6. Firea, E. (2003) - *Methodology of school physical education*, Bucharest: Ecological University
7. Iconomescu T. M., (2013) Didactics of Physical Education and Sport / Lecture Notes, Galati, p 36-37
8. Lyu, M. (2013) - *A case study of head-bounce spin skill classes in vault gymnastics with Hanaro teaching model*, Korean Association of Sport Pedagogy, Vol.20, no1, pp 143-162
9. Marcu, V. et al (2003) - *Psychopedagogy for teacher training,* Oradea: University Press
10. Sloan, S. (2007) - *An investigation into the perceived level of personal subject knowledge and competence of a group of pre-service physical education teachers towards the teaching of secondary schoolgymnastics*, European Physical Education Review, Vol.13, no.1, pp 57-80, London, Sage Publications Ltd
11. Şerbănoiu, S.(2004) - *Methodology of physical education,* Bucharest: University Book Publishing
12. Văideanu, G. (1988) - *Education to the formation of the millennium*, Bucharest: Didactic and Pedagogical Publishing

THE EFFECT OF TRAINING BALANCE USING INSTABLE SURFACES IN THE OPTIMIZED TRAINING OF WOMEN U16 HANDBALL PLAYERS

Costea Liana Maria[a], Acsinte Alexandru[b], Turcanu Florin[c]

[a]*Agricultural High School T. Savulescu, Tirgu Mures, Romania*
[b]*Health, Sports and Human Movement Sciences Faculty, Vasile Alecsandri University of Bacau, Romania*
[c]*University of Medicine and Pharmacy, Gheorghe Marinescu Street, Tirgu Mures, Romania*

Abstract

To carry out this study I started from the idea that implementing methods using unstable surfaces contribute to the development of balance in women U16 handball players. The role of unstable surfaces is to intensify muscular activity, particularly the neuromuscular component associated with static balance at the expense of the mechanical load. The correct and timely use of unstable surface procedures during training sessions, when compared to classical handball training methods, clearly lead to a better development of static and dynamic balance. The research was carried out during one sport season on two groups: experimental and control, each comprising ten players. The training of both groups was executed based on the same anual training plan, the difference being that on the experimental group unstable surface procedures were used, while on the control group procedures specific to handball training. The following tests were applied: stability test with multiple single leg jumps (right and left), two-leg balance with legs close together, eyes open and closed. After applying the tests there was visible improvement in results for the experimental group, while there was no obvious change in the results of the control group. The procedures used on the experimental group proved to be more effective than the procedures specific to handball training. The results of the experimental group in both tests, following the use of unstable surface procedures, shows an improvement in balance compared to control group subjects.

Keywords: Balance, unstable surface, optimization, handball;

Introduction

Lately there has been an increased demand for optimal development of competences and characteristics of young handball players' training process. According to researchers such as Milanovic, D., (2007) , Ilic, D., et.al., (2009), these have contributed mainly by an increase in applying scientific methods, by more efficient procedures of methodical training, as well as by shaping players according to their individual abilities and characteristics.

On a high level, handball players have a vast technical repertoire backed by their skills, like coordination, balance, or reaction and execution speed (Starosta, W., 2006).

One of the current trends is to introduce specific elements of proprioceptive development into frame of training programmes, meant to improve the specific indicators of static and dynamic balance, as well as neuromuscular coordination, starting from an early age (Acsinte, A., et.al., 2012).

The programmes meant to develop neuromuscular control often include balance exercises whose purpose is optimizing training, prevention of and recovery from injuries (Zech, A., et.al., 2010).

Posture control or balance can be defined as the ability to maintain a foothold with minimal movement, as well as the ability of executing a task while preserving a stable position. This is maintained by way of a dynamic integration of forces and both internal and external factors involving the environment (Lee, A., et.al., 2006;

Bressel, E., et.al., 2007). Adjusting balance dependson visual, vestibular and proprioceptive stimuli (Subasi, S.S., et.al., 2008; Gribble, P.A., et.al., 2007).

Maintaining posture control includes integrating information from neurosensors of three types, vestibular, visual and somesthetic, into the vestibular nuclei, to generate a motoric response in a certain context which leads to control of the anti-gravitational activity (Gauchard, G.C., et.al., 2003).

The authors Freiwald, J., et.al., (2006) and Gstöttner, M., et.al., (2009) underline the importance of training balance based on scientific programmes on coordination to prevent lesions and improve performance.

Various studies show that developing balance may lead to improving posture and neuromuscular control. The same studies show that, from a clinical point of view, developing balance leads to improving static and dynamic postural balance.

Periodical evaluation and monitoring of static and dynamic balance in young athletes may be an important instrument the correct layout and alternation of training programmes, depending on the sport in question, the improvement rate of balance scores in time and athlete's age. This would allow, in each period of the athlete's development, the creation and optimization of a large, well rounded set of fundamental motoric skills (Lidor, R., et.al., 2005).

The goal of this research is the development of static and dynamic balance by the use of unstable surfaces in order to optimize the training of women U16 handball players.

Hypothesis: this research was started from the idea that the optimization of the training of women U16 handball players, can be achieved with greater efficiency when developing balance by way of utilising unstable surfaces.

Material and Methods

This research was carried out during 2013-2014 sport season, on two groups: a experimental group and a control group. The athletes from the experimental group were players of Arena Sports Club Tîrgu Mureș. The training sessions were held in the gymnasium of „Serafim Duicu" Elementary School. The members of the control group were players of the Sporting Association of „Ioan Vlăduțiu" Elementary School from Luduș. The training sessions were held in the school's gymnasium.

The subjects of this research had the age of 15 to 16 and were a total of twenty (10 for the experimental group and 10 for the control group).

Both groups had five training sessions per week, each of a duration of an hour and half, based on the training plan devised by the two coaches. Traditional training methods were used, specific to the game of handball and adapted to the level of training of the two groups. In addition to these specific procedures of handball training, the experimental group, during individualized training, was subjected to specific balance developing procedures on unstable surfaces, with elastic bands, on gym balls and with TRXs, three times a week, for thirty minutes each.

The procedures proposed by us were adapted to the game of handball, especially for wings and line players, having the purpose of static and dynamic balance development.

The proposed program aimed at the development of the following skills: force, speed, balance and leg control. The procedures used were aimed at improving posture and neuromuscular control.

Ex.1. Forward movement on 10 lined-up balance fits.

Ex.2. Backward movement on 10 lined-up balance fits.

Ex.3. Forward movement on 10 lined-up balance fits while catching and passing the ball diagonally, left to right. Disturbing balance by way of elastic bands laid out at hip height by pulling back, to the side, left and right. For increased difficulty passing the ball will be carried out while standing on single leg.

Ex.4. Passing in twos (threes) with hand above shoulder, balancing on opposing leg to passing hand.

Ex.5. Passing in twos (threes) while sitting on gym ball, with dominant hand above shoulder.

Ex.6. Passing in twos (threes) while kneeling on gym ball, with dominant hand above shoulder.

Ex.7. Standing with left foot on balance fit, foot being fixed into TRX handle. Lunge backward with rebound on one leg. The exercise is repeated standing on right foot.

Ex.8. Standing with right foot on balance fit, facing climbing frame, holding TRX handles. Lunging back with left leg and rebound to standing position, jump with upward takeoff and landing on same leg. Balancing leg's knee is brought to the chest imitating the balancing move of the leg during jump shot on goal. The exercise is repeated standing on left foot.

Ex.9. Standing on foot on front arm's side with ball in hand. Step with foot opposite to shooting arm on balance fit, takeoff and jump toward 7m line to increase shooting angle, and finishing.

Ex.10. Standing in the corner, elastic band around hip. Penetration on pass receipt, takeoff from balance fit toward 7m line to increase shooting angle and finishing.

Ex.11. Elastic band around hip, drawn. Frontal takeoff and jump from both feet onto two balance fits, jump back downwards.

Ex.12. Standing on two balance fits in basic pivot position (facing the ball), with defender's opposition. This exercise will be executed both on first and second step of line player.

Ex.13. Elastic band around hip, drawn, sideways movement along goal area line to intermediary defenders' area, pass, pivot move (first or second pivot step), shot on goal from diving. Takeoff will be executed from foot opposite to shooting arm, from foot on shooting arm's side as well as with both feet on balance fit.
The efficiency of the procedures used during this research was verified by applying the following tests:
Two-leg balance with legs close together, eyes open (15 seconds recording time)
Two-leg balance with legs close together, eyes closed (15 seconds recording time)
Before the start of the training programme and at its end measuring sessions were held by means of AMTI BP400600 force plate (www.AMTI.biz).
Upon testing two-leg balance with legs close together and eyes open, a 0.065 (20.5%) cm lower average value of displacement was found for the experimental group. This difference shows an increase of static balance for the experimental group. The average values are 0.254 for the experimental group and 0.319 cm for the control group. The data dispersion is inhomogenous with the experimental group and homogenous with the control group. The difference is statistically significant according to the Mann-Whitney significance test, for z = -2.268 and p = 0.023 < 0.05. The effect size index (0.51) shows a high to very high difference between the two groups (Table 1).

Table 1. Two-leg balance with legs close together, eyes open

Group	The average	The average difference	The median	Minimal	Maximal	Variation coefficient	Mann-Whitney Z	P	Effect size
Experimental	0.254	-0.065	0.227	0.172	0.419	35.0%	-2.268	0.023	0.51
Control	0.319	-20.5%	0.321	0.274	0.379	10.8%			

The test for two-leg balance with legs close together and eyes closed showed a 0.144 (32.6%) cm lower average value of displacement for the experimental group. This signifies a better static balance of the experimental group. The average values are 0.299 for the experimental group and 0.443 cm for the control group. The data dispersion about the average is relatively homogenous with the experimental group and homogenous with the control group. The difference between the two average values is statistically significant according to the Mann-Whitney significance test, for z = -3.214 and p = 0.001 < 0.05. The effect size index (0.72) shows a high to very high difference between the two final testing (Table 2).

Table 2. Two-leg balance with legs close together, eyes closed

Group	The average	The average difference	The median	Minimal	Maximal	Variation coefficient	Mann-Whitney Z	P	Effect size
Experimental	0.299	-0.144	0.279	0.253	0.485	22.9%	-3.214	0.001	0.72
Control	0.443	-32.6%	0.455	0.356	0.532	12.6%			

Stability test with multiple single leg jumps (Figure 1):

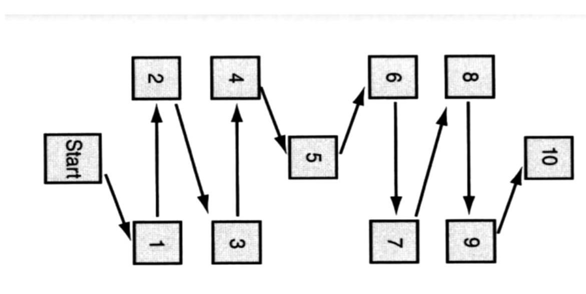

Figure 1. Stability test

The multiple single right leg jumps stability test showed a 29.90 (58.5%) point lower average value of execution errors for the experimental group. The average values are 21.20 for the experimental group and 51.10 points for the control group. The data dispersion with both groups is inhomogenous. The difference is statistically significant according to the Mann-Whitney significance test, for z = -3.100 and p = 0.002 < 0.05. The effect size (0.69) shows a high to very high difference between the two final testings (Table 3).

Table 3. Stability test with multiple single right leg jumps

Group	The average	The average difference	The median	Minimal	Maximal	Variation coefficient	Mann-Whitney Z	P	Effect size
Experimental	21.20	-29.90	20.50	6	36	53.1%	-3.100	0.002	0.69
Control	51.10	-58.5%	52.00	21	73	38.6%			

The multiple single left leg jumps stability test showed a 26.40 (52.8%) point lower average value of errors made by subjects from the experimental group. The average values are 23.60 for the experimental group and 50.00 points for the control group. The data dispersion with both groups is inhomogenous. The difference is statistically significant according to the Mann-Whitney significance test, for z = -2.879 and p = 0.004 < 0.05. The effect size (0.64) shows a high to very high difference between the two groups (Table 4).

Lettering and symbols should be clearly defined either in the caption or in a legend provided as part of the figure. Figures should be placed at the top or bottom of a column wherever possible, and as close as possible to the first reference to them in the paper. Leave one line space between the heading and the figure.

Table 4. Stability test with multiple single left leg jumps

Group	The average	The average difference	The median	Minimal	Maximal	Variation coefficient	Mann-Whitney Z	P	Effect size
Experimental	23.60	-26.40	22.00	6	43	55.8%	-2.879	0.004	0.64
Control	50.00	-52.8%	42.00	28	79	35.9%			

1. Discussion

The results recorded in this research indicate the emergence of significant differences between the two groups from the initial to the final testing, on account of, as we believe, the procedures carried out on unstable surfaces, proposed by us. After applying the Two-leg balance tests with legs close together, eyes open and closed (15 seconds recording time) and the Stability test with multiple single (right and left) leg jumps, a significant progress can be observed with the experimental group as compared with the control group.

It is recommended that with young athletes training balance be started with exercises aiming static balance, followed later by more complex ones for dynamic balance.

It is also recommended that training balance should start on a stable surface with a wide base for foothold and visual feedback. For increased efficiency the difficulty level of execution can be raised: narrow base for foothold with eyes open; wide base from foothold with eyes closed; narrow base for foothold with eyes closed.

The complexity of movements involved as well as the execution of exercises on different types of surfaces (sand, lawn, grass, various devices etc.) lead to the facilitation of the balance training process.

The role of unstable surfaces is to intensify muscular activity at the expense of mechanical load. By introducing unstable surfaces the proprioceptive feedback is unreliable due to the fact that the control mechanism responsible for maintaining balance is being permanently stimulated, its task thus becoming more difficult.

If similar, complete program of neuromuscular training were initiated on a large scale, handball players would likely achieve optimum level performances combining the effects of improving power, force, speed, hip-area stability, functional biomechanics and reducing injury proneness. In addition, when used at the right moment of muscular and movement control development, even greater effects could be attained as regards performance and reducing injury proneness.

In view of the results of this study we can conclude that implementing program that include procedures on unstable surfaces can have a considerable impact on performance by creating and optimizing a wide array of fundamental motor skills.

The role of unstable surfaces is to intensify muscular activity at the expense of mechanical load. By introducing unstable surfaces the proprioceptive feedback is unreliable due to the fact that the control mechanism responsible for maintaining balance is being permanently stimulated, its task thus becoming more difficult.

These exercises, carried out in special conditions (on balance fits, using TRXs, gym balls), stimulate proprioception and may lead to an increase in athletic performance both in case of a high stress game and of technical performance demands in particular situations: imbalance, shooting, passing etc.

References

1. Acsinte, A., Alexandru, E., Guiterrez a Quilar, O., (2012), *Neuro-muscular coordination and balance skills development in young female handball players*, 2nd EHF Scientific conference women and handball scientific and practical Approaches, 28-32;
2. Bressel, E., Yonker, J.C., Kras, J., Heath, E.M., (2007), *Comparison of static and dynamic balance in female collegiate soccer, basketball, and gymnastics athletes*, Journal of Athletic Training, 42-46;
3. Freiwald, J., Papadopoulus, C., Slomka, M., Bizzini, M., Baumgart, C., (2006), *Prävention im fußballsport. Sportorthopädie Sporttraumatologie*, 22, 140–150;
4. Gauchard, G.C., Gangloff, P., Jeandel, C., Perrin, P.P., (2003), *Physical activity improves gaze and posture control in the elderly, Neurosci Res* 45, 409-417;
5. Gribble, P.A., Tucke,r W.S., Whit, P.A., (2007), *Time-of-day influences on static and dynamic postural control.* J Athl Train 42, 35–41;
6. Gstöttner, M., Neher, A., Scholtz, A., Millonig, M., Lembert, S., Raschner,C., (2009), *Balance ability and muscle response of the preferred and nonpreferred leg in soccer players, motor control*, Human Kinetics,13, 218-231;
7. Ilić, D., Drašković, V., Marković, S. (2009). *Selection of students for handball gifted teaching physical education*. In Book of Abstracts 5-th FIEP Euoropean congress, 2- nd Serbian congress of P.E. Teachers (52). Niš: Ministry of youth and sport, Minisrty of science and technological development ministry of education;
8. Lee, A., Lin, W., Huang, C., (2006) *Impaired proprioception and poor static postural control in subjects with functional instability of the ankle*. J Exerc Sci Fit 4, 117–125;
9. Lidor, R., Falk, B., Arnon, M., Cohen ,Y., Segal, G., Lander, Y., (2005), *Measurement of talent in team handball: The questionable use of motor and physical tests*. J Strength Cond Res.; 19, 318–325;
10. Milanović, D. (2007), *Training theory*, Zagreb: Faculty of Kinesiology;
11. Starosta,W., (2006), *The concept of modern training in sport, Physical Culture And Tourism*, 13(2), 9-23;
12. Subasi, S.S., Gelecek, N., Aksakoglu, G., (2008), *Effects of different warm-up periods on knee proprioception and balance in healthy young individuals*. J Sport Rehab 17, 186–205;
13. Zech, A., Markus Hubscher, M., Vogt, L., Winfried Banzer, W., Hansel, F., Pfeifer, K., (2010), *Balance training for neuromuscular control and performance enhancement: a systematic review*, Journal of athletic training, 45(4), 392–403.

THIGH MUSCLES ELECTROMYOGRAPHY RESEARCH

Daniel Ganea

Department of Manufacturing Engineering, "Dunărea de Jos" University of Galati, Romania
daniel.ganea@ugal.ro

Abstract:
The aim of this study is to examine the effect of body mass increase (32.46% and 64.92%) over two main muscles of the human musculoskeletal system. Therefore, were analyzed the thigh muscles. More precisely was captured the electrical activity of rectus femoris muscle and biceps femoris muscle. For this experiment was used a BIOPAC MP 150 data acquisition system. The experiment consisted in five trials, 15 seconds each, departing from siting and followed by three normal steps and a relaxation phase. The resulted data revealed that although the lower limbs muscle structure is extremely complex the two muscle in question retrieve a large amount of overload, given that in some cases the electrical activity doubles in amplitude.

Key words: electromyography, biceps, rectus, muscle activity

1. Introduction

The human locomotor system is an extremely complex system that provides form support, stability, and movement to the body. A key component of the human locomotor system is the muscular system. Muscular system fundamental element is the muscle cell. Due to the excitability property, the muscle cell generates electric and magnetic fields and as a consequence forces that sustain in balance and propels the body. A method for analyzing the electric fields is electromyography (EMG). The electromyography represents the study of muscle activity by monitoring the electric signal produce at rest or moving by the muscle cell. In addition, this method is a noninvasive method for analyzing skeletal muscle. The EMG signal is a succession of action potentials (Motor Unit Action Potential – MUAP). Thus, the EMG signal results from summing of all fiber