Haaga-Helia
ammattikorkeakoulu Oy

Profiling tool for YMCA Heinola basketball club to assess athlete's physical qualities

Helena Hahtokari
Emma Virtanen

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Abstract

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Authors
Helena Hahtokari, Emma Virtanen

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Basketball is a growing sport in Finland. The number of licensed players has increased in the past years. Game of basketball has become faster in the past decade and it requires a player to have versatile physical qualities. Physical characteristics and physiological performance are significant factors in defining success in basketball. Movement patterns in basketball are versatile. In a basketball game a player must accelerate, decelerate and change direction quickly. In order to win the possession of the ball a player must be able to jump high and fight for the ball using body and being physical.

The amount of youth athletes who are doing competitive sports is increasing and thus coaches need new tools to keep athletes motivated to reach their potential. Profiling helps the athlete to understand where in the physical development one is at the moment and to see whether results are improving or not.

The primary aim of this thesis was to build a profiling tool for YMCA Heinola to assess youth basketball players' physical qualities. The secondary goal was to build a test manual to the coaches that includes information on the testing, specific tests and how to use the profiling tool in coaching.

YMCA Heinola is a youth basketball club in Heinola county in Finland offering players a safe growing environment as an athlete and an adoslescent. Yet they want to provide a platform in which players can practice and play competitively and reach their full potential. Profiling tool is made for the club but is targeted to be used in talent-group which is formed by 12-16 basketball talents who are from 13 to 18 years old.

Eight tests chosen for YMCA Heinola physical skill tests are antropometric, overhead squat, vertical jump, T-test, 20-meter sprint, 3RM squat and bench press, plank, and Yo-Yo level 1. Tests were chosen to be suitable for the YMCA Heinola environment. Time management factors were taken into consideration when selecting tests. There are several considerations when it comes to testing young athletes. At the age of 13 to 18, the body is going through an ongoing change and the physical qualities are developing all the time. Some players are developing faster than others and that is important to keep in mind when testing.

Project planning started in the spring 2018 by meeting with the YMCA Heinola's executive director. With the first draft of the profiling tool, a test day was held in YMCA training center in the spring 2019. Five coaches from the club took part and learnt how to use the profiling tool and run the tests. The club has since started using the manual and profiling tool to test the players and improve their training.

Keywords
Youth basketball, testing, physical qualities, profiling, YMCA Heinola

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1 Introduction

A growing number of children and adolescents are participating in competitive sports and training has become more specialized (Mountjoy, Armstrong, Bizzini, Blimkie, Ev-ans, Gerrard, Hangen, Knoll, Micheli, Sangenis & Van Mechelen 2008). In 2018 in Finland the number of licensed basketball players is over 20 000 for the first time in history (Suomen koripalloliitto ry 2018). A relevant and on-going testing becomes a significant part of training when goal is to take sport performance to the peak level (Mountjoy et al. 2008; Committee on sports medicine and fitness 2000).

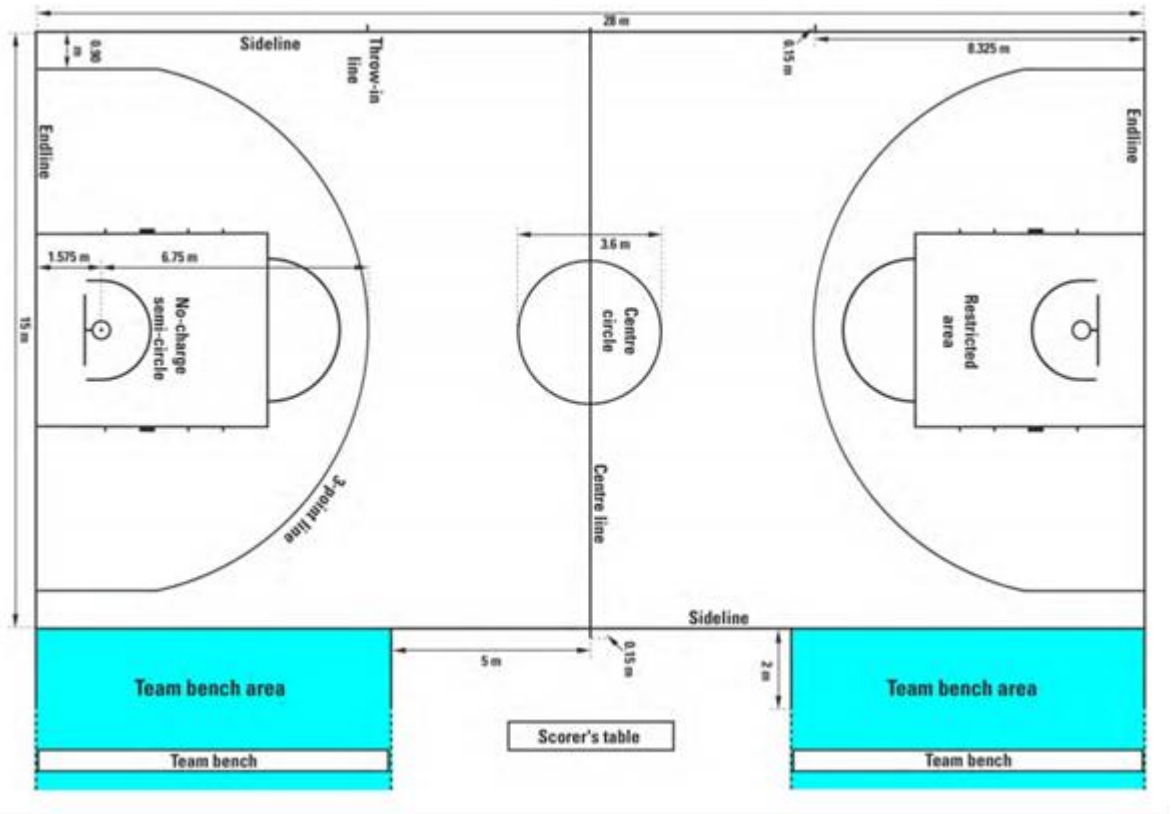
Assessment and monitoring of young athletes provide information on strengths and weaknesses, efficacy of a training program and understanding of the sport performance. Feedback from the test scores also contributes to greater motivation and helps to set measurable goals. (Barker & Armstrong 2011.)

Physical characteristics and physiological performance are significant factors in defining success in basketball (Carvalho, Coelho, Silva, Goncalves, Philippaerts, Castagna, & Malina 2011). Basketball player's anthropometry and fitness level are linked to playing position, playing success, minutes spend on the court, team success, skill performance and injury prevention (Drinkwater et al. 2008). A basketball player must have strength, speed, mobility and agility (McGee 2007, 11). Due to the duration of the game, playing basketball requires also endurance (McInnes 1995).

YMCA Heinola is a basketball club in Heinola county with a goal of supporting athletes' overall development. YMCA Heinola and two Vierumäki students together aimed to build a profiling tool and a test manual of physical abilities that would help coaches test appropriate components.

2 Basketball as a sport

Basketball is a game played by two teams of five players on each. Teams are trying to outscore the other team by scoring to the opponent's basket and preventing the opponent from scoring. The team that has scored more points at the end of game is the winner. A basketball court under FIBA rules is 28 meters long and 15 meters wide (picture 1). The center line divides the court into backcourt and frontcourt. Free-throw line is 4,23 meters and three-point line 6,75 meters from the basket. Basketball diameter is 23,7 cm and the basketball rim diameter is 45 cm. Height of a basket is 3,05 meters. A game under FIBA rules in Europe lasts 40 minutes. (FIBA 2018, 7.)



Picture 1. Court dimensions of a basketball court under FIBA rules (FIBA 2018, 7)

Players in a basketball team are divided into guards, forwards and centres. Point guards are often shorter, quicker and play far from the basket. They control the ball and coordinate offence. Forwards are good shooters and passers who help the centres to get rebounds. Centres are the tallest and biggest players on the team. They play close to the basket, scoring the points under the basket and collecting most rebounds. Centres also often coordinate the team defense. (Drinkwater, Pyne & McKenna 2008.) Study by Ben

Abdelkrim et al. (2010) (table 1) shows the differences of physical attributes between players from different positions.

Table 1. Mean values of five specific field positions in men's basketball

Field position	Height cm	Weight kg	BMI	Source
Point Guard	186	78.1	22.4	Ben Abdelkrim et al. 2010.
	±5.2	±5.8		
Shooting guard	194	85.6	22.8	
	±3.8	±5.2		
Small forward	202	87.8	22.9	
	±3.4	±4.4		
Power forward	202	95.8	23.7	
	±3.4	±4.3		
Centres	204	97.1	23.2	
	±4.7	±5.4		

The height and mass of a basketball player has an impact on the performance on the court for both male and female (Karpowicz 2006). Partially for that reason, height and weight are factors that are well documented in literature (Radu 2019, 128). Results of a study made on female players' mean values for height and weight are presented below (table 2).

Table 2. Mean values of guards, forwards and centres in women's basketball

Field position	Height cm	Weight kg	Source
Guards	172	66.1	Carter et al. 2005.
	±0.60	±6.2	
Forwards	181	73.3	
	±0.60	±5.9	
Centres	190	82.6	
	±0.60	±8.2	

The game requires an athlete to have versatile physical, technical, tactical and social skills (McInnesin, Carlson, Jones & McKenna 1995). Movements such as cutting, passing and screening are important in offensive end. The purpose is to create an advantage to have time and space to score. (Suhonen 2004, 71.) A player must be able to handle the ball while observing movements on the court and making quick decisions. Important sport specific skills are dribbling, passing and shooting as well as moving without the ball in offense and defense. (Mero 2004.)

3 Required physical components for a basketball player

Physical characteristics and physiological performance are significant factors in defining success in basketball. Physical attributes differ between players with higher or lower skill levels. Studies support that players with a higher skill level are more agile, faster and jump higher in vertical jump tests. (Carvalho et al. 2011.)

The prerequisite physical qualities for a basketball player are strength, speed, mobility, and agility (McGee 2007, 11). Due to the duration of the game, it requires also endurance which can be determined as the ability to repeat efforts at a higher intensity throughout the game (McInnes 1995; Radu 2019, 13). Study by Nikolaos (2015) stated that basketball is a physical contact game in which a player must accelerate, decelerate and change direction frequently.

3.1 Movement patterns in basketball

The movement patterns in basketball are unpredictable (Radu 2019, 36). An athlete performs cyclic and acyclic movements with or without the ball in a 40-minute game where a player covers 4,500-5,000 meters (Trninic 2003; Crisafulli, Melis, Tocco, Laconi & Concu 2002). Scanlan et al. (2012) reported that Australian state level female players covered 5215 ± 314 meters during a game. Only a few players play full 40 minutes. Playing time can be divided into active (clock ticking) and passive phases (clock not ticking). The total distance covered, when counted also the passive phase, is as high as 6,235 meters. The distance covered during active phase by elite Slovenian players was 2,476 ± 1,058 meters. (Erculj, Dezman, Vuckovic, Pers, Perse & Kristan 2008.)

Many movements are performed in a small area. The distance covered during a game does not necessarily give a clear picture of the demands for a basketball player. Some research is approaching intensity and form of movements in a game with more relevant categories and classifications. (Radu 2019, 37.) Such breakdowns of movement analysis by Matthew and Delaxtrat (2009) contain specific information on low, moderate and high-intensity movements. Whereas Scanlan et al. (2012) have reported movements such as standing, walking, jogging, running, sprinting, low shuffling, high shuffling, dribbling, jumping and upper-body movements.

In a study by Ben Abdelkrim et al. (2010) an elite junior athlete performed 30 % of the playing time in high-intensity activities such as sprinting, sideways running, shuffling and jumping. Moderate intensity activities were performed 28 % of the time and 42 % was spent in low intensity. Tessitore et al. (2006) suggest that older players spend more time walking (48%) and positioning (19%), and only a small amount of time running (17%), jumping (1%) and being inactive (15%). Intensity of activities on the court decreases in the second half of the game potentially because of the fatigue (Ben Abdelkrim et al. 2007; 2010).

3.2 Anthropometry

Anthropometry studies human size and shape and it can be used as part of athlete monitoring. Nevertheless, the results of anthropometric measurements should not be used in ranking athletes. Test-related reliability errors occur, and they may be bigger than the expected changes in the results. Therefore, professionals should be critical when analysing the results. (Fogelholm 2010.) A basketball player's anthropometry and fitness level are linked to playing position, playing success, minutes spend on the court, team success, skill performance and injury prevention (Drinkwater et al. 2008).

Research has also found a connection between basketball players' weight and scored points per game average (Torres-Unda, Zarrazquin, Gil, Ruiz, Irazusta, Kortajarena, Seco & Irazusta 2013). An average weight of a male U16 national team player was 81,25 ± 8,16 and 81,85 ± 10.35 kg in Croatia and Lithuania. Two years older players in the Lithuanian U18 national team weight 85,1 ± 7,4 kg. (Sporis, Naglic, Milanovic, Talovic & Jeleskovic 2010; Paulauskas 2015.) Tupamäki (2007) measured average weight in the beginning of the season 79,9 ± 8,5 kg in the Finnish men's national league players. Young female elite players from 27 different countries, who participated at an invitational U15 camp in Slovenia, were measured with results of 59.32 ± 6 kg (guards), 61.79 ± 4.67 kg (forwards).

High amount of subcutaneous fat tissue decreases relative power which has a negative impact on speed (Jakovljević, Karalejić, Pajić, Gardašević & Mandić 2011). Fat percentage measured from youth athletes with calipers shows a positive correlation between lower fat percentage and higher speed as well as agility (Jakovljević 2011; Chaouachi et al. 2009). Ponce-Gonzalez et al. (2015) measured the fat percentages for guards as 7-13 %, forwards 7-13 % and centres 9-20 %. Ostojic et al. (2006) determine that in general,

point guards have the lowest body fat percentages (9.9% ± 3.1), following forwards (10.1% ± 3.2) and centres with the highest percentages of 14.4 ± 5.6.

3.3 Speed and agility

Agility and speed play an essential role in predicting playing time in basketball (Hoffman, Tenenbaum, Maresh & Kraemer 1996). Speed allows an athlete to make a movement on the basketball court as fast as possible whereas agility determines the athlete's ability to accelerate, decelerate and quickly change direction (Radu 2019, 17; Parsons & Jones 1998). A basketball player must change direction quickly; therefore, agility is an essential skill that must be trained (McGee 2007, 13).

The nature of the game has changed during the past 20 years due to the rule changes that included reduction of time of shot clock from 30 to 24 seconds (FIBA 2014). It has made the game faster and altered the physiological demands of players (Ben Abdelkrim, El Fazaa, El Ati 2007; Delaxtrat & Cohen 2008). In a study of McInnes et al. (1995) male basketball players performed in average 105±52 sprints during a game whereas in a study by Scanlan, Dascombe, Reaburn & Dalbo (2012) female basketball players sprinted 108 ± 20 times in a 40-minute game.

3.4 Strength and power

Basketball as a game includes a lot of jumping, shuffling and sprinting (Crisafulli et al. 2002). Force production is highlighted especially in rebounding, jumping, shooting and in defence (Bell & Chen, 2002). Bober et al. (2006) stresses the importance of power: ability to generate maximum force at a short period of time. Movements cannot be produced without power and therefore it is the main ability in any sport activity (Hakkarainen 2009). High level of power is also crucial for high level of speed (Bompa & Haff 2009, 261). Body contact is involved especially in the performances that happen near basket. Muscular strength and body mass are important in maintaining and fighting for the position under basket. (Drinkwater et al. 2008.) Higher strength levels also correlate positively to both speed and agility (Chaouachi, Brughelli, Chamari, Levin, Ben Abdelkrim, Laurencelle & Castagna 2009).

3.4.1 Maximal strength

The focus on basketball players' strength levels has been on measuring 1RM strength (repetition maximum) in both upper and lower body (Radu 2019, 40). Early research by Hoffman et al. (1991 & 1996) suggests that 1RM squat strength test is a solid choice as a test performance and results of it predict playing time within collegiate players. Bench press exercise is another test that is used as the resistance test for strength levels. Respectively, 1RM squat in the range of 1,5 x one's weight seems to be adequate to play at the elite level of basketball. In bench press values above 0.85 x one's weight seems to be enough for a basketball player. (Radu 2019, 41.)

3.4.2 Dynamic strength

Vertical jump is a frequently performed movement within basketball. In given offensive and defensive situations, the player is supposed to jump higher than the opponent to win the possession of the ball. (Ben Abdelkrim 2010.) In a study by Hoare D.G. (2000), 125 male and 123 female junior players' vertical jump were measured during the national championships. The average age of female players was 15.2 and 15.4 for male. Values of Sargent jump test height range from 35.5 to 51.4 centimetres for female and from 49.4 to 70.9 centimetres for male basketball players. More average values shown for comparison in table 3. The subjects included players from all playing positions.

Table 3. Average vertical jump height in junior athletes

Players	Vertical jump height (cm)	Source
Greek juniors male	40.1	Apostolidis et al. 2004
U16 Australian state male	63.6	Hoare 2000
14-17 years old, Australian state male	65.5.	Stapff 2000
U16 Australian state female	46.5	Hoare 2000
U17 English national, female	47.6	Bale 1991

3.5 Core strength

Core is the link that combines the strength from legs to arms and the other way around (Kibler, Press, Sciascia 2006; Willardson 2007). Thus, the core is a major factor in defining whether a player can combine all together and translate their strength, speed or agility into effective basketball performance. The core includes the abdominal muscles, lower back muscles and the muscles of the hip girdle. Basketball players are often asked to stay down in an athletic position to be ready to move quickly and stay in balance. Strong core

is needed in performing movements such as pulling a rebound or penetrating to the basket. Without a strong core player will not be able to be as explosive, strong, and fast on the court. (McGee 2007, 13.)

3.6 Endurance

In basketball, endurance can be determined as the ability to repeat efforts at the same intensity throughout the game. Two types of metabolism are involved in an endurance performance: aerobic metabolism and anaerobic metabolism. (Radu 2019, 13-15.) In an aerobic exercise the use of oxygen meets the energy demands and the exercise can be performed for a longer period of time (Plowman & Smith 2007). In an anaerobic exercise intensity is higher and lactate forms into muscles (McArdle et al. 2006). According to Fox (1979) most of the energy supply (85%) during a basketball game is through adenosine triphosphate (ATP), phosphocreatine store and anaerobic glycolysis. Rest of the energy supply is through aerobic system (15%). Anaerobic energy system is subdivided into anaerobic-alactic and anaerobic-lactic. (Radu 2019, 16.) Lorenzo and Calleja (2010) (figure 1) separated the use of two different metabolism in basketball into time periods and intensity.

Figure 1. Use of two different metabolisms in basketball training

The target on measurements done on aerobic demands of basketball has been in oxygen consumption (VO2) and heart rate (HR). Study by Cortis et al. (2011) show that the heart rate of players was 85 % of their individual maximum heart rate for 80 % of the playing time. Mean value of VO2max measurements done on professional basketball players have been between 50 and 60 ml/kg/min (Apostolidis et al. 2003; Laplaud, Hug, & Menier 2004; Sallet, Perrier, Ferret, Vitelli & Baverel 2005; Ziv & Lidor 2009). Gocentas et al.

(2011) measured higher VO2max results for smaller players (52.2. ml/kg/min) playing far from the basket than bigger players (46.2. ml/kg/min) playing close to the basket. Ben Abdelkrim et al. (2009) measured a mean value of 52.2. ml/kg/min in elite junior players and suggested that the age of the player and the intensity level of basketball played influences the players' aerobic capacity. Differences in aerobic characteristics have a link to position specific physiology that develops due to the performances on court. For instance, perimeter players perform in higher intensity and at higher velocities than other players and have shown to have better results in aerobic characteristics. (Radu 2019, 38–39.)

3.7 Mobility and flexibility

The term flexibility and mobility should be used properly. From a structural perspective flexibility is described by McNeal and Schon (2006) as "the range of motion in a joint or a related series of joints". From a functional point of view flexibility has been characterised as the ability to move joints fluidly through a full range of motion (Heyward 1984, 5). Mobility is a wider term that includes flexibility. The term mobility means that a performed movement is incorporated with strength, power and motor control which effectively move a joint or multiple joints at a certain speed, in the right order, at the right time and in the right direction. For an athlete whether an adolescent or adult, the ability to perform movements freely without restriction is important. (McNeal & Sands 2014, 133.)

Flexibility is one of the most important skills in basketball because it helps the athlete to enhance performance in other physical qualities (McGee 2007, 12). Lohikoski (2009, 410) stated that mobility enables the player to be in a good athletic stance, produce more power and perform correct movement chains. As a result, injuries can be reduced or avoided by improving mobility.

4 Testing of athletes

Physical qualities assessment is a critical component of an athlete's preparation. When testing of an athlete is implemented correctly, performance assessment can provide important information. It gives information of the athlete's strengths and weaknesses, response of training programs, and ongoing monitoring. There's a wide range of assessment and monitoring tools available for strength and conditioning practitioners and they need to know which test they should use and how to implement them correctly in an applied setting. (McGuigan 2019, 1.)

4.1 When to test

Physical testing should first take place at the beginning of the pre-season training cycle. This provides a baseline of the athlete's strengths and weaknesses and helps the coach to plan the upcoming training cycle according to the test results. The same fitness test / testing battery should be executed twice with a 2-7-day gap in between testing. Testing twice at the beginning of pre-season will give information to the practitioner of what the difference in each tested physical quality would be for a specific athlete or a team. This information will help the practitioners to identify the athlete's changes in a particular test score in following fitness testing sessions. (McMahon, Jones & Comfort 2019, 34.)

The second time the athletes should be tested is at the end of the pre-season training cycle. This way the practitioners can assess the athletes' level of preparedness for competition. To assess the physical demands of competition, fitness testing should take place at some point within the competitive season. The alternative solution is to choose one or two key fitness tests (e.g. the vertical jump) to manage athlete-monitoring procedures. (McMahon, Jones & Comfort 2019, 34-35.)

When scheduling fitness testing, the practitioners should consider a few facts. The fitness test should be conducted when athletes are rested. At least 48 hours of rest is recommended after the last match or intense training session. (Holland 2019.) Also, an important fact to consider is the time of testing. Fitness testing should take place approximately at the same time of the day in every test to get valid results. Circadian rhythms impact several physical and morphological qualities such as muscle strength and tendon

stiffness. (Gauthier, Davenne, Martin & Van Hoecke 2001; Onambele-Pearson & Pearson, 2007, 35.)

4.2 Standardizing protocols

Reliability, variability, and comparability of the data collected will be affected if the testing isn't done the same way every time. It might be as simple as ensuring e.g. in a squat test that the squat depth and range of motion is consistent when testing dynamic strength. (Bryanton, Kennedy, Carey & Chiu 2012.) Also, the rest period must be standardized when testing (McMahon, Jones & Comfort 2019, 36-37). Reliability refers to how reliably and repeatedly a measurement is testing the phenomenon being studied. Validity refers to whether the test measures exactly what is being studied. (Valkeinen, Anttila & Paltamaa 2014.)

The testing environment is critical to standardize to ensure the best performance results. The most sport-specific results are reached in the conditions in which the athlete performs in training and competition. (Triplett 2012, 273.)

For jump test, there are factors that need to be standardized. It is important to consider whether athletes are permitted to swing their arms while jumping. Swinging arms has been shown to increase jump height but fractionally reduce measurement solidity. (Hara, Shibayama, Takeshita & Fukashiro 2006, 2008; Walsh, Böhm, Butterfield & Santhosam 2007; Markovic, Dizar, Jukic & Cardinale 2004.)

4.3 Testing order

The testing order depends largely on the amount of recovery time needed following a given test. According to McMahon et al. (2019, 37) non-fatiguing test (e.g. measurements of height and body mass and mobility) are preferred to perform first. After that comes the skill- and / or speed-based tests (jumps, agility, and sprints) followed by maximal strength test and lastly muscular endurance and aerobic capacity tests.

According to McGuigan (2016, 37) the first test to perform should be anthropometric, flexibility, and vertical jump tests followed by agility test, maximum power and strength test, sprint tests, muscular endurance tests, fatiguing anaerobic capacity test, and aerobic capacity tests.

In reality, the order will depend on time available for testing, equipment available, and the number of athletes being tested at the same time. If the ideal order of testing isn't possible to execute, then given athletes should perform the test in the same order in the following testing sessions. Ideally, the aerobic capacity test should be conducted last by all athletes. (McMahon, Jones & Comfort 2019, 37.)

4.4 Safety of testing

The safety of testing is considered as a relevant part of the whole testing process (Kallinen, Kujala & Tikkanen 2018, 32). Professional responsibility to protect all from harm is essential for those who are involved in physical testing. This protection extends to supervise the field environment and confirming the athletes are ready for the demands of testing. (Atkins 2019, 6.)

Physical testing is a potentially injurious activity. It involves the risk of sustaining musculoskeletal injury through a descending scale of potential risk for outcomes, such as cardiac dysfunction, thermal stress and serious injury caused by accident. Absolute risk of cardiac cases appearing in testing is low. (Riebe, Franklin, Thompson, Garber, Whitfield, Magal & Pescatello 2015.) Yet, it is clear that vigorous exercise is connected with elevated transient risk of such episodes compared to when at rest (Albert, Mittleman, Chae, Lee, Hennekens & Manson 2000). It is crucial that as a part of the tester's duty of care such risks are noticed and explained fully. This allows for fully informed decision making to be set about by the test participants. (Atkins 2019, 6.)

4.5 Ethical views of testing

There are several ethical views related to physical testing. First, in every situation related to testing the practitioners need to act with respect towards the participants and their safeguarding privacy. Good ethical testing protocols include professional staff, testing quality assurance, test and condition monitoring, the safety of the subject to be tested, and recording the implementation of testing. (Rinne 2012, 71.)

Group tests should be organized in such a way to minimize the number of participants to be evaluated by other participants. Especially when testing the anthropometry, it should happen in a place where nobody else is watching. (Rinne 2012, 71.)

Physical testers also need to consider the cultural background and religious background of the subjects being tested. The test situation may require special arrangements if group tests are carried out for members of different ethnic backgrounds or for people who need to be monitored, for example due to health or medical factors. The tester can anticipate how the participants themselves will experience the test situation and its significance. (Rinne 2012, 71.)

4.6 Special features of testing youth

A growing number of children and adolescents are participating in competitive sports. Hence, training has become more specialized with a goal of taking their sport performance to the peak level. (Mountjoy, Armstrong, Bizzini, Blimkie, Evans, Gerrard, Hangen, Knoll, Micheli, Sangenis & Van Mechelen 2008.)

Assessment and monitoring of young athletes provide information on: strengths and weaknesses, efficacy of a training program and understanding of the sport performance. Feedback from the test scores also contributes to greater motivation and helps to set measurable goals. (Barker & Armstrong 2011.) It's important to remember that children aren't so called mini-adults, but how children's and adults' physical performance differs, isn't clear. The test results can be inaccurate when testing children because the subjective strain children feel while testing can differ from what adults feel. Rarely we can be sure that a child gave "everything he had" in a testing situation and therefore test results with kids in pre-puberty and puberty are only directional. (Hakkarainen 2015, 53.)

Maturation needs to be taken into consideration when talking about youth athletes (Radu 2019, 27). Anthropometric measurements are affected by maturation, as well as body composition (Malina, Bouchard & Bar-Or 2004). Early or late maturation can influence success in physical skill test. Children at different biological stages should have tailored testing batteries. (Lidor, Côté & Hackfort 2011.) Table 4 shows what to emphasize in testing in each biological stage.

Table 4. What to emphasize in testing depending on the biological stage (Adapted from Saltin, 2007)

	Pre-puberty	Pu-berty	Post-puberty
Muscle Mass	n/a	+	+++
Anaerobic capacity	n/a	+	++
Aerobic capacity	+	+	+++

Major emphasis +++; normal emphasis ++; minor emphasis +; not applicable: n/a.

Individual and gender differences in growth and development are very large. The difference between the beginning and the end of the growth spurt is several years, which makes it difficult to compare the results of competitors competing in the same series according to the calendar year. Especially in boys, adolescence has a very strong effect on physical performance, and in physical performance, profit development occurs spontaneously. In this case, talent estimates based on physical tests and anthropometry (height, weight, and arm length and span) may be very inaccurate. (Hakkarainen 2015, 65-66.) Determining the biological age is a very important but often difficult task in competitive sports for children and youth. Definition often requires a qualified doctor or nurse. A number of international studies use Peak Height Velocity to measure the degree of biological maturity. (Hakkarainen 2015, 66.)

Some adolescents are mature enough biologically and psychologically to go through the physical tests. However, others may have not reached the level of maturation needed to manage the tests and consequently will not succeed in them. Maturation can be seen in the motivation to perform tests. Highly motivated and matured junior athletes understand the purpose of testing whereas others may perform the test because coach asks them to. (Lidor, Côté & Hackfort 2011.) Encouraging and motivating youth athletes to perform on a high level has a significant role in testing environment (Burrman, Struke & Streso 2007). Coaches must be aware of an athlete's biological and cognitive developmental stages,

level of difficulty of the test performance (athlete should be familiar with the movement), and the environment, when physical tests are chosen (Lidor, Côté & Hackfort 2011).

5 Physical quality test for basketball

Movement patterns and physiological requirements of the game support making the decision what qualities should be trained (Sallet 2005). The qualities that are trained should be tested to see whether an athlete has improved (Suni & Taulaniemi 2012). If the test does not measure fundamental performance aspects it is not efficient use of the players' time (Radu 2019). Tests that have been used to measure fundamental performance aspects are shown in table 5.

Table 5. Tests in basketball that measure fundamental performance aspects (Radu 2019, 45)

Non-fatiguing tests	anthropometry, flexibility, vertical jump
Agility tests	T-test, lane agility
Maximum power and strength tests	1 RM, isokinetic, dynamometry
Sprint tests	5, 10 and 30 meters
Muscular endurance tests	Push-up, sit-up tests
Fatiguing anaerobic capacity tests	Suicide runs, Wingate test
Aerobic capacity tests	VO2max, Yoyo intermittent recovery test

One of the requirements for YMCA Heinola's testing battery was that the tests can be executed in the YMCA training center. The chosen tests were the most optimal in regards of execution for the YMCA Heinola environment.

5.1 Anthropometry

Anthropometry tests should be conducted prior to court testing protocols. Anthropometry testing in young athletes should include measurement of height, weight, skinfolds, and arm length and span. Skinfolds are filed over seven site (triceps, biceps, subscapular, supraspinale, abdominal, front thigh, and medial calf). Skinfolds are reported by the individual measures and the sum of the seven sites. Measuring skinfolds requires a high degree of technical skills to get consistent results. It is recommended that the skinfold tests are conducted by an experienced tester who has been trained in these techniques. (Pyne, Montgomery, Klusemann & Drinkwater 2013, 274.)

Repeated anthropometric measurements can track changes in body composition targeted through specific training. The focus on this testing should be on changes in lean muscle mass rather than on weight loss or gains. (Pyne et al. 2013, 274.) With children and adolescents who are still growing, anthropometry should only be used based on strict considerations. Especially young girls who are in danger of eating disorders, body composition measures can do more damage than be beneficial for the athlete. (Fogelholm 2018, 47.)

5.2 Speed (20-meter sprint test)

The objective of the 20-meter sprint test is to cover the distance as quickly as possible. The purpose of this test is to assess athlete's acceleration ability needed in basketball and linear speed capabilities. (Triplett 2012, 260.)

Equipment needed for the 20-meter sprint consist of an indoor hall where the distance can be measured, measuring tape, stopwatch, cones or tape to point at start and finish lines, testing personnel at the start and finish line, and recording sheet (Triplett 2012, 260).

Recommended number of trials for a 20-meter sprint to achieve reliable best time is three (Moir, Button, Glaister & Stone 2004). Limited time can be a problem when considering the number of trials, especially if there are many athletes that need to be tested (McMahon, Jones & Comfort 2019, 131). Starting position in the 20-meter sprint test should be as close to the sport you practice as possible (McMahon, Jones & Comfort 2019, 128). The most suitable for basketball specific starting position is the split-stance.

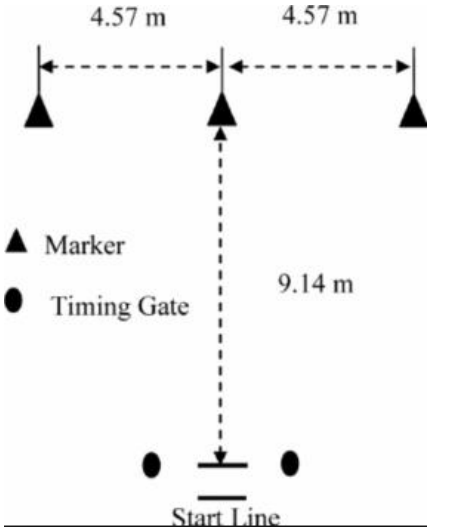
Winkelman, Clark & Ryan (2017) have provided instructions for practitioners to use to assure consistency for setting up athletes in a two-point stance: Athletes should stand with feet hip-width apart at the start line and place one foot behind the start line and the other foot back at a comfortable distance. Arms should be set so that they are positioned opposite from the legs. Lastly, legs are loaded and shifted forward so that athlete is ready to sprint with no delay.

5.3 Agility (T-test)

The main object of the T-test is to assess athlete's ability to change directions rapidly while maintaining balance without loss of speed (picture 2). It measures four-directional

agility and body control. (Semenick 1990.) Equipment needed for T-test consist of four marking cones, stopwatch, measuring tape, and recording sheet (Triplett 2012, 265).

The subject starts at cone A, at the base of the T. The subject should face forward in an upright stance. On the command of the timer, the subject sprints straight ahead to cone B and touches the base of the cone with their right hand. Next, they turn left and shuffle sideways to cone C, and also touch its base, with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. Finally, the subject shuffles back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A. (Triplett 2012, 267.)



Picture 2. T-test track model (Lockie, Schultz, Jeffriess & Callaghan 2012)

The test can be disqualified if the subject doesn't touch the base of any cone, crosses the feet when shuffling, and fails to face the front at all time (Semenick 1990). A good number of trials for the T-test is two or three times, with three to five-minute rest between trials (Triplett 2012, 268).

5.4 Strength

5.4.1 Maximum strength (squat and bench press 3RM)

Generally considered, the best representative test for maximum strength is the 1-repetition maximum (1RM), but there are concerns about safety, reliability, and maintenance of proper technique for athletes with low training age (Baechle, Earle & Wathen 2008). For

younger athletes, the 3-repetition maximum is rather used. The movements to assess maximum strength in basketball are squat and bench press and it should be performed in this order. (Pyne et al. 2013, 274.)

There are many factors to consider when testing maximum strength. It is important that the subject goes through a proper warm-up before testing. A maximum of 5 minutes recovery is allowed between trials and between the repetitions, no more than 2 seconds is allowed. The test should be completed within 4 trials without including the warm-up. At least one spotter is required when performing. (Pyne et al. 2013, 274.)

Equipment needed for the squat test include a standard squat rack (appropriate height), an Olympic barbell, and Olympic plates. All the repetitions should be performed with a proper technique. The subject grasps the barbell with a grip slightly wider than shoulder width and places the barbell above the posterior deltoids. The feet should be placed slightly wider than shoulder width. The squat is low enough, when the subject's top of the thighs is parallel to the floor. The barbell should rise without assistance in a continuous motion. (Moir 2012, 163.)

Equipment needed for the bench press test include a standard flat bench with barbell stands, an Olympic barbell, and Olympic plates. All the repetitions should be performed with a proper technique. The subject lies supine on the bench with five-point contact (head, shoulders, buttocks and both feet) and these contact points should remain during the repetitions. The bar is grasped with a grip slightly wider than shoulder width. The bar is lowered to touch the chest at around the level of the nipple and is then raised until the elbows are fully extended. The spotter helps the subject to remove the bar from the barbell stand and helps to put the barbell back there after the performed repetitions. (Moir 2012, 170-171.)

5.4.2 Dynamic strength (vertical jump)

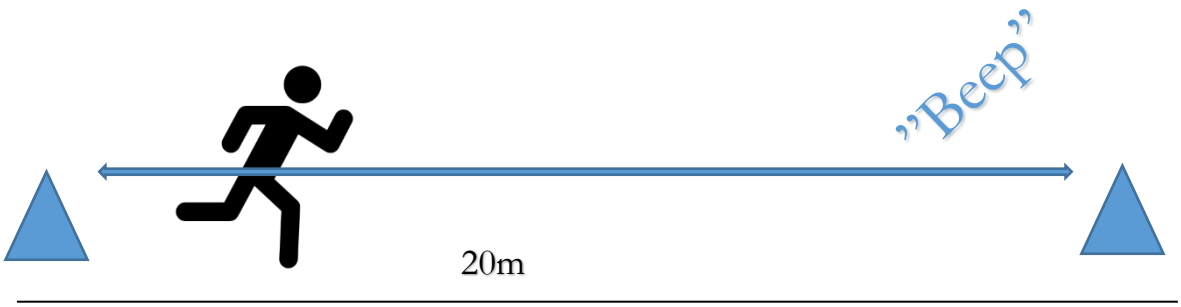
The vertical jump (VJ) test is a simple, practical, and valid measure of lower-body power (Peterson 2012, 235). Vertical jump ability has been linked to an athlete's playing time (Hoffman, Tenenbaum, Maresh et al. 1996). Equipment needed for the vertical jump consist of a tall wall, chalk or pen to mark hand, and measuring tape (Peterson 2012, 235).

To test the athlete's vertical jump, the first thing to do is to measure athlete's reach height. The subject chooses their dominant hand and rubs chalk on the middle finger. Keeping heels on the ground and facing straight ahead, the subject reaches as high as possible and makes a mark on the wall with the chalk finger. Then, the subject uses an arm swing and countermovement to jump as high as possible and makes a second chalk mark on the wall. The subject should be given at least three trials with rest periods between the jumps. The difference between the highest chalk mark and the recorded reach height is recorded as the vertical jump height. (Peterson 2012, 237.)

5.5 Repeated sprint ability

Yo-Yo test (level 1) is used to evaluate an athlete's capacity to perform sprints repeatedly and to perform intermittent exercise demanding maximal activation of the aerobic system (DiMenna & Jones 2019, 232). Yo-Yo test is broadly used in team sports to assess junior athletes' ability to perform repeated sprints in higher intensity (Armstrong, Welsman & Williams 2008, 55-66). The Yo-Yo test also provides a sufficient estimate of VO2max for intermittent-sport participants (Bangsbo et al. 2008; Thomas, Dawson & Goodman 2006) and basketball related endurance (Castagna, Impellizeri, Rampinini et al. 2008). The equipment required for Yo-Yo test contains of marking cones, measuring tape, pre-recorded audio CD or mp3, a CD player with a loudspeaker, and recording sheet (Woolford, Polglaze, Roswell & Spencer 2013).

A Yo-Yo test involves an athlete shuttling between two cones that are set 20 metres apart on flat ground (picture 3). The athlete starts on a beep and needs to get to the cone at the other end before the second beep. The subject then turns back and returns to the starting cone before the third beep. (Woolford, Polglaze, Roswell & Spencer 2013.) Total distance covered prior to test termination is recorded as the test result (DiMenna & Jones 2019, 232).



Picture 3. Draft of a Yo-Yo-test

5.6 Mobility (overhead squat)

Poor motor control of an athlete has a negative influence on the economy, efficiency, and accuracy of a basketball player's movements. According to studies made by Baratta, Solomonow & Zhou (1988) and Wilson, Press & Zhang (2009) poor motor control through a range of motion has been connected in joint injuries and ongoing joint pain. Mobility tests are crucial to assess an athlete's readiness to train or compete. (Pyne et al. 2013, 282-283.)

In the overhead squat test, the subject holds a wooden dowel overhead with shoulders fully extended and the elbows locked. The grip should be twice the shoulder width. The subject stands with feet shoulder width apart and toes pointing forward or slightly out. The lowering of the dowel continues until the crease of hips is below the top of the knee. Heels should be in contact with the floor the whole time. The athlete's torso should remain in an upright position during the repetition. (Pyne et al. 2013, 283.)

The practitioners should be well trained to assess mobility. The tester should be the same every time testing mobility to get as valid results as possible. The tests are scored on a scale from 0 to 3 (figure 2).

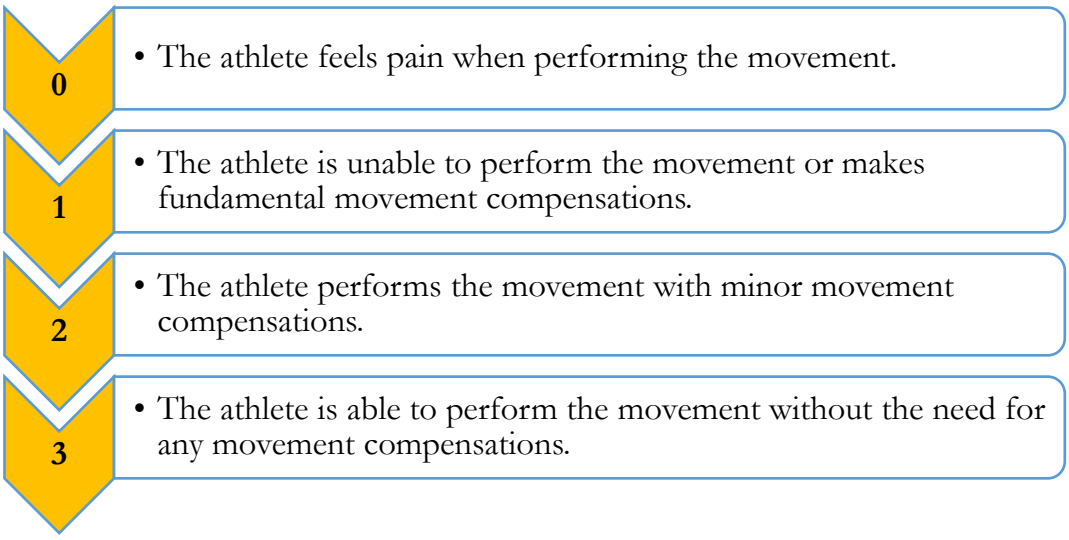


Figure 2. Scoring scale and requirements in mobility testing (Pyne et al. 2013, 284)

6 Athlete profiling

An athlete profile can include multiple key qualities (technical, physical, psychological and tactical) that have an effect on performance. Profile encourages an athlete to reflect on the qualities and to realistically assess their own development. Following the self-reflection an athlete has a chance to discuss with a coach to initiate specific training to the areas that need more development. (Weston, Greenlees & Thelwell 2011, 174.) Study by D'Urso, Petrosso and Robazza (2002) showed that athletes believed profiling being useful in increasing the self-awareness of qualities that have an effect on performance. Dale and Wrisberg (1996) mentioned that profiling increased communication within a team and made the team environment more open. Study by Jones (1993) gave evidence that profiling improved athlete's motivation. Furthermore, athletes believed profiling is helpful for knowing what they really need to work on, set goals for themselves and take responsibility for their own development (Weston, Greenlees & Thelwell 2011, 173-188).

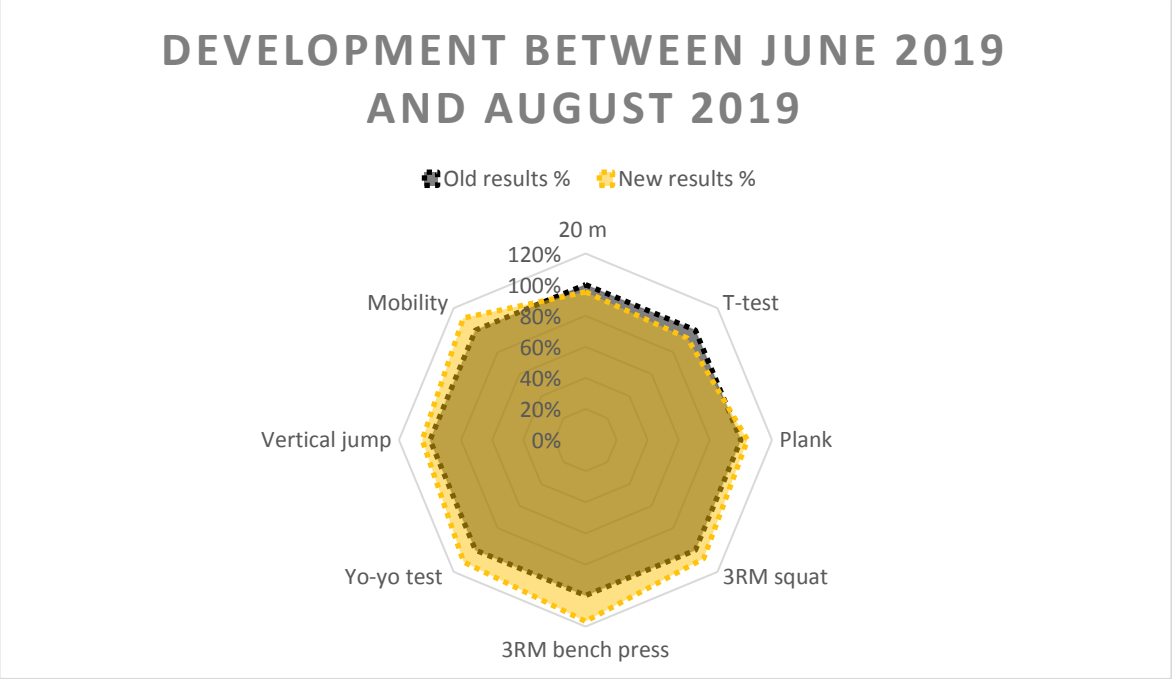
6.1 Profiling tool representing the physical abilities

Performance profile collects the information of an athlete's sports performance in the sport specific areas that are chosen to be tested (Butterworth, O'Donohogue & Cropley 2013, 572). Sports specific field tests that use indicators to find out the talent are often used in sports. Another way to test is to use tests such as Functional Movement Screen that include series of elements that assess abilities across multiple aspects of function. (Sleeper, Kenyon, Elliott & Cheng 2016, 1083.) O'Donohogue (2013) stated that an athlete profile is collected by using indicators and put together to represent athletes' performance. The purpose of profiling is to seek for knowledge on the athletes' performance and to get information on what needs to be developed (Butterworth, O'Donohogue & Cropley 2013, 572). Profiling can be also valuable in tracking the development when working towards sport specific goals (Meylan & Cronin 2014, 21).

6.2 Creating a profiling tool

Many methods in literature are used to represent the performance profile but none of them have been shown to be more effective than another (Butterworth et al. 2013, 581). Graphical data presentation approach such as radar charts make observation and comparison of the test data quick and easy because the results are shown in the same chart (Doyle & Parfitt 1996).

A visual chart is used to present the statistical data because Butterworth et al. (2013) have suggested it to be effective.



Picture 4. Profiling tool to visualize the development of physical qualities

Results of the test are put into profiling tool (an Excel sheet) which draws a visual chart (picture 4) to visualize the development between two separate measurement times. For instance, first measurement can be done before pre-season training starts and second after the pre-season training is over. The results from the first test time (e.g. before pre-season training) are shown in black color. The results from the second test time (e.g. after pre-season training) are shown in yellow color. The differences in the development depends on the amount that yellow color covers the black area. In the profiling tool when yellow color is exceeding black, it means that athlete has had an improvement in the result of the test. This means that training has a positive effect on the athlete's development. Yellow color being over the black means that the result is the same, and an athlete has had no negative or positive change in that area of physical qualities. When black color is seen under the yellow it means that training has had a negative impact on the development of the physical skill. This can also happen if there has not been training of the specific area after the first test. Notice that the rules with yellow and black exceeding each other are the other way around with speed and agility because the athlete is supposed to have a faster

time which means the result should be less than the measured the previous time. Demonstration on how to read the profiling tool is shown on the figure 3.

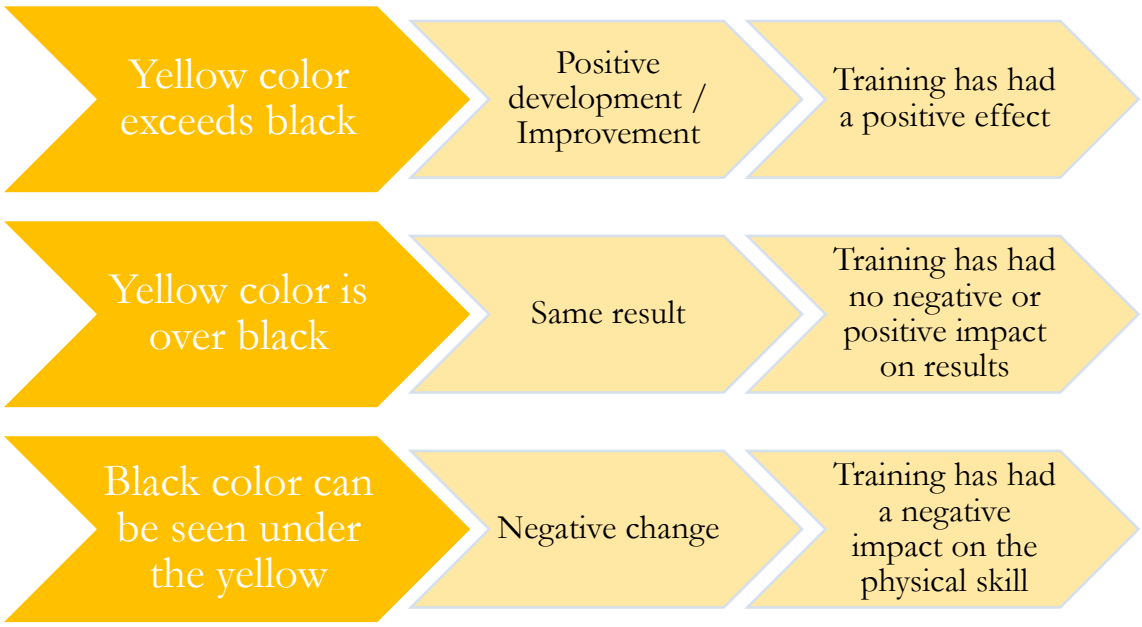


Figure 3. Explanations on how to read and explain changes seen in the profiling tool

Testing time of the day, tiredness of the athlete and some other coincidence which affects the mood or body may have an influence on the results and, thus, when results are interpreted this should be taken into consideration.

7 The aims of the project

7.1 Reasoning behind measuring and profiling

Purpose of the project-oriented thesis was to gather information on basketball players' physical components, how they are tested and according to findings, create a profiling tool and test manual for YMCA Heinola. We aimed to find information on what physical abilities support and predict basketball players' success, development and playing time in basketball. That way, when these components are tested and trained, youth players are supposed to take right steps towards being a better player. The purpose of the profiling tool is to have a tool that shows the results visually and helps the athlete to understand in which areas there has been development. The profiling tool can be helpful in motivating youth players to work on their physical qualities.

The test manual is done for a youth basketball club so special features of youth athletes are taken into consideration. Most of the tests used in the manual are used with elite junior basketball players in Australia. Similar tests have been used in Europe and in the United States, for example in the NBA Combine. (Pyne, Montgomery, Klusemann & Drinkwater 2013, 273.)

7.2 Developing players in YMCA Heinola

YMCA Heinola is a sports club, registered in 2000. The values; holistic development of an individual, cohesiveness/togetherness, the comparison of basketball as a hobby versus competitive sport, openness and the feel of security (mental environment), were listed by the board of YMCA Heinola and are strongly part of everyday coaching and activities. The emphasis was on making meaningful values that really can be obeyed by every participating person in the operations of the club. (Ainali, Pirkola, Ruutiainen, Roslöf, Hämäläinen 2016a.)

In the spring 2017 YMCA Heinola set a goal of having an own gym only for basketball. The project was set off because of the lack of practice time at school gyms in Heinola. At the same time basketball phenomenom around Finland was bringing new players to the club. Every year since 2015 the number of YMCA Heinola's licensed players has been increasing. YMCA Heinola's own gym "YMCA Training Center" opened in the spring 2018

for the teams and to public. It is a basketball gym but also a living room for the youth to come to after school. (Ymcaheinola 2019a.)

Ymca training center project supports the vision to make basketball the most popular sport in Heinola. Facilities provide great conditions to train basketball. For those who do not play, YMCA Heinola wants to provide with other possibilities, such as refereeing, coaching or being an equipment manager in teams.

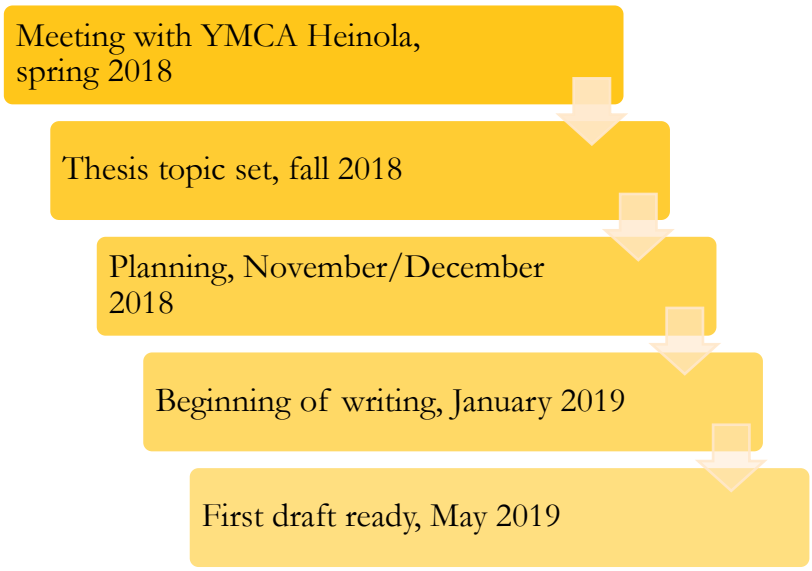
YMCA Heinola created a Talent-group for youth from age 13 to 18 in the fall 2018. Talent-group has 4 extra practices per week on top of team practice. Two of the practices are skill development and two for physical conditioning development. Player must go through an applying process to get into the talent-group. Goal of the talent-group practices is to support the players' development comprehensively and help them reach their potential. (Ymcaheinola 2019b.)

A profiling tool specifically designed to the use of YMCA Heinola is a next step on developing the players on all teams but especially the training in talent-group.

8 Project planning

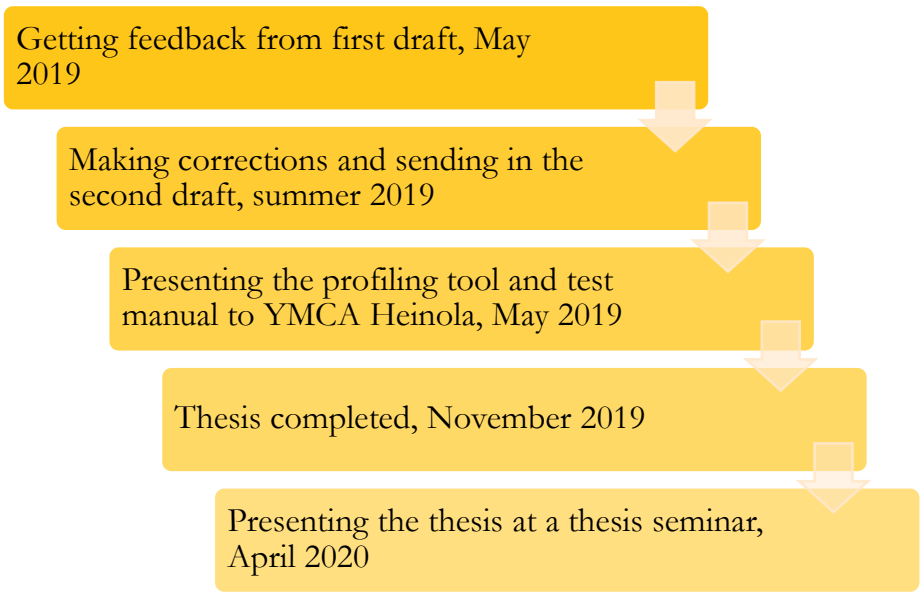
The thesis project started in the spring 2018 by having a meeting with YMCA Heinola's executive director. After hearing the need from the club, we had a discussion with a teacher at the University of Applied Sciences in Vierumäki. Soon after the meeting we were sent off to a summer holiday which gave us time to think and make decisions. Thesis topic was set after summer holiday in the fall 2018. Planning started later that year in the winter. We read a lot of literature and research and set some of the headings to our official thesis plan. Our teacher confirmed that our thesis plan had the needed structure and we had enough understanding of our subject to start writing. Spring 2019 was the main time of writing. Check point with the teacher in March and after that the first draft of the thesis was completed. First year of the thesis project is demonstrated in table 6.

Table 6. Timetable of thesis from spring 2018 to spring 2019



After the feedback of the first draft we modified the text and presented the profiling tool and test manual to the coaches of YMCA Heinola. Rest of the project is demonstrated in table 7.

Table 7. Timetable of our thesis from spring 2019 to the end of the year 2019



The biggest challenge during the process was to meet the financial requirements of the club and find tests that can be done with the least amount of expenses possible and in the YMCA training center environment. The tests we recommend and chose for YMCA Heinola physical abilities test manual are supported by research.

The test manual is based on sport analysis, literature and earlier research. Testing should be performed multiple times during the season because one of the main reasons for testing is to follow the athlete's physical development. The person who is testing the athlete should always observe and communicate with the athlete about one's feelings. The athlete has always a right to stop the test. After the test the results are interpreted to the athlete. Objective test results measure for instance time or distance. (Keskinen, Häkkinen & Kallinen 2007; 14-15,186.)

9 The implementation of the project

Once the profiling tool and test manual were complete it was introduced to the YMCA Heinola coaches 28.5.2019 at YMCA Training center. Invitation to the coaches was send via the executive producer of Heinola. We prepared a four-hour training clinic for the coaches. It included going through the tests with 10 players who are applying to the Talent-group for the upcoming season and testing how to use the profiling tool.

The training clinic started from introducing the topic to the participants. The day started with an individual warm up that had a game to get the heart rate up, dynamic stretches, activations to the muscles and a couple of sprints and jumps. Five coaches who participated in the training all had two players to supervise throughout the tests. Coaches tested their own players with help and supervision from us. Test results were collected to a Google slide sheet online. Results were also written on the profiling tool that creates a visual chart of physical qualities test results for each player.

At the beginning of every test, we explained the coaches and the players how to run the tests and why we chose to use these specific tests to assess basketball players' physical abilities. The coaches and players were familiar with some of the tests, but also new ones were introduced.

The tests ran smoothly and once we were ready with the testing, we asked the coaches and players for feedback from the clinic. A player mentioned that they didn't have specific goals what to reach. All the coaches explained that the tests are only for the players themselves and now that the summer is coming the goal is to train hard and do better in the tests the next time. Otherwise the players seemed satisfied with the clinic. The feedback we got from the coaches was about safety issues especially with the maximum strength test with the unexperienced athletes. The other feedback we got was about time management issues and how they can run the tests so that it doesn't take that much time. Other than that, the coaches seemed satisfied with the tests and the profiling tool. The club has since started using the manual and profiling tool to test the players and improve their training.

10 The description and results of the project

Purpose of the product-oriented thesis is to create a concrete product (Airaksinen & Vilkka 2003, 51), which in this project is a manual and a profiling tool for YMCA Heinola basketball club to assess athletes' physical qualities. The implementation is based on the planning phase (Ruuska 2007, 39), which means that the manual is based on sport analysis of basketball and fundamentals of testing physical qualities.

Project started from a need of YMCA Heinola club. The club wanted to develop their operations and daily training of the athletes. We gathered information from research and literature and chose as valid a test as possible to measure basketball specific physical abilities. The tests give comprehensive information on the athletes' abilities since they measure speed, agility, strength, endurance and mobility.

The test manual (attachment 1) explains to coaches and players what, when and how the abilities are suggested for testing and provides the information on how to put the measurement data on the profiling tool. More information about the reasoning behind the abilities that should be tested and what are the physiological demands in the sport of basketball is found in the thesis. The actual profiling tool is an Excel sheet that all coaches can access and use through YMCA Heinola database.

11 Discussion

Purpose of the thesis was to create a profiling tool for YMCA Heinola that is easy to use in everyday coaching. Our secondary purpose was to build a test manual to explain how to run the tests that were chosen to be used in the profiling tool to evaluate players' physical qualities. YMCA Heinola wanted to improve their daily functions in the club. Talent-group that has been part of the club for only one season was the target group of this profiling tool.

Sport analysis, literature and research were used to find out the best tests to evaluate basketball players' physical qualities. Physical characteristics and physiological performance are significant factors in defining success in basketball. Physical qualities differ between players with higher or lower skill levels. Studies support that players with higher skill level are more agile, faster and jump higher in vertical jump tests. (Carvalho, Coelho, Silva, Goncalves, Philippaerts, Castagna & Malina 2011.) When a basketball player develops the physical qualities that are performed in the YMCA Heinola testing, they are more likely to become better basketball players.

Relevant and on-going testing is a significant part of the adolescents training. It guides young athletes to reach and maintain high-level performance. (Committee on sports medicine and fitness 2000.) The chosen tests help the coach understand what physical qualities of the player need development. According to testing results coach can plan more individualized training for every player.

According to Bryanton, Kennedy, Carey & Chiu (2012) reliability, variability and comparability of the data collection will be affected if the testing isn't done the same way every time. We visited YMCA Heinola's gym to see the environment and created a standardized protocol how to run the tests and use the manual to make sure the tests and test results would be as reliable and valid as possible.

Resources of the club were limited so we had to pick tests that were valid but could be used with the least amount of money possible. We found valid, relatively new information to support that the test choices are good. All physical abilities must be tested a compre-

hensive image of the players strengths and areas of development is built. We got feedback from one coach of Heinola that the testing day was quite long. It can be divided into two days rather than not testing some of the physical qualities.

Target group for the profiling tool is young athletes. We thought it would be best to create a tool that gives a visual outcome because it is easier to read. Many methods in literature are used to represent the performance profile but none of them have been shown to be more effective than another (Butterworth et al. 581). Graphical data presentation approach such as radar charts make observation and comparison of the test data quick and easy because the results are shown in the same chart (Doyle & Parfitt 1996). Visual chart gives something else than numbers for the player. Test results on the profiling tool show what physical qualities the training should emphasize at that moment so they could become more versatile players.

Overall, we are satisfied with the visual outcome of the profiling tool. YMCA Heinola coaches were satisfied with it and said it is clear and easy to use. Profiling tool is an Excel sheet that is shared on YMCA Heinola's database and all coaches have access to it. One aspect that we are not happy with in the profiling tool is that agility and speed test results are shown the other way around in the visual chart. Normally if players test results improve, yellow exceeds black. In an agility and speed test when a player improves, the value of the result is less, meaning that there is improvement. Therefore, black should exceed yellow. This may be confusing for new coaches who start using the profiling tool and do not read the instructions carefully.

A growing number of children and adolescents are participating in competitive sports. Hence, training has become more specialized with a goal of taking their sport perfomance to the peak level. (Mountjoy, Armstrong, Bizzini, Blimkie, Evans, Gerrard, Hangen, Knoll, Micheli, Sangenis & Van Mechelen 2008.) Training should be based on knowledge and be progressive. Test results are a good tool for assessing training effectiveness when trying to reach one's own peak performance.

It's important to remember that children aren't so called "mini-adults", but how children and adults' physical performance differs, isn't clear (Hakkarainen 2015, 53). Maturation needs to be taken into consideration when talking about youth athletes (Radu 2019, 27). Anthropometric measurements are affected by maturation, as well as body composition

(Malina, Bouchard & Bar-Or 2004). Early or late maturation can influence success in physical quality test. Children at different biological stages should have tailored testing batteries. (Lidor, Côté & Hackfort 2011.) According to Hakkarainen (2015), determining the biological age is a very important but often difficult task in competitive sports for children and youth. With all the knowledge we learned during the process we figured that there should be testing batteries to see whether young athletes are even ready to be tested. This part is not largely discussed in our thesis, yet it should be taken into consideration that some adolescents are not ready to be tested because of physiological, pubertal, psychological or mental factors.

Schedule for the thesis was flexible. We had agreed on making it during the season 2018-2019. We were in contact with the executive director of YMCA Heinola monthly to give updates on the process. During the process we wanted to deepen our knowledge on testing and on the physical qualities that are required to be able to compete on a high level. As a result, the knowledge of basketball as a game increased.

For the future we would recommend the club to use some money on the testing equipment. A force plate or an application on a phone may give more valid results because the test can be more standardized. With field tests such as jumping and touching a backboard of the basket allows the players to use their hands differently. A good option would also be co-operation with Vierumäki and Haaga-Helia students because Vierumäki has all the necessary facilities and equipment to run the tests. For example, 20-meter sprint results are more valid when they are tested with photocell electronic timing gates. We would also change the agility and speed test result graph on the Excel to match the others. The future will show whether coaches of the club find the profiling tool useful and motivating.

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Appendices

Appendices 1. YMCA Heinola testimanuaali

Testimanuaali

Sisällysluettelo

Johdanto

1 Nuoren pelaajan fyysisten ominaisuuksien mittaaminen

- Kuinka usein testataan
- Miksi testataan
- Mikä on tärkeää testauksessa

2 Testit

- Nopeus 20 m
- Ketteryys t-testi
- Liikkuvuus
- Vertikaalihyppy
- Kestävyys piip-testi
- Keskivartalo lankku
- Kyykky
- Penkkipunnerrus

3 Testien toteuttaminen YMCA Training Centerillä

- Mittausvälineiden tarkistuslista
- Pohjapiirustus, johon merkattu mittauspaikat viitteellisesti

4 Tulosten kirjaaminen

- profilointi työkalun käyttäminen

Hei,

Käytössäsi on YMCA Heinolan C- A-joukkueille suunnattu testimanuaali ja profilointityökalu. Tuotokset ovat YMCA Heinolan kanssa yhteistyössä tehdyn opinnäytetyön *Profiling tool for YMCA Heinola basketball club to assess athlete's physical qualities* lopputulos, jossa tutkittiin koripalloilijoiden fyysisiä ominaisuuksia ja niiden testaamista.

Testimanuaalista löydät tarvittavat tiedot ja testit mittaamaan nuoren koripalloilijan fyysisiä ominaisuuksia. Yleisten ohjeiden lisäksi on tärkeää, että valmentaja ottaa huomioon jokaisen nuoren yksilöllisesti ja varmistaa, että urheilijalla on tarvittava valmius toteuttaa testit. Suurin osa testeistä soveltuu kaikille, mutta esimerkiksi voiman testaaminen toistomaksimeilla vaatii hyvää keskivartalonhallintaa ja oikeanlaisen tekniikan. Tämän materiaalin ja profilointityökalun on tarkoitus olla motivoiva sekä pelaajalle, että valmentajalle. Se tukee pelaajan ymmärrystä fyysisten ominaisuuksien kehittämisen tärkeydestä ja antaa valmentajalle työkalun suunnitella ja kehittää harjoittelua.

Testit on suunniteltu YMCA training centerin ympäristöön.

Tsemppiä testeihin!

1 Nuoren pelaajan fyysisten ominaisuuksien mittaaminen

Nuoret pelaajat tulisi testata ensimmäisen kerran ennen kesää uuden kauden alkaessa. Tämä antaa tärkeää informaatiota pelaajan heikkouksista ja vahvuuksista fyysisellä puolella ja se auttaa valmentajaa suunnittelemaan seuraavan treenisyklin. Seuraava testikerta on kesän jälkeen, ennen kilpailukauden alkua. Tämä antaa valmentajille kuvan urheilijan valmiudesta kilpailukauteen. Urheilijoita tulisi testata myöskin kilpailukauden aikana, jolloin saadaan tärkeää tietoa treeniohjelmien toimivuudesta ja urheilijan kehityksestä.

Fyysiset testit on parasta suorittaa silloin kun urheilija on levännyt. Suosituksena on vähintään 48 tuntia lepoa pelin tai kuormittavien treenien jälkeen. Jotta jokainen testi on validi ja verrattavissa edelliseen testikertaan, tulisi testit suorittaa samaan kellonaikaan päivästä, sillä fyysinen suorituskyky vaihtelee kellonajasta riippuen. Ennen jokaista testikertaa tulisi suorittaa sama alkulämmittely. Testien suorituspaikaksi suositellaan samaa paikkaa ja mieluiten samaa ympäristöä missä harjoitellaan ja pelataan. On myöskin tärkeää huomioida, että testauksia arvioi sama henkilö joka kerralla, varsinkin testeissä, joissa arvioidaan urheilijan liikerataa.

Testausjärjestys riippuu urheilijoiden ja testaajien määrästä, tarvittavista lepoajoista testien välillä sekä testausvälineiden saatavuudesta. Ihanteellinen järjestys olisi:

1. Pituus ja paino
2. Valakyykky
3. Vertikaalihyppy
4. T-testi
5. 20 m juoksu
6. 3RM kyykky ja penkkipunnerrus
7. Lankku testi
8. Piip-testi

Jos tämä järjestys on mahdotonta toteuttaa, tulisi antropometriset mittaukset suorittaa aina ensimmäisenä ja Piip-testi viimeisenä.

Aina ennen testausta tarkistetaan testauspaikan vaarattomuus. Lattialla ei tulisi olla mitään ylimääräistä vahinkojen minimoimiseksi ja kaikkien välineiden kunto tulisi tarkistaa ennen varsinaisia testejä. Testaukseen liittyy myös eettisiä näkökulmia ja sen kulmakivi on, että jokaista urheilijaa kohdellaan kunnioittaen ja suojellen heidän yksityisyyttään. Ison ryhmän testaamisessa tulee huomioida se, että jokainen urheilija saa suorittaa testit rauhassa ilman muiden painostusta ja varsinkin antropometriset mittaukset tulisi suorittaa yksitellen huoneessa, johon muut eivät pääse samaan aikaan. Nuoret ovat herkässä iässä oman kehonkuvansa suhteen ja esimerkiksi vaarassa sairastua syömishäiriöihin. Testauksessa olisi suotavaa miettiä, onko painon mittaamisesta enemmän haittaa kuin hyötyä.

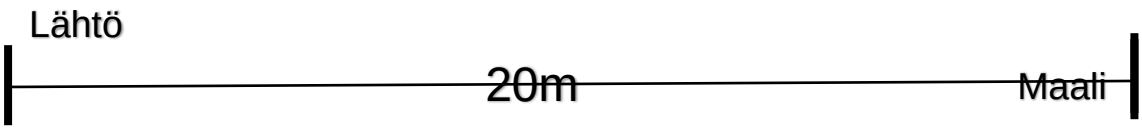
2 Testit

2.1 Antropometria

Antropometriset mittaukset suoritetaan ensimmäisenä. Niihin kuuluvat pituuden, painon ja sylivälin mittaaminen. Antropometrian avulla tutkitaan ihmisen mittasuhteita ja sitä voidaan käyttää urheilijan kehittymisen seurannassa. Ajoittaiset antropometriset mittaukset antavat tietoa nuoren fyysisen kasvun nopeudesta. Pelaajia ei tule laittaa paremmuusjärjestykseen antropometristen tulosten perusteella.

2.2 Nopeus (20m)

20 m nopeustestin tarkoitus on mitata urheilijan kiihdytyskykyä ja suoraviivaista nopeutta. Testi tulisi suorittaa samassa salissa, jossa harjoittelu ja pelit tapahtuvat. Testausvälineistöön kuuluvat sekuntikello, mittanauha, merkkikartioita, testauspöytäkirja ja kynä. Suositeltu yritysten määrä on kolme, jotta saadaan luotettavaa dataa. Alkuasennon tulisi olla sama mitä koripallossa usein käytetään, esimerkiksi pystyasennossa toinen jalka edessä toinen takana.



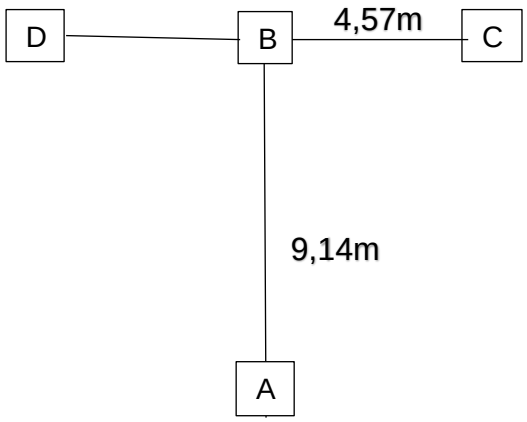
2.3 Ketteryys (T-testi)

T-testin tarkoitus on mitata urheilijan kykyä vaihtaa suuntaa ilman tasapainon ja nopeuden menetystä. Tässä testissä vartalon hallinta on suuressa merkityksessä. Testausvälineistöön kuuluvat neljä merkkikartiota, sekuntikello, mittanauha, testauspöytäkirja ja kynä.

Testin kulku: Urheilija aloittaa suorituksen aloitusviivalta, t-kirjaimen pohjalta. Testattavan rintamasuunta on eteenpäin ja yleensä alkuasentona on pystyasento. Urheilija lähtee liikkeelle ajanottajan merkistä ja juoksee merkkikartiolle B, mikä on suoraan edessä ja koskettaa merkkikartiota oikealla kädellä. Seuraavaksi testattava liikkuu sivulaukalla oikealle kohti kartiota C ja koskettaa tätä myöskin oikealla kädellä. Kartio C:n jälkeen liikutaan sivulaukalla kohti kartio D:tä ja tätä kosketetaan vasemmalla kädellä. Lopuksi palataan B

kartiolle ja kosketetaan sitä vasemmalla kädellä ja tämän jälkeen juostaan takaperin takaisin alkuun eli kartiolle A. Sekuntikello pysäytetään heti kun urheilija on ohittanut viimeisen merkkikartion.

Testiä ei hyväksytä, jos testattava ei kosketa kaikkia kartioita, hänen jalkansa menevät ristiin sivulaukassa tai rintamasuunta ei pysy eteenpäin testin ajan. Testauskertoja olisi hyvä olla kaksi tai kolme, kolmen-viiden minuutin tauoilla testauskertojen välissä.



2.4 Maksimivoima (kyykky ja penkkipunnerrus 3RM)

Koripallossa hyvät maksimivoiman mittarit ovat kyykky ja penkkipunnerrus ja testit tulisi suorittaa tässä järjestyksessä. Testissä mitataan maksimivoimaa käyttäen lisäpainomäärää, jonka urheilija jaksaa nostaa kolme kertaa puhtaalla tekniikalla. Ennen testaamista on tärkeää, että urheilija lämmittelee huolellisesti. Testattava saa levätä maksimissaan viisi minuuttia yritysten välissä ja kaksi sekuntia toistojen välissä. Urheilijan tulisi saada neljä yrityskertaa lämmittelyjen lisäksi. Yksi varmistaja on välttämätön testiä suoritettaessa.

2.5 Kyykky

Kaikki kolme toistoa tulisi suorittaa oikealla kyykkytekniikalla: testattava asettaa tangon epäkäslihaksen päälle lapaluiden yläpuolelle. Ote tulisi olla vähän olkapäitä leveämpi ja jalkojen tulisi olla vähän leveämmällä kuin hartioiden. Kyykky on tarpeeksi matala, kun testattavan reiden yläpää on samansuuntainen lattian kanssa. Tangon tulisi nousta ilman avustusta jatkuvalla liikkeellä. Tähän testiin tarvitaan kyykkyräkki, tanko, levypainoja, testauspöytäkirja ja kynä.

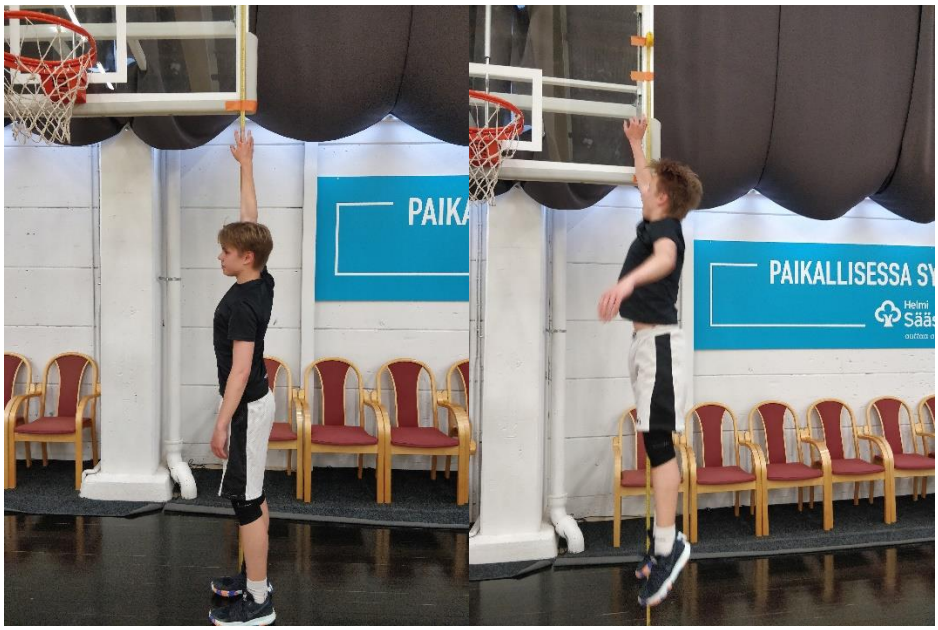

2.6 Penkkipunnerrus

Kaikki kolme toistoa tulisi suorittaa oikealla tekniikalla. Testattava asettuu painonnosto-penkille makaamaan selälleen ja seuraavat viisi kohtaa kehosta tulisi olla kiinni joko penkissä tai lattialla toistojen aikana: pää, olkapää, pakarat sekä molemmat jalat. Ote tangosta on hieman hartioita leveämpi. Tanko lasketaan alas niin että se koskettaa rintaan suurin piirtein miekkalisäkkeen kohdalla ja nostetaan ylös niin, että olkapäät ovat kokonaan ojennettuina. Varmistaja auttaa suorittajaa ottamaan tangon pois räkistä suorituksen alussa ja auttaa laittamaan sen takaisin räkkiin suorituksen lopussa. Tähän testiin tarvitaan tasainen penkki, tankoräkki, tanko, levypainoja, testauspöytäkirja ja kynä.



2.7 Dynaaminen voima (vertikaalihyppy)

Vertikaalihyppy on yksinkertainen, käytännöllinen ja validi testi kun halutaan mitata alavartalon voimaa. Testaustarvikkeisiin kuuluvat liitukynä, mittanauha, testauspöytäkirja ja kynä. Testatessa vertikaalihyppyä ensiksi pitää mitata testattavan kurotuspituus. Testattava valitsee dominoivan kätensä ja hieroo liitua keskisormeensa. Tämän jälkeen testattava kurottaa niin korkealle kuin mahdollista pitäen jalat maassa ja kylki seinää kohden ja tekee merkin seinään keskisormellaan. Sitten testattava käyttää käsienheilautusta ja ponnistaa alhaalta asti hypätäkseen niin korkealle kuin mahdollista ja tekee toisen merkin seinään keskisormellaan. Testin tulos on mitta ensimmäisen ja toisen merkin välillä. Testisuorituksia tulisi antaa vähintään kolme ja suoritusten välissä tulisi levätä.



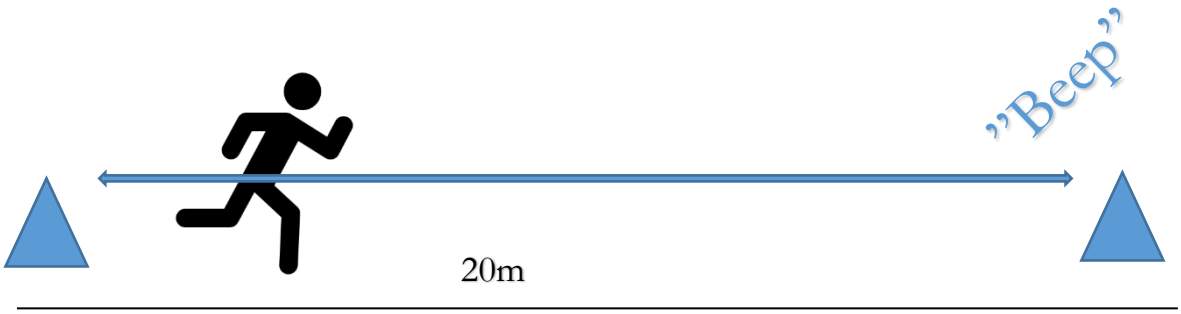
2.8 Piip-testi

Piip-testin tarkoitus on arvioida urheilijan kestävyyttä. Piip-testin avulla voidaan arvioida urheilijan VO2max-tasoa sekä koripallolle ominaista kestävyyttä, sillä testissä juostaan jatkuvia spurtteja lajinomaisesti.

Arvioitu VO2max kaava piip-testin tuloksesta: *VO2max = matka metreinä x 0,0084 + 36,4*

Testiin tarvittavia tarvikkeita ovat merkkikartiot, mittanauha, tallennettu äänite, soitin äänekkäällä kaiuttimella, testauspöytäkirja ja kynä.

Piip-testissä testattava juoksee edestakaisin merkkikartioiden väliä, jotka on asetettu 20 metriä toisistaan. Testi alkaa ensimmäisestä piip-äänestä ja testattavan on juostava toiseen päähän merkkikartion luokse ennen kuin kuuluu seuraava piip-ääni. Piip-äänet tihenevät mitä pidemmälle testi etenee. Testin tulos merkitään toistomäärinä; yksi juoksuväli on yksi toisto.



2.9 Liikkuvuus (valakyykky)

Liikkuvuus on tärkeä ominaisuus koripallossa. Se auttaa urheilijaa toteuttamaan kentällä tarvittavat liikkeet. Hyvä liikkuvuus edesauttaa hyvän peliasennon ylläpitämisessä, voimantuotossa ja oikeiden liiketjujen hallitsemisessa. Loukkaantumisia voidaan vähentää tai kokonaan välttää kehittämällä liikkuvuutta. Testaamiseen tarvitaan puinen keppi, testauspöytäkirja ja kynä.

Valakyykyssä testattava pitää puista keppiä pään yläpuolella olkapäät täysin ojennettuina ja kyynärpäät lukittuina. Kepin ote muodostaa 90 asteen kulman, kun toinen käsi on ylhäällä toinen sivulla. Jalkojen asento tulisi olla hartioiden levyinen ja jalkaterät tulisi osoittaa joko suoraan eteenpäin tai hieman ulospäin. Testattava kyykkää mahdollisimman alas. 3 pisteen kyykyssä urheilijan lonkka on alempana kuin polven yläosa. Kantapäät tulee pysyä kiinni maassa ja torson tulee pysyä suorana koko suorituksen aikana. Suoritus arvioidaan asteikolla 0-3:

0 - Urheilija tuntee kipua suorittaessaan liikettä.

1 - Urheilija ei pysty suorittamaan liikettä tai hän kompensoi liikettä (esimerkiksi selkä pyöristyy tai kantapäät nousevat).

2 - Urheilija suorittaa liikkeen minimaalisella liikkeen kompensaatiolla.

3 - Urheilija pystyy suorittamaan liikkeen ilman mitään liikkeen kompensaatioita.

2.10 Lankkutesti

Lankkutesti on pätevä ja käytännöllinen tapa mitata urheilijan keskivartalon kestävyyttä. Tähän testiin tarvitaan tasainen alusta, sekuntikello, testauspöytäkirja ja kynä. Testin tarkoituksen on pysyä lankkuasennossa niin kauan kuin mahdollista. Lankkuasennossa ylävartalo on tuettuna lattiasta kyynärpäillä ja kyynärvarsilla. Kyynärpäiden tulisi olla pystysuoraan olkapäiden alla ja kyynärvarret ja sormet tulisi osoittaa suoraan eteen. Jalat tulisi olla suorat ja paino on varpailla. Lantio nostetaan lattiasta ja niska pidetään neutraalina ja vartalon tulee olla suorassa linjassa päästä varpaisiin. Sekuntikello käynnistetään heti kun testattava pääsee oikeaan asentoon. Testi on ohi ja sekuntikello pysäytetään heti kun testattavan selkä ei ole enää suorana ja lantio laskeutuu alas. Testin tulos on sekuntikellon näyttämä aika.

3 Testien toteuttaminen YMCA Training Centerillä

Tarkistuslista testeissä käytettävistä välineistä.

Antropometria

- Mittanauha
- Puntari
- Kynä
- Testauspöytäkirja

20m juoksu

- Sekuntikello
- Mittanauha
- Tötsät
- Kynä
- Testauspöytäkirja

T-testi

- Sekuntikello
- Mittanauha
- 4 merkkikartiota
- Kynä
- Testauspöytäkirja

Maksimaalinen voima (kyykky ja penkkipunnerrus 3RM)

Kyykky

- Kyykkyräkki
- Tanko
- Levypainot
- Kynä
- Testauspöytäkirja

Penkkipunnerrus

- Penkki
- Tankoräkki
- Tanko
- Levypainot
- Kynä
- Testauspöytäkirja

Dynaaminen voima (Vertikaalihyppy)

- Liitukynä
- Mittanauha
- Kynä
- Testauspöytäkirja

Piip-testi

- Merkkikartioita
- Mittanauha
- Tallennettu ääni cd-levylle
- Cd-soitin äänekkäällä kaiuttimella
- Kynä
- Testauspöytäkirja

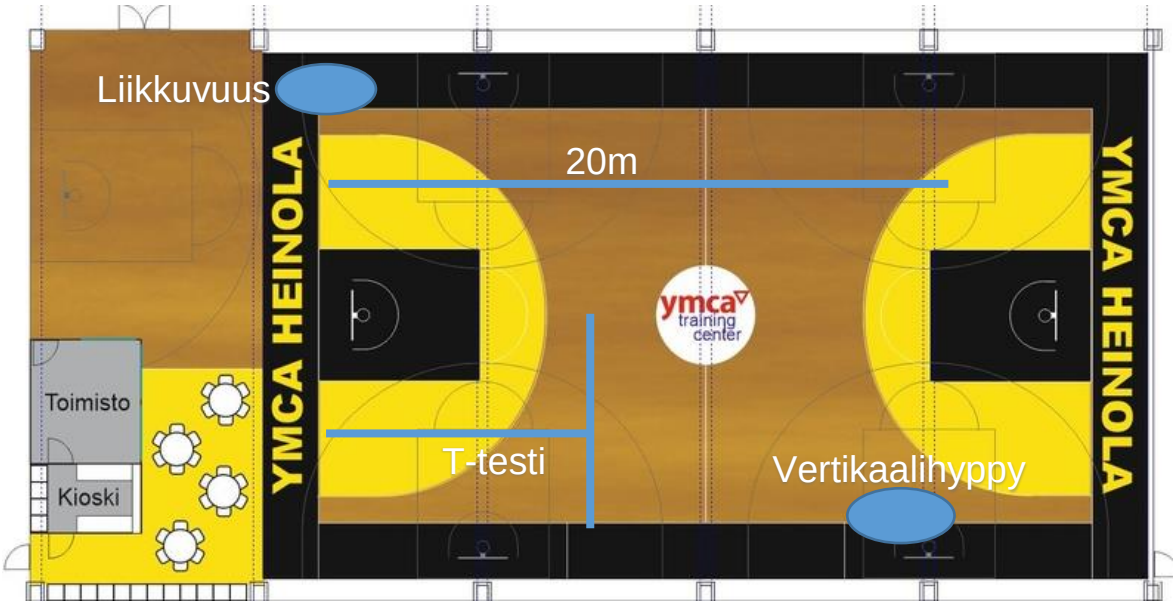
Liikkuvuus (valakyykky)

- Puinen keppi
- Kynä
- Testauspöytäkirja

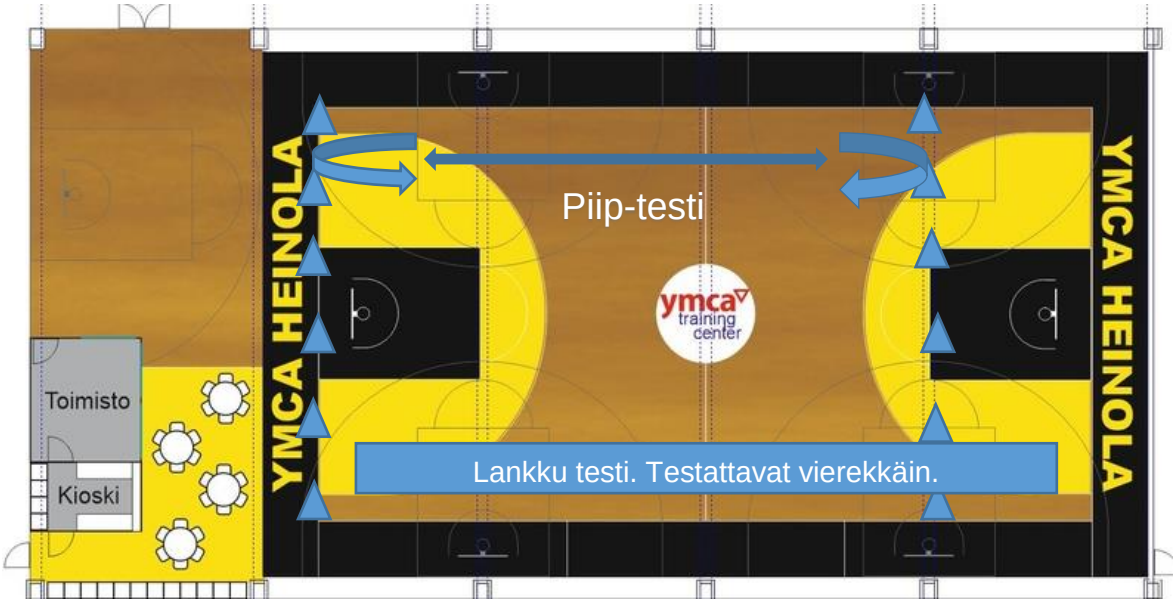
Lankku testi

- Sekuntikello
- Kynä
- Testauspöytäkirja

Alla oleva pohjapiirustus antaa alustavan kuvan, miten testipaikat on parasta asettaa saliin. Testattavien määrä ja käytössä oleva aika määrittää, kuinka monta testaajaa tarvitaan. Noin 30 nuoren testaamiseen olosuhteissa kului 2 tuntia (ei sisältänyt lämmittelyä), kun testaajia oli paikalla viisi. Voimatestit kyykky ja penkkipunnerrus ja antropometria testataan alakerrassa sijaitsevalla kuntosalilla.



Kuva1. Suuntaa antavat mittauspaikat testeihin, joissa testataan yksilöllisesti.



Kuva 2. Suuntaa antavat mittauspaikat testeille, joissa kaikki testataan samaan aikaan.

4 Tulosten kirjaaminen

Tuloksia kirjatessa on optimaalista, jos jokaisella testipaikalla on käytössä tietokone. Tällöin testaaja kirjaa tulokset suoraan koneelle. Tuloksia voi ottaa ylös myös paperille ja myöhemmin siirtää tiedot profilointityökaluun.

Ensimmäistä kertaa testatessa tulokset kirjataan valkoiselle alueelle *”aiemmat tulokset, johon verrataan”.* Pelaajalle voidaan myös asettaa arvot, johon hänen tulisi tähdätä esimerkiksi oman ikäluokan maajoukkuepelaajien tulosten keskiarvo.

Toisella mittauskerralla valkoisella alueella olevat tulokset pysyvät paikoillaan ja uudet tulokset kirjataan keltaiselle alueelle *”uusimmat tulokset”*, jolloin Excel taulukko automaattisesti tekee visuaalisen grafiikan tuloksista ja vertaa niitä keskenään. Älä koske harmaisiin alueisiin, joissa tulokset on ilmaistu prosentteina.

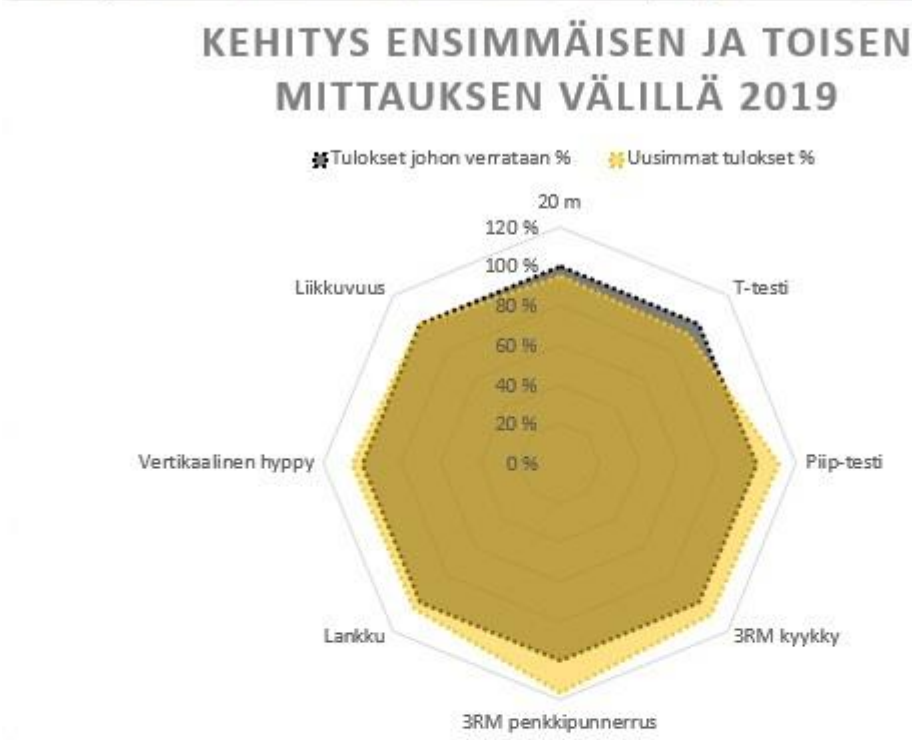
Jatkossa, kun uusia mittauksia tulee voit valita mitä tuloksia käytät vertailutuloksina. Suositeltavaa on aina verrata tietyn harjoitussyklin aikana tapahtunutta kehittymistä, jolloin valmentaja näkee tuloksista, ovatko ne osa-alueet kehittyneet, joita on pyritty viemään eteenpäin. Kauden lopussa voi olla mielenkiintoista vertailla alkukauden ja loppukauden tuloksia.

Profilointityökalun saat käyttöösi YMCA Heinolan valmentajien tietokannasta.

Pelaajan profiili

Fyysiset ominaisuudet

Pelaajan nimi	Hessu Heinola	Pelipaikka	Post-pelaaja	Syntymävuosi	2004



Vertailtavat tulokset

Testi	Tulokset johon verrataan %	Uusimmat tulokset %	Uusimmat tulokset	Aiemmat tulokset johon verrataa	Muuta
20 m	100 %	95 %	3,66	3,84	s
T-testi	100 %	93 %	4,03	4,35	s
Piip-testi	100 %	111 %	82	74,00	Merkitse toistot
3RM kyykky	100 %	108 %	70	65,00	kg
3RM penkkipunnerrus	100 %	117 %	35	30,00	kg
Lankku	100 %	104 %	3,78	3,94	min
Vertikaalinen hyppy	100 %	105 %	46	43,80	cm
Liikkuvuus	100 %	100 %	3	3,00	0-3

Kuva 3. Esimerkki tuloksia pelaajan ensimmäisen ja toisen mittauksen välillä