Sports Scientists Views in
Indian Journal of Physical Education, Sports & Applied Sciences
Available Online
www.sportscientistsviews. com
Journal DOI-05-2016-44975451
I.J.P.E.S.A.S
Scientific Journal Impact Factor-5.684

EFFECTS OF THE ON-EXERCISING-BALL WEIGHT TRAINING ON FEMALE VOLLEYBALL PLAYERS' LEG MUSCLE PHYSICAL FITNESS

Pariwatr Paso[1] Panida Chuwet[2]

AFFILIATIONS:

[1] Sport Science Teacher, Faculty of Liberal Arts and Science, Roi Et Rajabhat University, Thailand. Email: manratree@hotmail.com

[2] Sport Science Teacher, Faculty of Liberal Arts and Science, Roi Et Rajabhat University, Thailand. Email: panida_**2823**@hotmail.com

ABSTRACT

. Purpose: to study and compare the effects of the on-exercising-ball weight training on female volleyball players' leg muscle strength physical fitness between the pre-training, the eighth week and the twelfth week Methods: 64 populations were female volleyball players. After using G*Power, the sample size included only forty eight. The 48 samples with low-medium leg dynamic strength were selected from the populations by using the leg dynamic strength test. Using match pair to divide the samples into groups. Twenty four in the experimental group participated the on-exercising-ball weight training. Another twenty four in the control group attended the on-flat-floor weight training. The training programs lasted twelve weeks, three days a week. Data was collected from the leg dynamic strength test, the vertical jump, and the standing board jump. Using One-way repeated measure. Using one-way analysis of variance and post-hoc multiple comparisons with Bonferroni's correction. Comparing the differences of each group's means of leg muscle strength physical fitness after the 12 week training with the t-test. The statistical significance was predetermined at the .05 level Results: the experimental group's leg dynamic strength, vertical jump, and standing board jump increased more highly after the eighth week at the .05 level of statistical significance (p=.001, p=.001, p=.001, respectively). The control group's vertical jump, and standing board jump increased more highly after the eighth week, only the control group's leg dynamic strength increased more highly after the twelve week at the .05 level of statistical significance. Both groups' leg muscle strength physical fitness increased after 12 weeks, however, the experimental group's leg muscle strength physical fitness increased more highly.

Keywords: leg muscle strength, weight training, exercising balls, volleyball

1. INTRODUCTION

Volleyball athletes, in addition to sports skills competitions, are also competing in the development of the highest physical fitness of each team. (Zetou, Tsigilis, 2007) Enhancing the ability of the leg muscles by training with weightiest program to improve muscle contractions (Fujii and Akazawa, 1979) improves strength, power, speed, and reduces injury prevention for volleyball players (Aghabei, 2010; Yan, Hung, Gau & Lin, 2014). Get Games Serving, Serving Hitting the ball Interception The ability to challenge a single opponent requires leg muscle strength, both in motion while playing the ball. (Fédération International de Volleyball, 2015), in a one-point challenge, takes about 7-10 seconds, and the break time of 11-14 seconds is strongly related to the power and strength of the leg muscles (Ministry of Tourism and Sport, The athlete's strength in leg muscles is also higher (Mroczek, Superlak, Kawczñski & Chmura, 2017) the success of the sport depends on the skill and strength of the body, so leg muscle strength is an element that increases the chances of success for volleyball athletes. (Chuphong Chanarun, 2015)

Practicing with the simple weight, is one of the ways used to improve the strength by the scheduled training programs that use high heavy resistance, coupled with the training according to the program, practicing sports to develop muscle strength, coupled with the development of athletic skills (Yuya Watanabe, et al., 2015) said that weight training way's simple and effective training process, this is one of the possible ways to help add strength to the muscles and fine in accordance with (Poehlman and Melby, 1998), because while training and during competition, athletes require the ability to use erectile dysfunction leg muscle, both strength, durability, and muscle power recommended for the jumping skill in the vertical jump intercept and jump to SWAT challenge, the score jumps to hurled get the ball to the study of (Maffiuletti, Cometti , Amiridis , Martin, Pousson & Chatard, 2000) found that the jumping ability of the shooter by practicing with the weight training, can also affect the performance of the athletes. So trainers or athletes, so it should neglect training to increase leg muscle power and muscle strength, to athletes, to be ready always

According to research involving muscle strength training on the ball, unstable is widely used in sports and has a positive effect on the development of athletic performance, such as (Anderson & Behm, Saeterbakken, Andersen, Jansson, Kvellestad & Fimland, 2014; Behm, Muehlbauer, Kibele & Granacher, 2015; Badr, 2014; Mercola, 2014) The findings of Goodman and the faculty (Craig A Goodman, Pearce, Nicholes, Gatt, & Fairweather, 2008) show that there is no difference in the 1RM value from the Chest Press posture from unstable surface training and stable surface training. The research (Zemková, 2017) has compiled research related to weightiest training on exercise balls. It concluded that weight training on unstable areas had a better effect on muscle performance than traditional training, in line with (Juan, 2000; Boyer, Hammer, Jepson & Thompson, 2006; Zemková & Hamar, 2013; Bauer, 2013; 2017 ;) The formulation of weightiest training programs on the ball is possible for physical fitness in women's volleyball players. (Yaprak, 2018) Guidelines for Training Programs for Volleyball Players a good trainer should consider the suitability. It can correct the shortcomings of the athlete spontaneously. It can bring out the highest talents of the athletes as much as possible. Therefore, the creation of a weight training program on the ball is used to improve leg muscle fitness in this research (Newton, et al., 1999; Mounir & Nermeen, 2008; Craig, 2001).

Ball exercise is equipped with high elasticity; there are twos characteristics (Mercola, 2014) spherical ball with a diameter ranging from 45 - 75 cm.Like we were called a Swiss ball, fitness ball, gym ball, yoga ball, balance ball, and physics. And therapy ball and ball type, semi-circle with a diameter 58*28 cm. like we called as a Sobuball (Both Sides Utilized: BOSU) is

previously used widely, especially in the circles of rehabilitation in the group of athletes, sports trainers, or even groups of the exercise (Erwin, Fedewa, Ahn, & Thornton, 2016), with the aim for front ball exercise applied to increase the ability to maintain balance, increase muscle strength, core fatigue (Dicenso, 2017; Laudner & Koschnitzky, 2010) developmental challenge the work of the musculoskeletal system, the response of the nervous system (Waehner, 2017) by the use of ball exercise with the program to exercise more, to strengthen the strength of the muscles, especially the muscles associated with movement in everyday life. summertime days, or called "functional training" (Sharpe & Price, 2009; Justin, et al., 2018) highlight video of weight training on the ball exercise is to practice using weight training equipment, free weights, resistance, while the trainer must try poised on the device unstable from educational research (Zemková, 2017; Zemková, Jeleň, Radman, Svilar & Hamar, 2016) shows the effect of strength training on unstable affect the development of muscle power and strength of the muscles, but weight training on the ball exercise is to practice than usual, because while challenging the training, trainees must try to maintain a balance. With the resulting muscles, core fatigue development, including the intensity of training that can be adjusted both for replacing the data position of the body, the hands, the angle of movement and the weight from the equipment, free weights, (Craig, 2011), which is considered as a practice with the weightiest training concentration, can strengthen the performance of the body has many parts, while challenging coaching.

For this reason, the researchers want to study the results of weightiest training on the leg muscle strength, which will be researched to study the design of a variety of weightiest training programs by combining weight training principles on the ball to compare the effects of training on unstable surfaces (Bosu-ball and exercise balls) with weight training on the general floor. This research the results of the research are used to develop a training plan to develop potential development. The athlete's skills, as well as improvements in various sports, are more satisfactory with the results or statistics. This research is a rarely studied new research, so the results of the research can be used as a guide to the design of the leg muscle strength training program.

The Purpose of the study was to investigate 1. the effect of the training program with weight training on the ball exercise has on performance, the leg muscles of the sample pre-training, after training, 8 -12weeks, 2. to compare the performance leg muscles of pre-training, after training, 8, 12 weeks, of the samples group. and 3. to compare the performance of the worlds leg muscles after training, 12 weeks between the experimental group and the control group.

2. METHODOLOGY

This study is an experimental study of research design, 8 weeks after training and 12 weeks after training by the committee to certify humans Certificate number of Roi-Et Rajabhat University is 15/2562.

2.1 Population

The population is a volunteer volleyball club member. Healthy females A total of 68 people objected to the sample size by G*Power (3.1.9.4), based on the previous study of (Kibele & Behm, 2009) (Effect size f=0.25, Power = 0.95, $\alpha = 0.05$.we have 2group and 3 variable and has about 48 volunteers challenged the leg-stretching test to select those with moderate stretching force (1.74-2.41 kg/kg). Minimum level (1.33 1.69 kg/kg) According to the Physical Fitness Criteria, athletes of the University of Thailand (Tavorn Kamutsri, Amorn Treeraj, Chatchai Sriwilai & Jira Nabsanit, 2015)

2.2 Sample

A sample of 48 people, after a leg stretch test, then a stratified randomization of the samples in the experimental and control group, had equal leg muscle performance, with the group training with weight training on the ball (n = 24) and the control group trained on normal ground .

2.3 Instruments

2.3 1. Leg Muscle Strength Test Program applied to the Department of Physical Education's Field Fitness Test (Department of Physical Education, 2017)

2.3 2. Leg Muscle Strength Test (Katou & Yamasaki, 2009) using Leg dynamometer, Takei Back & Leg Dynamometer Model 5402 C

2.3 3. Vertical Jump (Sargent, 1921)

2.3 4. Standing Bord Jump (Wood, 2010)

2.4 Training Protocol

The weight training program on the ball, apply the theory of weight training (Jaruwat Yodchu, 2001; Bompa, 1993) Principles of Design Training Program (Fleck & Kraemer, 1987), The Principle of Exercise on the Ball (Juan, 2000), which was considered by the research equipment quality specialist, 3, the confidence of the entire training program was 0.94. The process of participating in the training program may have a potential impact on volunteers. Volunteers will be signed up for their consent to participate in the research. The training method of the sample is as follows:

TABLE 1
DETAILS OF WEIGHTIEST TRAINING PROGRAM ON THE EXPERIMENTAL GROUP'S BODY BALL

Posture	Week 1-4			Week 5-8			Week 9-12		
	65%1RM			75% 1RM			85% 1RM		
	Rep	Set	Rest (min.)	Rep	Set	Rest (min.)	Rep	Set	Rest (min.)
1.Barbell Squat on Bosu ball	10	2	1	8	3	1	8	4	1.30
2.Backward and forward Lunge on Bosu ball	10	2	1	8	3	1	8	4	1.30
3. Bosu Barbell Back Squa	10	2	1	8	3	1	8	4	1.30
4. Barball Deft lift on Bosu Ball	10	2	1	8	3	1	8	4	1.30
5. Hip Thrust with Stability ball	0	2	1	8	3	1	8	4	1.30

2.5 Data Collection

2.5 1. Before the study a week, the researchers challenged the fitness test leg muscles to stretch the legs with the test force the vertical jump and standing long jump, and informed the study participants to know the details of the training program, signed by the volunteers consent form, participated in the training program.

2.5 2. Experimental group experimental group challenge training with weight according to the program created by the researchers to replay the ball movement (Table 1). Through the challenging training period 17.00-18.30 hours. One week and three days are Monday, Wednesday and Friday by the experimental group in accordance with the program does not challenge the training, the date and time of coaching volleyball skills as described above.

2.5 3. Group control Challenge training according to the training program with sample weight, as usual in the moment, 17.00-18.30 pm. The week and 3 days are Monday, Wednesday and

Friday, respectively, the control group will not coach volleyball skills according to the challenge training program, the date and time as described above.

2.5 4. Challenge test leg muscle performance, by measuring the leg dynamic, the vertical jump and standing long jump practice week after 8: 00 and 12: 00 am with the experimental group page information, access to challenge test results analysis results, according to the program statistics to determine the performance of the leg muscles.

2.6 Statistical Analysis

Analyze the performance data of the results by looking for the average and standard deviation of the leg muscles. Testing whether the distribution is normal by using the test statistics tested by Shapiro-Wilk, it was found that the data distribution contained in the dataset is the arch of the normal distribution, so the difference of the variable was tested with statistical parameters Analyze the one-way variance of leg muscle performance before training after the 8th and 12th weeks of the trial and control group. If later analysis is found, the method used to find the difference is determined by Bonferroni Osaka's method of a couple of differences implied are statistically significant at $p<0.05$. Test average difference erectile dysfunction leg muscle leg dynamic the vertical jump and standing long jump after training 12 weeks with Test t-value (independent sample t-test)

3. RESULTS OF STUDY

To find out the significant differences on leg muscle performance among athletes of the University of Thailand , mean, SD, t-ratio and F-ratio were computed and data pertaing to this, has been presented in Table 2 and 3.

TABLE 2

ANALYSIS OF VARIANCE OF LEG MUSCLE ERECTILE DYSFUNCTION OF ATHLETES BEFORE TRAINING, AFTER 8 -WEEKS TRAINING AND AFTER12 WEEKS TRAINING

List	Group	Pre-training (N=24)		After week 8th training (N=24)		After weeks 12th training (N=24)		f	p
		M ($\bar{x}$)	S.D.	M ($\bar{x}$)	S.D.	M ($\bar{x}$)	S.D.		
Leg dynamic (kg/kg)	Test	1.80	0.23	1.99a,c	0.34	2.32a,c	0.33	17.289	.001*
	Control	1.72	0.14	1.77	0.14	1.84a	0.15	3.773	.028*
Vertical Jump (cm.)	Test	170.50	7.87	180.70a,c	5.64	194.62a,b	10.77	51.166	.001*
	Control	171.91	6.52	180.33a,c	5.50	186.62a,b	5.24	39.062	.001*
Standing Board Jump(cm.)	Test	190.20	7.99	202.58a,c	8.29	219.50a,b	9.42	70.238	.001*
	Control	190.00	6.31	195.62a	4.58	199.29a	6.08	16.102	.001*

* $p < .05$

a Difference to pre-training

b Different from after Week 8 training

c is different after Week 12.

From Table 2, we found that in the experimental and control groups, after training weeks 8 and 12 differently, when differences were found, the pair tested by Bonferoni's method. After 8 weeks and 12 weeks of training, the experimental group had a higher level of leg muscle performance than before training statistically significant at .05 ($p = .001$). 05 ($p=.001$) Long jump side found that after 8 and 12 weeks of training, the increase was higher than before practice, a statistically significant difference of .05 ($p= .001$) in the control group. However, there was no difference before practice, with the 8-week high jump side after 8 and 12 weeks of training, significantly different from before training. After eight weeks and 12 weeks of training, the difference between before training was statistically significant at .05 ($p=.001$).

TABLE 3

SIGNIFICANCE OF DIFFERENCE IN LEG MUSCLE ERECTILE DYSFUNCTION OF ATHLETES AFTER 12 WEEKS OF TRAINING

List	Group	After week 12th training		t	p
		M ($\bar{x}$)	S.D.		
Leg dynamic(kg/kg)	Test	2.32	0.33	6.328	.001*
	Control	1.84	0.15		
Vertical Jump(cm.)	Test	194.83	10.77	3.356	.002*
	Control	186.62	5.24		
Standing Board Jump(cm.)	Test	219.50	9.42	8.824	.001*
	Control	199.29	6.08		

*p<.05

From Table 3, after 12 weeks of training, the experimental group to practice leg muscles, leg dynamic was significantly higher than the control group three people significantly different statistical levels.05(p=.001) side, the vertical jump, the experimental group of three people significantly increased significantly higher than the control group statistical level.05(p=.002) standing long jump found that the experimental group and the control group three people were significantly different, a significant statistical level at 05(p=.001)

4. DISCUSSION

Research on the effects of exercise on the ball is on the leg muscle strength of female volleyball players. It was found that weight training on the ball can improve the strength of all leg muscles, which, considering the level of leg muscle strength that female volleyball players undergo, can increase the strength of all leg muscles as follows:

After training 8 and 12 weeks, the experimental group had a statistically significant increase in leg strength at .05 in line with (Boonta Khakai, 2006), which challenged research on the results of the exercise with the Exeter ball and romance share the strength of the back muscles, which was found after the group's post-muscular strength experiment. Unlike statistically significant control groups at .05 points, according to Jarunun Phanggamta, 2009, it is said that muscle fatigue training on the excel ball and floor training on the strength and weakening of the back muscles in gymnastics. It was found that strength training on the exemial ball had a greater percentage of strength and weakness in the back muscles than the ground and control groups, resulting in higher potential volleyball players, resulting in a higher chance of success in competition. When studying the results of heavy strength training in conjunction with the use of the ball, the body can also increase the strength of the leg muscles in line with (Mounir A. & Nermeen F., 2008) found that after practicing with bozuball, the ability to improve the skill of the athletes is consistent with the Saowanee Luangaram, et al. (2011) that the strength training of the athletes will improve. Physical ability reduces the fat accumulated in the body and increases the risk of injury due to sports, increases the strength and density of muscles as well as the ligaments, muscles and bones. In addition, its research (Jaruwat Yodchu, 2008) also shows that the training of core muscles fatigued with the ball off the body and Bosu-ball can develop weakness. Balance of movement, muscle strength Increased muscle endurance (Anderson K & Behm DG, 2005) Because while challenging the experimental group training, the experimental group must try to control the body to balance, as well as training the core muscles (David G. Behm, et al., 2015), which results in improved stability control.(Atle Hole Saeterbakken, 2014; Saeterbakken AH, et al., 2014) says bosuball can develop abdominal muscles, but it depends on proper weight.Confroms (Chaninchai intiraporn, 2001; Vithoon Yamasamit, 2009) the principle that a way to build muscle strength must be to challenge the fight against resistance or heavy

water gradually. It's a good fit for those who need balance, and helps to tighten your muscles. To tighten the back and muscles, it is possible to tighten the ball as the muscles are used to use the power from the inside (Nevin Badr, 2013) to strengthen all parts of the body, with a special emphasis on the back and abdominal muscles. The ball also challenges the support. Specific parts.

Small typency helps with flexibility and strength in combination with challenges in various systems of the body (Chiu-Fang Yan, et al., 2014). The long jump strain was found to be a long jump in the muscle strength of the experimental group, which the research team established to determine the sample sought to challenge the heavy weight at 65% ,75% and 85% of 1RM.Comfroms (Phanuphan Lapratlanathong, 2006; Ministry of Tourism and Sport, 2013; Milić Vladan, et. Al., 2008; Ronnie Lidor, et al., 2010; Zetou E, et al., 2007) training with weight 65% and 85% of 1RM for 12 weeks, resulting in an average leg strength increase.

About experimental group high jump. After training tests in weeks 8 and 12 showed a significant increase in muscle stiffness in the high jump legs. 05, this may be due to the fact that the combination of leg muscle strength training and the use of balls in the body lead to a significant increase in the efficiency of leg muscles. Standing in the high jump soars in accordance with (Stojanović Toplica & Kostić Radmil M., 2002) In addition, during the training program, the researchers were able to practice the same number of muscle groups associated with the muscles associated with the jump. According to (Newton RU, Kraemer WJ, Häkkinen K., 1999)) it was found that off-ball training can develop vertical jumps due to increased muscle strength. Weight training In addition, in the experimental group, it requires the ability to control stability on unstable surfaces. Heavy exercise affects the strength of the leg muscles and the ability of athletes to jump, which is considered vertical jumping. The impact of volleyball skills (Tourism and Sports Department, 2013) leads to jumping skills, so jumping, intercepting or jumping to challenge points increases the likelihood of consistency (John W. Masley, Ara Hairabedian & Donald N. Donaldson, 2013) which requires the strength of the leg muscles in exercise in order to play within a powerful time period. If the athlete has a lot of strength in the leg muscles. Volleyball also has a high potential, which is one of the elements that help volleyball players. Athletes with lower high jump abilities are more likely to challenge scores than high jumpers (Ronnie Lidor and Gal Ziv, 2010) and (Dariusz Mroczek,et al.2017). There is a greater chance of success at higher levels of sporting events.

5. CONCLUSIONS AND RECOMMENDATIONS

Practicing with the weight training program to increase muscle strength on an exercise ball can increase the performance of volleyball players. Have leg muscle performance Strong side, stand up, jump higher and stand a longer jump. Therefore, a weight training program on an exercise ball can be applied to enhance physical fitness, especially leg muscle performance. Depending on the suitability of the equipment, the training facility it also applies to other sports that require the ability of the athlete in leg muscle strength such as volleyball. Basketball Sepaktakraw etc.

REFERENCES

Anderson K, Behm DG. (2005). Trunk muscle activity increases with unstable squat movements. Can J Appl Physiol. 2005;30 (1):33–45. doi: 10.1139/h05-103

Atle Hole Saeterbakken, Vidar Andersen, June Jansson and Ann Charlotte Kvellestad. (2014). Effects of BOSU Ball(s) During Sit-Ups with Body Weight and Added Resistance on Core Muscle Activation. The Journal of Strength and Conditioning Research 28(12). June 2014.

Bompa, O. (1993). Periodization of strength: The new wave in strength training. Toronto: Veritas Publishing.

Boonta Khakai. The effect of exercise ball and roman chair training upon back muscle strength. Master of science (Sport Science), Interdisciplinary Graduate Program.

Boyer, Tina J., Hammer, Suzanne S., Jepson, Tyler L. and Thompson, Eric G. (2006). Effect of Instruction on EMG Activity of the Rectus Abdominis during a Crunch on a Swiss Exercise Ball. Physical Therapy Scholarly Projects.

Craig A Goodman, Alan J Pearce, Caleb J Nicholes, Brad M Gatt, Ian H Fairweather. (2008). No Difference in 1RM Strength and Muscle Activation During the Barbell Chest Press on a Stable and Unstable Surface. J Strength Cond Res. 2008 Jan;22(1):88-94.

Chaninchai Intiraporn. (2001). The comparison of the effects of combined plyometric training and weight training, plyometric training with weight and complex training on legs muscular power development. Master. Education (Physical Education). Chulalongkorn University. Bangkok. (Thailand).

Chuphong Chanarun. (2015) .Effect of leg strength training upon kicking ability of football players among the age of thirteen to fifteen. Master of Education Degree in Physical Education. Nakhon Sawan Rajabhat University.

Chiu-Fang Yan, Ya-Chi Hung, Meei-Ling Gau , Kuan-Chia Lin. (2014). Effects of a stability ball exercise programme on low back pain and daily life interference during pregnancy. Midwifery. 30 412–419

Colleen Craig. (2001). The World's Most Popular Workout Using the Exercise Ball. Inner Traditions Bear & Co.

Dariusz Mroczek, Edward Superlak, Adam Kawczñski & Jan Chmura. (2017). Relationships between motor abilities and volleyball performance skills in 15-year-old talent-identified volleyball players.Baltic Journal of Health and Physical Activity. Journal of Gdansk University of Physical Education and Sport in Gdansk.9(1): 17-27.

David G. Behm, Thomas Muehlbauer, Armin Kibele, and Urs Granacher. (2015). Effects of Strength Training Using Unstable Surfaces on Strength, Power and Balance Performance Across the Lifespan: A Systematic Review and Meta-analysis. Sports Med. 45: 1645–1669.

Department of Physical Education. (2017). Physical fitness field test Football-Futsal Volleyball Badminton. Ministry of tourism and sport. Bangkok.

E. Erwin, Alicia Fedewa, Soyeon Ahn, Michelle Thornton. (2016). Elementary Students' Physical Activity Levels andBehavior When Using Stability Balls. The American Journal of Occupational Therapy. March/April Vol. 70(2).

Eleni Zetou, Nikolaos Tsigilis, Athanasios Moustakidis and Andromachi Komninakidou. (2006). Playing characteristics of men's Olympic Volleyball teams in complex II. International Journal of Performance Analysis in Sport 6(1):172-177.

Eric T. Poehlman and Christopher Melby. (1998). Resistance Training and Energy Balance. International J. Sport Nutrition and Exercise Metabolism. Volume 8: Issue 2. pp.143 – 159.

Erika Zemková. (2017). Instability resistance training for health and performance. Journal of Traditional and Complementary Medicine Volume 7, Issue 2, April 2017, Pp 245-250

E. Zemková, M. Jeleň, I. Radman, L. Svilar, D. Hamar. (2016). The effect of stable and unstable lifting conditions on muscle power and fatigue rate during resistance exercises Kinesiology.

E. Zemková, D. Hamar. (2013). Utilization of elastic energy during weight exercises differs under stable and unstable conditions. J Sports Med Phys Fitness, 53 (2013), pp. 119-129.

Fédération Internationale de Volleyball. (2015). Rules of The Game Volleyball Casebook. Compiled and Prepared by the FIVB Rules of the Game Commission.

Fleck, S.J., and Kraemer, W.J. (1987). Designing resistance training programs. Champaign, IL: Human Kinetics.

Fujii, K. and Akazawa, K. (1979). Structure of skeletal muscle and its model. J. Soc. Instrument Control Engineers (Keisoku to Seigyo), 18(no.1): 10–15.

Frances Sharpe and Justin Price. (2009). The Complete Idiot's Guide to Functional Training,illustrated: The New Way to Exercise and Improve Everyday Activities. Penguin.

J. Bauer. (2013). The Effects of 12 Weeks of Resistance Training Under Stable and Unstable Conditions on Neuromuscular Performance in Handball Players. PhD thesis Comenius University in Bratislava, Faculty of Physical Education and Sports; p. 127.

Jarunun Phanggamta. (2009). The Effect of Core Body Training on Exercise Ball and the Floor Exercise upon Back Muscle Strength and Flexibility in Rhythmic Gymnastics. M.S. (Sports Science). Kasetsart University.

Jaruwat Yodchu. (2001). The effect of two types of pyramid weight training on leg muscle strength. Master of Education; Physical Education. Ramkhamhaeng University.

John W. Masley, Ara Hairabedian & Donald N. Donaldson. (2013). Weight Training in Relation to Strength, Speed, and Co-ordination. Journal Research Quarterly. American Association for Health, Physical Education and Recreation Vol. 24, 1953 - Issue 3 pp 308 – 315.

Joseph Mercola. (2014). Total Body Benefits Using a BOSU Ball. From: https://fitness.mercola.com/sites/fitness/archive/2014/11/21/bosu-ball-exercises.aspx.

Juan C.S. (2000). Stability Ball Training - Part 4. From: https://www.ptonthenet.com/articles/Stability-Ball- Training---Part-4-998.

Justin A. DeBlauw, Pratik M. Patel, Jesse A. Stein, Thomas J. Barstow, Craig A. Harms, Katie M. Heinrich. (2018). High Intensity Functional Training Improves Flexibility in Overweight and Obese Adults. American College of Sports Medicine -Annual Meeting.

Katou M, Yamasaki H. (2009). Comparison of reliability of isometric leg muscle strength measurements made using a hand-held dynamometer with and without a restraining belt. Journal of Physical Therapy Science 21(1):37-42.

Kevin G Laudner , Matthew M Koschnitzky. (2010). Ankle Muscle Activation When Using the Both Sides Utilized (BOSU) Balance Trainer. J Strength Cond Res. 2010 Jan;24(1):218-22.

Kibele, Armin, Behm, David. (2009). Seven Weeks of Instability and Traditional Resistance Training Effects on Strength, Balance and Functional Performance.Journal of Strength and Conditioning Research: December 2009 - Volume 23 - Issue 9 - p 2443-2450.

Maffiuletti NA, Cometti G, Amiridis IG, Martin A, Pousson M, Chatard JC. (2000). The effects of electromyostimulation training and basketball practice on muscle strength and jumping ability. Int. J. Sports Med. 21:437–443.

Milić Vladan, Nejić Dragan, Kostić Radomir. (2008). The effect of plyometric training on the explosive strength of leg muscles of volleyball players on single foot and two-foot takeoff jumps. Facta universitatis - series: Physical Education and Sport, vol.6, iss.2, pp. 169-179.

Ministry of Tourism and Sport. (2013). Analysis of Landing Characteristic and Frequency in Youth Volleyball Player. Research and Development Section. Bureau of Sport Science. Department of Physical Education.

Mounir, A, Nermeen, F. (2008). The effect of using the Swiss ball to learn some offensive basketball skills, 3rd international scientific conference, faculty of physical education for girls, Zagazig, March 2008.

Nevin Badr. (2013). The effects of Bosu ball training on Teaching and Improving the Performance of Certain Basic Skills. Science, Movement and Health, Vol. XIII, **ISSUE 2 supplement, 13 (2), 498-505 September 2013.**

Newton RU, Kraemer WJ, Häkkinen K. (1999). Effects of ballistic training on preseason preparation of elite volleyball players. Med. Sci. Sports Exerc. 31:323–330.

Paige Waehner. (2017). Core Exercises on the Ball. From: https://www.verywellfit.com/core exercises-on-the-ball-1230745.

Phanuphan Lapratlanathong. (2006). The Effect of Strength Training Leg Muscle on the Jumping of Basketball Player. Master of Science, Sport Science. Chiang Mai University.

Paul Rogers. (2020). A Fundamental Guide to Weight Training; The Basics of Weight Training Practices and Programs. From: https://www.verywellfit.com/weight-training fundamentals-a-concise-guide-3498525.

Ronnie Lidor, Gal Ziv. (2010). Physical Characteristics and Physiological Attributes of Adolescent Volleyball Players-A Review. Pediatric Exercise Science, Human Kinetics, 22, 114-134.

Richard A. Dicenso. (2017). Stability Ball Training – Benefits of Exercising with a Ball. from: www.shapefit.com: https://www.shapefit.com/exercise/stability-ball training.html.

Sargent, D.A. (1921). The Physical Test of a Man. American Physical Education Review, 26, 188-194.

Saeterbakken AH, Andersen V, Jansson J, Kvellestad AC, Fimland MS. (2014). Effects of BOSU ball(s) during sit-ups with body weight and added resistance on core muscle activation.

Stojanović Toplica, Kostić Radmil M. (2002). The effects of the plyometric sport training model on the development of the vertical jump of volleyball players. Factauniversitatis - series: Physical Education and Sport.vol.1(9,) pp. 11-25.

Tavorn Kamutsri, Amorn Treeraj, Chatchai Sriwilai & Jira Nabsanit, (2015). The Physical Fitness Norms of Thai University Athletes. Journal of sports Science and technolog The Sports Science Society of Thailand (SSST) Volume 15, No. 2, December 2015

Vithoon Yamasamit. (2009). The Effect of Weight Training of Pre - Cadet Quadricep Muscles Upon 50 Meter Speed in Academic Year 2008. M.S. (Physical Education). Bangkok: Graduate school, Srinakharinwirot University.

Wood, R. J. (2010). Complete Guide to Fitness Testing. Topendsports.com. Retrieved 7 March 2019, from https://www.topendsports.com/testing/

Yıldız Yaprak. (2018). The Effect of Core Exercise Program on Motoric Skills in Young People. International Journal of Sports and Exercise Medicine. Vol. 4(4).

Yuya Watanabe, Michiya Tanimoto, Naoko Oba, Kiyoshi Sanada, Motohiko Miyachi and Naokata Ishii. (2015). Effect of resistance training using bodyweight in the elderly: Comparison of resistance exercise movement between slow and normal speed movement. Epidemiology, Clinical Practice and Health.

Zetou E, Moustakidis A, Tsigilis N, Komninakidou A. (2007). Does effectiveness of skill in complex I predict win in Men's Olympic Volleyball Games. J Quant Anal Sport. 3:11. 2007.