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The effects of 8 week balance training on the kayaking performance of the beginners

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Abstract

Purpose: To analyze the effects of a special 8-week balance-training program on the static and dynamic balance values and on kayak specific balance values of female candidate athletes who are new to kayaking.

Material: The study included 25 volunteer healthy young women (mean age: 14.92 ±0.39 years, mean weight: 58.47 ±11.28 kg, mean height: 165.68 ±3.84 cm, mean body fat: 27 ± 7.61%); they were randomly divided into two groups as intervention (n=15) and control (n=10). The intervention group had a special 40-minute balance training (10-min warm-up and 30-min proprioceptive exercises) 3 days a week. The control group had their traditional training scheme only (initial 10-min run for warm-up, 40-min ergometer exercise and strength training, 10-min stretching; after 1 month, 10-min warm-up, 4x10-min technical training in water with 5-min rest between sets, technical training in water for 3 km, 20-min stretching). Along with these, both groups had "technical kayak training" 2 days a week. Static and dynamic balance measurements were done with Prokin Tecnobody Isokinetic balance measurement device; kayak-specific balance measurements were done on specially designed kayak prototype and on standard race kayak (K1).

Results: An improvement was found in the static and dynamic balance values of both groups as well as their kayak-specific balance values. It was found that the improvements in static and dynamic balance and especially in kayak-specific balance measured on the prototype kayak (\bar{x} =17.8 -82.4%) and standard race kayak (\bar{x} =36.2) were significantly higher in the intervention group ($p < 0.05$).

Conclusions: It was found that the 8-week-long special balance training had positive effects on kayaking balance performance of the beginners.

Keywords: sprint kayak, balance, balance training, beginners, training aid.

Introduction

Balance is the ability to protect a given posture with minimal movement during fluctuations that are caused by static or dynamic conditions [1]. Good postural stability is important not only for balance, but also for the use of extremities during daily functional activities [2]. Balance has been found to be a risk factor for injuries especially among female athletes [3]. Each sport requires sensorimotor processes at some levels in order to realize the athlete's capabilities to the fullest extent and to protect the neuromuscular system from injury [4]. As described by Zemkova (2014), static balance is important in sports such as shooting and archery whereas dynamic balance performance plays an important role in free style sports such as snowboarding and windsurfing. Likewise, balance in the sitting position is important in canoeing, rowing, and equestrianism [5]. Loss of balance may occur in almost every movement of canoeing or kayaking, which are performed on an unstable surface. The height of the balance level in a sport activity depends on the area of the support base, the position of the center of gravity, and the mass of the individual (body weight) [6].

Various forms of balance exercise emerge as a part of sports education or rehabilitation. However, the improvement achieved after such trainings is only specific for the task at hand [1]. Incorporating balance exercises

into the training programs for athletes from different sports has become a routine practice. The most effective type of balance training and its frequency, intensity, and duration are yet to be determined. It is difficult to create a training model that would be appropriate for every sport discipline, including its characteristics and demands [7]. On the other hand, there is an ongoing debate in the literature about the effect of balance training on the performance, balance improvement, and prevention of injuries of the athletes [8].

Kayaking is a paddle sport that requires a good sitting balance and involves high metabolic demands and challenges related to the balance control system [2, 9]. Paddle sports have two sub-disciplines: canoeing (C) and kayaking (K). Kayaking requires a comprehensive balance and stability training since maintaining a seated position requires a continuous balancing of the irregular sways in the upper part of the body [9] and due to the narrow designs of the flat-water kayaks [10]. In conventional canoeing/kayaking training, 'winter training session' lasts from October to March and consists of three parts, each covering a period of two months. In the first part, aerobic capacity should be increased; the second part should include balance-oriented exercises; and the third part involves the preparations for outdoor training [11].

It may be convenient to board the canoe/kayak on land; boarding in water requires good balance skills at the beginning. A wrong move or loss of balance can lead to

going overboard or hitting the ground. The same is also possible while getting off a canoe/kayak. Having good balance skills is a significant advantage in such situations. It is particularly more difficult for two people to carry out a task synchronously in a two-person canoe/kayak (K2-C2). And so, the role of balance training, the difficulties that may be faced, and possible solutions have been studied through interviews with canoers/kayakers and their coaches to conclude that balance skills are of great importance in canoeing/kayaking. It has been observed that due to the balance problems they have experienced, many of the candidate athletes who started training for this sport and put a great deal of effort during winter technical training off the water were unable to overcome their fear of falling once they boarded the kayak on water. Thus, all of the efforts put in during the season end in vain, resulting in the demise of athletes. Therefore, the aim of this study was to determine the effects of kayak-specific balance training exercises added to beginner athletes' usual winter training program on their general and kayak-specific balance performances in order to prevent the waste of their time, effort, and resources.

Key Points

- Regular participation in balance training practices can improve balance control more efficiently in young female (untrained) candidate athletes who are new to kayaking.
- Special balance training practices significantly improve the kayak-specific balance for beginners and facilitate learning the sport.
- Combining special balance training with the traditional kayak training method increases the overall effect of the training due to the interaction between the two.

Materials and methods

Subjects

The study included 25 healthy female subjects who were between the ages of 14 and 16, had no health problems, had no vestibular disorders such as neurological diseases, dizziness, or loss of balance within the last one year, had no serious complaint with extremities within the last six months, and were not involved in any sports activity. The group was randomly divided into two groups: intervention and control, which were comparable in terms of their physical characteristics ($p > 0.05$) (Table 1).

The approval for the study was obtained from the local ethics committee at Sakarya University (approval #: E.4612-61923333/044). The subjects and their parents/legal guardians were informed about the procedures and

the extent of the study and asked to sign a "Voluntary Participation Form".

Experimental Design

Since bad weather conditions increase the risk of kayak capsize, the study plan was prepared so as to start training in May when the weather and water temperatures begin to improve. In the context of study, pre/post-intervention body composition, and static-dynamic balance measurements were done in the laboratory. While the measurements on the kayak prototype were performed as both before and after the intervention, the kayak-specific dynamic balance measurements on standard racing kayak (K1) were performed after the intervention only since the subjects were new to kayaking. The intervention and control groups began their training program one week after the pre-intervention measurements. The post-intervention measurements were done one week after the end of the training program.

Training Program for Control Group: The control group worked with the training program known as "Traditional Training System": 3-day general endurance and strength training and 2-day technical kayak training per week for 8 weeks and kayak training on water at the end of one month.

Training Program for Intervention Group: Balance training were given as 40-min-long exercise programs 3 days a week for 8 weeks on uneven surfaces, with special balance tools, and with specially designed kayak prototype (Table 2). A "Balance Training Exercise Plan" was prepared for each week; each session included 10-min warm-up and six special balance exercises containing proprioceptive exercises (5 min each) performed in static and dynamic positions for a total of 30 minutes. The training exercises were designed as initial phase (first two weeks), middle phase (third and fourth week), and advanced phase (last four weeks). The intervention group also joined the control group for kayak technical training two days a week.

The kayak-specific dynamic balance training was performed on a wooden kayak prototype that was judged by coaches to adequately mimic the kayak sway and where fall and balance loss can be observed.

In the Balance Training Exercise Plan, special attention was paid to arranging the activities from simple to complex where static exercises were followed by the dynamic exercises, increasing the tempo to the appropriate speed gradually, performing the initial training on a stable surface (flat ground) followed by training under different conditions (on moving, soft, and slippery ground) and

Table 1. Physical characteristics of the intervention and control groups.

	Intervention (n=15)	Control (n=10)	<i>p</i>
Age (year)	15 ±0.3	14.8 ±0.4	0.242
Height (cm)	165.13 ±4.34	166.5 ±2.72	0.364
Weight (kg)	58.04 ±11.3	59.12 ±11.23	0.826
Body Fat %	27.3 ±7.43	26.57 ±7.85	0.819

Table 2. The training program for the intervention group.

Exercise Plan	Content	Equipment
Initial Phase (week 1-2)	Warm-up, static balance exercises with eyes open/shut, glider and flamingo postures, stretching exercises	None
Middle Phase (week 3-4)	Warm-up, static-dynamic balance exercises with eyes open/shut, Y balance exercise, posture exercises on balance pads, stretching exercises	Signs Balance pad Balance board Bosu ball
Advanced Phase (week 5-8)	Warm-up, dynamic balance exercises on fixed and moving surfaces, dynamic balance exercises with balance equipment, special balance exercises on kayak prototype, stretching exercises	Balance board Wobble board Pilates ball Balance pads Wooden kayak prototype

with external stimuli and balance training equipment (bouncing ball, balance ball, kayak prototype, etc.). A 30-second rest period was given after each exercise.

Tests and protocols

Body composition: Body composition of the subjects was evaluated with InBody 270 body composition analyzer (InBody Co. Ltd, Korea).

Balance Tests: Static and dynamic balance measurements were performed with Pro-Kin 252N isokinetic balance measurement device (TecnoBody Srl, Italy). The subjects were tested in their sports outfit after a 50-min warm-up and stretching. Tests started with body sensor attached to chest after the subjects tried the balance platform for about 2-3 minutes; the subjects were given 1-min rest between the test series. The subjects were asked not to use arms for support during the static tests. This position meant to reduce the effect of arms on balance and to prevent distorting the test results by touching the support rail. The subjects were told to limit upper body movements and use only legs throughout the test. The test was cancelled and repeated if a subject could not keep balance throughout the test and was found to touch the instrument or other things with hands or feet.

Static Balance Measurements: The static test was performed on the fixed platform in bipedal stance with eyes open. The subject was asked to look at a fixed spot in front; after reaching balance, the test was initiated by pressing the start button on the computer keyboard and terminated by the computer at the end of the test automatically. In the bipedal stance, the feet were open at shoulder width and equidistant from the origin point, with reference to the lines on the x and y-axis. The subject was asked to keep position during the tests, which lasted for 30 seconds, and allowed to observe their position on a screen. From among the data obtained as a result of the measurements, the ellipse area (EA) and perimeter were evaluated; higher values indicated poor balance, lower values indicated good balance.

Dynamic Balance Measurements: The dynamic test was carried out in bipedal stance. The optimal position was same as in the static balance measurement. The pressure level of the stabilometer for this test was set to difficulty level 5 (out of 50). The test was completed by rotating the platform clockwise 5 times in 60 seconds

to track the circular trajectory on the screen. Shown below the circular trajectory, the track errors (TE) chart displays the distribution of the errors during tracking the trajectory by platform sectors, and the average force variance (AFV) chart displays the distribution of center of gravity by platform sectors. Other parameters obtained as a result of the measurement were the trunk backward-forward standard deviation (TB-FSD), trunk medial-lateral standard deviation (TM-LSD), and trunk total standard deviation (TTSD), the stability index (SI), and the average track error (ATE), which are the data obtained from dynamic balance measurement. The resulting value represents the deviation from the trajectory that the subject was supposed to track. The subject's dynamic balance is good if the average track error is low, and it is poor if the error is high.

Balance Test with Kayak Prototype: The choice of the balance method and measure used in a particular exercise depends on a number of factors. Balance tests with dynamic components may be more sports-specific than static balance tests [12]. In this line, the dynamic balance measurements specific to kayaking were performed on the specially prepared kayak prototype as well as the standard kayak (K1).

The kayak prototype balance test was performed on a wooden kayak prototype that was judged by coaches to adequately mimic the kayak sway and where fall and balance loss can be observed. The subjects were tested in their sports outfits after a 5-min warm-up and stretching. They were asked to take a position on the prototype as they would sit in a kayak, and the test was initiated after trying the prototype a few times. Starting with sitting on the prototype, they were asked to stay in balance without falling while making the movements with the standard paddle for one minute. Touching the ground with any of the hands, feet, or paddle was considered an "error" and the time was stopped. Then the test resumed with the same rules. At the end of one-minute period, the number of falls due to the loss of balance was determined and recorded.

Balance Test with Standard Race Kayak (K1): The test was performed in a standard-size-and-weight race kayak in a way fall and balance loss can be observed. The subjects were tested following a few trials after a 5-min warm-up and stretching in their sports outfits. The

subjects were asked to board the kayak by holding on to the cockpit and take the sitting position. Starting with taking the sitting position in the kayak, they were asked to stay in balance without falling for one minute. Timing started when they took their hands off of the scaffold; each fall was considered an “error”, and the time was stopped. Since getting into kayak requires effort, each subject was given 30-sec rest period three times so as not to influence the results. Then the test resumed with the same rules. At the end of one-minute period, the number of falls due to the loss of balance was determined and recorded. All tests were administered by the same researcher.

Statistical analyses

Statistical procedures were carried out with SPSS 22 (SPSS Inc, USA). The *t* test was used in order to determine the differences between groups, and paired samples *t* test was used in order to determine differences between pre- and post-intervention tests. The significance threshold was set at 0.05.

Results

A significant decrease was found in post-intervention

bipedal-stance static balance scores EA and perimeter for the subjects in the intervention group ($p<0.05$). No significant differences were found in these variables in the control group (Table 3).

A significant decrease was found in post-intervention dynamic balance scores ATE, AFV, and SI for the subjects in the intervention group ($p<0.05$) (Table 4). Except for the negative change in the TB-FSD (-9.8%), all parameters were improved albeit not significantly. In the control group, however, no significant changes were found in these variables. Similarly, a negative change was found in the TB-FSD (-31.2%) albeit not significant.

A significant decrease was found in both groups' post-training scores on balance test with the kayak prototype ($p<0.05$). Looking at the rate of improvement, it was found that the improvement in the intervention group (82.4%) was almost twice that of the control group (45.5%) (Table 5).

The post-training scores on balance test with the standard race kayak (K1) for the intervention group was found significantly lower than those of the control group ($p<0.05$) (Table 6).

Table 3. Bipedal-stance static balance scores for the two groups before (test) and after (retest) the training program.

Parameters	Groups	Intervention			Control		
		\bar{x}	%	<i>p</i>	\bar{x}	%	<i>p</i>
Ellipse area (mm ²)	Test	419.9±250.49	49	0.012*	536.4±646.64	26.7	0.586
	Retest	214.1±119.73			393.3±419.67		
Perimeter (mm)	Test	520.8±135.01	18.7	0.041*	533.5±293.35	3	0.904
	Retest	423.4±103.29			517.7±253.30		

* $p<0.05$

Table 4. Bipedal-stance dynamic balance scores for the two groups before (test) and after (retest) the training program.

Parameters	Groups	Intervention			Control		
		\bar{x}	%	<i>P</i>	\bar{x}	%	<i>P</i>
ATE	Test	22.3±7.95	34.1	0.013*	26.7±10.36	19.5	0.238
	Retest	14.7±7.24			21.5±7.38		
TB-FSD	Test	2.0±1.06	-9.8	0.658	1.9±1.24	-31.2	0.311
	Retest	2.2±1.27			2.4±1.10		
AFV	Test	3.1±4.38	83.6	0.042*	3.4±8.42	35.4	0.701
	Retest	0.5±0.33			2.2±3.93		
TM-LSD	Test	5.9±3.39	14.6	0.463	3.7±2.47	3.1	0.908
	Retest	5.1±2.73			3.8±1.61		
SI	Test	0.9±0.36	28	0.037*	1.0±0.31	9.1	0.652
	Retest	0.7±0.26			1.1±0.49		
TTSD	Test	6.4±3.30	8.9	0.618	4.3±2.57	3.4	0.894
	Retest	5.8±2.67			4.4±1.91		

* $p<0.05$

Table 5. Kayak prototype balance test scores for the two groups before (test) and after (retest) the training program.

Groups		\bar{x}	p	Change (%)
Intervention Group	Test	17.8±1.47	0.000*	82.4
	Retest	3.9±0.96		
Control Group	Test	18.1±2.18	0.000*	45.5
	Retest	9±2.18		

*($p < 0.05$)

Table 6. Difference between the standard kayak balance test scores of the two groups after the training program.

	N	\bar{x}	P
Intervention Group	15	36.2±4.55	0.049*
Control Group	10	41.1±5.84	

*($p < 0.05$)

Discussion

A previous study of special balance training for the beginners of kayaking was not found in the accessible literature. Existing studies have generally focused on preventing sports injuries [8,13], rehabilitation [2,9], improving the performance of elite athletes (14–16), and the biomechanical analysis of the sports of canoeing/kayaking in order to improve performance [17,18].

This study aimed to analyze the effects of a special 8-week balance-training program on the static, dynamic, and kayak-specific balance values of female candidate athletes who are new to kayaking. The results supported the original hypothesis that regular participation in balance training exercises improves the balance control in young woman who are new to kayaking and facilitates learning the sport and that combining special balance training with the traditional kayak training increases the overall effect of the training.

In the beginning, there was no difference between the average static and dynamic balance scores of the intervention and control groups. The control group was engaged in the traditional training program for 8 weeks while the intervention group implemented a mixed training method in the same period. At the end of the 8-week period, there was a significant improvement in the ellipse area (49%) and perimeter (18.7%) parameters in bipedal-stance static balance tests for the intervention group (Table 3), suggesting that the balance training program benefited the subjects. Regular exercise is known to improve static and dynamic balance. In a study of the effects of dynamic and static balance exercises on lower extremities, Suveren et al. (2017) implemented these two exercise programs to two groups 3 days a week for 8 weeks. They found significant improvements in the dynamic and static balance parameters of both groups after the exercises. Together, this study and our study suggest that balance exercises increase muscle stabilization in the lower extremities and improve posture control [19]. Similarly, Kahle and Gribble (2009) found a significant difference between the control group and

the intervention group after implementing 6 weeks of core stability balance exercises with healthy individuals [20]. These results were also consistent with the results of Hrysonmallis' (2011) study, which showed that balance training was effective in improving sports performance and motor skills [21].

In the dynamic balance measurements, the ATE, an indicator of dynamic balance, AFV, and SI decreased significantly after the training programs in the intervention group but not in the control group, which suggested a positive effect. This means that the special balance training improved the dynamic balance of the subjects but the traditional training program did not. Similarly, comparison of pre-test post-test scores of the intervention group revealed a 34% improvement in the ATE, while the improvement in the control group was 19.5% (Table 4). Zech et al. (2010) reported that functional balance training was effective in improving static postural sway and dynamic balance [22]. Jamshidi et al. (2017) reported that a 6-week (3 days a week) training program involving backward walking improved the dynamic balance performance in healthy female athletes in high school and suggested that it could be used as a complementary training [23]. Sekendiz et al. implemented endurance, flexibility, and dynamic balance exercises to 21 sedentary women and found significant improvements in the post-test values [24]. Studies have shown that balance exercises are effective in improving the stability, proprioceptive values, and balance parameters [14, 25–27].

Similar to our study, Toube et al. (2007) reported in a study involving both children and adults that the balance training alone could improve performance without the resistance training. These results emphasize that the balance training improves the athletic performance as well as preventing injuries and providing rehabilitation [28].

In most of the sporting activities, the successful execution depends on having the proper posture and the ability to keep balance in this position [19]. In this line, our 8-week balance-training program was found

to significantly improve the static and dynamic balance of subjects in accordance with the literature. Lee et al. (2016) reported that dynamic balance of subacute stroke patients was improved after training for 6 weeks with a virtual reality game based on canoeing [2]. This study shows that improving the static and dynamic balance capabilities may depend on the balance training method used. A few studies about the balance in canoeing/kayaking exist in the literature. In a study comparing the postural stability of 23 young male canoeing and kayaking athletes (10 canoe and 13 kayak athletes) who trained in water for two hours 3 days a week to that of 15 healthy untrained controls, Stambolieva et al. (2012) found that body sways in both groups were significantly less than that of the controls, suggesting that the balance performances specific to canoeing/kayaking naturally improved through training in water [29]. In this context, balance training given to beginners beforehand may improve their canoeing/kayaking performance. In order to observe such effects, we implemented a balance test with a kayak prototype. After the training programs, significant improvements were observed in the dynamic balance values of the intervention group and the control group compared to their baseline values. Remarkably, the rate of improvement in the intervention group (82.4%) was almost twice that of the control (45.5%) (Table 5). This showed that the functional materials used in training programs and developing static and dynamic balance performances had an effect on the balancing skills on the kayak prototype. Similarly, the results of the balance test with the standard racing kayak (K1) revealed significantly

lower average errors in the intervention group after the balance training (Table 6). This suggested that both traditional and mixed training methods were effective in improving balance and that a training method integrating balance exercises to traditional exercises might be more effective in improving the balance skills specific to kayaking.

The nature and environment of movements observed in various sporting activities are known to influence postural adaptation [30]. According to Paillard (2014), each type of training results in different type of specific postural control. Therefore, this study, which integrated kayak-specific balance-training exercises with the traditional training program for the beginner athletes to investigate their effect on general and kayak-specific balance performances, has demonstrated that the sport-specific balance training produces the desired effect. The results suggest a significant improvement due to the balance-training program used in this study.

Conclusions

Balance-training program might be used for athletes intending to start kayaking to improve their balance performances and to help prevent the waste of their time, effort, and resources. Such a program might be recommended for long-term improvement of athletes' performance in all stages of their career as well as in the early stages.

Conflict of interest.

The authors state that there is no conflict of interest.

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Values of the body mass index of adolescents from Romania reported to the number for hours of physical education practiced

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Abstract

Purpose: The objective of this research is to show the values of the body mass index (BMI) of adolescents in Romania, Brasov county, reported to the number hours of physical education practiced.

Material: The experiment was conducted between October 2016 - January 2017 in four high schools in Brasov county: Andrei Şaguna High School, Andrei Mureşanu High School, Unirea High School and Sports High School. This research was conducted on 470 pupils, of whom 224 are boys and 246 are girls, aged between 14 and 18. All the subjects (n=470) had their BMI calculated, depending on gender/grade/age and high school.

Results: The results of the ANOVA One-Way analysis have shown a significant statistical difference between the four high schools in terms of BMI average level ($F=36.493$; $p<0.001$), in both boys and girls ($F=33.100$; $p<0.001$). Furthermore, also in terms of age, there are significant statistical differences between boys ($F=6.085$; $p<0.001$) and girls ($F=3.920$; $p=0.004$). The results of the Tukey test presented significant differences between the four high schools, as far as subjects' gender is concerned as well.

Conclusions: The study has shown that the values of the BMI are higher in pupils from Andrei Şaguna, Andrei Mureşanu, Unirea high schools and lower in pupils from the Sports High School, both in boys and in girls.

Keywords: adolescents, body mass index, pupils, high school.

Introduction

Problem of children and teenagers' physical training optimization is relevant for the last decades [1].

As we all know, sport has a major impact in our lives because it is an activity that affects our lifestyle, health as well as each individual's personality.

The practice of different sports activities not only helps us cope with the weight loss challenge, but also with daily stress, which became one of the most negative factors impacting our health, along with fatigue.

It is a known fact that practicing sports on a regular basis helps us lead a happier, more quiet, productive and stress-free life.

According to the Eurobarometer Survey carried out in 2013 [2], on the relation between sports and European countries and population, 60% of Romanians never practice, close to the European average of 59%.

Currently, in Romania, 3 out of 10 children and adolescents are overweight and 8% are obese. Romania is on the third place in Europe as far as child obesity is concerned, and the growing numbers of obese children make us expect to disastrous numbers in the upcoming years [3].

In an era of obesity, where children spend hours in a row in front of the computer, is required to take of some elementary measures which concern healthy development of preschools and school children, which become increasingly more sedentary.

The fact that physical education is no longer a priority in schools is not a novelty. In most of school's concentration is done on standardized tests and materials,

by minimizing the importance of physical education on children's health.

In Romanian schools, the food pupils eat consists mainly in croissants, biscuits, waffles or sandwiches soaked with sauces or unhealthy alternatives found in stores near the schools [4].

The consequences of obesity in children and adults are, amongst others, the inability of integrating into the community, the school and work environment, moving from one place to another or depression and suicide.

In this continuous struggle to control weight and maintain a good health, we should focus mostly on the type and quantity of the food and drinks we consume. In this matter, too little attention was paid to the amount of energy it takes to practice. It has been proven that 70% of the population in the western countries is not sufficiently active in order to have an optimal health and weight [5].

According to the findings of scientists, 75% of health issues are caused by inappropriate nutrition, unhealthy lifestyle and weight gain [5].

As far as the body mass index (BMI) is concerned, we mention that there are a number of researches that analyzed its values, both in teenagers, adults and in other categories of people [6-9].

A study conducted by Craig et al. [10], which examined BMI in pupils from Seventh Day Adventist schools in Australia, has shown low rates of overweight and obesity, but also higher rates of underweight, compared to the national standards. Statistical analyses of the study have proven that a lower BMI was associated with age, gender, regular breakfasts, a low consumption of soft drinks and regular practice. Also, pupils reported a frequent and high

consumption of fruit, vegetables and cereals, compared to the Australian national standards.

Another study conducted by Cuceu et al. [11], demonstrates the role and effects of physical exercises, more precisely aerobics, on the BMI in first year female students at the North University Center of Baia Mare. The results of the study present significant differences of the BMI values between the experimental and the control groups. The aerobics has a more positive effect on the BMI in female students from the experimental group, compared to the students in the control group, who did not also practice aerobics, as part of their physical education classes.

The purpose of this research is to show the values of the BMI in teenagers in Romania, reported to the number for hours of physical education practiced.

The hypothesis of this research is based on the assumption that practicing on a regular basis affects in a positive manner the BMI of teenagers from urban areas.

Material and methods

Participants: This research was conducted on 470 pupils, of whom 224 are boys and 246 are girls, aged between 14 and 18.

The subjects of this research were ninth, tenth, eleventh and twelfth grade pupils.

The pupils were distributed depending on gender and grade as follows: 121 ninth grade pupils (60 male, 61 female), 115 tenth grade pupils (52 male, 63 female), 118 eleventh grade pupils (58 male, 60 female), 116 twelfth grade pupils (54 male, 62 female).

The distribution for Andrei Șaguna High School are: for ninth grade: 32 pupils (20 male, 12 female); tenth grade: 30 pupils (14 male, 16 female); eleventh grade: 29 pupils (12 male, 17 female); twelfth grade: 30 pupils (15 male, 15 female). For Andrei Mureșanu High School: ninth grade: 31 pupils (10 male, 21 female); tenth grade: 30 pupils (10 male, 20 female); eleventh grade: 32 pupils (15 male, 17 female); twelfth grade: 33 pupils (13 male, 20 female). For Unirea High School: ninth grade: 32 pupils (12 male, 20 female); tenth grade: 30 pupils (10 male, 20 female); eleventh grade: 31 pupils (15 male, 16 female); twelfth grade: 29 pupils (10 male, 19 female). The Sports High School: ninth grade: 26 pupils (18 male, 8 female); tenth grade: 25 pupils (18 male, 7 female); eleventh grade: 26 pupils (16 male, 10 female); twelfth grade: 24 pupils (16 male, 8 female).

Organization of the research: The experiment was conducted between October 2016 – January 2017, in four schools in Brașov County: Andrei Șaguna High School, Andrei Mureșanu High School, Unirea High School and Sports High School.

We mention that one single class from each grade was chosen for this experiment, respectively, from ninth to twelfth.

In the first phase of this experiment, we assessed the subjects' height and weight by the researcher. Based on the obtained results, we calculated the BMI [12], for each subject, depending on gender/grade/age and high

school. The values of the BMI (kg/m²) were: less than 18.5 – underweight; 18.5 - 24.9 – normal; 25.0 - 29.9 – overweight; greater than 30.0 – obese.

Statistical analyses: Statistical analyses were conducted by SPSS (IBM SPSS Statistics Version 20). In order to determine if there are significant differences in terms of BMI levels in boys and girls, between the different high schools participating in this study and depending on age, we used the ANOVA One-Way analysis. For the verification and comparison of significant differences between values pairs we applied the post-hoc Tukey test.

Results

Table 1 describes the characteristics of the study sample. The average and the standard deviation were calculated both for boys and girls, as far as the BMI (kg/m²) is concerned, in each school, depending on age and the number of participants in the study.

Gender based analysis of the body mass index, depending on school type and age category

The results of the ANOVA One-Way analysis have shown that there is a significant difference, statistically speaking, between the four high schools, as far as average level of BMI is concerned ($F=36.493$; $p<0.001$).

In order to verify between which of the four high schools the differences are significant, we applied the post-hoc Tukey (see Table 2). The results that were achieved highlighted significant statistical differences between the average level of BMI in boys from the Sports High School ($m=21.99\pm 1.44$), compared to the other high schools: "Andrei Șaguna" ($m=23.90\pm 1.72$), "Andrei Mureșanu" ($m=24.62\pm 1.70$) and "Unirea" National College ($m=24.51\pm 1.39$).

Also, the results of the ANOVA One-Way analysis have shown that there is a significant statistical difference between the four high schools participating in this study, as far as the level of BMI in girls is concerned. ($F=33.100$; $p<0.001$).

Female pupils from the Sports High School have an average body mass index of 21.03, whereas female pupils from the other high schools have a BMI average of over 23.7.

The results of the intergroup Tukey test (see Table 3) are significant ($p<0.001$) for the comparison of the BMI level in girls from the Sports High School ($m=21.03\pm 1.78$), with the BMI level in girls from the other high schools: "Andrei Șaguna" ($m=24.07\pm 2.08$), "Andrei Mureșanu" ($m=23.74\pm 1.50$) and "Unirea" High School ($m=24.40\pm 1.42$).

The results of the ANOVA One-Way analysis have shown that there is a significant statistical difference between different age categories in terms of average level of BMI ($F=6.085$; $p<0.001$).

Results of the Tukey test (see Table 4) have highlighted significant statistical differences between BMI of 14 year-old boys ($m=22.50\pm 1.78$) on the one hand, and the BMI of 17 year-old boys, respectively 18 year-old boys ($m=24.17\pm 1.48$), on the other hand. Also, we have noticed significant differences between the BMI values on 15

Table 1. Descriptive statistics of the participants

Variables	Male Mean \pm SD	Female Mean \pm SD
N	224	246
BMI (kg/m ²)	23.60 \pm 1.91	23.66 \pm 1.98
BMI depending on school:		
Andrei Şaguna National College	23.90 \pm 1.72	24.07 \pm 2.08
Andrei Mureşanu High School	24.62 \pm 1.70	23.74 \pm 1.50
Unirea National College	24.51 \pm 1.39	24.40 \pm 1.42
Sports High School	21.99 \pm 1.44	21.03 \pm 1.78
BMI depending on age:		
Andrei Şaguna National College		
14 years old	22.53 \pm 1.84 (n=20)	22.91 \pm 4.06 (n=12)
15 years old	22.42 \pm 1.43 (n=2)	25.82 \pm 0.55 (n=2)
16 years old	24.0 \pm 0.87 (n=12)	23.95 \pm 1.21 (n=16)
17 years old	24.98 \pm 1.07 (n=27)	24.48 \pm 0.93 (n=30)
Andrei Mureşanu High School		
14 years old	22.29 \pm 1.70 (n=3)	22.3 \pm 22.38 (n=19)
15 years old	25.65 \pm 3.47 (n=7)	23.95 \pm 0.21(n=2)
16 years old	23.91 \pm 0.63 (n=10)	24.07 \pm 0.37 (n=20)
17 years old	24.52 \pm 0.94 (n=17)	24.28 \pm 0.69 (n=37)
18 years old	25.40 \pm 0.66 (n=11)	
Unirea National College		
15 years old	24.18 \pm 2.47 (n=12)	24.59 \pm 2.48 (n=20)
16 years old	24.10 \pm 0.79 (n=10)	24.36 \pm 0.67 (n=20)
17 years old	24.58 \pm 0.56 (n=15)	24.43 \pm 0.69 (n=21)
18 years old	25.21 \pm 0.67 (n=10)	24.18 \pm 0.97 (n=14)
Sports High School		
15 years old	20.73 \pm 0.95 (n=18)	21.11 \pm 3.62 (n=8)
16 years old	22.08 \pm 1.16 (n=7)	20.77 \pm 0.44 (n=7)
17 years old	22.25 \pm 1.54 (n=25)	20.94 \pm 0.55 (n=10)
18 years old	22.84 \pm 0.98 (n=18)	21.29 \pm 0.85 (n=8)

*. The mean difference is significant at the 0.01 level. BMI = Body mass index.

Table 2. Body mass index in male subjects depending on the school – multiple comparisons^a with Tukey Hsd

(I) School	(J) School	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
“Andrei Şaguna” National College	“Andrei Mureşanu” High School	-.71814	.30361	.087	-1.5041	.0678
“Andrei Şaguna” National College	“Unirea” National College	-.60762	.30541	.195	-1.3983	.1830
	Sports High School	1.91393*	.27750	.000	1.1955	2.6323
“Andrei Mureşanu” High School	“Andrei Şaguna” National College	.71814	.30361	.087	-.0678	1.5041
	“Unirea” National College	.11053	.32291	.986	-.7254	.9465
“Unirea” National College	Sports High School	2.63207*	.29665	.000	1.8641	3.4000
	“Andrei Şaguna” National College	.60762	.30541	.195	-.1830	1.3983
“Unirea” National College	“Andrei Mureşanu” High School	-.11053	.32291	.986	-.9465	.7254
	Sports High School	2.52155*	.29849	.000	1.7488	3.2943
Sports High School	“Andrei Şaguna” National College	-1.91393*	.27750	.000	-2.6323	-1.1955
	“Andrei Mureşanu” High School	-2.63207*	.29665	.000	-3.4000	-1.8641
	“Unirea” National College	-2.52155*	.29849	.000	-3.2943	-1.7488

*. The mean difference is significant at the 0.05 level. a. Gender = Male.

Table 3. Body mass index in female subjects depending on the school – multiple comparisons^a with Tukey Hsd

(I) School	(J) School	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
"Andrei Şaguna" National College	"Andrei Mureşanu" High School	.32845	.28835	.666	-.4175	1.0744
	"Unirea" National College	-.33725	.29084	.653	-1.0896	.4152
	Sports High School	3.03565*	.36392	.000	2.0942	3.9771
"Andrei Mureşanu" High School	"Andrei Şaguna" National College	-.32845	.28835	.666	-1.0744	.4175
	"Unirea" National College	-.66569	.27156	.070	-1.3682	.0368
	Sports High School	2.70720*	.34870	.000	1.8051	3.6093
"Unirea" National College	"Andrei Şaguna" National College	.33725	.29084	.653	-.4152	1.0896
	"Andrei Mureşanu" High School	.66569	.27156	.070	-.0368	1.3682
	Sports High School	3.37289*	.35077	.000	2.4655	4.2803
Sports High School	"Andrei Şaguna" National College	-3.03565*	.36392	.000	-3.9771	-2.0942
	"Andrei Mureşanu" High School	-2.70720*	.34870	.000	-3.6093	-1.8051
	"Unirea" National College	-3.37289*	.35077	.000	-4.2803	-2.4655

*. The mean difference is significant at the 0.05 level. a. Gender = Female.

Table 4. Body mass index in male subjects depending on age – multiple comparisons^a with Tukey Hsd

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
14	15	-.26657	.48139	.981	-1.5907	1.0576
	16	-1.16078	.48139	.116	-2.4849	.1634
	17	-1.50686*	.43091	.005	-2.6921	-.3216
	18	-1.66917*	.48139	.006	-2.9933	-.3450
15	14	.26657	.48139	.981	-1.0576	1.5907
	16	-.89421	.41465	.200	-2.0348	.2463
	17	-1.24029*	.35480	.005	-2.2162	-.2644
	18	-1.40260*	.41465	.008	-2.5431	-.2621
16	14	1.16078	.48139	.116	-.1634	2.4849
	15	.89421	.41465	.200	-.2463	2.0348
	17	-.34608	.35480	.866	-1.3220	.6298
	18	-.50839	.41465	.736	-1.6489	.6322
17	14	1.50686*	.43091	.005	.3216	2.6921
	15	1.24029*	.35480	.005	.2644	2.2162
	16	.34608	.35480	.866	-.6298	1.3220
	18	-.16231	.35480	.991	-1.1382	.8136
18	14	1.66917*	.48139	.006	.3450	2.9933
	15	1.40260*	.41465	.008	.2621	2.5431
	16	.50839	.41465	.736	-.6322	1.6489
	17	.16231	.35480	.991	-.8136	1.1382

*. The mean difference is significant at the 0.05 level. a. Gender = Male.

($m=22.77\pm 2.87$) and 17 year-old boys ($m=24.01\pm 1.61$), as well as on 18 year-old boys ($m=24.17\pm 1.48$).

The level of the BMI was also analyzed on girls, between the five age categories. The BMI average levels for the five age categories were in this order: 22.55, 23.76, 23.76, 24.03 and 23.13. The one-way variance analysis

(ANOVA) revealed a significant difference between these means $F(4.241)=3.920$; $p=0.004$. The measurement of the effect made via eta-square index shows a very insignificant effect, too little to be taken into consideration ($\eta=0.06$) (see Table 5).

Table 5. Body mass index in female subjects depending on age – multiple comparisons^a with Tukey Hsd

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
14	15	-1.20711	.48796	.100	-2.5483	.1341
	16	-1.21093*	.42480	.038	-2.3785	-.0434
	17	-1.47963*	.39900	.002	-2.5763	-.3830
	18	-.57681	.53978	.822	-2.0604	.9068
15	14	1.20711	.48796	.100	-.1341	2.5483
	16	-.00383	.42032	1.000	-1.1591	1.1515
	17	-.27252	.39423	.958	-1.3561	.8110
	18	.63030	.53626	.765	-.8436	2.1042
16	14	1.21093*	.42480	.038	.0434	2.3785
	15	.00383	.42032	1.000	-1.1515	1.1591
	17	-.26870	.31268	.911	-1.1281	.5907
	18	.63412	.47951	.678	-.6838	1.9521
17	14	1.47963*	.39900	.002	.3830	2.5763
	15	.27252	.39423	.958	-.8110	1.3561
	16	.26870	.31268	.911	-.5907	1.1281
	18	.90282	.45681	.281	-.3527	2.1584
18	14	.57681	.53978	.822	-.9068	2.0604
	15	-.63030	.53626	.765	-2.1042	.8436
	16	-.63412	.47951	.678	-1.9521	.6838
	17	-.90282	.45681	.281	-2.1584	.3527

*. The mean difference is significant at the 0.05 level. a. Gender = Female.

Discussions

The main findings of this study are:

1) there is a high number of overweight pupils from Şaguna, Andrei Mureşanu and Unirea high schools, whereas pupils from the Sports High School, in their vast majority, have a normal weight;

2) there are significant statistical differences between the BMI levels both depending on gender and on age categories, on all the pupils involved in the experiment.

Numerous studies examined the values of the BMI and of obesity in teenagers from different countries in the world. A UNICEF report 2009-2010 studied the health of a 11, 13 and 15 year-old children in 29 countries and revealed that the highest percentage of obese children was registered in the USA (nearly 30%) [13].

Siversten et al. [14] showed that there is evidence for a curvilinear relationship between BMI and both sleep duration and insomnia for girls, whereas the relationship was linear for boys. The study shows that compared to the average weekday sleep duration among adolescents in the normal weight range (6 hrs 29 min), both underweight (5 hrs 48 min), overweight (6 hrs 13 min) and obese (5 hrs 57 min) adolescents had shorter sleep duration.

A similar study was conducted by Halvorsen et al. [15], who demonstrates that overweight and obesity are associated with acne in girls aged 18 and 19, but the same association was not observed in boys. The prevalence of overweight was 9.5% in girls and 15.4% in boys. The prevalence of acne was 13.1% in girls and 14.0% in boys. Among those who were overweight or obese (BMI \geq 25),

the prevalence of acne was 18.5% in girls and 13.6% in boys. In girls, there was an unadjusted OR of 2.1 (95% CI, 1.4-3.3) between acne and overweight, and an adjusted OR of 2.0 (95% CI 1.3-3.2). In boys, no significant associations were found between acne and BMI.

Another study conducted on 199135 adolescents from 36 countries and 72900 children from 17 countries provided information on their height, weight and fast-food consumption. This study shows that there is an association between increasing frequency of fast-food consumption and higher BMI in 6–7-year-old children, but this association was reversed in adolescents. This cross-sectional study provides evidence that among children from many different nations, fast-food consumption may contribute to weight gain. The reverse association observed in adolescents should be interpreted with caution, as the results may be affected by bias, particularly underreporting of fast-food consumption and reverse causation [16].

Adesina et al. [17] highlighted that factors which contributes to the weight problems of adolescents are the high socioeconomic class, higher maternal education, spending > 3 hours a day watching television and frequent ingestion of snacks. Results showed that the prevalence of underweight, overweight, obesity and stunting was 6.4%, 6.3%, 1.8% and 5.4%, respectively. The authors recommend the need for evaluation periodic of adolescents and health education to promote healthy eating habits and regular physical exercise as part of the School Health Programme.

Some limitations of the present study have to be mentioned. Our findings are certainly limited by the relatively small sample size and the uncontrolled nature of the study design. The small sample size may decrease the power to detect statistically significant results in general. In addition, the assessment of the body mass index could have led to small inaccuracies which can allow for measurement errors.

The statistical power was further reduced when sexes were analyzed separately. Variations in body weight and height were found to widen along the age in the present study, and this is in line with nationally representative samples. Overall, the results of the present study should be replicated with a more representative sample to confirm the validity of the presented findings.

Conclusions

This study revealed that the values of the BMI are higher in pupils from Andrei Șaguna, Andrei Mureșanu

and Unirea high school, this being due mainly to unhealthy nutrition, a sedentary lifestyle and other factors. On the other hand, we noticed on pupils from the Sports High School very good values of BMI, because of the many hours of sports activities included in the educational program of this domain.

For the other theoretical high schools involved in the study, the curriculum includes one hour of physical education per week, insufficient for a good health of teenagers and for fighting obesity.

In conclusion, it is worth mentioning that sports must be a part of each individual's daily life, because, besides the positive effects that it has on health, it also helps us fight weight gain.

Conflict of interests

The author declares that there is no conflict of interests.

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Effect of swimming with the use of aqua fitness elements and interval hypoxic training on the physical fitness of boys aged 11-12 years

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Abstract

Purpose: to establish the integrated effect of training sessions using elements of aqua fitness and interval hypoxic training on the special physical fitness of swimmers.

Material: young swimmers participated in the study (n = 64, age 11-12, sporting experience - 2-3 years). The research was carried out in stages: before the experiment began, and then in 8, 16 and 24 weeks later. Frequency of classes in all groups was 6 times a week.

Results: the ability to work in anaerobic alactatic, lactate and aerobic energy supply zones was studied. It was established that such training sessions help to improve the performance and capacity of the anaerobic alactatious system. The feasibility of such combination is proved by the growth of performance indicators in areas of aerobic, anaerobic alactatic and lactate energy supply.

Conclusions: The feasibility of such training sessions is explained by: minimizing the negative impact on the children's body of exercises on the development of force in conditions of the aquatic environment; improving the functional capabilities of the body.

Keywords: disability, anaerobic, aerobic, alactatic, lactate, energy supply, hypoxia, aqua fitness, swimming.

Introduction

The results of the competitions (Olympics, World Championships, etc.) indicate the dynamics of the growth rates of performance from different sports. Such a phenomenon is conditioned by an increase in the efficiency of training sessions by introducing new technologies into the multi-year training of athletes [1-3].

An essential role in the training of young swimmers is to improve the strength of qualities [4]. Power training, [5] when working with swimmers, is carried out in the dry-swimming area. However, performing power exercises under such conditions can negatively affect the functional [6] preparedness of young swimmers. Therefore, we propose a part time program (force training in the dry-swimming area) to replace aqua fitness [7].

There is evidence that physical exercising in water has a positive effect on various functional systems of the body [8]. Such an effect of physical exercises in water is due to the following: phenomenon of gravity unloading of the body [9]; positive influence on the function of the cardiovascular system [10], respiratory systems [11] and vestibular apparatus [12].

Recently, in the physical education of people of different ages, auxiliary agents are used which increase the effectiveness of physical exercises [13-15]. It has been proved that the use of endogenous-hypoxic breathing techniques in cycling [16] and swimmers [17] positively

influences the dynamics of physical fitness. Other studies are evidence of the effectiveness of endogenous-hypoxic respiration when working with skilled hockey players on grass [18] and on ice [19]. Interval hypoxic training is used in practice of other sports: rugby [20, 21]; cycling [22]

Other authors [8, 11] proved the effectiveness of complex application of aqua fitness and endogenous-hypoxic respiration techniques when working with women of mature age. This is confirmed by the improvement of their physical condition [7]. Different breathing techniques are used in the preparation of swimmers [23-25]. The authors state:

- The effects of intermittent hypoxia training on blood, serum and other indicators and the effect of swimming training were analyzed. The practice has proved that the intermittent hypoxia training method was an economical and practical method, which can replace the traditional altitude training and improve the oxygen transport ability of the swimming athletes effectively [9];
- This study demonstrated that VHL (VHL group – low lung volume) training, when performed at supramaximal intensity, represents an effective method for improving swimming performance, partly through an increase in the anaerobic glycolysis activity [25];
- RSH-VHL (RSH – repeated-sprint training in hypoxia) improved RSA (RSA – repeated-sprint

ability) in swimming, probably through enhanced anaerobic glycolysis. This innovative method allows inducing benefits normally associated with hypoxia during swim training in normoxia [24].

In the program for the training of young swimmers, we propose to integrate the elements of aqua fitness and the method of interval hypoxic training (IHT) using the apparatus “Endogenic-01” [26]. There are no scientific data on the possibility of using ICT in combination with aqua fitness in the training process of swimmers of 11-12 years old.

Hypothesis. We anticipate that the integrated application of the endogenous hypoxic respiration method and the elements of aqua fitness in the training process of young swimmers will enhance their functional, general and special physical fitness.

The purpose of the study: to establish the complex impact of training sessions on elements of aqua fitness and the methods of interval hypoxic training on the special physical fitness of swimmers 11-12 years old.

Materials and methods.

Participants. In the experiment participated students of children’s and youth sports schools – boys aged 11-12 years ($n = 64$, sports experience - 2-3 years). Of these, there are three groups: control (CG, $n = 21$), the first basic (MG1, $n = 22$) and the second main (MG2, $n = 21$).

Organization of research. It was used the following swimming tests: “swimming with free style at a distance of 25 meters”, “freestyle swimming at distances of 4×50 m with a rest interval of 15 seconds”; “swimming with free style at a distance of 800 m”. It was also applied test to record the number of twists of 25 meters in the maximum possible speed (anaerobic mode of power supply). The number of repetitions was limited to an excess of heart rate of $170 \text{ beats per minute}^{-1}$ [17].

The research was carried out in stages: before the experiment begin, and then in 8, 16 and 24 weeks later.

Frequency of classes in all groups was 6 times a week. The content of the classes in the main groups was different from the control. Athletes of the first main group on each training session at the beginning of the preparatory part used interval hypoxic training (IHT) under the program of special “route maps” [26]. For this purpose, the device “Endogenic-01” was used.

Strength training for athletes of the second main group was carried out in water using elements of the aqua fitness power direction [7]. In the process of training used such aids as water belts, gloves, small and large dumbbells, nubs, boots, rubber shock absorbers, swimming boards [27].

Statistical analysis. Summing up are numerical indices that reflect the position of the center of empirical distributions and their scattering: arithmetic mean (\bar{x}); mean arithmetic mean error (m); mean square (standard) deviation (S); dispersion (S^2); coefficient of variation (V).

The values of the sample from the general population were subject to the law of normal distribution, which was verified using Pearson’s criterion. Student’s t-criterion

was used [28]. The difference was considered probable with a difference of 5% ($p < 0.05$).

Results.

Studies of special physical fitness of swimmers from the CG group showed that training sessions during 24 weeks did not cause any significant changes in any of the studied parameters.

Training sessions for swimming for 8 weeks in the group MG1 and the group MG2 did not cause any of the indicators of special physical fitness.

Six weeks after the beginning of classes in boys of the group MG1, an improvement (5.85%, $p < 0.05$) of the results of the first segment gliding recorded in the “ 4×50 m freestyle skating test with a rest interval of 15 sec” was registered (Table 1)

In the group MG2 (after 16 weeks), the “800m freestyle” and “free 25m style flying with the highest possible speed” test dropped by 2.81% and 4.13%. In this group, the time to overcome the first and second segments in the test “ 4×50 m free-range driving with a rest interval of 15 seconds” decreased by 5.11% and 5.00%, respectively. Also, the number of sailings of 25-meter intervals with maximum intensity (heart rate $150-170 \text{ beats per minute}^{-1}$) has increased (by 21.15%) (Table 1).

Boys of groups MG1 and MG2 (after 24 weeks) improved their results of performing tests that characterize the capacity in aerobic energy supply zone (by 3.42% and 5.66%) and efficiency in anaerobic alactated energy supply zone (by 6.22% and 9.26%). The capacity of an anaerobic alactatic system grew by 25.93% and 38.46% respectively.

Athletes of the group MG1 (after 24 weeks) decreased the time to overcome the first segment in the test “ 4×50 m freestyle diving with a rest interval of 15s” by 6.22%. In the second segment decreased by 5.86%. In the group MG2, the results of the first and second segments in this test improved by 9.48% and 6.23% respectively.

Discussion.

The results of control competitive testing of swimming are confirmed by the results of research by scientists [9, 17] on the limitation of the ability of swimmers of adolescence to perform work under conditions of anaerobic metabolism.

The information of scientists [9, 27] on the effectiveness of using interval hypoxic training in the system training of athletes has been confirmed and supplemented. Other authors [9, 17] used the technique of interval hypoxic training in swimmers. After 16 weeks of training sessions swimmers had a probable increase in work capacity in the area of aerobic and anaerobic lactate energy supply. The results of their own research have shown that the use of IHT in the training process of swimmers aged 11-12 years contributes to improving efficiency in areas of aerobic, anaerobic alactatious and lactate energy supply. The expediency of using our proposed program of training sessions with swimmers of 11-12 years old is also indicated by an increase in the capacity of anaerobic

Table 1. Indicators of special physical fitness of 11-12 years old swimmers at different stages of the study (CG, n = 21, MG1, n = 22, MG2, n = 21)

Indexes	Groups Before exercises start	Mean value, x±S			
		After 8 weeks	after 16 weeks	after 24 weeks	
Freestyle swimming 800 m, sec	CG	798,24±7,28	793,38±8,28	790,19±8,46	776,57±7,99
	MG1	797,82±7,25	790,59±6,68	778,27±6,68	770,55±6,34*
	MG 2	799,71±6,86	790,05±5,50	777,24±5,15*	754,43±4,32*
1st length, sec	CG	35,06±0,51	35,01±0,41	34,86±0,41	33,70±0,44
	MG 1	35,09±0,80	35,06±0,80	33,04±0,59*	32,91±0,60*
	MG 2	35,30±0,67	35,17±0,67	33,50±0,55*	31,96±0,50*
Freestyle swimming 4x50 m with a rest interval 15 sec:	CG	37,86±0,51	37,81±0,51	37,78±0,51	37,38±0,52
	MG 1	37,96±0,83	37,89±0,83	36,69±0,70	35,73±0,67*
	MG 2	38,01±0,68	37,92±0,67	36,11±0,59*	35,64±0,61*
3d length, sec	CG	40,48±0,61	40,37±0,61	40,27±0,62	39,74±0,63
	MG 1	40,84±0,85	40,75±0,85	40,58±0,85	40,04±0,83
	MG 2	40,71±0,71	40,57±0,69	40,36±0,69	39,27±0,59
4th length, sec	CG	43,35±0,78	43,29±0,78	43,21±0,77	42,69±0,77
	MG 1	43,61±0,85	43,52±0,85	43,29±0,86	42,15±0,76
	MG 2	43,42±0,74	43,29±0,75	43,08±0,76	41,64±0,64
Freestyle swimming on 25m, sec	CG	15,80±0,23	15,75±0,24	15,64±0,24	15,50±0,24
	MG 1	15,79±0,35	15,74±0,34	15,15±0,34	14,48±0,31*
	MG 2	15,85±0,26	15,63±0,24	15,20±0,15*	14,39±0,16*
Swim distances 25 m with HR 150-170 bits per minute ¹ , number of length	CG	2,48±0,18	2,71±0,12	2,76±0,12	2,86±0,12
	MG 1	2,45±0,17	2,73±0,11	2,86±0,11	3,09±0,11*
	MG 2	2,48±0,18	2,86±0,12	3,00±0,12*	3,43±0,12*

Note: HR is the heart rate.

alactated energy supply system for young swimmers.

For the first time, elements of aqua fitness and interval hypoxic training were used in the training process of young swimmers. The expediency of such innovation, we explain: minimizing the negative impact on children's body of exercises on the development of force in conditions of the aquatic environment; improving the functional capabilities of the body. The benefits of such combination are evidenced by the results of studies of special physical fitness after the completion of the molding experiment. In athletes of the MG2 group, after 24 weeks, the efficiency in the aerobic energy supply zone was significantly higher compared to the results of the groups of CG and MG1 (2.85% and 2.09%). The capacity of the anaerobic alactatious system of young swimmers by 20.00% and 10.92% exceeded the indicators of the groups of CG and MG1.

The time to overcome the distance of 25 m in free style with the highest possible speed in the group MG2 was

7.21% better than in the CG group. The time of sailing of the first and second segments at a distance of 4 × 50 m free style with an interval of 15 seconds also improved by 5.18% and 4.65% respectively.

The results of the implementation of control tests by the swimmers of the group MG2 supplemented the scientific information of other authors [8, 10, 27] on the effectiveness of the use of aqua fitness in training sessions. The correctness of our approaches to improving the physical condition of children is confirmed by other studies [29, 30].

Conclusions

The results of the research showed that training sessions with swimming with the use of elements of aqua fitness and interval hypoxic training contribute to improving the efficiency of swimmers of 11-12 years old in the zone of aerobic, anaerobic alactatious and anaerobic lactate energy supply.

Financing

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Conflict of interest.

The authors state that there is no conflict of interest.

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The effect of Psychological skills training (goal setting, positive self-talk and Imagery) on self-confidence of adolescent volleyball players

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Abstract

Purpose: Considering the increasing emphasis on the importance of psychological skills and its various applications in teaching and learning and improving exercise skills, the purpose of this study was to assess the effect of Psychological skills training (goal setting, positive self-talk and Imagery) on self-confidence among adolescent volleyball players.

Material: For this purpose, 30 out of 100 male volleyball players in Sarakhs city were selected by simple random sampling method. They were divided into two groups: control (N = 15) and experimental (N = 15). Control group and experimental group participated in regular physical activity but experimental group moreover followed psychological skill training program. Psychological skills training included 24 sessions, each week 3 times. First, Ottawa's Assessment Skills Questionnaire (OMSAT_3) was applied for screening mental skills levels. Then, before and after the intervention of the psychological training program (24 sessions) Trait and State self-confidence questionnaires from subjects were collected. To calculate the mean difference between groups, one-variable covariance statistical method was used and hypothesis testing was performed at a significant level ($p < 0.05$).

Results: The results of the study showed that the Psychological skills training program had a significant effect on state and trait self-confidence among adolescent volleyball players ($p < 0.05$).

Conclusions: Psychological skills training associated with technical and physical training should be used by coaches for attaining optimum self-confidence and peak performance of athletes.

Keywords: psychological, skills, training, trait, self-confidence.

Introduction

Performance enhancement in sports environments depends on athletes' self-confidence, motivation, and optimum performance [1]. It is noteworthy that sport-confidence is one of the most common mental factors, which results in sports achievements; the term self-confidence here refers to a successful implementation of a relatively specific action that can assess the optimism philosophy of that performance. For example, the one may have high confidence in driving, but low confidence in directing the golf ball toward the hole [2]. Volleyball is one of the beautiful and attractive sports with particular popularity among adolescents. Successive victories in this sport depend on different factors such as physical readiness, technique, tactics, and mental readiness; hence, the use of psychological skills enhancement techniques to provide optimal situation for athletes is of great importance [3]. In addition, past performance dependent innate resources, mastery of skills, coach leadership style, ability display, and physiological and psychological readiness are considered as the most important self-confidence resources [4]. Numerous interventional methods are employed to improve self-confidence, sport skills performance, and satisfaction in athletes, and the important role of such techniques in the improvement of athletes' performances are noted in different studies.

Here, cognitive strategies, by the use of effective patterns including self-talk, targeting, relaxation, and motivation regulation, had positive impacts or caused useful changes. Targeting is particular type of such techniques; evaluation of its qualitative and quantitative impacts on skills performances and improvement of self-confidence are of great importance. Based on the targeting studies, target is a powerful tool with direct/indirect impacts on behavioral changes [5]. Target has 2 important properties; first, it is direction-oriented and the athlete formulates his/her own target toward something, and the second, it has intensity and strength and may be very or relatively important to the athlete [6].

Recently, researchers combined self-talk with mental skills and reported positive outcomes in athletes' performances [7]. Positive self-talk is referred to an internal conversation can be done loudly or in silence though which the person teaches or strengthens him/herself [8]. Self-talk can be performed during, before, and even after a sport performance, comes from thoughts, usually happens unconsciously and emotionally, and can affect athletes performance. The popularity of self-talk is because of its association with sport performance. A set of studies indicated that positive self-talk is associated with performance development. A study by Hardy et al., showed that positive self-talk can increase self-confidence and anxiety control [9]. On the other hand, there are some factors, which is believed that may

increase self-confidence and improve sport performance; for example, successful performance, emotional and physiologic arousal, positive emotions, attention and concentration, targeting, and imagination of which sport imagination like physical exercises can establish a model of skills in the central nervous system [10], because imagination is the symbolic review of a physical activity without any clear muscular movement [11]. Nevertheless, neuroscience researches evaluated the activity of brain during the imagination procedure, which may provide useful knowledge about the imagination process [12]. Imagination can be used to learn skills and techniques (specific-cognitive) as well as strategies or tactics (general-cognitive); in addition, it may be employed to manage motivations and emotional excitements [13]. Sport Imagination is a common ability that athletes use at different levels in order to enhance different aspects of their performances such as refining and improvement of skills, regulation of excitements and levels of activation, management of cognitive aspects, and motivators [14]. In other words, Imagination is the visualization or cognitive review of a movement without physical performance. The benefits of sport Imagination are learning the skills, improving the injuries, rehabilitation activities, readiness for the optimal sports performance, and self-confidence increase [15]. It is very important to consider that there is no distance between imagination, and sport performance and self-confidence increase. Both refer to the cognitive processes that people build to judge their ability for the successfully performance of a sport goal [16]. Bases on many benefits of mental skills training on motor function, the question is: "Does targeting, positive self-talking, and imagination practices affect state and trait confidences?"

Since a very few studies were conducted on the effect of mental skills training on state and particularly trait confidence, it is expected that the results of the current study be used as an important cognitive strategy in the promotion of athletes and sport community in different competitions and sport fields.

Materials and methods

Participants. The study population included 100 male adolescent volleyball players from Sarakhs, North Khorasan Province, Iran. A total of 30 individuals from the study population were enrolled in the study using the simple random sampling method and allocated into 2 groups of case and control each with 15 subjects. All subjects and their parents signed the informed consent on the basis of participation in mental skills training program.

Research Design. The current quasi-experimental, case-control study was conducted based on a pretest-posttest design. The Ottawa Mental Skills Assessment Tool (OMSAT-3), trait confidence and state confidence questionnaires were used as data collection instruments in the current study. OMSAT was performed to screen subjects before mental skills training intervention; the questionnaire evaluates subjects in 3 cognitive, behavioral, and emotional aspects. The Trait Sport Confidence Inventory was developed to assess how confident athletes

generally feel, when they compete in sport. Items on the inventory ask the participants to compare themselves to the "most confident athlete you know" [17]. The inventory consists of 13 items, with no subscale components, utilizing a 9-point Likert scale anchored by 1 (low) and 9 (high). Trait sport confidence scores are obtained through a mean score or a summed score by adding up scores for the 13 items. Cronbach's alpha coefficient was measured as .93 for the TSCI, with test-retest reliability in two studies of .83 and .86, respectively [17].

Vealey's State Sport Confidence Inventory is a 13 question instrument which measures state sport confidence before sport competition. To aid in the conceptualization of sport-confidence, Vealey perused the literature on self-efficacy, perceived competence, and performance expectancy. Sport-confidence was defined "as the belief or degree of certainty individuals possess about their ability to be successful in sport" [17].

Exercise program

Psychological skills training involved goal setting, positive self-talk and Imagery and included 24 sessions, each week 3 times and each session 20 minutes. This training has been done before physical and technical training. Experimental group participated both Psychological skills training and physical and technical training but control group only participated in physical and technical training.

Procedure

Before intervention of Psychological skills training, demographic Questionnaire and Trait Sport Confidence Inventory were distributed among subjects (experimental and control group) around 24 hours before the first competition. State Sport Confidence Inventory (SSCI) were administered among volleyball players in experimental and control group within 30 minutes prior to the start of the competition. After intervention of Psychological skills training, once again volleyball players in both experimental and control group completed Trait Sport Confidence Inventory around 24 hours before the first competition and completed State Sport Confidence Inventory (SSCI) around 30 minutes prior to one of the important competition.

Statistical Analysis. The descriptive statistics was used to express frequency, figures, mean, and standard deviation (SD) of the study variables. To indicate differences and analyze mean values of the study variables in both the case and control groups in inferential statistics, the univariate covariance method was used. The Shapiro-Wilk test was used to evaluate the normality of data distribution and the Levene test was performed for the homogeneity of variances. Data analysis was done with SPSS version 16.

Results

Based on the results of the Shapiro-Wilk test in the current study (Table 1), distribution of data was normal for all variables in both pretest and posttest ($P < 0.05$).

Based on Table 2, the mean scores of state confidence in the control and experimental groups were respectively 74.4 and 74.2 for pretest and 66.80 and 89.90 for posttest.

The mean scores of trait confidence in the control and experimental groups were respectively 66.00 and 66.40 for pretest and 68.50 and 78.80 for posttest.

Based on the results of Table 3, the assumption of variances equality was considered in both the study groups ($P > 0.05$).

According to Table 4, there was a significant difference between the state confidence scores of the experimental and control group in the current study ($P < 0.05$). In other words, mental

skills training significantly improved the state confidence in the experimental group subjects ($P < 0.05$).

Based on Table 5, after the elimination of pretest effects, as an auxiliary random variable, the mean score reduced from 89.93 to 78.40, although the posttest scores differences between the groups was still significant, which

can be attributed to the role of independent variable, mental skills training program, in increasing the state confidence in the case group subjects.

According to Table 6, there was a significant difference in the trait confidence scores between the study groups. In other words, mental skills training program significantly improved trait confidence in the experimental group subjects ($P < 0.05$).

Table 1. Result of Shapiro-Wilk test

Group	Variables	Sig.
Control	Pre-test Trait Self Confidence	0.87
	Pre-test State Confidence	0.40
	Post-test Trait Self Confidence	0.50
	Post-test State Confidence	0.17
Experimental	Pre-test Trait Self Confidence	0.46
	Pre-test State Confidence	0.19
	Post-test Trait Self Confidence	0.73
	Post-test State Confidence	0.90

Table 2. The mean scores of state confidence in the control and experimental groups

Variables	Control Group(15)		Experimental Group(15)	
	Pre-test	Post-test	Pre-test	Post-test
State Self Confidence	74.40±10.60	66.80 ±10.10	74.20 ± 11.10	89.90 ± 13.10
Trait Self Confidence	66.00 ±7.80	68.50 ± 9.10	66.40 ± 7.30	78.80 ± 6.60

Table 3. Levene's test for variances homogeneity

Dependent variables	Levene's Statistic	Sign.
State Self Confidence	0.002	0.96
Trait Self Confidence	2.81	0.10

Table 4. Results of Covariance Analysis to Compare State Confidence Changes between the Study Groups

Source Changes	Sum Squares	Degree of freedom	Mean Squares	F	Sign.
State Self Confidence	856.73	1	856.73	7.71	0.01*
Group(Independent Variable)	4025.38	1	4025.38	36.22	0.00*
Error Variance	2999.93	27	111.109	-	-
Sum	192244.00	30	-	-	-

Table 5. Adjusted Mean after Eliminating the Effect of Pretest

Mean	Mean Standard Error	Confidence Interval	
		Lower Bound	Upper Bound
78.40	1.92	74.45	82.34

Table 6. Results of Covariance Analysis to Compare State Confidence Changes between the Study Groups

Source Changes	Sum Squares	Degree of freedom	Mean Squares	F	Sign.
Trait Self Confidence	31.48	1	31.48	0.480	0.49
Group(Independent Variable)	779.73	1	779.73	11.89	0.02*
Error Variance	1770.65	27	65.58	-	-
Sum	165396	30	-	-	-

Table 7. Adjusted Mean after Eliminating the Effect of Pretest

Mean	Mean Standard Error	Confidence Interval	
		Lower Bound	Upper Bound
73.66	1.47	70.63	67.70

Based on Table 7, after the elimination of pretest effect, as an auxiliary random variable, the mean score reduced from 78.80 to 73.66, although the posttest scores differences between the groups was still significant, which can be attributed to the role of independent variable, mental skills training program, in increasing the trait confidence in the experimental group subjects.

Discussion

Results of posttest analysis of covariance (ANCOVA) showed a significant difference in state confidence between case and control groups, which indicate the effect of physical and mental skills training on state confidence in the case group subjects; the results of the current study were in agreement with those of Abdoli et al., since due to the nature of volleyball, adolescent volleyball players encounter stressful situations during the game in which should respond them with strategies and skills; hence, their state confidence is improved. In fact, in sport achievements, skills and skillful performance can improve self-confidence in athletes [18].

Results of a study by Fulghan et al., showed that the mental skill training programme consisting imagination and targeting improved self-confidence and attitude of athletes; the results were consistent with those of the current study [5]. In addition, Hossinian indicated in his study that mental skills training programme, particularly positive self-talk training, had positive impacts on the reduction of social skills (performance phobia, social phobia, and performance avoidance), which improved self-confidence that was in adverse relationship with anxiety. It seems that the lower the anxiety, the higher the self-esteem [19].

A better explanation is that mental skills can improve focusing, attention, attention management, mental performance, and increase decision-making power, which in turn the athlete feels less anxiety and emotion; the conclusion was in agreement with those of Weinberg and Gould as well as Hatzigeorgiadis in a study on the motivational impact of self-talk on self-confidence, anxiety, and performance of juvenile and adult male athletes [5,20]. Results of the mentioned studies showed that the mental training package (imagination and self-talk) has more positive results and leads to the centralization of attention and changing attitudes in athletes; in addition, it controls the situation of trainee after the intervention and can increase self-confidence, manage emotions, and reduce cognitive anxiety in the trainee. Most of the psychological interventions deal with targeting; it is noteworthy that most of the psychological interventions applied to the US Olympic athletes dealt with targeting [21].

All in all, based on the results of different studies it can be concluded that state confidence is under the influence of different factors as well as a set of mental skills that affect the attitude of athletes, control of feelings, improvement of self-control, etc. in addition, it seems that relaxation let the athletes to learn stress coping strategies and control and maintain their confidence under stressful conditions. Hence, it is reasonable that such factors along skills and technical excellences, sport achievements, spending a lot of hours to exercise, the quality of exercise, or successful exercises can significantly affect the state confidence of athletes in tournaments and even cause fluctuation around their state confidence. In fact, sport state-confidence is the belief or a degree of certainty of a person in a special moment about his/her ability to success in sports. Hence, self-confidence fluctuations cause appropriate or inappropriate performance in sports. Higher degrees of state confidence may reduce anxiety in athletes and improve their performances.

The second objective of the current study was to evaluate the effect of mental skills trainings on trait confidence in male adolescent volleyball players. In this regard, results of ANCOVA posttest indicated a significant increase in the level of trait confidence in the case group than the control group. In other words, physical and mental skills trainings significantly increased trait confidence of male adolescent volleyball players. Results of the current study was consistent with those of Wilson et al., that considered focus on task, mastery of skills, new skill improvement, focus on the goal, mental and physical readiness, ability display, and social support as the factors and sources of self-confidence increase. Experimental researches also showed that promotion and creation of self-confidence improves the performance; the evidence not observed in the control groups. It seems that athletes with higher degrees of confidence show more interest to hard tasks. Athletes with adequate self-confidence and -control usually have positive self-expectations, which in turn increases their ability to deal with stressful factors [22]. Results of the current study were also in agreement with those of Krane and Williams; they showed in a study that athletes with more success also have higher self-confidence, self-regulation, self-arousal, better focus, controlled but not coerced attitude, positive thoughts and imaginations, and more wills and commitments. In other words, self-confidence relatively comes from personal features and different factors such as type of sport and personal features significantly affect self-confidence and the way of dealing with anxiety. In agreement with the results of a study entitled “Comparison of Trait and State Anxiety with Self-confidence in Male Athletes”, controversies over inheritance and environment as the

factors affecting mental health still remain in place; anxiety and self-confidence as 2 mental factors affecting athletes' performance are under the influence of different factors [23]. Since the level of state confidence depends on trait confidence and competitive orientation and as state confidence significantly increased after mental skills training interventions, the significant increase of trait confidence after mental skills training intervention is reasonable. In the current study, subjects attended a 24-session training course of targeting, positive self-talk, and imagination and it seems that the acquired skills could change their attitude and improve positive psychological factors as well as trait and state confidences.

Conclusion

Based on the results of the current study, acceptable levels of trait and state self-confidence play an important role in the success of athletes. Since mental skills training program, particularly targeting, positive self-talk, and imagination, had significant positive effects on trait and state confidence of male adolescent volleyball players in the current study, it is suggested to include such training and practicing programs along physical and skills practices on the agenda of sport coaches to create the degree of self-confidence necessary for peak performance.

Conflict of interest

The authors declare that there is no conflict of interest.

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Power abilities: the structure of development in girls of 12-14 years old

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Purpose: To determine the structure of the development of power abilities in girls aged 12-14 years

Material: Girls aged 12 years (n = 20) participated in the study; 13 years (n = 27), 14 years old (n = 30). Factorial analysis performed.

Results: It is determined that the most informative in girls of 12-14 years old are the following tests: which characterize the development of dynamic and static strength of muscles of the feet and hands (girls of 12 years old); which characterize the development of static, high-speed strength of leg muscles, static and dynamic strength of the muscles of the abdomen and hands (girls of 13 years old); which characterize the development of the static and dynamic strength of leg muscles, the dynamic strength of the muscle of the hands (girls of 14 years old).

Conclusions: Factor analysis allowed to determine informative indicators for controlling the development of power abilities in girls of 12-14 years old. The greatest weight in power preparedness has the relative and static strength of the leg muscles. In the second place, girls of 12-13 years old have the development of muscle strength shoulder girdle. 14 years old girls in second place, have the development of dynamic and static strength of the abdominal muscles and the dynamic strength of muscles of the shoulder girdle. Girls of 12 years old in third place have the development of coordination of movements, the static strength of the shoulder girdle and the dynamic strength of the back muscles. Girls of 13 years in the third place have development of the development of muscle strength of the abdomen. Girls of 14 years in third place have development of high-speed force and coordination of movements.

Keywords: girls, strength training, factor analysis, structure of force readiness.

Introduction

The problem of studying motor activity is one of the most important in the field of physical education [1, 2]. Physical education of schoolchildren is aimed at increasing the motor activity of children and adolescents [3, 4] and solves the following problem:

- optimizing the physical development, strengthening and health of the child [5, 6];
- improvement of the process of development of motor abilities [7, 8];
- improvement of the process of training physical exercises [9, 10].

In the structure of physical education, power abilities relate to the basic, their level of development affects the manifestation of motor abilities and the effectiveness of teaching physical exercises of schoolchildren [7, 11]. Based on numerous studies, conclusions are drawn:

- on the effectiveness of complex development of strength, vigor, coordination, endurance and flexibility in children [12, 13];
- on the influence of the level of development of force on the process of learning the physical exercises of schoolchildren [7, 14];
- on the effectiveness of the use of means and methods of training in the development of power capabilities [15, 16].

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In previously published works, attention was focused on: studying the relationship of indicators of the level of motor abilities' development [7, 17]; determining the structure of motor preparedness in children and adolescents [18, 19].

Multidimensional methods of mathematical statistics such as factor and discriminant analysis [7, 20] are effective for studying the structure of motor readiness of schoolchildren. Using factor analysis allowed to establish the structure of motor readiness of schoolchildren [21, 22]. However, in available literature there is not enough data on the peculiarities of the structure of power abilities development among middle class students.

Thus, the study of the peculiarities of the structure of power abilities development in girls of 12-14 years old is relevant.

The purpose of the research is to determine the structure of power abilities development among girls aged 12-14 years.

Materials and methods

Study participants. The study involved girls: 12 (n = 20), 13 (n = 27), 14 (n = 30) years old.

The study protocol was approved by the Ethical Committee of H. S. Skovoroda Kharkiv National Pedagogical University. In addition, the children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed-consent

document was obtained from all the parents.

Study organization. The study used the following methods: analysis and collation of scientific and methodological literature, general scientific methods of theoretical level, such as analogy, analysis, synthesis, abstraction, induction, as well as general scientific methods of empirical level: observation, testing, experiment.

Testing procedure. The testing program included well-known tests [7, 12, 23]. To evaluate motor preparedness, the study recorded the results of motor tests:

- Test 1. Pull-Up / Chin Up Test (low crossbar), quantity of times;
- Test 2. Bent Arm Hang Test (two hands), sec.;
- Test 3. Pull-Up / Chin Up Test (Rope Climbing), quantity of times;
- Test 4. Cadence Push-Up Test, quantity of times;
- Test 5. The subject lies in prone position, arms bent at the elbow 90 degrees - hold position in seconds;
- Test 6. Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times;
- Test 7. Hanging Leg Raises, sec.;
- Test 8. Decline Reverse Crunch on Bench, quantity of times;
- Test 9. Trunk Lift Test, quantity of times;
- Test 10. Squats Test (two legs), quantity of times;
- Test 11. Single Leg Squat (SLS) Test - right leg, quantity of times;
- Test 12. Single Leg Squat (SLS) Test - left leg, quantity of times;
- Test 13. Single Leg Squat (Pistol) - right leg;
- Test 14. Single Leg Squat (Pistol) - left leg;
- Test 15. Handgrip Strength Test, kg;
- Test 16. Standing Long Jump Test (Broad Jump), cm;
- Test 17. Eurofit Sit Up Test (for 30 sec.), quantity of times;
- Test 18. 4x9 m shuttle test, sec.;
- Test 19. Hand tapping test, sec.;
- Test 20. Seated Forward Bend, cm;
- Test 21. Flamingo Balance test - single leg balance test.

Statistical analysis. The IBM SPSS 20 statistical analysis software was used to process the study materials. A factor analysis was performed, for which the study used principal component analysis with the rotation method: Variamax with Kaiser Normalization.

Results

Tables 1-3 show the results of factor analysis.

For girls aged 12 years have been distinguished six factors, which explain the variance variation by 86,017%.

The first factor has a weight of 22,036%. The factor with the greatest correlation is the following:

- Test 14 "Single Leg Squat (Pistol) - left leg" - 0,940;
- Test 12 "Single Leg Squat (SLS) Test - left leg, quantity of times" - 0,926;
- Test 11 "Single Leg Squat (SLS) Test - right leg, quantity of times" - 0,919;
- Test 13 "Single Leg Squat (Pistol) - right leg" - 0,912.

The factor characterizes the development of the relative and static strength of the leg muscles.

The second factor is 15.264%. The factor with the greatest correlation is the following:

- Test 1 "Pull-Up / Chin Up Test (low crossbar), quantity of times" - 0,904;
- Test 4 "Cadence Push-Up Test, quantity of times" - 0,834;
- Test 3 "Pull-Up / Chin Up Test (Rope Climbing), quantity of times" - 0,669.

The factor characterizes the development of muscle strength of the shoulder girdle.

The third factor has a weight of 14.142%. The factor with the greatest correlation is the following:

- Test 18 "4x9 m shuttle test, sec." - -0,902;
- Test 5 "The subject lies in prone position, arms bent at the elbow 90 degrees - hold position in seconds" - 0,755;
- Test 9 "Trunk Lift Test, quantity of times" - 0,606.

The factor characterizes the development of coordination of movements, the static strength of the shoulder girdle and the dynamic strength of the back muscles.

The fourth factor has a weight of 13.593%. The factor with the greatest correlation is the following:

- Test 19 "Hand tapping test, sec." - -0,843;
- Test 17 "Eurofit Sit Up Test (for 30 sec.), quantity of times" - 0,729;
- Test 15 "Handgrip Strength Test, kg" - 0,723;
- Test 16 "Standing Long Jump Test (Broad Jump), cm" - 0,723.

The factor characterizes the complex development of motor abilities on the system of tests "Eurofit".

The fifth factor has a weight of 13.224%. The factor with the greatest correlation is the following:

- Test 7 "Hanging Leg Raises, sec." - 0,861;
- Test 6 "Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times" - 0,840;
- Test 21 "Flamingo Balance test - single leg balance test" - -0,703;
- Test 8 "Decline Reverse Crunch on Bench, quantity of times" - 0,625.

The factor characterizes the development of leg muscle strength.

The sixth factor has a weight of 7.757%. The factor with the greatest correlation is the following:

- Test 2 "Bent Arm Hang Test (two hands), sec." - 0,810.
- Test 20 "Seated Forward Bend, cm" - -0,458;
- Test 9 "Trunk Lift Test, quantity of times" - 0,448.

The factor characterizes the development of static muscle strength of the shoulder girdle.

Analysis of communities shows that the most informative in the structure of motor fitness girls 12 years are the following:

- Test 16 "Standing Long Jump Test (Broad Jump), cm" - 0,959;
- Test 5 "The subject lies in prone position, arms bent at the elbow 90 degrees - hold position in seconds"

Table 1. Factor structure of motor preparedness of the girls 12 years old. Method: principal component analysis. Rotation method: Varimax with Kaiser Normalization (n = 20)

No	Test	Component						h ²
		1	2	3	4	5	6	
1	Pull-Up / Chin Up Test (low crossbar), quantity of times		,904					,926
2	Bent Arm Hang Test (two hands), sec.						,810	,798
3	Pull-Up / Chin Up Test (Rope Climbing), quantity of times		,669		,566			,881
4	Cadence Push-Up Test, quantity of times		,834	,342				,871
5	The subject lies in prone position, arms bent at the elbow 90 degrees - hold position in seconds		,525	,755				,957
6	Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times					,840	,309	,832
7	Hanging Leg Raises, sec.					,861		,805
8	Decline Reverse Crunch on Bench, quantity of times	,319	,510			,625		,810
9	Trunk Lift Test, quantity of times	,509		,606			,448	,871
10	Squats Test (two legs), quantity of times	,608		,561			,355	,893
11	Single Leg Squat (SLS) Test - right leg, quantity of times	,919						,941
12	Single Leg Squat (SLS) Test - left leg, quantity of times	,926						,949
13	Single Leg Squat (Pistol) - right leg	,912						,940
14	Single Leg Squat (Pistol) - left leg	,940						,901
15	Handgrip Strength Test, kg			-,310	,723			,674
16	Standing Long Jump Test (Broad Jump), cm		,395	,455	,723			,959
17	Eurofit Sit Up Test (for 30 sec.), quantity of times		,432	,322	,729			,900
18	4x9 m shuttle test, sec.			-,902				,915
19	Hand tapping test, sec.				-,843			,804
20	Seated Forward Bend, cm	,422	-,356	-,416		-,309	-,458	,802
21	Flamingo Balance test - single leg balance test					-,703		,636
	% dispersion	22,036	15,264	14,142	13,593	13,224	7,757	86,017

- 0,957;

- Test 12 “Single Leg Squat (SLS) Test - left leg, quantity of times” - 0,949;
- Test 11 “Single Leg Squat (SLS) Test - right leg, quantity of times” - 0,941;
- Test 1 “Pull-Up / Chin Up Test (low crossbar), quantity of times” - 0,926.

The above tests describe the development of the dynamic and static strength of the muscles of the feet and hands of girls aged 12 years.

Sixteen factors have been identified among girls aged 13 years, which explain the variation of dispersion by 75.876% (Table 2).

The first factor has a weight of 22.019%. The factor with the greatest correlation is the following:

- Test 13 “Single Leg Squat (Pistol) - right leg” - 0,894;
- Test 14 “Single Leg Squat (Pistol) - left

leg” - 0,855;

- Test 10 “Squats Test (two legs), quantity of times” - 0,824;
- Test 12 “Single Leg Squat (SLS) Test - left leg, quantity of times” - 0,786;
- Test 11 “Single Leg Squat (SLS) Test - right leg, quantity of times” - 0,719.

The factor characterizes the development of the relative and static strength of the leg muscles.

The second factor has a weight of 16.518%. The factor with the greatest correlation is the following:

- Test 3 “Pull-Up / Chin Up Test (Rope Climbing), quantity of times” - 0,838;
- Test 8 “Decline Reverse Crunch on Bench, quantity of times” - 0,824;
- Test 1 “Pull-Up / Chin Up Test (low crossbar), quantity of times” - 0,817.

The factor characterizes the development of muscle

Table 2. Factor structure of motor preparedness of the girls 13 years old. Method: principal component analysis. Rotation method: Varimax with Kaiser Normalization (n = 27)

No	Test	Component						h ²
		1	2	3	4	5	6	
1	Pull-Up / Chin Up Test (low crossbar), quantity of times		,817					,748
2	Bent Arm Hang Test (two hands), sec.	,586				-,547		,683
3	Pull-Up / Chin Up Test (Rope Climbing), quantity of times		,838					,757
4	Cadence Push-Up Test, quantity of times		-,373	-,309	,648			,724
5	The subject lies in prone position, arms bent at the elbow 90 degrees - hold position in seconds		,616	,334				,666
6	Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times			,880				,869
7	Hanging Leg Raises, sec.			,865				,841
8	Decline Reverse Crunch on Bench, quantity of times		,824					,812
9	Trunk Lift Test, quantity of times		,615	,437	-,326			,739
10	Squats Test (two legs), quantity of times	,824						,795
11	Single Leg Squat (SLS) Test - right leg, quantity of times	,719			-,456			,769
12	Single Leg Squat (SLS) Test - left leg, quantity of times	,786						,776
13	Single Leg Squat (Pistol) - right leg	,894						,874
14	Single Leg Squat (Pistol) - left leg	,855						,778
15	Handgrip Strength Test, kg	-,308				-,676		,643
16	Standing Long Jump Test (Broad Jump), cm	,467		,507			,512	,798
17	Eurofit Sit Up Test (for 30 sec.), quantity of times				,790			,738
18	4x9 m shuttle test, sec.		-,348		-,370	,572		,758
19	Hand tapping test, sec.						,857	,812
20	Seated Forward Bend, cm			,599		,566		,756
21	Flamingo Balance test - single leg balance test	,643						,598
	% dispersion	22,019	16,518	14,428	8,760	7,688	6,464	75,876

strength of the shoulder girdle.

The third factor has a weight of 14,428%. The factor with the greatest correlation is the following:

- Test 6 “Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times” – 0,880;
- Test 7 “Hanging Leg Raises, sec.” – 0,865;
- Test 20 “Seated Forward Bend, cm” – 0,599.

The factor characterizes the development of the strength of the muscles of the abdomen.

The fourth factor has a weight of 8,760%. The factor with the greatest correlation is the following:

- Test 17 “Eurofit Sit Up Test (for 30 sec.), quantity of times” – 0,790;
- Test 4 “Cadence Push-Up Test, quantity of times” – 0,648;
- Test 11 “Single Leg Squat (SLS) Test - right leg, quantity of times” - -0,456.

The factor characterizes the complex development of

force.

The fifth factor has a weight of 7,688%. The factor with the greatest correlation is the following:

- Test 15 “Handgrip Strength Test, kg” – -0,676;
- Test 18 “4x9 m shuttle test, sec.” – 0,572;
- Test 21 “Flamingo Balance test - single leg balance test” – -0,703;
- Test 20 “Seated Forward Bend, cm” – 0,566.

The factor characterizes the complex development of motor abilities on the system of tests “Eurofit”.

The sixth factor has a weight of 6,464%. The factor with the greatest correlation is the following:

- Test 19 “Hand tapping test, sec.” – 0,857.
- Test 16 “Standing Long Jump Test (Broad Jump), cm” - 0,512;

The factor characterizes the development of velocity force.

The analysis of communities shows that the most

Table 3. Factor structure of motor preparedness of the girls 14 years old. Method: principal component analysis. Rotation method: Varimax with Kaiser Normalization (n = 30)

No	Test	Component							h ²
		1	2	3	4	5	6	7	
1	Pull-Up / Chin Up Test (low crossbar), quantity of times		,794				,425		,862
2	Bent Arm Hang Test (two hands), sec.					-,302		,863	,864
3	Pull-Up / Chin Up Test (Rope Climbing), quantity of times				-,500	-,353	,611		,860
4	Cadence Push-Up Test, quantity of times				,504			-,420	,779
5	The subject lies in prone position, arms bent at the elbow 90 degrees - hold position in seconds					,870			,828
6	Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times		,753						,788
7	Hanging Leg Raises, sec.		,826						,800
8	Decline Reverse Crunch on Bench, quantity of times		,821						,778
9	Trunk Lift Test, quantity of times		,461	,335		,552			,668
10	Squats Test (two legs), quantity of times	,731							,627
11	Single Leg Squat (SLS) Test - right leg, quantity of times	,908							,887
12	Single Leg Squat (SLS) Test - left leg, quantity of times	,911							,866
13	Single Leg Squat (Pistol) - right leg	,896							,913
14	Single Leg Squat (Pistol) - left leg	,889							,879
15	Handgrip Strength Test, kg				,867				,842
16	Standing Long Jump Test (Broad Jump), cm			,878					,833
17	Eurofit Sit Up Test (for 30 sec.), quantity of times	,389		,360	-,455			,331	,673
18	4x9 m shuttle test, sec.			-,832					,774
19	Hand tapping test, sec.		,631		,402			-,343	,774
20	Seated Forward Bend, cm						-,829		,710
21	Flamingo Balance test - single leg balance test		-,485			,362		,495	,700
	% dispersion	19,467	17,126	9,829	8,772	8,497	8,364	7,490	79,544

informative in the structure of motor preparedness girls aged 13 years are the following:

- Test 13 “Single Leg Squat (Pistol) - right leg” – 0,874;
- Test 6 “Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times” – 0,869;
- Test 7 “Hanging Leg Raises, sec.” – 0,841;
- Test 19 “Hand tapping test, sec.” – 0,812;
- Test 16 “Standing Long Jump Test (Broad Jump), cm” – 0,798.

The tests described characterize the development of static, high-speed strength of leg muscles, static and dynamic strength of muscles of the abdomen and hands in girls 13 years.

Seven factors have been identified in girls for 14 years, which explain the variance of variance by 79.544%.

The first factor has a weight of 19.467%. The factor with the greatest correlation is the following:

- Test 12 “Single Leg Squat (SLS) Test - left leg, quantity of times” - 0,911;
- Test 11 “Single Leg Squat (SLS) Test - right leg, quantity of times” - 0,908;
- Test 13 “Single Leg Squat (Pistol) - right leg” – 0,896;
- Test 14 “Single Leg Squat (Pistol) - left leg” - 0,889.

The factor characterizes the development of the relative and static strength of the leg muscles.

The second factor is 17.126%. The factor with the greatest correlation is the following:

- Test 7 “Hanging Leg Raises, sec.” - 0,826;
- Test 8 “Decline Reverse Crunch on Bench, quantity of times” - 0,821;

- Test 1 “Pull-Up / Chin Up Test (low crossbar), quantity of times” - 0,794;
- Test 6 “Pull Up Bar- Straight Leg Hanging Leg Raises, quantity of times” – 0,753.

The factor characterizes the development of the dynamic and static strength of the abdominal muscles and the dynamic force of muscles of the shoulder girdle.

The third factor has a weight of 9.829%. The factor with the greatest correlation is the following:

- Test 16 “Standing Long Jump Test (Broad Jump), cm” – 0,878;
- Test 18 “4x9 m shuttle test, sec.” – -0,832.

The factor characterizes speed-power and coordination readiness.

The fourth factor is weighing 8,772%. The factor with the greatest correlation is the following:

- Test 15 “Handgrip Strength Test, kg” – 0,867;
- Test 4 “Cadence Push-Up Test, quantity of times” – 0,504;
- Test 3 “Pull-Up / Chin Up Test (Rope Climbing), quantity of times” - -0,500.

The factor characterizes the development of the strength of the brush and the relative strength of the muscles of the shoulder girdle.

The fifth factor has a weight of 8,497%. The factor with the greatest correlation is the following:

- Test 5 “The subject lies in prone position, arms bent at the elbow 90 degrees – hold position in seconds” – 0,870;
- Test 9 “Trunk Lift Test, quantity of times” – 0,552.

The factor characterizes the development of the static muscle strength of the shoulder girdle and the dynamic strength of the back muscles.

The sixth factor has a weight of 8,364%. The factor with the greatest correlation is the following:

- Test 20 “Seated Forward Bend, cm” – -0,829;
- Test 3 “Pull-Up / Chin Up Test (Rope Climbing), quantity of times” - 0,611;
- Test 1 “Pull-Up / Chin Up Test (low crossbar), quantity of times” - 0,425.

The factor characterizes the development of flexibility and dynamic strength of muscles of the shoulder girdle.

The seventh factor has a weight of 7.490%. The factor with the greatest correlation is the following:

- Test 2 “Bent Arm Hang Test (two hands), sec.” – 0,863;
- Test 21 “Flamingo Balance test - single leg balance test” - 0,495;
- Test 4 “Cadence Push-Up Test, quantity of times” - -0,420.

The factor characterizes the development of static and dynamic muscle strength of the shoulder girdle and coordination abilities.

The analysis of communities shows that the most informative in the structure of motor readiness of girls aged 14 years are the following:

- Test 13 “Single Leg Squat (Pistol) - right leg” – 0,913;
- Test 11 “Single Leg Squat (SLS) Test - right leg, quantity of times” – 0,887;

- Test 14 “Single Leg Squat (Pistol) - left leg” – 0,879;
- Test 12 “Single Leg Squat (SLS) Test - left leg, quantity of times” – 0,866;
- Test 2 “Bent Arm Hang Test (two hands), sec.” – 0,864;
- Test 1 “Pull-Up / Chin Up Test (low crossbar), quantity of times” – 0,862;
- Test 3 “Pull-Up / Chin Up Test (Rope Climbing), quantity of times” – 0,860.

The above presented tests describe the development of static and dynamic strength of the leg muscles, the dynamic strength of the muscle of the hands of girls aged 14 years.

Discussion

The presented results indicate that the power abilities have structural features of development in girls of 12-14 years old. It was found that girls have the greatest weight in the development with relative and static strength of leg muscles (22,036%, 22,019%, 19,467% respectively). In girls of 12-13 years old in the second place the development of muscle strength shoulder girdle (15.264%, 16.518% respectively). In girls aged 14 years in second place, the development of dynamic and static strength of abdominal muscles and dynamic muscle strength of the shoulder girdle (17.126%). In girls aged 12 years in third place, the development of coordination of movements, the static strength of the shoulder girdle and the dynamic strength of the muscles of the back (14,142%). In girls aged 13 years in the third place the development of muscle strength of the abdomen (14,428%), girls aged 14 years – speed and coordination of movements (9,829%).

It is confirmed that multidimensional methods of mathematical statistics are effective for the study of the strength training structure of girls aged 12-14 years: factor and discriminant analysis [7, 20]. It is added that the use of factor analysis allows to determine the structure of the development of power abilities and their interrelation with endurance in girls aged 12-14 years [21, 22].

The obtained results characterize the peculiarities of the dynamics of force readiness of middle classes girls and complement the data of Veremeenko [24], Ivashchenko et al. [25] on the regularities of motor preparedness of children and adolescents. The authors recognize that with age, the weight of high-speed force and coordination of movements in the structure of motor-preparedness of girls increases. Our results complement the data on the development of coordination of movements in adolescents [14, 26].

On the basis of the analysis of communities it is determined that the most informative in girls aged 12-14 years are the following tests: which characterize the development of dynamic and static strength of muscles of the legs and hands (girls 12 years old); which characterize the development of static, high-speed strength of leg muscles, static and dynamic strength of the muscles of the abdomen and hands (girls 13 years old); which characterize the development of the static and dynamic strength of leg muscles, the dynamic strength of the muscle of the hands

(girls 14 years old). These results supplement the data of other authors [22, 25] on pedagogical control in the physical education of schoolchildren.

The results obtained can be applied in the process of planning force training of girls 12-14 years old. The structure of force's preparedness of girls points to the need for a comprehensive development of power abilities. Attention is paid to the development of the static and dynamic strength of the leg muscles. The most informative tests can be used to control girls' preparedness.

Consequently, the problem of development of power abilities is considered from the point of view of age dynamics [22] and the planning of work force in training sessions [27, 28]. The discussion of data is carried out from the standpoint of the purpose of the analysis [29]. Disclaimers and methodological approaches to the purpose of the analysis are set out in the work of Fisher [30].

Further investigations require the study of patterns of development and the relationship between strength and endurance of muscles among boys of middle school age.

Conclusions

Factor analysis allowed to determine informative indicators for controlling the development of power

abilities in girls of 12-14 years old. The greatest weight in power preparedness has the relative and static strength of the leg muscles. In the second place, girls of 12-13 years old have the development of muscle strength shoulder girdle. 14 years old girls in second place, have the development of dynamic and static strength of the abdominal muscles and the dynamic strength of muscles of the shoulder girdle. Girls of 12 years old in third place have the development of coordination of movements, the static strength of the shoulder girdle and the dynamic strength of the back muscles. Girls of 13 years in the third place have development of the development of muscle strength of the abdomen. Girls of 14 years in third place have development of high-speed force and coordination of movements.

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Conflict of Interest

The authors state that there is no conflict of interest.

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A comparison of isocapnic buffering phase of cross-country skiers and alpine skiers

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Abstract

Purpose: The purpose of this study was to compare the isocapnic buffering phase in cross-country skiers and alpine skiers during an incremental treadmill exercise test.

Material: International level male junior skiers including twelve cross-country skiers and ten alpine skiers took part in the study. All participants performed an incremental treadmill exercise test to determine ventilatory threshold (VT), respiratory compensation point (RCP), and maximal oxygen uptake (VO_{2max}). The isocapnic buffering phase was calculated as the difference in VO_2 (ICB_{VO_2}) and running speed (ICB_{SPEED}) between RCP and VT and expressed in either absolute or relative values.

Results: VO_{2max} , maximal running speed, time to exhaustion, both absolute and relative VT values and absolute RCP values were higher in the cross-country skiers than in the alpine skiers ($P < 0.05$), whereas relative RCP showed similar values in both group ($p > 0.05$). Absolute ICB_{VO_2} and ICB_{SPEED} showed similar values in both group ($p > 0.05$), whereas relative ICB_{VO_2} and ICB_{SPEED} were found to be significantly higher in alpine skiers than in cross-country skiers ($P < 0.05$). Maximal respiratory exchange ratio was higher in alpine skiers than in cross-country skiers.

Conclusions: The current findings suggest that anaerobic training may induces specific metabolic adaptations leading to increase in buffering capacity which may be a contributing factor to continue to exercise for relatively longer periods of time above the VT. Longer ICB phase in the anaerobic-trained athletes may an important factor in relation to the enhance high-intensity exercise tolerance.

Keywords: buffering capacity, maximal oxygen uptake, ventilatory threshold, respiratory compensation point, training.

Introduction

The ventilatory threshold and respiratory compensation point have been widely used to monitor the training status and prepare the training programs in the endurance athletes [1]. During incremental exercise, anaerobic threshold (AT) can be estimated from non-invasive gas exchange measurements alternative to the measurements of blood lactate concentration (lactate threshold), in this case referred to as the ventilatory threshold (VT) [2, 3]. VT corresponds to the nonlinear increase in carbon dioxide production and ventilation due to the bicarbonate buffering of hydrogen ions (H^+) in response to the systematic increase of blood lactate above resting values [3]. When H^+ can no longer be compensated by circulating bicarbonate leads to a decrease in blood pH and stimulates the carotid bodies to increase ventilatory drive results in hyperventilation [3]. This additional ventilatory response is called the respiratory compensation point (RCP) [4]. The region between AT and RCP is defined as isocapnic buffering (ICB) phase and represent a phase of compensation for the exercise induced metabolic acidosis [5]. The region between RCP and the end of exercise is defined as the phase of hypocapnic hyperventilation (HHV) [6, 7].

The length of the ICB phase may be related to buffering capacity, lactate kinetics as well as the sensitivity of the carotid bodies to exercise induced metabolic acidosis [5,

8, 9, 10]. Some researchers suggested that the ICB phase contribute to the aerobic capacity in athletes [7, 11]. On the other hand, according to some researchers, the ICB is not related to endurance performance [12]. Recently it has been shown that the relative ICB phase can be useful for predict both the aerobic and anaerobic capacity in the athletes [8].

The observation of the ICB phase during incremental exercise testing may provide useful information on the non-invasive estimation of buffering capacity. The length of the ICB phase among athletes from different sports may vary depending on their training regime [8, 11, 13]. A few studies have compared the ICB phase between aerobic and anaerobic trained athletes. These studies have been shown that the greater lactate increase during ICB phase in anaerobic-trained athletes than in endurance-trained athletes [8, 11, 13]. However, to our knowledge, no investigation has attempted to compare the VO_2 during ICB phase between anaerobic-trained athletes and endurance-trained athletes.

A cross-country skiing competition often lasts for 10 to 120 minutes, which requires skiers to have a high aerobic capacity [14]. Aerobic endurance training has always been the major component of training program in cross-country skiing [1, 15, 16]. On the other hand, anaerobic power is the best predictor of performance during alpine ski races lasting between 45 s and 3 min [17]. Traditionally, alpine skiers are trained with anaerobic exercises such as resistance training, speed, change of

direction and plyometric training [18, 19]. Measurements of athletes' ICB phase values can help to understanding the physiological adaptations in response to physical training. To our knowledge, no studies examining the ICB phase of cross-country skiers and alpine skiers. The purpose of this study was to compare the ICB phase in cross-country skiers and alpine skiers during an incremental treadmill exercise test.

Material and methods

Participants

International level twenty-two male junior skiers including twelve cross-country skiers and ten alpine skiers from the Turkey national team took part in the study. The demographic characteristics of cross-country and alpine skiers are given in Table 1. Erciyes University Medical Faculty Ethics Committee approved the study (217/554). All testing procedures were fully explained, and written informed consent was obtained for each subject. All measurements took place at the High Altitude and Sports Science Research and Implementation Center at Erciyes University.

Table 1. The physical characteristics of the alpine skiers and cross-country skiers (Mean ± SD).

	Alpine skiers	Cross country skiers	p	d
Age (year)	17.4 ± 2.4	16.8 ± 1.8	0.54	0.3
Height (cm)	175.6 ± 3.7	168.7 ± 5.6*	0.004	1.5
Body Mass (kg)	67.3 ± 9.1	59.6 ± 5.6*	0.02	1.09

Incremental treadmill test

Maximal oxygen uptake (VO_{2max}), VT and RCP were determined from a progressive intensity and continuous effort treadmill protocol. All tests were performed on a motorized treadmill (h/p/Cosmos Quasar med, Nussdorf-Traunstein, Germany). Oxygen uptake (VO_2), carbon dioxide output (VCO_2) and minute ventilation (VE) were measured online using a breath-by-breath cardiopulmonary exercise testing system (Quark PFT Ergo, CosmedSrl, Rome, Italy). Before each test, ambient conditions were measured and the gas analyzers and turbine flowmeter were calibrated with known certified gas concentrations (16 % O_2 , 5 % CO_2 , and balance N_2) and a 3 L calibration syringe, respectively, following the manufacturer's instructions.

Breath-by-breath VO_2 was smoothed using a five-step average filter and then reduced to 15 s stationary averages for the incremental test to reduce the noise so as to enhance the underlying characteristics. To make sure the athletes were properly warmed up, prepared, and accustomed to the treadmill, each athletes had to warm up for 6 min at their own pace. Then the athletes were

allowed to stop and stretch for about 3 min. Following the warm-up, athletes started running at 7 km/h with speed increments of 1 km/h (at constant 5% incline) every minute until they could no longer keep pace. The athletes were instructed to run until voluntary exhaustion, and given strong verbal encouragement throughout the test to elicit their best performance.

The VO_{2max} was defined as the highest 15 s VO_2 value reached during the incremental test. Achievement of VO_{2max} was considered as the attainment of at least two of the following criteria: 1) a plateau in VO_2 despite increasing speed, 2) a respiratory exchange ratio (VCO_2/VO_2) above 1.10, and 3) a HR (heart rate) within 10 beats per minute of age-predicted maximum HR (220 – age). The VO_{2max} value was expressed as a relative value (milliliters per minute per body mass; $ml\ kg^{-1}\ min^{-1}$). Time to exhaustion was recorded as the time from the start of the run until the point of exhaustion (the time at which the subject could no longer maintain the pace of the treadmill). Maximal respiratory exchange ratio (RER_{max}) was express as the highest 15 s average value obtained during the last stage of the incremental exercise test.

Determination of ventilatory threshold and respiratory compensation point

The VT and RCP were determined using the V-slope method described by Beaver et al. [2]. The VT and RCP were defined as the VO_2 value corresponding to the intersection of two linear regression lines derived separately from the data points below and above the breakpoint in the VCO_2 versus VO_2 , and VE versus VCO_2 relationships, respectively (Figure 1). Additionally, to increase the accuracy of the identification of VT and RCP, a visual identification technique was used as described below. VT was determined using the criteria of an increase in VE/VO_2 with no increase in VE/VCO_2 and an increase in end-tidal O_2 pressure with no fall in end-tidal CO_2 pressure, whereas RCP corresponded to an increase in VE/VCO_2 and decrease in end-tidal CO_2 pressure. To reduce the variability connected with the identification of VT and RCP, analyses were performed by two independent investigators. Each of the following variables was recorded at both the VT and the RC; running speed ($km\ h^{-1}$), VO_2 ($ml\ kg^{-1}\ min^{-1}$) and VO_2 as a percentage of VO_{2max} ($\%VO_{2max}$). Linear regression analyses were performed by using the Sigma Plot program (Sigma Plot 12.0, Systat Software Inc., Chicago, USA).

Determination of isocapnic buffering and hypocapnic hyperventilation phases

ICB phase was calculated as the difference in VO_2 (ICB_{VO_2}) and running speed (ICB_{SPEED}) between RCP and VT [20], and expressed in either absolute or relative values (expressed as a percentage of RCP previously described by Röcker et al.) [13]. HHV phase was calculated as the difference in VO_2 (HHV_{VO_2}) and running speed (HHV_{SPEED}) between the end of exercise and RCP [20], and expressed in either absolute or relative values (expressed as a percentage of VO_{2max} and maximal running speed).

Statistical analyses

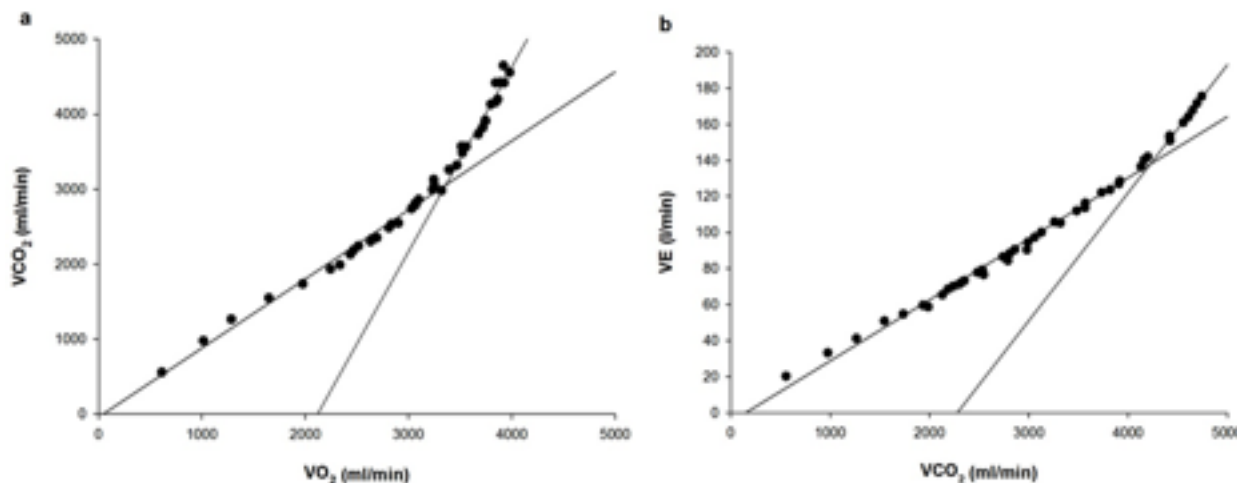


Figure 1. Examples showing methods of determining the ventilatory threshold (a) and the respiratory compensation point (b) in one subject.

Data are reported as means \pm standard deviation (SD). Statistical significance was accepted at $p < 0.05$. The normality of the data was examined by assessing the Shapiro-Wilk test on all measured variables. Ages, Speed_{max}, VT_{SPEED}, VT_{VO2}, absolute ICB_{SPEED} and absolute HHV_{SPEED} data were not normally distributed and so comparisons between the groups were made using the Whitney-U test. As the other data showed normal distribution, the differences in measures between groups were evaluated by unpaired t-test. To allow a better interpretation of the results, effect sizes were also calculated using Cohen's d [21]. Effect sizes were interpreted as negligible ($d \geq 0.2$), small ($0.2 \leq d \leq 0.5$), medium ($0.5 \leq d \leq 0.8$) or large ($0.8 \geq d$). IBM SPSS 21 software (IBM SPSS Statistics 21 Inc. Chicago, IL) was used for the statistical analysis.

Results

There was no significant difference between the two groups for age ($p > 0.05$), while a significant difference was found for height and body mass ($p < 0.05$). VO_{2max}, maximal running speed, time to exhaustion, VO₂ at VT and RCP, running speed at VT and RCP were higher in the cross-country skiers than in the alpine skiers ($p < 0.001$). There were no significant differences between the two groups in HR_{max}, HR at VT and RCP. RER_{max} was higher in alpine skiers than in cross-country skiers ($p < 0.05$).

The VT expressed as % VO_{2max} and maximal running speed were significantly higher in the cross-country skiers than in alpine skiers ($P < 0.05$), whereas RCP expressed as % VO_{2max} and maximal running speed showed similar values in both groups ($p > 0.05$). Absolute ICB_{VO2} and ICB_{SPEED} showed similar values in both group ($p > 0.05$), whereas relative ICB_{VO2} and ICB_{SPEED} were found to be significantly higher in alpine skiers than in cross-country skiers ($P < 0.05$). There were no significant differences between the two groups in the relative HHV_{VO2}, and absolute and relative HHV_{SPEED} ($p > 0.05$), while absolute HHV_{VO2} were higher in the cross-country skiers than in the alpine skiers ($P < 0.05$).

Discussion

This study compared ICB phase between cross-country skiers and alpine skiers. The results of this study indicated that VO_{2max}, maximal running speed, time to exhaustion, both absolute and relative VT values (expressed as VO₂ and running speed) were higher in the cross-country skiers than in the alpine skiers, reflecting the cross-country skiers have higher aerobic capacity. On the other hand, relative ICB phase values were higher in alpine skiers than in cross-country skiers. Our findings suggest that anaerobic training stimulus in alpine skiers may have enhanced the ICB phase which may be attributable to improve of the buffering capacity contributing factor to continue to exercise for relatively longer periods of time above the VT.

Because published literature is sparse, the current study compared ICB phase of anaerobic trained athletes and aerobic trained athletes. To our knowledge, only three studies have compared the ICB phase between aerobic and anaerobic trained athletes. Our findings were consistent with those of Röcker et al. reported that the ICB phase which the difference between the running speed at LT and at RCP expressed as a percentage of RCP was higher in elite 400-m runners than in aerobic trained group [13]. On the other hand, in their study, VO_{2max} and maximal running speed did not differ between 400-m runners and aerobic trained group. Similarly, Hasanli et al. found that although the relative lactate changes during ICB phase was higher in sprint-trained cyclists than in endurance-trained cyclists, no significant differences in VO_{2max} between the two groups [8]. Our study can be considered to be an appropriate model for the investigation of ICB phase in anaerobic and aerobic trained athletes.

It has been demonstrated that the longer ICB phase in trained subjects was associated with RCP occurring at higher intensities of exercise [22]. In our study, relative RCP values were no significant difference between in alpine skiers and cross-country skiers. Therefore, the longer ICB phase in the alpine skiers may be attributable to the lower relative VT. The alpine skiers were able

Table 2. Physiological variables corresponding to the ventilator threshold, respiratory compensation point, maximal values, isocapnic buffering and hypocapnic hyperventilation phases of the alpine skiers and cross-country skiers.

Variables	Alpine skiers	Cross country skiers	p	d
Ventilatory threshold				
VO ₂	41.6 ± 5.7	55.5 ± 3*	0.001	3.3
% VO _{2max}	79.5 ± 4.5	83.3 ± 3.1*	0.03	1.05
% Speed _{max}	66.4 ± 3.9	72.5 ± 4.8*	0.005	1.45
Speed (km h ⁻¹)	9.5 ± 0.7	12.2 ± 0.6*	0.001	4.38
HR (beat min ⁻¹)	173.6 ± 17.4	178.4 ± 12.3	0.48	0,34
Respiratory compensation point				
VO ₂	49.3 ± 5.7	62.1 ± 3.4*	0.001	2.7
% VO _{2max}	94.4 ± 2.3	93.1 ± 1.8	0.8	0.67
% Speed _{max}	85.3 ± 3.6	85.8 ± 4.8	0.16	0.12
Speed	12.2 ± 0.6	14.5 ± 0.6*	0.001	4.02
HR	188.6 ± 13	194.1 ± 9.4	0.29	0,52
Maximal				
VO _{2max}	52.2 ± 5.5	66.7 ± 3.9 *	0.001	3.24
Speed _{max}	14.3 ± 0.6	16.9 ± 0.6*	0.001	5.24
Time to ex	7.6 ± 0.6	10.2 ± 0.6*	0.001	4.54
RER _{max}	1.2 ± 0.03	1.1 ± 0.03*	0.04	3.5
HR _{max}	211.3 ± 14.9	208.8 ± 17.7	0.74	0.16
Isocapnic buffering phase				
Abs VO ₂	7.7 ± 1.4	6.5 ± 1.6	0.09	0.83
Rel VO ₂	15.8 ± 3.2	10.5 ± 2.3*	0.001	2.03
Abs Speed	2.7 ± 0.6	2.2 ± 0.6	0.06	0.87
Rel speed	22 ± 5	15.4 ± 3.7*	0.002	1.6
Hypocapnic hyperventilation phase				
Abs VO ₂	2.8 ± 1.2	4.5 ± 1.3*	0.005	1.2
Rel VO ₂	5.5 ± 2.3	6.8 ± 1.8	0.16	0.67
Abs Speed	2.1 ± 0.5	2.4 ± 0.9	0.44	0.42
Rel Speed	14.6 ± 3.6	14.1 ± 4.8	0.8	0.12

Values are mean ± standard deviation. VO₂ and running speed are expressed in ml kg min⁻¹ and km h⁻¹, respectively. * Significantly different from alpine skiers. Maximal = maximal values of physiological variables, Time to ex= Time to exhaustion (min), VO_{2max} = maximal oxygen uptake, RER_{max} = maximal respiratory exchange ratio, Abs= absolute, Rel = relative, Speed_{max} = maximal running speed.

to continue to exercise for relatively longer periods of time above the VT during the incremental treadmill test. Increase buffer capacities in the anaerobic-trained athletes may be a contributing factor to enhance anaerobic performance capacities [23].

VO_{2max} together with VT are the most important physiological variables used in the evaluation of aerobic endurance [24]. Therefore, it is expected that the VT values are high in the cross-country skiers. Different the physiological adaptations are provided depending on the intensity and duration of the training program. Traditionally, cross country skiers are trained at intensities below the VT in most of their training sessions [1]. It has been suggested that lower intensity training at slightly below AT induces mainly central adaptations, which provide the increase of AT, such as improvements in pulmonary diffusion, hemoglobin affinity and cardiac output [25]. Another possible explanation for high VT

values of the cross-country skiers (vs. alpine skiers) may be related to genetic makeup of this group. The percentage slow-twitch muscle fiber and the respiratory capacity of muscle may play an important role in determining the relative AT [26]. Ivy et al., reported a strong positive correlation between the lactate threshold (LT) values and the percentage slow-twitch muscle fiber and muscle's respiratory capacity [26].

Probably depending on differences in the metabolic pathways used during training sessions, AT, RCP and consequently the ICB phase varies between aerobic and anaerobic trained athletes. According to some researchers, intense training sessions involving anaerobic metabolism improves the buffering capacity leading to a shift in RCP towards higher intensities, and consequently extending the ICB phase [6]. On the other hand, training sessions involving aerobic metabolism may induces a similar shift in both VT and RCP [6]. Therefore, it appears that effect

of the high intensity training sessions on RCP may greater than AT. Alpine ski training stimulates the predominantly anaerobic energy pathways [18]. A large accumulation of lactate and H^+ during high intensity exercise may provide an important stimulus for adaptations of the muscle pH regulating systems [27]. This is supported by increases in muscle buffer capacity in response to high-intensity interval training [28]. In addition, sprint training has been reported to increase the muscle buffer capacity, whereas endurance training had no effect [29]. The current findings suggest that anaerobic training stimulus in alpine skiers may have been improved the buffering capacity leading to a shift in RCP without change in VT, and consequently enhancing the ICB phase.

Another possible explanation for longer ICB phase of alpine skiers may be related to the percentage of fast-twitch muscle fibers. Fast-twitch muscle fibers may have a higher buffering capacity than the slow-twitch muscle fibers [30]. Previous studies significant relationships were observed between muscle buffering capacity and percentage of fast-twitch muscle fibers in mixed group of untrained, sprint and endurance trained athletes [30, 31]. The increased in buffer capacity after training has been attributed to an increased the concentration of carnosine which is mainly present in fast-twitch muscle fibers [31]. It has been shown that the greater muscle buffering capacity in anaerobic-trained athletes than in endurance athletes [32]. During the ICB phase, more H^+ has been reported buffered by the non-bicarbonate buffer system in sprint-trained cyclists than in endurance cyclists [8].

Higher RER_{max} values recorded despite shorter running time to exhaustion in alpine skiers than in cross-country skiers. Although we could not directly measure blood lactate levels, higher RER_{max} values in alpine skiers may reflect a greater accumulation of lactate than cross-country skiers [33]. It has been demonstrated that increase in lactate during the ICB phase was higher in anaerobic trained athletes than in aerobic trained athletes

[8, 11, 13]. In addition, negative relationships reported between the relative lactate changes during ICB phase and aerobic fitness (VO_2 at LT, and VO_{2max}) [8, 11]. This may be indicates that different physiological adaptations have developed to the physical training depending on the contribution of the aerobic or anaerobic energy production. The major metabolic results of the adaptations of muscle to endurance exercise training are less lactate production during exercise of a given intensity [34]. On the other hand, it has been shown that the anaerobic training led to a greater accumulation of lactate both in the muscle and blood during exhaustive exercise [29, 35]. These higher lactate concentrations after anaerobic training may be explained by the increase of the muscle buffer capacity and glycolytic enzymes [29, 35].

Conclusions

Relative VT values were found to be significantly higher in cross-country skiers than in alpine skiers, while relative RCP values were similar in both groups. Therefore, the longer ICB phase in the alpine skiers may be attributable to the lower relative VT. The current findings suggest that anaerobic training may induces specific metabolic adaptations leading to increase in buffering capacity which may be a contributing factor to continue to exercise for relatively longer periods of time above the VT. It can be suggested that longer ICB phase in the anaerobic-trained athletes may an important factor in relation to the enhance high-intensity exercise tolerance.

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Conflicts of interest

The authors have no conflicts of interest relevant to this study.

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Peculiarities of aqua fitness exercises influence on the physical preparedness of women 30-49 years old using endogenous-hypoxic breathing method

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Abstract

Purpose: To establish the complex influence of aqua fitness exercises and endogenous-hypoxic breathing techniques on the physical preparedness of women 30-49 years old.

Material: The study involved 41 women who had no previous experience of systematic physical education. 2 groups were formed: MG1 (n = 20, age 30-36 years old); MG2 (n = 210, age 37-49 years old). The experiment lasted for 24 weeks. At classes, aqua fitness was applied to the method of endogenous-hypoxic respiration. At the various stages of the study (8, 16 and 24 weeks) it was examined physical preparedness of women. Frequency of classes was 3 times a week.

Results: Indicated in the need for dosage loading, taking into account the age factor and the level of physical and functional preparedness of women. It was established that classes contribute to improvement: explosive force; active flexibility of the spine; force dynamic endurance of the muscles of the lower extremities; speed-strength endurance of muscles of the abdominal press; power static endurance of muscles of the back, neck and buttock muscles; overall endurance.

Conclusions: Aqua fitness exercises together with the endogenous-hypoxic respiration method contribute to the improvement of the physical fitness of mature women. For women of 30-36 years old, improvements in physical fitness were reported earlier compared with older women.

Keywords: aqua fitness, physical qualities, physical fitness, women, mature age.

Introduction

Each age period of a person depending on sex is characterized by a specific alteration of the body [1]. In the body of women after 30 years, there are changes that are reflected in a decrease in the level of functional capabilities, indicators of physical development [2], the ability to exhibit physical qualities [3].

For women from 30 years of age, it is advisable to use physical education, which improves physical condition. This can be done through the following: stimulating aerobic energy supply processes [4]; increase in the energy cost of physical work [5, 6]; reduction of gravitational influence on cartilage formation of joints [7]; quenching the body [8, 9]. Such remedies include aqua fitness. Aqua fitness is characterized by a wide range of activities: health [10]; recreational [11]; conditioner [12]; educational and sports-oriented orientation [13]. There are a number of scientific papers on the methodology of using aqua fitness in the health-training process of different groups of the population. The authors found that:

- Aqua Power aerobics can be recommended for middle-aged females for the treatment of overweight and in the process of cardiopulmonary fitness improvement [14];
- Swimming, aqua-fitness, cycling and (Nordic)

walking are favourable sport disciplines for patients after laryngectomy for laryngeal cancer [15];

- Aqua walking appears to be a feasible alternative exercise modality to over-ground walking for cardiac rehabilitation and can be recommended for older adults with coronary artery disease and osteoarthritis [16];
- Aerobic activity in water seems to have had better effects on the mood state and on the physical efficiency than a comparable activity carried out in a gym. The aqua fitness programs are therefore highly recommendable as a sport for elderly women [17].

However, guidelines for the use of this remedy for workouts with women of 30-49 years old need to be completed.

In the practice of physical education, certain means are used that enhance the effectiveness of the health effect of physical exercises [18]. Specialists recommend to use method of creating in an organism the state of hypoxia. For this purpose it is used "Endogenic-01" [19]. The results of researches testify to successful application of the method of endogenous-hypoxic respiration (EHD) in a complex with physical exercises. The effectiveness of this application is proved by the improvement of the functional state of hockey players [20], swimmers [21], patients with asthma students [22]. The authors note that:

- Water-based exercise is a training modality capable of enhancing cognitive function and quality of life through improved mental health in healthy adult women [23];

- Aging is accompanied by a decrease in aerobic capacity. Therefore, physical training has been recommended to soften the effects of advancing age [24];

- Both localized gymnastics and water aerobics can promote significant improvements in flexibility, balance and functional autonomy in elderly women after 12 weeks of training [25];

- Both water-based training (aerobic and combined) are effective in improving functional capacity and QoL perception of elderly women [26].

Other studies [2] have proved the effectiveness of complex application of aqua fitness and endogenous-hypoxic respiration techniques when working with mature women. The results of researches are confirmed by improvement of their functional readiness [12].

Hypothesis. We predicted that the complex application of aqua fitness training and EHD techniques with women of 30-49 years old would increase their physical fitness.

The aim of the study: to establish the complex influence of aqua fitness training and endogenous-hypoxic breathing techniques on the physical fitness of 37-49 years old women.

Materials and methods.

Participants. The experiment was attended by women of 30-49 years old ($n = 41$) who had no previous experience of systematic physical education. Two groups were formed – the first main (MG1, $n = 20$, age – 30-36 years old) and the second main (MG2, $n = 21$, age – 37-49 years old).

Organization of research. Physical fitness was studied using tests that characterize the following physical qualities: speed; explosive force; agility; force dynamic endurance muscles of the shoulder girdle; force dynamic endurance of the muscles of the lower extremities; speed-strength endurance of muscles of the abdominal press; power static endurance of muscles of the back, neck and gluteal muscles; active flexibility of the spine; general endurance.

The speed was determined on the basis of the test, “running at 30 m from a high start”, an explosive force – “jump in length from place”, agility – “shuttle running 4×9 m with the transfer of cubes”. Force dynamic endurance of muscles of the shoulder girdle was determined by the number of flexions-extensions of the hands from the gymnastic bench. According to the index of flexion-extension of the legs (the woman holds her hand behind the chair) evaluated the force dynamic endurance of muscles of the lower extremities. The speed-strength endurance of the muscles of the abdominal press was determined by the number of flexion-extensions of the legs: the woman lays on the back of the gymnastic bench; maximum tempo, duration of exercise – 15 seconds. Strength of static endurance of muscles of the back and neck was estimated by the duration of maximum lifting

above the couch of straight arms and legs (arms and legs slightly dilated, a woman lying on her stomach). Strength of static endurance of the spinal muscles was estimated by the length of holding the posture: the woman is on the abdomen, her legs are bent in the knee joints at an angle of 45°, the legs are raised as much as possible above the couch and diluted by 10°. Active flexibility of the spine was determined by the inclination of the trunk ahead: the woman is on the stairs, the height of the swamp – 30 cm. Overall endurance was estimated by the result of a 12-minute freestyle swimming test.

The research was carried out in stages: before the experiment began, and then in 8, 16 and 24 weeks later.

Frequency of classes was 3 times a week. In the process of training were used such aids as waterbaths, gloves, small and large dumbbells, nudls, boots, rubber shock absorbers, swimming boards [27]. The loading was dosed taking into account the age factor and level of physical and functional preparedness of women. Such dosage prevents the risk of negative effects of physical exercise in water on the body of women. The peculiarity of aqua fitness programs is the rational and systematic use of artificially created hypoxia and hypercapnia with the help of the apparatus “Endogenic-01”. This technique was used at the beginning of each training session for 24 weeks in accordance with the route maps [19].

Statistical analysis. Summarizing numerical indices were presented that reflect the position of the center of empirical distributions and their scattering: arithmetic mean (\bar{x}); mean arithmetic mean error (m); mean square (standard) deviation (S); dispersion (S^2); coefficient of variation (V).

The values of the sample from the general population were subject to the law of normal distribution, which was verified using Pearson’s criterion. In order to determine the validity of the difference between the mean values it was used Student t-criterion. The difference was considered probable with a difference of 5% ($p < 0.05$).

Results

The complex application of aqua fitness exercises and endogenous-hypoxic respiration techniques generally results in an improvement in physical fitness of women 30-49 years old.

8 weeks after the start of classes in both groups of women (MG1, MG2), there were no probable changes in any of the indicators of physical fitness.

In women of the group MG1, after 16 weeks of training, had the following results: explosive force (by 8.15%), active flexibility of the spine (by 73.28%), dynamic endurance of the muscles of the lower extremities (by 50.98%), speed-force endurance of muscles of abdominal press (by 23,94%), power static endurance of muscles of the back and neck (by 80,35%) and sphincter muscles (by 73,85%). Also, the result of a 12-minute swim test (Table 1) is likely to improve (by 44.06%).

In the group MG1, after 24 weeks, there is a probable improvement in the results of the tests, which characterize the following: explosive force (by 9.46%); dynamic force

Table 1. Influence of aqua fitness exercises on the physical preparedness of women 30-49 years old (MG1, n = 20, MG2, n = 21) using endogenous-hypoxic respiration method

Indexes	Group	Mean values, $\bar{X} \pm S$		
		Before exercises begin	after 16 weeks	after 24 weeks
Running for 30 m from a high start, sec	MG1	6,76±0,10	6,66±0,10	6,63±0,10
	MG2	7,31±0,10	7,21±0,10	7,19±0,10
Jump in length from place, cm	MG1	152,15±3,26	164,55±2,71*	166,55±2,40*
	MG2	134,43±3,08	140,29±3,02	145,71±2,72*
Shuttle running 4x9 m, sec	MG1	12,89±0,09	12,77±0,08	12,71±0,08
	MG2	13,59±0,27	13,46±0,26	13,46±0,26
Bending-extension of the hands (position lying) from the gymnastic bench, the number of times	MG1	8,65±0,98	10,85±0,98	11,20±0,86
	MG2	4,24±0,89	5,76±0,89	6,57±0,89
Bending-extension of the legs (standing position, holding the back of the chair) the number of times	MG1	25,60±2,21	38,65±3,01*	44,95±2,28*
	MG2	18,05±1,48	21,52±1,30	26,33±0,89*
Bending-extension of the legs (position lying on the gymnastic bench), the number of times for 15 sec.	MG1	14,20±0,68	17,60±0,43*	18,25±0,43*
	MG2	12,67±0,65	14,14±0,65	15,29±0,77*
Position 1#, sec	MG1	46,30±3,94	83,50±7,57*	87,65±7,26*
	MG2	35,67±2,07	41,14±2,01	60,81±1,42*
Position 2##, sec	MG1	55,45±4,12	96,40±7,93*	103,20±7,20*
	MG2	44,62±4,14	55,57±3,96	77,33±3,67*
Tilting forward (standing position), cm	MG1	6,55±0,80	11,35±0,74*	12,70±0,68*
	MG2	2,90±0,41	4,10±0,47	5,52±0,59*
Test of a 12-minute swimming by K. Cooper, m	MG1	219,00±13,84	315,50±15,38*	347,75±15,38*
	MG2	215,48±13,31	266,67±10,35*	305,52±14,08*

Note. * - statistically significant differences with respect to the initial data;

position 1 – the woman lies on the couch (on the stomach): legs and arms are slightly dilated and raised up;

position 2 – the woman lays on the couch (on the stomach) and holds her hand behind the couch: her legs are diluted by 10 degrees and bent at knees at an angle of 45 degrees; feet maximally raised above the couch.

endurance of the muscles of the lower extremities (by 75,59%); speed-strength endurance of muscles of the abdominal press (on 28,52%); power static endurance of the muscles of the back and neck (by 89.31%) and the spinal muscles (by 86.11%); active flexibility of the spine (by 93.89%); general endurance (by 58.79%).

In the group MG2, after 16 weeks, only the result of control test, which represents overall endurance (by 23.76%), is likely to be improved. The remaining indicators remained unchanged.

In the group MG2 at the end of the study, the indicators have increased significantly: explosive force of 8.40%; speed-strength endurance of muscles of the abdominal press by 45,91%; speed-strength endurance of muscles of the abdominal press by 20,68%; power static endurance of muscles of the back and neck on by 70,49%; femoral muscles by 73.32%; active flexibility of the spine by

90,16%. In the group MG2 within 24 weeks, the result of the test, which characterizes overall endurance, has probably increased (by 37.93%).

Discussion.

The results of testing the physical fitness of women aged 30-49 years are confirmed by the results of research of scientists about age changes: level of physical capacity [22]; indicators of physical development [2]; functional capabilities [28]. There is a decrease in the physical state of the body as a whole [5].

The information of other authors [7, 20, 21] on the effectiveness of the application of endogenous-hypoxic respiration method in a complex with physical exercises has been confirmed and supplemented.

The results of the research [27] prove the positive effect of training exercises with swimming using force

exercises from aqua fitness and the technique of EHD for the special physical fitness of swimmers aged 11-12 years. Unlike the above, our research in general was intended to justify and develop a program of aqua fitness training to improve the physical condition of mature women.

For the first time, we scientifically grounded and developed the program of aqua fitness classes for women aged 30-49 years. The peculiarity of such program is the use of endogenous-hypoxic respiration method [12].

Our program involves a gradual increase in exercise designed to develop overall endurance. At the initial stages of the woman's work twice a week, they worked mainly for the development of strength endurance, and once – for the general. In the main period, the number of classes for the development of general endurance gradually increased. At the same time, the load was dosed taking into account the age factor, the level of physical and functional preparedness of women. The method of endogenous-hypoxic respiration was integrated into the program to enhance the effect of exercise in water.

The results of our studies have shown that the use of endogenous-hypoxic respiration techniques in aqua fitness classes with women aged 30-49 years contributes to improving the manifestation of their physical qualities. Women of 30-36 years old have such changes occurred earlier compared with women aged 37-49 years.

For the first time, experimentally proved the positive influence of aqua fitness exercises using the method of endogenous-hypoxic breathing on the physical condition of women aged 30-49 years. The information of other authors [3, 12, 29, 30] about the positive influence of aqua fitness exercises on the physical condition of mature women has been confirmed and supplemented.

The advantages of our methodology are the results

of the physical fitness of women after the completion of the molding experiment. After 24 weeks from the beginning of exercises in women recorded an increase in the indicators that characterize: explosive force; force dynamic endurance of the muscles of the lower extremities; speed-strength endurance of muscles of the abdominal press; power static endurance of muscles of the back, neck and gluteal muscles; active flexibility of the spine; general endurance.

The results of control tests in the groups MG1 and MG2 supplement the scientific information of other authors [3, 13, 27, 31] on the effectiveness of aqua fitness in training sessions.

Conclusions

The results of studies have shown that aqua fitness classes using endogenous-hypoxic respiration techniques help to improve the physical fitness of mature women. For women aged 30-36 years, improvements in physical fitness were recorded earlier compared with women of 37-49 years old.

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Conflict of interest.

The authors state that there is no conflict of interest.

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Parent expectations towards participation to extracurricular sport activity of high school students

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Abstract

Purpose: Extracurricular activities are the activities that are carried out inside and outside of the school after the class depending upon a plan and program, and that contain the traits designed for the various purposes. This activities are important for adolescents in terms of discovery the skills, interests and strengths, and creating a chance to get to know themselves. Besides, the activities provide to strengthen the relationships with persons in school, and to build up academic success and moral life factors. This study aims to determine the expectations of parents from the extracurricular sportive activities.

Material: In research, interwoven single case study design, one of the qualitative research approaches, was used. Easy accessible sample was benefited for the selection of study group. Parents of 14 students studying in different high schools in the city center of Kırıkkale in 2014-2015 academic years were included in the research. Data were obtained from the semi-structured interview form and applied a content analysis.

Results: As a result of the obtained findings, it was figured out that expectations of parents from the extracurricular sportive activities are generally the contributions of activities on children to spend a quality leisure time. 5 categories were obtained as a result of analysis. These categories are "being a healthy individual", "keeping away from the harmful habits", "socializing", "keeping away from the bad circle of friends", "providing skill development" and "providing being an intellectual individual".

Conclusions: As a result, parental opinions revealed that extracurricular sportive activities are important in terms of children spending a quality leisure time. Parents' expectations from these activities are also in this direction.

Keywords: extracurricular sport activity, interview, parents, qualitative research, expectation.

Introduction

Extracurricular sportive activities are the activities that are performed inside and outside of the school depending on a certain plan and program after the class and that contain features designed for various purposes [1]. In other words, extracurricular activities are defined as an activity that aims to develop children's some special skills and abilities, depending on certain rules, providing inspection through adults and being performed in a programmed way [2]. These activities enable individual to gain many characteristics. These characteristics are: providing physical and psychological security, gaining the sense of belonging to school, gaining positive social norm [3]. Besides, Activities provide the children giving individual an opportunity to develop the skills and providing adaptation to family, school and society [4].

Even though extracurricular activities have some negative results [5], the opinion that these activities have generally a positive effect on the adolescents is quite common [4]. Activities contain the features of adolescents making social circles, identifying their own abilities [5], the development of the sense of self-sufficiency, the increase in their academic successes and many other developmental factors [6]. It is stated that these activities particularly reduce the drug abuse of adolescents [5], and also reduce various behavior tendencies such as absconding from school [7] and committing a crime [8]. In addition, activities are useful for students to gain the

sense of belonging to school [9] and to develop positive attitude for school [6]. Extracurricular activities that provide academic success and serve as an important intercessor [10] can be associated with children's sense of belonging to school [11], their motivation and academic success [12]. School success of adolescents who have the sense of belonging to school shows increase [13]. Studies that handle the relationship between the participation in the extracurricular activities and academic success of adolescents [14] revealed that there was an increase in the weighted educational composite point of the students who participated in extracurricular activities. Particularly, activities give adolescents a chance. They provide gaining and performing social, physical and intellectual skills in a wide area in school [15]. Activities gain to children being a member of society and contribute to public welfare and identify socially a group and belong to it [15]. In addition, to be able to create a social relation with peers and adults that will be able help at the present time and in the future and these activities provide experience and deal with the difficulties [15]. O'Brien & Rollefson [16] stated that extracurricular activities enable students to learn the importance of team work, individual and group work, physical power and strength, competition, being versatile, culture and society unity.

Since the activities are structured, they have influence on taking adolescents' post-school times under control [17]. Since parents have the chance to control the children's extracurricular times to some extent [18], the fact that thanks to these activities children spend

the post-school time in a planned and programmed way minimizes the parents' anxieties. Knowledge, skill and ability that students gain from the field of sport prevent adolescents from bad habits by valuing ideally the leisure time. Because these activities are structured and contain inspection, so enable students to participate in the activities in a secure environment. Furthermore, activities give students an opportunity to reveal their own interests in a secure environment until the parents come to home after completing their works [19].

Parents' perspectives for extracurricular sportive activities and their expectations from these activities are the determinative factors in directing the children to these activities. The fact that parents' perspectives for sportive activities are positive can show that they have the awareness about the expectation from the activities. Families can make a positive inference from children's successes obtained from these activities. Accordingly, they can support their children to participate in these activities. There is a positive relationship between family support and the pleasure that children get from the sport [20]. In society, child's success and failure are attributed completely to families. When the children get success in sports, people believe that it is the family factor that stands behind this success. For instance, when Tiger Woods, a famous golf player, started showing success in tournaments, everyone described Earl Woods, Tiger's father, as a good and smart parent and considered him as fundamental support behind Tiger's success. The same situation is seen in the example of Richard William, father of Serena and Venus Williams [21]. Studies that examine the attitudes and opinions of parents for extracurricular sportive activities [22, 23] were encountered in literature, there were limited studies that handle their expectations from these activities [24, 25]. This conducted study is important in terms of revealing the parents' expectations and it is expected that this study will provide a different perspective for researchers and implementers about extracurricular sportive activities being more qualified by evaluating the obtained results.

Materials and methods

Research Model

In research carried out to determine the parents' expectations from the extracurricular sportive activities; interwoven single case study design, one of the qualitative research approaches [26] was benefited. Case study designs are expressed as an analysis and definition of an example, fact or social unit in a holistic way [27].

Participants:

In the selection of study group was used easy accessible case sampling, one of the purposeful sampling methods that contain sample units which serve for the research [28]. This sampling provides energy and pecuniary resource by reaching the sample in a fast and easy way [29] so that detailed information on research can be collected and data quality can be high [30]. Parents of 14 students studying in different high schools in the city center of Kırkkale in 2014-2015 academic years were included in the research.

Data Collection

Semi-structured interview form that was prepared for the interview used in the qualitative chapter of research. This form was applied on 14 parents between the dates of 05.09.2015 and 11.09.2015 in the city center of Kırkkale in a place and time period that participants saw fit.

Semi-Structured Interview Form: Interview method was used in present study to obtain profoundly information on the subject. Interview is an instrument that provides to reveal what people think and why; what their feelings, attitudes and emotions are and which factors lead their behaviors [31]. In interview, questions are addressed to participants for a purpose and answers are received in a mutual communication process [33]. Kvale [34] tried to explain this process with a miner metaphor. Interview process can be likened to an excavation that miner carries out deeply to seek a mine. In just the same way as a miner excavates to find a valuable mine. Research tries to learn and reveal the individuals' way of thinking, perceptions, thoughts, emotions and remarks through a systematic question within the scope of results intended to be revealed [35]. The use of interview technique changes according to the aim of research object. In this study, semi-structured interview form was used to determine the parents' opinions on extracurricular sportive activities. In the semi-structured interview form that Bogdan & Biklen [32] suggest and that gives participants a chance to express freely their thoughts about a certain subject, researcher gets profoundly information through questioning that provides to obtain true data. In this interview, pre-prepared questions guide researcher during the interview. The reason why this interview technique was selected is that it has the flexibility of addressing new questions to participants pending the interview [36, 37].

- ✓ Specific questions for each subject,
- ✓ Fact that will be handled for each subject and specific questions for each fact,
- ✓ Specific instructions for each subject, fact and question [38].

Before preparing the semi-structured interview form, studies about the subject [39] and studies in which the interview technique used in qualitative research was used were examined. The questions and questions that serve for the aim of research were prepared. These questions were presented to evaluations of 5 (five) experts. This experts are 3 from the field of physical education in terms of content validity, 1 from the field of Turkish education in terms of legibility and understandability and 1 from the field of assessment and evaluation. Questions in the interview form prepared in the direction of experts' suggestions and criticisms were tested by interviewing with two parents that have similar characteristics with participants. Evaluating the reactions of participants to questions after this pilot practice, corrections were made in the direction of feedbacks obtained from them and final form was given. It was determined as a result of pilot practice that duration of interviews changed between 5-16 minutes. Questions included in the interview form were prepared based on literature; it was aimed to

examine deeply the subject and to prepare questions that aim to examine diffusively the reasons lying behind the behaviors. Parents were asked their opinions that contain their perspectives for extracurricular sportive activities and their expectations from these activities. The interview form consists of two chapters. In the first chapter, there are questions about interview date, the time of interview, nickname in the interview, person's name of interviewer and the chapter in which the aim of interview is introduced to participant. In the second chapter, questions about research were presented. Questions included in the interview form were given below:

- ✓ First of all, what is your general opinion about the extracurricular sportive activities?
- ✓ What are your expectations from the extracurricular sportive activities?

Data Analysis

Before starting to analyze, interview records obtained by researcher from participants were transferred into text. In this process, listening were carried out repeatedly to prevent data loss. In case confusion can occur during and after the analyses, participant interview forms were enumerated from K1 to K14. Every participant was given nicknames. The aim here is to provide evidence for validity by supporting the themes revealed in the findings chapter with participant opinions. In the data analysis, content analysis that requires interpreting the similar data by gathering them as part of concepts and themes and arranging them in a way that readers can understand [40] was used. In the process of analysis, the below steps were followed;

- ✓ The obtained data were read by the researcher by reviewing it over and over, and code list was created by writing codes. Because in the qualitative analysis, codification is the first and fundamental process for the analysis to find out the data contents [41]. By evaluating the data obtained as a result of interview, codifications were conducted as part of research problem. In the analysis; words, sentences and paragraphs

used for the determination of the participants' statements were coded by conceptualizing them [42].

- ✓ Afterwards, codes were categorized by gathering them according to their common traits. The sub-categories under these categories and the codes representing these categories were interpreted by getting explained in relevant to each other, and the results were received [43].
- ✓ Literature and relevant studies were benefited for the interpretation of the obtained findings. In addition, the obtained data were tabulated and findings were interpreted by including the participant opinions. Accordingly, it was tried to provide the validity of the obtained data.

Validity and Reliability

Validity can be provided with an impartial observation as far as possible and a natural state of the research subject. Process steps followed concerning the validity and reliability were indicated in Table 1.

Data were analyzed separately by another expert apart from the researcher to determine whether or not the conceptual categories obtained. As a result of data analysis aimed at research reliability represent the obtained themes and the obtained codes. The categories that codes represent were compared. Both researchers discussed the dissenting points and reached agreement. The formula of Miles & Huberman [50] $[\text{Agreement} / (\text{Agreement} + \text{Dissent}) \times 100]$ was calculated to provide the data reliability. Agreement among experts was calculated as 96% for the reliability of study results.

Research Environment

Appointments were gotten from the participants to receive their opinions on the researcher and interview time and place were determined. The quality of place where the interview is carried out is significant in terms of the quality of information that researcher will obtain. Therefore, it was paid attention to prefer places where the factors such as sounds, noises etc. that can disable the communication between the researcher and participant can be minimized.

Table 1. Validity and reliability criteria towards qualitative research

Validity	Internal Validity	Receiving expert opinions Participant confirmation Spending a long time with participants Direct quotation
	External Validity	Explanation of data collection tool and process Explanation of data analysis process Explanation of characteristics of study group Explanation of role of researcher Explanation of reason of selection of the used method Explanation of validity and reliability precautions
Reliability	Internal Validity	Preventing data loss by using recorder Presenting directly the findings
	External Validity	Discussing the data in a proper way Controlling the consistency between the data

[*44-49] * validity and reliability criteria related to research.

Moreover, requests of the participants who are the target resources were considered for the selection of place so that they can feel comforted and express themselves well. The recordings of the participants' opinions on the interview were given in Table 2.

In Table 2; information on the date, time and place of the interview carried out with participants were given. Interviews with participants were done after getting an appointment. Interviews were carried out with participants one to one between the dates of 05.09.2015 and 11.09.2015. Importance was given to prefer places which participants considered as appropriate.

Results

Findings about parents' expectations from the extracurricular sportive activities were indicated in Figures. It can be said that each of these expectations has the aim of children spending the post-school time in a quality way. It appears that the frequencies of parents' expectations from extracurricular sportive activities are respectively "being a healthy individual (n=11)", "Keeping away from the harmful habits (n=8)", "socializing (n=7)" and "keeping away from the bad circle of friends (n=5)". Two categories with the lowest frequency are "providing skill development (n=3)". Opinions towards parents' expectation with the highest frequency were given below.

It was seen that parents expected from these activities to make their children physically and psychologically good and to provide children to have a high sense of self-confidence.

The category of "being a healthy individual" has the highest frequency in terms of participants' expectations from extracurricular sportive activities. This category contains the sub-categories of "feeling psychologically relieved" and "having a good physical development". Parents generally stated the necessity of these activities to be functional in terms of children being psychologically healthy individuals. Ayse, one of the participants, specified that her expectation from these activities is her child feeling psychologically relieved:

"... I think that sport will be effective in terms of child resting and gathering thoughts back with other things by taking up sports." Kubra's expectation from these activities is similar, as well: "It is a thing getting rid of thoughts in her mind through sport... Perhaps she can be physically tired but she can mentally relax, I think she will have a different mood".

It was determined that participants have expectations from these activities that contain opinions on children regenerating mentally, being psychologically steady like having a good mood. The other sub-category of the category of being a healthy individual is "having a good

Table 2. Information on time and place of interview

Participant	*Nickname	Date of Interview	Time of Interview	Place of Interview
K1	Fatih	05.09.2015	12.35-12.45	Kırıkkale Police Headquarters
K2	Ayşe	05.09.2015	14.05-14.22	Public Health Directorate
K3	Yasemin	07.09.2015	11.35-11.46	Community Health Center
K4	Songul	07.09.2015	14.59-15.05	Public Health Directorate
K5	Neriman	07.09.2015	15.30-15.35	Public Health Directorate
K6	Kubra	08.09.2015	12.05-12.16	Public Health Directorate
K7	Mehmet	09.09.2015	15.40-15.49	Community Health Center
K8	Mustafa	09.09.2015	17.41-17.50	Kırıkkale /City Center
K9	Izzet	10.09.2015	14.18-14.25	Kırıkkale /City Center
K10	Sukran	10.09.2015	16.43-16.49	Kırıkkale/Kaletepe (Home Visit)
K11	Meral	10.09.2015	18.17-18.26	Kırıkkale/City Center (Home Visit)
K12	Canan	11.09.2015	10.07-10.15	Kırıkkale/City Center (Home Visit)
K13	Emine	11.09.2015	15.16-15.28	Kırıkkale/City Center (Shop)
K14	Yasin	11.09.2015	19.27-19.32	Kırıkkale/City Center (Grocery Store)

* Names mentioned above are the nicknames that represent the participants included in the study.

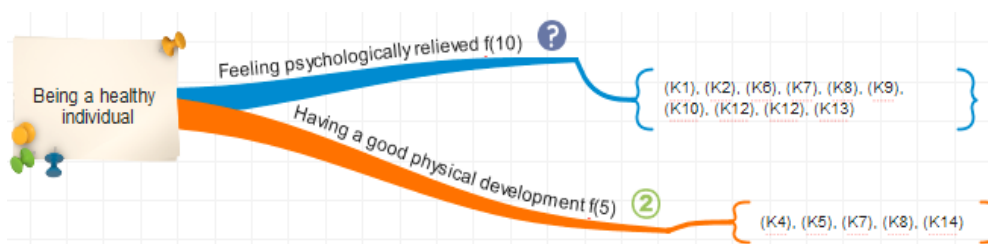


Figure 1. The category of being a healthy individual

physical development”. In this sub-category, it was stated that participants have expectations such as providing children’s weight control, their children growing tall, muscle development, having a good posture through extracurricular sportive activities. It appeared that some participants direct their children to a sport branch by carrying out researches on which sportive activity could contribute more to physical development of children. Here is the opinion of Mehmet about this subject:

“My child plays football. I wanted to choose different fields. I wanted him to build muscles for physical development, for health. I encouraged him... For example, I tell him to go to basketball to grow tall. Tell him to go swimming to exercise his all muscles. I try to direct him by expressing these”. Mustafa’s opinion on extracurricular sportive activities supporting the physical development of children is so: “I want him to have physically an adequate structure. Reasons like getting tall or not to gain weight”. It was figured out that participants have expectations from these activities in terms of their children’s physical and psychological developments.

The category of “keeping away from harmful habits” has the second highest frequency in terms of participants’ expectations from extracurricular sportive activities. This category shows that there are participants’ expectations in terms of preventing children to spend a long time with social media, television and smartphone. Stating particularly that adolescents spend a long time with social media or smartphone, participants specified the importance of extracurricular sportive activities in terms of spending the post-school time in a more qualified way. Ayse, one of the participants, stated that her child is always at the computer or phone when he is at home and she is troubled with this situation.

“We take our son’s phone from him when he is at home. He is occupied either with computer or phone.

He needs to study for university exam because he is in senior class. No matter how much we struggled, we could not prevent him from some things. However, we tried to keep him away from harmful habits through restrictions like taking his phone. At this point, I support his participation in sportive activities”.

“He is now at the computer. He is always at the computer after coming from the school. So he has not a quality and qualified life. I wish he can spend the time with sport (Songul)”.

“After the classes, she spends time at the computer and smartphone at home. That is why I cannot get in contact with her (Neriman)”.

Other participants have similar problems and their opinions for the increase in their belief in children to be able to spend more quality time thanks to these activities are so:

“...in post-school times, he sometimes goes out on the street. Mostly he sits at home. He spends lots of time with computer and smartphone. We get angry him but he does not listen us. I want him to participate in these activities but he does not want (Meral)”.

“...we want him to exercise at the least since he is at the computer so much time. The fact that he cannot go out so much and accordingly spends so much time at the computer worries us and obesity that is the illness of our age is on the agenda. We want him to exercise, to make friends and to identify his own skills (Canan)”. Another one of parents’ expectations from extracurricular sportive activities is socializing (n=7).

In the category of socializing, there are three sub-category which are having new friends f(3), having new environment f(2) and having different circles.

“I myself took my child to swim course and picked up him from course so that he can make new friendships, discover new environments (Fatih)”.



Figure 2. The category of keeping away from harmful habits



Figure 3. The category of socializing

“... Does not exercise, because he is at the computer now. Always computer after the school. Therefore, he does not have a qualified and quality life. If there was sport, he could have some certain times in his life. He could both have a conversation with his friends and walk around. Also he could play sports (Songul)”.

“...He spends post-school time at the computer or being occupied with smartphone at home. Since he gets bored and especially he is not active in any sportive activities in this period called the puberty, he fights with his siblings. We cannot get in contact with him, cannot talk with him. This is because of computer, but not that much (Neriman).” One of the another category of expectation of parents is keeping away from bad circle of friends f(5).

As shown in Figure 4, this category consists of two sub-categories that are preventing smoke and drug and alcohol use.

“Because of the period child is in, he is always after something. For a moment in past, he started smoking just because his friends smoked. But we made him give up smoking. If he participates in these activities, perhaps he will contact with others and his introversion will be gone. I will know where he is. At the moment, I worry about where he is. For example, if you smoke here, I will also want to smoke. These activities keep the child away from the bad circle of friends (Meral)”.

“...In my opinion, activities keep child away from bad habits. School, sportive activity and course take already child’s time. So child has not so much time to make bad friends. He goes to sport, he goes to sport in school, then he studies; therefore, he cannot find time to make bad circle of friends and habits... being under teachers’ inspection, physical education teachers’ inspection or trainers’ inspection keeps

already child away from these bad habits and circles (Canan)”.

“...Because participating in these activities keep my children away from bad habits and behaviors. I mean that when they exercise these activities out there, I think they are prevented from bad habits and making bad friends since they exercise under a better teacher or trainer and they are not left unconfined in a way. They have a regular life-style, at least I think so (Kubra)”.

Participants’ expectations are their children to prevent from bad habits such as smartphone addiction or computer which has become the illness of our age for adolescents. Most of parents do not have any idea how to put this habit away. At this point, it can be said that parents have the expectations that spending post-school time by participating in these activities can enable children to spend time usefully. Other subjects parents worry about are drug abuse, smoke and alcohol which reveal because of bad circle of friends of children. Particularly, nowadays providing the addictive drug is easy and adolescents spend more time with friends than family; therefore, it gets easy to gain these bad habits. Participation in the extracurricular sportive activities makes it easier for parents to know the children’s circle of friends and the place they are in and to control their children. The last category related to expectation of parents about extracurricular sport activity is providing skill development f(2).

As shown in Figure 5, this category consists of two sub-categories that are exploring children ability and being able to do the movements peculiar to sport branch. The opinions related to category are given below.

“I want from my child to identify her own skills and to feel the sense that I can do something (Canan)”.

“Since I could not swim, I was always at the coast. I directed my child to the swimming team of school so that he can develop his swimming skill (Fatih)”.



Figure 4. The category of keeping away from bad circle of friends

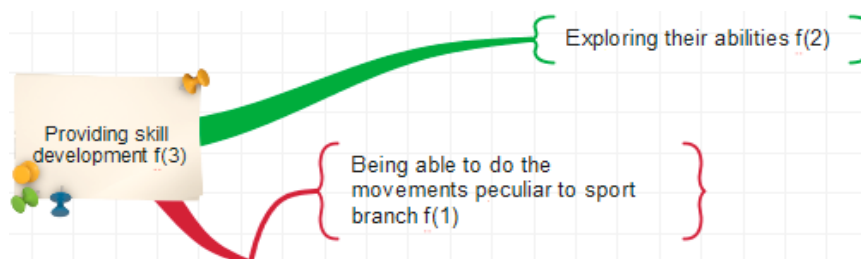


Figure 5. The category of providing skill development

Discussion

In this research, documents were examined which were obtained as a result of interviews carried out to identify the expectations of parents from extracurricular sportive activities. Parents expressed their expectations as “being a healthy individual”, “keeping away from the harmful habits”, “socializing”, “keeping away from the bad circle of friends”, “providing skill development” and “providing being an intellectual individual”. The category of being a healthy individual contains the contribution psychologically on children’s development. In the study of [51], it was revealed that these activities contribute psychologically to children’s development. Similar result was obtained in the study of [15] entitled extracurricular activities and adolescent development. It was concluded that individuals’ skills and social relationships, school success, educational and professional level, welfare level, health and positive social behaviors developed with the participation in activities. Extracurricular sportive activities support the physical development of adolescents. Parents asserted two concepts under health category which are psychological and physical development concepts.

Parents drew attention to importance of extracurricular sportive activities in terms of children displaying physically healthy development. It was determined that parents have expectations that sport enables their children to control their weight and provides adolescence’s effect on human physiology to be balanced, children can get tall especially with sportive branches. It was seen that particularly some parents have a high awareness level towards the sport’s effects on children. They direct their children to a sport branch by carrying out researches on which sportive activity could contribute more to physical development of children. Mahoney, Larson & Eccles [52] emphasized that these activities contribute to physical development of children and adolescents. O’Brien & Rollefson [16] revealed that extracurricular activities give students an opportunity to learn acquisitions such as rivalry, physical power and strength.

Remarking that with the development of technology, addiction level of children to smartphone and computer has increased, parents stated that children could be more active thanks to the participation in these activities. For instance, Bartko & Eccles [53] revealed that unstructured activities, which are defined as an inactive life style such as spending time at computer or watching television, could generally cause problems for children and adolescents. In the study of Gurkan & Ballı [54] “Parents’ expectations and opinions about children’s participation in leisure time activities and sports”, it was figured out that children preferred mostly passive activities such as watching television, listening music, spending time at computer and internet. In the same study, parents stated that they wanted children to participate in active sportive activities instead of passive activities. In another study on high school students in US; Larson et al. [55] revealed that students spend limited time with parents and they are occupied more in passive activities such as watching television, surfing on internet, playing video games during

the school time.

Parents remarked that children can stay away from bad circle of friends and harmful habits thanks to these activities. There are studies that support these findings [6, 24]. In the study of Franklin [19], it was determined that since these activities are structured in a planned and programmed way and parents know what their children do and how they spend the time after school, they have low anxiety levels. Particularly, working parents have limited chance to control their children’s extracurricular time [18], they specified that these activities enable their children to spend the post-school time in a planned and programmed way.

Structured extracurricular activities create conditions for children to acquire different social skills which couldn’t be developed with normal studies in school [56]. It was figured out that parents’ expectations from these activities are in this direction. Parents emphasized that activities have a great contribution on children to make new friendships, to gain leadership skills and to collaborate with other individuals. There are studies which reveal that structured activities that affect directly the development of adolescents play a role in changing their nature of social development [57]. Study of Darling [58] indicated that these activities enable adolescents to socialize with their peers, to set a target and achieve it, to compete fairly and to resolve the problems peacefully. Study of Darling et al. [4] indicated that activities provide adolescents to perform the common interests together and accordingly enable them to create new relationships with their peers and to gain social capital.

Another expectation of parents from extracurricular sportive activities is to contribute to skill developments of their children. Study of Akgul et al. [59] supports present study. In study, it was concluded that thanks to activities children and adolescents can spend the leisure time in a good way, they use their energies positively and they can prevent themselves from bad habits and develop their knowledge, skills and abilities by getting rid of stress. That is because lessons that are lectured in school might not contain everything for children’s education. These can be provided by extracurricular activities in the direction of the aim of education. Through extracurricular activities, insufficiency of typical education programs is fulfilled; students’ physical and spiritual necessities are taught by experiencing and conducting it on vital problems; skill developments of students are provided [60].

Conclusion

Considered the findings related to subject, it appeared that the biggest anxieties of parents about children are that children have bad circle of friends and gain bad and harmful habits. It was revealed that they have expectations from extracurricular sportive activities in terms of dealing with these harmful and bad habits. The facts that these activities are performed under adult (trainer, family etc.) and structured in a planned and programmed way prompt parents to direct their children to these activities for post-school time. In this direction,

expectations from these activities can be summarized so: supporting healthy developments of children, keeping away from harmful habits, giving opportunity to socialize, keeping away from bad circle of friends, supporting skill development and giving a chance to be an intellectual individual. Considered these results, it can be said that effect of extracurricular sportive activities on adolescent

development is incontrovertibly significant. Therefore, it should be given importance to perform extracurricular sportive activities, giving a chance for parents to follow closely these activities.

Conflict of interest.

The authors state that there is no conflict of interest.

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