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Postural balance and 7-meter throw's accuracy in handball

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Abstract

This study aims to identify if there is a relation between postural balance and the accuracy of 7 meters throws in handball. There is an increase need to improve the success of the 7 meters throw, due to its impact regarding a win or loss over the past years during high-end competitions. Subjects: 173 subjects were involved in this study, 123 males and 50 females with the ages between 18 and 21 years old. Materials: We've conducted the balance test using the AMTI NETforce BP 400600 force platform and for the accuracy test we've conducted a shooting trial that quantified the spread of a series of throws from the 7 meters mark. We've observed the radial dislocation, area and length of the center of pressure for the balance test and for the shooting trial we've measured the distance of the throw from a preset spot. Results: There were no correlation between the important factors of balance like Dislocation, Area, Length, and throwing percentage for the Circle, Area 1, Area 2, Missed balls. Instead, between the 3 important factors of balance, there are strong and positive correlations, drawing the conclusion that when we have big numbers for center of gravity deviations, total trajectory (cm^2) and the area values, the chances to score a goal from 7 meters are lower. Conclusions: The results of the study confirm the hypothesis. The objectives for a future study is to find ways/methods to improve the general balance, in order to increase the efficiency for the 7 meters throwing.
Key words: sport, handball, balance, throw, 7 meters.

Rezumat

Obiectul acestui studiu este să identifice existența unei relații între echilibrul postural și acuratețea aruncării de la 7 metrii în jocul de handbal. Nevoia de îmbunătățire a ratei de succes în aruncarea de la 7 metrii este din ce in ce mai mare, datorită impactului pe care îl are asupra unui meci din cadrul competițiilor importante, fiind decisive în câștigarea sau înfrângerea unui meci. Subiecții: 173 de persoane au reprezentat eșalon în cadrul acestui studio, 123 fiind de gen masculine iar 50 de gen feminine, cu vârste între 18-21 de ani. Materiale: Am efectuat testul folosind platforma AMTI NETforce BP 400600 și pentru testul de acurateţe am folosit o serie de aruncări de la 7 metrii ca și cuantificare a ariei de aruncare. Am constatat deplasarea radială aria și lungimea centrului de presiune pentru testul de echilibru și pentru serile de aruncări am măsurat distanța aruncării de la un punct prestabilit. Rezultate: Nu am găsit nici o corelație între factorii importanți ai echilibrului precum Deplasarea, Aria, Lungimea și Procentajul de aruncare pentru cerc Zona 1, Zona 2 precum și mingi ratate. În schimb Între cei trei factori importați ai echilibrului am stabilit corelări pozitive și puternice, concluzionând că avem valori mari cu privire la deviațiile centrului de gravitate, traiectoria totală (cm^2) și valori ale ariei, șansele de a înscrie un gol de la 7 metri fiind scăzute. Concluzii: Rezultatele studiului confirmă ipoteza. Obiectivele unui viitor studiu sunt de a găsi căi/metode de a îmbunătății echilibrul general, cu scopul de a mării eficiența aruncărilor de la 7 metri.
***Cuvinte cheie**:* sport, handbal, echilibru, aruncare de la 7 metri.

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Introduction

The postural balance is a determining factor in the accuracy of the goal-throw, as the athlete has a better stability, the more successful his scores to score. 7-meter throws are crucial in getting to a higher stage in a competition or winning a cup or championship. As the importance of 7-meter throws increased, the scientific approach to the phenomenon also intensified [1].

The Champions League 2015/2016 Championships, both women's handball and men's handball, were decided on the 7-meter throws after the matches ended in a draw in both the 60-minute and the half-extra-time.

In other news, the lack of efficiency at 7-meter throws highlighted a neural point: in countless key moments, handball players reap four opportunities out of ten of them, and a 40% share seems inconsistent with targets at any level competition. When discussing the 7-meter throw we should consider two components: the technical ability of the athlete performing - that is, his skill with the ball - and his power of concentration [2].

The biomechanical analysis of the movements is the possibility of providing an image of human motricity, both analytical and synthetic, in the case of integrated motor action chains [2].

The biomechanical analysis of the muscular effort in the handball game highlights a number of general peculiarities, common to any sporting game, as well as features specific to each technique [3].

The way of arranging the muscles around the kinematic chains is of mechanical importance. The muscles provide the movements allowed by the articulation of the joints with a single degree of freedom, the muscles are disposed on both sides of the spindle, at the joints with two degrees of freedom, they form four functional groups, arranged in such a way that they can make movements both alternately, both simultaneously. In the spheroidal joints, muscle groups are numerous and provide movements around many axes, participating in full or only part of their fibers [2, 4].

The bipedal of the primitive man was one of the first jumps that differentiated it from anthropoids, turning it into "homo erectus." The whole body has had to adapt to this situation, linked to new living conditions. The spine curves have increased, the chest has fallen in front and the pelvic belt has widened [5].

From a biomechanical point of view, steady state - according to the law of equilibrium - is achieved when the vertical projection of the center of gravity of the human body falls within the base of the support. As position stability is even greater as the center of gravity projection is closer to the center of the support base to maintain balance, the activity of all muscle groups is coordinated in this respect.

Indeed, from a neuromuscular point of view, maintaining the balance in the orthostatic position is, ultimately, the result of a set of reflexive acts [6].

The asymmetrical bipedal orthostatic position (throw at the 7-meter gate) represents the relative resting position in which the supporting effort is mainly taken up by the capsulitis systems and the articular bone supports. The toraco pelvis muscular group on the side of the hip relaxes and the opposite side passes into passive distension. Gluteal muscle fan on the side of the support hip goes into passive distension and the opposite one relaxes.

The hyper extensive hip stabilizes by energizing the Bertin-Bigelow ilio-femoral ligament, and the hiperextins knee enters the latch position. Practically, almost all of the static muscular labor is taken up by sural triceps of the inferior support member [5].

To "pull" as strong as possible, the handball player adds to the force of the upper and lower limbs, the force that is transmitted to the body, causing it to lose its balance. Movement starts from standing. The center of gravity at the level of the last lumbar vertebra is projected into the middle of the support base.

The body is in balance, preparing to shoot, the player kissing his knees in the position on the tips. The support base is reduced, the balance is unstable, the center of gravity decreases, its projection falls in the middle of the low base of support. Raising the upper limb standing forward and the right back helps to maintain balance. By even more emphasizing the legs and moving the trunk forward, the center of gravity continues to descend and its projection falls before the support base.

The balance "breaks" and falls forward. At the moment of unbalance, the ankles and knees suddenly expand, the center of gravity is projected

forward and upward, and the upper right leg extends. The ball is thus thrown together with the combined force of the lower limbs and the upper limb.

From now on, the center of gravity descends and the body of the player contacts the ground. From the moment, the hands reach the ground, the support base is very large and the balance is restored [2].

Assumption

Starting from the importance of 7-meter throws in handball, we assume that throwing efficiency increases with a well-developed player balance, no matter what age and training they are activating.

Objectives

The objectives of the research are the measurement of the students of the first year of the Faculty of Physical Education and Sport from Cluj - Napoca in two stages, the first being the measurement on the equilibrium platform, and in the second stage the efficiency of the throws at the gate from 7 meters. So, we want to see how the balance influences the throwing at the gate. Subjects of research

The subjects of the research are students in the first year at the Faculty of Physical Education and Sport of Cluj - Napoca. The total number of subjects who participated in the study was 173, of which 123 were male and 50 were female between 18 and 21 years of age. They were enrolled in the curriculum at the Babeş-Bolyai University in Cluj - Napoca, Faculty of Physical Education and Sports.

Students are mostly former performance athletes who still do regular physical activity because of the practical classes they have in the first year of semester I. This is of major importance to the study, with students being physically well trained.

Materials and methods

The first part of the study included the equilibrium measurements that took place in the Evaluation Laboratory, the Interdisciplinary Research Center for Physical Education and Sport, at the Faculty of Physical Education and Sport of Cluj-Napoca, and the second part included the measurements the accuracy of the throw at the 7-meter gate and took place in the gym "Gheorghe Roman" in the "Dr. Iuliu Haţieganu ".

Balance measurements were made using the AMTI NETforce platform, BP400600, offering high precision. It is made of aluminum with a weight of 31.82 kg and the dimensions of 400x600x82.55 mm (Fig. 1).

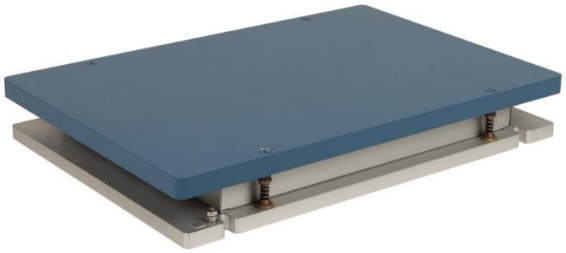

FIG. 1 Equilibrium Platform (amti.biz 2017)

The platform offers several balance analysis tools and algorithms to calculate variables such as: center of pressure, standard deviations, radial measurements, balance parameters. Of these we have used the software called BioAnalysis.

Of all the variables the analysis program offers, we used the following: - Displacement - represents the deviation of the pressure center during the test from the center position of its position; - Area - is the numerical value of the surface on which the pressure center has moved during the test. The value is measured in cm2 (square centimeters); - Length - represents the total trajectory on which the pressure center has moved during the test. It is measured in cm (centimeters);

To quantify the subjects' throws, the study for the practical trial required a handball ball (size II), a handball, a gym and elastic circle to delimit the gate areas.

The handball was delimited by elastic to delimit the casting areas of the subjects, thus having the Circle Zone, Zone 1 and Zone 2 (Fig. 2).

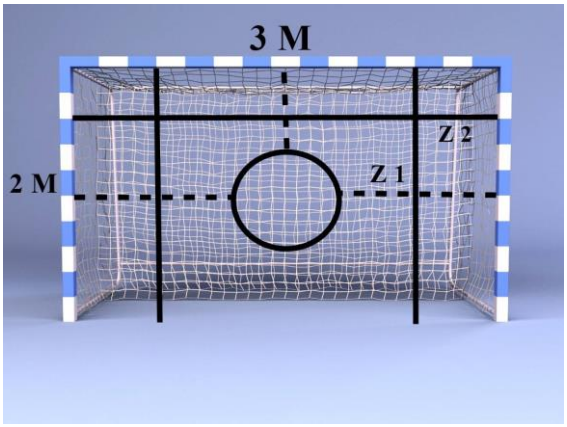

Fig. 2 Delimiting the gate on the throw area

For the correlation of data, a widely used program for statistical analysis in social sciences such as SPSS was used. It is also used by market researchers, researchers in the field of society, research companies, government, researchers in the field of education, etc. Compared to statistical analysis, the basic software features are data management (case selection, file remodeling, creation of derived data).

The student's measurement on the equilibrium platform was performed according to the following protocol: - 3 - 5 minutes explaining the test; - 2 minutes preparation of the test instruments; - Calibrate the device (the subject was put on the platform and calibrated); - Measuring the first position for validating the measurement; - Measurement of the throwing position at hand with the handball ball; - Pause 10-15 seconds, and if not valid, repeat;

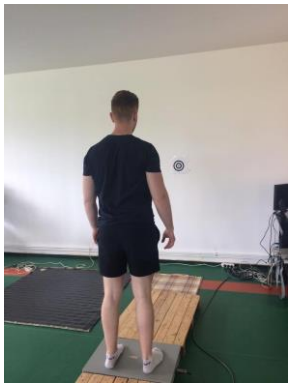

Fig. 3 Standing on the equilibrium platform

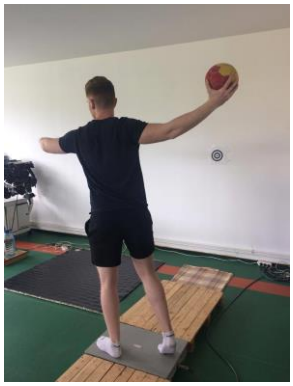

Fig.4 Gate position at the gate

Measuring positions on the plate:

1. Sitting, the arms around the body, the fixed target look - was used to calibrate the device (Fig.4);
2. Sitting, one leg in front, the other in the back. The trunk slightly twisted to the throwing arm, the left arm forward and bent 90 degrees, the throwing arm, the ball held in the hand, the look to the fixed point - was the position for effective testing (fig.5);

To measure the accuracy of the 7-meter throw, each student had 3 consecutive throws at the midfield goal, thus quantifying the data for the research we performed.

Protocol for handball ball accuracy measurements:

- 3 to 5 minutes presence;
- 2-3 minutes explaining the test;
- 10 to 15 minutes of subjects warming (Body Training for Exercise, Selective Influence of the Moon Machine and a few throws at the gate for each);
- Quantification of gate throws;

Results

Between the 3 determinants of the Displacement, Area and Length equilibrium, and the accuracy of the Proc_C, Proc_Z1, Proc_Z2, Proc_R throws, no correlations were identified. However, a not ideal correlation exists between Arie and Proc_R (Table 1) and shows us a look in terms of other results. There is a relationship but not very visible, and the causes may be the following:

Table no. 1 Correlation between the Area and the percentage of missed throws

Correlations			
		Area	Proc_R
Area	r	1	0,133
	p		0,080
	n	173	173
Proc_R	r	0,133	1
	p	0,080	
	n	173	173

- The protocol was not ideal (the breaks between tests may be too low or too high, students may have increased fatigue, hours before the test, etc.);
- The casting accuracy test was not perfect (throws without good heats, the number of 3 throws may be too low, no skidding before the test, etc.);
- Big balance can influence the accuracy of the throws (students who move from the automatism before the 7m blow).

By interpreting table data with the correlations between Displacement, Area and Length (Table 2), their determinants are related to the accuracy of 7-meter gate throws.

Table no. 2 Correlations between Displacement, Area and Length

Correlations				
		Displacement	Area	Length
Displacement	r	1	0,912**	0,882**
	p		0,000	0,000
	n	173	173	173
Area	r	0,912**	1	0,951**
	p	0,000		0,000
	n	173	173	173
Length	r	0,882**	0,951**	1
	p	0,000	0,000	
	n	173	173	173

The Pearson correlation coefficient was calculated to evaluate the relationship between displacement and Area. There was a strong and positive correlation between the two variables, r = 0.912, n = 173, p = 0.000. The increase in Dislocation was correlated with the increase of the Area. This means that Displacement is a statistical link with the Area.

Conclusions

High performance sportspeople have automated formats in terms of throws of 7 meters. The greater the deviation of the center of gravity from the fixed point and the large value as well as the distance it has passed (cm2), there are high chances to miss. Two determinants in the goal score of 7 meters in the handball game. The Pearson correlation coefficient was calculated to evaluate the relationship between Displacement and Length.

A strong and positive correlation was identified between the two variables: r = 0.082, n = 173, p = 0.000. Increasing Displacement has been correlated with increasing length. This means that Displacement is a statistical link to Length.

Thus, after the correlation between Dislocation and Length, we note that there are two factors that influence the accuracy of the throw. The deeper the center of gravity is, the higher the overall trajectory it travels, and becomes an obstacle for the athletes to score through the 7-meter throws.

The Pearson correlation coefficient was calculated to evaluate the relationship between Area and Length. A strong and positive correlation was found between the two variables: r = 0.951, n = 173, p = 0.000. Area increase was correlated with increasing length. This means that the Aria is a statistical link to Length.

Regarding the accuracy of the throws, the percentage analysis shows that a characteristic of the measured population (students) has an affinity /preference to cast in the Circle Area, the percentage of the other throws for the other portions of the gate decreasing logically and gradually scoring them through a circle.

For the accuracy of the throws in Zone 1 and Zone 2, a strong and negative correlation is identified, but we do not find a clear link between throws and the two areas. The students seem to throw at random without focusing on the throw, thus observing the accuracy of their poor throws.

The difference between Zone 1 and Zone 2 is not significant for them, even if the goal is to cast as central as possible within the circle. Another cause may be the weak balance affecting the biomechanics of the throw, which in turn determines the accuracy of the throw. The more arm is laterally, or excessive truncation or bending of the trunk is identified, the

accuracy of the successes towards the center of the gate is affected.

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