EFFECTS OF A MINI-TRAMPOLINE EXERCISE DURING 15 WEEKS FOR INCREASING THE VERTICAL JUMP PERFORMANCE

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Abstract
Background: Mini-trampoline exercise is becoming a very popular form of training. The purpose of this study is to examine the effects of 15-week trampoline training on vertical jump parameters in boys who do not exercise regularly. Methods: The subjects (13 years +/- 6 months) old boys were randomly allocated to one of two groups: trampoline training group (TG, N=23) and control group (CG, N=29) to examine effects of 15-week trampoline training (1 time per week). Optojump we measure the following variables: time of flight phase (s), height of jump (cm), specific energy (J/kg) and total energy (J). Sixteen variables were used to estimate the explosive power of lower extremity: DJ drop jump 20cm, DJ drop jump 40cm, SJ squat jump and CMJ countermovement jump. The t-test was used to compares the means of two groups. For this analysis, the significance level is 0.05. Results: As a result; whereas 15 weeks of trampoline exercise improved vertical jump preformance of subjects. Differences between the pre-test and post-test in TG are statistically significant (P<0.05). TG in regards to CG differs in the height of the jump DJ20cm for 1.161 cm, DJ40cm for 0.580 cm, SJ for 0.141 cm and CMJ for 0.313 cm in benifit of TG. Conclusions: The trampoline training used in our study may form an example for the sports educators for improving the explosive strength of the lower extremities in children. Using a mini trampoline offers a variety of health benefits for the body.

Key words: *Trampoline training, Children, Muscle strength, Explosive power.*

INTRODUCTION

Teaching of physical education and sport in Bosnia and Herzegovina in primary schools is realized two hours a week from I to IX grade. Gymnastics program lessons are included in 1/7 of the overall teaching lessons. Gymnastics lessons in all grades of primary education, as well as some methodical units which deal with elements of a acrobatic jumps.

Acrobatics is acyclic sport that encompasses a large number of various simple and complex static and dynamic elements with precisely defined technique, which can be interconnected and combined (Živčić & Krističević, 2008). Acrobatic elements have a significant influence on the ability to move the body in space, which improves overall coordinative motor ability of the entire body and its parts. Also, very accurate and fast work and alternating activation of individual muscles and muscle groups, acrobatics develop all forms of strength, where the explosive strength is the most important (Živčić, 2007; Cigrovski & Matković, 2007) . When athlete performs certain acrobatic elements, the range of motion in certain joints and joint systems is very important, as well as an aesthetic component, which is manifested through the accuracy of the position of the body and body parts. Therefore, the acrobatics requires but also affects on the development of flexibility as one of the essential motor abilities. The most significant characteristic of acrobatics is the specific strength of the upper body, required for the performance of most acrobatic elements.

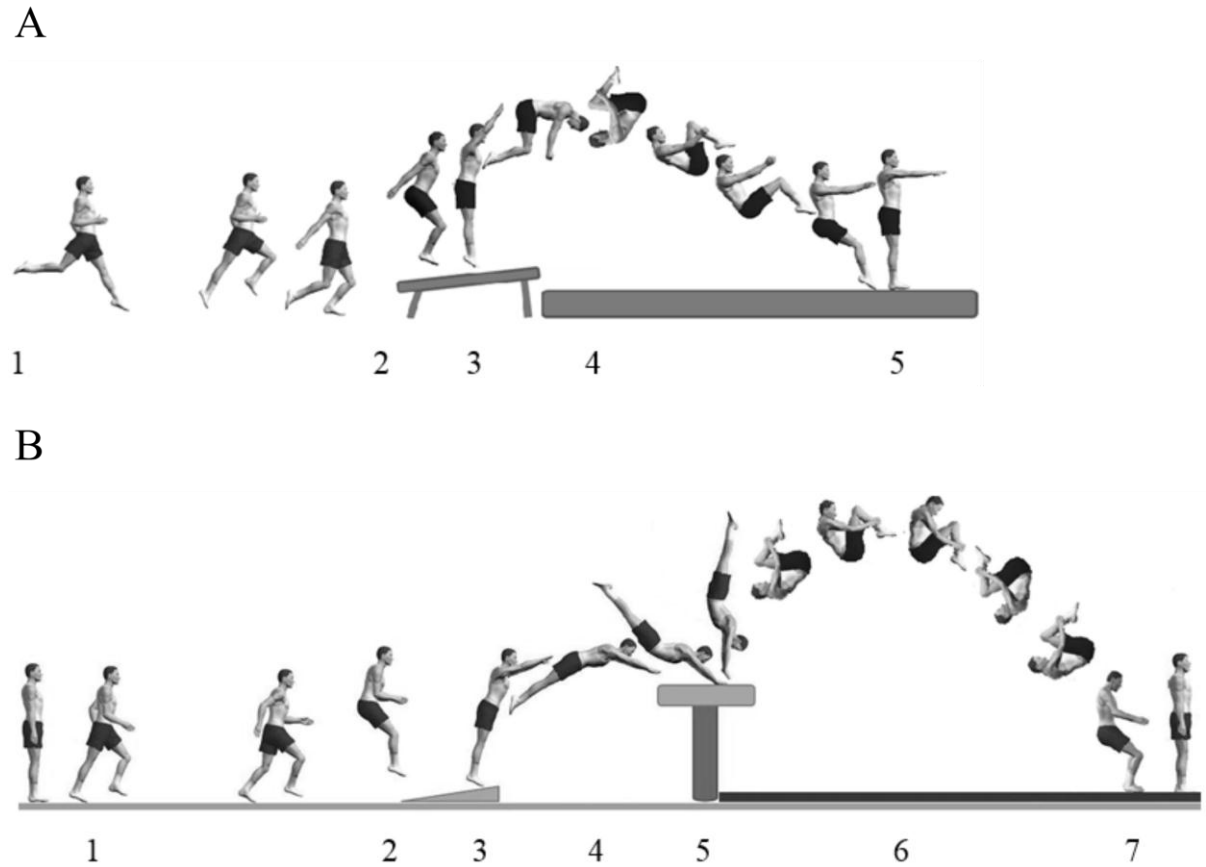
Acrobatics is very widespread in all sports branches. It should be noted that many sports use acrobatic elements for easier mastering of certain specific movements (Kostelić, 2005). Therefore, it is not uncommon that wrestlers, judo players and in general martial art athletes, track and field athletes such as high and pool vault jumpers, skiers, snowboarders and other athletes practicing acrobatics elements for easier and more successful mastering of certain jumps, falls, throws, turns and also their significant influence on development of coordination abilities. Also, acrobatic elements are an integral part of some sports, such as diving, acrobatic rock 'n' roll, skydiving, ice skating, acrobatic skiing, parkur, etc (Mujanović et al, 2014).

Trampoline is the equipment on which to perform different types of jumps. There are different sizes and shapes, and according to the elementary division we distinguish large, double mini and a mini trampoline. Trampolines are equipment, which allow the man the extension movement in the non-resistance position (flight phase). That is the reason why this is the favorite equipment in all age categories of people, from preschool children to the older ones. A mini trampoline is a device that is used for jumps, or as an assisting device in sports, education and recreation. With regard to the ease of use, price, availability, and use of polyvalence, mini trampoline should be more mandatory

represented in the teaching process of physical education, in all ages of school youth.

Jumps on a mini trampoline can be divided into: jumps without turning, jumps with turns around the frontal axis of the body, jumps with a turns around the longitudinal or vertical or the body, jumps with turns around the frontal and the longitudinal axis or the body. In each jump to the mini trampoline from the mentioned groups, we differentiate the jump phases: *1-run, 2-jump on trampoline, 3-trampoline support phase, 4-flight phase, 5-landing* (Figure 1A). In artistic gymnastics vaulting over the valtuting table is a dynamic activity performed in both men's and women's artistic gymnastics. Success in vaulting depends on a multitude of variables, some independent and some within a gymnast's control. Each vault and group of vaults has a different time structure. Vault can be divided into 7 phases (Figure 1B) (Atiković & Smajlović, 2011). Some vaults require faster run, some slower, some vaults have long 1st and 2nd flight phase, some short etc. Of the seven phase jumps on trampoline has five stages, if five sevenths of that element, and can greatly serve as early element and easier way to jump into the adoption of elements of the analytical method of learning that are commonly used in the adoption of such gymnastic elements.

Figure 1. *Mini trampoline five and vault seven phases*



Abbreviations: A: Mini trampoline phases: 1-run, 2-jump on trampoline, 3-trampoline support phase, 4-flight phase, 5-landing; B: Vault phases: 1-run, 2-jump on springboard, 3-springboard support phase, 4-first flight phase, 5-support on the table, 6-second flight phase, 7-landing

During the jump on mini trampolines, the most dominant motor ability is the explosive power of the lower extremities. Explosive power is usually defined as the ability that allows an individual maximum acceleration of one's own body, an object or a partner in activities such as throws, jumps, bumps and sprint (Milanović et al., 2005). This motor activity is reflected in all the movements in which the whole body, or its parts or load (equipment), prolong their movement due to the resulting pulses, i.e. the initial acceleration. Explosive power, as such, represents one of the determinants of the success in all activities that require the manifestation of maximum muscle forces in a short unit of measurement (Newton & Kramer, 1994).

The word plyometry is derived from the Latin words "plyo" and "metric" which means "the measurably increase". That increase is, in fact,

related to the increase of mechanical output of the muscle or muscle force and strength, if muscles do in eccentric-concentric operation mode (SSC-stretch-shortening cycle) (Verhoshansky, 2017). "Plyometric" is a training method of the strength and power that is based on the application of exercise cycles of stretching and shortening (SSC) for the purpose of maximizing produced muscle force'' (Marković, 2013). This type of contraction appears in the majority of sports and is very much the factor of success. The ability of the muscles to contract and then, in high speed, abbreviate allows athlete faster, higher and stronger reaction in a particular situation. Forms of training in which leaps dominate are often called in practice plyometric training.

Leg muscle power in general, and vertical jump performance in particular, are considered as critical elements for successful athletic performance (Canavan & Vescovi, 2004; Potteiger et al., 1999; Bobbert, 1990), as well as for carrying out daily activities and occupational tasks (Kraemer et al., 2001; Bassey et al., 1992). Much research has been focused on the development of vertical jump performance. Although various training methods, including heavy-resistance training (Wilson et al., 1996; Wilson et al., 1993), explosive-type resistance training (Wilson et al., 1993; Adams et al., 1992), electrostimulation training (Malatesta et al., 2003) and vibration training, have been effectively used for the enhancement of vertical jump performance, most coaches and researchers seem to agree that plyometric training (PT) is a method of choice when aiming to improve vertical jump ability and leg muscle power Ebben & Blackar, 2001; Ebben et al., 2004; Simenz et al., 2005; Marković et al., 2007). Many of the papers compared the parameters with specific height of jump offs (Lees & Fahmi, 1994; Walsh et al., 2004; Makaruk & Sacewicz, 2010; Bassa et al., 2012; Čoh et al., 2015; Booth & Orr, 2016). The effects that can be achieved by the influence of 15 weeks (1 time per week) kinesiology treatment jumps on mini trampolines would represent the aim of the study and determine that there is a difference among children of VI and VII grade who participate in an extra program and those who were not included in the program.

MATERIALS AND METHODS

Subjects

The sample of respondents of this study on the initial measurement consisted of 52 students of VI and VII grade of elementary school "Džemal Bijedić" Miljanovci Tešanj (age of 13 +/-6 months) of the male gender, who have not actively been involved in organized extracurricular physical activity and sport, and who have classes of physical and health education as the only organized sport activity.

Study design

The sample is divided into two sub-samples: first, the control group of 29 subjects (students working on a regular program of physical education classes twice a week for 45 minutes) and the second, an trampoline group of 23 subjects. Students working on a regular program two times a week plus additional program - once a week for 60 minutes.

Testing procedures and instrumentation

Measurements were carried out on PE classes in the morning shift from 9-11 hours, in the 2017, the school year. All measurements were carried out in a sports hall. Test points were provided the necessary equipment instruments tested the same quality. The order of measurement was always the same. All kids who participated in this study were subjected to testing under the same conditions. The instruments were calibrated and the standard of each day prior to measurements. All measurements were carried out by two professors of PE and Sport, of the Faculty of PE and Sport of University of Tuzla who were trained to assist in the investigation. In the research methods were used, oral, demonstrations, analytical methods, synthetic, and practical methods combined. Measurements were performed small gruops at between 8 to 10 kids in the each class. To measure the characteristics of vertical jump we used the laser Optojump™ system (Microgate, Bolzano, Italy) length of 2 meters. Optojump has high values of reliability (Dukarić, 2016; Glatthorn et al., 2011), time series are measured in 1/1000th second. Optojump we measure the following variables: time of flight phase (s), height of jump (cm), specific energy (J/kg) and total energy (J). Sixteen variables were used to estimate the explosive power of lower extremity: DJ drop jump 20 cm (mm:ss), DJ drop jump 20 20 cm (J/kg), DJ drop jump 20 cm (J), DJ drop jump 20 cm(cm), DJ drop jump 40 cm (mm:ss), DJ drop jump 40 cm (J/kg), DJ drop jump 40 cm (J), DJ drop jump 40 cm (cm), SJ squat jump (sek.), SJ squat jump (cm), SJ squat jump (J/kg), SJ squat jump (J), CMJ countermovement jump (sek.), CMJ countermovement jump (cm), CMJ countermovement jump (J/kg), CMJ countermovement jump (J).

Data and statistical analysis

We calculate basic descriptive statistics for all variables: N. – number of performances; M – mean; SD – standard deviation. The dependent t-test was used to compares the means of two groups to determine whether there is a statistically significant difference between these means. For this analysis, the significance level is 0.05. To determine statistically significant differences in between the groups of respondents on initial and final measurement, a multivariate (MANOVA) variance analysis was used. Data obtained in this study were analyzed using a software system SPSS 23.0 (SPSS Inc, Chicago, USA).

Training protocol

In the program were implemented following jumps and preparatory exercises on mini trampoline Eurotramp size 125 x 125 cm. All the exercise equipment are FIG (*Fédération Internationale de Gymnastique*) approved contest equipment and have protection sliding mats that conform to international standards. During the program, after a 12-minute general warm-up exercises, 10-minute special warm-up exercises specific to gymnastic branch, Later, the basic movements of standing, jumping, rotating and landing on mini trampoline (8 sets, 4 - 6 repetitions, pauses of 30 s between the series), cool down stretches 8-minutes.

Table 1. *Trampoline training program*

Week	Units asic exercises performed mini trampoline
1	Running and hopping exercise on the mini trampoline
2	Teaching arms, legs, head and body straight position while jumping mini trampoline
3	Imitation swing with hands on floor at a standstill, imitation swing with hands on floor with jump, imitation swing with hands on trampoline at a standstill, connecting swing hands with low jumps with and without turns
4	Jump straight to height 30, 50 cm and jumps over a height of 30, 50 cm
5	Jumps without rotation: straddled jump, tucked jump, piked jump
6	Piked jump (rep.), piked straddled jump
7	Landing exercises: piked jump in sitting position, jump in straddled sitting position, jump on bent knee
8	Jumps with rotation around the longitudinal or the body: straddled jump with turns 90 (1/4), 180 (1/2), 360 (1/1) degrees
9	Jumps with rotation around the transverse or the body: jump in front support or fall with arms to mat, jump into lying on your back, jump into lying on the stomach
10	Ľ, ˝ twist on the trampoline, before landing mini trampoline
11	1/1 twist on the trampoline, before landing mini trampoline
12	Forward roll on the mat 60 cm after jumping on the mini trampoline
13	Dive roll
14-15	Salto forward tucked

RESULTS

The results from vertical jump performance of the controlled group at the first and second measurement are compared by *t-test* of the dependent samples: DJ_20cm_mm_ss t (56) = -7,79, p = .000, DJ_20cm_J t (56) = -2,01, p = .049, DJ_20cm_cm t (56) = -2,32, p = .024, DJ_40cm_mm_ss t (56) = -8,46, p = .000, DJ_40cm_J_kg t (56) = -2,16, p = .035, DJ_40cm_J t (56) = -3,21, p = .002, DJ_40cm_cm t (56) = -2,91, p = .005, SJ_cm t (56) = -2,10, p = .040, CMJ_sek t (56) = -2,19, p = .032, CMJ_J_kg t (56) = -2,21, p = .031, CMJ_J t (56) = -2,07, p = .042. The results from vertical jump performance of the trampoline group at the first and second measurement are compared by T-test of the dependent samples: DJ_20cm_mm_ss t (44) = -9,66, p = .000, DJ_20cm_J t (44) = -3,32, p = .002, DJ_20cm_cm t (44) = -2,59, p = .013, DJ_40cm_mm_ss t (44) = -2,78, p = .008, DJ_40cm_J_kg t (44) = -2,69, p = .010, DJ_40cm_J t (44) = -3,45, p = .001, DJ_40cm_cm t (44) = -2,78, p = .008, CMJ_cm t (44) = -2,83, p = .048 (Table 2).

The values of the height of the jump expressed in centimeters of the noted differences in the height of the jumps between two groups are in the above mentioned variables. Hence, we can see that the value of the jump DJ 20 cm is increased by 1.161 cm, DJ 40 cm by 0.580 cm, SJ by 0.141cm and CMJ by 0.313 cm in favor of the trampoline group. The differences among the groups mostly manifests in a variable that refers to the height of the jump (cm).

Table 2. Basic descriptive parameters and t-test of the analyzed group of respondents at the initial and the final measurement.

Variable	CG	n	M	SD	p	TG	n	M	SD	p
DJ_20cm_mm_ss	1	29	.469	.123	.000*	1	23	.383	.137	.000*
	2	29	.684	.081		2	23	.720	.095	
DJ_20cm_J_kg	1	29	1.946	.409	.079	1	23	1.501	.440	.018*
	2	29	2.147	.444		2	23	1.820	.442	
DJ_20cm_J	1	29	113.775	29.641	.049*	1	23	82.457	28.016	.002*
	2	29	128.657	26.519		2	23	109.242	26.552	
DJ_20cm_cm	1	29	19.406	3.534	.024*	1	23	14.952	4.993	.013*
	2	29	21.893	4.535		2	23	18.600	4.535	
DJ_40cm_mm_ss	1	29	.439	.130	.000*	1	23	.355	.145	.000*
	2	29	.697	.099		2	23	.677	.085	
DJ_40cm_J_kg	1	29	1.862	.471	.035*	1	23	1.358	.477	.010*
	2	29	2.126	.459		2	23	1.742	.488	
DJ_40cm_J	1	29	104.572	27.090	.002*	1	23	75.752	27.171	.001*
	2	29	127.611	27.565		2	23	104.561	29.298	
DJ_40cm_cm	1	29	18.248	4.298	.005*	1	23	13.740	4.834	.008*
	2	29	21.693	4.698		2	23	17.765	4.971	
SJ_sek	1	29	.416	.047	.089	1	23	.384	.046	.065
	2	29	.437	.043		2	23	.408	.038	
SJ_cm	1	29	21.265	3.867	.040*	1	23	18.382	4.119	.062
	2	29	23.658	4.756		2	23	20.634	3.862	
SJ_J_kg	1	29	2.131	.460	.126	1	23	1.829	.352	.079
	2	29	2.320	.466		2	23	2.024	.378	
SJ_J	1	29	125.933	23.279	.056	1	23	108.309	24.205	.071
	2	29	139.140	27.985		2	23	121.121	22.764	
CMJ_sek	1	29	.418	.0486	.032*	1	23	.393	.054	.104
	2	29	.444	.0419		2	23	.418	.047	
CMJ_cm	1	29	21.972	4.658	.051	1	23	18.895	4.479	.048*
	2	29	24.437	4.750		2	23	21.673	4.771	
CMJ_J_kg	1	29	2.134	.454	.031*	1	23	1.887	.692	.178
	2	29	2.402	.467		2	23	2.126	.468	
CMJ_J	1	29	128.688	27.269	.042*	1	23	111.983	25.839	.057
	2	29	143.762	27.940		2	23	127.530	28.012	

*Abbreviations: CG – control group, EG – experimental group, n - number of respondents, M - Mean, SD – Std. Deviation, 1 - First measurement, 2 - Second measurement, *Sig - significant at the level p = 0.05.*

The differences in an explosive power of the lower extremities between the control (N. = 29), and the experimental group (N. = 23) were examined by the single-factor, multi-variation analysis of variance (Table 3). No, statistically significant, difference is determined between two groups at the initial measurement of the trampoline group 1 and the control group 1, F (16, 52) = 1.46, p = 0.17; Wilk's Λ = 0.59; partial η^2 = 0.40. Statistically significant difference is determined between two groups at the final measurement of the trampoline group 2 and the control group 2, F (16, 52) = 1.88, p = 0.05; Wilk's Λ = 0.53; partial η^2 = 0.46. Statistically significant difference is determined between two groups, the control group 1 and 2 (measurement II), F (16, 29) = 1.88, p = 0.00; Wilk's Λ = 0.24; partial η^2 = 0.75. Statistically significant difference is determined between two groups, the trampoline group 1 and 2 (measurement II), F (16, 23) = 7.57, p = 0.00; Wilk's Λ = 0.19; partial η^2 = 0.80.

Table 3. Multivariate analysis of variance, MANOVA between groups and between the initial and final measurements of each group (TG i CG group).

Group	Wilk's Λ	F	df1	df2	p	Partial η^2
TG1:CG1	.59	1.46	16	52	.17	.40
TG2:CG2	.53	1.88	16	52	.05*	.46
CG1:CG2	.24	8.05	16	29	.00*	.75
TG1:TG2	.19	7.57	16	23	.00*	.80

*Abbreviations: TG1- initial state trampoline group, TG2- final state trampoline group, CG1- initial control group status, CG2- the final state of the control group, F-test, df1- degrees of freedom (for variables), df2- degrees of freedom (for students), *Sig - significant at the level p = 0.05.*

DISCUSSION

The research results have confirmed that the additional program of jumps on mini trampolines combined with the regular teaching of physical and health education produces significant positive effects on improving the explosive power of the lower extremities of the students in acrobatics, with respect to the regular classes only. The results of this research study which had the character of experimentally-empirical type provided information about development characteristics within the motor ability of children. The application of experimental training program represents the cybernetic model in transforming the basic motor skills among children.

Our findings are in agreement with previous studies *motoric abilities* Ross & Hudson study the efficacy of a repetitive jumping program on the mini-trampoline for improving the vertical jump. The first objective was to determine if jump height was increased after the training program. The second objective was to investigate changes in technique after the training program. In terms of balance, there was significantly less forward translation in the jump. Range of motin, as indicated by knee flexion in the crouch, decreased for most subjects. And the coordination of the thigh and shank was relatively simultaneous after the training program. The results of study Atilgan (2013) report positive effects of trampoline training on jump, leg strength, static and dynamic balance of boys. This study have investigation the effects of 12-week trampoline training on static dynamic balance, vertical jump and leg strength parameters in boys who do not exercise regularly. According to results, differences between the pre-test and post-test bipedal SB, VJ, DB in TG are statistically significant. No significant difference was observed between the pre and post-test results in terms of unipedal SB, LS. Whereas in the CG, there was no significant difference between pre-test and post-test results based on any of the performance parameters.

However, *health benefits* are also important aspects of the sport. Another study using (Giagazoglou et al., 2013) effects of a trampoline exercise intervention on motor performance and balance ability of children with intellectual disabilities. The experiment group attended a 12 weeks trampoline training intervention program consisting of daily individualized 20-min sessions, while the control group followed the regular school schedule. Trampoline intervention resulted in significant improvements of participants' performance in all motor and balance tests.

On the other hand (Karakollukcu et al., 2015) report, trampoline exercises are used as effects of mini trampoline exercise on male gymnasts' *physiological parameters* of male gymnasts. As a result; whereas 12 weeks of trampoline exercise improved standing long jump and also vertical jump, 20 meter sprint speed and anaerobic power of subjects. Authors (Hahn et al., 2015) also observed that effect of modified trampoline training on balance, gait, and falls efficacy of stroke patients. Twenty-four stroke patients participated in this study. Both groups participated in conventional physical therapy for thirty minutes per day, three times a week for six weeks. The trampoline group also took part in trampoline training for thirty minutes per day, three times a week for six weeks. Modified trampoline training resulted in significantly improved balance, dynamic gait, and falls efficacy of stroke patients compared to the control group.

Aalizadeh et al., 2016 mentioned the effect of a trampoline exercise on the anthropometric measures and motor performance of adolescent students. They conclude that 20-week trampoline training with four physical activity sessions/week in 11–14-year-old students seems to have a significant effect on body fat% reduction and effective results in terms of anaerobic physical fitness. Autors also observed that trampoline exercises can help students to promote the level of health and motor performance. We also observe in the results of Cogoli et al., 1979 authors showed that the increased G-force helped increase Lymphocyte activity. The lymph system transports immune cells throughout the body and supports immune function. For this reason, rebounding is often suggested as a detoxifying and immune boosting activity. Rebounding, since it affects each cell in the body, can also increase cell energy and mitochondrial function. One of the major benefits of rebounding is its benefit to the skeletal system.

Most of the scientific literature on trampolining highlights the it also improves *functional abilities*. Some of the papers confirm these findings. Bhattacharya et al., 1980 presented the results indicate that, for similar levels of HR and VO2, the magnitude of the biomechanical stimuli is greater with jumping on a trampoline than with running, a finding that might help identify acceleration parameters needed for the design of remedial procedures to avert deconditioning in persons exposed to weightlessness. Cugusi et al., 2016 from a study effects of a mini-trampoline rebounding (MRE) exercise program on functional parameters, body composition and quality of life in overweight women try to evaluate manifold health outcomes after 12 weeks of an MRE program in a group of overweight Italian

women. MRE appears feasible to ensure positive effects on overall health and can be proposed to populations that could greatly benefit from training programs, such as overweight women. Recently, Sahin et al., 2016 compared the effect of mini-trampoline training on VO_{2max}, body weight, fat % and vertical jumping height. After the eight week training intervention, there was a significant ($p<0.05$) difference in $VO_{2\ max}$ and vertical jump height between running and trampoline groups. There was no significant ($p>0.05$) difference in fat % and body weight between trampoline and running groups. These results support the hypothesis that the use mini-trampoline may improve $VO_{2\ max}$, vertical jumping distance and reduce body fat %. Nuhu and Maharaj[43] mentioned the effect of mini-trampoline rebound exercise on insulin resistance and lipid profile in type 2 diabetics. The findings suggest that mini-trampoline rebound exercise is beneficial for individuals with type 2 diabetes and can serve as a useful exercise approach in the management of cardiovascular risk in diabetes. With regards to the safety of the exercises performed on the mini trampoline, research has shown that tram-poline exercises involve a low limb injury risk (Grapton et al., 2013). Moreover, research has supported the recommendation of the safe use of trampoline in school environment as a tool to minimize injury risk (Johnson et al., 2011).

According to studie (Sovelius et al., 2006) try to compare the effects of two different training methods in reducing muscular loading during in-flight and cervical loading testing (CLT). Both training methods were found to be effective in reducing muscle strain during in-flight and CLT, especially in the cervical muscles. There was no statistically significant difference between the training groups. Introduced exercises expand muscles capacities in different ways and the authors recommend both strength and trampoline training programs to be included in fighter pilots' physical education programs. Kidgell et al., 2007 for purpose of this research was to compare the effect of 6 weeks of balance training on either a mini-trampoline or a dura disc on postural sway and to determine if the mini-trampoline or the dura disc is more effective in improving postural sway. These results indicate that not only is the mini-trampoline an effective tool for improving balance after lateral ankle sprain, but it is equally as effective as the dura disc. Aragão et al., 2011 this study aimed at investigating the effects of a 14-week mini-trampoline exercise intervention regarding the mechanisms of dynamic stability on elderly balance ability during sudden forward falls. Mini-trampoline training intervention increased elderly abilities to recover balance during forward falls; the improvement was attributed to the higher rate of hip moment generation.

Some studies demonstrate that the exercises *injury risk* Kasmire et al., 2016 the objective was to identify trends in emergency department visits for trampoline park injuries (TPIs) and compare TPI characteristics with home trampoline injuries (HTIs). TPI patterns differed significantly from HTIs. TPIs are an emerging concern; additional investigation and strategies are needed to prevent injury at trampoline parks. Arabatzi (2018) the purpose of this study was to investigate the impact of trampoline plyometrics on postural control, and jumping height in pre-pubertal children. Training on elastic surface could be incorporated into children's exercise programs aiming to enhance balance and lower-limb strength to reduce injury rates. For injury prevention during trampoline training, close supervision by experienced personnel is recommended.

Given that the results of the application of the trampoline program of work are, for a period of 15 weeks, positively valorized, this research has a specific applicability in teaching process and training practice. The results can contribute to the rationalization of the planning teaching process, programming and implementation of work in the process of regular and additional teaching physical and health education by applying the experimental program of work. The results can contribute to the results, the proper routing and selection of potential candidates for practicing gymnastics. The research results can serve as a basis for future research which would also include other anthropological characteristics (morphological characteristics, cognitive abilities, personality characteristics and social status) whereby it would be sure to obtain more valid information about population of students this age. The experimental treatment has also differentiated these two groups of respondents in all tests of the explosive power of the lower extremities. Another positive effect of the program is reflected in its educational effects and direct improvement of motor skills of respondents.

CONCLUSIONS

Due to the contributions of the above mentioned abilities to differentiation of the groups, it can be concluded that only one additional hour for students can improve explosive power of the lower extremities, which is in the line with previous research that has shown that children included in the additional programs achieve better results when it comes to motor and functional abilities. When it comes to the intensification of the teaching process, this means that students should be offered more

attractive contents and lessons, adapted to their age, degree of traits and abilities, level of their motor skills and achievements, or simply allow each student to teaching process that takes place in accordance with the current state of the anthropological status and one of the activities can surely be an additional hour of class on mini trampolines.

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