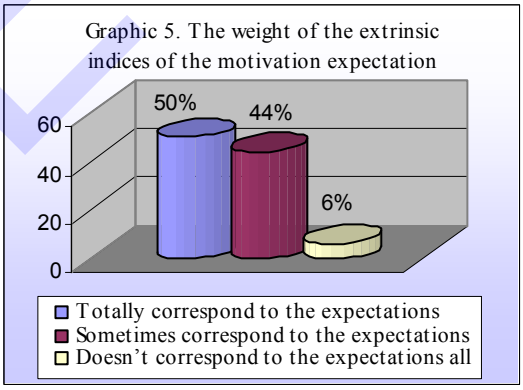
Questions no.	Subjects no.			Points no.			
	3	2	1	3	2	1	Average of answers
1	38	56	6	114	102	6	2.22
2	38	56	6	114	102	6	2.22
3	63	33	5	189	66	5	2.60
4	40	53	7	120	106	7	2.33
5	29	66	5	87	132	5	2.24
6	48	47	5	144	94	5	2.43
7	29	57	14	87	104	14	2.05



The answer of the questionnaires concerning the extrinsic indices of the motivation expectations are recorded in the table 7. From graphic 5, we see that 50 % of the inquiry's subjects chose the first variant of answer, 44 % the second saying that the extrinsic factors correspond to their expectation only sometimes, and 6 % of the athletes say that the material advantages, the facilities, the material conditions, the social prestige, the management style of the trainers don't correspond to their expectations at all.

Table 7. The valences of the extrinsic indices of the motivation expectation

Questions no.	Subjects no.			Points no.			
	3	2	1	3	2	1	Average of answers
8	33	55	12	99	110	12	2.21
9	35	47	18	105	94	18	2.17
10	34	50	16	102	100	16	2.18
11	28	55	17	84	110	17	2.11
12	41	43	16	123	86	16	2.25
13	47	47	6	141	94	6	2.41
14	41	49	10	123	98	10	2.31



The analysis and interpretation of the answers to the evaluation questionnaire of motivation instruments

From the data concerning the intrinsic indices of the motivation instruments, recorded in table 8 and represented in graphic 6, we see that 51 % of the track and field performance athletes chose the first variant, 47 % - the second and 2 5 – the third. This shows that the athletes assumes significant responsibilities in training and consider that their active and aware participation in sportive planning and training is very important in getting sportive performance.

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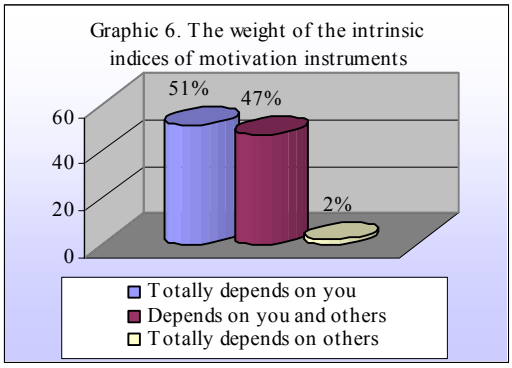
Table 8. The values of the intrinsic indices of the motivation instruments

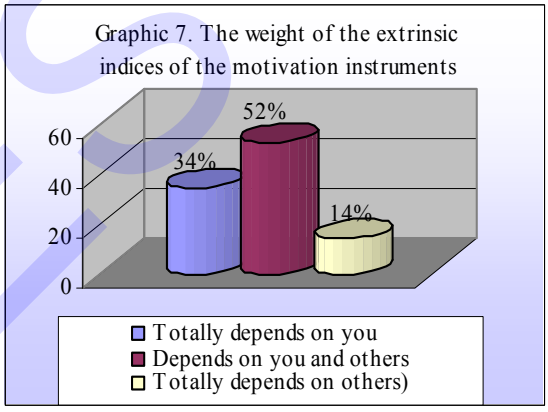
Questions no.	Subjects no.			Points no.			
	3	2	1	3	2	1	Average of answers
1	18	77	5	54	154	5	2.13
2	43	53	4	129	159	4	2.92
3	53	42	5	159	126	5	2.90
4	34	57	9	102	114	9	2.25
5	39	57	4	117	114	4	2.35
6	57	39	4	171	78	4	2.53
7	51	44	5	171	88	5	2.64



In the following table there are presented the data concerning the value of the extrinsic indices of the motivation instruments. From graphic 7 we see that 34 % of the subjects say that, in the sportive activity, some extrinsic factors depend totally by them, 52 % say that the extrinsic motivation depends on them and others and 14 % chose the third variant. These data show that the persons used in our questionnaire see the need of their contribution in achieving the sportive training in optimum conditions.

Table 9. The value of the extrinsic indices of the motivation instruments

Questions no.	Subjects no.			Points no.			
	3	2	1	3	2	1	Average of answers
8	17	33	50	51	66	50	1.67
9	15	59	26	45	118	26	1.89
10	26	52	22	78	104	22	2.04
11	30	62	8	90	124	8	2.22
12	12	49	39	36	98	39	1.73
13	43	52	5	129	104	5	2.38
14	10	47	43	30	94	43	1.67



The establishment of the M.F. on motivation factors and of the G.M.F.'s value

The establishment of the M.F. on motivation factors was achieved by using the values adequate to the motivation instruments V and E. After the processing of these data we established a rank hierarchy of M.F., achieved in a decreasing order of the motivations factors' values. From the table 10 we can see the importance of the intrinsic motivation in sportive training of the athletes' participants in T.F.U.N.C.

The intrinsic motivation factors (passion for the sport; the need of performance: to be the best, to win; the content of the sportive activity: trainings, contests, cantonments, recovery; the level of sportive endeavor: promotions in superior categories, group selections) occupy the first places in the rank hierarchy of M.F., and they are followed by the extrinsic motivation factors such as: material advantages and facilities got in the sportive activity and the material conditions, too. So, the athletes consider that in the practiced sportive activity, intrinsic motivation has an important role.

They also consider important the obtained benefits, the conditions for the training and the management style applied by the trainer. In table 10 the data of the inquiry are presented by a rank hierarchy of the motivation factors that show the importance of the M.F. on motivation factors and GMF's value.

Table 10. The rank hierarchy of the M.F. on motivation factors GMF's value

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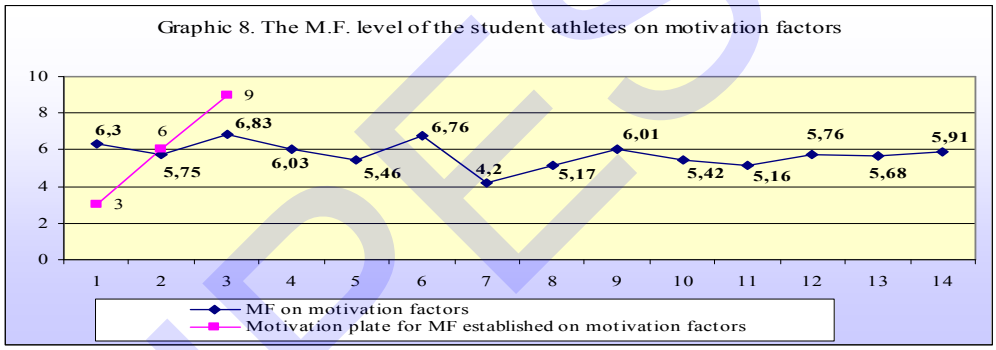
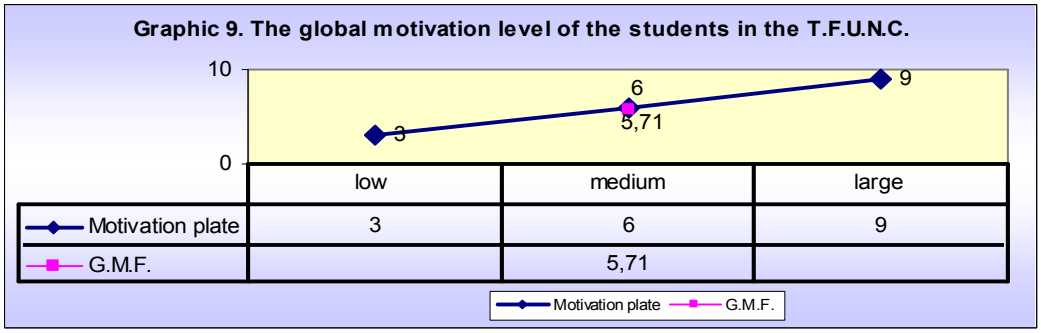
No.	MOTIVATION FACTORS	MF	
		points	rank
1.	The sportive activity content: trainings, contests, cantonments, recovery.	6.30	III
2.	The chances of utilization and development of the sportive capacities in a creative way	5.75	VIII
3.	The passion for the practiced sport	6.83	I
4.	The level of the sportive endeavor: promotion in superior categories, group selection	6.03	IV
5.	The tendency of personal affirmation: integration and hierarchical promotion in the team	5.46	X
6.	The performance need: to be the best, to win	6.76	II
7.	The failure fear: failing, losing, injuries, opponents, security tendency	4.20	XIV
8.	The sportive activity standards: rules, statutes, regulations	5.17	XII
9.	Material advantages and facilities: bonus, prizes, dwelling, official trips, etc	6.01	V
10.	The social climate: family, club, audience, trainers, pres, radio, TV	5.42	XI
11.	The social prestige of the athlete, practiced sport, club and trainer	5.16	XIII
12.	The management style applied: by the trainer, club administration	5.76	VII
13.	The relation between sport – school: the possibility to be a performance athlete and pupil/student	5.68	IX
14.	The material conditions: installations, equipment, material base, program - schedule	5.91	VI
	GFM	**5.71**	

From the graphic presentation of the values for M.F. on motivation factors we can see a medium level of its value for the all motivation factors. We can observe small value differences, but it is obvious the strong tendency to a medium motivation level of this sample.



The G.M.F. of student athletes records a value of 5.71. We can say that their motivation level has a strong tendency to a medium value of the motivation. Perhaps this value is caused by the fact that our subjects were both performance student athletes and students who won the right to participate in the T.F.U.N.C. by achieving the participation standard; the track and field not being an activity practiced by them in order to achieve maximum performance.



As it concerns the M.I. we can talk about a value of 5.65. From the below table (table 11) we can observe that we can act especially to increase the extrinsic motivation level which records law values, but there is a possibility to improve some intrinsic motivation factors

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Table 11. Rank hierarchic of M.I. on motivation factors and M.I.'s values

FACTORI MOTIVATIONALI	IM	
	Pct	Rang
1. Sportive activity content: trainings, contests, cantonments, recovery	6.04	IV
2. The utilization and development chances of the sportive capacities in development way	7.56	II
3.Pasion for the practiced sport	7.62	I
4. Sportive endeavor level: superior categories promotions, team selection	5.82	V
5. Personal affirmation trend: team hierarchal integration and promotion	5.73	VI
6. Performance need: to be the best, to win, to overtake	7.03	III
7. Failure fear: missing, defeats, accidents, opponents, security trend	5.41	X
8. Sportive activity normative: lows, statutes, regulations	3.90	XIV
9. Material advantages and facilities: bonus, prizes, dwelling, official trips, etc	5.23	XI
10. The social climate: family, club, audience, trainers, pres, radio, TV	5.07	XII
11. The social prestige of the athlete, practiced sport, club and trainer	5.43	VIII
12. The management style applied: by the trainer, club administration	4.42	IX
13. The relation between sport – school: the possibility to be a performance athlete and pupil/student	5.61	VII
14. The material conditions: installations, equipment, material base, program – schedule	4.27	XIII
MI	**5.65**	

Conclusions

Based on the analysis of the questionnaire results realized at the National University Track and Field Championship, 2009, we can say the following:

1. The first hypothesis concerning the G.M.F. of the performance athletes can be quantifiable is confirmed. This thing gives the possibility to determine the motivational level of the performance athletes during sportive activity.

2. From this research we established that by determining the G.M.F. and M.I. the psychological training of the athletes can be optimized, in generally, and the motivation, especially, offering the possibility to use a didactic strategy focused on objectives concerning the motivation directing in order to achieve the optimum motivational level specific to the achievement of the maximum performance level (maximum performance), in the objective competitions.

3. After the centralization of the results we can observe that the research subjects consider the intrinsic motivation factors very important and that put these factors in the first places of the motivation factors hierarchy. From all of these the passion for sport occupies the I place, the performance need the II place, the content of the sportive activity the III place and the other intrinsic motivation factors are placed on the IV, VIII, X and XIV place. From the extrinsic motivation factors the best positions are occupied by: the material advantages rank V, material conditions rank VI and the manager style adopted by the coach and club.

4. The motivation hierarchy that is synthesized in 6 models, corresponding to the motivational factors (valence I, expectance II, instrumentality III, M.F. IV and M.G.F. V, M. I. VI), presents the real differences between models, sinuous trajectories and a permanent restructuration of hierarchy.

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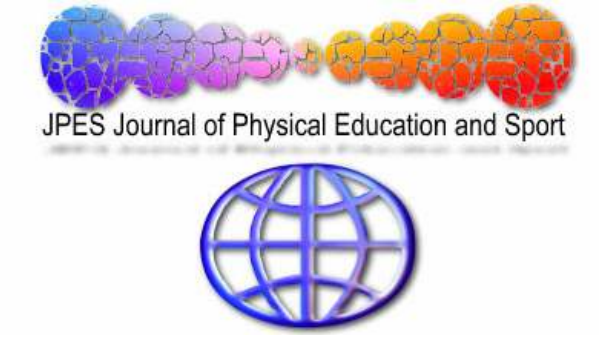

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ORIGINAL RESEARCH

THE RELATIONSHIP BETWEEN AEROBIC POWER AND REPEATED SPRINT ABILITY IN YOUNG SOCCER PLAYERS WITH DIFFERENT LEVELS OF VO_2 MAX

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Abstract

In some team sports such as soccer which is interval, athletes need to prepare themselves immediately for the next activity. Therefore it is very important to have enough information on characteristics of recovery phase and quick recovery to the first situation and to have the minimum speed reduction. The purpose of this study was to determine the relationship between aerobic power and repeated sprint ability (RSA or decrement index) in young soccer players in three different levels of Vo_2max. Methods: For this reason 41 volunteers were divided in to three groups with different levels of Vo_2max $ml.kg^{-1}.min^{-1}$ low 37.22 ± 2.3 (n= 18, age 17.1 ± 0.9 year, height 170.6 ± 0.76 cm, weight 67.1 ± 5.05 kg) medium 46.46± 1.97 $ml.kg^{-1}.min^{-1}$ (n= 13, age 17.6± 0.76 year, height 173.8 ± 4.84 cm, weight 65.9 ± 4.92 kg) and high 55.63 ± 1.52 $ml.kg^{-1}.min^{-1}$ (n=10, age 17.4 ±0.69 year, height 177 ± 3.23 cm, weight 71.4 ± 3.94 kg). To determine Vo_2max a graded exercise test until volitional exhaustion on treadmill was used, and also RAST was used to measure RSA. The lactate accumulation was measured before and after RSA protocol. Pearson's correlation was used to determine the correlation between the aerobic power and RSA. The results indicated that there are significant relationship between Vo_2max and decremental index in low Vo_2max group (r= 0.86, p= 0.001), no significant relationship medium Vo_2max group (r= 0.14, p= 0.63) and negative significant relationship in high Vo_2max group (r= - 0.64, p= 0.04). There are no significant relationship between Lactate accumulation and decremental index in medium (r= 0.005, p= 0.98) and high Vo_2max groups (r=0.27, p= 0.45). Discussion: It is possible that the recovery of inter muscular resources relates to aerobic ability, but there are other factors effective in RSA rather than Vo_2max and Lactate accumulation. The current study showed a normal curved relationship between Vo_2max and RSA.

Key Words: Vo_2max, Repeated Sprint Ability, lactate, Soccer Player

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Introduction

The essential requisite of success in most of team sports such as soccer is speedy performance (1). In soccer which is an intermittent play, the athletes should prepare themselves for the next activity quickly thus it is important to know the characteristics of recovery period to initial position. In this way, repeated sprint ability as quick as possible is a determinant of quality and level of athletes' plays. Researches on soccer matches report that players (young and adult) pass less distance in second half of play compared to first one, certainly this decrease of distance has an effect on players speed(2). Castagna et al. (2003) reported that young soccer players in second half of the play have less repeated sprints than first half (3). In other study it was reported that the ability of elite adult players for repeated sprint activity in last 15 minutes of match is 43% less than first 15 minutes (4). Relatively few information is available about fatigue and metabolism mechanism process in those team sports with the characteristic of repeated and short time vigorous exercises and limited recovery phase. Since energy production and recovery in rest phases after intermittent activities is done in aerobic way (5), so aerobic power can be a determinant of repeated sprint activity. Although there are many researches on physiological factors of sports with intermittent nature, some fitness components such as repeated sprint ability in these team sports have been represented as weak and trivial, thus few studies there are about this subject. It should be noted, of course, that research on this matter is very difficult since speedy repetitions nature in team sports is unpredictable. For example, in a soccer match there are more than 1000 different movements with approximate time interval of 6s (6) and recovery phase medium ranging from 3 seconds to 2 minutes (7). By review of literature, researches performed in two last decades can be categorized into three groups: 1) researches indicating significant relationship (8-13), 2) researches indicating medium significant relationship (14-15) and, 3) researches reporting no significant relationship (16-20), but because sprint duration, number of sprint repetition, recovery duration, type of exercise, mode of exercise and training status are very important in evaluation of this kind of fitness and since these factors were different in previous researches, thus comparing their results seems impossible. In addition, since most previous researches used laboratory specific protocols and with regard to the fact that intensity of exercise is unpredictable and constantly changing in team sports, so it is recommended that field tests validity of which is evaluated can be used for evaluation of repeated sprint activities (16). Also in most studies related to body metabolism recovery time, often longer periods (more than 24s) have been used and shorter periods (less than 10s) which are more compatible with real condition of team sports have not been covered (21). Therefore this study by using a field protocol including 6 repetitions of sprint (35m) with maximum effort and 10s recovery between repetitions which are more compatible with soccer performance, aims to answer following question: is there a significant relationship between aerobic power and repeated sprint ability in young soccer players with different levels of Vo_2 max?

Research Methodology

Subjects and the Method of Subject Selection

Subjects were 41 soccer players of national football team and Tehran premier league teams with different levels of Vo_2max. These subjects were categorized into three groups according to criterion of Vo_2max suggested by Tomlin and Wenger (2002) and Brown et al, (2006): 1) first group consisted of 10 ones with high Vo_2 max (55.63 ± 1.52), 2) second group consisted of 13 ones with medium Vo_2max (46.46± 1.97) and, 3) third group consisted of 18 ones with low Vo_2max 37.22 ± 2.3). It should be mentioned that all subjects participated and were studied in the way of available.

Data Collection Method

Subjects stated their consents for participating in the research after being informed of the way of protocol implementation and possible dangers and problems. After measuring weight and height, all subjects performed aerobic protocol from 9.30 to 11.30 on treadmill in physical education institute laboratory of science, research and technology ministry considering at least 48 hours after last performed match and/or after very energetic exercise. In addition, all subjects became familiar with test procedure and way of working on treadmill before performing aerobic protocol in order to determine Vo_2max, and they were asked to continue the test until reaching to exhaustion state. Then, repeated sprint ability test was performed after 48 hours and lactate accumulation in pre-test and post test was measured. Repeated sprint ability test used in this research, was

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RAST[2] field test, validity and consistency of which have been proved (23). In addition, subjects' feed were free and there was no control and all test were performed in the matches' season.

Vo_2max Test Implementation Method

In this test, each subject performed pre-exercise for 3 minutes with 4km/h speed on treadmill. Then main activity were performed with 8km/h speed and 1km increased per each 2min. until speed reached to 16km/h, then slope of device increased 1 degree per each 2min. until subjects reached to exhaustion state. After reaching to this state, subject performed recovery with 4km/h speed for 3min. then heart pulses were recorded (24). In order to ensure achieving Vo_2 max in subjects, one of the following conditions should be gained (12): 1- heart pulses equals to 95% of maximum heart pulse, 2- ratio of respiratory exchange equals to 1/1, 3- diagram of oxygen consumption and heart rate (VO_2/HR) reaches to steady state, 4- exhaustion state declaration by subject. Vo_2 max was measured by using Ergospirometry (model: 600 ZAN) (respiratory gases analysis).

RAST Test Implementation Method

This test included 6 repetitions of sprint with highest power in a 35m distance and rest time interval of 10s between each effort. Subjects performed light and extension pre-exercises for 10min. before test. In order to gain optimal result in this test, subjects were asked to avoid dividing energy between repetitions and perform each activity with highest effort. Time recorded for each repetition was informed to subject to motivate him for utilizing his highest effort while performing the activity. Variables measured in RAST test are as following: 1- best time of sprint activities (the fastest time of running among 6 repetitions), 2- sum of sprint activities time (sum of 6 repetitions of 35m running time), 3- speed reduction index (12).

$$*RSA = \frac{\text{Best time of sprint activities} \times \text{the repetitions of number}}{\text{Sum of sprint activities time}} \times 100$$

* Unlike fatigue index in RAST test, if speed decremental index is bigger it shows better performance of subject.

Lactate Level Measurement Method

Blood sample of right index finger tip was collected before and 3 minutes after repeated sprint activity test in order to accumulate subjects' lactate and by using lactate meter device (product of German, ce 0483 lactate scout) it was measured. For this purpose, right index finger of subject was washed with water and dried, then it was disinfected by alcohol-contained cotton and finally lactate was measured, by calculating the time period that subject came to blood sampling place after finishing of the last 35m repetition, lactate measurement time last 3min. after repeated sprint ability test.

Statistical Method

Descriptive statistics (mean and standard deviation) and Kolmogorov-Smirnov test (K-S) were used in order to samples condition description and data normality examination respectively. For testing research hypotheses and information analysis, Pearson correlation coefficient was used. Statistical analysis was performed by using SPSS15 software and in $P<0.05$ significance level.

Research results

Table (2) shows the mean and standard deviation of measured parameters. Table (3) represents results of statistical analysis by using Pearson's method. As it can be seen in this table, the level of significance of Pearson's correlation test is with the group with low Vo_2max ($r=0.86, p=0.001$) indicating there is significant relationship between aerobic power and repeated sprint ability in young soccer players with low Vo_2max. Also with regard to statistical calculations of table (3), correlation coefficient is in the group with medium Vo_2max between aerobic power and repeated sprint ability ($r=0.14$, $p=0.63$) and repeated sprint ability with lactate

[2] Running-based Anaerobic Sprint Test

Journal of Physical Education and Sport Vol 27, no 2, June, 2010
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accumulation level (r=0.005, p=0.98), which means there is no significant relationship between aerobic power with repeated sprint ability and lactate accumulation level with repeated sprint ability in young soccer players with medium Vo_2max. Statistical data represented in table (3) determine the relationship between aerobic power and repeated sprint ability in high Vo_2max group (r=-0.64, p=-0.04). Therefore there is negative relationship between aerobic power and repeated sprint ability in young soccer players with high Vo_2max. With regard to statistical data of table (3) significance level of correlation test is between repeated sprint ability and lactate accumulation (r=-0.27, p=-0.45) which suggests there is no significant relationship between repeated sprint ability with lactate accumulation in soccer players with high Vo_2max.

Discussion

Results indicate that there is positive significant relationship between Vo_2max and RSA in group with low aerobic power (r=0.86, p=0.001). Although generally aerobic system is involved in long activities with low intensity, it has an important role in energetic activities lasting just few seconds. When we are performing 6s speedy repetitions, consumed oxygen increases rapidly in the beginning of the activity (24), so that this increase continues to next repeated sprint activity (24-26) and it can reach to about 70 percent of Vo_2max.

When performing vigorous intermittent activities, increase in Vo_2max between repeated sprints causes Vo2max phosphocreatine recovery increase (27), result of which is power maintenance increase in next repetitions. Tomlin and Wenger (2002) found the same maximum power in two groups of non-professional female soccer players with medium and low Vo_2 max, but the group with medium aerobic power has less decrease in performance ability when repeated sprints (13).

In this study we didn't observe any significant relationship between aerobic power and repeated sprint ability in people with medium Vo_2 max statistically (r=9.14, p=0.63). Hoffman's (1997) research on 197 soldiers showed that just having preliminary level of aerobic fitness suffices for required recovery, thus it can be said that even more Vo_2max may have not more benefit for recovery (10). It seems that Vo_2 max index is a weak predictor for phosphocreatine recovery and it is applicable more in people with high aerobic power for determining difference in phosphocreatine recovery percent, because such people possibly have high phosphocreatine level in the beginning so it seems that in an equally time they have more phosphocreatine recovery. Thus when people have Vo_2 max more than medium level, other factors are more important in phosphocreatine recovery and recovery phase than Vo_2max.

One of the findings of this study is negative significant relationship between aerobic power and repeated sprint ability in people with high Vo_2max (r=0.64, p=0.04). There are some evidents suggesting phosphocreatine discharge is dependent to exercise condition as well as to duration of repeated sprint activity (21). Although this was not studied in athletes of team sports, Hirvonen et al discussed that phosphocreatine discharge is more in a group of sprint runners compared to athletes running with lower speed that can be due to such reasons as consistency to sprint activities in former group and Vo_2max increase because of sprint exercises (28). Seiler et al, (2002) showed that the shorter bout duration in sprint activities, the more increase in Vo_2 max because work hardness decreases (29). Rozenek et al, (2007) reported that sprint activities with high intensity and short duration can lead to speed improvement and Vo_2 max increase if have active recovery phases, so that athlete can perform strength activity with higher speeds (30). Sport science experts believe that performance depends on capacity of using high energy phosphates (ATP,PC) at the beginning of repeated sprints, two enzymes, Miokinase (ATP recovery enzyme of ADP) and creatine phosphokinase enzyme(PCr breakdown responsible) have the main role. Miokinase creatine phosphokinase and increase is low following sprint activities in elite athletes and their body can consume phosphocreatine better with lower fitness (28). Phospho ferocto-kinase(main current regulator from glucose 6-phosphate to Pyruvate), lactate dehydrogenase (causing Pyruvate transformation to lactate) and glycogen phosphorylase (causing glycogen movement from muscle supply into glycolytic paths) enzymes increase after repeated sprint activities. Glycolytic enzymes activities increase that is possible in repeated sprint activities, can be responsible for improvement of athletes' performance that use repeated sprints in their training program (31, 32). A characteristic of this study is the evaluation method of this kind of fitness, since duration of each repeated sprint activity, the number of speedy repetitions, duration of recovery, recovery kind, subjects sport field and age range of subjects are the identical, so comparison of three groups with regard to their aerobic power level is possible and generally results of this study indicate that there is a relationship between Vo_2max and repeated sprint ability in the form of normal curve.

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One of the findings of this study is that there is no significant relationship between lactate accumulation and speed maintenance ability in repeated sprint activities in young soccer players with high and medium Vo_2 max. Tesch et al, (1983) reported that there is significant correlation between capillary supply and blood lactate concentration. They also suggested increase in capillary supply leads to improving lactate removal improvement (33), therefore theoretically it was expected to find a significant relationship between lactate accumulation and RSA in young soccer player in this study, but the findings of this study didn't prove this prediction. The study by Bishop et al, (2004) is the only one finding a relationship between lactate accumulation and RSA. This research performed on 34 non-athlete women. They find a significant relationship between these two factors (9). The disagreement between this study and Bishop's research can be due to exercise level of their subjects. As it was noted above, Bishop's subjects were non-athletes and have lower Vo_2max. Tomlin and Wenger (2001) stated since H^+ accumulation causes fatigue, so H^+ accumulation reduction can provide desired environment with more capacity of contractibility, which in this way, lactate should be removed from muscles quickly by means of an effective aerobic system (34). Therefore it seems that the reason for not finding relationship between lactate level and speed reduction index is possibly shorter repeated sprint activities and recovery phase indicating that the main used resource of energy was phosphocreatine, thus lactate concentration was low. In addition, lactate measurement time is a determinant and important variable in blood lactate release (34), that in this study we sampled 3 minutes after test, but Bishop et al, (2004) didn't mention the lactate measurement time duration after repeated sprint activity test. One of the reasons of difference between non-significant relationship level in two groups with high and medium Vo_2 max can be consistency with speedy exercises. Hydrogen ion is a form of lactic acid which is fatigue causing factor in high intensity exercises. However we know that skeleton muscles compensate change in PH by different buffering mechanisms such as, phosphate, protein hemoglobin and bicarbonate chemical buffer in red globule. In addition, findings of different researches indicate that sprint activity causes improving muscular buffering ability (33).

Conclusion Generally results of this study indicate that there is a relationship between Vo_2max and repeated sprint ability in the form of normal curve. Researches show that high level players are very fast runners during a 90 minutes match, they often run 2.5 to 3.5 km distance in average with anaerobic threshold of 1.5 to 2.5km and 600 to 1200m (35). Thus it is recommended trainer consider specially sprint exercises in physical fitness program planning, because movement speed or play rhythm has become more speedy in modern football in last recent years and players can run faster, perform technical skills with higher speed and better make tactical decisions, thus speed or lack of it is the direct responsible for many wins and losses. Also it should not be forgotten that continuous exercises would not be adequate for athletes' needs during match after reaching to e medium aerobic fitness (36, 37).

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Table1: physical characteristics of low (n=18), moderate (n=13) and high (n=10) aerobic power groups.

Variable Index	*Group*	*Mean*	*SD*	*MAX*	*MIN*
Age (years)	Vo_2max low	**17/11**	**0/90**	**19**	**16**
	Vo_2max mod	**17/61**	**0/76**	**19**	**17**
	Vo_2max high	**17/40**	**0/69**	**18**	**16**
Height (cm)	Vo_2max low	**170/61**	**5/34**	**182**	**160**
	Vo_2max mod	**173/84**	**4/84**	**181**	**167**
	Vo_2max high	**177**	**3/23**	**191**	**169**
Body mass (kg)	Vo_2max low	**67/11**	**5/05**	**74**	**57**
	Vo_2max mod	**65/92**	**4/97**	**73**	**58**
	Vo_2max high	**71/40**	**3/94**	**78**	66

Table2: Results (MEAN, SD, MAX, MIN) of variable of the groups.

Variable Index	*Group*	*Mean*	*SD*	*MAX*	*MIN*
Vo_2 max (ml/kg/min)	Vo_2max low	**37/22**	**2/30**	**40/5**	**34/30**
	Vo_2max mod	**46/46**	**1/97**	**49**	**43/20**
	Vo_2max high	**55/63**	**1/52**	**57/5**	**52/90**
Decrement (%)	Vo_2max low	**0/922**	**0/027**	**0/969**	**0/884**
	Vo_2max mod	**0/930**	**0/021**	**0/952**	**0/888**
	Vo_2max high	**0/960**	**0/006**	**0/973**	**0/953**
Total time (s)	Vo_2max low	**40/56**	**3/50**	**46/64**	**35/14**
	Vo_2max mod	**34/77**	**0/56**	**35/45**	**33/50**
	Vo_2max high	**33/47**	**0/99**	**35/41**	**32/28**
Best time (s)	Vo_2max low	**6/22**	**0/39**	**6/94**	**6/5**
	Vo_2max mod	**5/39**	**0/14**	**5/62**	**5/14**
	Vo_2max high	**5/34**	**0/13**	**5/56**	**5/15**
Lactate pre test (mmol)	Vo_2max low	---	--	--	--
	Vo_2max mod	**1/85**	**0/57**	**2/70**	**1/10**
	Vo_2max high	**1/73**	**0/64**	**2/90**	**1/10**
Lactate post test (mmol)	Vo_2max low	---	--	--	--
	Vo_2max mod	**9/00**	**1/49**	**10/9**	**5/80**
	Vo_2max high	**6/97**	**0/81**	**8/2**	5/60

Table3: Correlation coefficients between vo_2max, lactate and RSA test performance indices in three groups.

Variable Index	*Groups*	*r*	*v*	*p*
Vo_2max	Vo_2max low	**0/86**	**0/73**	**0/001**
	Vo_2max mod	**0/14**	**0/02**	**0/63**
RSA	Vo_2max high	**-0/64**	**0/41**	**0/04**
RSA	Vo_2max low	---	---	--
	Vo_2max mod	**0/005**	**0/001**	**0/98**
Lactate	Vo_2max high	**0/27**	**0/07**	0/45

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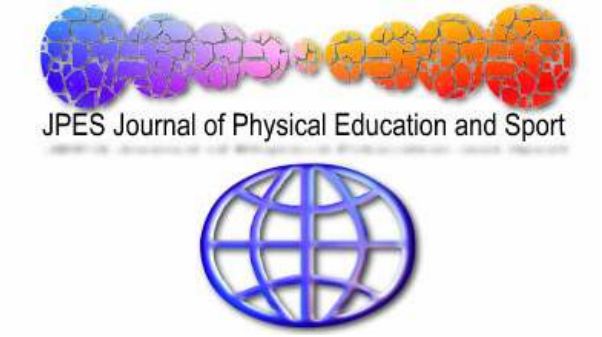

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ORIGINAL RESEARCH

A COMPARATIVE STUDY OF PERSONALITY OF INTERNATIONAL VOLLEYBALL PLAYERS OF BRAZIL AND INDIA

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Abstract:
The main objective was to study the personality of the volleyball players of India. All the players of Indian team and the players of Brazil team, who came for FIVB Men Volleyball World Championship held at Pune in August 2009, were selected for the study. They were administered the Cattell's 16 PF questionnaire. The results were analyzed with the help of 't' test which showed that there are significant differences found between Indian volleyball players and Brazilian Volleyball players on seven factors but not on nine factors of 16 PF Questionnaire. Indian players scored high on factor 'F', factor 'I' and factor 'M' whereas Brazilian players have scored high on factor 'B', factor 'G', factor 'H' and factor 'L'. Indian players scored low on Factor B which means that they tend to be slow to learn and grasp and they were dull as compared with Brazilian team, and gives concrete and literal interpretation. This dullness simply represents poor functioning.

Introduction:

Millions of people play volleyball across the world. In many countries, it has been ranked as one of the top-level competitive sport. FIVB (Federation of International de Volleyball) is the largest sports organization in the world with 220 affiliated member countries.

As a highly competitive sport, Volleyball arrived on the international level relatively late in the late 1950's. At that time, a few countries from Eastern Europe were winning the international championships and competitions.

Nowadays, there are many international top-level teams in four of the five confederations, which are able to compete with the best for the top ranks in the World Championships or the Olympic Games. India is one of the best examples of this kind. India reached at the fourth position in Junior Men Volleyball World Championship held at Pune (India) in August 2009.

The purpose of this study is to compare Indian and Brazilian team's psychological abilities in world championship.

This is the age of technology. Every movement is witnessing the rise of novel technologies. At present the top teams and players are trying to cope up with the forceful technologies to develop their capacity and uplift the quality of games.

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In the World Championship Brazil and India were played in the semi final. The Match was played in the best of five sets. In the fifth set, India lost the match. Reason behind this failure was physical and psychological abilities.

Physical and psychological abilities are most important in the critical situation in any kind of sport. Any athlete can develop his skills and get competence in related sport at the fullest by developing his physical fitness. Therefore, the physical fitness helps athletes to uplift their performance.

There were many differences in both the teams. The first was of the height. The average height of Brazilian team was more than Indian volleyball team. Nevertheless, the advantage of Indian team was the support and cheering of audience. Therefore, the home ground played significant role for the Indian team. The Brazilian counterpart lacked it. Both the teams had different pressures. Brazilian team had spectators' pressure. Due to continuous cheering, they lost their concentration and top form and Indian team had the pressure of world champions. Due to this pressure, Indian team lost its confidence. As a result, both of the teams lost 2-2 sets initially. In the fifth and deciding set, based on physical and psychological abilities Brazilians overcame the Indian team.

Method:

Sample:

The main objective was to study the personality of the volleyball player of India. All the players of Indian team and the players of Brazil team, came for FIVB Men Volleyball world championship held at Pune in August 2009, were selected for the study.

Table no 1: Showing the sample selected for the study.

Name of the Country	No. of Players
India	**12**
Brazil	**12**

*Tools used for the study: Cattell's 16 PF questionnaires

They were administered the Cattell's 16 PF questionnaire.

Statistics: students't' test was used for the analysis of the data. The results were analyzed with the help of't' test. The scores on the test were compared.

Results and interpretation:

The result shows that there is significant difference found between Indian volleyball players and Brazilian volleyball players on seven factors but not on nine factors of 16 PF Questionnaire. The details are as follows:

Indian players scored high on factor 'F', factor 'I' and factor 'M' whereas Brazilian players have scored high on factor 'B', factor 'G', factor 'H' and factor 'L'

Table 1: Showing the't' value on factor 'F'

Country	Mean	N	Std. Deviation	't' value
1.00	5.67	12	1.37	
2.00	4.67	12	1.15	1.93*
Total	5.17	24	1.34	

significant at 0.05 level

Mean comparison indicate that, Indian team scored high than Brazilian team on Factor 'F' this which means that they are tend to be cheerful, active, talkative and expressive. They are frequently chosen as elected leaders. They may be impulsive and mercurial.

Table 2: Showing the't' value on factor 'I'

Country	Mean	N	Std. Deviation	't' value
1.00	5.58	12	1.00	
2.00	4.50	12	1.00	2.66*
Total	5.04	24	1.12	

significant at 0.05 level

Indian team scored high than Brazilian team on Factor 'I' that means that they are tend to be tender-minded, sensitive, intuitive, refined premsia

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Table 3: Showing the't' value on factor 'M'

Country	Mean	N	Std. Deviation	't' value
1.00	5.58	12	1.00	
2.00	4.50	12	1.00	2.66*
Total	5.04	24	1.12	

significant at 0,05

Indian team scored high than Brazilian team on Factor 'M' it means they tend to be absent –minded, absorbed in thought, impractical Autia.

Table 4: Showing the't' value on factor 'B'

Country	Mean	N	Std. Deviation	't' value
1.00	1.83	12	1.03	
2.00	5.33	12	2.64	4.28**
Total	3.58	24	2.65	

significantat 0.01 level

Indian players scored low on Factor B means that they tend to be slow to learn and grasp, they were dull compared with Bazillion team, and given to concrete and literal interpretation. This dullness may simply represent poor functioning.

Table 5: Showing the't' value on factor 'G'

Country	Mean	N	Std. Deviation	't' value
1.00	4.17	12	1.11	
2.00	5.50	12	1.51	2.26*
Total	4.83	24	1.46	

significant at 0.05 level

Indian players scored low on Factor G means that they tend to be Expedient, disregard rules, self-indulgent weaker super ego strength.

Table 6: Showing the't' value on factor 'H'

Country	Mean	N	Std. Deviation	't' value
1.00	5.75	12	0.87	
2.00	6.75	12	1.36	2.15*
Total	6.25	24	1.22	

significant at 0.05 level

Indian players scored low on H Factor hence they tend to be shy, withdrawing, cautious, retiring, 'wallflowers.' They usually have inferiority feelings and tend to be slow and impeded in speech and in expressing themselves; they complex dislike occupations with personal contacts, prefer one or two close friends instead of a large groups, and are not given to be keeping in contact with all that is going on around them.

Table 7: Showing the't' value on factor 'L'

Country	Mean	N	Std. Deviation	't' value
1.00	4.92	12	2.02	
2.00	7.33	12	1.30	3.48**
Total	6.13	24	2.07	

significant at 0.01 level

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Indian players scored low on Factor L tend that means they are of free and, adaptable, cheerful, uncompetitive, keep concerns about others, a good team worker, and willing to take a chance with people.

Discussion:

The personality and the sport are two sides of a coin. Personality strengthens the sport and sport shape the personality; whatever be true, one thing is definitely true that they are interrelated. Here, we are trying to find out the personality traits, which are responsible for the success of a game. The failure of the Indian team in FIVB Men Volleyball World Championship held at Pune in August 2009 has motivated the -researchers to find out the shortcomings of the team. This is one of the attempt.

There are various reasons we can see. There were many differences in both the teams. The first was the height. The average height of Brazilian team was more than Indian volleyball team. Nevertheless, the advantage of Indian team was the support and cheering of an audience. Therefore, the home ground played significant role for the Indian team. Indian team that reached in the semi final lacked it and the same thing happened with the Brazilian counterpart. With atmosphere and spectators, Brazil team to be under pressure, personality factors are also important. We compared both teams' personality traits.

We have found that Indian team has scored high on three factors namely factor 'F' (cheerful, active, talkative, frank, expressive, effervescent, and carefree), factor 'I' (tender-minded, sensitive, over-protected, intuitive, refined premsia) and factor 'M' (imaginative, absent –minded, absorbed in thought, impractical Autia.); whereas the Brazilian team scored high on four factors i.e. factor 'B' (denotes about abstract thinking, more intelligent, bright, high scholastic mental capacity;), factor 'G' (Conscientious, conforming, moralistic, staid rule bound stronger ego strength,);, factor 'H'(Bold, venturesome, uninhibited, can take stress Parmia; and factor 'L' (suspicious, hard to fool, distressful skeptical, pretension).

According to observation, the main reason of losing the match was that we were lagging behind on all fronts as compared to Brazil. The Indian team was weaker than the Brazilian team. However, in sports weaker team has more advantage than the stronger one. The same thing proved to be completely true in this match.

Besides the support of audience to the Indian team and its confident game resulted in better performance in service, block, counter attack and team combination only in the second and the fourth set. Because of these things, there was immense pressure on the Brazilian team and as a result, it lost two sets. Moreover, in the deciding set because of glorious past as well as quality and confidence; supported by professional sportsmanship, the awesome performance of the Brazilian team was witnessed to make their way to the finals.

Conclusion:

The personality traits of the volleyball players of India and the Brazil are significantly different, which are responsible for the sport-performance i.e. defeat of India. Failure of the Indian team may be due to the lack of certain personality traits, which are critical for maintaining high level of morale of the team.

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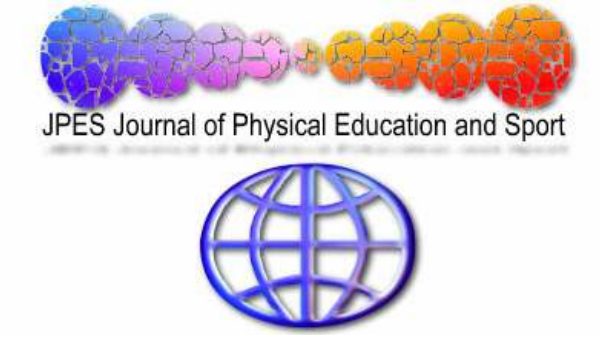

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ORIGINAL RESEARCH

ANTICIPATING AND REGULATING BIOSYSTEM

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Abstract:

Regulating biosystems closely related to human beings are structures still difficult to understand. Numerous intimate processes taking place in these systems, even their actual constitution, are insufficiently decoded, and that they have populated the world long before man invented the first regulator, appears not to have contributed much to their knowledge. This work is intended to highlight what regulating biosystems are. There is no secret that somatic muscles perform control operations which no act of moving would be possible without. All actions are the result of dynamic controlled processes adjusted to strict control laws. By treating them very seriously may lead to knowledge of processes occurring in complex systems.

Keywords: *biosystems, control systems*

Introduction:

We often ask ourselves: is risk anticipation a science? To be an exact science, we should be able to determine the exact future. As everyone knows, the future is unknowable in detail, especially since it is a more distant perspective full of complex events. Thus, risk anticipation is a scientific component (the collection of statistics and facts, statistical analysis of data), but also an intuitive component (interpretation of data, to some degree). Biological systems highlight the advantages of introducing anticipation in control systems. The system is warned by action that follows. It will be able to respond to control conditions more complex than when the differential component would be absent. Here is an example in which anticipation advantages the control system, namely anticipation of ski turn.

Anticipation of ski turn, as we know it today, was introduced internationally, by Ingemar Stenmark in the early '80s, and in Romania, by Professor Bogdan from the ski school near CSS Sinaia, after a period of training in Austria. In summary, it's the 'hanging' on the outer edge of the inside ski before completing the turn. The process is useful and applicable only in short turns. Dynamic prediction is only mentioned in the world of amateur or recreational skiing, since ski schools tend to make as much of the opportunities offered by pure carving. And cut skis, although revolutionary, are still limited in terms of turning radius, pure carving forcing the curve near the huge slalom , ie large or moderate turns. Dynamic anticipation substantially shortens turns somewhat detrimental to carving. What it is and when is it useful?

It is useful primarily on slopes inclined enough to impose a strict control of speed, on narrow passages or untended traverse. We refer only to fast slopes. Carving practice and theory teach us to stand relaxed and as long as we can on the outside ski, launching the turn and leave the ski to conclude it in its own rhythm. But when we talk about steep slopes that any delay with skis on the 'fall line' leads to rapid acceleration beyond the comfort level, which excludes long turns. Most skiers know this instinctively, from the moment of evaluating all sides and then try to curtail the powers of the turns. Dynamic prediction is described in the following sequences:

Exiting the turn, the skis are almost perpendicular to the slope.

Outside ski is loaded.

Before completing the turn the mass is transferred on the inside ski. The shoulder line is perpendicular to the slope wire. The trunk bends to the valley while performing. The ski on the outside edge „runs" on the inner edge by the easy lifting of the inner schi Once the turn occurred press against the outside leg knee vigurously

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This action tends to conclude the turn very quickly, with a slight slippage of the tails. It is very important not to change the position of the trunk. The shoulder line will be perpendicular to slope. This will create a voltage kick in the abdomen and back muscles which will make changing direction almost automatically and effortless. From the outside, sliding skiers will be seen as a straight line, the trunk will remain almost stationary, just the feet swinging left and right in a fast pace. There is a beneficial side effect: when the slope is very fast or there is very bad snow, "landing" in the final turn produces a new kick, this time vertically, which makes the next turn more easier. The discussion above highlights the advantage of introducing anticipation in control systems; the system is somehow warned by the action that follows. It's no secret that the striated muscle achieves adjustment operations, without which none of the habitat acts would be possible because they are the result of controlled dynamic processes which obey very strict regulating laws. We naturally ask ourselves whether muscle fiber is simply an effector. Even at a first approach of the question, the answer is negative because it is hard to believe that a system so demanding will make use of directly executed elements, that is effector in open circuit.

CONTENT

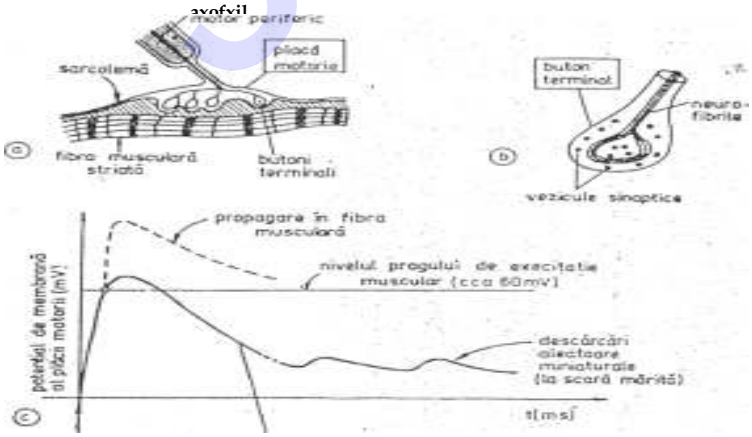
As we shall see below there is a whole system of sensors that transmit information at various levels to carry out orders received by the muscle fiber. Fig.1 (according to D Theodorescu 1978). The basic elements of the somatic muscles system are the muscle fibers which can be found in muscles in intrafusal fiber form, having the role of kinesthetic transmitters or extrafusal fibers, which are contractile elements of the muscle itself. Intrafusal muscle fibers are arranged in parallel with the rest of the fibers, and those close to tendon are "sequenced" with extrafusal fibers. In other words, extrafusal fibers are not directly related to tendon, but through transmitters (intrafusal fibers); the latter is the peripheral segment of kinesthetic analyzer.

Striated muscles in somatic muscle structure respond to voluntary and involuntary nervous commands, unlike the smooth muscles and glands of internal secretion, which respond only to unintentional and unconscious commands. However, muscle fiber control is synaptic and a typical example for these synapses established between nervous fiber and effector cell is the so-called motor plate. The peripheral motor neuron axon has many branches at the plate level, provided with terminal buttons.

The scheme of a terminal button is depicted in Figure 1.b. The terminal buttons are both provided with neurofibers leading the nervous influx from the axon and synoptic vesicles. They have a diameter of 300-600 Å and contain a specific chemical mediator (particularly acetylcholine) that is designed to transmit the nervous influx through the gap, from the terminal button to the plasma membrane of the muscle fiber.

The gap in question, called synoptic slit, is no more than 200 Á, so that when the nervous influx reaches the terminal button, synaptic vesicles burst and release acetylcholine, which acts on muscle fiber membrane by increasing its permeability for Na+ ions. Thus, an electrical potential is achieved by depolarization (action potential). Depolarization then spreads out triggering the muscle fiber contraction. Depolarization potential varies with the characteristic shape in Figure 1.c. This is because of the muscles excitation level (60 mV) when propagation in muscle fiber (interrupted line) deforms potential depolarization. In fact, this feature can only be fully achieved at neuromuscular junctions where the fiber propagation was blocked by curarization [1.4].

At least two things deserve to be seen in relation to the control mechanism described above. The first one refers to the apparently complicated solution to achieve this command, solution including the sequence: frequency modulated impulses- chemical mediator - depolarization and contraction. Indeed, synaptic vesicles do not occur in the motor plate, but they are generated in the body of the neuron from where they migrate to the



• nervous system action potential (depolarization)

Fig. 1.Neuromuscular junction (a), terminal button(b) and junction response to a nervous stimulus (depolarization

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terminal buttons. Once "consumed" in the synaptic slit, vesicles are assumed to be replaced and that replacement is problematic, especially during long-term efforts. However, that solution can also be found at other levels than at the neuromuscular junction. It is widespread and at least for neuromuscular junction the explanation seems to lie in the fact that the processes of storing and releasing energy at muscle level are essentially biochemical. As a result, choosing a chemical signal at the end of the command chain, achieved through a mediator such as acetylcholine is most natural.

The second issue relates to the randomness of the processes at the neuromuscular junction level. The processes described above occurring in the motor plate are accompanied by random miniature discharges of chemical mediator producing corresponding variations of depolarization potential. Continuously noisy miniature discharges, make up the action potential (depolarization). Reaching the threshold value that expresses the character of nonlinear component of muscle fiber is produced by increasing the likelihood of overlap miniature discharges due to the appearance of a nervous stimulus.

Therefore, the motor plate is the place of random processes characterized by a low level of command, during the period preceding the incidence of nerve impulses and achieves a state of high command after the impulse emergence. In terms of quantum model, Rupert Sheldrake as postulated the existence of morphogenetic extraphysical fields justifying morphogenesis in biology.

What happens when material forms functions are not performed properly? Here comes the concept of vital body. The body has vital biological functions of the original plans, morphogenetic fields represented by the physical body organs. Once made representations, the organs implement the programs that fulfill biological functions.

Consciousess is what makes these representations, it is the programmer. It uses vital plans to make physical representations of its vital functions, whose archetypes are encoded in our supramental, body of laws and archetypes, Figure 2. (according to Goswami, A. 1999)

When consciousness collapses (it moves from possibility to actuality) quantum possibilities of a body in the field of actuality where it could fulfill a specific biological function also collapse. What we perceive as a meaning is exactly this movement.

If movements are possible, then we can say that mental movements are also possibilities of meanings. When you choose the possibilities of meanings, we get a concrete plan.

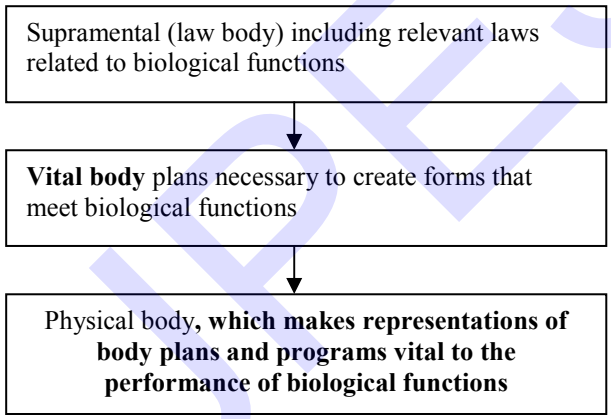

Fig 2. Stages of biological functions shift from supramental into material

In any experience, consciousness physically perceives the mental object, and mentally perceives its meaning. Consciousness is the foundation of our entire existence, the fundamental matter and mind. Matter and mind are both possibilities of consciousness. When consciousness turns - through collapse - these possibilities into a real event, some possibilities are represented physically and others mentally.

Physicist Fred Alan Wolf (1986) clarified the mechanism by which muscles record memory. Each muscle is a string of 30 cm long fibers, contains numerous cell nuclei and fine fibers called myofibrils. They are composed of several sarcomeres arranged along the longitudinal axis of the cylindrical muscle. Muscle bioenergy depends on the free movement of calcium ions. When a muscle is strained (as happens when we supress an emotional trauma) sarcomeres are flooded by these calcium ions. Even after the traumatic incident, a part of the calcium may remain in sarcomeres. This leads to the continuation of muscle tension, becoming a memory of supressed trauma. The muscle maintains a "body memory", of suppressed emotional trauma. We can say that the muscle retains a memory of when it is set in a certain position and cannot relax.

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Conclusions

Regulating biosystems model provides a mixture of surprisingly varied and efficient solutions.The optimal nature of these solutions recommends statistical modeling of processes, possibly by using optimized statistical models. The discussion presented above is a preamble to the analysis of somatic muscles system through models. From the perspective of quantum mechanics, when we deal with the same stimulus, mind is not allowed to collapse certain mental states of emotional reaction awareness; the muscle memory does not collapse either. Therefore, that muscle will not be reactivated by subsequent emotional experiences, whether the existing defense mechanism always operates at the mental level.

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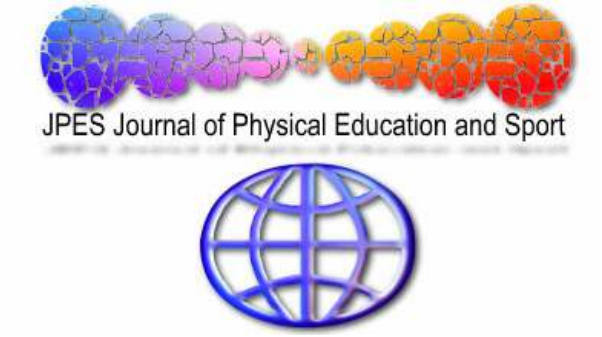

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ORIGINAL RESEARCH

A SCHOOL-BASED INTERVENTION PROGRAM FOR IMPROVING THE RISK FACTORS FOR CARDIOVASCULAR DISEASE AT AGES 12 TO 16.

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ABSTRACT

Background. Cardiovascular disease begins in childhood and this can be correlated with the presence of risk factors in adults. It is reasonable to initiate healthful lifestyle training in childhood to promote improved cardiovascular health in adult life. The purpose of the study was to evaluate the effectiveness of a school-based program designed to reduce specific modifiable risk factors for preventing cardiovascular diseases.

Methods. The sample was 343 students (160 boys, 183 girls) aged 12–16 years from the prefecture of Larissa, Greece. The duration of intervention was 1 school year. The practical part of intervention took place during the class of physical education, while the theoretical part took place in the classroom. Measurements were taken at the beginning, in the middle and at the end of the intervention. The following parameters were measured: weight, height, blood pressure, heart rate, components of the Healthy Eating Index, VO_{2max}, Fitnessgram test battery (1 mile run-walk, trunk lift, push up, curl up, back saver sit and reach).

Results. There were significant differences between the school-groups in the 1 mile run walk ($p<0,001$), 90° push up test ($p<0,001$), Healthy Eating Index ($p<0,001$), fruit component ($p<0,001$), saturated fat intake ($p<0,05$) and variety component ($p<0,001$). In the intervention group there was significant increase in VO_2max ($p<0,05$), in the weight ($p<0,001$), in the Healthy Eating Index ($p<0,05$), in the trunk lift test ($p<0,001$), in the push up test ($p<0,05$), in the sit and reach test ($p<0,001$) and in the component of fruits ($p<0,001$), while there was significant reduction in the 1 mile run walk test ($p<0,001$), in the body mass index ($p<0,05$) and in the component of saturated fat ($p<0,05$).

Conclusion. The intervention program was successfully implemented in schools and there were many significant and positive effects. These results highlight the importance of multicomponent programs for the prevention of CVD in schools. Additional studies are needed to evaluate more precisely the effectiveness of school-based interventions.

Key words: blood pressure, exercise, healthy eating index, school intervention program, VO_2max.

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INTRODUCTION

The major cause of morbidity and premature mortality in most of the industrialized world is cardiovascular disease (CVD) (1). Several sources, including the American Heart Association (AHA) (2), the Centers for Disease Control and Prevention–Youth Risk Behavior Surveillance Surveys (CDC-YRBSS) (3), provide representative data on the distribution and prevalence of major risk factors and CVD-related health behaviors in children and youth. Several evidences underscore the importance of primary prevention of CVD in childhood and the need for population-based approaches to cardiovascular health promotion and risk reduction. Data from the Bogalusa Heart Study (4) and Finland (5) reaffirm the link between risk-factor exposures in childhood and adolescence and atherosclerosis in adulthood. Risk factors for coronary artery disease are present in children and adolescents and tend to track or remain through adulthood. Risk factors that have been shown to track are physical inactivity, obesity and blood pressure (6,7).

The primary prevention of CVD should begin from the early childhood and it is supported by a great number of epidemiological, clinical and laboratory studies (4,5,8). The childhood years provide a unique opportunity for promotion of cardiovascular health. The staff of the schools has access to a large numbers of children in an environment that has the potential to support healthy behavior and is favorable for the delivery of health promotion programs (9). For this reason schools are particularly suitable for cardiovascular health promotion intervention programs, as children in this age group are responsive to health messages and behavioral changes that may be maintained into adolescence and adulthood (10).

A number of school-based health promotion interventions have been developed since the late of 1970's. The first-generation studies were didactic and focused on health knowledge, attitudes, and self-reported behaviour. In the decade of 1980 school-based research focused on theoretically behavioural interventions and incorporated the assessment and measurement of physiological risk factors for CVD. The second-generation trials demonstrated the potential of school-based interventions for improving the CVD risk status of children and youth (11) and informed the third generation of research that extended beyond the classroom, with interventions focused on the broader school environment, including food, physical activity programs that affect health-related behaviours. Example of the third generation of school-based research was the Child and Adolescent Trial for Cardiovascular Health (CATCH) (12,13,14). The results of school-based intervention support the recommendations of America Heart Association outlined in the AHA's Guide for Improving Cardiovascular Health at the Community Level (15) that emphasized schools as important components of population-based cardiovascular health promotion and risk-reduction efforts. The majority of the school-based studies (16,17,18,19) reported significant effects on health knowledge, attitudes, and behaviour of the students.

Nevertheless, some apparent controversies with the results of the school-based studies as well as the limited research evidence among school children and adolescents in Greece, was the cause of this study. Therefore, the purpose of the present study was to evaluate the feasibility and efficacy of an intervention designed to reduce specific risk factors for heart disease such as the levels of physical fitness, VO_{2max}, obesity, blood pressure, and dietary intake of children 12 to 16 years old, contrasting changes in the intervention vs control participants.

METHODS

Study Population

A total of 343 students (160 boys, 183 girls), aged 12 to16 years, were invited to participate. Of the 343 students who participated at baseline, 16 students from the intervention and 10 from the control group were not able, for various reasons, to participate at the intermediary or the final measurements.
Table 1.

Intervention school**s** were not randomized selected, but asked to participate in the intervention and research. The inclusion criterion was that schools needed to participate in a health education program with a teacher for two hours per week. Seven public high schools in the prefecture of Larissa, Greece, were recruited into the study. Chosen school**s** were in rural and urban settings and all students in these schools were eligible to participate, except them that were trained systematically in sport clubs or followed any form of training program. The intervention was implemented from September to April. Three measurements were conducted: baseline (September), intermediate (December) and final (May). Parental consent and child assent were obtained before the intervention. The study was approved by the Department of Physical Education and Sport Science, and the Ethics Committee of Democritus University of Thrace, Greece.

Procedure and Measurements

There were three data collection phases over one school year (9 months). Measurements were taken at the beginning of the school year prior to the intervention (initial results), assessed after 15 weeks

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(intermediate results), and repeated at the end of the school year after 35 weeks from the begging (final results). All measurements took place in schools and questionnaires were filled out under the supervision of the teachers.

Intervention procedure

The intervention was taught as a course that integrated exercise, health and nutrition education during school time and consisted of two components:

(i) Classroom theoretical component

Classroom theoretical component was offered only in the schools of intervention for 2 hour per week. Before the beginning of the program, there was a two-day seminar on health and diet issues, for those teachers who agreed to teach these lessons. No theoretical component took place in the control group schools. The educational materials of theoretical component were 3 books and a videotape, published by the Ministry of National Education and Religions Affairs in Greece. The two student manuals titled "Fitness and cardiovascular diseases" and "Diet and Health" provided students with information about cardiovascular diseases and exercise, heart, circulatory system, pulse rate, blood pressure, physical exercise, young's diet, healthy foods, diet and physical exercise, obesity, dietetic habits of family, as well as quizzes, crosswords, various tests and questionnaires. Teacher's manual titled "Fitness and cardiovascular diseases" covered subjects about health, circulatory system, the risk factors for cardiovascular disease and basics of fitness and physical activity. Videotape entitled "Fitness and cardiovascular diseases for students of 12-16 years" included topics among others about the function of the heart and vessels, physical exercise and circulatory system, risk factors for cardiovascular disease, physical activity and cardiovascular diseases, and fitness for young people.

(ii) Physical education component

Physical education component was offered in the intervention group. All physical education teachers, received advices and training before and during the intervention. Among other instructions that were given to them, there were written daily lesson plans for skill-fitness activities (volleyball, basketball, football, track and field) for the daily physical education lessons. The intervention program consisted of 40-55 minute classes conducted for 2 to 3 days per week, for 35 weeks during the course of physical education. For the improving of cardiovascular fitness it was used aerobic exercise. The intensity of aerobic exercises oscillated from 40-60% of their age-predicted maximum heart rate and included a variety of activities such as running, fast waking, jogging, jumping, stair stepping and others. Students were taught how to monitor their heart rate during exercise. Resistance exercise was used to improve muscular strength and endurance. As all secondary schools in Greece the control group schools have PE courses either. There were not standard structures for the PE lessons, but this depends on the facilities of the schools.

Measurement procedure

Anthropometric measurements. Height and weight were measured with the students wearing light clothing and no shoes. Height was recorded to the nearest 0.5 cm and weight to the nearest 0,5 kg. Age at baseline was computed from the reported birth date.

Body mass index (BMI). It was calculated as weight (kg) divided by height squared (m^2) per age and sex specific cut off points (20).

VO_{2max} Aerobic capacity was predicted from mile run time, age, gender and BMI, using the equation of Cureton et al. (1995).

Blood pressure. Two measurements of systolic blood pressure (SBP) and diastolic blood pressure (DBP) were taken at 30-60 seconds intervals with an automatic digital oscillometer, after sitting on a chair for at least 10 min, with the left arm at heart level resting on a table. The mean of the two measurements was used.

Physical fitness. The Fitnessgram tests that used were: one-mile run/walk, 90 degree push up, back saver sit and reach, trunk lift and the curl up.

Diet records. The dietary intake was measured by using one 24-h recall questioner. Students were instructed on how to keep the previous one-day food record.

Dietary questionnaire. A 24-h dietary written recall questioner was conducted to each student. Photographs of foods and serving sizes were used to assist students in recalling the exact types and quantities of food and beverages they were consumed during the previous day.

Healthy Eating Index (HEI). For the calculation of the HEI score, all daily food records were analysed. Grain, vegetable, fruit, milk and meat components of the Healthy Eating Index measures the degree to which a person's diet conforms to the Food Guide Pyramid servings recommendations for the grains, vegetables, fruits, milk and meat.

For each of the five food group components of the Index, individuals who consumed the recommended number of servings received a maximum score of 10. A score of zero was assigned to any food group that no items from that category were consumed. Scores between the two levels were scored proportionally.

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Total fat and saturated fat consumption measures total fat and saturated fat as a percentage of total food energy intakes. Total fat less than 30% and saturated fat less than 10% of the total calories were assigned a score of 10 points. A zero score assigned when the proportion of total fat calories was more than 45%, or more than 15% for saturated fat. Intakes between the two levels were scored proportionately. Total cholesterol and sodium consumption measures total cholesterol or sodium intake. A 10 point value was assigned when intake for cholesterol or sodium was less than 300 mg. or 2.400 mg, and zero points when intake was more than 450 mg or 4.800 mg respectively. Variety examines the amount of in a person's diet over a 1 - day period. A maximum score was given if 8 or more different food items were consumed. A score of zero was given if three or less different items were eaten. Scores between the two levels were scored proportionately.

Statistical Analysis

All statistical analyses were carried out using the SPSS software version 9.0 for Windows (SPSS Inc., Chicago, IL) package for personal computers. Data were analysed for the main effects of group and time and the interaction of group by time with a 2 (group) × 3 (test period) repeated-measures analysis of variance (ANOVA). Least Significant Difference (LSD) test used to perform all pairwise comparison between group and time means. For all statistical comparisons, a significance level of $P< 0.05$ was chosen.

RESULTS

The baseline characteristics of the study population are shown in Table 2. Descriptive statistics (mean ± SD) for age, body mass index, height, weight, systolic blood pressure, diastolic blood pressure, pulse rate, 1 mile-run walk, curl up, 90^o push up, back saver sit and reach test, trunk lift test, VO_2max, Healthy Eating Index, grain consumption, fruit consumption, vegetable consumption, milk consumption, meat consumption, total fat consumption, saturated fat consumption, cholesterol consumption, sodium consumption, and variety component were calculated for participants in intervention and control groups.

(table 2).

Multiple comparisons were assessed by Repeated Measures ANOVA. Two-way repeated measures ANOVA (school-group × time), with repeated measures for the time factor, were used to compare variables in intervention and control group at baseline, in the middle after 15 weeks and in the final of the intervention program, after 35 weeks. The independent factors were school group (intervention, control) and time (baseline, middle and final). The dependent variables of interest were body mass index, weight, systolic blood pressure, diastolic blood pressure, pulse rate, 1 mile run-walk, curl up, 90^o push up, back saver sit and reach and trunk lift.VO_{2max}, Healthy Eating Index score and the components of Healthy Eating Index. Pairwise comparisons among school-group means were done using the least significant difference (LSD) procedure**.**

The between school-groups tests indicates that there were significant differences in the following dependent variables: 1 mile run walk ($F_{1,328}$=35,27, p<0,001), 90^o push up test ($F_{1,328}$=18,85, p<0,001), HEI ($F_{1,239}$=20,74, p<0,001), fruit component ($F_{1,239}$=69,07, p<0,001), saturated fat intake ($F_{1,239}$=18,89, p<0,05) and variety component ($F_{1,239}$=15,79, p<0,001).

(table 3).

Using the least significant difference (LSD) test, we observed that there were statistically significant differences in the intervention school-group between initial and final measurement, or between the intermediate and final measurement in the following variables: HEI, component of fruits, saturated fat intake, body weight, BMI, $VO_{2max,}$ 1 mile run-walk test, push-up test, back saver sit and reach test, trunk lift test (table 4). Also there were statistically significant differences in control school-group, between initial and final or between the intermediate and final measurement in the following variables: component of fruits, body weight, BMI, one mile run-walk test, push-up test, trunk lift test

(table 4).

DISCUSSION

The purpose of the present study was to evaluate the effects of a one year school-based intervention program that includes health and physical education for the primary prevention of the modifiable risk factors for cardiovascular disease. These factors were cardiorespiratory fitness, nutrition, hypertension and obesity.

Aerobic capacity. After 1 school year of intervention positive effects were found in the aerobic capacity between the initial and final measurement in the intervention group. No changes were found between the initial and final measurement in the control group, or between the intervention and the control group.

Similar surveys had conflicting results, due to the different methods that were used in the school-interventions programs, like the improvement of 20% of VO_{2max} during the intervention of 1 year (21), or the decreased of oxygen uptake in another study (22). In our study the increased aerobic capacity may be attributed to the intervention program, that included theoretical lectures of 40 to 55 minutes, twice a week, emphasizing heart health and cardiovascular fitness, combined with physical activity including aerobic exercise and circuit weight and flexibility training.

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Students understood the importance of the aerobic capacity for their cardiovascular health, which can be achieved in the school environment during the physical education lessons. This not only upgrades the physical education in schools, but this approach is absolutely compatible with the modern perceptions for exercise and health (23).

The improvement of aerobic capacity for cardiovascular benefits was feasible in Greek schools and we could apply the theoretical model, and according to it, aerobic exercise should take place for at least 3 times per week, for 40-55 minutes each time (24). Indeed, the frequency of physical education in secondary schools is 3 times per week and the duration ranges from 40 to 55 minutes, enough time according to Pate at al. (25) to have cardiovascular benefits, when the program includes aerobic exercise with medium intensity. For this reason students easily learned to find the intensity from their pulse rate. Knowing the pulse rate that corresponds to the 40-60% of the highest pulse rate, (220 minus age) they knew if they were in the levels of intensity that they should exercise (26). The overall results revealed also that an intervention program in the school environment could provide multiple benefits and other important adaptations, like flexibility and muscular strength and endurance.

We had to use a valid, reliable and objective as well as fast and economic way to calculate the aerobic capacity, because there were many and repeated measurements that should take place in schools. For this reason the equation of Cureton et al. (27) that predicts the VO_{2max}, from the one-mile run-walk Fitnessgram test was chosen to be the most proper. The rationale for using the one-mile run walk test to estimate VO_{2max} is based on the fact that for exhaustive exercise lasting longer than two minutes, energy is provided primarily through aerobic metabolism (28).

Obesity. Over the past 20 years, several school-based studies have implemented and evaluated programs aimed at reducing cardiovascular disease risk and obesity prevalence (29, 30). Our study produced small changes in BMI and no reductions in body weight of the students. This is because not only the short duration of the intervention and it's components but also the lack parent's and family involvement may affected the success for reduction of obesity in children. A meta-analysis of 41 intervention studies aimed to reduce the children's weight, found that interventions that incorporate both a behavioral and knowledge component, particularly those that include exercise in the intervention, are likely to produce weight loss (31). It is known that the reduction of the body fat in children requires a net decrease in positive energy balance. This can be achieved by reducing energy intake, increasing energy output through physical activity, or both. Our intervention provided only theoretical information to the students about the food choices and no any intervention to their family menus.

Dietary intake. The study estimated also the quality of student's nutrition by the Healthy Eating Index score. The effectiveness of the intervention was successful and the students improved considerably the quality of their diet. The theoretical courses for nutrition played a major role for the improvement of the HEI score. The knowledge that students acquired, allowed them to follow a diet, better and healthier concerning their initial diet.

The same improvement was not observed in all components of the Healthy Eating Index, because it is difficult to change all dietary habits that concern the entire family. Also this is related to economic and social conditions, as well as habits that had been solidified over the time. The most important improvement was in the component of fruits consumption of the HEI. This can be interpreted as the easier and with small cost dietary modification, which can be achieved only with the increase of consumption of seasonal fruits.

It is difficult to compare directly the findings of our intervention, aimed to improve the diet quality, with other similar interventions, as Simons-Morton et al. (32), aimed also to improve students' diet, or that of Sahota et al. (33) intervention, that included modification of school meals. The reason is the implementation of different programs and intervention methods, the different time duration, and the different methods of measurement and evaluation of diet quality.

The quality of student's diet can further improve, because the mean score of HEI in the intervention group was 68 that represent a diet that "needs improvement". Despite the improvement of 4% of the HEI in the intervention group, the indicator abstains enough from the "excellent" levels ranges from 80-100. In our study the majority of students (83%) belonged in the HEI category "needs improvement", and this was observed by other studies too (34).

According to the results of the study, Greek student's diet approaches the models and the dietary habits of "western" type diets. Similar results were found in America, where the HEI score was 63,8 and the lowest score was in the consumption of fruits as in our study (35). It is likely the shift of dietary habits of Greek population in "western type" diets abandoning the traditional Mediterranean diet that has been recorded before (35), it is also presented in the results of our study. Consequently, it is necessary to have interventions aiming to modify dietary habits in Greek young as the one we applied in our study.

Blood pressure. The program appeared to have no effects on blood pressure or heart rate. There are several randomized and controlled studies with interventions that examined the effects on blood pressure in children. Interventions were generally conducted over several months, with sample sizes as well as interventions varied widely, from regular aerobic activity programs to participation in activity-related games or other activities. In

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these studies we observe controversial results. Same findings like ours were observed in a study (16), that included theoretical knowledge and aerobic exercise, in another study (14) where the CATCH program was implemented or finally in the Ewart et al. study (36) that a program with 30 minutes of aerobic exercise, had no any positive results concerning blood pressure. In contrary, important differences were observed in blood pressure, when the program "Know your Body" was applied (37). Finally, decrease in systolic and diastolic blood pressure was found in another study, compared to the control group in children 9-11 years of age (38). Probably the variety of intervention programs, in combination with the duration of the intervention, shows the controversial results regarding the possibility to have changes in blood pressure in children's age.

CONCLUSION

Health is strongly linked with education. The majority of the children attend high schools, which are especially effective and efficient to provide health education. Lifetime patterns of physical activity and diet as well as many of the risk factors for cardiovascular diseases often have their roots in childhood. Comprehensive intervention programs including health education, nutrition education and physical activity during the school time could help students to develop positive health attitudes.

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Appendix

Table 1. Number of students at the beginning of intervention (initial measurement) per age and sex.

	Boys					
	Girls			Total		
Intervention group	86 (6*)		80 (2*)	166 (8*)		
Control group	86 (5*)		78	164 (5*)		
	12 years	**13 years**	**14 years**	**15 years**	**16 years**	**Total**
Intervention group	46 (7*)	32	45	35 (1*)	8	166 (8*)
Control group	43 (1*)	50 (1*)	50 (1*)	8	13 (2*)	164 (5*)

*** They did not participate in the intermediary or in the final measurement.**

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Table 2. Baseline physical characteristics, physiological measures, Fitnessgram tests and Healthy Eating Index components for intervention and control participants (mean ± SD).

	Intervention group (n=174)	Control group (n=169)		Intervention group (n=174)	Control Group (n=169)
Age (years)	13,56±1,23	13,38±1,16	**$V0_{2max}$ (ml/kg/min)**	43,62±6,44	43,18±5,49
BMI (kg/m^2)	22,40 ±4,32	21,65±3,77	**Healthy Eating Index**	5,50±12,0	64,44±10,0
Height (m)	1,61±0,09	1,64±0,08	*Grain consumption*	6,14±3,30	4,96±3,50
Weight (kg)	59,02±14,96	59,35±13,35	**Fruit consumption**	2,22±2,70	1,75±2,60
SBP (mm Hg)	107,80±12,7	106,40±10,0	**Vegetable consumption**	3,72±3,20	3,71±3,30
DBP (mm Hg)	74,10±10,40	78,30±9,00	**Milk consumption**	5,52±3,40	6,06±3,00
Pulse rate (bpm)	87,58±11,32	85,14±12,05	**Meat consumption**	7,89±3,80	6,88±4,30
1 mile run walk (min)	9,52±2,03	10,67±2,50	**Total fat consumption**	9,89±1,00	9,76±1,20
Curl up (rep.)	49,52±20,56	45,81±14,2	**Saturated fat consumption**	3,70±4,20	3,05±3,80
90^o Push up (rep.)	14,71±9,18	11,62±5,40	**Cholesterol consumption**	8,14±3,90	9,30±2,70
BSSR (cm)	24,35±6,77	23,96±7,94	**Sodium consumption**	10,00±0,00	10,00±0,00
Trunk lift (cm)	32,51±5,58	30,50±7,47	**Variety component**	9,27±1,50	8,96±1,50

Note. BMI = Body Mass Index, SBP = systolic blood pressure, DBP = diastolic blood pressure, BSSR = back saver sit and reach test.

Table 3. Mean and significant differences for intervention and control group from baseline to final assessment.

	Initial measurement		Intermediate measurement		Final measurement	
	Intervention group	Control group	Intervention group	Control group	Intervention group	Control group
BMI (kg/m^2)	22,40	21,65	22,05	21,37	22,21	21,65
Weight (kg)	59,02	59,35	58,70	59,29	59,63	60,45
SBP (mm Hg)	107,80	106,40	108,00	108,50	106,70	106,70
DBP (mm Hg)	74,10	78,30	74,90	78,20	74,60	78,60
Pulse rate (bpm)	87,58	85,14	87,98	85,04	85,80	84,96
Mile run walk (min)	9,53	10,68 *	9,38	10,73 *	9,16	10,96 *
Curl up (rep.)	49,53	45,81	50,54	46,53	51,60	45,83 *
Push up (rep.)	14,70	11,62 *	16,01	13,85 *	15,90	11,13 *
BSSR (cm)	24,35	23,96	24,06	23,71	25,25	23,78
VO_{2max} (ml/kg/min)	43,63	43,18	44,10	43,26	44,08	43,46
Trunk lift (cm)	32,51	30,50 *	33,93	32,52 *	33,93	30,46 *
Healthy Eating Index	66,50	64,44 *	69,51	64,09 *	69,11	62,79 *
Grain consumption	6,14	4,96 *	6,26	5,43	5,45	5,22
Fruit consumption	2,22	1,75	2,78	1,07 *	6,21	1,92 *
Vegetable consumption	3,72	3,71	4,48	3,65	3,52	3,43
Milk consumption	5,52	6,06	5,40	5,67	5,16	5,40
Meat consumption	7,89	6,88	7,22	7,95	7,73	7,44
Total fat consumption	9,89	9,76	9,91	7,95 *	9,81	9,57
Saturated fat consumption	3,70	3,05	4,85	2,64 *	3,60	2,15 *
Cholesterol consumption	8,14	9,30 *	9,12	8,99	8,24	8,96
Sodium consumption	10,00	10,00	9,92	9,98	9,97	10,00
Variety component	9,27	8,96	9,59	8,91 *	9,40	8,69 *

Note. BMI = body mass index, SBP = systolic blood pressure, DBP = diastolic blood pressure, BSSR = back saver sit and reach test.

* . Significant differences between the intervention and control group in all three measurements.

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Table 4. Mean and significant differences from baseline to final assessment in intervention and control group.

	Intervention group			Control group		
	Initial	Inter mediate	Final	Initial	Inter mediate	Final
Weight	59,02	58,70	59,63 #ƒ	59,35	59,29	60,45 #ƒ
BMI	22,40	22,05	22,21 #ƒ	21,65	21,37	21,65 ƒ
VO_{2max}	43,63	44,10	44,08 #	43,18	43,26	43,46
Mile run walk	9,53	9,38	9,16 #ƒ	10,68	10,73	10,96 #ƒ
Push up	14,70	16,01	15,90 #	11,62	13,85	11,13 ƒ
BSSR	24,35	24,06	25,25 #ƒ	23,96	23,71	23,78
Trunk lift	32,51	33,93	33,93 #	30,50	32,52	30,46 ƒ
HEI	66,50	69,51	69,11 #	64,44	64,09	62,79
Fruit	2,22	2,78	6,21 #ƒ	1,75	1,07	1,92 ƒ
Saturated fat	3,70	4,85	3,60 ƒ	3,05	2,64	2,15

#. Significant differences between initial and final measurement
ƒ. Significant differences between intermediate and final measurement

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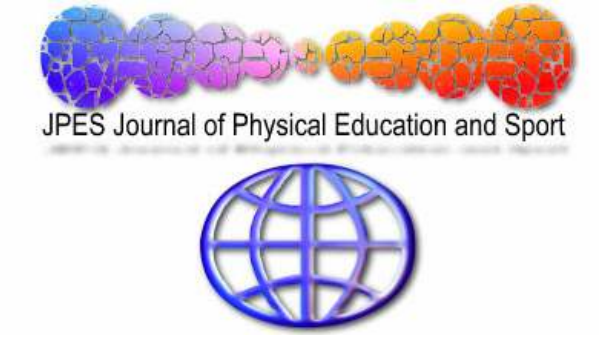

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ORIGINAL RESEARCH

THE ROLE OF HIGH - IMPACTS EXERCISES IN IMPROVE BONE MINERAL DENSITY IN POSTMENOPAUSAL WOMEN WITH OSTEOPENIA OR OSTEOPOROSIS

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ABSTRACT

Purpose - The aim of this study was to examine the effect of high - impacts exercises program based on weight-bearing and strengthening exercises in improve bone mineral density in postmenopausal women with osteopenia or osteoporosis.
Material and Methods – This study included 46 postmenopausal women with osteoporosis or osteopenia whose diagnoses were made by dual energy X-ray absorptiometry (DEXA) showing T-scores of less than -2.5 and in a range of -1 to -2.5, respectively, aged between 43 and 65 years. Subjects were divided into two groups, the experimental group (N=23) and the control group (N=23).
The experimental group followed a multiple therapy based on medication, a diet and exercises program (high - impacts exercises), while the control group was submitted only to diet and medication. Areal bone mineral density (BMD) and T-score was measured on the lumbar spine (L1–L4) with dual-energy X-ray absorptiometry – DEXA (Osteocore Medilink) at baseline and after 12 months of exercise.
Results - After 12 months of high-impact exercise intervention, both groups exhibited significant improvements in T-score (-0,79 vs -0,42 mean variation), and bone mineral density in lumbar spine (0,091g/cm^2 vs 0,042g/cm^2 ; p<0.001). But, the exercise group demonstrated a significant gain compared with the control group in T- score (30,3% vs 21,83%;) and Spine BMD (12,56% vs 6,25%).
In terms of changes after the treatment, a significant difference between the two groups was observed (p<0.001). The two groups differ significantly with respect to the differences between the mean (-1,84 vs -2,19; p<0.001 for T score and 0,816 vs 0,748; p<0.001) improvements obtained after the exercise program.
Conclusion - This study indicates that high-impact exercise is safe and effective in improving bone mineral density in the lumbar spine in postmenopausal women with osteopenia or osteoporosis. If done on a regular basis, this type of training may be an efficient, safe, and inexpensive way of preventing osteoporosis later in life.

Keywords: osteoporosis, endurance training, BMD

Introduction

Osteoporosis, the main chronic bone disorder, is determined by the progressive disruption of the microarchitecture of bone tissue, being declared by the OMS as the third issue of public health, coming after cardiovascular diseases and cancer. Osteoporosis is a frequent disease which generates numerous inferences, high costs (for individual, as well as for society) implying an early diagnosis and an efficient prophylactic treatment.

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Osteoporosis is considered one of the most common skeletal disorders in elderly. The bone loss process can occur with no symptoms and the individual feels fine until a fracture occurs; therefore the attribute "silent" given to the disease. If untreated, it can lead to suffering, dysfunction, and death in the elderly population (Goldmann and Horowitz, 2000).

Repercussions of this disorder influence the whole body functionality. Due to its considerable complications (bone frailty, skeleton deformity, fractures) and disabilities, the individual's quality of life is seriously affected. The bone mineral density (BMD) is one of the main risk factors for osteoporotic fractures (Nigel Arden, 2006). The diminution of the bone mass generates bone frailty with an increased risk for fractures, but the incidence of fractures is not compulsory.

Strong body of evidence suggests the fact that, besides other therapies, namely, dietary therapy and medication, regular physical exercise may significantly reduce the impairment of the bone mass considering the age, and thus, it may prevent the occurrence of the moment when osteopenia clinically develops into significant osteoporosis (Qin L, et al, 2002, Villareal et al., (2003), Beck and Snow (2003) Hamilton, C.J., 2009). Moreover, physical exercise has an important role in maintaining or, even, increasing the bone mass, registering a more significant influence; physical exercise primarly facilitates the improvement of the muscular mass by enhancing its strength, balance and coordination, and has a major positive impact over stability and walking (Ilinca I, 2008).

According to the existing data in the field literature, it results that the recovery or prophylactic kinetic treatment, recommended to individuals already diagnosed with osteoporosis or those at high risk for developing this disease, is generaly based on exercise programs meant to enhance strength which promotes bone health and exercises against gravitational forces (Kemmler,2004).

From a physiological point of view, force training registers an important stimulating effect on a series of hormones in women, as well as in men. An analysis of Kraemer and Ratamess (Kraemer, W.J., Ratamess, N.A., 2005) article indicates the fact that this type of training promotes the release of testosterone and of increasing hormone, encouraging the use of certain variables specific to the exercise. These two hormones have an anabolic effect over the bone, and according to Christiansen, it enforces the valuation of endurance training over BMD (Christiansen, P., 2001).

Material and Methods

The study has been achieved on a group of 46 postmenopausal women diagnosed with osteoporosis or osteopenia based on densitometric criteria, aged between 43 and 65 years. Women presenting orthopedic or neurological disorders could not handle the exercise program. Subjects were divided into two groups, the experimental group (N=23) and the control group (N=23). The experimental group followed a multiple therapy based on medication, a diet and physical exercises, while the control group was submitted only to diet and medication.

The resistance training, undertaken by the experimental group, was performed twice a week and developed on a period of 12 month, under the close surveillance of a physical therapist. Each training session included stretching exercises, for improving joint mobility and trunk stability, and exercises for strengthening and toning paravertebral and abdominal muscles in order to increase the density of the osteoporotic spine and to innervate bone periosteum through physical exercises, which constitutes a stimulus for bone formation. Contraindicated movements, leading to an increased risk for osteoporotic fractures, were avoided, namely, forward excessive leaning of the head and trunk excessive flexion.

The program registered a total span of one hour, from which 10 minutes of warm up, 40 minutes for enhancing strength and 10 minutes of cool-down activities. The warm up exercises included static stretching for the superior part of the body followed by walking breathing exercises and easy running. The effective training part included strength exercises for the superior limbs using slight loads (1kg) from sitting and orthostatism, and calisthenics exercises from decubitus position and orthostatism for the abdominal and paravertebral muscles. Initially, during the adjustment period, under close surveillance, subjects performed each exercise 8 to 10 times with recovery pauses of 1 minute between the exercise sets, and subsequently, they registered an evolution rate which was about12 to 15 times higher.

During the entire experiment period, all the 46 subjects used the same medication which included Fosamax, calcium supplement and vitamin D, and a diet rich in diary products and vegetables. Nonexercising controls were asked to maintain their current lifestyle.

Bone loss was assessed through evaluation of the following two bone density parameters: BMD (expressed as g/cm^2); *T* -score (variation in relation to young adults; expressed as mean and standard deviation, SD);

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Areal bone mineral density (BMD) and T-score was measured on the lumbar spine (L1–L4) with dual-energy X-ray absorptiometry – DEXA (Osteocore Medilink) at baseline and after 12 months of exercise (Fig. 1)

Results

The data are expressed as mean ± standard deviation and are presented in Table 1.The statistical analysis was performed using WINKS SDA 6.0.5. statistical package. Paired samples t-test was used to analyze the change from baseline within the groups.

The comparison between the baseline and outcome measurements was made using a paired-samples T-test. In Table 2, the calculate t shows that there are significant differences ($p<0,001$) between the Experimental group and Control group for all measured parameters.

Characteristic	Experimental Group (N=23)	Control Group (N=23)
Age(years)	58,26±6,39	59,04±5,89
Years since menopause (years)	46,47±6,40	48,13±5,02
Weight (Kg)	59,21±9,39	60,52±8,19
Height (cm)	161,34±5,54	162,69±5,62
BMD –Lumbar bone mineral density (g/cm^2)	0,724±0,06	0,703±0,05
BMC (g)	37,35±3,30	38,20±2,84
T-score	-2,64±0,06	-2,61±0,4

Table 1 Characteristics of the Subjects that were included in the training program

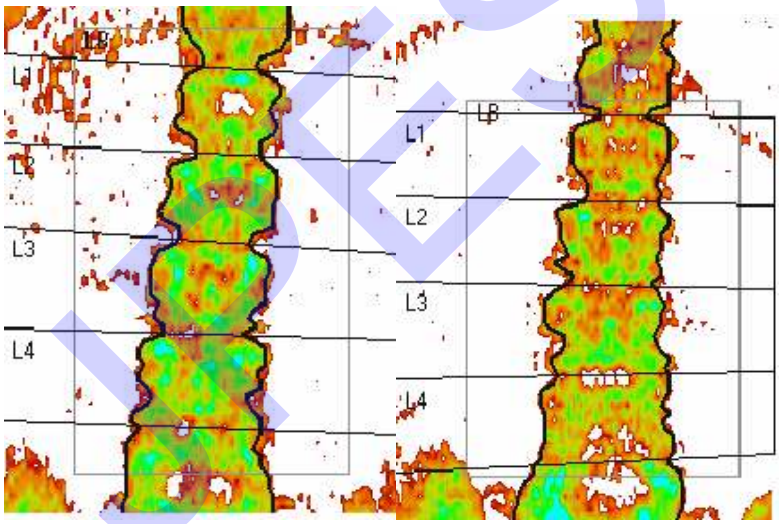

Fig 1. D.E.X.A. Bone Densitometry

	Experimental Group			Control group			P-value
	Baseline	At 12 Months	Variation mean	Baseline	At 12 Months	Variation mean	
T-score	-2,64±1,1	-1,84±0,3	-0,79±1,01	-2,61±0,4	-2,19±0,4	-0,42±0,1	0,001 (t=3,96)
BMD - Lumbar (g/cm^2)	0,724±0,06	0,816±0,05	-0,091±0,04	0,703±0,05	0,748±0,05	-0,044±0,03	0,001 (t=5,73)

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Table 2. Results of initial and final BMD and T-score of control and experimental group

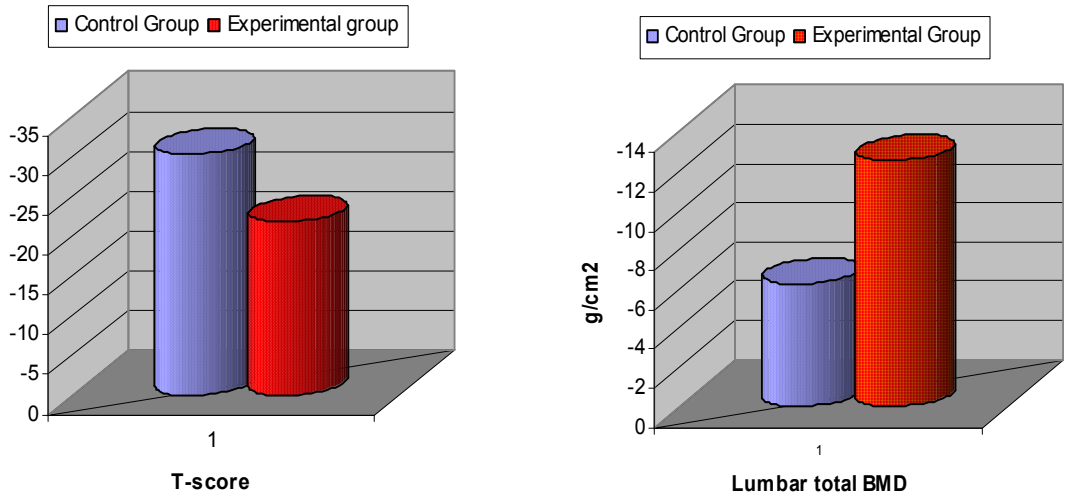

Fig.2. Comparison (percentage) of variation of the *T- score and Lumbar total BMD* between the experimental and the control group

We analyzed the characteristics of the nonparticipants and found they did not differ from the study group (Table 1). The mean (SD) T- score for Experimental group at start was – 2,64 (1,10) and 0, 724 (0,06)g/cm^2 in spine BMD, and for control group was – 2,61 (0,04) and 0, 703 (0,05)g/cm^2. After 12 months of high-impact exercise intervention, both groups exhibited significant improvements in T-score (-0,79 vs -0,42 mean variation), and bone mineral density in lumbar spine (0,091g/cm^2 vs 0,042g/cm^2 ; p<0.001, Table 2). But, the exercise group demonstrated a significant gain compared with the control group in T- score (30,3% vs 21,83%;) and Spine BMD (12,56% vs 6,25%) (Fig. 2.).

In terms of changes after the treatment, a significant difference between the two groups was observed (p<0.001; Table 2). The two groups differ significantly with respect to the differences between the mean (-1,84 vs -2,19; p<0.001 for T score and 0,816 vs 0,748; p<0.001) improvements obtained after the exercise program.

Discussion

There is a series of available methods meant to determine the individual's bone density, but presently, the most popular method is called DEXA (Dual Energy X-ray Absorptiometry) which allows the measuring of bone mineral density at the level of the lumbar spine, femur and forearm bones. The achieved values revealed by the measuring are compared to statistical average values of bone density within a population of young healthy individuals of the same sex. The result is expressed as T-score which indicates the difference between the real calculated value and the reference value determined by the population chosen as "witness".

Several researchers have studied the possibilities of improving bone density in osteoporotic women. For example, Crilly and collaborators have analyzed the reaction of bone density to medication for periods of 6 and 12 months, observing an increase of BMD during both periods of time, concluding, thus, the fact that determining the efficiency of the treatment of imaging the lumbar vertebra with DEXA is plenty enough (Crilly RG, et al., 2000). Yamazaki et all has emphasized the effects of exercise program on BMD, using the DEXA after a period of 6 months (Yamazaki S, Ichimura S, 2004).

The present study proposes this method for the evaluation of bone density and calculation of T-score in the case of postmenopausal women with osteopenia or osteoporosis in order to determine the role of high - impact exercises for improving the two parameters already mentioned. BMD rating has been repeated to an interval of 12 months in order to investigate the progress of experimental group.

As a result of the analysis of the evolution registered by the two groups involved, we have noticed that after 12 months of regular high-impact exercise, the experimental group, as well as the control group, have manifested a significant increase of the BMD and T score (p <0,001), although, the progress of the exercise group registered a higher value reflected by a variation mean of - 0,79 compared to - 0,42, for T score and a variation mean of - 0,091g/cm^2 versus - 0,044g/cm for BMD. The greatest difference in variation between the two groups was found in both T-score (-1,84 vs -2,19; p<0,001) and BMD (0,816 vs 0,748; p<0,001).

Journal of Physical Education and Sport Vol 27, no 2, June, 2010
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Our research outcomes fit in with previous randomized controlled high-impact exercise interventions in pre and postmenopausal women. According to a recent meta-analysis, having as topics the effects of strength training on BMD of the femur, lumbar spine and radius in women, the resistance training appeared to be an effective means of maintaining BMD in the lumbar spine for women of all age groups (Häkkinen, A., et all, 2000). Sinaki and colleagues reported in their 3-year randomized controlled trial of dose-specific loading and strengthening exercises that lumbar spine BMD improved at 1 year with increased levels of exercise in the subjects who had lower BMD initially (Sinaki, M., et all, 1996).

Other studies oriented on pre and postmenopausal women have revealed the fact that a regular and continuous attendance to strength exercise programs (weight transfer and strengthening exercises), on long term, contributes in a positive manner to the improvement of BMD of lumbar vertebrae, femur neck and trochanter.

Another research including a number of 15 studies has indicated the fact that aerobic exercises, as well as, load-bearing exercises, had a positive impact on the lumbar spine mass in post-menopausal women (1.6% bone loss prevented vs. 1% bone loss prevented respectively) (Wallace, B.,A., Cumming, R.,G., 2000).

As a result of the application of our exercise program, significant progresses have been achieved within the experimental group, as well as the control group. Therefore, we may conclude that, regardless of the osteoporosis stage, the exercises training registers important improvements.

Conclusion

In conclusion, this study indicates that high-impact exercise is safe and effective in improving bone mineral density in the lumbar spine in postmenopausal women with osteopenia or osteoporosis. If done on a regular basis, this type of training may be an efficient, safe, and inexpensive way of preventing osteoporosis later in life. For this reason, the exercise program must be incorporated into a lifestyle change and be lifelong due to the chronic nature of bone loss in older women.

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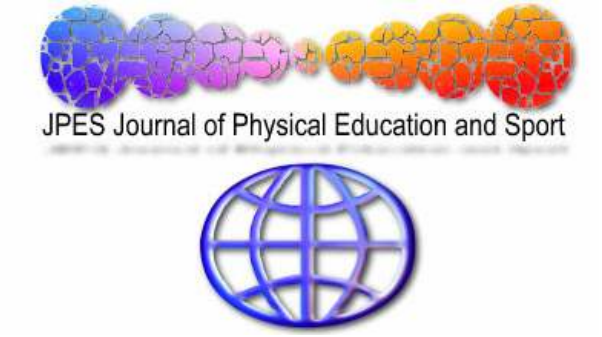

Online Publication Date: 20 June, 2010

ORIGINAL RESEARCH

HEALTH AND FITNESS: A BRIDGE BETWEEN KNOWLEDGE AND SUBJECTIVE MEANING

PERROTTA Francesco - Faculty 'of Motor Science, Italy

Abstract

The pedagogical perspective is now acquired the undoubted importance that, when referring to the learning processes of those in children, the interconnection between those that are defined in informal and formal knowledge. The first relate to the meanings that they attach to their own subjects, and external events, according to their cultural coordinates of reference within their life contexts. The second concern the powers that come to these same phenomena from the acquisition of concept maps and behavioral patterns related to the knowledge transmitted and practices called for in educational institutions, aspects that have formalized and generalized.

This approach has been applied in our case, the issues of health and well-being and interventions of their promotion in the school, whereas youth. In other words, the application of this perspective leads to say that such interventions, intended to encourage the construction of formal knowledge on these issues (from which to derive changes in our behavior), must in the first instance to consider the meanings attributed by young these issues involving their personal development and social meanings derived from their cultural contexts (informal knowledge).

keyword: health, quality of life, health and physical activities

Introduction

The deep and detailed analysis of these meanings is therefore necessary to give effect to implementing preventive interventions in schools, engaging projects and practical training in the cultural horizons of young people in order to solicit their motivations and their interests. Preventing it means to act for the preservation and maintenance of health, enacting forms of communication and relationship with young people, which are very effective in their effects, and they are not perceived as cultural overlaps far from their mental processes and their experiences. Furthermore, it seems increasingly to belong to the collective consciousness the awareness that prevention not only can contain the damage and suffering to come, but also makes it less heavy social costs necessary for the implementation of interventions to support and care to be paid back when the loss Health has already occurred.

The effectiveness of prevention must be based primarily on major conceptual coordinates, which assume significance in the introduction of health as a set of features on the whole person, integrating the bio-psycho-social components that allow life. Secondly, it should be a shared sense of health concerns, not an isolated individual, but placed in different contexts to report on various cultural dimensions, in different physical environments, natural, urban, which in turn contribute, or threaten individual health.

Prevention comes first set (or put) in place in the educational base, such as family and school. However, compared to the variability of family cultures, and importantly, the school is the only social institution involved in education and education of children, adolescents and youth, and is therefore the main institutional context in which to propose effective preventive interventions on the developmental age.

It should be noted that in perspective that is pointing in this paper the focus is precisely to prevent solicited from educational projects aimed at school to the entire youth population, and not only by actions that relate to the containment of phenomena of concern more or less already severe in some groups of pupils. These

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actions, while necessary and equally important, however, lie in retrospect, when the critical phenomena are already present in part or in whole. Such intervention is thus repair and should be considered in their specificity, referring to forms of maladaptive youth, divided into various forms of manifestation (drug addiction, aggression, anti-social, etc.).

Although present in many Italian schools initiatives in prevention, we can say that there is still a serious delay in activating appropriate preventive projects implemented through the promotion of educational initiatives designed, disseminated and, above all, permanent. Although in recent decades are discussed, more and more the importance of prevention, and the school is mentioned as the social institution in which the interventions in this field can involve all the young people, apparently still a long way to go.

And 'our conviction, however, that even with more "profound and widespread their effectiveness would be weakened without the adoption of the intervention model that is being analyzed in this paper, ie in the absence of prior and ongoing negotiation of meaning between adults and young people, and not just at school, but in any relational context (education, nursing, social sense above), in which adults and young people, or more generally, subjects are more varied Meet attempt to pursue the development of health and well-being for all sections of the human population. This negotiation is possible if interventions designed and implemented by adults (in our case by the school teachers wishing to promote educational projects in this area) leave, in the introduction, the analysis of the meanings attributed by young people to these essential for personal development and communities, meaning they have drawn on their cultural context.

If we assume the principle that training plans are important for the development of young people (which should involve more classes in the school, if not the whole school) should be based on the analysis of meaning already present in the recruitment of students, it becomes evident ' importance of exploring these meanings (defined precisely informal). From the perspective of the research presented in this paper, arises at this point two problems. The first is to refer to a literature that justifies the importance of cultural reference in the construction of knowledge of young people that construction is explicit in all the meanings they attach to internal and external reality (see point 2). The second problem is to identify the most appropriate arrangements to enable young people themselves to make posters, adopting methods that present survey reliability, in our case reported to the health and well-being (see also point 3).

THE PERSPECTIVE CONSTRUCTION MEMBER

The first issue of further consideration, as stated above, the reference to prospects that justify the importance of cultural context in the process of mental development and cognitive development in the 'evolution of subjects.

Here, we intend to refer to some psychological theories, which, although not designed specifically with reference to health issues, can be called to deepen this step. We refer specifically to the theories of cultural psychology, which from the perspective of the Russian psychologist L. Vigotskij (1896-1934), they found, especially in the last thirty years, significant development in American psychological research (J. Bruner, M . Cole can be considered well-known scholars from relevant reference) and European (Bruner, 1990.1996; Cole, 1996).

According to these theories are inter-psychological relations and cultural and social affiliations that create the material basis for the development of individual knowledge, and then adults who are in contact with the subjects in children (in educational institutions) play a significant role in support the development of these same subjects, in the proposal of the cultural models of reference. The cultural, and relational, interacting with the development of individual thought and are permanent area of interdependencies between culture, social groups that send children and youth, and developing them.

In this perspective, mental processes are in the first instance perpetually stimulated by cultural membership (the fact that cultures offer from J. Bruner is called the "toolbox" because these processes dynamic subjectively), and is therefore interesting to ask If there arises an educational perspective, as should be designed and implemented training interventions in classroom settings because these "cultural artifacts", these meanings already present in cognitive dimension of students according to their cultures of belonging can be enhanced and conjugated with the processes of school learning (Carugati Selleri, 2001).

Since cultures of belonging are woven of multiple systems of meaning, which (if it refers to entities in children) are mostly mediated within intergenerational relationships, the creation and negotiation of meaning between adults and individuals in development (including young people) on the side allows the construction of identity and the subjective sense of individuality, while, in the social, this creates the negotiating history of cultural change.

This perspective aims at understanding the development of complex mental processes. This complexity is not only stimulated by the multiplicity of systems of meaning present in the cultures of reference (think to anthropologists like C. Geertz and U. Hannerz), but also by the many forms of development of the mind in each individual (the reference is to the psychologist H. Gardner with his theory on multiple intelligence). The game

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and the intertwining of these multiple paths of meaning leads to recall both the phenomenological aspects of human relationships (as it is expressed in the mediation between systems of meaning expressed in cultures and development of the individual) and a more large complexity of mental forms through which the thought develops and knowledge is developed (Gardner, 1987; Geertz, 1998; Hannerz, 1998).

This is to enhance the relationship between cultural complexity and social organization of the processes of signification, referring to the primary matrix of the flow of meanings within and between social groups and peoples emerging from 'set of cultural interactions on which organizes the social dimension. According to U. Hannerz culture is interwoven "... meanings that people create, and that in turn create people as members of a society ..."(Hannerz, 1998, 5) "...(The) distribution of items cultural population structure is a matter of cultural meanings people give such a distribution (including these otherwise distributed) that are more or less correct, and that set of differences. The main implication of the idea of culture as a distribution organization of diversity is not simply to remember the fact that individuals are not all equal, but rather that people are faced with the meanings of others, namely that exist in the environment of a person, meanings and forms on which significant others individuals, groups, or groups have more claims, but to which everyone is in a sense asked to give an answer ... " (Ibid., 21-22)

If we refer to these brief notes, it is reasonable to say that compared to the issues and world events, cultures belonging to operate in the proposed interpretations (significant forms) and explanations (meaning) that are mediated in the first instance within intergenerational relations, but which continue to be the land of interpersonal exchange in any type of human relationship.

Each report can therefore be considered an interactive trail to negotiate meanings so, returning to the issue of health and meanings that can be attributed to it by the youth, should be reported and the following steps. There are first meanings of this term present in adults who come into contact with the subjects in childhood (both parents, teachers, doctors or others), just as there are meanings found in general reference cultures to which these same adults belong and that they mediate for young people. Conversely, on the other hand there are also meanings of health in patients in children, that those same adults have received interpretation, but from which they draw on to construct their own meanings of this essential aspect of physical life and mental meanings solicited from other informational sources that young people today use (media, new technology) or their subcultures group reference.

In every area where action is taken to prevention (protection and maintenance of health), or implement care interventions, meaning negotiation that all stakeholders have to be explicit. If we refer to the school context, this means promoting among teachers and students which might be called Alliance for Health. This alliance has as its premise the exchange of views between the speakers, making explicit the expectations and discuss common strategies to achieve goals that must be shared, because they were considered useful to be pursued by all relevant players.

If our attention is turning to younger age groups, and especially if the reflections are focused on the exposed side of prevention groped need to know in depth the meanings young people attach to health and well-being. Deficiency which must be filled is that of knowing what they are meanings attributed to these essential aspects of their growth and their development, to give them the stature and dignity of actors able to negotiate meanings with others with whom they come into contact in educational contexts.

THE CONSTRUCTION OF MEANINGS FOR HEALTH AND WELL-BEING

In most of the literature that focuses on research concerning the methods of construction of meaning on the health and well-being (well-being), the focus is mainly on the analysis of this second condition (note the well-being) as an explicit indicator of the presence of health. The studies tend to consider the meanings that are developed in this regard related to the presence, or lack of general equilibrium condition bio-psycho-social, relate to the quality of life of each person, groups or entire societies.

In the first case the meanings are built by derivation from an experience of positive well-being, in seconds as opposed to a condition more or less severely lacking on this floor. Of these meanings also have meanings more complex and extensive than those related to the subjective situation, since the condition is related to individual coordinates environmental and socio-cultural context that determine the quality of life, and therefore affect personal health and collective.

Regarding the construction of these meanings, we can therefore identify two research approaches in dealing with this problem, approaches that focus respectively on the side of more external conditions, or more towards the subjective conditions. The first approach poses the question in terms of social indicators of well-being (social well-being), in other words, the meanings attributed to this state from cultures to which it belongs. The second approach focuses on the meanings that individuals attach to the well-being (subjective well-being)

Since the original studies by F. Andrews and S. Withey (1976) until the most recent CLKeyes (1998) placed in the first research area is focused on just the socio-cultural effects on the subjective perception of well-

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be (such as models of social realization, acceptance, belonging, inclusion, that convey the meanings found in the dominant cultures of reference).

In the second area, which saw a much wider development of formulations and empirical tests (eg Brief et al, 1993; Brunstein et al, 1993, Feist et al, 1995), are part of the research aimed to investigate the meanings that subjects attributed to the well-being, is trying to detect individual differences. There is no doubt that a matrix of these variations makes reference to the plane of the meanings attributed to that condition, as background to cognitive behavior occurs.

Many other studies correlate the development of personality with the subjective well-being (Emmons and Diener, 1985; Headey and Wearing, 1989; Omodei and Wearing, 1990, Diener and Fujita, 1995), identifying personality traits (such as the ' intelligence, emotional stability, the imaginative ability, extraversion, self-sufficiency, self-control) interacting with the well-being. According to this research (based on theories defined top-down theories) is the personality of the subject leads him to react in a positive or negative, to external situations. Considering the well-being identified with the life satisfaction, have for some time that different from other theoretical approaches (bottom-up theories), they considered satisfaction as the sum of moments satisfactory in various conditions of existence in certain areas (family financial situation, etc.)..

Efforts are being made to apply to research an integrated model of the two theoretical approaches, and some of them try to investigate the correlation between this model and the analysis of whether the well-being. In other words you want to understand how the personality of the person and external events (which encourage, or contrast, the well-being) affects the health of the subject, and its meanings are assigned by the same person.

Even more specifically as regards health (which can therefore be considered the key component of well-being), there are different meanings attributed to it, which determine the behavior of individuals and groups. Precisely for this reason is found not only the complexity of prevention, but also its effects, which, being experienced differently by individuals, it does not provide the necessary durability, which would involve the modification of behavior more or less at risk . The same psychological research directed to investigate this issue (Taylor, 1990) indicates the need for a reconceptualization of the terms of health and disease, and notes that promoting health in the contemporary needs of a changing behavior, resulting not only from new lived on an emotional level, but also new concepts at the cognitive.

THE DESIGN OF AN EMPIRICAL RESEARCH

Considering all the issues reported so far, at the Faculty of Psychology, University of Padua, created in 1997 a research team (composed of educators and psychologists) coordinated by one of the authors of this paper (R. Semeraro). The research aims to analyze the meanings attributed by young people to the health and well-being, so that prefigured prevention initiatives in schools, based on constant negotiation of meaning among the actors involved.

The research is based, in the introduction, the acquisition of certain coordinates considered valid based on the acquired theoretical and experimental approaches (see previous paragraphs of this essay).

First assume that education, as a process characterizing relations between the generations, can not be fully effective if cultural models offered by adults do not meet the attribution of meaning that characterize the forms of knowledge of those in children and orient behavior.

The second premise is that the education of young generations, and plans to complete the training program (such as those of health education in schools) should be seen as dynamic processes that should allow for continuous mediation between the meanings that young develop within the cultural and environmental contexts of reference (meaning that they organize themselves into what are called informal knowledge) and formal knowledge, more general and elaborate. It shows the importance of investigating the informal knowledge of students, as well as detect whether the families of specific meanings (in this case they refer to the health and well-being) are a consequence of differences in their cultures of reference (in our If identified in different urban cultures). For this reason the research (after the preliminary stages of development and calibration of the instrument of investigation) is addressed to young people attending the last years of secondary school (aged between 17 and 19 years), placed in different urban environments (cities of Milan, Taranto and Venice) and several secondary addresses.

Considering the approaches of investigation reference (presented in paragraph 3 of this essay), the comparison between different groups of young suspects, in the three cities would have to answer the following questions: a) the meanings attributed to the health and well-being by these same young people were differentiated according to the urban environment (with reference to bottom-up theories), or if you would predispositions configured to attach more significance related to the personality of adolescents as such, that their conditions Life (in reference to top-down theories), less possible if the differences between the groups were not found to be relevant and statistically significant

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The young people surveyed were about 700 during the pre-search (for the construction and calibration of the instrument used) and 1200 in the research phase itself (with 400 groups in three cities under consideration, equally divided between males and females)

Analysis of the data (presented briefly in the next section 5 of this paper) there are interesting indications that, for example, the meanings attributed to the health and well-being in general, focus more on qualitative (with attributes of state or process conditions) and involving (in their construction), in turn, plans of sensation, perception, representation and so on. In other words, the health and well-being of young people are assigned meanings that express the connection between states (current conditions in the subject) and dynamic (tension simultaneously in the same subject) oriented balance and harmonization between the physical conditions , psychological and mental health of the person. Even when they are asked to assign meanings to the health and well-being related to their life contexts, such meanings reflect the centrality of attention refers to the subjective conditions rather than external conditions that promote health and individual well-being.

Contrary to what happens in American research, many of which are directed to explore what the external conditions that can generate well-being in people and almost never referred to the young, emerge from the research data presented here stress the components more representational and conceptual construction of meaning (components that could be defined more related to personality traits of young people and gender identity), which have extensive and explicit references to the external environment, although some issues are highlighted significant differences between groups of youth three cities.

The data, although support the effective adoption of a mixed model in process of construction of meanings related to the health and well-being (a cross between top-down and bottom-up theories) tend to emphasize more the 'importance that the internal components of personality and gender identity (differences between males and females) in the design and construction of these meanings.

The reference to these results could result in schools that, in the design and implementation of interventions aimed at prevention, through the spread and practice of educational experiences aimed at promoting health and well-being in young people, attention teachers go in the first instance issues related to age and sex among young people, encouraging them to make explicit the meanings they attach to these words, as well as oriented to combine considering the cultural contexts in which they live

RESEARCH AND ITS RESULTS

THE CONSTRUCTION OF THE QUESTIONNAIRE

The first protocol of investigation was built by a research group, created in 1997 and coordinated by Prof. Raffaella Semeraro, consisting of educators and psychologists. For the construction of the questionnaire refers to the integrated model of theory top-down and bottom-up, respectively, which indicate the meanings of health and well-being divorced from context and placed in context. The objectives of the survey are configured in the collection of data on the meanings attributed by adolescents to the health and well-being in general (top-down-theories). These meanings are also considered in assigning to their well-being in specific circumstances (holidays, leisure), and in particular contexts of life (school, friends, family), as well as allocated, according to the subject , mass-media (bottom-up theories). In this first phase, requiring free responses from the subjects.

Initial survey were then collected for writing about the meanings expressed by 200 subjects (between 17 and 19) stimulated by incomplete sentences such as: "For me the meaning of health corresponds ..." "For me the meaning of well- corresponds to-be ... "" For me the meaning of well-being (family, friends, school, vacation, leisure, presented by the media) is to ... ". Each subject completed the sentences. The research team analyzed each protocol, selected responses, discussed the meaning ascribed to them in terms of health, well-being in different institutional contexts and relationships, building a map of items, in different scales and specifications corresponding to different meanings given to the terms indicated. From this first selection were assigned different meanings: health (40 items), the well-being in general (52 items), the well-being in the family (25 items), friends (28 items), school (36 items), on holiday (23 items), leisure (25 items), presented by the media (27 items). To proceed with the construction of the instrument itself were involved in the spring of 1999 about 550 teenagers. The subjects of the sample groups were divided in proportion to the number of items selected in each scale, giving responses to a second five-level Likert scale (from complete agreement than disagreement).

The data obtained from administration of the protocol were subjected to factor analysis (principal components and Varimax rotation) using the statistical program SPSS. He then proceeded to interpret the factors that emerged from analysis (assuming a variance> .40), and analysis of internal consistency (Cronbach's alpha => .62 for each of the eight scales considered) to select Significant items within the different scales, items that would make the search tool itself. From this second selection were assigned different meanings: health (37 items), the well-being in general (45 items), the well-being at school (28 items), the well-being leisure (18 items) , the well-being in the family (23 items), the well-being with friends (28 items), the well-being on vacation (17 items), the well-being presented by the media (25 items).

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Journal of Physical Education and Sport Vol 27, no 2, June, 2010
e – ISSN: 2066-2483
p – ISSN: 1582-8131

RESEARCH

1240 questionnaires were administered to subjects in the last two years of upper secondary school in the city of Milan, Taranto, Venice and their suburban areas. The idea was to identify any significant differences between youth groups in three cities in the attribution of meaning, and infer from what the impact of informal knowledge about the same assignments.

The survey sample was divided according to different contexts, sub-regional origin of subjects: 422 subjects in the province of Venice, 418 subjects in the province of Milan, and 400 subjects in the province of Taranto. The comparison between the different subgroups would answer the following questions: a) the meanings attributed by adolescents to the health and well-being vary in their spatial context (bottom-up theories), or b) Is there special predisposition to meanings attributed mainly related to personality characteristics of adolescents as such (top-down theories).

SEX							
MALE				FEMALE			
		CITY			CITY		TOTAL
AGE	VENICE	MILAN	TARANTO	VENICE	MILAN	TARANTO	
16						2	2
17	54	66	48	64	90	49	371
18	78	93	104	117	95	112	599
19	44	49	48	65	25	37	268
TOTAL	176	208	200	246	210	200	1240

The data obtained from administration of the protocol were subjected to factor analysis (principal components and Varimax rotation). He then proceeded to interpret the factors that emerged from the analysis (considering a variance> .40), and analysis of internal consistency (Cronbach's alpha => .60 for each of the eight scales considered) which have emerged factors for each subscale. As regards the meaning of health, the characteristics ascribed by the factors identified are: a) balance and inner energy, b) no physical illness, c) openness to the socio-cultural, d) physical and mental balance.

As for the meanings attributed to the well-being in general have been reported: a) no problems, b) harmony and inner satisfaction, c) positive relationship with oneself and with society, d) ability to interact with the 'other than itself.

Considering instead the meanings attributed to the well-being, as experienced by adolescents in various contexts of life, you can report the following specifications:

- Family well-being: a) mutual sharing of values, b) freedom of action, c) time-sharing.
- Well-being at school: a) management of school work, b) positive interaction with the group class, c) recognition of such efforts.
- Well-being on vacation: a) freedom to experiment without constraints, b) pleasure of discovery, c) rest.
- Well-being in their free time: a) engage in leisure activities, b) engage in activities that interest you, c) no worries.
- Well-being with friends: a) feelings of reciprocity, b) spend time together, c) absence of conflict.
- Well-being presented by the media: a) external, b) solidarity for those in difficulty, c) pursuit of its objectives to the detriment of others.

He then proceeded to calculate the Pearson correlation coefficient, used to express the degree of internal correlation between different scales in order to identify the connections between them (eg between the scale health and well-being scale, and so on).

Also we tried to see if the meanings emerged from factorial differ for gender identity (thus independent from the urban contexts of belonging) or if they have significant differences between students of the cities examined in relation to their life contexts. Specifically we posed the question whether the meanings attributed by the students and students with questions from survey instrument were to be given to issues related to their gender identity or cultural diversification.

Finally we tried to see if there are any interactions sex * city can influence the beliefs held by students always considering the subjects' responses as to the factors identified.

RESULTS

Analysis of the results was conducted in three phases complementary. In a first phase was analyzed by gender differences using the Student t. Since the difference between the responses of males and females were

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statistically significant in 18 out of 26 factors, it can be concluded that the independent variable sex can influence the meanings attributed to health and well-being.

Careful analysis of the data appears to be a tendency to give women a greater consensus towards what we might call relational factors (positive relationship with the other "," positive interaction with the class group ") and introspective (" equilibrium physical and mental, "" inner harmony "," mutual sharing of values), while males seem more oriented towards factors that might be called experiential ("freedom of action" and "freedom to experiment without constraints). This type of result seems to confirm an increased susceptibility by females, with attention to their internal world, and their emotions, confirming that the expression of emotion is linked to greater openness to the processes of socialization. Moreover, the differences between the sexes trend noted above, seem reinforced by way of understanding interpersonal relationships. For example, with regard to friendship, females seem to have an understanding of friendship based on the exchange of confidences and affection ("reciprocity of feelings", "no conflict"). Furthermore, it seems geared more specifically to investigate the psychological aspects of the report, related to intimacy, mutual devotion to mutual support. The males however, would seek friendly relations in particular in the sharing of time and experience, are in fact primarily interested in finding friends to share activities and interests, which try together in a series of "adventures" on the plan of action.

Another important aspect which manifests the distinction between males and females is about how to design the well-being at school. Indeed females prove to be highly motivated towards school, and that want to commit to academic success through a good organization ("management of school work") and a good climate class ("positive integration with the group class) , they also consider it important that their commitment is also recognized (recognition of such efforts). Males, although whereas the school context of their lives, especially, appreciate more free time. They consider it as a time when to let go and relax even while females prefer to spend their free time engaging in interesting activities.

A final consideration is that the females give an average response significantly (higher than their male counterparts) to factor "externality" of the ladder well-being presented by the media. This factor the well-being to the acceptance of the image outside, and this reveals a greater sensitivity to the need for physical beauty at all costs, being always in step with fashion. The findings should make us reflect on the role of media messages, in reference to what has been observed, should be critically reviewed and corrected in view of the hidden processes of persuasion that are transmitted through them.

In a second phase was the comparison between different cities through the analysis of variance, to investigate whether there was a significant difference in approach to health, well-being and the well-being in the contexts under city of residence. The results that emerge are very interesting. Indeed, there is in most cases (statistically significant differences according to the city of residence in 23 out of 26 factors) effect on the city-way of perceiving the dimensions considered by adolescents.

Analyzing all of the issues presented by the tool in different scales (see Section 2.2 of this essay, where you indicate the factors identified) is not there a difference between adolescents in Milan than in Venice and Taranto, in relation to able to express agreement on the meanings proposed. Indeed, adolescents who reside in this city, a significant share almost all the allegations emerged analyzing data. From This suggests that adolescents Milan draw more complex systems of meaning applied to the health and well-being than other groups of two cities considered. Instead, they are young Taranto expressing agreement and therefore a lower degree of complexity of meaning in the explanation of the scale investigated. It is plausible that this pattern of responses that reflect the real views of children, is influenced by local culture that conveys meanings and ways of looking at life together different.

In a third phase was finally considered (by applying the two-way ANOVA) whether or not there were significant differences in the attribution of significance to health, well-being and the well-being in contexts, due to a possible interaction between city of residence and sex. In this additional analysis comparing males and females of the three cities the differences described above are further confirmed. There is indeed a sharing of meanings with regard to general and abstract concepts of health and well-being, but the differences are found in the definitions of well-being in contexts both in the cities of residence for subdivisions under sex. In fact, males and females show different interests as regards the well-being in contexts probed by the survey. Teenagers give the three cities, in fact, important other aspects of context. We noticed that are important relationships with family, friends, in the context of life for both sexes. However, while for females these relations are marked by intimacy and sharing of values, for males the most important aspect of sharing time and the possibility of new experiences. This finding confirms what has already emerged in the first phase of data analysis. Three cities in the relational dimension is greater in the cities of Milan and less in the city of Taranto. The key feature that is believed to possess size is authenticity: the boys asked to be themselves and feel accepted and loved for who they are, but also that their interlocutors are sincere and open, that does not mask behind roles fixed or conventional. Another key feature of this dimension should be reciprocity: the equal dignity of the actors while recognizing and respecting differences.

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Another important fact is the request to have the opportunity to grow culturally, and at school, at play, in addition to requiring more time and freedom to engage in interesting activities. Linked to this is the need, particularly males, do not feel oppressed, to be serene and free to act even in the choice of activities in which to engage. This need is most felt by teenagers in the city of Milan than the other two cities, one can assume, therefore, are more willing to receive reductions in the area of freedom.

CONSIDERATIONS ON THE SCIENTIFIC LITERATURE OF REFERENCE

The aim of the investigation to determine whether the meanings attributed by adolescents to the health and well-being were influenced by local culture (bottom-up theories) or more general factors such as the personality of adolescents (top-down theories) is response in the data.

The analysis conducted seem to support bottom-up theories to the extent that the responses of children of the three cities considered to differ significantly from each other.

These theories, however, should not be considered all-encompassing as the differences in responses by males and females of the three cities are linked to membership of gender, and somewhat independent of the local culture. As indicated above, while females are predisposed to search for factors most intimate (such as socialization, understood as exchange of experience and affection), the males point their attention on more practical factors (such as knowing how to face and overcome problems).

For this reason, the research data tend to lead to the need to integrate the two approaches do not neglect the influence of general variables (the being of adolescents as such), but also taking into due consideration the local variables (the sub -culture of belonging). Analyzing these data, we can say that the health education of young generations must therefore be conceived as a dynamic process which should enable the mediation continues between the meanings that young people develop within the cultural and environmental contexts of reference, meaning arising more general knowledge from formal and processed with a relative distance from these same contexts.

REFLECTIONS ON HOW 'MOTION FOR A PROJECT IN SCHOOL HEALTH EDUCATION

The ultimate goal of data collection is to develop an education project to the health and well-being in school or other educational environments in which adolescents live. This intervention begins with an innovative concept of educational planning and educational as these are considered priority needs of pupils and not only aspects related to acquisition of knowledge notional. To this end key is attention to context variables. There are, in fact, the constraints that come from the school external contexts and conditions should be an explicit map of values and social and cultural expectations that can not be disregarded in the process of education. So far it projects for education and health promotion have been made without taking into account the meanings of this size were given by the subjects to which these projects were addressed. He also referred to a conception of health as opposed to the disease condition and, therefore, health education projects are proposed with a containment function of pathological phenomena rather than support for a positive condition of life. The account from which side, however, is that health is a more complex, which includes psychological, environmental and social, so it is this complexity that must be the premise of educational interventions.

Precisely for this reason must first assess the needs of recipients in this area. It is important that an education project to the health and well-being part of a dialogue with their recipients, by understanding their specific system of meanings. The data collected in the survey reported here briefly, show many differences within the youth population even if some issues recur constantly, above all the importance of peer relationships, sincere and positive. An intervention project would then have a basis of a general nature made from these common needs identified in the overall population of adolescents, but should then be implemented flexibly, adapting to specific needs and requests of who is in front. Adolescents rely on their daily experience to define the meanings of health and well-being and, therefore, might be desirable action that takes into account situations that are known by young people to make acceptable to them every educational project.

Another point to be considered in designing health education interventions concerning the involvement of people who are part of the life contexts in which they are young friends, family, teachers play a key role in the complex meanings and that's why they can not be involved in such projects. The educational activity that school plays in health is not primarily addressed to the then "defense" or "protect" but rather to discover new concepts of health and well-being in young people to better involve them in educational projects. They should be geared towards capacity building, reporting for the development of personal and group potential, identification of balancing mode, active adaptation to the constraints and limitations intervening in everyday life. Health promotion in fact is linked to continuous adaptability on the part of man, is characterized by a future-oriented time perspective and the evolution towards new and different balances.

Finally, prevention to be effective, must first refer to the health and well-being as dimensions that include sections on the whole person in the integration of its components, bio-psycho-social. Secondly, the meanings attributed to the health and well-being should not refer only to individuals but should be related to the

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various relational contexts, the various cultural dimensions, and different physical environments, natural, urban, in turn, promote or threaten individual health.

NOTES

1 Sections 1.2, 3, 4 of this essay were written by R. Semeraro. Point 5 was prepared by Dr. E. Ghedin, a graduate in Psychology and PhD course at the PhD in Educational and Pedagogical Sciences, Department of Educational Sciences, University of Padua.

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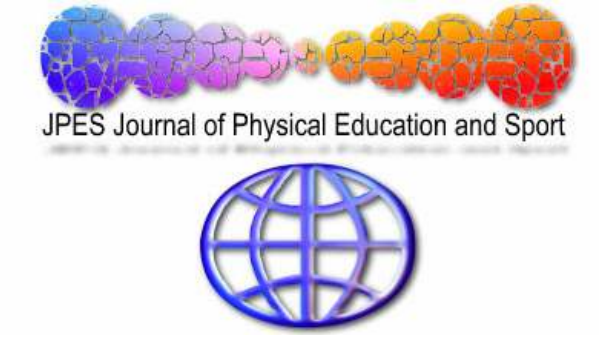

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ORIGINAL RESEARCH

COMPARISON OF THE RELATIVE STRENGTH AMONG THE DIFFERENT WEIGHT CATEGORIES OF POWER LIFTERS

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Abstract:

The purpose of the study was to compare the relative strength among the different weight categories of power lifters. The subjects were selected from the male lifters of All India Inter University Power Lifting Championship held at Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh (India). Fifty four (54) male Power lifters were divided into three groups of Eighteen (18) each and the best six (6) in each weight categories was selected as the subject for the study. The Power lifting performance or scores in respective body weight were presented to compare the relative strength among the different weight categories of power lifters. The relative strength of power lifters can be obtained by dividing recorded performance or score with body weight of the subjects. To see the significant difference of relative strength among the different weight categories of power lifters the analysis of variance "F-ratio" was applied at.05 level of significance. For further analysis "Post-Hoc Test" (LSD Test) was applied. The obtained value of "F-ratio" (37.974) was greater than the tabulated value (3.18). The analysis of data reveals that there is a significant difference in the entire three groups in their relative strength, however group I had shown highest relative strength as its mean value is highest among all groups.

Keywords: Relative strength, Body weight, Lifting score, Power lifters

INTRODUCTION

Today is an era of minimum input and maximum output and for this; every possible work is being done to increase efficiency. Every perspective angle is being thoroughly scrutinized by researchers and scientists together, so that sportsman can get maximum mechanical advantage to improve their performance, clear insight of sports during Greek period was reflected in the epic period of Homer. Games were the part of the daily life of the people or any important event.[1] Sports can improve the components of fitness namely: Strength, speed, endurance, flexibility and suppleness. Strength, the ability to exert muscular force is a component of physical fitness and has been of interest since antiquity and many account of super human quality to lift stupendous weight have been recorded. The scientific principles of increasing the load of resistance against which muscles work that strength increases has been called progressive exercise and has been employed extensively in modern times by individuals interested in strength development and athletic performance.[2] Research indicates that for untrained individual not engaged in heavy manual labor or exercise, maximum muscles strength is reached between the ages of eighteen and twenty, after which it decreases gradually. With increased age and disuse of muscle there can be marked reduction in muscular strength.[3] Strength is also one of key to success in modern games and sports. Such as a statement may sound extreme but nevertheless it is true strength, however is the key element because it is more improved than other elements? It is in fact the only element that can only be

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improved with one hundred percent success.[4] Strength training is not only limited to competitive sports, but also training for prevention and rehabilitation, as well as strength training as a leisure time activity in gym is now quite common, strength training was, and still is a major part of athletic training with the aim to improve performance.[5] Power lifting consists of three separate lifts; the squat, bench press and dead lift. In competitions people are grouped into weight classes where they compete against people of similar weight. Each lifter is allowed 3 attempts in each lift to lift the most weight they can. In order for a lift to be considered "good" at least two of three judges must agree that it was "good" lift, meeting all the rules of the power lifting competition for that lift.[6]

OBJECTIVE OF STUDY

The objective of the study is to examine the comparison of relative strength among the different weight categories of power lifters.

METHODS

SUBJECTS

The subjects were selected from the male lifters of All India Inter University Power Lifting Championship held at Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh (India). Fifty four (54) male Power lifters were divided into three groups of Eighteen (18) each and the best six (6) in each weight categories was selected as the subject for the study.

CRITERION MEASURE AND RELIABILITY OF DATA

Criterion measure for this study was to compare the power lifting performance or score in the respective body weight categories in All India Inter University Power Lifting Championship for the year 2006-2007. The reliability of data was ensured by establishing the instrument reliability and testers competence. All the instruments and equipments like weighing machine, bar, weight plates, collars, squat stands, benches and outfits were taken from Lakshmibai National Institute of Physical Education, Gwalior, research block and weight training hall, which has been supplied by well know standard agencies and companies. Before the use of these instruments and equipments, they were calibrated for the accurate result. Since the data's for the study is taken from the performance of "All India Inter University Power Lifting Championship" which was held at L.N.I.P.E., Gwalior and was conducted by the qualified National and International referees, these scores were assumed to have higher level of reliability.

PROCEDURE FOR COLLECTION OF DATA

The comparison of relative strength of various lifters of different group, the data was collected from the results of "All India Inter University Power Lifting Championship". The sum of the best 3 lift of respective events was considered as the scores of the lifters.

PROCEDURE FOR ADMINISTRATION OF TEST

The procedure for administration of the test only nine (9) categories of actual eleven (11) body weight categories was taken by eliminating the first and last two categories i.e. up to 52 kilograms and + 125 kilogram category for relative strength of power lifters. The score or performance achieved in the power lifting namely: Snatch, Bench press and dead lift by the subjects can be divided with the body weight. The relative strength was recorded in kilograms. The scores or performance of the lifters were analyzed by calculating the means and the data were subject to one way analysis of variance in order to find out the significance difference in the means. It was assess by conducting the test in institute laboratory by skilful and specialized experts with use of highly technological instruments.

STATISTICAL TECHNIQUE EMPLOYED FOR ANALYSIS

To see the significant difference of relative strength among the different weight categories of Power lifters. The analysis of variance "F-ratio" was applied at.05 level of significance. For further analysis "Post-Hoc Test" (LSD Test) was applied.

FINDING

Findings pertaining to relative strength of the different weight categories of power lifters 54 subjects were divided into three groups of 18 each. The sum of the best 3 lifts of respective events was considered as the scores of the lifters. The mean values of all the three groups are having been presented in the following tables 1.

Journal of Physical Education and Sport Vol 27, no 2, June, 2010
e – ISSN: 2066-2483
p – ISSN: 1582-8131

TABLE-1
MEAN OF SCORES OF THE RELATIVE STRENGTH OF LIFTERS FROM DIFFERENT BODY WEIGHT GROUPS

S.NO	GROUP	MEAN(M)
1	I	8.998
2	II	8.038
3	III	6.261

M = Mean value of relative strength in kilograms.

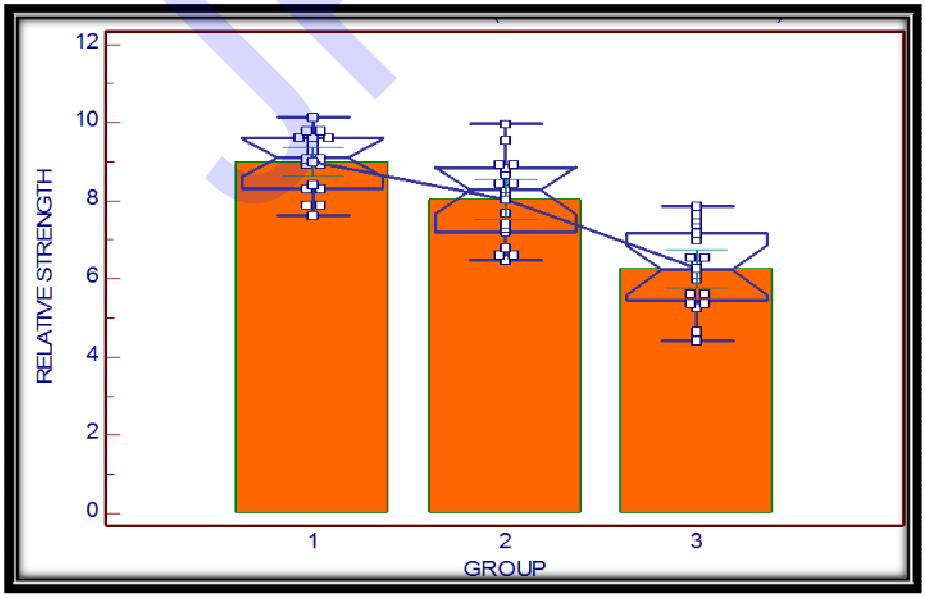
The data were further subjected to one way analysis of variance. The results of one way analysis of variance (ANOVA) of the data of subjects in relative strength are presented in table 2.

TABLE-2
ANALYSIS OF VARIANCE (ANOVA) FOR THE DATA OF RELATIVE STRENGTH OF VARIOUS DIFFERENT CATEGORIES OF POWER LIFTERS

Source of variation	Sum of squares	D.F.	Mean square
Between groups (influence factor)	69.5714	2	34.7857
Within groups (other fluctuations)	46.5370	51	0.9125
Total	116.1084	53	
F-ratio	38.122		
Significance level	P < 0.001		
Factor	**N**	**Mean**	**Different (P<0.05) from factor nr**
(1) 1	18	8.9988	(2)(3)
(2) 2	18	8.0380	(1)(3)
(3) 3	18	6.2589	(1)(2)

Tab. F.05 (2, 51) = 3.18

TABLE-3
PAIRED MEAN DIFFERENCES OF RELATIVE STRENGTH OF VARIOUS DIFFERENT CATEGORIES OF POWER LIFTERS



As shown in Table 2 that the obtained value of 'F' ratio that is 38.122 was greater that the tabulated value of 3.18 for the selected degree of freedom and level of significance which indicates that the subjects of the

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p – ISSN: 1582-8131

entire group differ significantly in relative strength. To further analyses which group is better! Pair wise mean comparison analysis was done by using Post Hoc Test.

TABLE-4
POST HOC TEST FOR THE COMPARISON OF RELATIVE STRENGTH AMONG THE DIFFERENT WEIGHT CATOGARIES OF POWER LIFTERS

MEAN OF DIFFERENT GROUP			MEAN DIFFERENCE	CRITICAL DIFFERENCE
I	II	III		
8.998	8.038		0.960	0.637
8.998		6.261	2.737	
	8.038	6.261	1.777	

Above Table 4 indicate that there were significant differences in the entire three groups.

TABLE-5
POST HOC TEST FOR THE COMPARISON OF RELATIVE STRENGTH AMONG THE DIFFERENT WEIGHT CATOGARIES OF POWER LIFTERS

M3	M2	M1	CD at 5% Level
6.261	8.038	8.998	0.637
"	"		

After applying the Post Hoc Test it was found that there was significant difference in the entire three groups in their relative strength. However group I had higher relative strength.

DISCUSSION OF FINDING

The analysis of data reveals that there is a significant difference in relative strength of various categories of lifters was found at the selected level of significance which establishes that various categories of lifters possesses different level of relative strength. After applying the Post Hoc Test it was found that there was significance difference in groups I (8.998), Group II (8.038) and Group III (6.261) in their relative strength. However group I had higher relative strength. This may be due to the different nature training and pre-requisite components for lifters. Such results may be due to small size of sample and factors such as different body types, difference in the body compositions etc.

The significant differences in relative strength of different weight categories of power lifters were probably due to the different nature of training and pre-requisite components for athletes. Such results may be due to small size of sample and other factors such as different body type, difference in the body composition etc.

SUMMARY AND CONCLUSION

The purpose of the study was to compare the relative strength of the power lifters belonging to various categories. Fifty four male lifters who have participated in various categories in All India Inter University Power Lifting Championship held at Lakshmibai National Institute of Physical Education, Gwalior for the year 2006-07 were selected as subjects. Their relative strength was recorded in kilograms. The scores or performance of the lifters were analyzed by calculating the means and the data were subject to one way analysis of variance in order to find out the significance difference in the means. The results have shown that the lifters participated in various categories differ significantly in their relative strength. The selected level of significance was 0.05. After

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applying the Post Hoc Test it was observed that there were significant difference in relative strength, however group I (8.998) had highest relative strength as its mean value is highest among all group. The lifters participated in various categories showed a significant difference in their relative strength. Group I had the highest relative strength and its mean value is highest among all the groups.

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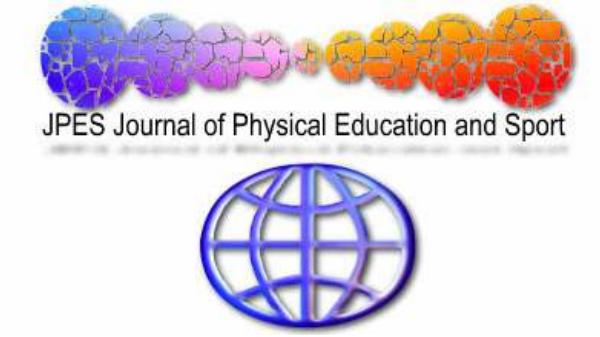

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ORIGINAL RESEARCH

QUANTITATIVE ANALYSIS ON THE PARTICIPATION OF ROMANIAN FEMALE NATIONAL TEAM IN WORLD HANDBALL CHAMPIONSHIP – CHINA 2009

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Abstract:

The 19th Women's World Handball Championship took place in China from 5 to 20 December 2009.

Matchess of C group, group that included Romania, took place in Suzhou.

In analyzing the evolution of the Romanian handball team in the 2009 Women's World Championship there were used the observation methods (direct observation method or simply watching the matches) and the statistical-mathematical method, having as support statistics provided by the organizers through websites of the competition and of the International Handball Federation.

Low efficiency of 9 m line players and of goalkeepers, missed 7m shots in important games led to defeats in all confrontations with the European teams. 9m line players and wing players had a low contribution to the scored goals.

The team showed little psychological preparation, evidenced by the series of negative results recorded after the first defeat, in the next 4 matches they got one win, a draw and 2 defeats.

In the 9 games in dispute there were obtained 5 wins, one draw and 3 defeats. In comparison, the world champion – Russia played 10 matches with 9 wins and one defeat, and world vice-champion won 8 games and lost 2.

At the end of these 9 matches there was an average of 34 scored goals per game and 25.66 received goals. For matches with the European teams the average is 26.25 scored goals and 27.75 received.

Key words: handball, female, world championship, quantitative analysis

Introduction

The 19th Women's World Handball Championship took place in China from 5 to 20 December 2009.

The 110 matches were hosted by 6 cities: Wuxi, Zhangjiagang, Suzhou, Changzhou, Nanjing, Yangzhou. Matchess of C group, group that included Romania, took place in Suzhou.

The playing schedule was a complex one, including a preliminary round involving 24 teams divided into 4 groups (A, B, C, D). In the second stage of the competition, meaning the main round, there were 12 teams, 3 teams from each preliminary group.

In the second round there were formed two main groups (M I, M II), each counting 6 teams.

Teams eliminated after the preliminary round continued to play for the competition named *The President's Cup*, organized in 2 groups (PC I, PC II) each group counting 6 teams, which determined the final ranking of matches.

The nucleus of players trained and participants in World Championship was composed of a total of 18: goalkeepers – 3, wing – 4, backcourt – 6, center back – 2, line players – 3; 14 players being nominated for every match.

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C group included national teams of Romania, Chile, Japan, Hungary, Tunisia, Norway. Romanian national team matches were held following the schedule below:

5.12.2009 Romania – Chile (51 – 17)
6.12.2009 Romania – Japan (37 – 28)
7.12.2009 Romania – Hungary (31 – 25)
9.12.2009 Romania – Tunisia (39 – 22)
10.12.2009 Romania – Norway (24 – 25)

Romania achieved 4 wins and one defeat, being the 2nd team in C group ranking. The wins against teams representing areas like Asia (Japan), South America (Chile) and Africa (Tunisia) were achieved at very high score differences, between 9 and 34 goals.

The match with the Hungarian team ended in favor of Romanian players, being a difference of 6 goals, while with Norway they lost to one goal.

In the second stage of the championship, Romania was in the main group II, consisting of teams ranked in places 1 to 3 in C and D groups: Norway, Hungary (C group), Spain, South Korea, China (D group).

There were maintained the results of preliminary round matches with teams of C group (group that included Romania), each team having to play 3 matches, meaning with the other three teams of D group.

In the second stage of groups, Romania got the following results:

12.12.2009 Romania – China (40 – 21)
13.12.2009 Romania – Spain (25 – 26)
15.12.2009 Romania – South Korea (34 – 34)

Romanian Women's Handball Team won against China, got a draw with South Korea and was defeated by Spain.

With the results obtained in the main group, Romania ranked 4, leading to participation in the final round of ranking games (for places 7 to 8):

17.12.2009 Romania – Germany (25 – 35)

Thus, Romania was the 8th in the final ranking of this championship.

Support – method

In analyzing the evolution of the Romanian handball team in the 2009 Women's World Championship there were used the observation methods (direct observation method or simply watching the matches) and the statistical-mathematical method, having as support statistics provided by the organizers through websites of the competition and of the International Handball Federation.

Analysis on participation in World Championship

This analysis takes into account the matches against teams from outside Europe, the matches with national European teams and the quantitative analysis of Romanian national team matches.

In confrontations with European teams (4 matches) Romania got 3 defeats and one victory, and the goal average was 105 to 111.

Romania played against teams with which it was in direct competition and the results of these matches led to the 8th position in the final ranking of this championship.

This study took as benchmark data of speciality literature, data regarding the shots'efficiency (shots specific to each game post). (Taborsky F., 2001):

- Efficiency of the whole team in attack:60%
- Backcourt: 40 – 45%
- Wing: 55 – 60%
- Central part of 6 m line: 60 – 65%
- Counterattack: 70 – 75%
- 7 m shots: 75 – 80%
- Attacks without shots: 15 – 20%;
- Goalkeepers: 35 – 40%.

Comparing the efficiency of the Romanian team to the standards listed above, we notice that its efficiency in attack was of 42,51% and 53 attacks were without shots (22,46%) of a total of 247.

For all indicators, the efficiency is below values recommended by speciality literature. The only values approaching to minimum requirements refer to 9m shots, 7m shots, shots of central part of 6 m line (Table 1).

Goalkeepers' efficiency was as average of 37,99%, falling within the optimum level between 35 and 40% (Table 2).

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Team Shots	Goals	Saves	Missed	Post	Blocked	Total	%
6m Shots	23	11	3	2	0	39	58,97
Wing Shots	12	9	2	2	0	25	48,00
9m Shots	22	18	7	2	10	59	37,29
7m Shots	14	0	0	5	0	19	73,68
Fast Breaks	18	6	1	3	1	29	62,07
Breakthroughs	16	5	1	1	0	23	69,57
Totals	**105**	**49**	**14**	**15**	**11**	**194**	**54,12**
Attacks without shot	0	0	0	0	0	53	21,46
Totals	**105**	**49**	**14**	**15**	**11**	**247**	**42,51**

Table 1 Attack's efficiency in matches with European teams (Hungary, Norway, Spain, Germany)

Goalkeepers	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
Totals	68/179	37,99	14/53	26,42	11/19	57,89	26/50	52	5/13	38,46	5/27	18,52	7/17	41,18

Table 2 Goalkeepers' efficiency in matches with European teams

In matches with teams from outside Europe, 5 in number, they got 4 wins, one draw, goal average 201 – 120.

For each game post, shots percentage falls within or above the minimum. 7 m shots were the negative aspect, the efficiency being below average. Goalkeepers' efficiency was of over 40%, thus helping to achieve the 4 wins (Tables 3 and 4).

There were 73 attacks without shots of a total of 368 (19,84%).

Team Shots	Goals	Saves	Missed	Post	Blocked	Total	%
6m Shots	42	19	1	1	0	63	66,67
Wing Shots	34	9	0	4	0	47	72,34
9m Shots	20	10	11	4	4	49	40,82
7m Shots	17	6	1	4	0	28	60,71
Fast Breaks	65	10	3	3	0	81	80,25
Breakthroughs	23	2	1	1	0	27	85,19
Totals	**201**	**56**	**17**	**17**	**4**	**295**	**68,14**
Attacks without shot	0	0	0	0	0	73	19,84
Totals	**201**	**56**	**17**	**17**	**4**	**368**	**54,62**

Table 3 Attack's efficiency in matches with teams from outside Europe

Goalkeepers	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
Totals	82/202	40,5	23/55	41,82	17/34	50	27/52	51,92	2/14	14,29	7/24	29,17	6/23	26,09

Table 4 Goalkeepers' efficiency in matches with teams from outside Europe

Analyzing on the whole the 9 matches (5 wins, 1 draw, 3 defeats), the general goal average was 306 – 231.

Team's efficiency in attack was of 49,76%, there were 126 attacks without shots (of a total of 615), their share being of 19,84% (Table 5).

In limits of recommended or superior efficiency there were the goalkeepers (39%) and the following shots: wing (64%), 6m central area (64%), counterattack and second phase (78%), 7 m (76%).

Backcourt players' efficiency (39%) and the 7m shots (66%) fell within the minimum. (Tables 5 and 6).

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Team Shots	Goals	Saves	Missed	Post	Blocked	Total	%
6m Shots	65	30	4	3	0	102	63,73
Wing Shots	46	18	2	6	0	72	63,89
9m Shots	42	28	18	6	14	108	38,89
7m Shots	31	6	1	9	0	47	65,96
Fast Breaks	83	16	4	6	1	110	75,45
Breakthroughs	39	7	2	2	0	50	78,00
Totals	**306**	**105**	**31**	**32**	**15**	**489**	**62,58**
Attacks without shot	0	0	0	0	0	126	20,49
Totals	**306**	**105**	**31**	**32**	**15**	**615**	**49,76**

Table 5 Attack's efficiency (9 matches)

Goalkeepers	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
Totals	150/381	39,37	37/108	34,26	28/53	52,83	53/102	51,96	7/27	25,93	12/51	23,53	13/40	32,50

Table 6 Goalkeepers' efficiency (9 matches)

Comparing Romania (8th place) to the top 4 teams (Russia, France, Norway, Spain), we obtain these data in tabular form (Table 7).

	Places I – IV	Romania
		8th place
Efficiency of attacks with shots (%)	57,00	62,58 (51)
Goalkeepers' efficiency (%)	39,75	39,37 (27)
Attacks' efficiency (%)	45,75	49,76 (45)
Goal average	285,75 – 217	306 – 231
	+68,75	+75

Table 7 Efficiency of the Romanian team compared to the top 4 teams

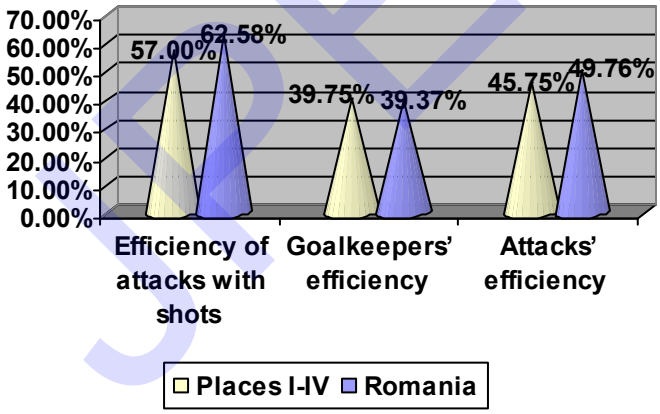

Figure 1 Efficiency of Romania versus the top 4 teams

In parentheses there is presented the efficiency in matches with the European teams, 4 in number.

As a percentage, Romanian team's results are higher than the results of the top four teams, the same situation being also for the goal average. This is due to the results of matches with weak teams that lead to good overall values. The same analysis only for matches with the European teams indicates a decline showing we are well below the values of the top four teams.

The 8th position of Romanian female handball team in the final fanking was due to its modest evolutions against the European teams, winning only one match.

In *Top Scorer*, Romanian line player Ionela Stanca was the 36th with 38 goals.

In *Decissive Passes Top* we noted the backcourt players Carmen Amariei – 26 assists and Narcisa Lecusanu – 23 assists.

Referring to *Top Goalkeepers*, Paula Ungureanu was the 4th, a percentage of blocked shots of 41.

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Regarding *Team Fair – Play*, Romania was on 1st place (51 points in 9 matches). This ranking was made comparing data to the number of matches, depending on 4 parameters measured by a certain number of points: yellow card-1 point, 2 minutes elimination – 2 points, red card – 5 points, exclusion -10 points.

Conclusions

The players demonstrated quick perception and rapid decision-making. In defence play, they responded not only to their opponents but exhibited anticipation and took active control of the game.

One-to-one offence play generally led to paired and three-player offence combinations and turned into dynamic offence sets.

Attacks lasted 25-30 seconds, being in line with referees' interpretation of "passive game" rule.

Low efficiency of 9 m line players and of goalkeepers, missed 7m shots in important games led to defeats in all confrontations with the European teams. 9m line players and wing players had a low contribution to the scored goals.

The team showed little psychological preparation, evidenced by the series of negative results recorded after the first defeat, in the next 4 matches they got one win, a draw and 2 defeats.

In the 9 games in dispute there were obtained 5 wins, one draw and 3 defeats. In comparison, the world champion – Russia played 10 matches with 9 wins and one defeat, and world vice-champion won 8 games and lost2.

At the end of these 9 matches there was an average of 34 scored goals per game and 25.66 received goals. For matches with the European teams the average is 26.25 scored goals and 27.75 received.

To properly prepare a team one should take possession of motorial, technical, tactical and motivation tasks; to learn thinking in a game and to solve situations in complex conditions.

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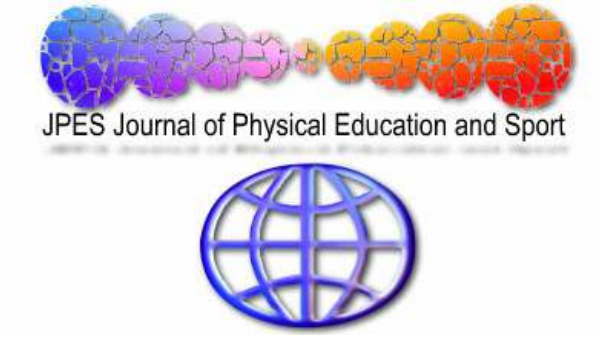

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ORIGINAL RESEARCH

DESIGNING PHYSICAL EDUCATION LESSONS IN PRIMARY SCHOOL BY CONTENT TYPE FEED-FORWARD

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Abstract

In actual didactic design is need to anticipate problems that may arise during implementation of proposed interdisciplinary content in the physical education lesson in class, by projecting sequential forward type of content, there by ensuring quality and efficiency. Its necessary to include in the design content of physical education lessons in primary sequence type of feed-forward, to increase the quality and effectiveness of physical education lessons at the operational objectives achieved.

To development modern didactics of physical education we can keep some purchases of traditional teaching, but still with emphasis currently reconsidering its entire system on the content, forms, methods of education.

Key words: primary school, feed-forward, didactic design

Introduction

The characteristics of starting to fulfill the goal and the end of the educational process implicitly includes the phenomenon of feedback. Anticipate how the purpose is restored causal feedback feed-forward type. Feed-forward your acting preventively controlling sequentially moving towards the objective pursued. "Feed-forward mechanism expresses contextual virtues, creating multiple choice or intermediate stages.
Applying this type feed-forward mechanism involves adaptation of the educational process went, offering solutions for problems that may limit sequential quality and effectiveness of the proposed content during any activity itself.

Premises

Problem efficient teaching-learning activity-assessment for physical education discipline, is an ongoing process subject to optimization. This is due to qualitative implications that can provide human material involved in the training of gifted children for favoring skilled sport performance, physical development and a harmonious social integration in any situation.

Regarding the evolution of modern didactics of physical education, noted the tendency to keep some purchases from traditional teaching, the whole system reconsideration of the content, forms, methods of education from the perspective of contemporary science and technology achievements, as follows:

- prospecting action - studying predictive of future investigations and education company;
- reassessment and selection of content and education - the introduction into school curricula, but the essential knowledge to cope with pace of information. Choice criterion knowledge of their importance, are matters for the future of didactics;
- identify strategies work for students, operated and productive. It is necessary to design and use systems, mechanisms that mimic phenomena occurring in nature and thinking.
- enhance learning, so that within a relatively short time, the student to assimilate the necessary knowledge and tools to form mental work;

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- oriented education. Education begins from the first moment of life. Different occupations Man exercising.
- activity classes and lessons to transform a micro groups activity groups and to develop internal resources of the student;
- turning modern technical means - use for teaching;

It is noted mainly tend to give equal attention to two aspects of teaching, information and training - is the specific gravity tends to transfer from teacher to taught.

- provide a permanent feedback. Teachers and students are on line, transmitter and receiver of information;
- provide a report teacher - student relationship based on cooperation and direct guidance to facilitate the individualization of labor;

Aim of research

It represented the need to anticipate problems that may arise during implementation of proposed interdisciplinary content in the physical education lesson in class, by projecting sequential forward type of content, thereby ensuring quality and efficiency.

Research hypothesis

If we include in the design content of physical education lessons in primary sequence type of feed-forward, then we increase the quality and effectiveness of physical education lessons at the operational objectives achieved.

Conducting research

The research was to develop a half planning the class I for the 2008-2009 school year in physical education and sport discipline. Plan was implemented in six schools, which was involved in a number of 200 children, divided into two equal samples which were control group and experimental group.

Biannual planning group prepared to present witnesses, respecting existing requirements imposed on developing such a planning document:

Table no. 1 - Planning traditional semester - Class I

Unit of learning	Reference objective	Contents	Week / No. lessons
Elements of organization and spatial and temporal orientation	5.1. To recognize the simple rules established for the organization and practical activities 5.2 to show interest and perseverance to develop motor and mental qualities	➢ Align in column, dash, circle, arc, etc.. ➢ Bands assembly and displacement ➢ Travel in groups imposed by a given item ➢ U-turns and changes direction of movement of walking / running and standing ➢ Dynamic games and relay	1-2/ 3 lessons
Learning crawl, push and traction-site teambuilding	3.1. apply in practical activities and basic driving skills on the tool-applied 3.3. learned to perform physical exercise, according to the individual opportunities in complex conditions 5.2. to show initiative in collaboration with colleagues during practical activities	➢ Moving objects by drag and thrust, individually or in groups ➢ Crawl on hands and knees ➢ Low creep and crawl on his knees and forearms ➢ Moving objects by educating team spirit ➢ Dynamic Games¬ and Relay	1-3/ 6 lessons
Running speed and first aid rules	1.3 To implement specific race driving skills taught sports industries 2.2 to be animated by the desire to compete	➢ Running speed of foot home ➢ Accelerated running normal, portable objects ➢ Speed up launch ➢ Contest and competitions	4-6/ 5 lessons
Mini game and development of communication and socialization	1.3 To implement specific race driving skills taught sports industries 2.2 to be animated by the desire to compete	➢ bird and catching the ball with two hands instead ➢ Bird with one hand and catching with two hands on	3-8/ 12 lessons

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		the place ➢ Dribble simple and multiple place ➢ Relay contest and games including procedures learned	
Specific learning processes rounders game	1.3 To implement specific race driving skills taught sports industries 2.2 to be animated by the desire to compete	➢ throwing the rounder ball held in remote ➢ outlet and initial position ➢ momentum ➢ throwing thrown ➢ throwing races	6-8/ 6 lessons
Harmonious physical development through music	1.2 To perform correctly the main physical development exercises 2.1 To act for the orderly development of their own body, at the suggestion of the teacher and of their own	➢ complex physical, composed of teachers, including free exercise	9-12/ 6 lessons
Basic motor skills - jumping and communication	1.1 To implement the practical work properly acquired basic driving skills 2.1 To act for the orderly development of their own body, at the suggestion of the teacher and of their own	➢ To jump rope - standing and moving - the detachment from one and both legs ➢ Dynamic games and relay	9-12/ 6 lessons
Learning to balance and skill practice	1.2 To perform correctly the main physical development exercises	➢ movements and balance on narrow surfaces raised ➢ relay race as	12-14/ 3 lessons
Acquiring the habit of throwing, catching and numeracy	1.1 To implement the practical work properly acquired basic driving skills 2.1 To act for the orderly development of their own body, at the suggestion of the teacher and of their own	➢ throw tossed over the shoulder with one hand, the target and at different distances ➢ catching with two hands in self throws • up • the floor • in wall ➢ dynamic games and relay	12-14/ 3 lessons

When planning the type carried forward for the experimental group, we see that for each sequence of content design, in our case the unit is expected to provide content and instructional objectives proposed by the forward-type activities.

Table no. 2 - Planning quarterly feed-forward type - Class I

Unit of learning	Contents	Feed-forward type activities	Week/No. lessons
Elements of organization and spatial and temporal orientation	➢ Align in column, dash, circle, arc, etc.. ➢ Bands assembly and displacement ➢ Travel in groups imposed by a given item ➢ U-turns and changes direction of movement of walking / running and standing ➢ Dynamic games and relay	➢ Games to develop turns and changes direction of movement ➢ Games walk/run and place.	1-2/ 3 lessons
Learning crawl, push and traction-site teambuilding	➢ Moving objects by drag and thrust, individually or in groups ➢ Crawl on hands and knees ➢ Low creep and crawl on his knees and forearms ➢ Moving objects by educating team spirit ➢ Dynamic Games¬ and Relay	➢ games that include the movement of objects in pairs or teams. ➢ games that mainly contribute to the education of team spirit.	1-3/ 6 lessons

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Running speed and first aid rules	➢ Running speed of foot home ➢ Accelerated running normal, portable objects ➢ Speed up launch ➢ Contest and competitions	➢ Eexercises aimed at the transport of objects of different positions and distances. (Shuttle) ➢ Dynamic games that include content elements of speed	4-6/ 5 lessons
Mini game and development of communication and socialization	➢ bird and catching the ball with two hands instead ➢ Bird with one hand and catching with two hands on the place ➢ Dribble simple and multiple place ➢ Relay contest and games including procedures learned	➢ exercises aimed at catching the ball and place the bird in motion ➢ dynamic games that include elements of assessment of content objects in place or moving. ➢ content specific nonverbal communication. (signs they may receive care or they may pass, in which part will receive the ball, etc.)..	3-8/ 12 lessons
Specific learning processes rounders game	➢ throwing the rounder ball held in remote ➢ outlet and initial position ➢ momentum ➢ throwing thrown ➢ throwing races	➢ activities develop more precision throwing various objects at targets of different sizes and dimensions	6-8/ 6 lessons
Harmonious physical development through music	➢ complex physical, composed of teachers, including free exercise	➢ activities include movement of body parts made the beat.	9-12/ 6 lessons
Basic motor skills - jumping and communication	➢ To jump rope - standing and moving - the detachment from one and both legs ➢ Dynamic games and relay	➢ activities include jumping over various objects, one leg or both legs.	9-12/ 6 lessons
Learning to balance and skill practice	➢ movements and balance on narrow surfaces raised ➢ relay race as	➢ activities include travel to maintaining the balance of the body parts of objects.	12-14/ 3 lessons
Acquiring the habit of throwing, catching and numeracy	➢ throw tossed over the shoulder with one hand, the target and at different distances ➢ catching with two hands in self throws • up • the floor • in wall ➢ dynamic games and relay	➢ one must be changed during the performance of work and difficulty of the proposed mathematical operations ➢ will be included only in mental arithmetic operations concentrated 0-100 without crossing the tens or units.	12-14/ 3 lessons

Results:

After application product developed curriculum, we conducted an evaluation of the results achieved so far as the control group and experimental group for each learning unit, the light of achieving its goals in the quality of education. Quality of training is provided for educational strategies focused on targets which recorded value (quality) but the degree to which instructional goals were met.

This requires the total elimination of improvisation and the ballast of choice for those training strategy or operational steps which contribute to operational objectives targeted.

Quality training can be calculated using the following formula:

C.I. = R.O. / O PO. P.

C.I. - Quality of instruction;
R.O. - Results obtained
O.OP.P. - Proposed operational objective.
Summary table that captures the weight of the objectives of both groups is given below:

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Table no. 3 - Share the objectives - CLASS I

Nr. crt.	UNIT OF LEARNING	OBJECTIVE	Group control	Group experiment
1.	Elements of organization and spatial and temporal orientation Learning crawl, push and traction-site teambuilding	**O1**. To run back to the right and left (4 of 6 attempts)	40%	45%
		O2. Positions and alignments to perform in various bands (3 of 6 attempts)	58%	84%
2.	Running speed and first aid rules Mini game and development of communication and socialization	**O3.** To run the distance of 20 meters in 7 seconds	62%	81%
		O4. To carry two items of first aid on distance 10 meters in 15 seconds	45%	57%
3.	Specific learning processes rounders game Harmonious physical development through music	**O5.** To execute the game "Huştiuliuc" a total of three passes without losing possession	48%	43%
		O6. To perform dribble among landmarks on distance of 6 m in 8 seconds	52%	64%
4.	Basic motor skills - jumping and communication Learning to balance and skill practice	**O7.** Strikes a target ball horizontally from at least 3 m and 5 m boys girls three times in five attempts	75%	72%
		O8. To a vase made with natural materials	71%	89%
5.	Acquiring the habit of throwing, catching and numeracy	**O9.** To teach dance steps to "Alunelul" and "The Dance"	62%	72%
6.	Elements of organization and spatial and temporal orientation	**O10.** Transport to carry the entire team of 3 components of the distance of 10 meters in 30 seconds	41%	38%
7.	Learning crawl, push and traction-site teambuilding Running speed and first aid rules	**O11.** To perform two jumps on the right leg and two on his left foot without treading the line "hopscotch"	54%	69%
		O12. To perform three successive jumping rope on one foot without stopping	49%	57%
8.	Mini game and development of communication and socialization Specific learning processes rounders game	**O13.** To perform three successive jumping rope on one foot without stopping	58%	65%
		O14. To keep the two cards on each hand moving the distance of 10 meters	63%	81%
9.	Harmonious physical development through music	**O15.** execute three passing and catching with two mathematical solution in 15 seconds	38%	48%

Conclusion:

1. Of the 15 targeted operational objectives, three have a greater percentage for the control group, while 12 are favorable experimental group, which confirms that the inclusion of content designed feed-forward type sequences will increase quality and effectiveness of physical education lessons at the operational objectives achieved.

2. Efficiency problem of the relationship between theory and educational practice in general and physical training particularly in terms of personnel is an ongoing process subject to optimization, the tendency to give equal attention to two aspects of teaching, information and training, transferring specific weight of the educated teacher.

3. Design for the primary school physical education lesson in a feed-forward type approach, contributing in a more pragmatic and effective implementation of the ideal and global educational goals and operational.

4. The development of modern didactics of physical education noted tend to keep some purchases of traditional teaching, but still with emphasis currently reconsidering its entire system on the content, forms, methods of education, in our case in terms of feed-forward type design.

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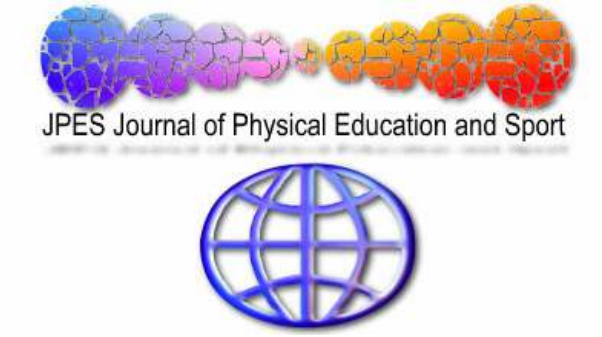

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ORIGINAL RESEARCH

THERAPEUTIC APPROACH OF THE PAINFUL LUMBO-RADICULAR SYNDROME (SDLR) IN THE LACU-SĂRAT RESORT AND THE "SC FIZITER SRL" BRĂILA PHYSICAL REHABILITATION CENTRE

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Abstract

Introduction. The high frequency of painful lumboradicular syndromes (SDLR) is visible in the international specialised literature, bearing upon a diversity of specialisations (orthopedics, rheumatology, neurology, brain surgery, internal medicine, physiotherapy, social assistance services). **Material and method** .The present study took place in the interval 2007-2009 and comprised 2847 clinical cases of various types of painful lumbar syndromes (44. 43%) out of a total of 6517 patients admitted in our service during the three years of the study, aiming at identifying differentiated nosological entities, presenting the clinical diagnosis criteria and singling out the treatment methodologies. The study proves that a careful and competent clinical examination as well as the accurate interpretation of paraclinical results may provide diagnosis elements allowing the isolation of various distinct nosological entities out of the totality of painful lumbar syndromes, which are subsequently enumerated establishing the percentual proportion to the 2 947 S.D.L.R. cases, as well as to the methodologies of kinetic approach of these entities. 1. The lumbar disc hernia (the multi- or single-level discogen lumboradicular syndrome (phase III st. III) 34.60%. 2. The "lumbago" discogen lumbalgic syndrome (phase II) 4.66%. 3. The myofascial syndrome 39.5%. 4. The facetal syndrome 1.53%. 5. The post-surgery HDL syndrome 12.85%. 6. The lumbalgic syndrome in generalised filrositis 4.25%. 7. Lumbar pains of other origins. **The conclusions and results** of this research topic provide useful information, in view of a more certain diagnosis, accurate therapeutic orientation, adequate guiding of patients towards the suitable therapy, the kinetic approach of these entities, elements which may avoid prolonging the evolution, the useless increase of temporary work incapacity, applying precipitous treatments and patient's iatrogenisation.
Key words: **lumboradicular, kineto, posture, pain.**

Introduction The observations in our ambulatory services over a period of 20 years, either clinical or statistical, evince the fact that the degenerative pathology of the spine in general, and lumbar spine in particular, take the first place in the cases submitted to our clinic. By comparing this observation to the statistics of other units of recovery therapy of locomotive profile, it has been remarked that our statistics is not singular in this high incidence of the lumbar spine pathology. The high frequency of painful syndromes (SDLR) is included in the international specialised literature, bearing upon various specialisations (orthopedics, rheumatology, neurology, brain surgery, internal medicine, physiotherapy, social assistance services).

The multidisciplinary approach of the lumbar spine pathology may constitute the explanation of the many options in defining nosological entities and diverse opinions regarding the treatment methodology, medicine administration, orthopedic, surgical , hydrophysical and kinetic means.

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I. Working hypothesis.

For several years, our services have been concerned with the detailed approach of SDLR, in view of analysing them thoroughly, which enabled us to single out several nosological entities, more nuanced diagnoses, in order to optimise the treatment methods (medicine, hydrotherapy, kinetotherapy).

The adequate assessment of the data provided by anamnesis, the data resulting from the objective clinical examination of the locomotive apparatus, from a clinical and functional point of view, the investigation of the psycho-emotional behaviour of each patient, have been basic requirements in assessing the best diagnosis, both anatomo-clinically and functionally speaking. In order to reach this objective, we have managed to put together a unitary system of clinical observation charts and treatment programmes for each entity.

Ignoring subjective or objective symptoms, the erroneous assessment of the diagnostic value of some of the clinical elements, deficient techniques in effecting the objective clinical examination represent a part of the factors still favouring a poor diagnosis orientation and therapeutic conduct.

Thus, the following clinical entities were isolated within SDLR:

1. Lumbar disc hernia with radicular bearing or discopathy of third phase (according to de Seze);
2. Acute or subacute lumbalgic syndrome corresponding to the second phase discopathy (de Seze);
3. Acute lumbalgic syndrome of myofascial origin;
4. Facetal syndrome (or posterior interapophisary syndrome);
5. Residual syndrom post HDL surgery;
6. DL syndrome within generalised fibrositis;
7. Other S.D.LR. more difficult to isolate by regular clinical and paraclinical means (the syndrome of stenosis of the lumbar channel, the lateral recesus syndrome, tumors, visceral problems bearing on the lumbar area, inflammatory or infectious processes in the pelvian area, etc.) (apud Lucescu) (1,5).

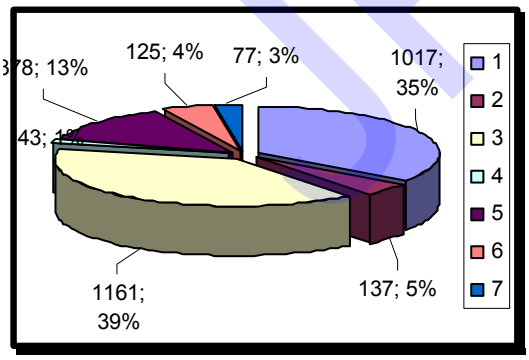
Material and methods

In order to write this paper, 6617 patients admitted to our care were studied clinically and paraclinically within the period 2007-2009, out of whom 2947 patients with SDLR i.e. 44.43% were retained as significant for the purposes of the present study.

Table I

Painful lumbar syndrome (SDL)	*No of patients*	*% of SDL*	*% of total patients*
Disc hernia (phase III discopathy)	1017	34.60	15.38
Acute and subacute lumbago (phase II discopathy)	137	4.66	2.07
Myofascial syndrome	1161	39.50	17.54
Facetal syndrome	43	1.53	0.69
Residual syndrome post HDL surgery	378	12.85	5.72
D.L. syndrome in generalised fibrositis	125	4.25	1.90
SDL of unknown origin	77	2.61	1.16

Distribution of SDL entities (table I).(fig.1,fig.2.)



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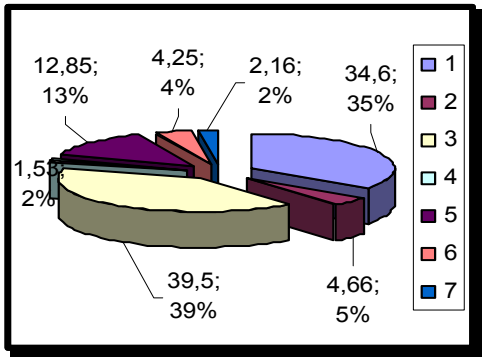

2.

Figure1. Distribution of SDL entities % out of the total no. of admittances

Figure 2. *Distribution of SDL* entities % out of the total SDL

We shall proceed to presenting each nosological entity from the point of view of the clinical criteria used, diagnosis, treatment methodology and post-therapeutic results.

1. Lumbar disc hernia with radicular bearing. The diagnosis criteria within this type of SDLR are the typical ones: vertebral syndrome; dural syndrome; radicular syndrome; myofascial syndrome; neuropsyhic syndrome; interpretation of lumbar X-rays, RMN, CT; the check-up of the diagnosis criteria by the therapeutic test (the fast-improving responses lead to diagnosis re-evaluation). Performing a careful clinical exam when the patient is admitted, according to a a unitary and rigorous technique, repeated during the patient's stay in hospital, allowed

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the precise decision on a diagnosis of HDL in a number of 1017 patients out of the total of 6617 admitted during the three years of the study. Table II shows the statistical data referring to the anamnesis aspects of these patients with lumbar illnesses. The data recorded within our research topic are not different from those in the specialised literature: HDL mainly affects men (70.51%), mostly within the age group 31—50 (72.08°/), but there were no significant differences in the incidence of HDL related to the two groups of jobs — static or dynamic. The table shows that there is a long period of time between the first signs of the disease and the decision to get admitted (77.77% of the patients got admitted after a period of 1—3 months from the start of the condition and only 14.65% were admitted early, i.e. under 1 month). It is to be noticed that the therapeutic attitude in the ambulatory service (inadequate and procrastinating) ignored a basic therapeutic principle, according to which such patients in full crisis should be confined to bed rest, at an early stage.

We have also opted for a conservative and armed expectative treatment in the case of 291 admitted patients (28.61%), exhibiting radicular pareses — paralyses, as we considered the optimum moment for surgery had already passed. The neurologic deficit of these patients was differentiated function of the degree of radicular conductibility into: *slight* (presence of integumental dysfunctions, of ROT); *moderate* (manifested by pareses of the affected muscles in which the muscular testing revealed functional muscular values of 2 or 3, according to the known evaluation scale); *severe* (presence of paralysis with values under 2). The treatment methodology was instituted in a differentiated manner, related to the existent clinical form, the illness' evolutive stage and the stage objective. In point of therapy with an immediate methodological and practical value, there are three main groups of patients: 1. in acute crisis; 2.in post-acute stage; 3. in subchronic stage of clinical remission. Depending on this stage differentiation, differentiated methodologies and consequently stage objectives were envisaged.

a) The presence of the acute radicular syndrome had as a main objective the alleviation of pain, which imposed a sparing methodology involving compulsory bed rest on a hard plane, postures of relaxation, and tension release during the entire period of intense algia (6—10 days) association of medicine administration, adapted to the objective clinical state and psychoemotional behaviour: sedatives only (151 patients == 14.84%), painkillers and A INS (174 patients = 17.10%) and corticotherapy (ACTH and/or cortisone) for 44 patients = 4.32%). All patients in acute crisis (some in hyperalgic crisis) also benefited from supporting bed therapy consisting in sedative massage, electrotherapy (interferential, laser, ultrasounds with local or segmental topography). An efficient method of diagnosis and implicit alleviation of discoradicular conflict was found to be akinetic kinetotherapy (posturation) in positions of muscular relaxation with a muscle trope and radiculotrope antialgic objective; the next step is targeted kinetotherapy (after the exclusion of negative side effects), which is a painstaking method, requiring trained personnel and only useful under supervised conditions in specialised units.(2,3)

Acute pain of the spine (relaxing postures)

Posturation in DD , the feet are fixed on a wall, stool, so that the thigh and the calf should form a right angle.

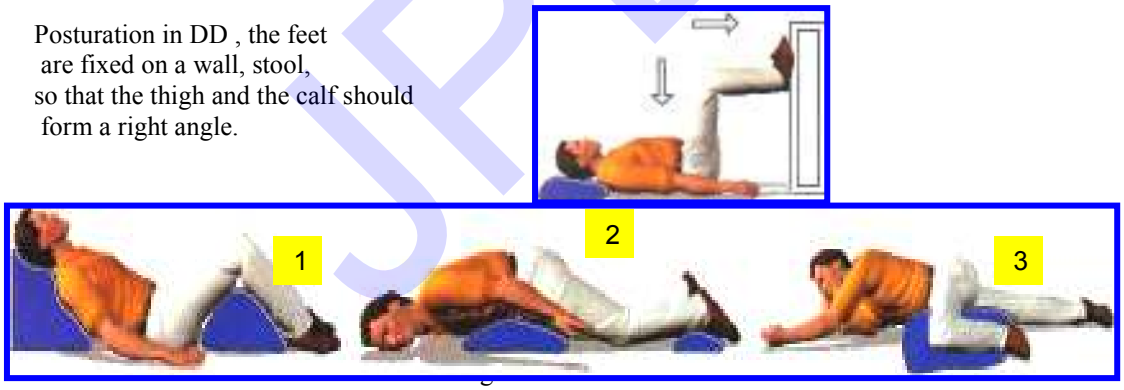

Figure 3. 1.Posturing in DD with a pillow under the head and a pillow under the knee (semiflexion)
2.Posturing in DV, arms alongside the body, with a pillow under the abdomen
3.Posturing in DL, the painful leg with a bent knee, supported by a pillow

b) For patients admitted with post-acute radicular syndrome or those admitted in crisis but evolving towards a post-acute stage, the specific methodology of our service was applied, i.e. hydrotherapy (usig water and sapropelic mud in The Lacu-Sarat lake). We introduced or continued the electrotherapy procedures with antalgic, musculotrope, neurotrope, vasculotrope objectives (low, average and high frequency currents) known in all physiotherapy services. The effects of relaxing or correcting postures were used in the clinical cases requiring objectives of such a nature. Some kinetotherapy procedures were introduced, having a preventative role in postural or muscular deficiencies, or recovering at an early stage the existent or potential muscular deficiencies, without charging the lumbar spine. The moment of kinetotherapy introduction into the treatment methodology requires judicious decision power, a lot of clinical experience and highly competent kinetotherapy

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nurses. In our services, we managed to organise the implementation of kinetotherapy individually and in a personalised manner, both at the patient's bed and in the kinetotherapy cabinets, on an individual basis. The strict observance of kinetotherapy norms, effected by qualified nurses and under constant medical supervision led to eliminating rush maneuvers with acutisation risk and favoured the stabilisation of the mobile lumbar segment, facilitating the passage to the next step.(2,3)

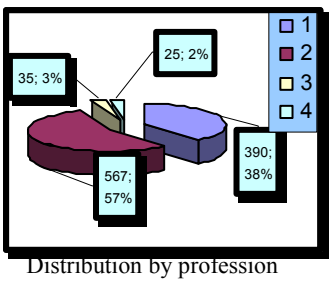
HDL with radicular bearing

1) *No. of patients* 1 017 = 34.60% out of SDL and 1.36% out of total admittances.
2) *According to gender*: women 300 (29.49%) ; men 717 (70.51%)
3) *According to profession* : static 390 = 38.35% ; dynamic 567 (55,.75%); retired 35 (3.45%; housewives, /students 25 (2.45%)
4) *According to age* : under 20 3 = 0.30%; between 21-30 = 10.12% - 103; between 31-40 - 445 = 43.76%; between 41-50 238 = 28.32%; between 51-60 149 = 14.65%; over 60 29 = 2.89%
5) *Period start -admittance* :-under one month 149 (14.65%);between 1-3 months 791 = 77.77%; over 3 months 77 = 7.58%
6) *Therapeutic conduct up to admittance*: not treated : 203 = 19.95%; physically treated in ambulatory service 170 = 1674%; medically treated in ambulatory 349 = 34.31%;treated in various hospitals 295 = 29%
7) *According to clinical form*: irritative 248 (24.39%); irritative-compressive 478 (47.%); paretical-paralysing 291 (28.61%)
8) *According to the affected radix*: radix L3 = 13 patients 1.27% out of which paretical 3; radix L4 = 52 patients = 5.11 % out of which paretical 8;radix L5 = 398 patients = 45.53% out of which paretical 161; radix SI 480 patients = 47.20% out of which paretical 96 ; radix L5 and SI 9 patients = 0.89%.(Fig.5)Table 2.

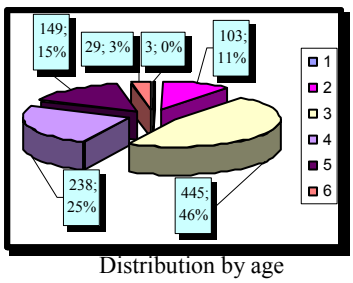
Table II

Clinical signs clinice	***Affected radix***					***Total bolnavi***	
	L3	***L3-4***	***L4***	***L5***	***L5-***	***nr.***	***%***
• Vertebral syndrome	**4**	**6**	**6**	**7**	**-**	**23**	**2,26**
	6	**30**	**182**	**236**	**4**	**458**	**45.04**
Cifosis	**1**		**4**	**4**	**-**	**9**	**0.89**
cifoscoliosis	**-**	**3**	**26**	**24**	**-**	**54**	**5.21**
scoliosis	**2**	**13**	**245**	**209**	**5**	**464**	**46,60**
• Vertebral syndrome slight	**5**	**13**	**60**	**47**	**1**	**126**	**12,40**
moderate	**7**	**34**	**242**	**247**	**6**	**536**	**52.70**
severe	**1**	**5**	**161**	**186**	**2**	**355**	**34.9**
• Neurological signs	**3**	**10**	**112**	**82**	**-**	**207**	**20.35**
slight	**8**	**34**	**191**	**296**	**9**	**238**	**52.90**
moderate	**2**	**8**	**157**	**102**	**-**	**269**	**26.45**
severe	**-**	**-**	**3**	**-**	**-**	**3**	**0,30**
Lasegue sign	**4**	**26**	**57**	**50**	**-**	**137**	**13.47**
Negative over 60%	**7**	**22**	**158**	**163**	**4**	**354**	**34.5-**
moderate (45 - 50°)	**2**	**2**	**131**	**130**	**3**	**268**	**26,36**
severe (sub 45°)	**-**	**1**	**117**	**137**	**2**	**258**	**25.37**
controlateral	**1**	**1**	**110**	**108**	**-**	**220**	**21,63**
Myofascial syndrome 318 bolnavi 31,26%							

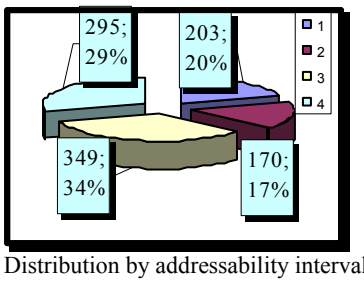
Treatment : sedatives only 151 = 14.84%; painkillers and AINS 174 = 17.10%; ACTH-cortisone 44 = 4.32%



Distribution by profession



Distribution by age



Distribution by addressability interval

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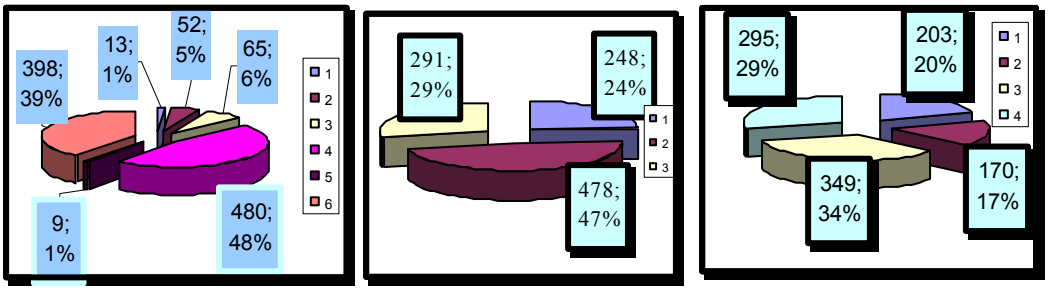

Distribution by affected radix Distribution by clinical form Distribution by treatment prior to admittance

Figure 5.

c) SDL with algia in subchronic stage (in clinical remission) present from admittance or evaluated under this stage during hospitalisation – a much larger , more demanding therapeutic complex was applied, aimimg at removing the residual pain, flexibilisation of the retractured muscular and ligamentary structures, resuming muscular and postural balance, and in the peculiar cases represented by pareses and paralyses we aimed at recovering the distal motor defficiency. The therapeutic means applied were hydrotherapy with water and mud (38°—20') , electrotherapy procedures targeted locally and regionally, hydrokinetotherapy with patients in similar stages, individual kinetotherapy, as well as collective kinetotherapy in the CFM hall (with homogenuous groups) having programmes of exercises of careful, gradual physical demands on the lumbar spine.Wuiliams I,II,III.(Fig 7.)(2,3)

The therapeutic programe, instituted in all the three clinical situations, was well tolerated on the whole. The average hospitalisation period was 15-18 days. The post-therapy results may be grouped as follows:

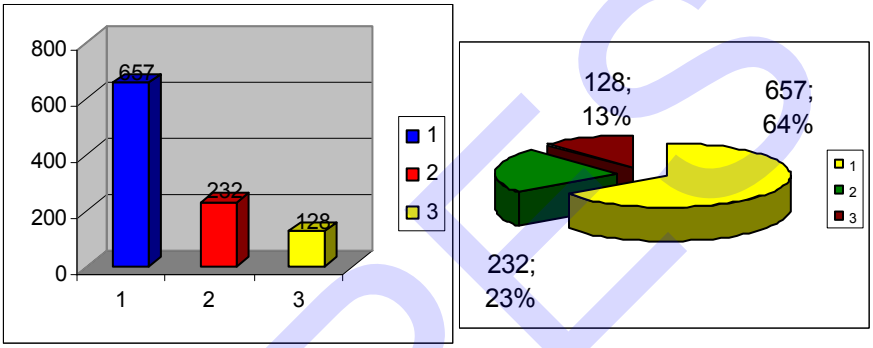

Fig.6 . Graphical distribution of results

- good and very good results = 657 patients = 64.50%
- average results = 232 patients = 22.80%
- poor results = 128 patients = 12.60%.

As for the these 128 patients, for whom the first stage treatment was unsatisfactory, a new clinical balance was carried out, leading to the conclusion that 28 patients were definite candidates for surgical intervention.

In the case of 100 patients, the clinical balance did not show elements constituting a certain recommendation of surgical intervention and thus it was decided to include them in the group of patients with surgical recommendation as a last resort. (table 2.).

Observation of our clinic of over 20 years has evinced the possibility of reducing the disco-radicular conflict, by temporization, taking advantage of the chance of a slow recession of this disco-radicular conflict, if these patients are re-admitted. In this sense, the patients were granted a period of home rest of 2—3 weeks, after which they were re-admitted for a new treatment stage of 3 weeks (table 3.).

HDX with surgical recommendation in the extreme (out of 1017 patients)

1. No. of cases 100 = 9.83%
2. Gender - men 71= 71%; women 29 = 29%
3. Profession: static 17; dynamic 72; retired 3; housewives and pupils 8
4. Age : under 20- 2 = 2%;between 21 - 30 -10 = 10%; between 31 – 40 — 5.2 = 52%; between 41 - 50 - 23 = 23%; between 51- 60 — 10 = 10%; over 60 = 3%
5. Duration up to hospitalisation: under one month 21 patients; one month — 31 patients; 2 months — 30 patients; 3 months — 11 patients; over 3 months 7 patients.

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6. Therapeutic conduct up to hospitalisation: not treated 26 patients; physical treatment in ambulatory service 18 patients, medicine administration in ambulatory service 35 patients; hospital treatment 21 patients.
7. Radicular affectation: -radix L4 = 5 patients; radix L5 — 49 patients; radix SI = 46 patients.
8. Clinical form: *1.irritative* 22 patients L5 = 13 patients, SI = 9 patients*; 2.irritative compressive* 35 patients L4 = 4 patients,L5 -7 patients,SI = 26 patients;*3.paretical* -43 patients -L5 -29 patients,SI = 14 patients
9. Functional lumbar blockage -*severe* = 69 patients;*moderate* = 24 patients; *minor* = 7 patients.
10. Lumbar scollosis: present = 84 patients; absent =16 patients.
11. Lumbar cifoscollosis = 35 patients.
12. Lasegue sign *: severe* = 57 patients*; moderate* = 34 patients; *minor* = 9 patients.
13. Results: 6 patients operated; 94 patients improved, out of which 27 slightly improved.

At the end of the therapeutic programme in the second stage a new clinical evaluation was performed, thus sending 6 patients to the neurosurgery sevice, the remaining 94 patients manifesting obvious clinical improvements, excluding the surgical recommendation.

2. *Lumbar discopathy of second phase*

This acute or sub-acute painful lumbar syndrome is frequently generated by a muscular and ligamentary instability of the motor lumbar segment, or triggered by disc protruding phenomena. In current practice, in the ambulatory service, the incidence of this nosological entity is quite high. The clinical picture of this syndrome may produce diagnosis confusion and therefore erroneous therapeutical orientations, i.e. exaggeration or minimisation of symptom importance. The quick identification of this nosological entity which usually has a self-limitative character in the current medical practice represents one of the main conditions for the orientation towards a simple treatment methodology, thus avoiding polypragmasis (the exclusion of rush cortisone therapy) or other aggressive methods. (2,3)

The diagnosis criteria in this type of SDL may be grouped into the information collected in anamnesis (repeated lumbar pain crises of short duration), the objective clinical examination (minor static and dynamic vertebral lumbar syndrome, with scarce pseudo-algic elements, negative Lasegue sign, no neurological signs), positive therapeutical test (quick favourable results) following a simple therapy. After the triage of 2940 patients with SDL we focused on 137 cases (4.66%) of SDL (table IV).(Fig. 7.)

Acute/ subacute lumbalgia through discopathy phase II

1. *No. of patients*: 137 patients = 4.66% of SDL and 2.07% of the total no. of patients admitted in 3 years.
2. *Gender of patients*:men = 1.03 patients = 75.18%
3. Age groups: under 20 -1 patient = 0.73%; 21-30 years-old - 22 patients = 16.05%;31-40 years-old- 64 patients = 46.71%;41-50 years-old - 48 patients =35.03%;51-60 years-old 2 patients =1.48%
4. *Characteristic professional activity*: static-45 patients = 32. 4%;dynamic- 65 patients = 47.46%; unemployed- 26 patients — 18.97%;retired = 1 patient (0.73%)
5. *Duration up to hospitalisation*: under 10 days = 34 patients = 24.81%; 0-20 days = 38 patients = 27.77%; 21-30 days = 45 patients = 32.84%; over 31 days= 20 patients = 14.58%
6. *Treatments in ambulatory conditions*: no treatment = 30 patients 21.89%; medicine prescription = 58 patients = 42.33%; physical and medical treatment = 49 patients 35.78%
7. *Subjective symptoms*: low lumbalgias = 88 patients = 64.23%; lumbar-sacral pains (uni- or bilateral) 49 patients 35.77%.
8. *Objective symptoms* :

I.*Altered vertebral static posture* by: a) reduction or removal of lumbar lordosis 99 patients (72.26% 0. b) minimal lumbar scollosis 39 patients (27.74%);

II. *Altered dynamics* -limited fore-flexion 93 patients (67.95%); limited flexion and extension 44 patients (32.05%)

III.*Paralumbar muscle contraction* – 76 patients = 55.47%

IV.*Absent Lasegue sign for 100%*

V. *Absence of neurological signs in the lower limbs in 100%*

9. Results obtained:

- improvement 100% after 10 days of treatment 57 patients = 41.60%
- after 15 days of treatment 80 patients =58.40%.

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Out of the total number of admitted patients, only 34 showed a clinical manifestation of acute lumbar suffering, which imposed a sparing treatment methodology (bed rest in relaxing posture, simple medication with ordinary sedatives and painkillers) for 6-7 days.

The remaining 66 patients manifested clinical symptom pertaining to the subacute stage or clinical remission, their treatment being oriented from the very beginning towards major immediate objectives: lumbar stabilisation, recovery of the static and dynamic lumbar balance. The treatment methodology consisted in using a wide range of therapeutical means (hydrothermotherapy, electrotherapy, individual or homogeneous group kinetotherapy) . (4)

3. Painful lumbar syndromes of myofascial origin

The painful symptoms localised in the lumbo-sacral area (uni- or bilateral) –with or without aspects of pseudoradicular pain, accompanied by a vertebral lumbar syndrome under a static and/or dynamic aspect, are very frequently encountered in balneary resorts, polyclinics (physiotherapy, rheumatology, neurology, orthopedics) and even in hospital environments. The muscles in the lumbar-sacral area and the corresponding fasciae undergo — under special circumstances — morpho-functional alterations (recently evinced by studies of standard and electronic mycroscopy), generating pain of a repetitive character, with multiple localisations, which may well affect other levels of the spine, not just the lumbar-sacral segment.

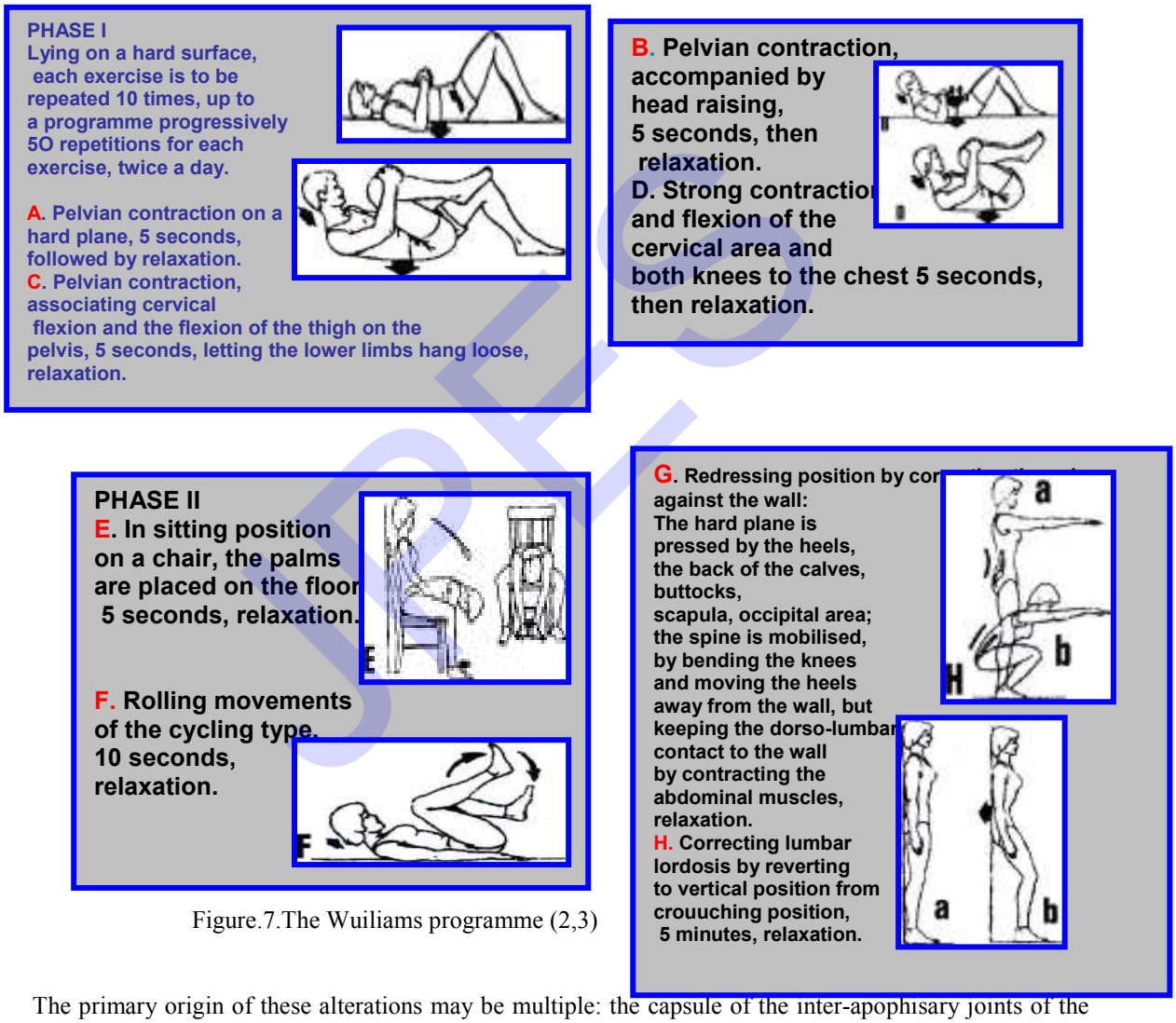

Figure.7.The Wuiliams programme (2,3)

The primary origin of these alterations may be multiple: the capsule of the inter-apophisary joints of the spine affected by degenerative processes, pathological vertebral discs (discarthroses, relapsing discopathies, multiple-level discopathies), laminectomes, arthroses of the sacral-illiac joints, pelvian torsions, lower limbs inequality, musculo-ligamentary dysfunctions (in which the structural hyperlaxeness plays an important role), etc. The myogelosis areas, the "Trigger"* points may undergo intermitent activations, triggered by mechanical factors (overstrains, trauma, muscle strains by prolonged isotonic activities), various discriniae, (hypothyroidism, hyperthyroidism, latent spasmophilia), pychoemotional factors (recent studies emphasize the role of depressions,

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even minor ones) , etc. In this context, the nosological attribution of lumbar pains requires the clinician to perform not only a careful clinical examination (careful, complete loco-regional palpation , the evaluation of static and dynamic alterations, muscular-articulatory review), but also a vast conception of the functional pathology of the spine. Table IV shows a synopsis of the data characterising this type of SDL(2,3,7)

Myofascial syndrome

1. *No. of cases:* 1 161 (17.4%) of the total of 6 514 patients admitted to the clinic, out of whom 2940 (39.50%) with S
2. *According to genre* : men 619 == 53.34%, women 542 = 46.66%
3. *According to age* : 20-30 years-old 54 patients = 4.6%;31-40 years-old 276 patients = 23.76%;41-50 years-old 357 patients = 30%; 51-60 years-old 400 patients = 34.45%;over 60 years-old 75 patients = 6.5%
4.*According to profesion* : dynamic 728 patients = 62.70%;static 237 patients = 20.32%; housewives 81 patients = 6.9%; retired 115 patients = 9%.
5.*The duration of the ailment:* under 1 year 177 patients = 15.25%;1-5 years 239 patients = 20.58%; 6-10 years 425 patients = 16.60%; over 10 years 320 patients = 27.55%; scollosis -168 patients = 14.37%; cifoscollosis 147 patients = 12.57%
6.*Alterations of lumbar mobility*: severe 21 patients 1.8%; moderate 641 patients = 55.24%; light 489 patients 42.11%
7.*The Lasegue sign*: absent 794 patients = 1.8%; slightly positive-3 67 patients = 31.60%
8.*Locomotive apparatus of hyperlax type* 24 patients = 20.90%
9.*Lumbar dysfunctions* flexion 325 patients = 28%; extension -419 patients = 38%; mixed 272 patients 23.51%
10. *Muscular dysfunction*: *muscular refractions* = lumbar extensors ; ischias = 492 patients = 42.37% adductors thigh. *muscular hypotonia* –abdomen; buttocks = 333 patients = 29%
11. Presence of myogeloses 319 patients = 27.50%
12.*Presence of active* Trigger points: lumbar-sacral-gluteal 477 patients =41% ; in row 169 patients = 14.50%; multiple 101 patients = 8.7%
15. *Character of lumbar pain : acute 124 patients* = 10.76%; subacute 733 patients = 63%; chronic 304/ 25.32%
16. *Presence of infection centres*: 166 patients = 14.30%
17. *Presence of radiological alterations of :* spondilosis 327 patients = 28.10% ; discarthrosis 160 patients =13.80%
18. *Therapeutic results*: excellent 752 patients = 64.70%; good 321 patients = 27%; mediocre 88 patients = 7.5%

The clinical statistics provides a view to the frequency of lumbar-sacral- gluteal pain (over 70% of the patients) and the pseudo-radicular symptoms, originating in the activated ”trigger" points, located in the middle gluteal muscle and the tensor muscle of the fascia lata, mimicking a clinical situation of L5 radicular ailment. It was not a rare occurrence that trigger points in a row (14.5%) or multiple (8.7%) were signalled.

The alterations of vertebral static posture were found in all patients, but in a moderate or minor degree. No severe dynamic dysfunction of the spine were found, and the Lasegue sign was never significantly positive, without the presence of objective signs. The tricky character of these symptoms often generate confusing diagnoses, leading to their overevaluation, or overdiagnosis, viz. the inclusion of this group of patients as major discopaths, weighing a lot in their therapeutic orientation.

The main therapeutical objectives are: alleviating pain, hypothermisation of the myogelosis states, and the trigger points, flexibilisation of the retractured muscles, toning the hypotoned muscles, recovering the mobility of the inter-apophisary joints, static posture rebalancing. The balneary and physical means applied generally and locally were completed by local targeted infiltrations with xiline and cortisone, approaching some intensely active trigger points or in myogelosis nuclei resistant to physical therapy. In order to modify the general reactivity, hydrothermotherapy procedures and underwater showers were used, proving extremely useful. Here are a few exercises used.

Exercises for the toning of the back and abdominal muscles

1.The patient lies in DD, bends his knees, strains his abdominal muscles and pushes his spine into the floor. He counts down to 5 and then relaxes his muscles. Then the two exercises are connected. **2**.Similar position: the arms are along the body. The head is lifted, touching the chest with the chin, then the upper body is lifted in sitting position. Then the initial position is resumed. The effort is higher if the hands are clasped by the chest. Similar position: the legs are put together and the knees are pulled close to the left shoulder. Concomitantly the head and the upper body are lifted so that to touch the right hip with the hands. The muscles are relaxed and the exercise is symetrically repeated on the other side. (fig.8,9)

Figure.8,9

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3.Similar position: the pelvis is lifted and the buttock muscles are tensed. The body is in straight line. The muscles are relaxed. The effort will be higher if at the same time a leg is extended. The exercises should be started after the spinal pains has subsided. The warm-up consists of extension exercises, followed by exercises for the strenghtening of abdominal and dorsal muscles, ending in relaxation. The output is better if the exercises are performed daily.The purpose of the exercises is the fortification of the muscles supporting the spine and the improvement of the spinal flexibility. The exercises should not cause or heighten the pain. **Extension exercises**

1. The patient is placed in DD, lifts an extended leg and grips it by both hands under the knee, trying to pull it as high as possible. The exercise is repeated with the other leg.(Fig.10)

2. The patient is placed in DV, the upper body is lifted and the forearms provide the support.(Fig.9)
The pelvis is close to the floor all through the exercise.


Fig.9,10

Figure 11
Exercises for the prevention of spinal pain (2,3,6)

The patients should be mobilised as soon as possible by procedures of hydrokinetotherapy in the swimming pool, individual and collective kinetotherapy, as well as the imposition of small self-mobilisation programmes with simple sets of exercises performed in the ward several times a day; it was noticed that these procedures were very useful even in modifying the patient's behaviour towards his condition. After a hospitalization of 15-17 days very good results were obtained in 64.70 % cases, good results in 27% and mediocre in the rest of the cases.

Figure 12.

Figure 13

5. Residual syndrome post HDL surgery

The issues raised by the residual pathology after performing surgery for HDL constituted the objective of a research topic in our clinic within the period 2007-2009. It focused on objectives of utmost importance regarding: the inventory and more precise definition of individual types of "post-laminectomy sequellae" , the elaboration of an accurate recuperating balneary and physical treatment methodology, the evaluation of post-therapy effects, the study of prophylactic possibilities in this condition. The present study comprises 378 patients, representing 5.71% out of the total number of patients admitted in hospital during the past three years, and 12.85% out of the total SDL. Table VI shows a synthesis of the data resulting from the study of the clinical treatment charts. (Table VI)

Operated H.D.L.

1.No. of patients: 378 = 5.71% out of the total of 6 614 hospitalised patients = 12.85% out of the total number of lumbalgias: 2 940 2.Gender: men 226 patients = 59.78%;women 152 patients = 40.22%

3.*Age groups*: under 20 -1 patient = 0.37% ;20-29 - 9 patients -2.38%;30-39 - 86 patients – 22.75%; 40-49 - 132 patients – 34.92%; 50-59 - 117 patients -30.85%; over 60 - 33 patients – 8.73%

4. *Profession:* static 108 patients -28.57%; dynamic 141 patients -37.30%; retired (on medical grounds) 99 patients – 26.20%; retired (on age grounds) 30 patients -7.93%.5.*Radicular sequellae*: absent - 34 patients – 9.00%; irritative 131 patients – 34.65%; compressive 67 patients -17.72%; paretic 125 patients -3308%; horse tail 21 patients -5.55%

6.Affected radix: absent - 24 patients – 9.00%; L3 5 patients – 1.32%; L4 21 patients - 5.55%; L5 178 patients- 47.08%; SI 101 patients – 26.73%; biradicular 39 patients – 10.32%; centrolateral 2 patients – 0.52%

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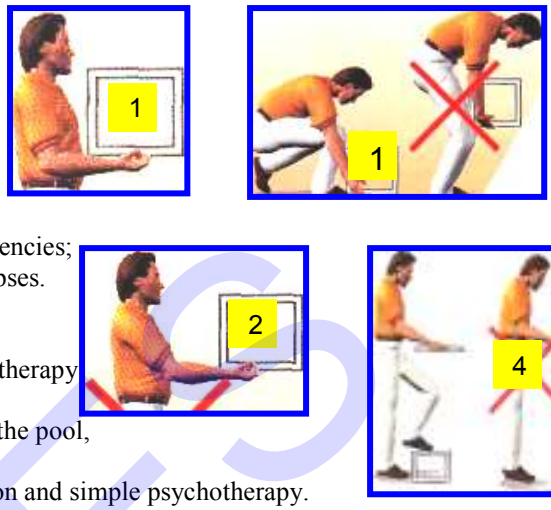
8. *Lumbar vertebral syndrome of residual static type*: absent 82 patients 2 – 21.69%; delordosation 224 patients – 59.28%; scollosis 57 patients – 15.07%; cifosis 7 patients – 1.85%; hyperlordosis 8 patients -2,11%
9.Lumbar vertebral syndrome of residual dynamic type: absent 32 patients - 8.46%; light 180 patients – 47.62%; moderate 157 patients – 41.54%; severe 9 patients – 2.38%
10.*Predominant residual syndrome*: vertebral 202 patients = 53.44%; radicular 176 patients = 46.56%
11.*Active algic lumbar areas*: of the"trigger" type 230 patients – 60.85%; of the myogelosis type 33 patients - 8.73%; absent 115 patients — 30.42% . *Surgery for DHL:* twice -56 patients -14.81%; three times -3 patients – 0.79%
Associated obesity in women 73 total = 154 patients = 40.94%;-men 81.*Recuperatory treatment* effected prior to hospitalisation: yes 140 patients = 37.03%; no 238 patients = 62.97%. *Drug treatment applied in our service*: absent - 287 patients = 75.92%;sedative 57 patients = 15.08%; antalgic and AINS 34 patients = 9.00%; corticoid -0.
Sequellae post HDL surgery are delineated as follows*:* residual radicular syndromes = 344 = 91%*;* vertebral syndromes of static type= 296 = 78.30%; residual dynamic vertebral syndromes by adaptive lumbar shortening-retraction -346 – 91.53%.
The therapeutic objectives were :

- combatting painful muscular lumbar spasm;
- recovering the suppleness of paralumbar soft tissues;
- correcting the static-postural unbalance;
- recovering the appropriate movement control;
- improving the neuromuscular tone;
- recuperating the possible motor radicular defficiencies;
- behavioural education for the prevention of relapses.



The therapeutic programme included a vast range of balneary and physical procedures: hydrothermotherapy (analgetic hiperemisant, decontracting), individual kinetotherapy at the C.F.M. hall and in the pool,

targeted electrotherapy, massage, sanitary education and simple psychotherapy.
The very good therapeutic results refer to correcting dysfunctional vertebral syndromes, either static or dynamic, as well as the clinical elements of the myofascial type.

Positions of spinal protection in daily activities
1.When the orthostatic position is held for a longer duration, it is recommendable to support a leg on a higher easement.
2.The weight is to be carried as close to the trunk as possible, balanced in both hands.
3.In orthostatic professional activities, the entire body should be oriented towards the performed activity.
4. The weight is to be lifted from the crouching position . (Fig.14)(2,3,6)

Figure.14.

Favourable results were also obtained in the case of sequellar radicular ailments of the irritative-compressive type. Functional progress was made in the case of paretic syndromes, weaker results being registered in patients with paralyses, horsetail syndromes, epiduritis, patients in whom the persistent repetition of balneary physical programmes represent a clear justification either for repeated hospitalisations, or repeated treatments in specialised resorts.

CONCLUSIONS

1. Carrying out the present research topic was imperative due to the high frequency of cases generated by the painful lumbar syndromes confronting specialists and kinetotherapists.
2. The diversity of the clinical forms exhibited by these painful lumbar syndromes frequently leads to difficulties of diagnosis and therapeutic orientation.
3. The highly accurate isolation of the type of painful lumbar syndrome constitutes the basic premise for a good triage of cases in order to decide on the competent medical staff towards whom the patients should be oriented (ambulatory, hospital, balneary resort) and on the treatment methodology.

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4. Under the circumstances of our services, the precision of diagnosis, the adequate setting of treatment objectives, the selection of methodology, the accurate application of therapeutic means have combined in obtaining good and very good results in most cases (on average 65-75%). The present study also results in the conclusion that, out of the approximately 100 patients with surgical recommendation in the extreme for HDL, 94 patients avoided surgery by the therapeutic strategy of temporization (by being re-admitted to hospital).

5. Kinetotherapy is an integral part of the therapeutic programme of SDLR, and thus it cannot only be conducted by the kinetotherapist, but by an entire team, depending on the stage and clinical form.

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