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Research for Correlation between: Running Speed and Medicine Ball Throws in Finnish Baseball

Thesis

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THESIS ABSTRACT

School Health and Sports	Degree Programme Sports and Leisure Management
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The topic of the thesis was to search for correlation between running speed and medicine ball throw backwards overhead from the data of results provided by Vuokatti-Ruka Urheiluakatemia from the students of year 2012. The background of the thesis was to search answer for hypothesis in the sport of Finnish baseball for the correlation between: medicine ball throw backwards overhead and running speed. The topic was given to the author by Vuokatti-Ruka urheiluakatemia and the aim of the thesis was to search answers to the hypothesis and help the day to day teaching and coaching of the teachers of Vuokatti-Ruka urheiluakatemia field of Finnish baseball.

The main research question was to find out if there is correlation between: the medicine ball throw backwards overhead and sprinting. Secondary questions were how much do students improve their results in the tests of medicine ball throw backwards overhead and sprinting during the study years. The research was executed as a quantitative research and the data contained results of physical tests of 9 female and 8 male students from first to third study year. The results were analysed by using PASW Statistics –statistics-software. The results were put into measurable form using Excel – software.

The results were that there can be found a correlation between: medicine ball throw backwards overhead and running speed results. The results for secondary questions were marked so that the results contained minimal, maximal and average change of the results.

Language of Thesis	English
Keywords	Correlation, Medicine Ball Throw, Sprinting, Baseball
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PREFACE

There is no substitute for hard work

- *Thomas edison*

CONTENTS

1 INTRODUCTION

The psychological qualities are essential part of performance structure in sprinting of track and field. Positive attitude towards competitive sports training, high training moral as well as good psychological competition qualities are prerequisites of top-level performance ability (Bauersfield 1989, 65). Same can be said about the sport and training of Finnish baseball. The sport is highly tactical and there are many things to train for example physical qualities and sport specific training. So to be able to train whole off-season and to transfer that into games the good psychological qualities are crucial.

In Finnish baseball there are not very many university level researches and the knowledge has passed on through own experiences and from person to person. And even though nowadays baseball organisations use more people from different sports, for example track and field coaches to help bringing in more knowledge, this should help smaller organisations and clubs to expand their knowledge and skill. There has been a hypothesis inside the field of Finnish baseball that medicine ball throw backwards overhead correlates with running speed. The origin of the hypothesis is unknown.

The purpose of the thesis was to investigate and analyse is there a correlation in running speed and throwing medicine ball backwards over the head. Basically analysing does running speed improve if the distance of medicine ball throws increases. As well as the correlation, the purpose was to find out how much development do three years of training in Vuokatti-Ruka Urheiluakatemia provide in test results of sprint tests and medicine ball throw backwards overhead. The thesis examines the test results of sprint and medicine ball throw backwards overhead provided by Vuokatti-Ruka Urheiluakatemia.

Like all the different kinds of jumps medicine ball throws are used to develop explosive power for lower-body and especially hip area. Medicine ball throws are good way to test explosiveness of athlete because the throws are purely explosive movements and it has been proved to be a valid and reliable test of explosive power. (Stockbrugger 2001.)

To assess maximal running speed in team sports, similar total distances are used. Typically 30- or 40- meters. Timing gate systems offer ease and accuracy of measurements when evaluating times. (Gamble 2010, 30 – 31.)

The aim of the thesis for working life was to investigate correlation between: medicine ball throw backwards overhead and running speed. As well as to provide University level study for Finnish baseball through Vuokatti-Ruka Urheiluakatemia. The analysis gave insight on does sprinting speed and medicine ball overhead throws backwards correlate. The aim for the author is to widen his understanding and knowledge in his line of studies as sports instructor.

2 FINNISH BASEBALL

Finnish baseball is Finland`s national game and the rules of the game its general foundation. Baseball referee`s manual that contains examples of applying the rules and recommendable procedures reinforces the rules of Finnish baseball. The referees consists of game-, pitch-, baseline- and rear line referees. The highest decision making power has the game referee. (Kallio, 2015, 1.)

In Finnish baseball game there are two teams who compete against each other. The match is played inside a field specified by the rules with detailed rules for the game. Each of the two teams are in outfield and infield alternately. The aim for team in infield is to hit as many runs as possible. The number of hit runs decides who wins the sequence and the number of won sequence`s decides who wins the game. (Kallio, 2015, 3.)

The player of the team in the infield is an active player when he/she is as a batter or a runner. The batter hits the ball in the home field from the pitch of the pitcher within the team that plays in the outfield. When the batter leaves the home base he/she becomes a runner. The aim of the runner is to advance through all three bases to home base without getting "injured" or out. Other infielders try to help the first runner to advance between bases. After advancing through all the bases to home base within the rules the infield team gets a run. (Kallio, 2015, 3.)

The outfielders aim is to prevent the team infield from making runs by "injuring" (catching the ball before it touches the ground) or having the infielder called "out" by throwing the ball into a base where the runner is trying to advance before the runner is in the base. (Kallio, 2015, 3.)

The teams switch from infield to outfield and other way after three players from the infielder team has been called out or the team has not been able to gather required amount of runs before running out of players (every player is able to go as a batter only once if the team does not get two runs before the starting player is again as a batter). Inning has been played after both teams have been once as infielders. A match contains two sequences, which are made

from 2-4 innings and extra inning and run batting contest if the game is tied after two sequences. (Kallio, 2015, 3.)

3 VUOKATTI-RUKA URHEILUAKATEMIA

The commissioner of the thesis is Vuokatti-Ruka Urheiluakatemia and more specifically the Finnish baseball side of the academy. The sports high-school got its official status at 1994 and the name changed to Sotkamo sports high-school. At 2010 the school took new steps of development when Vuokatti Urheiluakatemia was established. At 2010 Vuokatti Urheiluakatemia started its academy coaching also in Kajaani in the field of football, ice hockey and floorball. Vuokatti Urheiluakatemia was joined by Kainuu vocational school, High school of Kajaani, Kajaani University of Applied Sciences and brigade of Kainnuu. Ruka alp school was responsible for supporting the career of sportsman from junior to national level at Kuusamo region. The sports know-how of the two regions was united at 1.12.2013 and was named Vuokatti-Ruka Urheiluakatemia. (Vuokatti-Ruka Urheiluakatemia 2016.)

The main point of Vuokatti-Ruka Urheiluakatemia - network is to provide all-around support of young athletes training and studying. Vuokatti-Ruka Urheiluakatemia provides possibility for combining studying and sports already from upper comprehensive school to military service and university level studies. The sports Vuokatti-Ruka Urheiluakatemia provides support for are: alpine -, freestyle -, cross-country –skiing, biathlon, ski jumping and combined, football, ice hockey, volleyball, snowboarding, floorball, swimming, athletics and Finnish baseball. (Vuokatti-Ruka Urheiluakatemia 2016.)

3.1 Vuokatti-Ruka Urheiluakatemia as Commissioner

The idea of the thesis topic to investigate correlation between medicine ball throw backwards overhead and sprinting came from Vuokatti-Ruka Urheiluakatemia field of Finnish baseball. The goal for the thesis is to help the day to day coaching of Vuokatti-Ruka Urheiluakatemia Finnish baseball teachers. The task of Vuokatti-Ruka Urheiluakatemia as commissioner in this thesis process was to provide recorded data for the author.

4 WHAT IS SPEED

Old general definition of speed: "speed is power that is controlled by skill" (Hämäläinen 2015, 241).Speed is a physical quality that is one of the hardest to develop and its heritance has been thought of being strong because of inherited levels cells and nerves (Hämäläinen 2015, 236). From physical point of view speed is many times divided into different subspecies (Hämäläinen 2015, 238). The factors that have influence in speed are: sports specific techniques/skills, common skills, strength, inheritance, relaxedness and training (Mero 2016, 245).

For long time there has existed thought about the training not having effect on the development of speed. When the components of speed and development are being examined more specifically, one is able to see that speed is a quality that can be developed even though it is challenging. (Hämäläinen 2015, 236; Mero 2004, 296.)

Speed is one of the hardest physical qualities to develop and this is why it is such a challenge in for coaching. In ball sports the absolute propagation velocity is reached only at times. Still the players in ball sports benefit from high level of speed because it is difficult to develop good sport specific speed from poor level of basic speed. (Hämäläinen 2015, 236.)

Speed appears in different ways in different sports. For example in sprinting and speed skating the maximal propagation velocity is measured but quite different factors have effect in the speed. The time to produce power is noticeable shorter in sprinting and this is why the training should be partly different in the two sports. (Hämäläinen 2015, 236) As a speed drill the sportsmen mostly use the sports specific performance from their main sport but when training for basic speed other drills can be used. For example playing football is a basic speed drill for skier. (Mero 2004, 296.)

5 FINNISH BASEBALL RUNNER SKILLS AND PHYSIOLOGICAL DEMANDS

According to mister Jukka Peltoniemi the largest problems of a Finnish baseball coach is to create training programs and drills that correlate with the development level of focus group and its individuals. It is highly important to know the sport specific demands and aim to emphasize the training in fields of skill, tactics and physical conditioning. In a book named "Lasten ja nuorten harjoittelu" mister Peltoniemi has made a sports analysis on Finnish baseball and it can be shown as following: skill 40%, tactics/eye for the game 30%, speed 10%, strength 10% and endurance 5%.(Mero 1990, 380 – 381.)

The basic sports specific skills needed in Finnish baseball are: batting, throwing, catching, advancing (running between bases), sliding and pitching. Basic physical qualities needed in Finnish baseball are speed, endurance and strength. (Mero 1990, 381). In Finnish baseball the aim of training basic physical qualities and their subspecies is to transfer the development into sports specific skills which results as higher efficiency in sports specific skills and eventually leads into better results. For top level performance it is important for a player to have control of one`s muscles in fine motoric level and the high know-how of the sports specific skills. (Kuosmanen 2016.) Particles that have influence on manifestation of sports specific speed besides the subspecies of speed are the structure, proportion, composition as well as psychological factors (Hämäläinen 2015, 239)

The speed of Finnish baseball player is mostly so called speed skill which means reacting correctly and fast to different stimuluses. The need for speed is at highest when advancing between bases but good reaction and acceleration abilities can be exploited also as outfielder. Good reaction and acceleration skills are needed in both outfield to be able to move, catch, throw and react to the ball and in infield to bat hard and be able to advance between bases. As well as good physical condition and speed, for advancing between bases the players need eye for the game to get a good start from bases and perform correct dive. (Mero 1990, 381.)

Strength needed in Finnish baseball is mainly speed-strength and explosive power. The levels of maximal strength have effect partly on the two previous but large levels of maximal strength are needed mostly in the adductors and abductors of feet and body. In Finnish baseball

strength training one should remember that the aim is to develop speed qualities and building foundation for effective speed training. (Mero 1990, 381.)

The main purpose of endurance training in Finnish baseball is to develop durability for training and the ability to recover in training and game situations as fast as possible. Efficient movement as outfielder sets demands for aerobic endurance. More important form of endurance in Finnish baseball especially when advancing between bases is anaerobic endurance. The speed endurance needed in Finnish baseball is mainly without lactic acid which should be taken into account when sprinting. (Mero 1990, 382.)

5.1 Training for Speed

Speed depends very highly from the ability to function of the nervous system, the contraction ability of muscle cells and energy – metabolism. The muscles must be able to produce energy anaerobically especially from immediate sources of energy. There are many particles that have effect on speed qualities and especially on sport specific speed that can be developed through training. (Hämäläinen 2015, 238, 239.)

In article "Relationship between strength qualities and sprinting performance" made by Warren Young, Brian McLean and James Ardagna the idea was to investigate if the strength measures have influence on sprinting performance and how the relationships varied in different phases of sprinting. The study revealed that in different sports played in field or court the sprinting distances are too short to reach the maximum speed so the concentration should be on developing starting and acceleration. The results of the study was that strength qualities were related to sprinting but the relation differed for starting and maximum speed sprinting. (Young 1995, 1.) Speed in Finnish baseball is mainly speed skill and the demand for speed is at highest when advancing between bases. Maximal speed should be developed as well but the training should be done as close to sports specific training as possible to answer the needs of the sport. Finnish baseball is an interval sport without lactic acids. The performances last less than 5 seconds and strain mostly instant supplies of energy. (Kuosmanen 2016; Mero 1990, 381.)

When sprinting short distances speed is the most important quality because when talking about top results, one needs to reach the maximal level of all the elements of speed. These elements are reaction speed, rate of movement and movement speed and in sprinting these elements are interacting with other particles such as power and coordination which become apparent especially in acceleration and maximal speed. (Bauersfeld & Schröter 1988, 66.)

The development of speed depends mainly from inherited trainability potential and environment for example from physical activity in childhood. From researches made from the running speed of school aged children who exercise normally (physical activity in free time), the development of speed is steady regardless of the gender before puberty. During puberty the development of boys running speed accelerates for few years whereas the girls do not seem to have the same kind of phase. (Hämäläinen 2015, 236.) The training for speed should start at as young age as possible because it is more effective to have influence on the neuromuscular system in the childhood. The speed features are strongly inherited but versatile physical activity during the childhood allows maximising the inherited potential. (Hämäläinen 2015, 252.)

When sprinting short distances speed is the most important quality because when talking about top results, one needs to reach the maximal level of all the elements of speed. These elements are reaction speed, rate of movement and movement speed and in sprinting these elements are interacting with other particles such as power and coordination which become apparent especially in acceleration and maximal speed. (Bauersfeld & Schröter 1988, 66.)

Good strength and power qualities are very important for sprinting because they create the requirements for powerful acceleration especially in the first meters. Essential qualities of strength in sprinting are speed-strength (explosive power), maximal strength and basic strength. Maximal- and basic strength are fundamental elements for speed-strength and in sprinting every single step requires certain amount of speed-strength. (Bauersfeld & Schröter 1988, 66.) To develop speed all its subspecies as well as physical qualities should be trained progressively and with as sports specific training as possible to get the best possible development and assure the transmission to performance (Hämäläinen 2015, 236; Gamble 2010, 100).

The speed training should be done on so called principles so the effects would be clearly developing speed. The principles include seven points:

1. The speed of the performance: when practicing maximal speed the speed of performance is mainly at 96 – 100 % of the capability and in submaximal 85 – 95 %. In supramaximal performances the aim is to use 101 – 103 % of the capability.

2. Duration of the performance: the duration of the performance is 1 – 6 seconds so the body uses immediate sources of energy.

3. Recovery: the recovery between repetitions is usually 2 – 9 minutes (depending on the level of speed) and between sets 6 – 12 minutes (depending on the level of speed) so that the immediate sources of energy recover.

4. Amount: the amount of repetitions in a single exercise for speed is 5 – 10 (maximal and supramaximal area) or 10 – 20 if the level of performance is at 85 – 95 %.

5. State of recovery: speed exercises have to be done in recovered state so that speed would develop. In other cases speed is maintained or speed – endurance is developed.

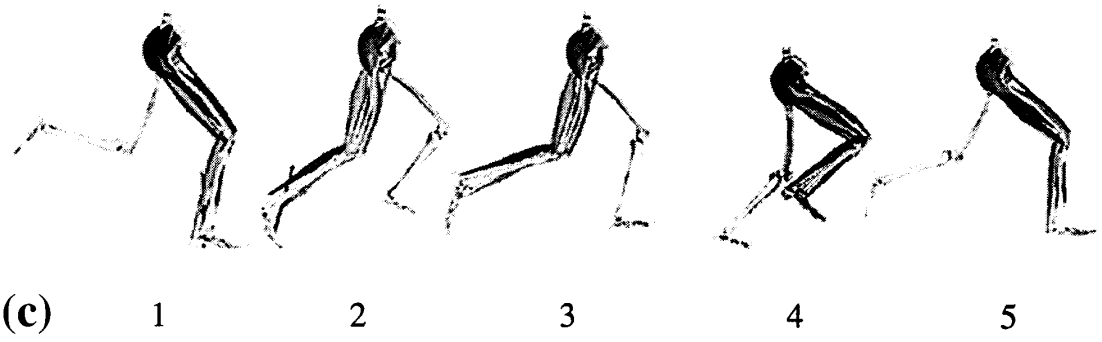
6. Use of willpower: speed exercises demand strong use of willpower because the performance is maximal. The effects of training are aimed at fast motoric units. The challenge is to combine maximal effort and relaxed function of muscles.

7. Variation of stimulus: there has to be variation inside speed exercise and it can be varied by changing the speed, duration, stride length or frequency. (Mero 2016, 245, 246.)

5.2 Sprinting Technique and Gait Cycle

The most important feature for sprinting is maximizing the technical elements (Bauersfeld & Schröter 1988, 73). There are two main phases in gait cycle (stride), stance- and swing phase, these phases can be divided into series of functions. Stance-phase can be divided into: stance phase absorption and stance phase generation (parts 1 and 2 in the picture 1.) and swing phase can be divided into: swing phase generation, -reversal and –absorption (parts 3, 4 and 5 in the picture 1.). Stance phase is finished when the foot is not in contact with the ground anymore and the swing phase of the gait cycle starts. When the running speed increases the time spent in stance phase decreases as the time of swing phase increases. (Novacheck 1998, 79.)

Gait cycle starts when foot makes contact with the ground and ends when the same foot makes contact to the ground again. This contact phase is also referred as initial contact. Sprinting differs from running and walking in multiple things: it is done on forefoot, during the gait cycle there are no periods when both feet are contacting ground same time, during sprinting: body and its parts are being moved as fast as possible during the entire time, the biggest difference of running and sprinting is in the goal to be achieved (running longer distances, sprinting is faster and for shorter distance). (Novacheck 1998, 79.)



Picture 1 Gait Cycle (Novacheck 1998, 79)

5.3 Use of Medicine Ball in Speed Training

Training for speed is done through speed principle. When trained with the principle the effects of training concentrate powerfully on the fast motoric units of neuromuscular system (Mero 2016, 249.) Running, jumping and throwing are basic skills of moving that require explosive power production from neuromuscular system. When trying to maximise the movement speed of those skills, the starting speed of body / equipment or the capacity of power production the decisive factor is how much power can be produced in a short time. This particular ability is called speed strength which can be defined as ability to produce as large submaximal level of force in a short time. The training of speed strength develops primary the speed of power production as well as increasing the maximal power production by recruiting as many fast motor units as possible. (Mero 2016, 265, 270.)

Finnish baseball is a game where players use basic skills such as batting, throwing, catching and base running (Mero 1990, 381). In many sports there are fast changes of direction and kicks / hits where the level of speed strength defines the efficiency of the movement (Mero 2016, 265). One of the principles of training for speed strength is the sports specificity (Mero 2016, 269). In a study "Effect of twelve weeks of medicine ball training on high school baseball players" the researchers divided forty-nine high school baseball players into two groups randomly. The groups performed the same resistance training for 12 weeks with an exception of group 2 performing additional rotational and full-body medicine ball exercises 3 days per week. The groups were tested at the beginning without training and after 4, 8 and 12 weeks of training. The tests used in the study were parallel squat, bench press, medicine ball hitter`s throw and dominant and non - dominant torso rotational strength – tests. The results of the test were that both groups made statistically significant increase in dominant and non – dominant rotational strength tests and in medicine ball hitter`s throw, the group 2 made significantly greater increase in these tests which indicates that with medicine ball training program greater sport-specific training improvements are provided. Both groups made significant increases in parallel squat and bench press tests but no difference was found between the groups. (Szymanski 2007, 894.)

6 NEUROMUSCULAR SYSTEM

Neuromuscular system consists of nervous system and the muscles itself. Generally muscles can be reckoned as tissue which function is mostly dependent of the orders of nervous system. The development of the muscles is mainly dependent of the maturation of nervous system. (Hämäläinen 2015, 69)

The training can develop the qualities of speed but heritance has effect on the power production of fast motoric units (fast twitching muscle cells) and in the end defines how much the speed can develop (Mero 2016, 245). There are over 660 skeletal muscles inside human body that participate in production of power during movement and motions. Skeletal muscles are covered by different kinds of connective tissues which are connected to bone along with a ligament. This particular structure makes it possible for chemical energy to transform into motion energy in a lever system. (Mero 2004, 51 – 52.) For running and moving in the game of Finnish baseball the most important muscles are glutes, quadriceps, hamstrings and calves (Kuosmanen 2016).

6.1 Nervous System

Human nervous system contains two large areas: central- and peripheral nervous system. Central nervous system includes brains and spinal cord and peripheral nervous system the spinal nerves and the nerves of autonomic nervous system which is divided into two parts: sympathetic and parasympathetic nervous system. (Mero 2004, 37.)

Human nervous system forms crucial "mechanism" for generating power and movement in co-operation with muscles, tendons, connective tissue and bones. The task of nervous system in this co-operation is to maintain balance of the organism, send and receive commands of action to the peripheral parts of the body and inner organs and back. (Mero 2004, 37.)

Central nervous system is the part of human nervous system which sends the commands and information towards the muscles. The commands are taken to muscles either through motoric

nerves or through autonomic. Motoric nerves start from the front root of spinal cord and their axons are transferring the information towards the muscles. The task of spinal cord in central nervous system is to transfer nerve impulses and information through nervous systems and the most of the voluntary muscles are innervated through spinal cord. The peripheral nervous system brings messages for central nervous system to process from the receptors of peripheral nervous system through tactile nerves. (Mero 2004, 37; Mero 2016, 89.)

6.2 Muscles And Functions

There are three different types of muscle tissue: skeletal, smooth and cardiac. They differ from each other by the structure of cells, location, function, and why they contract. All the muscles are formed from muscle cells that are called muscle fibres and the contraction depends on myofilaments. (Marieb 1998, 261.)

Inside every muscle there are muscle cells, connective tissue, blood vessels and nerves. The cells of skeletal muscles are big cells that are formed during embryo-stage as many small cells are merged into one. Because of this there are numerous nucleuses lined up beneath the cell membrane. Muscle cell is also referred as muscle fibers and like nerve cells the relapse is limited after birth. The growing of skeletal muscles is based on growth of a single fiber. (Bjålie 2005, 189 – 190.)

Every muscle fiber is surrounded with thin membrane. The fibers form bundles that are surrounded with a bit thicker membrane. Multiple bundles form a muscle that is surrounded by fascia. In the points of muscle all of the collagen filaments of these membranes are united straight to tendons. This way every single muscle fiber is united with tendon and the contraction power of even a single muscle fiber stretches the tendon in some amount. All the blood vessels and nerves of muscles are located in connective tissue. The rapid energy-metabolism of a working muscle demands powerful circulation and there is capillary network for every muscle fiber. (Bjålie 2005, 189 – 190.)

6.3 Power Production

In sports coaching it is important to understand the factors that have effect on power production in muscles. Skeletal muscles are in control of nervous system which means that naturally the nervous system have significant role in production of power. As well as nervous system the muscle mechanics have large influence on the power production of skeletal muscles. (Mero 2016, 93.)

Muscle actions are divided into isometric (no movement) and dynamic (movement) by the change of length of the muscle. The latter is divided still into eccentric (muscle lengthens) and concentric (muscle shortens) functions. A muscle produces maximal power during eccentric phase, second largest in isometric and smallest amount of power in concentric action. The performances in sports are most of the time combinations of dynamic and isometric muscle functions. (Mero 2004, 53 – 54.)

Motoric unit is the basic unit in production of power and like stated earlier fast motoric unit produces power faster than slow motoric unit. Because of differences in types of unit and estate of training there are also measurable individual power-time –qualities in different muscle groups. These measurements have been made with power dynamometer during isometric muscle actions. Results of these tests have proven that fast motoric units produce power faster than slow motoric units, although it is hard to define the part that is inherited and the part that is earned through training. For example when training for speed the aim is to develop the production of power to produce lot of power in a short amount of time which means that neuromuscular system is adjusted to recruit as many fast motor units as possible and increase the ignitability. (Mero 2004, 54 – 55.)

7 RESEARCH TASKS

The purpose of the thesis was to investigate and analyse is there a correlation in running speed and throwing medicine ball backwards over the head. Basically analysing does running speed improve if the distance of medicine ball throws increases. As well as the correlation, the purpose was to find out how much do test results of sprint tests and medicine ball throw backwards overhead improve during the study years. The research was based on a hypothesis in Finnish baseball that claims that there is a correlation between medicine ball throw backwards overhead and sprinting. The origin of this thesis was unclear to the author. The analysement was done using PASW Statistic –statistic software.

The aim of the thesis for working life was to investigate correlation between: medicine ball throw backwards overhead and running speed. As well as to provide University level study for Finnish baseball through Vuokatti-Ruka Urheiluakatemia and help the day to day work of the teachers of Vuokatti-Ruka Urheiluakatemia. The investigation gave insight on does sprinting speed and medicine ball overhead throws backwards correlate. The aim for the author was to widen his understanding and knowledge in his line of studies as sports instructor.

The research questions were:

1. Does medicine ball throw backwards correlate with sprinting?

2. How much does test result in medicine ball throw backwards overhead improve during three years in Vuokatti-Ruka Urheiluakatemia for average, best and worst?

3. How much does running speed improve during three years in Vuokatti-Ruka Urheiluakatemia for average, best and worst?

8 RESEARCH METHODS

The teachers of Vuokatti-Ruka Urheiluakatemia provided the research data of the 2012 year students. The data is from both male and female students and it included training focuses and test results of three academic years. The data is analysed using PASW Statistics –statistic software.

8.1 PASW Statistics –statistic software.

PASW Statistics –statistic software is a software that provides different statistical methods and possibilities to analyse data. The software is widely used in researches made in universities and universities of applied sciences. (Holopainen 2004, 5, 13.)

8.2 Quantitative Research

Quantitative study is a form of study that is widely used in social science. Its roots are in natural sciences and many methods are similar in these field of sciences. In its background there is so called realistic ontology and according to it reality is built from objectively from discovered facts. (Hirsijärvi 2007, 135 – 136.)

Essential issues for quantitative study are: conclusions from earlier studies, former theories, presenting hypothesis, definition of concepts, planning collection of data in which is important that the data fits into quantitative, numerical measuring, choosing test subjects, forming a chart and bringing data into statistically on the hand and drawing conclusions based on statistical analysis. Basic research process in quantitative study starts at research problem, then a model is made, hypothesis`s, implementation, results and then theory. (Hirsijärvi 2007, 136, 141.)

8.3 Implementation of Research

The material existed and was gathered by Vuokatti-Ruka Urheiluakatemia teachers. All the material was sent to the author in two separate Excel – files. The author asked help from teacher Simo Määttä to be able process the material into a form that could be transferred into PASW Statistics –statistic software.and calculate correlation with it. The two separate Excel – files were made into one and processed so that correlation between: medicine ball throw backwards and sprinting could be calculated with the PASW Statistics –statistic software.

8.4 Focus Group

The focus group for the investigation consists of 8 male and 9 female students of the year 2012 of Vuokatti-Ruka Urheiluakatemia. The problem of the focus group is the fact that they are all individuals so the test results and development will not follow the same pattern with every student. The focus group was selected because the data needed already exists and had been gathered by the teachers of Vuokatti-Ruka Urheiluakatemia in equal circumstances which makes the results more reliable. The group also provides enough variables for one to draw conclusions about correlation.

During a school year in Vuokatti-Ruka Urheiluakatemia they are testing the students three times. First in October, second in January and third in April. The tests are organized in Vuokatti-Ruka Urheiluakatemia the way they are so that the students have had month or two between the tests to train with the training plans the teachers have planned and to see that the students are progressing physically towards the season.

Physiological main abilities for sprinting are speed, endurance and power. Speed development is at the peak of the performance and before getting there it is important to build a solid base. Building strong, powerful, quick body one has to start from the basics: first step is to build flexibility/stability and hypertrophy, second is to increase maximal strength (relative or absolute), third step is developing power and fourth is speed. (Brandon 2010, 23.)

The students in focus group are 15 to 18 years old which means that the training is already very much of the same type as the training during adulthood. The training quantity and performance level increase yearly towards the number of adults. The largest differences between 16 to 18 year olds and adults are the shortage of experience (tough games) and in physical performance, mostly in speed and strength. (Mero 1990, 384.)

8.5 Speed Test

To assess maximal running speed in team sports, similar total distances are used. Typically 30- or 40- meters. Timing gate systems offer ease and accuracy of measurements when evaluating times. (Gamble 2010, 30 – 31.)

The running speed test were done in Vuokattihalli. The tests were done so that they had measured 30 meter distance and there were timing gates in the beginning and in the end. These gates measured the time the students ran. The acceleration had to start at rest and the students ran through the gates so that the time was recorded.

8.6 Medicine ball throw backwards overhead

Like all the different kinds of jumps medicine ball throws are used to develop explosive power for lower-body and especially hip area. Medicine ball throws are good way to test explosiveness of athlete because the throws are purely explosive movements and it has been proved to be a valid and reliable test of explosive power. (Stockbrugger 2001.)

The medicine ball throw tests were done in Vuokattihalli. The tests were done by marking a starting point for the throw which the students couldn't cross and measuring the distance between starting point and the point where the ball lands. The medicine ball used in backwards overhead throw weighted 2 kilograms.

8.7 Other Tests

In sports coaching the shape of neuromuscular system is tested by doing performances that need power with different sized loads. With this method the coaches are able to gather valuable information about the strength and speed qualities of an athlete. (Mero 2004, 55 – 56.)

Other tests used by Vuokatti-Ruka Urheiluakatemia to measure and evaluate development in physical condition of the students were Cooper-test, medicine ball throw forwards overhead, squat-test, clean, bench press, abdominal, jumping forwards with both feet 5 times and jumping forwards 5 times switching feet, pull-ups and mobility tests for shoulders, hamstrings, thigh adductors and bridge. These tests were listed to show how diverse tests are used to measure the physical condition of the Finnish baseball players and how diverse the training is in the sport of Finnish baseball because if the students would not train these physical aspects then they would not be tested.

8.8 Reliability & Validity of Results

Reliability of a study means repeatability of the research which means the ability to give non-random results. Reliability can be noted in multiple ways. For example if the same person is studied in different researches and get similar results the results can be stated as reliable. Qualitative studies have developed different statistic methods that can be used to evaluate the reliability of the indicators. (Hirsijärvi 2007, 213.)

Another concept that is connected to the evaluation of the research is validity. Validity means ability of the indicator or research method to measure exactly what it is meant to study. In both qualitative and quantitative study one is able to use multiple methods to specify the validity of the research. Triangulation means joint using research methods. For example researcher-triangulation means that multiple researchers participate in gathering the data and especially in analysing and interpretation. (Hirsijärvi 2007, 213, 215.)

The reliability and the validity of the tests used in the research is good because all of the tests were done in Vuokattihalli so the environment and circumstances were similar every time.

The measurement devices and methods were similar during the tests and the tests were observed by competent teachers.

9 RESULTS

The author decided to take test results of maximum strength test of clean into the calculations to be able to do a correlation matrix from the results of correlation calculations. The author decided to take the clean test results because there was most of the data, the muscles used are mainly same as in running and medicine ball throw backwards overhead and it was proven in the study of mister Young that strength qualities and sprinting performance are related. The author decided to remove the test results of person number 1 when calculating the correlation and values for mean, maximal and minimal changes in clean, sprinting and medicine ball throw backwards overhead tests. This decision was based on the fact that person number 1 had only 3 test results for sprinting test which distorted the results when calculating correlation and mean, maximal and minimal values of the sprinting test.

The test results of the female students were modified so that there are only test results from October, January and April. Before the modification there were also test results from November. Reasons to leave the results of November out of the picture were the fewness of the students who had tested them as well as the similarity in number of tests with male and female students.

9.1 Sprint Test Results

Person	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sex	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M
Sprint y1 1/3	4,92	4,51	4,81	4,92	4,78	4,72	4,59	4,57				3,94	3,81	4,26	4,31	4,46	4,42
Sprint y1 2/3	4,78	4,37	4,72	4,78	4,64	4,66	4,57	4,56	4,69	4,21		3,91	3,72	4,16	4,22	4,41	
Sprint y1 3/3	4,69	4,36	4,70	4,68	4,63	4,59	4,57	4,58		4,10	4,31	3,99	3,74	4,07	4,12	4,45	4,09
Sprint y2 1/3		4,49	4,93	4,84	4,78	4,64	4,69	4,75		4,19	4,30	3,93		4,11	4,03	4,37	4,21
Sprint y2 2/3		4,32		4,68		4,58	4,51	4,56	4,80		4,25	3,90	3,76	4,04	4,01	4,35	4,06
Sprint y2 3/3		4,27	4,70	4,56		4,55	4,43	4,52		4,20	4,24	3,91		4,03	4,01	4,35	4,06
Sprint y3 1/3		4,50	4,80	4,63	4,71	4,70		4,79	4,84	4,22	4,18	3,86	3,80		4,06	4,24	3,96
Sprint y3 2/3		4,38	4,86	4,48	4,70	4,54	4,47	4,64	4,69	4,12	4,08	3,84	3,71	4,06	3,98	4,21	3,95
Sprint y3 3/3				4,58	4,62									4,02		4,21	3,92

Picture 2. Combined sprinting test results of class 2012. (Vuokatti-Ruka Urheiluakatemia, 2016)

In picture 2 are the results of class 2012 sprinting test sent to author by Vuokatti-Ruka Urheiluakatemia. The data was modified to this form by the author to be able to calculate results and see the change with PASW Statistics –statistic software as well as protect the anonymity of the students. The students are marked as numbers in the top of the picture and their gender is marked below the number so that the author knew whose data the author sees. On the left after person and their gender are the tests in order from the first tests of first year to third test of third year. The test results are marked as seconds and hundredths.

Statistics

Sprintchange

N	Valid	16
	Missing	1
Mean		-,14100
Minimum		-,448
Maximum		,120

Picture 3. Change in sprinting

Picture number 3 states the change in medicine ball throw backwards overhead throughout the overall of nine tests. The picture shows the mean of change in sprint tests as well as the minimal and maximal change in the results. The results were calculated from 16 participants and PASW Statistics –statistic software calculated both negative and positive change from the results. In this picture the maximum and minimum values should be read so that the largest change in sprinting time is -.448 seconds and the smallest change is +,120 seconds.

9.2 Medicine Ball Throw Backwards Overhead Test Results

Per-son	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sex	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M
Pyty1 1/3	10,30	13,90		14,60	13,90	11,80	13,00	11,80	11,90	18,20		20,70	21,30	22,05	17,60	17,80	16,80
Pyty1 2/3	10,40	14,40	13,80	14,60	14,15	11,20	14,00	11,80	12,00	20,35		20,55	21,55	19,50	17,90	17,90	
Pyty1 3/3	11,10	14,20	13,10	16,50	14,15	12,30	15,00	11,55		19,65	20,30	21,65	21,65	21,15	19,65	19,40	19,50
Pyty2 1/3	11,40	13,40	14,00	14,80		12,60	15,00	12,75	11,50	19,30	19,90			21,30	19,80	18,90	20,50
Pyty2 2/3	11,60	14,60		15,90		11,80	14,50	12,00	12,60	19,70	20,30	20,70	22,45	20,70	18,70	17,40	21,20
Pyty2 3/3	12,20	15,40	14,85	16,50		12,95	16,40	12,55									
Pyty3 1/3	12,70	14,90	14,05	16,60	14,10	13,75		12,25	13,30	20,60	23,00	21,40		21,50	21,60	22,10	24,00
Pyty3 2/3	13,20	15,30	13,00	16,95	14,55	13,20	14,80	13,20	13,30	21,80	23,90	21,40	22,10	21,10	21,90	22,00	24,40
Pyty3 3/3	12,70			15,40	13,40									23,80		21,40	

Picture 4. Combined medicine ball throw backwards overhead test results of class 2012. (Vuokatti-Ruka Urheiluakatemia, 2016)

Picture 4 shows the results of tests of medicine ball throw backwards overhead. The file has been modified by the author to same form as the sprint test results. In the first row there are the persons marked with same number as in sprint test results. The second row shows the gender of the student and the rest of the rows show the test results in meters and centimetres from first test of the first year to third test of the third year.

Statistics

Medballchange

N	Valid	16
	Missing	1
Mean		2,61900
Minimum		-,128
Maximum		8,792

Picture 5. Medballchange

Picture number 5 states the change in medicine ball throw backwards overhead throughout the overall of nine tests. The picture shows the mean of change in medicine ball throw backwards overhead as well as the minimal and maximal change in the results. The results were calculated from 16 participants and PASW Statistics –statistic software calculated both negative and positive change from the results.

9.3 Clean Test Results

Person	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sex	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M
Clean y1 1/3	28	45	40	50	55		45	40	40	65		68	75	68	63	65	60
Clean y1 2/3	38	53	53	60		33		45	50								
Clean y1 3/3	43	53	55	60	65	38		50		75		80	80	80	80	70	80
Clean y2 1/3	38	40	58	60		35		50	45	80	80			80	85		95
Clean y2 2/3	40		58	55		40		50	53		90	80	85		90	85	110
Clean y2 3/3	40	50		55		45		50	58	85	100		90	95	90	85	100
Clean y3 1/3	45	50	55	55	60	48		45	55	85	100	100		95	95	95	115
Clean y3 2/3	46		55	63	60			48	68	90	110	95	95	100		100	120
Clean y3 3/3	45			55	60												

Picture 6. Clean Test Results

Picture 6 shows the results of tests of clean. The file has been modified by the author to same form as the previous. In the first row there are the persons marked with same number as in sprint and medicine ball throw test results. The second row shows the gender of the student and the rest of the rows show the test results kilograms from first test of the first year to third test of the third year.

Statistics

CleanChange

N	Valid	16
	Missing	1
Mean		25,57750
Minimum		1,664
Maximum		67,048

Picture 7. CleanChange

Picture 7 shows the average, minimum and maximum change calculated from the results of calculating first the coefficients for regression line and calculating the change from the coefficients by using the PASW Statistics –statistic software frequencies calculator.

Per-son	Med.ball Coef-ficient	Med. Ball Change	Clean Coef-ficient	Clean Change	30m Sprint Coeffi-cient	30m Sprint Change
1	0,367	2,936	1,692	13,536	-0,115	-0,92
2	0,204	1,632	0,217	1,736	-0,008	-0,064
3	0,012	0,096	1,422	11,376	0,007	0,056
4	0,203	1,624	0,208	1,664	-0,044	-0,352
5	-0,016	-0,128	0,212	1,696	-0,007	-0,056
6	0,282	2,256	2,929	23,432	-0,015	-0,12
7	0,282	2,256	-	-	-0,022	-0,176
8	0,170	1,360	0,667	5,336	0,015	0,120
9	0,232	1,856	3,043	24,344	0,008	0,064
10	0,352	2,816	3,301	26,408	-0,001	-0,008
11	0,828	6,624	7,000	56	-0,043	-0,344
12	0,089	0,712	4,253	34,024	-0,015	-0,120
13	0,130	1,040	2,911	23,288	-0,003	-0,024
14	0,214	1,712	4,629	37,032	-0,023	-0,184
15	0,600	4,800	5,143	41,144	-0,041	-0,328
16	0,557	4,456	5,147	41,176	-0,034	-0,272
17	1,099	8,792	8,381	67,048	-0,056	-0,448

Picture 8. Coefficients and Changes

Picture 8 shows the results of coefficient calculations for regression line and the calculations of changes calculated with PASW Statistics –statistic software.

9.4 Correlation Results

Correlations

		Med-balC	CleanC	SprintC
MedbalC	Pearson Correlation	1	,844	-,749
	Sig. (2-tailed)		,000	,001
	N	16	15	16
CleanC	Pearson Correlation	,844	1	-,641
	Sig. (2-tailed)	,000		,010
	N	15	15	15
SprintC	Pearson Correlation	-,749	-,641	1
	Sig. (2-tailed)	,001	,010	
	N	16	15	16

**. Correlation is significant at the 0.01 level (2-tailed).

Picture 9. Correlation

In picture 9 are the results of correlation calculations with the PASW Statistics –statistic software. The calculations were done as 2-tailed because it was not justified to presume the direction of correlation. (Kajaanin Ammattikorkeakoulun www – webpage.)

	30m sprint	Medicine ball throw backwards overhead	Clean Lift
30m sprint	1	-0,749	-0,641
Medicine ball throw backwards overhead	-0,749	1	0,844
Clean Lift	-0,641	0,844	1

Table 1. Correlation Matrix

Table 1 shows a correlation matrix of the variables. It shows the correlation factors of every variable.

10 DISCUSSION

The main research problem of the thesis was to investigate is there correlation between medicine ball throw backwards overhead and sprinting. So hypothesises were made: H0 = There is no correlation between medicine ball throw backwards overhead and sprinting, and H1= There is a correlation between medicine ball throw backwards overhead and sprinting. The author modified the test results of sprinting and medicine ball throw backwards overhead from two separate Excel – files into one which he then put into PASW Statistics –statistic software for calculations and took third variable (clean).

Calculations were made by first using the regression line to calculate the coefficients to be able to calculate the changes by multiplying the coefficient with number 8 from the results. The multiplying number was chosen to be 8 because the first number was the coefficient itself and there were 9 tests organized so 9-1=8. The regression line was used to leave out the result of bad day and the missing results to predict the starting and ending values for everyone in the focus group. The coefficient informs how much the value of y changes when the value of x changes one unit.

The linear correlation of the changes in the results was calculated by the author using PASW Statistics –statistic software. After calculating the changes in the tests the author put the information of the changes into PASW Statistics –statistic software.

The author used the Pearson correlation to calculate linear correlation between the changes in medicine ball throws, cleans and changes in sprinting. The correlation factor gets values between -1 and +1 and the factor has to differ significantly from the value of 0 when can be said that there is linear correlation between the variables (Heikkilä 1998, 206). The correlation factors got from Pearson correlation calculation suggest that there is a negative correlation between the results of sprinting and medicine ball throw (-0,749) as well as sprinting and clean (-0,641).

The values of correlation factor itself does not tell is there a linear correlation. The way to test it is to check the value of sig. (between sprinting and med. ball throw 0,001, sprinting and clean 0,01, med. ball throw and clean 0,00 and sprinting and clean 0,01), the PASW Statistics

–statistic software informs when the correlation is significant [**. Correlation is significant at the 0.01 level (2-tailed).] and the values of sig. have to be less than the sig. level the PASW Statistics –statistic software informs. (Heikkilä 1998, 206.)

Because the Pearson correlation calculation of medicine ball throw and sprinting speed got values of -0,749 for correlation and 0,001 for the level of sig. and the PASW Statistics –statistic software informed that the correlation is significant at the 0,01 level it means that there is a significant negative correlation between the medicine ball throw backwards overhead and sprinting which shows that the hypothesis H1 was correct there is a correlation between the two variables. As well as sprinting and medicine ball throws the other levels of sig. are under the level of 0,01 which shows that there is significant correlation.

The reason for medicine ball throw backwards overhead effecting running speed is that the throws are good way to increase explosive power. This means that using medicine ball throws as exercise for speed – strength teaches the neuromuscular system to recruit more fast twitching motor units and increase the speed that they produce power. When sprinting every time foot contacts the ground it generates force and with increase of speed – strength the neuromuscular system is able to produce more force to the ground. Other technical factors of running and phases of gait cycle benefit from increased ability to function of neuromuscular system.

The secondary research questions were how much do the results in 30m sprint and medicine ball throw backwards overhead change in average, minimal and maximal during the 3 years in Vuokatti-Ruka Urheiluakatemia. The average change in medicine ball throw: is 2,6 meters, minimum -0,128 meters and maximum of 8,79 meters and in 30m sprint: average -0,14 seconds, maximum -0,448 seconds and minimum +0,120 seconds.

The differences in results between genders and years can be seen in pictures 2, 4 and 6. Naturally when the training is progressive like in Vuokatti-Ruka Urheiluakatemia the results get better year after year with small exceptions. The results of the tests should be compared with the test results of same individual next year at the same point of time. The reason for not having linear change between the results can be explained with the different emphasizes during the training season.

When comparing the results of different members of the focus group one has to keep in mind few things. First of all the physical difference between the genders. For example: usually the motoric performance ability of men is little bit better than females, the muscle mass and power are larger with male than females and the anaerobic performance level is higher with males (Mero 2016, 77, 78, 79, 80). The differences within the gender between individuals can be the training background, technique, flexibility, weight for example.

10.1 Reliability & Ethics

Ethical questions for acquiring material for the research are anonymity of the material, using ethically safe internet material and observing the target group without permission. Anonymity will be solved by changing the names of the subjects, the safety of internet material will be checked by using information about articles and researches from free or partly free databases, and the permission to observe the target group is solved by having the commission do observation and gathering the data.

The reliability of the research means the ability to give non-random results. In other words reliability evaluates the constancy of the results from measurement to another. The question is about repeatability. The research is reliable and accurate when repeated measurement will give exactly same results regardless of the researcher. (Vilkka 2005, 161; Hirsjärvi et al. 2005, 216.) In the reliability of the research, mainly the issues and accuracy of the measurement are examined when executing the research. With accuracy of the research is meant that the research does not include any accidental errors. (Vilkka 2007, 149).

10.2 Professional Development

This thesis process developed author in competence of physical activity, health promoting physical activity and coaching. This thesis developed the authors understanding of anatomy and physiology, developing physical qualities with various methods, knowledge of the factors affecting human development and ability to take them into consideration in physical activity due to working to help day to day coaching of Finnish baseball and reading through literature concerning coaching and physical activity. (Kamk www-webpage.)

The generic competences the thesis developed were learning competences, working in community competence and innovation competence. Learning competences developed were developing one`s competence and learning methods as well as ability to retrieve and analyse information and evaluate it critically. (Kamk www-webpage.)

Working community competences developed were ability to operate in communicative and interactive situations in working life, ability to utilize information and communications technology in field of physical activity because of being in contact with the commissioner and supervising teacher and receiving information through technology and using different search tools to find other studies. The process developed the knowledge on conducting research project on existing information and methods due to searching for earlier researches, literature and articles regarding similar subjects. During the process the author developed the problem solving, decision making and working methods due to making decisions about the research questions and facing problems when working on the thesis. (Kamk www-webpage.)

10.3 Further Development

Ideas for developing this thesis further came from supervising teacher and commissioning party. The ideas author got were created by commissioning party, supervising teacher and by the author when meeting and discussing about the topic of the thesis. The thesis was done by the author alone and one could not manage to fulfil all the ideas due to limited amount of time and problems with using the PASW Statistics –statistic software.

The commissioning party and the author agreed that the main focus of the thesis is to investigate is there correlation between medicine ball throw backwards overhead and sprinting. One of the development ideas for this thesis is to investigate other factors that correlate with sprinting from the test results. If the author would have started to search for other correlations the thesis had not been done within the time limit due to problems with the PASW Statistics –statistic software.

Other development idea would be to include training programs to the research to see how much did the focus group use medicine ball throws during their weekly training. This way could be investigated how much do students of Vuokatti-Ruka Urheiluakatemia train throws with medicine ball and sprinting in different periods of off season to get the greatest benefit and gain speed. By knowing these training regimens could be seen how individual differences in training have effect on training for speed.

11 CONCLUSIONS

The thesis was meant to investigate for correlation between: medicine ball throw backwards overhead and sprinting speed. The focus group of the investigation was all the students from the class of 2012 in Vuokatti-Ruka Urheiluakatemia. The data for the research was collected by the teachers of the Vuokatti-Ruka Urheiluakatemia and the data included test results of many kinds from all the three study years of the class of 2012.

Speed can be divided into four categories: reaction speed, explosive speed, movement speed and speed skill (Mero, Nummela, Keskinen & Häkkinen 2004, 293-305). Speed is an ability that is very important for Finnish baseball player for both as an infielder for example to be able to advance between bases and outfielder to be able to get to the ball. This is why all these areas are trained during the off-season, pre-season and in-season.

Inside Finnish baseball there has been a hypothesis that medicine ball throw backwards overhead correlates with sprinting speed. The purpose of this study was to investigate this hypothesis and investigate if there is a correlation between the two (throwing medicine ball backwards overhead and sprinting speed). Speed and explosiveness have grown more and more important physical qualities when the game of Finnish baseball has developed.

For Finnish baseball it is important to have straight line speed because it is easy to shape into other forms of speed. The straight line speed is measured in Vuokatti-Ruka Urheiluakatemia with timing gates for 30 meters. The 30 meters are chosen because of the short distances between bases in Finnish baseball. The medicine ball throw tests have been proven to be valid test when measuring explosive power (Stockbrugger 2001).

When sprinting short distances speed is the most important quality. Because when talking about top results, one needs to reach the maximal level of all the elements of speed. These elements are reaction speed, rate of movement and movement speed and in sprinting these elements are interacting with other particles such as power and coordination which become apparent especially in acceleration and maximal speed. (Bauersfeld & Schröter 1988, 66.)

For sprinting fast one particle needed is the ability to produce explosive power and because the medicine ball throws have been proven reliable test for measuring explosive power, the idea of correlation between the two (sprinting and medicine ball throws) can be drawn. The author decided to use PASW Statistics –statistic software to calculate the linear regression to be able to calculate the changes in the test results of sprinting and medicine ball throws backwards overhead from the focus group during the three study years in Vuokatti-Ruka Urheiluakatemia and then investigate the correlation by calculating Pearson correlation using the values of the changes in test results. The secondary research questions were answered by using the values of changes and calculating the mean, maximum and minimum change of the test results.

The investigation for correlation between the medicine ball throw backwards overhead and sprinting proved the hypothesis H1 = there is a correlation between medicine ball throw backwards overhead and sprinting to be true because the level of sig. was under 0.01 (picture 9). When looking at pictures 2, 4 and 6 one is able to see that the results develop during the time in Vuokatti-Ruka Urheiluakatemia with most persons in the focus group.

The author is pleased to the conclusion of thesis process even though he was not able to do all the subjects the author and commissioning party talked about in the beginning of the process. The thesis process taught and developed author`s skills in the field of physical activity as well as use technology for research, work with data and use different programs for calculating and analysing.

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