

Comparative analysis of aerobic gymnastics and gymnastics competitors based on a test of performance strategy (TOPS)

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Abstract:

The aim of the paper was to study aerobic gymnastics and gymnastics competitors parallel with a psychological skills point of view. Groups of adult elite female competitors in Aerobic Gymnastics (n=36) and Gymnastics (n=43) were compared in this study. The applied mechanism was the Test of Performance Strategy (TOPS), which was adapted to the Hungarian language (see Kalmar et al., 2015). The hypothesis was formulated that there are significant differences between the two samples as far as the differences between the two sports and the specific adaptations of their psychological skills are concerned. The statistical analysis resulted in a presentation of these differences. The main characteristics of the aerobics competitor sample are the use of wide-range automaticity to which a high value of relaxation is attached in the trainings (practice). Movements executed together with the same rhythm of music well serves this purpose. The values of emotional control are low, and negative thinking during the competitions is frequent. The high level of goal-setting, the frequent imagery and the application of self-talk are characteristics for the gymnastics sample. At the competition, emotional control and, during the training, concentration is high. It can be seen that the individual character of gymnastics favours the formation of these variables. The differences between the training (practice) and competition were also investigated in each sample. Fewer variables increased or decreased in aerobic gymnastics (in two cases) than in gymnastics (in five cases) during the competition compared to training. The dynamic changes in skills also show the differences between the two sports.

Key Words: specific adaptation, psychological skills, performance strategy, sports psychology, emotional control, self-talk

Introduction

Beyond the general adaptation, a specific adaptation also takes place because of the different movement patterns and specific aims of the sports. Based on our hypothesis, different specific skills and qualities develop at different levels; moreover, they become the characteristics of the athletes. These practical observations make it possible to formulate the research hypothesis: differences existing between competitive aerobics and gymnastics competitors manifested in abilities and skills make it possible to formulate the hypothesis which requires confirmation with this study.

It is well understood that gymnastics and aerobic gymnastics belong to the same sport group, and their movement patterns are similar as well. So the question arises as to how certain psychological indices reflect the similarities or differences of these two sports. As far as the differences are concerned, there are clear ones in terms of working methods, goal setting and exercises.

Five essential differences can be determined between competitive gymnastics and aerobic gymnastics:

- Method of execution – aerobic gymnastics routines are mostly executed in groups. The synchronized movements of the group are choreographed. Gymnastics is only characterized by individual execution – with different choreography on each apparatus. Routines are executed on an apparatus, including the floors as well.
- Rhythm of movement – In aerobic gymnastics the complex and high-intensity movements executed continuously for music are performed with a continuous and brisk rhythm. Music and rhythm have a central role; the movement and music is synchronized. Gymnastics movements use a varied rhythm which is modified by the apparatus. Rhythm depends on the body build of the gymnast, the complexity of the acrobatic elements, the gymnastic moves and jumps. Music is not used on the apparatus, except in the floor, where music without singing is compulsory (to the execution of the routine....)

- Movement coordination – There are no apparatus in the movement pattern of aerobic gymnastics. (In one category an apparatus is also used). The coordination between the body (torso) and the extremities dominates in the routines executed on the floor, which is strengthened by the synchronization to music. Based on the choreography, movement coordination is supplied by the coordination among team-members – depending on the choreography. In gymnastics coordination is highly dependent on the apparatus. During the routines executed on the apparatus and the floor, varied coordination is required between the body and the apparatus.
- Length of the routines – The length of the routine and music in aerobic gymnastics is strictly given for both the team and the individual; it is a maximum of 1 minute 25 seconds. In gymnastics the time differs according to the apparatus between some seconds (e.g. in Vaulting) to 90 seconds (in floor, asymmetrical bars and beam).
- Psychophysical load – Variable static and dynamic muscle strength, demanding flexion and extension, explosive power, endurance, flexibility, sense of rhythm and balance are characteristic for aerobic gymnastics. Maximal and sub-maximal strength, static and dynamic strength endurance, explosive power, flexibility, sense of balance and spatial awareness are required in gymnastics.

Researches related to Aerobic Gymnastics and Gymnastics are first of all connected to the problems of physical and psychological health and well-being (Roth & Holmes, 1987). Aerobics exercises and circuit trainings result in a fitness state even in non-competing, only practicing participants (Henry et al., 2006). Physical activity and psychological well-being are linked, and together they result in a higher level of health (Biddle et al., Eds 2000). It was proven in preventive medicine that aerobics exercises have long-range effects on the psychic functions (DeLorenzo et al., 1999).

Many researchers have dealt with the specific effects of physical training, and they confirmed these effects with measured results. Training led to an aware physical self-concept (Sonstroem, 1988), which, at the same time, favoured the regulation of mood as well (McInman & Berger, 1993). This latter fact was proven with Australian dancers. Several researches have been conducted in relation to body image. A six-week danceaerobic intervention favourably influenced the body image and self-concept of adolescent girls (Burgess, Grogan, Burwitz, 2006). Others reported an increased level of satisfaction among the participants with regards to their body (Le Page & Ebbeck, 2010). Body image and related satisfaction are especially important in the so-called immanent sports (aerobics, gymnastics, RG, dance), as the main concept is the showing of the body during the performance. Aerobics routines have an effect on activity based on a report of a meta-analysis (Reed & Buck 2009). The relationship between personality traits and body image was confirmed by a comparative analysis as well (Allen & Walter, 2016). Neuroticism has a positive correlation with negative body image in both men and women, but extraversion showed the opposite; there is a negative correlation with negative body image. This proved the important role of body image in relation to personality (Allen & Walter, 2016).

Several variables were examined in a non-athlete female sample in relation to aerobics training. It was stated that even a one-week regular practice had a positive correlation with psychological well-being, self-concept, body absorption, and had a negative correlation with negative emotions (Sági & Szekeres, 2012). Others investigated the effects of only one aerobics practice lesson (Béres, Czeglédi & Babusa, 2017). It was proven that even one hour of training has a positive influence on body image, but it is improbable that this influence would be long-lasting. A new research trend has been formed in connection with the question of what psychological skills influence or regulate performance. The possibility of investigation could be realized with the Test of Performance Strategies (TOPS), elaborated by Thomas et al. (1999). TST is mostly used in researches and in giving psychological sport-related advice (Weinberg & Gould, 2011). There is proof that psychic skills are components of performance, but they can be developed; thus, it is the result of preparation in sport (Weinberg & Florenza, 2012).

The TOPS method was used earlier for comparing different sports groups. Taylor and others (2008) differentiated sportsmen preparing for the Sydney Olympic Games into a medal winner and an also-ran group, in which significant differences were found in almost all variables, with an advantage to the medal winner's sample. Kastikas et al. (2009) pointed out that in Greek adult track and field athletes the Greek national sample had significantly higher values in emotional control, goal setting, imagery, activation and relaxation items, and there was a significantly negative correlation in the use of negative thinking compared to the also-ran adult sample. Faggian and others (2011) proved the development of psychic skills in a case study about an acrobat, through which the athlete's performance improved.

The results of a research by Eun-Hee Jeong (2012) carried out among dancers, showed that the relationship between the "flow" and "imagery"-levels differed from moderate to high. Besides this, pictures of the flow and relaxation resulted in an effective improvement in optimal positive experience and dance performance.

Soós et al. (2016) analysed the correlations between performance strategies (TOPS) and state of mood (BRUMS) in British university basketball players. As a result of the research, it turned out that the technical and tactical abilities of the higher-level (first division) players have more automaticity than in those playing at a lower level (in the second division). Unfortunately, none of the groups (samples) made use of the possibilities hidden in the positive effect of self-talk during the matches. They stated that activation and automaticity are

strongly connected to the positive mood states. They found a high positive correlation between emotion control and attention concentration ability. The reason for this might be that players with a stable emotional state and mood can concentrate much better in a risky situation, which may result in higher-level performance.

Luis Vaz et al. (2017) studied rugby players according to the position in the team. Their results show that players in the front (forward players) generally reached higher levels in self-talk and activation than the back players. They drew the conclusion that certain psychological skills used during the competition change based on the game situation, and that rugby players can much better influence the successful performance of their team with better directing their negative thinking.

In Hungary the Test of Performance Strategy (TOPS) was adopted and used on a sample of selected female gymnasts from twelve European countries to determine their psychological skills during training and competition (Kalmár et al., 2014). From among the psychological skills, seven were used during both training and competition: activation; goal-setting; movement imagery; relaxation; self-talk; emotional control and automaticity. From the rest attention control was used only in training (practice) and negative thinking only during the competition (see Methods). The detailed comparative research of British and Hungarian gymnasts has proven the diagnostic applicability of the method. The research had two important results: 1) The questionnaire method well matches the test criteria and 2) the variables showed the differences during the comparison.

Material & methods

Aim and Hypothesis

The aim of the paper is to study aerobic gymnastics and gymnastics competitors parallel with a psychological skills point of view. The main hypothesis is that, as a result of specific adaptations, great changes occur in the psychological skills of aerobic gymnastics and gymnastics competitors; it is supposed that these changes can be demonstrated. A further hypothesis is that there are differences between the two samples in terms of psychological skills and that this can be proven. If the expected research results support the differences existing between the two sports, empirically formulated in five different points in the introduction, the hypothesis is verified.

Participants

In the present study two samples, the female aerobic gymnasts group (n=36, age: 15.7±2.5) and the adult female gymnastics group (n=43, age: 16.4±2.4) are compared with the application of the SPSS statistical programme. The level of psychological skills was determined, the differences between the two groups and the training and competition are stated, and comparative consequences are drawn based on the gained data.

The two samples are characterized by descriptive statistics presenting the mean (M), the standard deviation (SD), the minimal (min) and maximal (max) values. The mathematical statistical evaluation aims at comparing the two samples, which is why the divergences are stated with the help of the independent sample t-test and the significances are calculated. The SPSS programme was used in the calculation. The results are presented in tables, and then the conclusions are drawn.

Method

The TOPS (Test of Performance Strategies, TOPS, Thomas et al., 1999) comprises eight Likert scales for training and eight for competition. Each item has five multiple choice answers: “almost never, rarely, sometimes, often/frequently, and almost always”. It refers to both training and competition: activation; relaxation; movement imagery; goal-setting; emotional control and automaticity. A further scale (attention control) aims at only training (T), with one (negative thinking) only at competition (V).

Each scale comprises four items, so the whole test consists of 64 items. The following signs were used for the variables: Training: activation (Ta); relaxation (Tr); imagery (Ti); goal setting (c); emotional control (Te); self-talk (Tb); automaticity (Tt); concentration control (disruption) (Tf); Competition: activation (Va); relaxation (Vr); imagery (Vi); goal setting (Vc); emotional control (Ve); self-talk (Vb); automaticity (Vt); negative thinking (Vg). The TST test, adapted to Hungarian, was used (Kalmár et al., 2014). The inner consistency (Cronbach alpha) and the temporal stability (test-retest correlations) of the different variables were calculated based on the data of n=34 gymnasts. The values can be seen in Table 1.

Table 1. Reliability of TOPS scales							N= 43
Scales of practice		Cronbach alpha	Test-retest	Scales of competition		Cronbach alpha	Test-retest
Activation		0.89	0.66	Activation		0.88	0.66
Relaxation		0.81	0.68	Relaxation		0.84	0.68
Imagery		0.91	0.89	Imagery		0.83	0.78
Goal-setting		0.74	0.63	Goal-setting		0.88	0.87
Emotional control		0.88	0.72	Emotional control		0.86	0.63
Self-talk		0.93	0.78	Self-talk		0.86	0.80
Automaticity		0.90	0.70	Automaticity		0.73	0.80
Concentration		0.85	0.72	Negative thinking		0.84	0.72

Source: Kalmár (2011-2015), PhD dissertation, p. 29

The Cronbach alpha values show high consistency among the items of certain variables, so they can be accepted as reliable. The results of retests refer to the temporal stability of the measured variables, although the retest was carried out within a three-week interval. So the test has to be accepted as a reliable one.

To ensure the validity of the test, its inventor applied a discriminate analysis between the samples of top athletes and those doing recreational sport. In most variables significant differences were found showing an advantage for the athletes. During the Hungarian test, adaptation validity was repeated to prove constructive validity (Kalmár et al., 2014). This meant that in the majority of the variables for elite world gymnasts (n=183), a strong, significant correlation was found, with the exception of automaticity. So the data changed in unison in one direction, for elite sportsmen. So the validity of the test is accepted.

The described adult and junior aerobics and gymnastics female competitors selected were investigated with the described valid and reliable method, and within that, results were received for training (T) and for competition (V).

Ethical Considerations

The study followed strict ethical standards that were compliant with EU regulations pertaining to human subject research. In brief, all subjects participated in this study voluntarily and without any undue influence. Subjects did not receive any compensation. We ensured that participant information was de-identified at the point of data collection and no data could be linked to individuals from the aggregate. Subjects were told that their participation in the study had no bearing on their training and sport activities. Data were protected with physical and electronic measures and only investigators had access to study records.

Ethical statement: the authors report no conflict of interest in this research; the experimental protocol was conducted in accordance with the Declaration of Helsinki.

Results

The results first show the divergences between the two samples according to the training and competition variables (Significance differences: $p < 0.05$ S, and $p < 0.001$ S)

Table 2. Comparative statistics of training

AER	TOR	AER	TOR	AER	TOR	AER	TOR
Ta		Tr		Ti		Tc	
M= 10.73	10.77	14.73	7.91	9.4	13.22	8.2	14.97
SD=2.9117	2.4855	3.4233	2.7503	2.9314	3.3561	2.2651	2.1578
Min = 6	6	7	5	4	4	4	12
Max =16	17	20	17	15	11	15	18
t= 0.9121	p>0.05 N	t=6.3356	p<0.001 S	t= 5.396	p<0.001 S	t=1.1989	p<0.05 S

AER	TOR	AER	TOR	AER	TOR	AER	TOR
Te		Tb		Tt		Tf	
M= 11.7	12.77	8.43	16.44	11.33	11.72	8.94	12.94
SD=2.4374	1.4949	2.9087	2.3957	1.1908	1.6494	2.1901	1.5979
Min= 8	4	4	4	6	4	7	10
Max= 18	17	18	18	17	18	15	17
t= 0.1637	p>0.05 N	t= 4.830	p<0.001 S	t=0.1711	p>0.05 N	t=3.7982	p<0.001 S

Table 3. Comparative statistics of competition

AER	TOR	AER	TOR	AER	TOR	AER	TOR
Va		Vr		Vi		Vc	
M=7.80	14.9	11.25	14.88	6.86	14.6	8.91	14.58
SD=2.2655	2.4281	3.6203	3.1238	2.086	2.9581	3.074	2.5282
Min=5	11	4	7	4	6	4	9
Max=14	19	17	17	12	19	14	18
t=3.6201	p<0.001 S	t=0.2391	p>0.05 NS	t=1.0103	p>0.05 NS	t=6.9187	p<0.001 S

AER	TOR	AER	TOR	AER	TOR	AER	TOR
Ve		Vb		Vt		Vg	
M=8.36	15.48	9.25	16.11	13.72	9.72	17.02	6.83
SD=3.3987	2.4139	3.1926	2.7098	2.8041	2.292	2.6347	2.7336
Min=4	13	4	11	4	6	11	4
Max=17	20	17	20	18	14	20	14
t=1.9425	p<0.05 S	t=2.1133	p<0.05 S	t=2.6574	p<0.001 S	t=2.9554	p<0.01 S

Based on the values of variables referring to training (T-values), it can be stated that the aerobics sample has a significantly higher relaxation level than the gymnastics sample. On the other hand, the imagery, goal setting, self-talk and attention concentration of female gymnasts is significantly much higher. As far as the level of activation, emotional control and automaticity are concerned; there is no significant difference between the two samples.

When comparing the variables (V values) related to competition, it can be seen that the aerobic gymnastics sample has significantly higher automaticity and negative thinking, and has a higher imagery level as well. In contrast, gymnasts showed higher activation and a higher level of imagery, goal setting, emotional control and self-talk. In relaxation the difference does not reach a significant level. An evaluation of the differences is detailed in Discussion.

In the next phases we examined what differences can be found in the variables referring to training and competition. We expected to get an answer as to what changes were caused by the training load and competition performance in the measured psychological skills.

Table 4. Divergences between training and competition

AEROBICS (N=36)				GYMNASTICS (N=43)		
Training	Competition			Training	Competition	
M	Msign.		variable	M	Msign.	
10.97	7.80	NS	a	10.4	15.3	p<0.001
15.19	11.25	p<0.001	r	7.5	11.2	p<0.001
9.27	6.86	NS	i	13.2	13.7	NS
8.66	8.91	NS	c	13.1	15.5	p<0.01
11.97	8.36	p<0.001	e	11.4	7.9	p<0.001
8.72	9.25	NS	b	16.7	16.3	NS
11.33	13.72	NS	t	12.5	9.9	p<0.01

The basic aim in all sports is to prepare for the competition with training. So the training load has decisive importance in terms of competition performance. This relationship presents itself differently when the two samples are compared. In aerobics no. significant decrease can be observed in activation (a) at the competition, while there is a significant increase for gymnasts. Relaxation (r) significantly decreases in the aerobics sample, which refers to a higher level of stress (excitement) in the competition. At the same time relaxation significantly increases in gymnasts at the competition. As far as the imagery (I) is concerned, there is no significant change between training and competition. Goal setting significantly increases in gymnasts during the competition, which can be connected to the execution of extremely difficult and risky elements. Goal setting did not change in the aerobics sample. Emotional control (e) is significantly lower in both samples in the competition. Values of self-talk (b) change in neither of the samples between training and competition. Automaticity increases, but not significantly in the aerobics sample, while it significantly decreases for gymnasts at the competition.

Discussion

Based on the trends of recent researches, it can be stated that they have mainly dealt with the effects of aerobic gymnastics and gymnastics exercises, like, for example, well-being, body image, self-concept and changes in mood, which are all related to health awareness and health preservation. Health-related psychophysiological effects can always be revealed, independent of the frequency and intensity of the work carried out with the samples (see References).

In the next period of the researches, variables referring to real sports performance were investigated. Such questions have come to the foreground as to what effects the regular, long-lasting and competitive trainings have on the participants, and what skills and features training and competitions develop, well-being, positive mood and similar things are not enough for performance. So the studies shifted from health-orientated researches to performance-orientated ones, carried out, for example, by Taylor (2008) and Kastikas (2009). New research methods have received an honoured role in this trend, which were developed by Taylor et al. (1999) (the TST). Detailed analyses have been made possible by the fact that the questionnaires comprised such items which have become suitable for measuring psychological skills, and that these variables could be stated separately for training and for competition.

Recognizing the possibilities of these new reach methods, Kalmar et al. (2014) showed significant differences in female gymnast samples from twelve selected national teams, and explained these differences with the different strategies used during the preparation. Based on this research, a comparative analysis of female aerobics and gymnastics competitors was undertaken. The following analyses are based on the results of Tables 2 and 3.

Activation is evaluated as a movement (motor) drive. During training, (Ta) activation of the two groups is the same, but in competitions (Va) the gymnasts are significantly more active. Efforts for automaticity in the trainings (Tt) are also at the same level, while this value is significantly higher for aerobics in the competitions

(Vt). It seems that the joint execution and the rhythm of music favour the automation of execution. Automaticity decreases in gymnastics during the competition. Relaxation is present at a high level in training (Tr) in aerobics, so the gymnasts' levels of stress are lower than those of the gymnasts; however, they lose this advantage in competition (Vr), where they become tenser. Although the values of gymnasts increase, there is no significant difference between the two samples.

There are certain risky and sometimes dangerous movement elements in the executions at the competitions, but goal setting limits these risks. From among the two samples the gymnasts set higher goals for themselves during the training (Tc) and competition (Vc), and based on our experience, one cannot fully prepare for this, which is why emotional control is required. The emotional control in the trainings (Te), where the learning and practising of new routines takes place, is slightly higher in the aerobics sample, but at competitions (Ve) this level is higher than in the gymnastics sample; the athletes guarded against failure with the application of imagery: they imagine and think over their movements in the routine. Recently, mental training exercises have also been used, specially prepared for this aim. The gymnastics sample has significantly higher imagery values, both during training and in competition (Ti-Vi).

Attention concentration and negative thinking are two variables which refer only to training (attention) and competition (negative thinking). According to the obtained data, concentration (Tf) is significantly lower in aerobics, and negative thinking (Vg) is significantly higher, which means that self-control (reassurance) is low. These supplement the picture described above where the two sports are compared. The several presented variables make a different analysis and profile description of the two sports possible. However, the analysis is still not complete at this point, as an aesthetic approach is missing for which there is no research method. It is well-known that the performance in aerobics (and gymnastics as well), is demonstrated by the "strength" of the routine, together with the aesthetic execution. Professional literature has yet to consider aesthetic analysis.

Psychic skills dynamically change between training and competition, and there are differences between the female gymnastics and aerobic gymnastics samples (Table 4). The gymnastics sample significantly increased its activation in competition, which is constant in the aerobic gymnastics sample. Relaxation significantly changes in both samples, but in opposite directions. In the aerobics sample it decreases during competitions, while it increases in gymnastics competitions. The level of goal setting is constant in the aerobic gymnasts sample, while gymnasts set higher goals for competitions. Automaticity remains at a high level in the aerobic gymnastics sample; it does not change between training and competition, but it significantly decreases in the gymnastics sample. The values of self-talk are just the opposite in automaticity: it remains high in the gymnastics sample, and it is the same in the aerobics sample as well, but at a lower level.

In summary, it can be stated that aerobics competitors are characterized by high automaticity, especially in competitions. They work with high relaxation skills in trainings which significantly decrease in competitions, as a certain excitement (a "psych up" state) appears, and negative thinking is also present. This does not counterbalance positive-type self-talk, which has lower values both in training and competition. It is not favourable that there are low scores regarding emotional control. They show a low level of goal setting; thus imagery does not have high scores either. In general, aerobics teams do shared work, executed with the same music and rhythm, which is why the execution has a routine character. Individual goal-setting is raised to a team level, which makes it difficult to synchronize with the rhythm of music, movements and the team members. This division of attention makes it difficult for the team to execute a perfect routine.

Suggestions for further researches

Based on the analysis, we have formulated careful developmental suggestions for the aerobics sample. The starting and basic conditions of a good performance are good music and spectacular choreography which has to be executed together synchronously. An important factor is the high sense of rhythm. At the moment the tested sample is at the routine level phase. To get from the level of performing correctly to the level of performing in an enjoyable way, one has to exploit the given opportunities. The mental (and not physical) execution of the routine should be practised and combined with the physical one. One has to strive to implement such excellent and spectacular peaks, the execution of which does not cause problems for the team members. It is important that the participants should regulate their emotional state individually, so that they can stabilize their psychic stress increasing the performances of own and team.

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