






Swiss ball as a tool supporting the learning of safe fall (*ukemi*) and shaping the balance of the body for trainers, sport instructors and Physical Education teachers

Authors' Contribution:

-  **A** Study Design
-  **B** Data Collection
-  **C** Statistical Analysis
-  **D** Manuscript Preparation
-  **E** Funds Collection

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Abstract

Many years of professional practice of the authors of this study indicates that it is “Swiss ball” that is the best tool for learning *ukemi* and body balance. The Swiss ball was produced in the 1960s in Italy. There are many studies in which “Swiss ball” was used as a tool to activate specific muscle groups, especially the abdominal muscles, as well as to improve the stability of the body and the economisation of effort. The aim of the work is the recommendation of the possibility of using “Swiss balls” as a tool supporting learning to fall as anti-traumatic prophylaxis.

Material & Methods:

“Swiss balls” are inflated rubber balls originally produced in Italy under the name “Pezzi balls”, currently offered by various companies, of varying quality and in different sizes and even different shapes. The balls with diameters 55.65 and 75 cm are most often used. The vast majority of these balls can withstand a load of 200kg and more. Exercise people put on the ball, on the stomach, arms, legs and head are close to the ball creating the so-called. “Frog position”. In this way, they learn to keep their balance and control the forward, backward and side tilts. This arrangement of the body is the basic element preceding the controlled roll-up of the ball with the ball. It is important that the ball is properly selected to the student's body height. The research on the suitability of the use of balls was carried out on blind and visually impaired people practising “Gold ball” in the Wrocław sports club, as well as on children attending kindergarten and school in the number of 500 people.

Results:

Practical application of the Swiss ball based on three phase: the first consists in allowing the exercising person to familiarise him or herself with the ball by means of introductory exercises; second, includes exercises proper performed under the instructor's supervision and protection (in this phase the difficulty of exercises is increased, which requires a great deal of attention from the instructor; In the third phase, exercises properly are performed by the exercising persons on his or her own, without the instructor's protection.

Conclusions:

The use of “Swiss balls” to learn the balance of body *ukemi* is an innovative approach in the broadly understood anti-traumatic prevention in the event of sudden collisions and falls. Exercises with the ball cause a better understanding and quicker absorption by the practising movement structure than in the classic teaching approach of *ukemi*. The classes themselves are more interesting and create a sense of fun, which is not without significance when working with children and teenagers.

Keywords:

anti-traumatic prophylaxis • fall injury prevention • “Gold ball”

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Fall – is unintentional, a sudden change from vertical to horizontal posture [31].

Ukemi – the term for breakfalls designed to process the body when thrown [32].

Injure – verb to hurt someone or a part of the body [33].

Injury – noun damage or a wound caused to a person's body [33].

O goshi – full hip throw.

Swiss ball – constructed of soft elastic with a diameter of approximately 35 to 85 centimetres (14 to 34 inches) and filled with air (...) It is most often used in physical therapy, athletic training and exercise (...) The ball, while often referred to as a Swiss ball, is also known by a number of different names, including balance ball, birth ball, body ball, ball, fitness ball, gym ball, gymnastic ball, physioball, pilates ball, Pezzi ball, sports ball, stability ball, Swedish ball, therapy ball, or yoga ball (Wikipedia).

Non-apparatus test – that motoric test (exercise endurance test) of the required reliability (accurate and reliable), which use does not require even the simplest instruments [34].

INTRODUCTION

When considering the human-ground interaction, we may assume, with great simplification, that a person in motion possesses two types of energy: potential and kinetic [1]. In everyday life circumstances, we have no influence on the amount of that energy, as it depends on the weight and height of our body and the speed of our movement. The occurrence of injuries during falls is primarily determined by the manner in which mass is distributed on the ground and the path. The energy arising from the distortion of our body may be increased or decreased; it depends on the size of the body's contact with the ground and the stopping distance. A merely twofold increase in both of these values reduces the energy in a given case by 16 times, while a 5-fold increase – by as many as 625 times [1, 2]. Our body is, therefore, able to withstand very large overloads, provided that they last for a short time and the stopping is distributed over a large surface, which we increase through multiple rotational movements of the body. Such a situation may be excellently reproduced through the use of a large exercise ball – the so-called Swiss ball.

The long-time professional experience of the authors of this study indicates that a “Swiss ball” is the best tool supporting the learning of *ukemi* and the development of body balance. It was created in the 1960s in Italy and, according to Otterli and Larsen [3], was first used by an English physiotherapist, Dr Mary Quinton, who noted that it could be applied in the medical rehabilitation of children suffering from neurological disorders (such as cerebral palsy). There have been many studies in which a Swiss ball was used as a tool for activating particular muscle groups, especially the abdominal muscles [2, 4], as well as for improving body stability and effort economisation [5-7].

The aim of the work is the recommendation of the possibility of using “Swiss balls” as a tool supporting learning to fall as anti-traumatic prophylaxis.

MATERIAL AND METHODS

This article is intended to:

- identify selected objectives of the use of Swiss balls as a tool supporting the learning of *ukemi* (falling),
- familiarise the reader with the application of Swiss balls in injury prevention,
- consider the use of Swiss balls to reduce mental tension during body rotation in persons undergoing the initial phase of adaptation to *ukemi* (falling),
- reveal the application of Swiss balls for coaches, sport instructors and physical education teachers as well as trainees.

The research on the suitability of the use of balls was carried out on blind and visually impaired people practising “Gold ball” in the Wrocław (Poland) sports club, as well as on children attending kindergarten and school in the number of 500 people.

What are the Swiss balls?

They are inflated rubber balls, originally manufactured in Italy under the name Pezzi balls and currently offered by various companies. They are of varying quality and come in different sizes and even different shapes. The most frequently used balls are those with diameters of 55.65 and 75 cm. The overwhelming majority of these balls can withstand a load of 200 kg and more. Exercising persons lie down on the ball, on their stomach, with their arms, legs and head clinging to the ball, forming the so-called ‘frog position’. In this way, they learn to maintain their balance and control their forward, backward and sideways tilts. This body arrangement is the basic element preceding the exercising person is controlled rolling with the ball. It is important to ensure that the ball is properly selected to suit the trainee's body height. The following ball sizes are used on

the basis of the person's height: body height of less than 154 cm – ball diameter of 45 cm; body height of 155-172 cm – ball diameter of 55 cm; body height of 173-189 cm – ball diameter of 65 cm; body height of more than 190 cm – ball diameter of 75 cm.

It must be ensured that the ball is strongly inflated so that it can roll freely and gives the impression of being stable and well made. It also cannot be ragged or nicked. Exercise balls may have protrusions (stimulating circulation and sensory receptors and making it easier to maintain balance and stability) or be completely smooth on their surface [8].

Safety

Balls are simple to roll, and therefore, during initial classes, instructors must exercise extreme caution, apply and modify exercises accordingly and demonstrate familiarity with the principles of protection and safety [9]: exercises with a person's head turned down may only be performed when there are no contraindications to assuming the so-called 'frog position' and when such a position does not cause dizziness or other ailments, e.g. those of the abdominal cavity; persons with increased anxiety or those with a disturbed spatial orientation should always perform exercises under the constant supervision and protection of their instructor or, otherwise, they may sustain bodily injuries; persons with advanced

osteoporosis should not use Swiss balls at all, as their bones are too fragile; a person performing ball exercises should be protected until he or she is able to maintain balance (frog position) on their own and correctly perform the designated rotation together with the ball; exercises with a Swiss ball are best carried out on a tatami mat or properly arranged gymnastic mattresses, so that the exercising person does not experience any pain when coming into contact with the ground; one should never use a damaged ball.

RESULTS

Practical application of the Swiss ball

The first phase consists in allowing the exercising person to familiarise him or herself with the ball by means of introductory exercises. In Figures. 1-2 the instructor is familiarising the exercising person with a Swiss ball.

In the following exercises the trainee performs, on his or her own but under the instructor's supervision, simple induction exercises with the equipment, being various forms of contact with the ball aimed at acquainting the user with it. In these exercises the trainee assumes various positions in relation to the ball, e.g. lying on the ball, sitting on it while trying to maintain balance, etc. (Figures 3-7).



Figure 1. Familiarising the exercising person with the ball – rolling the ball over the exercising person lying on his or her back.



Figure 2. Familiarising the exercising person with the ball – rolling the ball over the exercising person lying on his or her stomach.



Figure 3. Lying on the ball on one's stomach and gripping the ball firmly with both hands.



Figure 4. Sitting on the ball while trying to maintain balance – with feet on the ground.



Figure 5. Maintaining balance on the ball with front support – with legs on the ball and hands on the ground.



Figure 6. Lying on the ball on one's back – with feet on the ground.



Figure 7. Keeping the ball between one's legs while lying on the back.

The second phase (after the exercising person has become familiar with the equipment) includes exercises properly performed under the instructor's supervision and protection. In this

phase, the difficulty of exercises is increased, which requires a great deal of attention from the instructor. Example exercises for this phase are presented in Figures 8-11.



Figure. 8 A-D. The instructor is controlling the trainee's position in relation to the ball, preparing him or her to learn *ukemi*.

In the third, phase exercises proper are performed by the exercising persons on his or her own, without the instructor's protection. This phase may begin after the exercising person has

become thoroughly acquainted with the ball and mastered a set of exercises with the instructor. Exercises are performed in various directions and various positions, also with the use and the



Figure 9 A-C. Rolling backwards over the ball with the instructor's protection.



Figure 10 A, B. Rolling backwards from a sitting position on the ball with the instructor's protection.

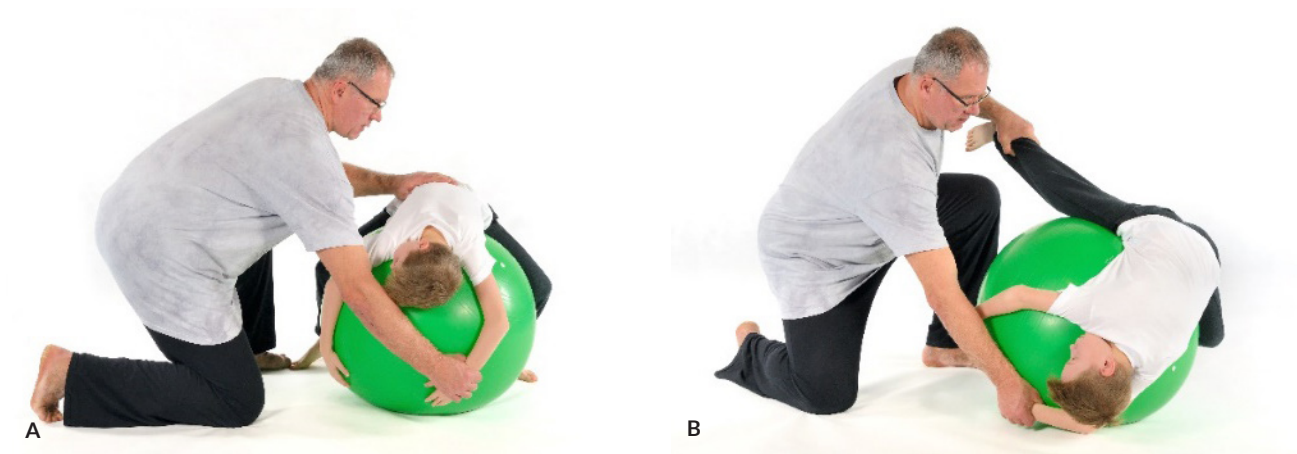


Figure 11 A, B. Rolling forwards with the instructor's protection.

assistance of another exercising person, who takes over the role of the instructor. A ball may also be used to familiarise a person with some judo throws, e.g. *o-goshi* (a hip throw). Example exercises are presented in Figures 12-14.

DISCUSSION

The presented method is an alternative to the long-standing “Polish school of safe falling” based on the theory of the soft fall of Ewaryst Jaskólski & Zbigniew Nowacki [1]. The biomechanical



Figure 12 A-C. Rolling sideways over the ball.

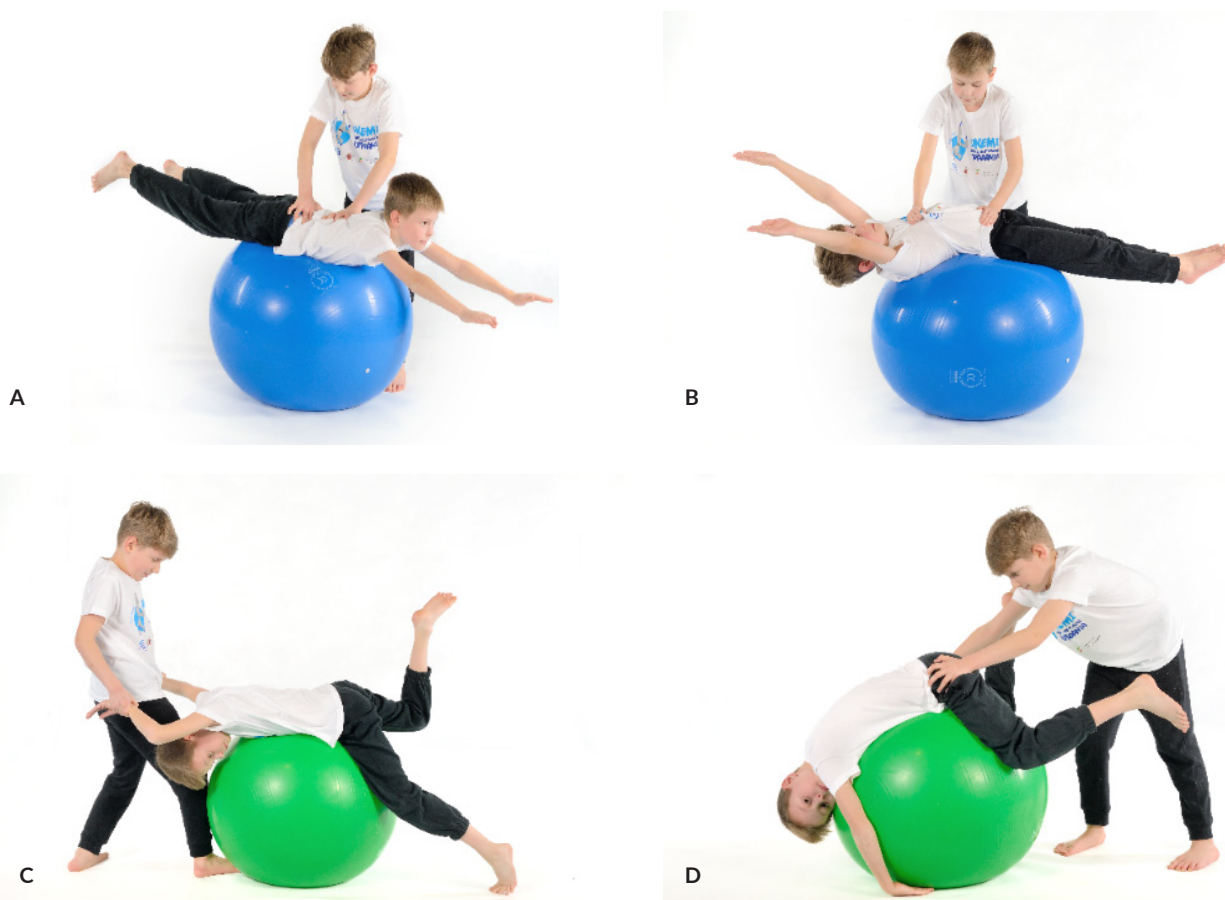


Figure 13 A-D. Exercises performed in pairs without the instructor.



Figure 14 A, B. Using the ball to become familiar with the structure of the movement that occurs when doing a big hip throw (*o-goshi*).

analysis of the rolling of the human body developed by A. Mroczkowski [10] is very suitable for the Swiss ball method used in this work. Andrzej Mroczkowski (PhD promoted by Ewaryst Jaskólski) also added an original rotating training simulator [11, 12].

However, the greatest contribution to the development of “Polish school of safe falling” was made by Roman Maciej Kalina (the first PhD promoted by Ewaryst Jaskólski in the 1982 year). Inspired by Jaskólski, RM Kalina, together with his son Artur, they developed theoretical and methodological bases of the teaching of the lower extremity of safe-flying [13]. Six years earlier, Artur published the results of an empirically verified hypothesis that safe fall exercises is universal and can be used from the youngest years of life to adulthood [14].

After many years of empirical verifications of individual programs and methods of using safe fall exercises for various risk groups (people with *eye diseases* and blindness, limb amputation patients, obese people [15-20]) RM Kalina promoted (January 2018) the first PhD of Health Sciences with such unique qualifications – Bartłomiej Gąsienica Walczak [19] (in 2009 Master of Physiotherapy). Master of Physiotherapy Dariusz Mosler (promoted by RM Kalina in 2013) conducts original research on

effects of cognitive-behavioural kinesiotherapy based on innovative agonology methods in the reduction of unintentional fall-related injuries of patients with mental impairment [21-23].

The original test developed by RM Kalina (non-apparatus category) “the susceptibility test to the body injuries during the fall” (STBIDF [24, 25]) is widely used not only in the studies cited above [26]. Together with non-apparatus safe falls preparations test (N-ASFPT [27]) are simple tools for qualifying patients (clients) for individually recommended kinesioprophyllactic (or kinesiotherapy) programs based on safe fall exercises. However, the most reliable information about the effectiveness of kinesioprophyllactic based on safe fall exercises, but also on avoiding collision with an object in motion exercises provide original laboratory research using the latest biomechanical and virtual reality technology [28-30].

CONCLUSIONS

Using a Swiss ball to teach *ukemi* (falls) and body balance on the ground is an innovative approach in the area of broadly conceived injury prevention in cases of sudden collisions and falls. Exercises with a ball help achieve a better understanding and a more rapid acquisition of the movement structure by the exercising person than under the

classical approach to teaching *ukemi* (falls). The classes themselves are more interesting and create a sense of fun, which is not without significance when working with children and youths. A Swiss ball may be helpful in relieving the exercising person's stress. In the case of any rotation of the body the shape and structure of the

ball ensure comfort during rolling. A Swiss ball offers many possibilities for coaches and sport instructors, both helping to increase the athlete's movement potential and providing the fun effect, which facilitates the achievement of sport objectives.

REFERENCES

- Jaskólski E, Nowacki Z. Teoria, metodyka i systematyka miękkiego padania. Part I. Teoria miękkiego padania. Wrocław: WSWF; 1972: 83-88 [in Polish]
- Jaskólski E, Witkowski K, Kubacki R. Profilaktyka przeciw urazowa w klasach I-III. Jak nauczać padów na zajęciach wychowania fizycznego. Zajęcia ruchowe w kształceniu zintegrowanym. Wrocław: AWF; 2000: 183-186 [in Polish]
- Oetterli S, Larsen C. Bewegungskoordination auf dem Ball. Physiotherapie. J Swiss Fed Physiother; 1996
- Escamilla RF, Lewis C, Bell D et al. Core Muscle Activation During Swiss Ball and Traditional Abdominal Exercises. J Orthop Sport Phys 2010; 40(5): 265-276
- Stanton R, Reaburn P, Humpreis B. The effect of short term Swiss Ball Training on Core Stability and Running Economy. J Strength Cond Res 2004; 18(3): 522-528
- Marshall PW, Murphy BA. Core stability exercises on and off a Swiss ball. Arch Phys Med Rehab 2005; 86(2): 242-249
- Monroy Antón AJ, Rodríguez Rodríguez B, López Jiménez D et al. Swiss ball training versus stable surface. Arch Budo 2015; 11: 47-52
- Marshall PWM; Murphy BA. Increased Deltoid and Abdominal Muscle Activity During Swiss Ball Bench Press. J Strength Cond Res 2006; 20(4): 745-750
- Carrier B. The „Swiss Ball”. An effective tool In physiotherapy for patients, families and physiotherapists. Physiotherapy 1999; 85(10): 552-561
- Mroczkowski A. Motor safety of a man during a fall. Arch Budo 2015; 11: 293-303
- Mroczkowski A. Rotating training simulator – an apparatus used for determining the moment of inertia, assisting learning various motor activities during rotational movements and simulating falls imposed by internal force. Arch Budo Sci Martial Art Extreme Sport 2014; 10: 59-66
- Mroczkowski A, Mosler D. Rotating training simulator as an assessment tool measuring susceptibility of the body injuries during the fall caused by an external force – validation procedure. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 202
- Kalina RM, Kalina A. Theoretical and methodological aspects of teaching lower extremity amputees safe falling. Adv Rehabil 2003; 17(3): 71-87
- Kalina A. Universal character of exercises on safe falls – an empirical verification. In: Kalina RM, Kaczmarek A, editors. Ukierunkowane przygotowanie obronne. Warszawa: PTNKT; 1997; (3): 100-106 [in Polish]
- Kalina RM, Barczyński BJ, Jagiełło W et al. Teaching of safe falling as most effective element of personal injury prevention in people regardless of gender, age and type of body build – the use of advanced information technologies to monitor the effects of education Arch Budo 2008; 4(4): 82-90
- Gąsienica-Walczak B, Barczyński BJ, Kalina RM et al. The effectiveness of two methods of teaching safe falls to physiotherapy students. Arch Budo 2010; 6(2): 63-71
- Gąsienica-Walczak B, Kalina RM. Zmodyfikowany test bezpiecznego upadania – aplikacje w diagnozowaniu specyficznych kompetencji motorycznych osób niewidomych. In: Włoch T, editor. Międzynarodowa Jubileuszowa Konferencja Naukowa Wydziału Rehabilitacji Ruchowej AWF Kraków [proceedings book]; 2012: 100 [in Polish]
- Gąsienica Walczak B, Kalina A. Susceptibility of body injuries during a fall of people after amputation or with abnormalities of lower limb. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 193-195
- Gąsienica-Walczak BK. Motoryczne, metodyczne i mentalne kwalifikacje studentów fizjoterapii z zakresu bezpiecznego upadania – perspektywa prewencji upadków osób z wadami wzroku, z unieruchomioną lub amputowaną kończyną. [PhD Thesis]. Rzeszów: Uniwersytet Rzeszowski, Wydział Medyczny; 2017 [in Polish]
- Gąsienica Walczak B, Barczyński BJ, Kalina RM. Evidence-based monitoring of the stimuli and effects of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions as a condition for optimizing the prevention of body injuries in a universal sense – people with eye diseases as an example of an increased risk group. Arch Budo 2018; 13: 79-95
- Mosler D. Changes of susceptibility of body injuries during a fall of patients with mental impairment participating for several months in special cognitive-behavioural therapy. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 196-198
- Mosler D. Fall as an extreme situation for people with mental disorders: a review. Arch Budo Sci Martial Art Extreme Sport 2016; 12: 87-94
- Mosler D, Barczyński B, Kalina RM. The use of cognitive-behavioural kinesiotherapy based on innovative agonology methods in reduction of unintentional fall-related injuries of children with developmental disabilities. 19th Global Congress on Pediatricians and Child Psychiatry. J Psychiatry 2017; 20(4) (Suppl): 53
- Kalina RM. Miękkie lądowanie. Medical Tribune 2009; 7(13): 28-29 [in Polish]
- Kalina RM, Barczyński BJ, Klukowski K et al. The method to evaluate the susceptibility to injuries during the fall – validation procedure of the specific motor test. Arch Budo 2011; 7(4): 201-215
- Kalina RM, Mosler D. Risk of Injuries Caused by Fall of People Differing in Age, Sex, Health and Motor Experience. In: Ahram T, editor. Advances in Human Factors in Sports, Injury Prevention and Outdoor Recreation. AHFE 2017. Advances in Intelligent Systems and Computing. Cham: Springer; 2018; 603: 84-90
- Kalina RM. Non-apparatus safe falls preparations test (N-ASFPT) – validation procedure. Arch Budo 2013; 9(4): 255-265
- Michnik R, Jurkojc J, Wodarski P et al. Similarities and differences of body control during professional, externally forced fall to the side performed by men aged 24 and 65 years. Arch Budo 2014; 10: 233-243
- Michnik R, Jurkojc J, Wodarski P et al. Similarities and differences of the body control

- during professional collision with a vertical obstacle of men aged 24 and 65. Arch Budo 2015; 11: 27-39
30. Michnik R, Wodarski P, Bieniek A et al. Effectiveness of avoiding collision with an object in motion – virtual reality technology in diagnostic and training from perspective of prophylactic of body injuries. Arch Budo 2017; 13: 203-210
31. WHO Global Report on Falls Prevention in Older Age. France: World Health Organization; 2007
32. Budō. The Martial Ways of Japan. Tokyo: Nippon Budokan Foundation; 2009
33. Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black; 2006
34. Kalina RM. Applying non-apparatus and quasi-apparatus tests in a widely understood concept of health promotion – an example of flexibility measurement and assessment. Arch Budo 2012; 8(3): 125-132

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