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Original Article

Light stimulation exercises and their impact on attention focus (visual and auditory), lactic acid levels, and skilled hand speed for wheelchair basketball players

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Abstract
Objectives: This study aimed to determine the effect of light stimulation exercises on attention focus (visual-auditory), lactic acid, and skilled hand speed of wheelchair basketball players. **Methods:** We used the experimental method on 24 wheelchair players who were divided into two groups, the first experimental (N = 12; age, 20.58 ± 0.90 years; training, 4.71 ± 0.62 years). The other was a control (N = 12; age, 20.67 ± 0.62 years; training, 4.77 ± 0.58 years).Lactic acid was measured by Lactate Pro 2 Blood Lactate Meter, attention focus (visual-auditory) was measured using the Li Lafayette Instrument 63035, and skilled hand speed was assessed with the Modified Y-Test for Measuring Skill Hand Speed (Three-Zone Shooting). The proposed program was applied over 10 weeks at a rate of four weekly training units. Results: Results showed improvement in the level of attention focus (R.H; LH) at a rate of (p = 0.001) and a decrease in the level of lactic acid BE, AE (1,3,5 Min) with a value of P = 0.001 (P<0.05). The modified three-zone shooting T-test showed an improvement (p = 0.001) in favor of post-measurements of the variables under study for the experimental group of wheelchair basketball players. The experimental group was superior to the control group, as it showed an improvement in the level of attention focus (R.H; LH) at a rate of (p = 0.000) and a decrease in the level of lactic acid BE with a value of p = 0.002, AE (1,3,5 Min)P=0.000.The modified three-zone correction T-test showed improvement (p = 0.000) for wheelchair basketball players. **Conclusions:** We suggested that the light stimulus can be used in a more appropriate and effective way in training of wheelchair basketball players. This primarily applies to decision-making which is often more challenging during specific sports performance.
Keywords: FITLIGHT Trainer, Disability Sport, Wheelchair Basketball, Disabled, Reaction Time ,Lactic Acid.

Introduction

The disability sport of the disabled has become one of the sports of great importance in the preparation and rehabilitation of people with disabilities special needs physically, mentally and psychologically. and one of the practical and optimal means in the return of the disabled to society with a sense that he becomes an active member of society, which is an important part in its composition (MAKSYM M. et al. 2018). and since the practice of sports has taken another dimension after it was a recreational therapeutic sport aimed at eliminating leisure time to be developed into a more sophisticated sport in the field of improving and developing the physical, skillful, planning and physiological .aspects as well as the psychological aspects to achieve sports achievement and the global results and numbers that have been falling apart and successively at the hands of heroes with special needs, whose names were recorded from the light in the records of international sports federations in various sports games and events (Goosey-Tolfrey,2010).

Wheelchair basketball (WB) is a popular Paralympic sport and has grown in popularity through international competitions around the world., where the high level of performance and increased attention require more scientific insight into performance as a basis for improving training programs and conditions, raising the high level of sports for players and the refinement of coaches (Van der Slikke, et al. 2020). The game as well as the team's performance is affected by the movement of players in wheelchairs, and is determined by the interaction between the athlete and the wheelchair (VIOREL O. 2018). Where performance depends largely on the individual performance of wheelchair movement, as movement and transition require the player to have a great deal of speed and maneuverability with a maximum speed of performance, movement, and rotation (Veeger, et al. 2019).

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The game of WB is a motorsport with a high degree of functional and psychological benefit, as all parts of the body are involved in its performance, so it requires neuromuscular compatibility and great speed to control the ball and the movement and maneuver of the wheelchair. In general, performance in the game depends on the movement of the chair and the athlete (Van der Slikke, et al. 2016). The movement performance of the chair is related to the interaction of the athlete with the wheelchair (Veeger, et al. 2019). Therefore, this game requires speed, flexibility, agility, compatibility, and strength of the upper limbs in order to better perform all offensive skills and implement tactical duties in a good way. Nowadays, due to rapid technological advancement, scientific equipment and devices have been developed with high validity and reliability, increased economic accessibility, and data mining and analysis (Oliva-Lozano,2020).

FITLIGHT training is one of the forms of training using modern technology globally in the sports field, FITLIGHT uses wireless light units that are remotely controlled by a tablet computer and can be positioned at distances of up to 50 yards from the console (Hassan AK,et al. 2023). Training with FITLIGHT can elicit cardiovascular and muscular responses of highly trained players specifically over a relatively short period of time than other devices and affect reaction time as well as simple and complex visual stimulation (Comi . Z. et al. 2015).

The FITLIGHT trainer is one of the devices used to develop the physical, skill and visual performance of players in basketball (Hassan, A. et al. 2022).The lights have an internal sensor that interacts with proximity or touch to deactivate the light. Each light can be programmed independently or as a group with different stimulation patterns and durations (FITLIGHT Corp, Ontario, Canada). Besides being able to program different sequences for each light, FITLIGHT can be installed on any surface including walls, columns, floors, and other training equipment (Perroni, F.,2018).

Eye-hand -coordination is the most important factor for sports performance, as during performance there is a transmission of nerve signals between the nervous and muscular systems, so most of the skills that are frequently performed require a good degree of compatibility (eye and hand) to do the skill performance to the fullest, and visual coordination training helps to improve the mutual connection between the eye, the brain and the movements that you perform and thus it makes the player think quickly (Samir T.&Matthias N.2015). The game of basketball revolves around shooting, passing, and holding the ball and poor coordination between the eyes and hands can lead to the loss of balls and passes that cannot be caught, loss of control of the ball under the pressure of the opponent (Candra, O. 2019).

The nature of performance in WB is a compound that is integrated within the game. The player needs to integrate motor compatibility and coordination between the use of hand and eye with visual training in order to develop his skills and achieve the highest level of concentration of attention and this correlation represents the realistic and actual performance performed by the player during the game, that the use of visual information and sending it to the brain works to guide and regulate motor performance because the faster a player sees the ball, teammate or open space, the better and more effective his decisions and movements are (Oudejans, R. 2012). Visual training with modern means and devices contributes to improving visual neuroprocessing and some functions in the brain, and vision training programs improve sports performance as they work to improve hand-eye coordination, reaction times, and peripheral awareness, as well as improving the field of play (Clark J.2020).

We found the lack of sufficient attention by WB coaches with the speed of hands, which creates gaps and makes it easier for the opposing team to exploit those gaps and score points or score on the basket, as the nature of the game of WB requires the player to have a high degree of compatibility between the eye and the hand to receive, pass and aim the ball on the basket and also move the wheels of the wheelchair in addition to the speed in the visual reaction to switch from attack to defense and vice versa. Therefore, this negatively affects the level of skill performance of players. A number of researchers (Comi . Z. et al. 2015; Perroni, F.et al., 2018; Clark J. et al. 2020; Hassan, A. et al. 2022; Forni, F. et al. 2022; Myers, L. et al. 2022; Gutiérrez-Vargas, et al. 2020; ALSASUA R. et al. 2021; VIOREL O. 2018) have reached through reviewing many research and studies to the use of FITLIGHT exercises and within the limits of their knowledge that these exercises contribute to the development of reaction speed and increase the compatibility between the eye and hand with increasing the focus of attention, whether visual or auditory, with the effect on lactic acid and skillful hand speed. So the movement of the wheelchair is closely related to the interaction between the player and the wheelchair and what this requires from increasing compatibility and coordination between the eye and hand in moving the wheelchair and the use of hands in the process of passing, receiving and shooting. The researchers conducted an exploratory study of the tests. Hence, the researchers confirmed the low level of players in those tests, which prompted them to conduct such a study in an attempt to find out the effect of light stimulation exercises on attention focus (visual and auditory), lactic Acid, and speed of the skillful hands of WB players. This helped coaches to know the best means and methods to develop the level of performance of WB players.

The study is a scientific attempt to identify the effect of light stimulation exercises on attention focus (visual and auditory), lactic Acid, and speed of the skillful hands of WB players, as well as trying to direct the attention of specialists and coaches to the importance of FITLIGHT training and how much benefit from these exercises in developing the level of skill performance of WB players through them, which may help coaches to

know the best methods used in developing and improving research variables in addition to exercises in developing the skill performance of players Wheelchairs. FITLIGHT training opens a new field for conducting many studies and research for various sports activities and various skills while enriching scientific knowledge with regard to the training field for the physically disabled category, and this study is considered a qualitative scientific leap in the field of training WB players, which gives the spirit of fun and competition between players and the ability to perform well and avoid boredom and monotony.

Accordingly, this study aims to clarify the effect of photo-stimulation exercises on attention focus (auditory-visual), lactic acidity, and speed of skillful hands of WB players. Continuously we assume a) that there are statistical differences between the previous and post measurements of the experimental group in the concentration of attention (visual and auditory), lactic acid, and the speed of the skilled hands of the WB players, in the direction of the post measurement. b) There are statistical differences between the previous and post measurements of the control group in the concentration of attention (visual and auditory), lactic acid and the speed of the skillful hands of the WB players in the direction of the post measurement. C) There are statistical differences between the dimensional measurements of the experimental and control groups in the concentration of attention (visual and auditory), lactic acid and the speed of the skillful hands of the WB players in the direction of the experimental group.

Materials and Methods

Experimental Approach

The study program was conducted over 10 weeks on WB players in Minya Club of A.R.E to improve attention focus (visual-auditory), lactic acid, and hand speed skills of WB players. With the FITLIGHT Training System, FITLIGHT training components were designed into the training program. We used the experimental method on 24 wheelchair players who were divided into two groups, the first experimental (N = 12; age, 20.58 ± 0.90 years; training, 4.71 ± 0.62 years). The other was a control (N = 12; age, 20.67 ± 0.62 years; training, 4.77 ± 0.58 years).Where the light stimulus training program was applied to the experimental group, while the control group was applied the traditional program. we supervised the training of the players to determine the effect of FITLIGHT exercises. The participants were fully informed of the risks and benefits of the study prior to their entry and they signed an institutionally approved informed consent form. The protocol was approved by the Research Ethics Committee at King Faisal University, Saudi Arabia (KFU-REC-2023-JAN-ETHICS519).

Tools and Devices

Restameter for height and wight measurements, a basketball, and Attention Focusing Device Response Panel (Visual - Auditory) 63035A for Measuring Combined Reaction Time (3700 Sagamore Parkway North, Lafayette, IN 47903 USA) , Lactate Pro 2 Blood Lactate Meter for Measuring Lactic Acid, Modified Y-Test for Measuring Skillful Hand Speed (Three-Zone Shooting), Stop watch, FITLIGHT, stands for carrying the FITLIGHT disc, Ropes, Lactate Pro 2 Test Strips. The validity and reliability of the used device was confirmed by comparing its results with the results of other devices such as the Visual Response Board 63014 (Lafayette Instrument Company, 3700 Sagamore Pkwy N, Lafa-yette, IN 47903, USA), Lactic Acid V-5000 VIS Spectrophotometer Visible (M&A INSTRU-MENTS INC, Italy). The exploratory study was conducted by applying the measurements on a sample outside the original sample to ensure the validity and reliability of those measurements. Figure 1. shows the Li Lafayette instrument (Lafayette, IN, USA) 63035A Reaction Time (Visual and Auditory Attention Focus) instrument response board,which contains a Complete with four stimulus lamps, a Sonalert, for auditory stimulation,and five response keys,Line Voltage (Model 63035) 105/125V AC 50/60 Hz, Power (Model 63035A) 12V DC Wallmount transformer, Timer Relay Contact Rating 0.5 amps @ 30V DC, 0.5 amps @ 50V AC,Inductive loads should be arc Supressed, Stimulus Lamps #47 6.3V Chicago-Miniature, Figure 2. shows Lactate Pro 2 Blood Lactate Meter for measuring Lactic Acid, and Table 2. shows the training program (see Appendices A-D for more information).

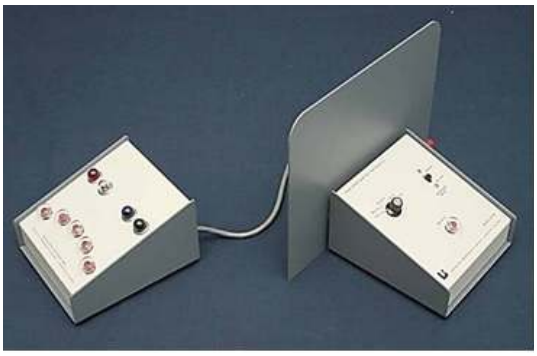

Figure 1. Visual reaction time apparatus 63035 (Appendix A)

Figure 2. Lactate Pro 2 Blood Lactate Meter (Appendix B)

Procedures

Program implementation procedures

The program aimed to improve the concentration of attention (visual and auditory), the level of lactic acid, and the speed of skillful hands of WB players Table 1 shows the time distribution of the training program applied to the experimental sample for a period of 10 weeks.

Table1. Time distribution of the sports program

Stages	W	MAX	H	Mini	UT	TW	TT	TPT
General Preparation Phase	1		●		90 min	360 min	1080min	3600min
	2	●			110 min	440 min		
	3			●	70 min	280 min		
Special Preparation Phase	4		●		90 min	360	1880 min	
	5	●			110 min	440 min		
	6			●	70 min	280 min		
	7		●		90 min	360 min		
	8	●			110 min	440 min		
Competition Preparation Phase	9			●	70 min	280 min	640min	
	10		●		90 min	360 min		

W= Weeks; MAX= Maximum;H= High; Mini= minimum;UT= unit time;TW= time of the week;TT= Total Time;TPT= Total Program Time.

Testing Procedures

Before starting the program, all research variables were pre-measured in the group. Players did not perform strenuous exercise within 48 hours prior to testing. First, a direct blood sample was taken from the right or left thumb and placed on the test strips, on 10/10/2022 at 5:00 PM , and then lactic acid was measured before and after the effort for wheelchair players using the Lactate Pro 2 device. Measurement was done after (1,3,5) minutes after exertion (Katanić B. et al.2020) . Where the measurement was done through the device, Pricking was done with a special needle, the sample was placed on the test strips, and the reading was done directly from the device (see Appendix B). Secondly, there was a uniform 15-minute warm-up. This included stepping and running for short distances. Third, they were randomly selected to avoid fatigue from one test to the next. Fourth: Verbal encouragement was given to motivate the study sample to apply the test to the best of their abilities. We conducted pre-measurements for the two study groups to test focus of attention (audio and visual) using the Visual Reaction Time Apparatus 63035A response board. and measured dexterous hand speed with a modified Y-test (three shootings) (Dean, H. et al. 2011) (see Appendix C). during the 12-13 of October 2022. The researchers looked at applying the tests to all individuals uniformly. The proposed training program was applied for a period of ten weeks starting on October 15, 2022 and ending on December 22, 2022 through four training units per week on Sundays, Tuesdays, Wednesdays, and Thursdays, and 40 units of the FITLIGHT exercise training program were implemented and applied to members. After the application of the training program ended, we conducted subsequent measurements for the two groups, from December 24 to 26, 2022, in the same way as the pre-measurement. The statistical package for the social sciences (SPSS) (IBM SPSS Statistics 26.lnk, Chicago, IL, USA) was used for statistical analyses. The mean and standard deviation were calculated. t-test and Cohen's D were applied. at the level of significance at $p < 0.05$.

Results:

Figures 3, 4, and 5 show the mean, standard deviation, and t-values of the pre and post measurements of the two study groups in the tests. Figure 3. shows the averages of the pre- and post-measurements of the experimental group, where in the Right Hand Attention Focus (R.H) test we found the pre-measurement was(0.406 ± 0.012 ms) and the post-measurement was (0.309 ± 0.003 ms), with an improvement of (24.03%). Whereas the Attention Focus Test for the left hand (L.H) resulted in a pre-measurement of (0.472 ± 0.012 ms) and a post-measurement of (0.349 ± 0.006 ms), with an improvement of (26.01%). The modified Y-test (three-point shooting) (Speed hand) resulted in a pre-measurement of (27.549 ± 0.108 s) and a post-measurement of (24.403 ± 0.136 s), with an improvement rate of (11.42%),(BE) was (1.923 ± 0.213 mmol/l), while the post-measurement was (BE) was (1.433 ± 0.165 mmol/l), with an improvement rate of (25.48%), and with a value of p= 0.001 (p <0.05). While the pre-measurement (AE) (1,3,5 Min) was (9.876 ± 0.438; 6.699 ± 0.168; 5.475 ± 0.075 mmol/l), the post-measurement was (7.040 ± 0.580; 4.698 ± 0.031; 4.308 ± 0.014 mmol/l), with an improvement rate of (32.17; 28.58; 8.30%), with a value of p = 0.001 (p <0.05). Table 2. presents the results of the pre- and post-measurements for the experimental group

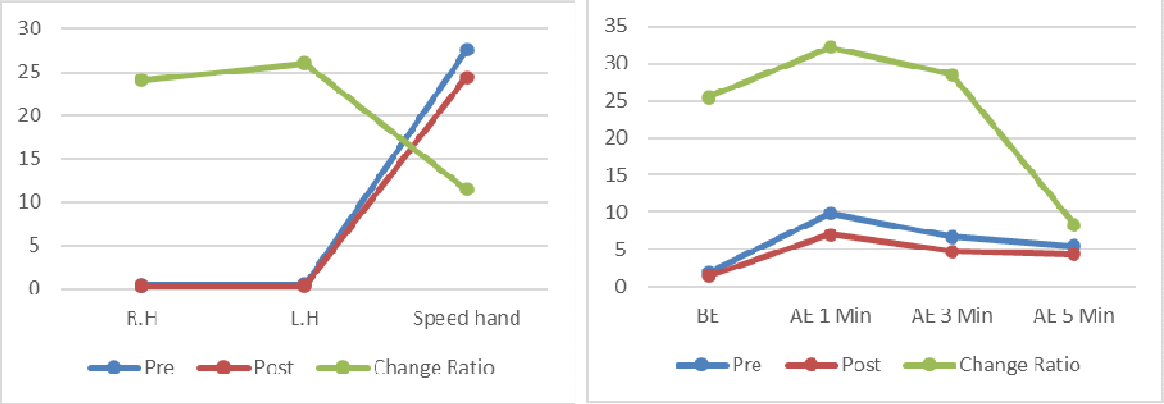

Figure 3. Pre and Post- measurements of the experimental group of WB players.

Table 2. Experimental group measurements for WB players (N = 12).

Test	Unit of Measurement	pre	post	95% Confidence Interval		T-value	D	Change Ratio	Sig
		Average ± SD	Average ± SD	Lower	Upper				
Attention Focus Test									
R.H	Ms	0.406 ± 0.012	0.309 ± 0.003	0.090	0.106	26.657	7.69	24.03	0.001
L.H	Ms	0.472 ± 0.012	0.349 ± 0.006	0.105	0.141	14.754	4.26	26.01	0.001
Speed hand	Sec	27.549 ± 0.108	24.403 ± 0.136	3.063	3.230	83.232	24.03	11.42	0.001
Lactic Acid									
BE	mmol/L	1.923 ± 0.213	1.433 ± 0.165	0.29	0.69	5.49	1.58	25.48	0.001
AE 1 Min	mmol/L	9.876 ± 0.438	7.040 ± 0.580	2.30	3.38	11.54	3.33	32.17	0.001
AE 3 Min	mmol/L	6.699 ± 0.168	4.698 ± 0.031	1.88	2.12	37.58	10.85	28.58	0.001
AE 5 Min	mmol/L	5.475 ± 0.075	4.308 ± 0.014	1.12	1.22	51.43	14.85	8.30	0.001

R.H = Right Hand; L.H = Lift Hand; Before Effort =(BE); After Effort =(AE); SD = Standard Deviation; D= Cohen's d; *t*-value at a significance level of 0.05 = 1,796

Table (2) shows the significance of the differences between the two criteria for the experimental group in attention focus (RH, LH), hand speed for WB players, lactic acid (BE, AE 1 Min, AE 3 Min, AE 5 Min), the calculated "T" value was greater From the "T" value of the table at the level of (0.05), where we found that the value of "Cohen's d" ranged between (1.58 - 24.03), and the change rate ranged from (8.30 - 32.17%).

Figure 4. shows the differences between the averages of the pre-and post-measurements of the control group for the variables under consideration, where we found that the result of Attention Focus Test, for the right

hand (R.H) the pre-measurement was (0.438± 0.045ms) and the post-measurement was (0.404±0.046 ms), with an improvement of (7.76%). Whereas the Attention Focus Test for the left hand (L.H) resulted in a pre-measurement of (0.478±0.011ms) and a post-measurement of (0.420±0.019 ms), with an improvement of (12.13%). The modified Y-test (three-point shooting) (Speed hand) resulted in a pre-measurement of (27.563±0.136 s) and a post-measurement of (26.088±0.414s), with an improvement rate of (5.35%), Lactic Acid (BE) was (1.925±0.222 mmol/l), while the post-measurement was (BE) was (1.738±0.243 mmol/l), with an improvement rate of (9.84%), and with a value of p= 0.000 (p <0.05). While the pre-measurement (AE) (1,3,5 Min) was (9.938±0.389; 6.716±0.132; 5.499±0.077 mmol/l), the post-measurement was (9.475±0.442; 6.213±0.269; 5.136±0.071 mmol/l), with an improvement rate of (4.63; 7.59; 6.55%), with a value of p = 0.000 (p <0.05). Table 3 presents the results of the before and after measurements of the control group, and the t-values.

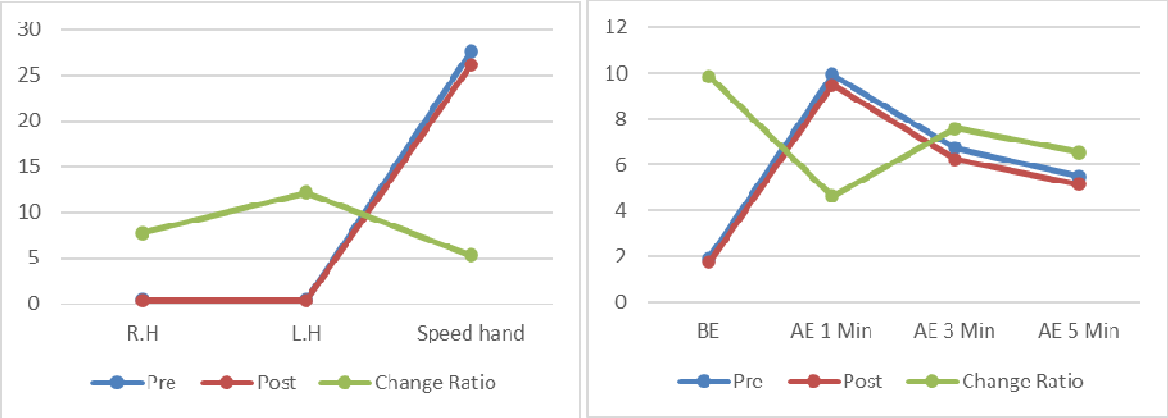

Figure 4. pre and post- measurements of the control group of WB players

Table 3. Control group measurements for WB players (N = 12).

Test	Unit of Measurement	pre	post	95% Confidence Interval		T-value	D	Change Ratio	Sig
		Average ± SD	Average± SD	Lower	Upper				
Attention Focus Test									
R.H	Ms	0.438±0.045	0.404±0.046	0.02	0.05	6.36	1.84	7.76	0.000
L.H	Ms	0.478±0.011	0.420±0.019	0.05	0.07	12.99	3.75	12.13	0.000
Speed hand	Sec	27.563±0.136	26.088±0.414	1.23	1.72	13.31	3.84	5.35	0.000
Lactic Acid									
BE	mmol/L	1.925±0.222	1.738±0.243	0.13	0.24	7.33	2.12	9.84	0.000
AE 1 Min	mmol/L	9.938±0.389	9.475±0.442	0.36	0.57	9.46	2.73	4.63	0.000
AE 3 Min	mmol/L	6.716±0.132	6.213±0.269	0.37	0.64	8.08	2.33	7.59	0.000
AE 5 Min	mmol/L	5.499±0.077	5.136±0.071	0.32	0.41	17.45	5.04	6.55	0.000

R.H = Right Hand; L.H = Lift Hand; Before Effort =(BE); After Effort =(AE); SD = Standard Deviation; D= Cohen's d; *t*-value at a significance level of 0.05 = 1,796

Table (3) shows the statistical significances between the two measures of the control group, attention focus (RH, LH), hand speed for WB players, lactic acid (BE, AE 1 Min, AE 3 Min, AE 5 Min) The calculated "T" value was greater than The value of "T" for the table is at the level of (0.05), where we found that the value of "Cohen's d" in the tests ranged between (1.84 - 5.04), the percentage change from (4.63 - 12.13%).

Figure 5. shows the results of post-measurements for the two study groups, where we found the experimental group outperformed the control group, and we found differences in the percentage of improvement for the concentration of attention test for (R.H) by (16.27%), (LH) by (13.88%). The modified Y-test (three-point imaging) (hand speed) resulted in an improvement (6.07%), and lactic acid (BE) had an improvement (15.64%) with P-value = 0.002 (p < 0.05). The differences in improvement between the two groups (AE) were (1,3,5 minutes) at a rate of (27.54; 20.99; 1.75%), with p-value = 0.000 (probability < 0.05). Table 4 presents changes in the post-measurement differences of the experimental and control groups.

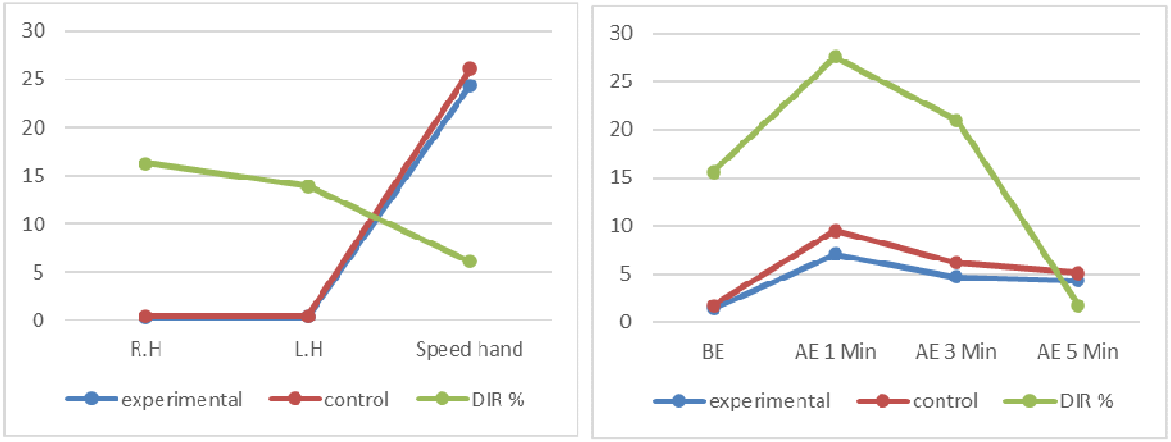

Figure 5. Results of subsequent measurements of the experimental and control groups of WB players

Table 4. Experimental and Control groups measurements for WB players (N = 12).

Tests	Unit of Measurement	G1	G2	T-value	D	DIR%	Sig	95% Confidence Interval	
		Average ± SD	Average± SD					Lower	Upper
Attention Focus Test									
R.H	Ms	0.309 ± 0.003	0.404±0.046	6.77 1.95		16.27 0.000		-0.12	-0.07
L.H	Ms	0.349 ± 0.006	0.420±0.019	8.49	2.45	13.88	0.000	-0.09	-0.05
Speed hand	Sec	24.403 ± 0.136	26.088±0.414	12.87	3.72	6.07	0.000	-1.96	-1.41
Lactic Acid									
BE	mmol/L	1.433 ± 0.165	1.738±0.243	3.49	1.01	15.64	0.002	-0.49	-0.12
AE 1 Min	mmol/L	7.040 ± 0.580	9.475±0.442	11.38	3.29	27.54	0.000	-2.88	-1.99
AE 3 Min	mmol/L	4.698 ± 0.031	6.213±0.269	18.55	5.35	20.99	0.000	-1.68	-1.35
AE 5 Min	mmol/L	4.308 ± 0.014	5.136±0.071	38.18	1.01	1.75	0.000	-0.87	-0.78

G1= experimental group; G2= control group; R.H = Right Hand; L.H = Lift Hand; Before Effort =(BE); After Effort =(AE); SD = Standard Deviation; D= Cohen's d; DIR= Differences improvement rates; *t*-value at a significance level of 0.05 = 2.228

Table (4) shows the statistical differences between the post-measurements of the two study groups in attention focus (RH, LH), hand speed for WB players, lactic acid (BE, AE 1 Min, AE 3 Min, AE 5 Min) where the calculated "T" value difference For the "T" value of the table at the level of (0.05), the value of "Cohen's d" in the tests ranged between (1.01 - 5.35), $p < 0.005$.

Discussion

The study aimed to investigate the effect of light stimulus training on focusing attention (auditory and visual).lactic acid, and skillful hand speed for wheelchair basketball players. Attention focus (R.H), (L.H), Lactic Acid in (BE), (AE) (1,3,5 Min), and skillful hand speed were improved with a value of $p = 0.001$ ($p < 0.05$).The results also showed superiority of the experimental group compared to the control group, as it showed an improvement in the level of attention focus (R.H; LH) at a rate of ($p = 0.000$) and a decrease in the level of lactic acid BE with a value of $p = 0.002$, AE (1,3,5 minimum) $P = 0.000$. The three-zone corrected modified T-test showed improvement ($p = 0.000$) for wheelchair basketball players. This is due to the use of FITLIGHT exercises, which significantly contributed to the improvement of the visual and auditory reaction, and the containment of these exercises on light stimuli. Moreover, although the FITLIGHT TRAINER system is not age specific, it is considered a valid tool in research settings for measuring and evaluating RT, focus of attention, physical activity, and physical fitness, as demonstrated by studies (Hassan, A. et al. 2022; Katanić B.et al.2020; VIOREL O.2018). Physical activity, sport quality and development are associated with improved RT (Shelly,

Z.,et al.2019; Silvestri, F. et al. 2023) . RT is necessary in a wide variety of playing situations, where athletes are required to make quick and decisive decisions for the success of their actions. (Lynall, R. et al. 2018) .

A group of studies concluded that the optical stimulus system can be used as a training and evaluation tool with great reliability and validity with diversity in measuring the simple and complex reaction to visual stimuli for different groups of individuals. (Lynall, R. et al. 2018; Vater, C., et al. 2019).Another The application of the optical stimulation system targeted high-performance sports, as it was used to train and measure reaction times for motor aspects, and hand-eye coordination. In addition, it contributes to improving reaction times for players. (Theofilou, G. et al. 2022). Reaction time plays an important role in physical traits) Wilke, J. et al. 2020) as well as the concentration of attention, such as visual scanning techniques, visual and auditory scanning speed, and anticipation (Lima, R. et al. 2021).

The level of lactic acid decreased as a result of light stimulation training (FITLIGHT), which is characterized by continuity and regularity with reliance on high-intensity training loads to withstand fatigue resulting from the accumulation of lactic acid in the muscles and blood. Regular exercise leads to a physiological and chemical change in the blood and the ability of the muscles to cope with fatigue resulting from the rapid and repeated performance of muscle contractions. Training reduces the accumulation of lactic acid during rest and after exertion (Šimonek, J. et al. 2017), and there has been a decrease in the concentration of lactate in the blood (Sheppard, J. & Young, W. 2006). These exercises reduce the concentration of lactate in the blood during exercise, which indicates an improvement in the physical aspects of the players. (Brandon C. 2015) . Studies have shown that regular exercise leads to lower blood lactate concentrations at static loads (Baker J. et al. 2012; SUSZTER L. et al. 2020; Zhao T, et al. 2021) . The study of Gmada N., et al.(2005) suggested that the level of physical fitness and training plays an important role mainly in the pattern of blood lactate decrease.

We found an improvement in a test of dexterous hand speed (three-point shooting) for WB players (P = 0.000). This is shown by using FITLIGHT. These exercises are related to the theory of visual stimulation, where the coach presents stimuli to the players (audio and visual). The training included variable variations that required the player to quickly change their speed as well as their body positioning and direction of movement when performing basic skills (Andraši´c, S. et al. 2021). Lap basketball requires speed in changing a given situation with good performance of all skills under time pressure. Orientation change is associated with various external stimuli, this depends on the decisions made by the player (Hassan A. et al., 2023). A clear improvement was also shown in the skill performance and shooting speed of wheelchair basketball players (Van der Slikke, et al. 2020). Through the aforementioned, the hypothesis was validated.

Conclusion

In conclusion, we found that a 10-week program of WB training improved attentional focus (audio visual), lactic acid reflux, and skill hand speed of WB players. However, photo-stimulation exercises are used in addition to this program, the WB players were faster in the attention focus tests (visual-auditory) R.H&L.H, the modified Y-test (three-point shooting) to measure the speed of skillful hands compared to the control group players, with differences in improvement rates, respectively (16.27, 13.88, 6.07%). The rate of lactic acid decreased for the experimental group compared to the players of the control group in AE at a rate of (15.64%), and BE (1,3,5 Min), compared to the control group players, with differences in improvement rates, respectively (27.54; 20.99; 1.75%). For this reason, light stimulation training could be a useful tool to increase attention focus (visual-auditory), and hand speed with decreasing lactic acid level for WB players. The use of light stimuli, such as FITLIGHT TM, can increase the management of training fluctuations (eg light colors and stimuli onset time). Moreover, it allows the preparation of individual training programs, and this enables the coaches to manage and train different groups of players at the same time, which makes their training distinct and contributes to the development and flying of the players' performance and away from monotony and boredom. Thus, these devices can have a positive effect on focus and reaction time, vital organs, and decision-making strategies for WB players. Therefore, the focus of visual and auditory attention should be evaluated through separate evaluations with attention to different measures of shooting speed at the basket as well as hand speed and hand-eye coordination in the performance of WB players. The interest of researchers is in conducting scientific research on wheelchair players. The most important message is that the visual and auditory reaction should be developed through different training systems, which should include activities specific to the sport and take into account gender.

Author Contributions:

Conceptualization,A.K.H,A.K.BandM.M.A.;methodology,M.S.A.andM.A.S;formalanalysis,A.K.H.;investigation, A.K.H. and M.M.A.; resources, A.K.H., M.M.A., and B.E.H.; data curation, M.A.S.; writing—original draft preparation, A.K.H. and M.M.A.; writing—review and editing, A.K.H. and M.S.A.; visualization, B.E.H. A.K.B; supervision, A.K.H., M.M.A., and B.E.H.; project administration, A.K.H., M.M.A.,M.S.A.,M.A.S,A.K.B and B.E.H.; funding acquisition, A.K.H., M.M.A., and B.E.H. All authors have read and agreed to the published version of the manuscript.

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Appendix A: Attention Focus measurement Test (Figures1)

This accessory contains a device for measuring auditory and visual attention focus for wheelchair basketball players. This unit is versatile for use with an external timer. This unit is used to provide simultaneous contact closure with stimulus onset and simultaneous contact release with correct response for accurate measurement of reaction times. Appendix B: Blood Lactate Test (Figures2)

The Lactate Pro TM 2 quantitatively measures the level of lactic acid in fresh arterial blood samples. Lactic acid in the blood reacts with the reagent in the Lactate Pro TM 2 strip producing a small electrical current. The strength of this current is proportional to the concentration of lactic acid in the blood. The meter measures this current and calculates the level of lactic acid in the blood. Appendix C: Modified Y-test (three-point shooting)

A Y-shaped skill hands speed test (shooting from three areas) was used in this study. This assessment is reliable and valid (Horníková, H. 2021).

Appendix D: Light stimulation exercises

This appendix contains exercises using light stimulation, and a training program.

References

ALSASUA R. , ARROYO R., ARANA J.,LAPRESA D.,ANGUERA M.(2021). Influence of the functional class of the players in wheelchair basketball: a comparative match analysis,JPES,21(6), pp. 3483 - 3495 . DOI:10.7752/jpes.2021.06472

Andraši´c, S.; Guši´c, M.; Stankovi´c, M.; Ma˘cak, D.; Bradi´c, A.; Sporiš, G.; Trajkovi´c, N.(2021) Speed, change of direction speed and reactive agility in adolescent soccer players: Age related differences. Int. J. Environ. Res. Public Health, 18(11), 5883. https://doi.org/10.3390/ijerph18115883

Baker J. , Thomas N. , Cooper S. , Davies B. & Robergs R.(2012) Exercise Duration and Blood Lactate Concentrations Following High Intensity Cycle Ergometry, Research in Sports Medicine,Volume 20, Issue 2, pp.129-141. https://doi.org/10.1080/15438627.2012.634723

Brandon C.(2015) Sprint Interval Cycling Training The Effect of Tabata Protocol on Collegiate Level Distance Running ,J Sports Sci Med , vol,. 14 ,Issue 4, PP.474

Candra, O.(2019)The Contribution of Eye-Hand Coordination to Basketball Lay Up Shoot Skills. Advances in Social Science, Education and Humanities Research, 464, 864-869.DOI:10.2991/assehr.k.200824.192

Clark J. , Betz B. , Borders L.(2020) Vision Training and Reaction Training for Improving Performance and Reducing Injury Risk in Athletes: Sports Vision Training, J Sports Perf Vis ,Vol 1(1):e8–e16, https://doi.org/10.22374/jspv.v2i1.4.

Comi . Z. , Roi G.S. , Cicchella .(2015) SIMPLE and complex reaction time At visual stimulation ‹before and after a rehabilitation after knee surgery in football players international conference on sports rehabilitation and traumatology London. https://2u.pw/JXT1YE [accessed on September 2022].

Dean, H.; Martí, D.; Tsui, E.; Rinzel, J.; Pesaran, B.(2011) Reaction time correlations during eye–hand coordination: Behavior and modeling. J. Neurosci., 31(7), 2399–2412. DOI:https://doi.org/10.1523/JNEUROSCI.4591-10.2011

Forni, F.; Farinini, E.; Leardi, R.; Rinaldo, A.(2022) Effects of visual training on motor performance in young tennis players using FitLight trainer. J. Sports Med. Phys. Fit, 62, 585–592. doi: https://doi.org/10.23736/S0022-4707.21.12145-0.

Gmada N., Bouhlel E., Mrizak I., Debabi H., Ben Jabrallah M., Tabka Z., Feki Y., Amri M .(2005) Effect of Combined Active Recovery from Supramaximal Exercise on Blood Lactate Disappearance in Trained and Untrained Man, J Sports Med, 26(10): 874-879. DOI: 10.1055/s-2005-837464

Goosey-Tolfrey, V.(2010)Supporting the Paralympic athlete: Focus on wheeled sports. Disabil. Rehabil,32(26):2237-43, DOI:https://doi.org/10.3109/09638288.2010.491577

Gutiérrez-Vargas, R.; Ugalde-Ramírez, J.A.; Sánchez-Ureña, B.; Ulloa-Sandí, A.; Gutiérrez-Vargas, J.C.; Rojas-Valderde, D.(2020) Agreement and reliability of a neuromuscular and cognitive test based on light stimuli to assess integrative reaction time in in sports. J. Sports Sci, ISSN: 1885-7019 / Vol. 16, Nº 2/ 119–126. https://www.researchgate.net/publication/342665599 [accessed on November 2022]

Hassan AK, Alibrahim MS and Sayed Ahmed YAR . (2023)The effect of small-sided games using the FIT LIGHT training system on some harmonic abilities and some basic skills of basketball players.Front. Sports Act. Living , 5:1080526. doi: 10.3389/fspor.2023.1080526

Hassan, A.K.; Alhumaid, M.M.; Hamad, B.E.(2022) The Effect of Using Reactive Agility Exercises with the FITLIGHT Training System on the Speed of Visual Reaction Time and Dribbling Skill of Basketball Players. Sports, 10, 176. https://doi.org/10.3390/sports10110176

Horníková, H.; Jele ˇn, M.;Zemková, E.(2021) Determinants of Reactive Agility in Tests with Different Demands on Sensory and Motor Components in Handball Players. Appl. Sci., 11, 6531 . https://doi.org/10.3390/app11146531

Katanić B. , Predrag I., Aleksandar S., Manja V.(2020) The application of Fitlight trainer system in sports , Centre for Evaluation in Education and Science (CEON/CEES) in Fizicka kultura , Volume 74, pp 115-126; https://doi.org/10.5937/fizkul74-27189

Lima, R.; Pereira, J.; Caleiro, F.; Clemente, F.; Rico-González, M.(2021) Reliability of a Reactive Agility Test for Youth Volleyball Players. Pol. J. Sport Tour. Sciendo, 28, 8–12.

Lynall, R. C., Blackburn, J. T., Guskiewicz, K. M., Marshall, S. W., Plummer, P., and Mihalik, J. P.(2018) Reaction time and joint kinematics during functional movement in recently concussed individuals. Arch. Phys. Med. Rehabil, 99, 880–886. DOI: 10.1016/j.apmr.2017.12.011

MAKSYM M., OLEG K., VIACHESLAV M., LARYSA T.,ZHANNA G., OLENA T., VLADYMYR H., KATERYNA M., IRYNA P. (2018). Problems and features of technique in the development of coordination abilities of players specializing in wheelchair basketball,JPES,18(2), pp.1016 – 1020 . DOI:10.7752/jpes.2018.s2150

Myers, L.R.; Toonstra, J.L.; Cripps, A.E.(2022) The Test–Retest Reliability and Minimal Detectable Change of the FitLight Trainer™. Int. J. Athl. Ther. Train, 6, 1–5. DOI:https://doi.org/10.1123/ijatt.2022-0012

Oliva-Lozano, J. M., Rojas-Valverde, D., Gómez-Carmona, C. D., Fortes, V., & Pino-Ortega, J.(2020) Impact Of Contextual Variables On The Representative External Load Profile Of Spanish Professional Soccer Match-Play: A Full Season Study. European Journal of Sport Science, 0(ja), 1–22. https://doi.org/10.1080/17461391.2020.1751305

Oudejans, R.(2012) Effects of visual control training on the shooting performance of elite female basketball players. International Journal of Sports Science & Coaching, 7(3), 469-480. DOI:10.1260/1747-9541.7.3.469

Perroni, F., Mol, E., Walker, A., Alaimo, C., Guidetti, L., Cignitti, L., & Baldari, C.(2018) Reaction time to visual stimulus in firefighters and healthy trained subjects: A preliminary comparative study. The Open Sports Sciences Journal, 11(1), 69-77. https://10.2174/1875399X01811010069 .[accessed on 7 September 2022].

Samir T., Matthias N. (2015): Visual Coordination Training (DVD) http://www.1x1sport.com/visual-coordination-training/ . [accessed on 4 September 2022].

Shelly, Z., Stewart, E., Fonville, T., Burch, R. F. V., Chander, H., Strawderman, L., May, D., Smith, J. E., Carruth, D., & Bichey, C.(2019) Helmet prototype response time assessment using NCAA division 1 collegiate football athletes. International Journal of Kinesiology and Sports Science, 7, 53–65. https://doi.org/10.7575/aiac.ijkss.v.7n.4p.53

Sheppard, J., & Young, W.(2006) Agility literature review: Classifications, training and testing. Journal of Sports Sciences, 24,919–932. https://doi.org/10.1080/02640410500457109

Silvestri, F.; Campanella, M.; Bertollo, M.; Albuquerque, M.R.; Bonavolontà, V.; Perroni, F.; Baldari, C.; Guidetti, L.; Curzi, D.(2023) Acute Effects of Fitlight Training on Cognitive-Motor Processes in Young Basketball Players. *Int. J. Environ. Res. Public Health* , *20*, 817. https://doi.org/10.3390/ijerph20010817

Šimonek, J., Horička, P., & Hianik, J.(2017)The differences in acceleration, maximal speed and agility between soccer, basketball, volleyball and handball players. Journal of Human Sport and Exercise, 12, 73–82. https://doi.org/10.14198/jhse.2017.121.06

SUSZTER L., IHÁSZ F. , SZAKÁLY Z., NAGY D., ALFÖLDI Z., BÁLINT M.V.,MÁK E.(2020). Effect of a five-week beta-alanine supplementation on the performance, cardiorespiratory system, and blood lactate level in well-trained rowing athletes: A double-blind randomized pre–post pilot study,JPES, 20 (5), pp. 2501 - 2507. DOI:10.7752/jpes.2020.05341

Theofilou, G.; Ladakis, I.; Mavroidi, C.; Kilintzis, V.; Mirachtsis, T.; Chouvarda, I.; Kouidi, E.(2022) The Effects of a Visual Stimuli Training Program on Reaction Time, Cognitive Function, and Fitness in Young Soccer Players. Sensors, 22, 6680.

Van der Slikke, R.M.A.; Berger, M.A.M.; Bregman, D.J.J.; Veeger, H.E.J.(2020) Wearable Wheelchair Mobility Performance Measurement in Basketball, Rugby, and Tennis: Lessons for Classification and Training, Sensors, 20(12), 3518;DOI:https://doi.org/10.3390/s20123518

Van der Slikke, R.M.A.; Berger, M.A.M.; Bregman, D.J.J.; Veeger, H.E.J.(2016) From big data to rich data: The key features of athlete wheelchair mobility performance. J. Biomech, 49, 3340–3346. https://doi.org/10.1016/j.jbiomech.2016.08.022

Vater, C., Luginbühl, S., & Magnaguagno, L.(2019)Testing the functionality of peripheral vision in a mixed-methods football field study. Journal of Sports Sciences,37, 2789–2797.https://doi.org/10.1080/02640414.2019.1664100

Veeger, T.T.; De Witte, A.M.; Berger, M.A.; Van der Slikke, R.M.; Veeger, D.H.; Hoozemans, M.J.(2019)Improving mobility performance in wheelchair basketball. J. Sport Rehabil, 28, 59–66. https://doi.org/10.1123/jsr.2017-0142

VIOREL O. (2018).Evaluation of trunk muscle strength for basketball players in wheelchairs from Romania, JPES, 18(5), pp. 2088 - 2091. DOI:10.7752/jpes.2018.s5313

Wilke, J.; Vogel, O.; Ungricht, S.(2020) Traditional Neuropsychological Testing Does Not Predict Motor-Cognitive Test Performance. Int. J. Environ. Res. Public Health, 17, 7393.

Zhao T, Le S, Freitag N, Schumann M, Wang X and Cheng S.(2021) Effect of Chronic Exercise Training on Blood Lactate Metabolism Among Patients With Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. Front. Physiol, 12:652023. doi:10.3389/fphys.2021.652023