THE THROWING VELOCITY AT DIFFERENT PHASES OF TEACHING HANDBALL ELEMENTS

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Abstract

The aim of this research is to study the ball throwing velocity at different phases of teaching handball elements to female students in their first year of study at Faculty of Kinesiology, Zagreb. The set of variables contains three throwing velocity tests: 1. handball throwing velocity from the standing position (ST), 2. basic shot throwing velocity (RT) and 3. jump shot throwing velocity (JT). The speed of the ball was estimated by a radar gun (Stalker ATS) three times for each shooting type and it was expressed in km/h unit. Measuring was conducted twice in the course of the summer semester of the academic year 2017/2018. The first measuring was carried out after the first lesson and the second one a month later. The average throwing velocities recorded during the first measuring were: ST - 59.25 km/h, RT - 61.60 km/h and JT 61.62 km/h. On the following occasion, the average results were: 59.36 km/h (ST), 61.33 km/h (RT) and 61.33 km/h (JT). No statistically significant differences in the observed set of variables were found by using the t-test for the dependent samples on either occasion. The obtained results can be interpreted in regard to the methods of directing and evaluating the teaching process, as well as in regard to an effective program for improving explosive throwing power.

Keywords*: physical education, students, shooting, improvement*

Introduction

Shots are elements of handball that enable the players to score in matches. Eriksrud et al. (2019) consider shots to be the result of sequential muscle activation, torque generation, energy transfer and a proximal to distal increase of joint angular velocities in the kinetic chain that starts in the lower extremities and progresses through the trunk into the upper extremities (Bartlett, 2000; Fradet et al., 2004; Herring and Chapman, 1992; Joris et al., 1985; Roach et al., 2013; van den Tillaar and Ettema, 2004; 2007; 2009; Wagner et al., 2011; 2012; 2014a). For throwing motions, this indicates a progressive sequence that starts with a thrust of lower limbs, a forward rotation of the pelvis, followed by the trunk and thereafter the throwing arm (Serrien and Baeyens, 2018). The efficiency of the kinetic chain process depends on three broad factors: 1. the position of the segments in space, 2. participation of the muscles involved and 3. sequence of participation of the various segments, which in turn is affected by the transfer of angular impulses from the most proximal segment to the most distal one (Manchado et al., 2017). The review article of Wagner et al. (2014b) identified the order of maximal joint angular velocities as follows: pelvis rotation, followed by trunk rotation, trunk flexion, elbow extension, shoulder internal rotation, forearm pronation and shoulder flexion. Kinetic chain analyses of handball throwing found correlations between throwing velocity and maximum joint positions obtained during the cocking and acceleration phase (van den Tillaar and Ettema, 2007; Wagner et al., 2011). Roach and Lieberman (2014) reported that proximal kinetic chain segmental mobility is limited by bracing decreased joint power generation throughout the kinetic chain, angular velocities, elastic storage of energy at the shoulder and throwing velocity.

Beside kinematic release movement analyses, which have included detailed illustration of all corresponding parameters for specific body segments involved, the ways of increasing the ball release velocity by applying different training means and programmes have been the object of numerous studies (van den Tillaar, 2004). Elite male handball players can improve ball velocity, anthropometrics, maximal upper-body strength and power during the competition season by implementing a medicine ball throwing programme (Hermassi et al., 2015). Young female team handball players increased velocity for all types of shots within the elastic resistance band training period (Andersen et al., 2018). Manchado et al., (2017) showed that after 6 weeks of specific core muscle training, the velocity of the handball players' shots improved. Sabido et al., (2018) found

that regarding the throwing performance, daily undulating periodization significantly improved young male handball players' performance of the 9 m jump shot, while there was a significant decrease of the 7 m standing throw performance.

A timely feedback on shot performance contributes both to the release velocity as well to shooting precision. Štirn et al. (2017) show that frequent immediate knowledge of results enhances the increase of throwing velocity in overarm handball performance for physical education students. The throwing velocity ranged approximately 85% of the maximal throwing velocity when instruction emphasized accuracy, which indicates that experienced team handball players are trained to throw accurately at relatively high velocity (Van den Tillar & Ettema, 2003).

The final objective of the shooting performance, realized after avoiding defenders' blocks, outplaying the goalkeeper and scoring, is reflected in the process of teaching this handball element as being the most interesting one in the game. Future teachers of PE are also attending Handball College at Faculty of Kinesiology in Zagreb. College courses include teaching different handball shots to the students. Contemporary teaching methods are student-centred which implies the collaborative role of a teacher who takes into account the curricular context and all the individual characteristics of the students when planning the classes. Evaluation, as an important part of the educational process, plays a significant role here too, as it offers feedback on teaching, defining basic quality teaching features, defining measurable indicators and providing the ability to use new tools to evaluate, self-analyse and improve the teaching process by all participants. An intended goal of service-learning subjects is the development of the student as a complete person. The learning experiences are unique since they are designed to fulfil municipal requirements while raising awareness, developing respectable citizenship and building knowledge and skills in students (Bringle and Hatcher, 1996). Conceptualization of assessment should comprise co-designed outcome including self-efficacy, decision to participate, personal and professional experience, perceptions of participants in addition to determining skills and competencies gained through the process.

Methods

Subjects

The sample consisted of 46 first year female students in the course Handball, at University of Zagreb, Faculty of Kinesiology during the academic year 2017/2018. Each subject was considered healthy and injury-free at the time of the study.

Procedures

The measuring was performed twice during the 2017/18 summer semester course. The first measuring was performed after the first lesson had taken place and the other one a month later. During this month, the lessons included teaching students different shooting techniques from all handball playing positions. According to the Handball course curriculum, the lessons occurred twice a week in the form of a seminar and exercises. The seminar included practical classes predominantly focused on acquiring knowledge and understanding the shooting technique by performing detailed theoretical and practical movement structure analysis of different shots. Practical lessons, exercises, involved learning objectives that were in correspondence with the functional application of shooting technique regarding the conditions of the game and they were taught by using versatile methodological approaches. Throwing velocity was evaluated in 3 different overarm throws: the penalty throws (PT), 3-step running throw (RT) and 3-step jump throw (JT). The penalty throw was performed from the 7–meter line and the subjects were required to keep one foot in contact with the floor during the throw. When performing the running throw, the subjects did a 3-step run before the throw. Likewise, the lead foot had to be in contact with the 9-meter line when the ball was released from the hand. When performing the jump throw, the subjects performed 3 steps before jumping vertically. The ball had to be released when aligned with, or slightly behind, the 9-meter line. The subjects were instructed to throw as hard as they could and aim for the velocity radar gun (Stalker ATS) positioned in the centre of the goal, 1 meter behind the goal line. The ball used during testing was an EHF/IHF-approved Select ball (mass 325–375 g, circumference 54-56 cm). In general, 3 attempts were allotted for each type of throw.

Statistical analysis

The data are reported as means and standard deviations. Before using parametric tests, the assumption of normality was verified by using the Kolmogorov–Smirnov test. Student's t-test was used to detect between-group differences in the pre- and post-tests.

Results and discussion

Table 1 shows descriptive parameters of the female students' ball release velocities measured individually for each shooting type and separately on two occasions, and values of t-test of the initial (Pre) and the final (Post) measurement of variables for evaluating throwing velocity.

Table 1. Central and dispersive parameters and values of t-test in the initial (Pre) and final (Post) phase

No	Var	Mean	Std.D.	K-S	t-test	Sig
1	PT Pre	59,25	7,02	0,08	1,16	0,25
	PT Post	59,36	7,45	0,15		
2	RT Pre	61,60	6,56	0,13	0,53	0,60
	RT Post	61,33	6,90	0,05		
3	JT Pre	61,62	7,26	0,10	1,28	0,21
	JT Post	61,33	6,34	0,12		

Notes: PT Pre - the penalty throw initial measurement; PT Post - the penalty throw final measurement; RT Pre - 3-step running throws initial measurement; RT Post - 3-step running throw final measurement; JT Pre - 3-step jump throw initial measurement; JT Post - 3-step jump throw final measurement

Average ball release velocities on the first measuring occasion included: the penalty throw (PT) 59.25 km/h, 3-step running throw (RT) 61.60 km/h and 3-step jump throw (JT) 61.62 km/h. On the second occasion, they were: the penalty throws (PT) 59.36 km/h; 3-step running throw (RT) 61.33 km/h and 3-step jump throw (JT) 61.33 km/h.

By applying dependent sample t-test, it was established that there were no statistically significant differences within the examined variables' set on two separate occasions.

The average results obtained for the sample female students when performing shot in place are almost identical to the results obtained by Štirn et.al. (2017) who, on the sample of female students at Sport Faculty in Ljubljana, monitored an average 60.75 km/h release velocity values when performing running throw. Comparison of the results of the female student population with the female handball players of different ages shows higher release velocity values in all shooting types for the female population actively training handball. Ortega-Becerra et al. (2018) published that the release velocities of the female elite handball players vary from 88.92 km/h, for jump throw, to 92.52 km/h, for standing throw; U18 female handball players: 79.20 km/h for both jump and standing shot; female handball players U16: 79.00 km/h, jump throw and 72.72 km/h. standing throw. Andersen et al. (2018) established exactly the same values for the junior female handball players (U16) when performing jump throw (72.00 km/h) and slightly smaller ones in the case of standing throw (69.00 km/h). There is a difference in handball release velocity between elite and top elite female handball players (Fergut et al., 2018) - the higher release velocity values being the ones of the top elite female handball players. Top elite handball players demonstrate slightly higher release velocity values when performing a standing shot in comparison to jump shot (Fergut et al., 2018). The variations of the release velocities depending on the shooting technique were not observed for the tested female students. Identical values were registered regarding release velocities for both types of shots, jump and standing (61.33km/h) in post testing and slight difference was observed in pre testing (61.60 km/h vs. 61.62km/h). Female elite players have demonstrated 11–27% higher throwing velocities than female non-elite players (Ortega-Becerra et al., 2018). The authors suggest that inadequate technique and low strength and/or power of the upper and lower limbs, resulting in educed efficiency during the transfer of momentum through the pelvis and trunk to the throwing arm, might be held responsible for slow throwing (Ortega-Becerra et al., 2018).

The teaching and training process in which the sample female students participated did not result in statistically significant changes of the release velocity values regarding neither of the shooting types (Table 2). Progress in ball release velocity is possible when implementing specific additional programs aimed at enhancing explosive strength (Hermassi et al., 2015; Manchado et al., 2017 Andersen et al., 2018; Sabido et al., (2018). Educational methods and approaches applied in the course Handball, which are predominantly directed toward accomplishing basic technique of the movement structure (the existence of all the performance stages as well as space and time coordination of activating specific segments of the kinetic chain when releasing the ball), such as numerous repetitions and timely feedback on the shooting performance, are not sufficient for a significant handball release velocity progress.

However, the obtained results can not only be interpreted in regard to determining effects of the implemented program on the improvement of the ball release velocity but also in regard to the directing and evaluating methods of the teaching and learning process. This is an opportunity to evaluate the professional competence of the students and to apply their knowledge and skills in

the community, during their service-learning experience. The purpose of the evaluation process is to help students recognize progress they have made, identify their strengths and weaknesses and suggest possible ways to improve their performance. The evaluation is based upon specific, objective and cumulative data. Assessment modes should be sufficiently varied to enable students to verify the range of knowledge, skills, understanding and competences developed by the educational programme and to provide the students with the clear idea of their progress. An assessment scheme should be a central objective of safeguarding and enhancing the standards of the teaching profession. The assessment of students' competencies should be embedded in a profiling system that runs throughout the programme and across disciplines and areas of study (Petry et al., 2008). The evaluation process is considered extremely important. We tend to regard test results as a valid basis for decision making. The terms measuring and evaluation are widely used, but often with little regard to their meanings. They are independent concepts - measuring is the collection of information on which a decision is based, while evaluation is the use of measuring in decision making. Tests are the tools used to collect information and can be interpreted quite broadly. The gathered information is interpreted by the means of evaluation to establish certain standards. Formative and summative evaluation should complement each other and they occur at the end of a teaching unit. Co-designed outcomes, including self-efficacy, decision to participate, personal and professional experience and the perceptions of participants, intend to determine skills and competencies students gained through the process. Students identified changes in how they perceived their own efficacy over the course of their service-learning experience. On one hand, they expressed understanding of the socioeconomic context of the training settings and confidence in their capacity to function in the training setting. On the other hand, they recognized their limited experience and articulated a sense of responsibility to respond in a clinically appropriate manner in the context of their role. Students decided to participate in the service-learning experience program, which required from them an additional engagement, outside the regular requirements of the course curriculum, because they were motivated by the previous positive experience of their peers. Students tend to describe the benefits of 'the real-life experiences' as being helpful for learning how to effectively communicate and how to apply their knowledge. They characterized the training experience as the one promoting their independence and self-reliance. It created an environment in which the tasks to be performed were dynamic and changing, depending on the specific interactions. Students reflected on their personal growth or professional development in every learning unit. The teaching process contributed to the increase in awareness among other students and teachers of the impact that the lack of knowledge and resources might have. All the above mentioned factors led to students' articulation of the perceived outcomes of the teaching unit. The additional result of the students' participation in the service-learning experience might open up the issue of collaborative partnership between students and teachers that could be examined in more detail in the future.

Conclusion

The primary aim of the study was to analyse the female PE students', future teachers, handball release velocity on two instances while being trained at the course Handball. The further analysis included defining effects of the programme applied on the increase of the ball velocity release, as well as the interpretation of the ways of directing and evaluating teaching and learning process. In conclusion, the analysed throwing velocity at different phases of teaching handball elements to female students, future PE teachers, shows that there is no difference in values at the beginning and after a four-week learning process. The obtained results can be interpreted in regard to the programme that effects the improvement of the explosive throwing power, as well as in regard to the methods of directing and evaluating the teaching process. Developmental and co-designed approach should be deconstructed in order to include self-efficacy, decision to participate, personal and professional experience with perception of students and teachers.

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