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BACHELOR THESIS

Difference in Jump Height and Jump Length in Youth Soccer Players Selected or Not Selected for the National Team

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Abstract

Background: With the aim of professional status and sporting success, selection processes and talent identification in youth players are common in football clubs and national teams. Football requiring different types of abilities, standing out in certain abilities can be important in the selection process for national teams. Physical abilities including maximal power can differ between players in the same age group due to growth and maturation and might therefore be important factors in the selection process. Previous studies have mentioned maximal power as one of many performance indicators for football performance. However, few studies have investigated its importance regarding youth players selected or not selected for the national team. **Aim:** The study was designed to measure and compare jump height and jump length in three different jump tests between youth soccer players selected or not selected for the national team. **Methods:** Twenty-two (n=22) players, eleven national players and eleven non-national players performed three different jump tests. The players were 17±2 years old from the club Halmstads BK, Halmstad. The study was an observational cross-sectional study that was designed to measure and compare jump height and jump length in three different jump tests between youth soccer players selected or not selected for the national team. The jump tests that were used in the present study was Countermovement Jump (CMJ), Abalakov Jump (AJ) and Standing Long Jump (SLJ). Mean scores for the tests in both groups were analyzed and compared and the criterion level for significance was set to $p \leq 0.05$. **Results:** The results showed a significant difference between the groups regarding jump height in CMJ ($p=0.013$) and in AJ ($p=0.010$). No significant difference was found regarding jump length in SLJ ($p=0.084$). **Conclusion:** The findings of this study showed a significant difference in Countermovement Jump (CMJ) and Abalakov Jump (AJ) between national players (NP) and non-national players (NNP). The study found no significant difference between the groups in Standing Long Jump (SLJ). The results indicate the use of maximal power as a performance indicator and part of the selection of players to national teams. Anthropometric data (age, weight and height) was similar between the groups, therefore, other maturation and growth factors together with biological age are aspects that might have influenced the results. Future studies are suggested to investigate maturation status and its importance for maximal power in national players and non-national players.

Abstrakt

Bakgrund: Med syftet att nå professionell status och sportslig framgång är urvalsprocesser och talangidentifiering hos ungdomsspelare vanliga i fotbollsklubbar och landslag. Fotboll är en idrott som kräver olika typer av förmågor och att ha framstående förmågor kan vara viktigt i urvalsprocessen för landslag. Fysiska förmågor inklusive maximal power kan skilja sig mellan spelare i samma åldersgrupp, på grund av tillväxt och mognad och kan därför vara viktiga faktorer i urvalsprocessen. Tidigare studier har nämnt maximal power som en av många prestationsindikatorer för fotbollsprestationer. Få studier har undersökt betydelsen av maximal power för ungdomsspelare i eller utanför ungdomslandslag. **Syfte:** Studien var utformad att mäta och jämföra hopphöjd och hopplängd i tre olika hopptester mellan ungdomsfotbollsspelare i eller utanför ungdomslandslaget.
Metod: Tjugotvå (n = 22) spelare, elva ungdomslandslagsspelare och elva icke-ungdomslandslagsspelare utförde tre olika hopptester. Spelarna var 17 ± 2 år gamla från Halmstads BK, Halmstad. Studien var en observationell tvärsnittsstudie som utformades för att mäta och jämföra hopphöjd och hopplängd i tre olika hopptester mellan ungdomsfotbollsspelare i eller utanför ungdomslandslaget. Hopptesterna som användes i studien var Countermovement Jump (CMJ), Abalakov Jump (AJ) och Standing Long Jump (SLJ). Medelvärden för testen i båda grupperna analyserades och jämfördes och nivån för signifikans sattes till $p < 0,05$. **Resultat:** Resultaten visade en signifikant skillnad mellan grupperna avseende hopphöjd i CMJ ($p = 0,013$) och i AJ ($p = 0,010$). Ingen signifikant skillnad hittades avseende hopplängd i SLJ ($p = 0,084$). **Konklusion:** Resultaten från denna studie visade en signifikant skillnad i Countermovement Jump (CMJ) och Abalakov Jump (AJ) mellan ungdomslandslagsspelare (NP) och icke-ungdomslandslagsspelare (NNP). Studien fann ingen signifikant skillnad mellan grupperna i Standing Long Jump (SLJ). Resultaten indikerar användningen av maximal power som en prestationsindikator och del av urvalet av spelare för ungdomslandslag. Antropometriska data (ålder, vikt och längd) var likartade mellan grupperna, därför är mognad- och tillväxtfaktorer tillsammans med biologisk ålder aspekter som kan ha påverkat resultaten. Framtida studier föreslås undersöka mognadsstatus och dess betydelse för maximal power hos ungdomslandslagsspelare och icke-ungdomslandslagsspelare.

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Background

Football is one of the most popular sport in the world, with more than 3 billion in-home television viewers watching the FIFA World Cup in Brazil 2014 (Wenner, 2017). Football is also the world's biggest sport in terms of active players. 265 million players were reported as active players by FIFA in a report conducted in 2006 (Fédération Internationale de Football Association, 2007). Due to the popularity, globalization and economization of football, football clubs look for the best players using different methods, one of them being recruiting and developing young players (Giulianotti & Robertson, 2012; Reilly, Bangsbo & Franks, 2000). The method is also used by national teams who arrange camps and gatherings to select and develop young players for their youth national teams (Svenska fotbollförbundet, 2017). Developing young players can be economically beneficial, lead to sporting success, make players reach international level and the senior national team. Therefore, football clubs and national teams are trying to predict talent in young players from different predictors, one being physical capacity (Reilly, Bangsbo & Franks, 2000).

The football clubs want to create the best environment for youth development, leading to greater focus on talent identification, selection processes and early sport specialization for youth players with the aim to reach professional status and sporting success (Bergeron et al., 2015). Somewhat, leading to an increase in volume and frequency of both training and competition in youth football with greater competitiveness and professionalism (Bergeron et al., 2015). As a consequence of increasing volume and frequency, higher numbers of overuse injuries and health problems have been registered in youth football players (Jayanthi, LaBella, Fischer, Pasulka & Dugas, 2015; DiFiori, Benjamin, Brenner, Gregory, Jayanthi, Landry & Luke, 2014). Therefore, previous studies suggest a wider perspective regarding youth development and early sport specialization. The studies recommend players to take part in varying sporting activities to improve skills in daily-life movements, education and framework for coaches in youth sports and a wider perspective regarding sporting success (Bergeron et al., 2015; Merkel, 2013).

Development of Swedish youth football players

The Swedish Football Association (SvFF) is in charge of the development and support of Swedish football both inside the country and outside by representing Sweden in different

tournaments. SvFFs aim is to keep football as the main sport in Sweden and to have active players in both elite and amateur clubs and organizations. It is also important to keep players active for a long time, contributing to exercise and an active healthy lifestyle. Another aim for SvFF is for the senior national teams to qualify for the big tournaments like the World Cup and European Championship (Svenska fotbollförbundet, 2017).

To reach their aims, SvFF have created a plan of development and process for finding the best players and putting together a national team for each age group starting at the age of 15. To select players for the national teams, different camps and gatherings are organized each year where the best players in each region of Sweden take part and have the opportunity to get selected for the national team (Svenska fotbollförbundet, 2017). In the plan of development SvFF describes four abilities that are the foundation for youth soccer players. The abilities are physiology, psychology, game intelligence and technique. The abilities form a whole which influence the decisions and movements players perform on the field (Svenska fotbollförbundet, 2013). The selection process for youth football players for national teams in Sweden is not stated in their plan of development. However, specific physical abilities are mentioned as of importance regarding physical training in youth football players. The abilities mentioned are coordination, flexibility, aerobic capacity, anaerobic capacity and speed. (Svenska fotbollförbundet, 2013). Based on previous studies, clubs and national teams often use different tests to measure physical ability (Giulianotti & Robertson, 2012; Reilly et al., 2000). Physical ability might therefore be an essential part of the overall evaluation in the selection process.

Physical demands in football

Football is a complex sport involving physical, mental and tactical aspects. The physical demands involve actions in both high and low intensity in different movements. Jumping, sprinting, tackling, kicking and moving in different directions are just a few (Sjökvist et al, 2011; Balsom, 2007). A football game consists of two periods of 45 minutes, 90 minutes in total which requires great physical ability. Aerobic and anaerobic energy systems are used to perform football actions through muscle contractions (Kirkendall, 2011). The aerobic system provides energy for low intensity activities using oxygen. The aerobic system use oxygen to produce energy from primarily carbohydrates and fat. Carbohydrates and fat have large supplies which make it possible to supply energy for activities for several minutes or more

(Kirkendall, 2011). The anaerobic system provides energy for high intensity activities where oxygen is absent (McArdle, Katch & Katch, 2015). There are two ways to produce energy with the anaerobic system, the first one is breaking down stored adenosine triphosphate (ATP) and phosphocreatine (PCr), which can be described as the currency of energy and is used in muscle contractions. PCr can be described as an energy reserve that can be used to generate ATP fast. The second method is breaking down glucose (carbohydrates) to ATP through glycolysis. The anaerobic methods produce less ATP than the aerobic system which means the supply can last for seconds to a few minutes (Kenney, Costill & Wilmore, 2012; McArdle et al., 2015).

During a football game players run approximately 9-12 kilometers and perform 1000-1400 actions (Sjökvist et al, 2011). Actions can be physical, as functional movements as the examples above, furthermore, actions can also be mental and/or tactical, for example thoughts or strategies (Sjökvist et al, 2011). The ability to perform actions in high intensity, can be essential for performance and suggested as an important element for youth development (Meylan, Cronin, Oliver & Hughes, 2010). To perform actions successfully, certain physical skills/abilities have shown to be important, for example ability to recover, speed and maximal power (Bangsbo, Mohr & Krustrup, 2006). Great maximal power has also been mentioned as a possible factor concerning players that have reached elite level both nationally and internationally compared to players that have not (le Gall, Carling, Williams & Reilly, 2010). Although power is mentioned as a possible performance indicator, Vaeyens, Malina, Janssens, Van Renterghem, Bourgois, Vrijens & Philippaerts (2006) suggest that the importance of different physical skills/abilities might vary between different age groups in adolescents.

Maximal power

Maximal power can be explained as work through time in muscle contractions (National Strength & Conditioning Association, 2008). The aim of the contraction (e.g. movement) is producing the highest possible force for the desired movement outcome in the shortest possible time (Kraemer & Newton, 2000). In football, typical movements are for example sprinting, jumping and kicking. The ability to perform movements with great force and high speed can be crucial for performance (Meylan et al., 2010). Maximal power is depended upon several different biomechanical factors, e.g. body size, muscle fiber arrangement and neural

control, with neural control being mentioned as the most important factor (National Strength & Conditioning Association, 2008). Neural control can be described as collaboration of the brain, nervous system and muscle fibers (Kenney et al., 2012). Muscle fibers are single muscle cells that together form muscles in the body. The link between the nervous system and muscle fibers are motor neurons. Nerve impulses (e.g. signals from the brain) are transferred through motor neurons to muscle fibers. A single motor neuron can connect to approximately 10-100 individual muscle fibers depending on the size of muscle fibers (National Strength & Conditioning Association, 2008). The amount and size of motor neurons and muscle fibers that are recruited for a specific movement depend on its magnitude. When the nerve impulses reach the muscle fibers, the muscle is activated, which is called a muscle contraction (Kenney et al., 2012). By deciding rate of force and timing of the muscle contraction, motor neurons can distribute different amounts of force depending on the aim of a movement (National Strength & Conditioning Association, 2008). Neural control is one factor affecting development of maximal power in youth players. Other factors mentioned are for example genetics, muscle mass and muscle size. Depending on growth and maturation, development of maximal power is highly individual (Meylan et al., 2010).

Physical development in youth players

Maximal power can differ between youth players, since maturation and physical development is highly individual. Maturation has been discussed as a major factor for different selection processes in sport, including football (Meylan et al., 2010). Maturation can be described as the development of function, including skeletal maturity, chronological age and sexual maturity. Skeletal maturity signifies the growth of bones, chronological age refers to the occasion for certain maturity events and sexual maturity signifies function of the reproductive system (Kenney et al., 2012; Bergeron et al., 2015). Body tissues and their growth are also important for maturation, for instance bones, body size, muscles, fat and nervous system. For boys, growth and maturation can range from 10 to 22 years (Kenney et al., 2012).

Growth of body tissues has a big impact on physical abilities, including maximal power (Kenney et al., 2012). For instance, the nervous system is fully developed in the early twenties. However, 95% of the growth is attained between six and seven years of age. Therefore, development of basic movement patterns (e.g. walking, running and jumping) at that age, in addition to early growth and maturation in other parts of the body, may have a

great advantage in movements depending on speed, strength and power (Malina, Bouchard & Bar-Or, 2004).

Growth and maturation are not the only factors affecting physical capacity and performance in youth players. Training and development of specific skills are possible to a certain extent, as an increased level of training intensity and duration can improve aerobic and anaerobic capacity. However, the improvements are rather small and can mostly still be explained by growth and maturity of organs, endocrine and nervous systems (Kenney et al., 2012).

Selection processes and talent identification are major focus areas for many clubs trying to develop youth players (Giulianotti & Robertson, 2012; Reilly et al., 2000). Selection processes often include physical tests, including measuring maximal power, since research suggest a relationship between maximal power and football performance. For instance, le Gall et al. (2010) found that maximal power among other physical abilities can be factors separating players reaching the highest level compared to those who will not, since they found significant differences in maximal power between the groups.

Measuring maximal power in football

Maximal power can be measured in various validated and reliable ways. Common testing procedures are different jump tests, since they are easy to administer and perform efficiently on the field (Gore, 2000). Markovic, Dizdar, Jukic and Cardinale (2004) suggest that different vertical and horizontal jump tests can be used as measurements of maximal power, including Countermovement Jump (CMJ), Abalakov Jump (AJ) and Standing Long Jump (SLJ). Measuring maximal power through jump tests are based on the similarity in leg-activity in jump tests compared to other explosive movements (Markovic et al., 2004).

The Countermovement Jump (CMJ) is a vertical jump test where the participant is not allowed to use their hands and arms to gain momentum or speed. The subject uses the force from the bending movement in the knee to jump as high as possible vertically. CMJ might not be as sport-specific as AJ since the arm swing is restricted, however, CMJ is the most valid and reliable test measuring maximal power and was therefore chosen as a test for this study (Kenny, Caireallán & Comyns, 2012; Markovic et al., 2004; Rodríguez-Rosell et al., 2017).

The Abalakov Jump (AJ) uses the same procedure as CMJ. However, in AJ the participant is allowed to use both hands and arms to gain momentum and speed. It is considered sport-specific as the player is allowed to produce more force with help from hands and arms (Lees, Vanrenterghem & De Clercq, 2004; National Strength & Conditioning Association, 2008). AJ was therefore chosen as a test for measuring maximal power in this study (Kenny, Caireallain & Comyns, 2012; Markovic et al., 2004; Rodríguez-Rosell, Mora-Custodio, Franco-Márquez, Yáñez-García and González-Badillo, 2017).

The Standing Long Jump (SLJ) is a horizontal jump test where the subject jump as far as possible horizontally with both feet. SLJ is a valid and reliable measurement especially for physical strength, but also maximal power and was therefore chosen as a test for this this study (Castro-Piñero, Ortega, Artero, Girela-Rejón, Mora, Sjöström & Ruiz, 2010).

Taken together, football requiring different types of skills including physical ability, standing out and performing well in a specific skill can be the difference regarding talent identification for national teams. Due to growth and maturation, physical ability and maximal power can differ between players in the same age group and therefore be a crucial factor in the selection process (Lloyd & Oliver, 2014). As maximal power has been described as a physical ability that can be important for football performance, measuring maximal power can give an indication on its importance in the selection of players to youth national teams (le Gall et al., 2010). There is little evidence regarding difference in maximal power measured by jump tests between youth football players on different levels. Therefore, knowledge from this study can give indications and suggestions for future selections, strategies, and studies.

Aim

The aim of this study was to investigate the differences in jump height and jump length between youth soccer players selected or not selected for the national team.

Research questions

Is there a difference in jump height in a Countermovement Jump between youth soccer players selected or not selected for the national team?

Is there a difference in jump height in a Abalakov Jump between youth soccer players selected or not selected for the national team?

Is there a difference in jump length in a Standing Long Jump between youth soccer players selected or not selected for the national team?

Methods

Subjects

Forty male players (N=40) were contacted to participate in the study. The players were contacted through the coach of the U-17 and U-19 team in the football club Halmstads BK. Of the forty players that were contacted, twenty-six male youth soccer players from Halmstad, Sweden volunteered to participate in the study. Inclusion criterions were players playing in either u-17, u-19 or the senior team. Players from all different playing positions were asked to participate, including goalkeepers. Players were split into two groups, national players (NP) and non-national players (NNP). Inclusion criterions for the NP-group were that the player participated in at least one gathering with a national team in football. The exclusion criterions for all players were participating in a game within 48 hours before the test session, players with injuries in the lower extremity and players that did not complete the full test session.

Study design

The study was performed as an observational cross-sectional study that was designed to measure and compare jump height and jump length in three different jump tests between youth soccer players selected or not selected for the national team. Three jump tests were conducted: Countermovement Jump (CMJ), Abalakov Jump (AJ) and Standing Long Jump (SLJ). The tests are used to estimate maximal power as an indicator for football performance (Bangsbo et al., 2006; le Gall et al., 2010).

Testing procedures

Data was collected during two test sessions. The sessions were performed on an indoor synthetic football field and on an indoor track with a tartan surface. The players were instructed to wear football boots during all tests. Both sessions were performed under the same environmental conditions, although on different times of the day. Five players were tested in the morning and 21 players were tested in the afternoon.

Prior to the test session anthropometric data was collected consisting of weight in kilograms (kg) and height in centimeters (cm). Height was measured with a measuring tape with the player standing against a wall without shoes. Weight was measured with the player standing on a scale without shoes. Prior to the test, the players were also informed about the study and the signed informed consents were collected (appendix 1). Players who did not complete the full test session, injured players (lower extremity) or players participating in a game within 48 hours prior to the test were excluded. Data from players who did not complete the full test session were excluded after the test session was performed.

All three jump tests were performed in the same session. The order of the test routine was randomly selected before the test sessions and the groups were split afterwards by data and group belonging (Markovic et al., 2004). The test sessions were instructed and supervised by the same test leader in both test sessions. The test leader was a student from the biomedicine program at Halmstad University. The players had three attempts on each test, only the best attempt was used in the analysis. One trial jump was performed before each different jump test (Chamari, Chaouachi, Hambli, Kaouech, Wisløff & Castagna, 2008; Castagna & Castellini, 2013).

A standardized 15-minute warm-up was performed at the beginning of the test session. Warm-up involved five minutes of light jogging and ten minutes of specific warm-up with sprints and different types of jumps. The aim of the specific warm-up was to prepare for and imitate the test demands (McArdle et al., 2015; Chamari et al., 2008). All three tests followed the same format regarding amount of attempts, resting time between each test type and standardized warm-up. The resting time between each attempt and each test was between one and two minutes to reduce the possibility of fatigue (Chamari et al., 2008).

Countermovement Jump and Abalakov Jump

In the Countermovement Jump (CMJ) test, the players were instructed to stand with their feet hip-wide between the transmitter and receiver which were placed on the floor. The players were then instructed to squat down to approximately 90-degree angle in the knee and then jump as high as possible vertically with their hand placed on their hips. When landing the players were instructed to land on both feet with straight legs to avoid knee bending and variation of measurements (Bellardini, Henriksson, Tonkonogi & Roberts, 2009; Markovic et

al., 2004). The same procedure was used during the Abalakov Jump (AJ) except that the players were allowed to use their arms during the test. Both tests were measured with the photoelectric system "IVAR" (IVAR Testsystem, SH sport & fitness, Mora, Sweden), which is an infra-red system with a transmitter, receiver and the connected classic clock which collects the data. The transmitter and receiver were placed on the floor with 150 centimeters spacing. "IVAR" then measured flight time from standing to landing and transferred that to jump height in centimeters. To ensure approval and reliability of the jump attempts, the tests were observed from the side to monitor angles of the knees in the jump tests.

Standing Long Jump (SLJ)

To monitor jump length a sports field measuring tape was used to measure jump length in cm. The measuring tape was 10 meters long (m), with both m and cm measurement points. A marker was placed on the 0 cm marker of the measuring tape which the players had to stand behind. The players were instructed to stand on both feet with their toes behind the marker and feet hip-wide. The players were then instructed to jump as far as possible horizontally. When landing, the players were instructed to land on both feet without falling forward or backwards. The results were measured by manually marking the spot where the back heel which were closest to the starting point landed with a ruler.

Validity and reliability of the testing procedures

CMJ and AJ

Previous studies have examined the validity and reliability of the CMJ and AJ using contact mats similar to the IVAR-system. Several studies have showed a higher validity and reliability using contact mats in comparison to both jump-and-reach tests and force platforms when measuring jump height (Kenny et al., 2012; Markovic et al., 2004; Rodríguez-Rosell et al., 2017). The validity and reliability is depended upon the standardization of CMJ and AJ tests. When used under standardized circumstances and thorough testing procedures both tests are valid and reliable for measuring flight time to estimate lower limb power (Markovic et al., 2004). Higher reliability can be reached by using and analyzing the best attempt in each test compared to an of all attempts performed on each jump test (Chamari, Chaouachi, Hambli, Kaouech, Wisløff & Castagna, 2008; Castagna & Castellini, 2013; Moir, Shastri & Connaboy, 2008). Another factor affecting validity is the fact that the IVAR-system uses a

calculation to measure jump height through flight time and not jump height directly (Cormack, Newton, McGuigan & Doyle, 2008). To avoid cofounders, the selection of subjects is important and can exclude gender, body size and maturation as factors if the selection group is heterogeneous, especially in adolescents where body size can differ a lot in similar age groups (Jaric, 2002).

SLJ

The validity and reliability of SLJ is high, although not as high as CMJ or AJ when estimating maximal power (Markovic et al., 2004; Almuzaini & Fleck, 2008). However, SLJ is valid and reliable when measuring lower body muscular strength in general (Castro-Piñero et al., 2010). In similarity to CMJ and AJ, the selection process is significant for measuring a heterogeneous group and exclude possible cofounders regarding body size, growth and maturation in adolescents (Jaric, 2002).

Ethical and social considerations

The study followed the principles of the Declaration of Helsinki regarding human research including autonomy, the principle of not damaging the kindness of law and the principle of justice (World Medical Association, 2013). The players received information about the test through an informed consent, which they then signed as their approval of participation, see appendix 1. The players were also informed about the aim of the study, the fact that it was voluntary to participate and that the data was handed confidentially. Termination of the tests without reason was possible at any stage of the testing process. If so, the particular players collected data was removed from the study. Four players were excluded due to not completing the full test session and their results were therefore removed. Each player was assigned a serial number during the data collection to preserve confidentiality. Information connected to the players' serial number was saved on an encrypted USB-drive that was accessible by the test leaders only. Data and informed consent were saved and stored at Halmstad University. Results were presented at group level, however, the players were able to get access to their individual data upon request. Testing procedures and informed consent were permitted by Halmstad University.

Social considerations

The study is contributing with an evaluation of physical demands and abilities that can be important for sporting success in football. Depending on results different strategies can be used for more efficient training programs for football players regarding different abilities. This will lead to better performance for youth players in general and as a product of them, youth and senior national team players with greater success both individually and in a team setting. Football being the most popular sport in the world, success and better players will lead to a positive environment with players staying active in the sport longer. The latter is one of SvFFs aims for contributing to society in terms of healthy living and exercise, since staying active and exercising are major factors for well-being and staying healthy. Successful players can also lead to success as a country, people coming together through sport in different international tournaments. The result of the study can also lead to development in football in general and might suggest a shift in balance of resources in clubs and national football federations.

Statistics

To calculate if data (CMJ, AJ, SLJ) was normally distributed a Shapiro-Wilks test of normality was performed. The test showed that data for all three tests in both groups were normally distributed, hence parametric statistics were used. Mean and standard deviation (SD) were used to describe results for the different groups. The variable units measured were centimeters with one decimal. An independent t-test was used to compare differences between the groups. The significant value was set to $p<0.05$ for each test. IBM SPSS Statistics for Macintosh (IBM Corp. Released 2011, Version 20.0, Armonk, New York, USA), was used to analyze the data.

Results

Twenty-two (n=22) players, eleven national players (NP) (50%) and eleven non-national players (NNP) (50%) met the inclusion criterions and participated in the study. The players were 17±2 years old from the club Halmstads BK, Halmstad. Table 1 presents the descriptive statistics of age, weight and height in both NP and NNP.

Table 1. *Descriptive statistics for national players (NP) (n=11) and non-national players(NNP) (n=11)*

Variables	NP (n=11)	NNP (n=11)
Age **years ± SD**	16.8±0.9	17.2±0.9
Weight **kg ± SD**	68.8±8.7	71.2±6.0
Height **cm ± SD**	179.0±4.7	180.3±5.9

Results are presented in centimeters (cm) with standard deviation (SD).

The results showed a significant difference between the groups regarding jump height in CMJ (p=0.013) and in AJ (p=0.010) as seen in table 2 and figure 1. However, no significant difference (p>0.05) was found regarding jump length in SLJ (p=0.084) as seen in table 2 and figure 2.

Table 2. *Differences between national players (NP) (n=11) and non-national players(NNP) (n=11) in Countermovement Jump (CMJ), Abalakov Jump (AJ) and Standing Long Jump (SLJ).*

Variables	NP (n=11)	NNP (n=11)	Mean difference	p-value
CMJ (height) **cm±SD**	39.9±5.0	34.2±4.9	5.7	0.013
AJ (height) **cm±SD**	47.1±5.4	40.9±4.7	6.2	0.010
SLJ (length) **cm±SD**	246.2±17.9	232.9±16.5	13.3	0.084

Results are presented in centimeters (cm) with standard deviation (SD).

Results and difference in CMJ

The mean difference between the groups was 5.7 cm in favor of the NP group (table 2 and figure 1).

Results and difference in AJ

The mean difference between the groups was 6.2 cm in favor of the NP group (table 2 and figure 1).

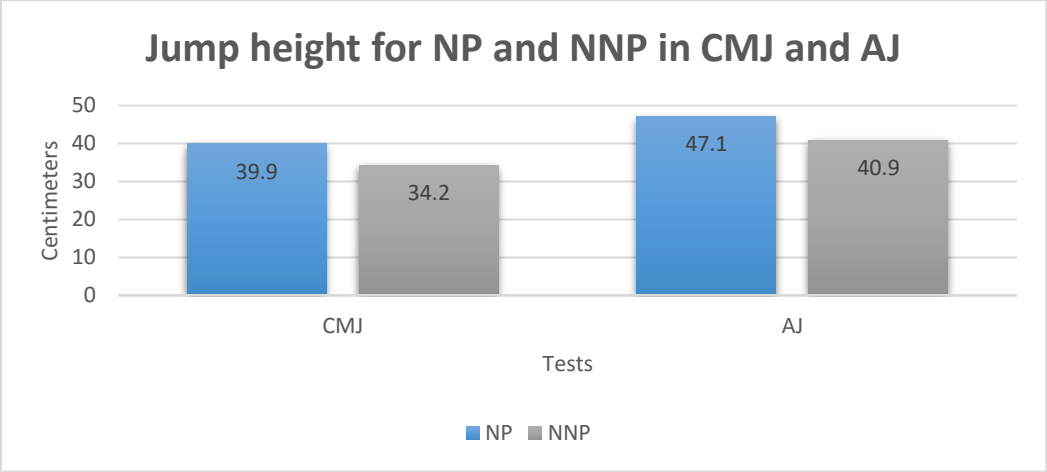

Figure 1. *Jump height results in national players (NP) (n=11) and non-national players (NNP) (n=11) in Countermovement Jump (CMJ) and Abalakov Jump (AJ) in centimeters.*

Results and difference in SLJ

The mean difference between the groups was 13.3 cm in favor of the NP group (table 2 and figure 2).

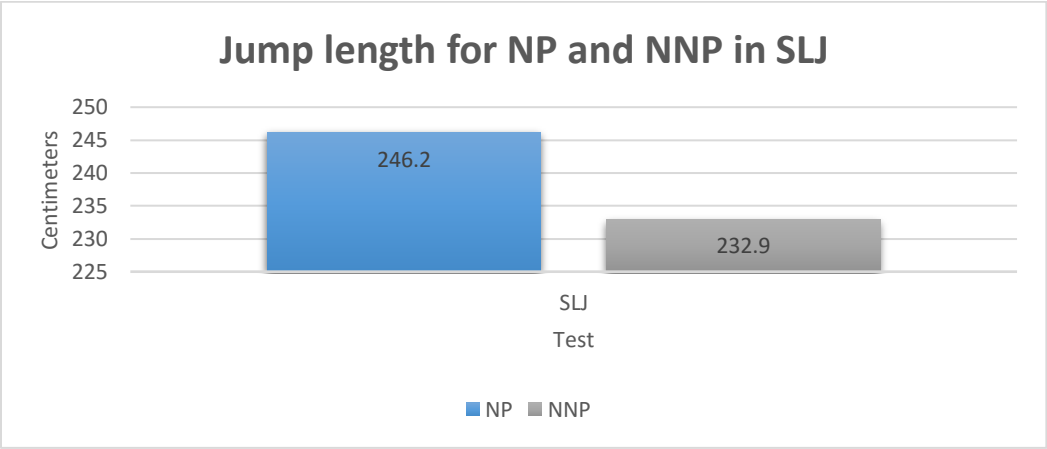

Figure 2. *Jump length results in national players (NP) (n=11) and non-national players (NNP) (n=11) in Standing Long Jump (SLJ) in centimeters.*

Discussion

Few studies have examined the difference between youth national players (NP) and youth non-national players (NNP) regarding maximal power, therefore the aim of this study was to investigate possible differences between the groups. Jump height and jump length were

measured and the presented result showed a significant difference between NP and NNP in Countermovement Jump (CMJ) and Abalakov Jump (AJ), but no significant difference between the groups in Standing Long Jump (SLJ). Measurements were used as an indicator for maximal power (Markovic et al., 2004).

Result discussion

Jump height in CMJ and AJ was measured and showed a significant difference between NP and NNP. Jump length in SLJ was also measured but showed no significant difference between the groups. The results are partly in agreement with previous studies suggesting differences in physical abilities including maximal power between players on different levels (le Gall et al., 2010). While anthropometric data (weight and height) and chronological age was similar between the groups, data regarding maturation, growth and biological age was not gathered. Maturation and growth have shown to have big impact on maximal power and may therefore be factors influencing the result (Kenney et al., 2012).

Neural control being a major factor for maximal power performance, development of neural control can be crucial for the results of this study (Meylan et al., 2010). Since neither neural control, maturation or growth parameters have been measured in the study, the effect of these factors are unknown. However, previous studies suggest its importance for maximal power. If that is the case, early maturers might have an even greater benefit (Meylan et al., 2010; National Strength & Conditioning Association, 2008).

Selection processes and talent identification are often built upon different performance tests including physical tests with the purpose of selecting players with specific skills (Lloyd & Oliver, 2014). Since maximal power has been suggested as a performance indicator for football performance, certain clubs and teams might value maximal power in their selection process (le Gall et al., 2010). The difference between the groups might therefore be influenced by players having maximal power as a specific skill or players having other specific football skills that benefit from great maximal power (le Gall et al., 2010).

Talent identification and physical skills/abilities for players in different age group might also be important in the selection process. Previous studies have mentioned that the importance of different performance indicators for different age-groups. Vaeyens et al. (2006) suggests that

the selection process should be more dynamic and look at the process in a long-term perspective. Referring back to maturation, results can therefore differ between an age-group one year but not be as significant the next year (Vaeyens et al., 2006). Therefore, the results from this study might not be significant for the two groups in the future.

Being selected to play on a higher level e.g. in a national team at a young age might lead to higher intensity and greater duration of training (Bergeron et al., 2015). Since intensity and duration improve aerobic and anaerobic capacity, players can benefit from these factors to some extent. The improvements can be rather small, regardless, they can still have an impact on players being selected or not selected for the national team (Kenney et al., 2012).

The variety of movements in different sporting activities is also a factor to consider. Players that have participated in other sports and activities besides football might have benefited from that matter (Bergeron et al., 2015). Different sporting activities can develop skills and neural control that differ from football, which might benefit their performance in specific movements where maximal power is needed, and in football in general (Bergeron et al., 2015).

The absence of significant difference in SLJ might be due to fact that the players were unfamiliar with the testing procedure, unlike CMJ and AJ which they had performed more times than SLJ. The validity of SLJ as a maximal power measurement has been questioned and investigated due to the movement being technically complex. Castro-Piñero et al. (2010) found that SLJ was a valid performance indicator for lower body strength, however not necessarily maximal power in its independence. The similar results between NP and NNP in SLJ might therefore depend on other physical determinants rather than maximal power.

Method discussion

The majority of the players knew how the exercises CMJ and AJ were conducted, SLJ on the other hand, was somewhat unfamiliar in both groups. The different experiences with SLJ could be due to being in different teams with various plans and tests for development. To avoid great test-retest variances, players were able to perform trial jumps for each different jump test. Due to technical complexity in SLJ, as mentioned above, future studies could investigate SLJ further, with players being more familiar with the test. On the other hand, the

significant differences in CMJ and AJ could be affected by the same circumstances. Reilly et al. (2000) suggests that testing procedures including physical tests are common in elite clubs and national teams. Players that have performed the tests several times before might therefore have a benefit.

The sport specificity for the tests in relation to valid and reliable test methods may also be questioned. A recent study by Rodríguez-Rosell et al. (2017), investigated the correlation between two standardized jump tests (CMJ and AJ) with two sport specific jump tests (run up and takeoff with one (1-leg) or two legs (2-leg)). They found a significant correlation between CMJ, AJ and 2-leg which supports the use of sport specific jump tests as an indicator for maximal power. However, CMJ was mentioned as the most valid and reliable test, with support from several other studies as well, due to its low variability between jump trials (Kenny et al., 2012; Markovic et al., 2004). This might be an interesting area for future studies to investigate the value of sport specific jump tests and its relationship with maximal power and other sport specific skills.

The players performed the different jump tests in random order to avoid fatigue and other carry-over factors that might affect the result. A limitation to the testing procedure might be the resting time concerning trials in the different tests. Resting time varied between one and two minutes, which may affect the result since fatigue can differ between players. The idea was initially to have two minutes resting time for all subjects but due to the testing procedure it was hard to keep track of the time being only one test leader. Previous studies have used different resting times, Chamari et al. (2008) used two minutes while Rodríguez-Rosell et al. (2017) only used 45 seconds between trials, which suggests that different resting times might work well. However, in this study, it is the variance in resting time that might affect the results.

Conclusion

The findings of this study showed a significant difference in Countermovement Jump (CMJ) and Abalakov Jump (AJ) between national players (NP) and non-national players (NNP). The study found no significant difference between the groups in Standing Long Jump (SLJ). The results indicate the use of maximal power as a performance indicator and part of the selection of players to national teams. Anthropometric data (age, weight and height) was similar

between the groups, therefore, other maturation and growth factors together with biological age are aspects that might have influenced the results. Future studies are suggested to investigate maturation status and its importance for maximal power in national players and non-national players.

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Appendices

Appendix 1

Information avseende studien ”Jämförelse av olika hopptester mellan ungdomslandslagsspelare och icke-ungdomslandslagsspelare”

Syftet med studien är att undersöka skillnader mellan ungdomslandslagsspelare och icke ungdomslandslagsspelare i tre olika hopptester. Detta kan vara viktig information för att ta reda på vilka färdigheter som kan påverka uttagningen till landslaget. Anledningen till att du är tillfrågad är att du antingen varit med på någon landslagssamling, ännu inte blivit uttagen eller spelar i ett lag där det finns spelare som blivit uttagna i landslaget.

Övningarna kommer vara Counter Movement Jump (CMJ), Abalakov Jump (AJ) Stående Längdhopp (SL). CMJ är ett vertikalt hopptest där du hoppar rakt upp i luften medan du håller händerna i sidan. AJ är också ett vertikalt hopptest där du hoppar rakt upp i luften och använder armarna för att få extra kraft. SL är ett horisontellt hopptest där du står med båda fötterna på en linje och sedan hoppar framåt så långt som möjligt. För att mäta CMJ och AJ används en infra-röd kontaktmatta som ligger på golvet. Den mäter tiden från att du hoppar till du landar och använder sedan tiden för att räkna ut hopphöjden. För att mäta stående längdhopp används måttband för att mäta längden på hoppet. Om du skulle välja att vara med i min studie, vilket är helt frivilligt, så är det helt okej att avbryta träningen eller studien när som helst, utan att det får någon konsekvens för dig.

Om du väljer att delta i studien kommer du att genomföra testerna under ett tillfälle tillsammans med övriga studiedeltagare. Du kommer delta i en gemensam uppvärmning och sedan genomföra testerna. Totalt kommer du genomföra tre försök på varje test, alltså nio hopp totalt. Mellan varje test får du lite längre vila. Hela testtillfället beräknas hålla på i 1,5 timme. Innan testtillfället kommer vi väga och mäta dig. All information kring din vikt, längd och vilka resultat du får på testerna, är konfidentiellt. Det betyder att ingen annan än testledarna kommer få tillgång till dina resultat. Vill du sen få reda på hur dina resultat såg ut kan du få det individuellt genom att kontakta mig på julary14student.hh.se.

Det finns alltid en skaderisk när man utför tester med maximal insats. Deltagandet sker på egen risk och någon speciell försäkring finns inte för testsituationen. Resultatet i studien hoppas jag kan bidra med kunskap kring vilka färdigheter som påverkar uttagningar till landslag i fotboll.

Jag som genomför studien heter Julia Arvidsson och studerar Biomedicin – inriktning fysisk träning på Halmstad Högskola. Resultatet av studien är en del av min C-uppsats. Har du några funderingar över studien, ditt deltagande eller annat så är det bara att ringa eller maila mig på kontaktuppgifterna nedan.

Kontaktperson
Julia Arvidsson
Email: julary14@student.hh.se

Handledare
Emma Haglund
Email: emma.haglund@hh.se

Informerat samtycke

Nedan ger du ditt samtycke att delta i studien som mäter hoppförmåga hos ungdomslandslagsspelare och icke ungdomslandslagsspelare. Läs igenom informationen noga och ge ditt medgivande genom att signera ditt namn nederst på sidan.

Genom att signera samtycket medgiver jag till att:

- Jag har tagit del av informationen kring studien och förstår vad den innebär.
- Jag har fått ställa de frågor jag önskar och vet vem som är ansvarig för studien om jag har fler frågor.
- Deltar frivilligt i studien och förstår varför jag blivit tillfrågad.
- Vet att jag när som helst kan avbryta studien utan att ange orsak.
- Jag intygar att jag har läst det informerade samtycket och tagit del av informationen kring studien. Jag förstår vad deltagande i studien innebär och ställer upp frivilligt.

Datum:_____

Ort:_____

Underskrift: _____

Namnförtydligande: _____

Julia Arvidsson, Halmstad, 2017-05-23.

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