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**Running, Strength Training and
Nutritional Guide for
Trail-Running
Vuokatti Trail Challenge**



Bachelor of Sports
Studies

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ABSTRACT

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The aim and purpose of the thesis was to produce a scientifically reliable trail-running guide. One of the objectives was to promote trail-running and make the starting of the sport easier with practical guidance. The guide was produced, in both English and Finnish, to reach more readers.

The commissioning party was chosen to be Kainuun Liikunta Ry, which promotes wellbeing in Kainuu region and organizes mass sport events e.g. Vuokatti Trail Challenge. The guide was published on the webpage of Vuokatti Trail Challenge. The guide was planned to match the design of webpages.

The research tasks were: 1. To make a scientifically reliable guide. 2. To find out how to make the guide clear and practical. 3. To include usable information for both beginners and experienced runners. 4. To set the frames to prevent the guide from branching out too much.

This thesis was a product development process. The process started with planning the guide and collecting scientifically reliable information. Next, the guide was produced and a selected group of people evaluated the first version. This group of people included the supervising teacher, the commissioning party and potential users of guide. The guide content and design was modified based on the feedback and after that, the guide was published.

This thesis and guide can be further used to introduce the basics of trail-running, as well as promotion for the sport and Vuokatti Trail Challenge event. The future opportunities are to go deeper in topics, introduce new areas e.g. recovery, and/or to specialize in different distances.

FORWARD

Running on the trails at Korouoma National Park 27th of September. 2016:

“Nothing beats running in beautiful scenery like this”

“Shall we turn left or right? – Let’s go right and follow the dots”

“Why are the boardwalks piled up here?”

“Let’s slow down the pace, my legs are starting to cramp.”

“We must be close by; we have been running for hours already”

“I think we are lost... the shortest route back to the camp site is about 30 kilometers”

“Shhhh, can you see those two moose 50 meters away?”

“Trail-running is fun as long as you are not waist deep in swamp, out of water and aware that you are lost.”

“Either let’s go over the river, or walk another two kilometers in the swamp. – Let’s go over the river”

“My phone battery is dying”

“Only 17 kilometers to go and we can follow this road”

“We don’t need help, we are fine, and we are coming”

“Thank you for picking us up”

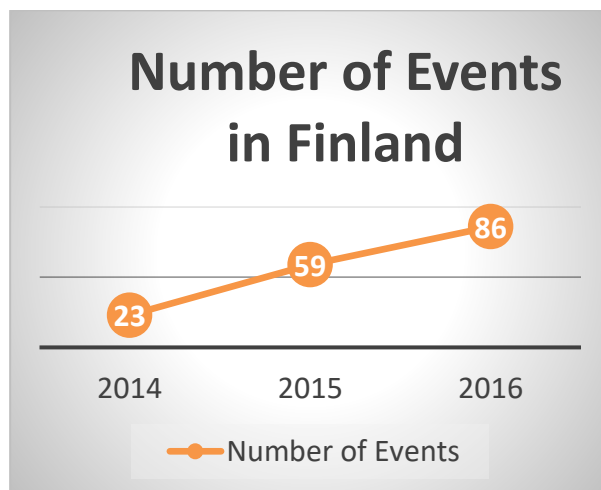
1 hour later: “Are you up for a couple of kilometers long, night time orienteering?
– Of course, let’s go”

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1 INTRODUCTION

Trail-running has increased in popularity during the last few years. In 2014 there was 23 different trail-running events arranged in Finland. In 2015, the number of events increased to 59 events, and in 2016, 86 events. In three years, the number of events has grown significantly and this increase can be interpreted as increase in demand. (Classic trail Ry, 2016.) The popularity of trail running can also be seen from the number of participants in these competitions. In Vuokatti Trail Challenge, the number of participants in 2016 was 145 and for Bodom trail run, organized in Espoo, 1051. (Bodom trail, 2016, Haasta itsesi kunnolla, 2016.)



Picture 1. Number of Events in Finland (Classic trail Ry, 2016) by Brillii & Puhakka (2017)

Due to the increase in popularity of trail-running, we decided to produce a trail-running guide as our thesis. The main idea of the thesis was to publish a trail-running guide that would be a scientifically reliable. The knowledge and data that was used in the process was based on scientific research and articles.

Kainuun Liikunta is a non-profit organization, which aims to improve the wellbeing of the citizens of the Kainuu region (Kainuun Liikunta, 2017). Kainuun Liikunta was chosen as the commissioning party because they annually organize a trail-running event called Vuokatti Trail Challenge. Another reason was that Kajaani University

of Applied Sciences (KUAS) does cooperation with Kainuun Liikunta. Fortunately, they were interested in the idea of a trail-running guide. Due to the reason that Vuokatti Trail Challenge is an international event, the guide was chosen to be published in English and in Finnish.

This process gave us the opportunity to specialize in endurance sports, and coaching while teaching us how to make a guide. The thesis improves our skills to plan and execute guidance for a diverse target groups. The whole process also taught us professional communication skills, which will be needed in working life. We have retrieved basic knowledge for the thesis by finding scientifically reliable sources and reviewing them.

2 TRAIL-RUNNING

Trail-running is a sport where participants run different distances on trails in nature. According to International Trail-Running Association (ITRA), “trail-running is a pedestrian race in a natural environment with minimal possible paved or asphalt road. The amount of roads should not exceed 20% of the distance.” (ITRA, n.d. [a]). However, recreational running on trails also fits into the definition.

Trail-running has increased in popularity over recent years both globally and in Finland. In 2016 there were 86 trail-running events in Finland that covered different distances. (Classic Trails Finland Ry 2016.) Trail-running is a relatively new competitive sport, but as recreational hobby it has been done for long time. Distances in competitions can vary from under 42km to over 100km distances. (ITRA, n.d.[a]) Trail-running can be done almost everywhere and competition environments vary from deserts to steep mountain races.

As mentioned before, the sport is new in terms of international competition. The International Trail-Running association (ITRA) was established in 2013 and was recognized by the International Association of Athletics Federations (IAAF) in 2015. The main purpose of the ITRA is to develop and promote trail-running as a sport, and to supervise events and athletes (ITRA, n.d. [b]). The second Trail World Championships will be held 2017 in Tuscany, Italy. (ITRA, n.d. [c])

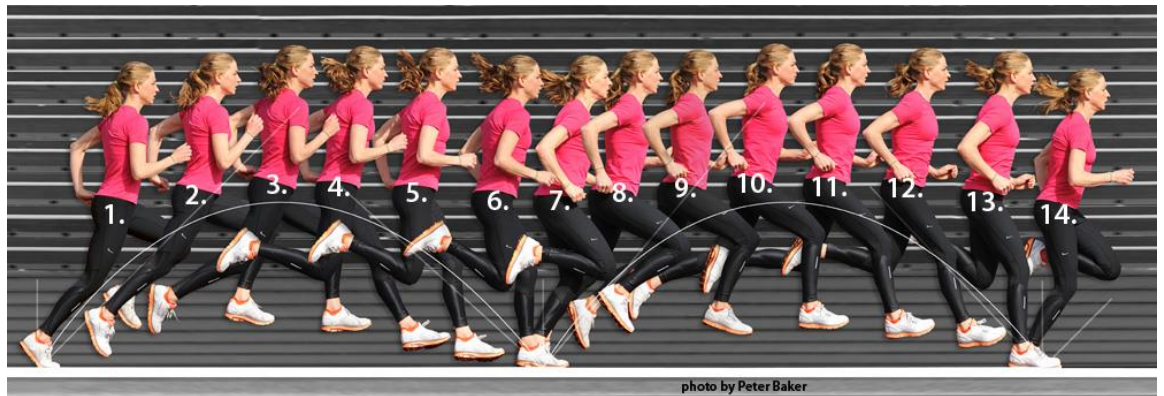
3 THEORETICAL BACKGROUND

Theoretical background introduces the theory that the guide is based on. It includes biomechanics of running which explains mechanical requirements of the sport. Training follows the principles set by the biomechanics, but also physiology e.g., endurance and strength is taken into consideration. The text includes also basic periodization model for trail and long distance running.

3.1 Biomechanics

“Biomechanics is defined as the application of the principles of mechanics to the study of biological systems” (Enoka, 2002, 1). Sports biomechanics focuses on mechanics affecting individual’s performance in sports. In this part of the text, we will introduce the factors affecting running.

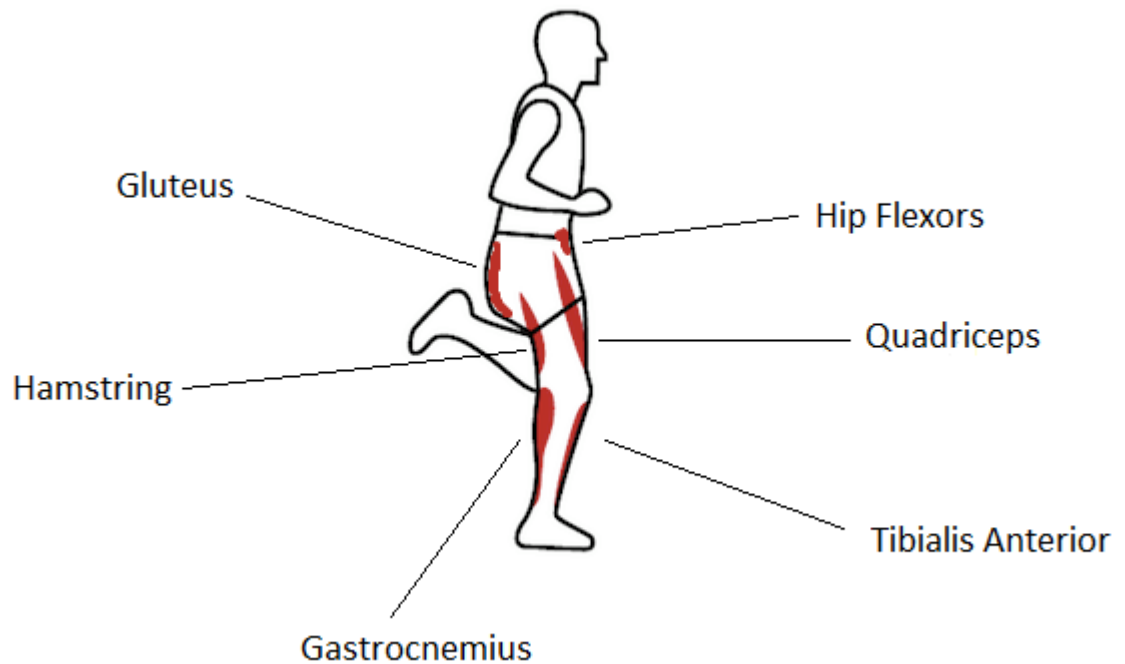
Running consists of five stages: take-off, flight, airborne swing, contact and mid-stance. The take-off refers to the push-off from the ground and take-off is followed by flight. In the take-off stage muscles are contracting and producing force in a concentric manner. (Sandström & Ahonen, 2011, 333 – 335.) Concentric muscle contraction refers to muscle activity that shortens the muscle length and produces force (Enoka, 2008, 241). In the flight stage both feet are above the ground (no contact). Airborne swing is the stage where the back leg extends and moves in a swing like motion to the front of the body. The contact stage is the moment when the contact to the ground occurs. In this stage the muscle contracts in an eccentric manner, which lengthens the muscle and produces force (Enoka, 2008, 241) Mid-stance refers to the moment when the foot has already come contact with ground and is below the body’s center of mass. (Sandström & Ahonen, 2011, 333 – 335.)



Picture 2. Stages of running (Baker, n.d.)

Running speed consists of two variables, stride length and stride frequency. In trail-running both stride length and frequency vary more than in running on flat surfaces because of the terrain. In less demanding terrain, the frequencies are higher and in demanding terrain, the frequencies are lower. There is also variation between stride frequencies in individuals running uphill and downhill. Running stride length increases on trails by five to fifteen centimeters compared to running on roads. (Havas, 1989, 17.)

Running requires muscle work from all the big muscle groups of the body. Lower body movement is done by leg muscles, the core prevents unnecessary movements from upper and middle body, and the upper body muscles control the movements of arms and head. Lower muscles that work during the running are: quadriceps, hamstrings, calf, hip flexors and gluteus. The quadriceps extend the knee and produces force in the take-off stage. This muscle group also absorbs force in the contact stage. The hamstrings flex the knee and control knee extension by working as antagonist muscle for quadriceps. Gluteal muscles extend the hip and support the running posture. Hip flexors flex the hip and help in bringing knee forward in the airborne swing stage. The calves extend the ankle and absorb shock from ground contact. (Enoka, 2008, 147.)



Picture 3. Muscle Activation (Born to Run, 2015). Modified by Brilli.

Core muscles are used to support running posture and prevent unnecessary movements. Core muscles used in running are abdominals, lower and upper back muscles. Upper body muscles that are working in running are: deltoids, trapezius, muscles of the neck and pectoral. In addition, muscles of the arms are assisting. These different muscle groups are used in cooperation in running stages. (Enoka, 2008, 147.) Muscles used in breathing are also important. During maximal effort they use from five to fifteen% of total energy expenditure (Hynynen, 2016, 122).

3.2 Training

Trail-running is aerobic performance and thus the majority of energy produced during the activity is done with oxygen. The energy produced in long-distance is mainly done with aerobic energy production. The shorter the distance and higher the intensity, more anaerobic is involved. (Gastin, P. 2001, 735—738.) Due this reason, the use of fat as source of energy is emphasized in long lasting performances. However, the carbohydrates remain as the main source of energy, since the glycogen stores are smaller than fat (Mero 2016, 204 – 205).

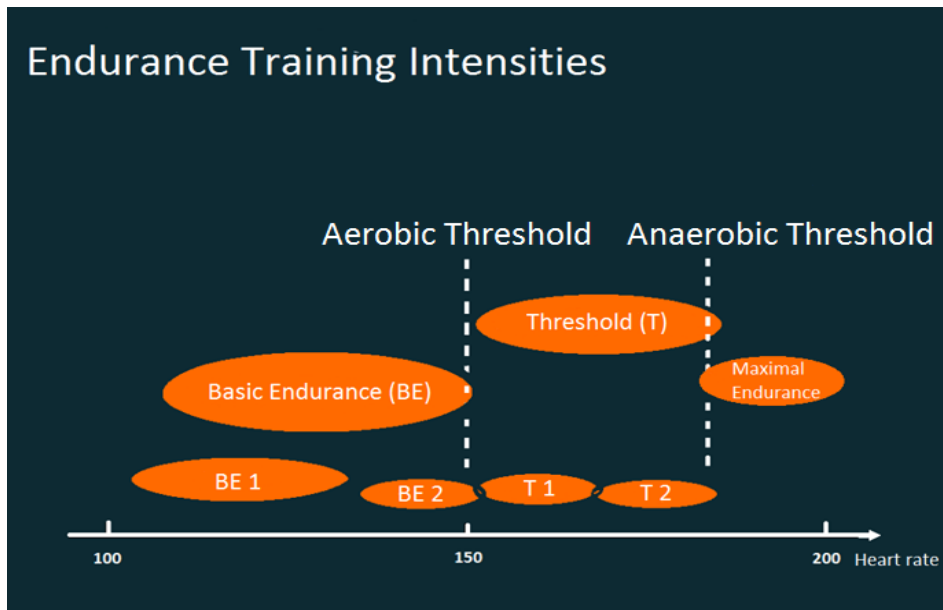
The terrain in trail-running can be demanding and forces the runners to change the pace and rhythm frequently. During the changes in terrain or pace, the intensity may rise close to the anaerobic threshold if the pace is not changed. Uphill running is in direct correlation with increase in effort if the pace is kept the same. The increase can be seen from the increase in heart rate, ventilation and lactate levels. (Creagh, Reilly & Nevill, 1998, 34—38.) This factor also affects to the utilization of carbohydrates and fats in energy production.

The reasons mentioned before e.g. terrain and pace, sets requirements for strength and endurance training. Individuals must be able to save energy in less demanding terrain and conditions, and act so that they have enough energy to perform in more demanding terrain and conditions.

3.2.1 Endurance

Endurance training consists of different intensity training. The intensities are basic endurance, threshold and maximal endurance. The focus should be on basic endurance training, because threshold and maximal endurance training is built on a strong base. The correct relation between basic endurance training and higher intensity training is needed. High intensity exercises are physically and mentally demanding, and if done carelessly they predispose runners to the risk of overtraining. Basic training will increase the performance level only up to a certain point. Top level athletes need high intensity level exercises to peak their performance level for the main competitions, and to improve condition. (Nummela, 2016, 272—275.)

Endurance can be categorized into three sections, basic endurance, threshold and maximal endurance. Basic endurance training is performed at low intensities, < 70% of VO₂max. The goal of basic endurance training is to improve aerobic fitness and create a strong base for competitions and high intensity training. (Nummela, 2016, 272—275.)



Picture 4. The Physical Principles of Training (SUL, 2002). Modified by Brill.

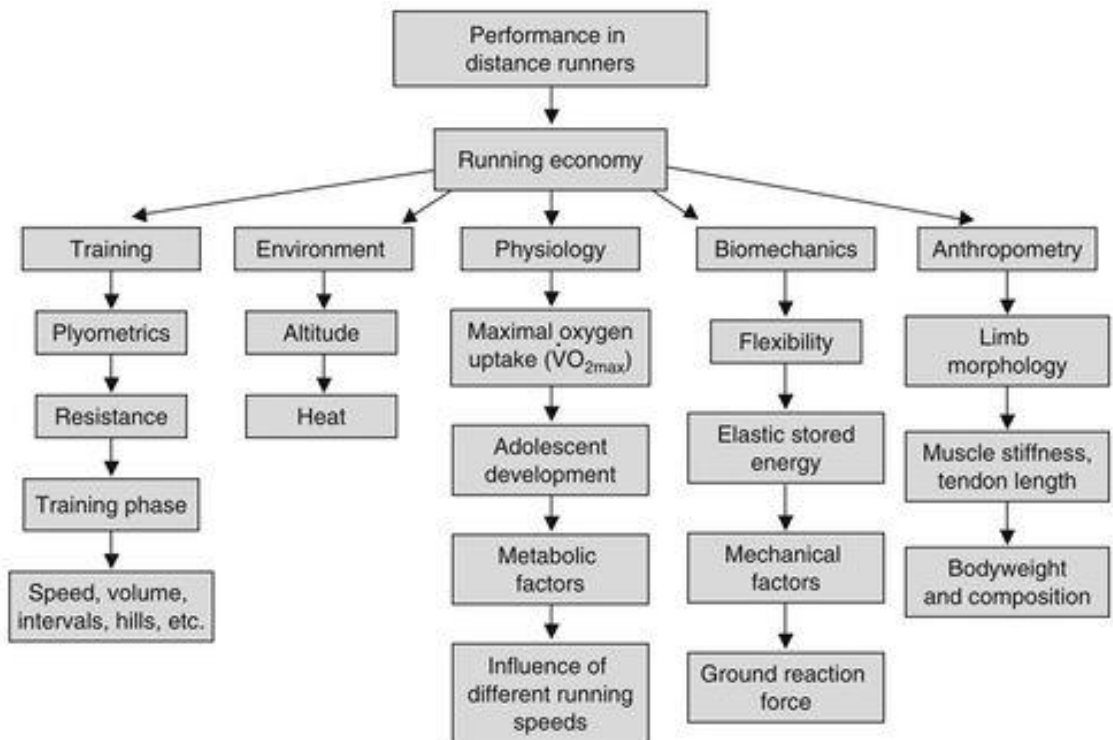
Long lasting basic endurance training also help the body to adapt to long lasting physical stress. Long lasting training is traditionally done as long slow distance (LSD) training where the session can last for several hours and intensity is low. (Vuorimaa, 2016, 482.) LSD training improves aerobic properties e.g. fat metabolism and increases the amount of capillaries in muscles. However, excessive use of LSD running may decrease individuals' running speed. (Nummela, 2016, 295—298.) A runner's body will adapt to slow paced training by causing fast twitch muscle fibers to take on aspects of slow twitch fiber (Pette, 1984). However, this can be avoided by developing speed properties by doing e.g. sprints. (Nummela, 2016, 295—298.)

Other adaptations for aerobic endurance training include an increase in mitochondria, myoglobin, and capillary content of muscles; in addition, aerobic training increases energy reserves through improved fat metabolism. (Nummela, 2016, 273—274.) Muscles are able to store more energy and fat mobility is increased thus making energy production more efficient. (Lucía et al, 2015.) Basic endurance training should form the majority of training up to 80% of total training (Seiler & Kjerland 2004). Generally, it is used also as a recovery training. In recovery training the intensity and the duration are low. (Nummela, 2016, 273.)

Threshold training is used to adapt to fast-paced running and increase the use of glycogen in energy production. The amount of threshold training should be significantly less than basic endurance training. Training intensity varies between aerobic and anaerobic thresholds. (Vuorimaa, 2016, 480 – 485.)

Aerobic threshold is the level where lactate levels start to increase, but the body is able to control its accumulation (Moilanen, 2008, 16). The body uses chemical buffering methods e.g. liver and ventilation to remove the lactic acid. The heart and kidneys also use lactic acid as fuel in energy production (Mikkola, 2014, 57.) Anaerobic threshold is the level where lactate level starts to build up rapidly and body is not able to control the accumulation anymore. The level of fatigue increases rapidly. Recovery rate after threshold or tempo run depends on the intensity, and it might take days to fully recover after high intensity tempo run. However, high-level endurance athletes are able to perform several threshold exercises per week. (Vuorimaa 2016, 482 – 483.)

Maximal endurance training improves VO₂max, running economy at high intensities and use of glycogen stores in energy production. It is done at maximal intensities, 90% and over of VO₂max. Maximal endurance training can be performed as intervals or as continuous training. Intervals are used to maintain high intensity during the training while maintaining high total loading (Nummela, 2016, 275.) Continuous training sessions can be used to determine the competition level e.g. 5-kilometer test run. For example, the athlete runs four times 4min intervals with 3-minute recovery time with 90% of VO₂max intensity (Helgerund et al, 2006). However, in ultra-distances, the athletes perform at sub-maximal levels and performance with high VO₂max levels is not the limiting factor. In ultra-distances, running economy is in a key role. Runners with good running economy use less energy for the same work and thus, are more efficient. The factors affecting the running economy are training, environment, physiology, biomechanics, and anthropometry (Saunders et al, 2004).



Picture 5. Factors affecting to running economy (Saunders et al, 2004)

3.2.2 Strength

Typically, recreational endurance athletes tend to ignore strength training or it includes only muscle endurance training. Researches have shown that strength training may be beneficial in increasing performance level in running. Especially training with maximal loading has improved running performance through changes in running economy. In trail-running it can be assumed that maximal strength training is beneficial due to certain aspects of the sport. These aspects include variation in running surface, altitude and carried equipment. Physical factors that might explain the improvement are, increase flight time and thus increased time for muscle relaxation, improved rate of force production (RFD) during contact, and improved muscle activity (Støren et al, 2008, 1091 – 1093.)

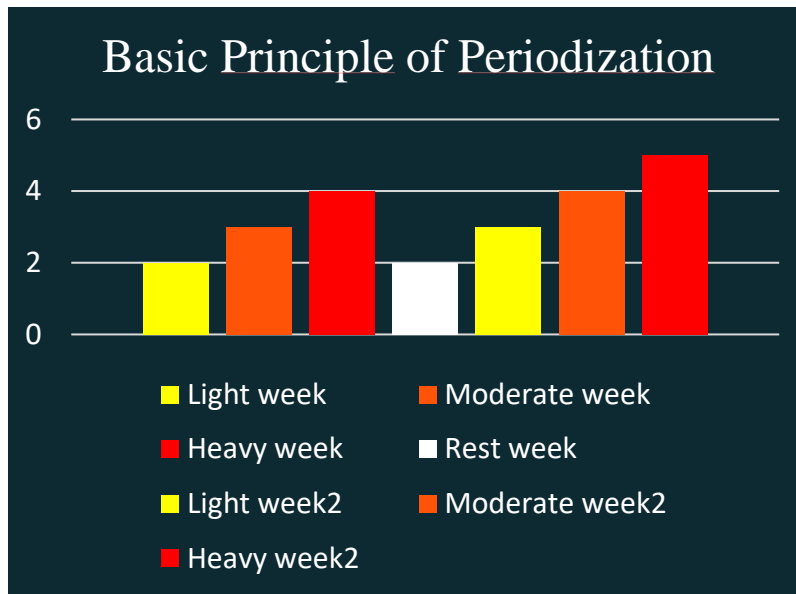
Maximal strength training affects to scaling meaning maximal strength is in relation to body weight and thus requiring lower % of strength to produce the same movement. The gains in strength occur due to adaptations in the nervous system rather than increase in muscle mass. (Støren, Helgerud, Støa & Hoff, 2008.) Stronger

muscles help to maintain good running posture during performance. An example of maximal strength training can be doing squats with 90-100% of one repetition max (1RM). The improvements in running economy are linked to the intensity the runners have been training during the strength training intervention. Increase in economy is tied to certain running pace. (Nummela & Häkkinen, 2016, 284—289.)

People who do not have experience on strength training can also start to build up strength with bodyweight training. Study has shown that muscle endurance training e.g. circuit training with own bodyweight can also improve strength and power in endurance athletes. However, it is not the most effective way to improve running performance. (Taipale et al 2009.)

3.3 Periodization

Typically, distance runners have the following periodization: general preparation 1&2, competition preparation, competition and transition periods. Intensity is progressively increased towards competition so that the performance level is at top level when it is needed. However, individual differences need to be taken into consideration when planning an exercise program. Some might be able to withstand high volume while for others it might be more beneficial to train in higher intensities. (Nummela, 2016, 272—282.)



Picture 5. Basic principle of periodization by Brilli & Puhakka (2017).

General preparation 1 and 2 are the phases where the base for competition and future training are built on. The future training includes high intensity workouts and strong base makes high intensity training possible without causing problems in recovery. It includes mainly LSD running which lasts several hours. The general preparation 1 typically lasts between 12-16 weeks and general preparation 2 lasts for 10-12 weeks. (Nummela, 2016, 275 – 277.) If necessary, it is possible to do a training block to improve or to maintain other properties e.g. strength, and to break adaptations.

The competition preparation period prepares the athlete physically and mentally for the upcoming competition period. Training reaches its peak and intensities are close to competition intensities. These exercises increase the performance level close to its peak and gives an idea of the athlete's condition. Exercises include long lasting basic endurance and threshold runs. (Nummela, 2016, 277—280.) Maximal endurance training is also used but the benefits for ultra-distances is not significant, as mentioned before. In competitions, the athletes are performing at the levels where the body's ability to use carbohydrates is not the limiting factor neither the VO₂max. In ultra-distances, the limiting factor is the ability to endure the physical stress for long time and the ability to produce energy from fats (Illander 2014, 241). The key is to run as efficiently as possible for the majority of the competition.

During the competition period, the goal is to reach peak performance level for the main competition of the season. Other competitions are used as high intensity exercises and basic endurance levels are maintained during the period. The amount of training is reduced significantly, so that the individual can perform at the optimal level in the competition. (Nummela, 2016, 280—283.)

The transition period is used to recover physically and mentally from the competition period (Haff, 2004). During transition period, the next periods are planned and goals are set for the upcoming season. Exercises can be done to maintain fitness level. This period is good time to do other sports, and rest from running. This is beneficial mentally, and gives different type of physical stress than running.

4 NUTRITION

Nutrition is extremely important for individuals who are doing a sport in competitive level and for recreational individuals as well. Proper nutrition makes exercising more efficient and improves recovery from the exercises. A versatile diet that considers limitations ensures that the most important areas e.g. vitamins, minerals and macro- nutrients are covered. The recommended total energy intake varies between individuals, sports and training period. The emphasis of macronutrients varies between sports. Endurance sports require more energy from carbohydrates than sports related to speed and power. (Mero 2016, 177.)

The specific training period, as mentioned before affects energy requirement level. During the general preparation periods, energy intake varies from 3000 kcal to 6000 kcal depending on the exercise duration and intensity. One rule of thumb is to calculate daily need with 45-70 kcal/kg of body weight. Total energy intake should vary depending on the need, however, the amount of carbohydrates should remain high to be able to maintain proper recovery. Total energy intake should be 100-300 kcal over the daily consumption to recover and improve optimally. (Mero 2016, 204 –205.)

4.1 Carbohydrates

Carbohydrates form the base of nutrition for endurance athletes. Carbohydrates are needed as an energy source during long lasting exercises and in recovery. The amount of carbohydrates consumed should be 6-10 g/kg or 60-75% of total energy intake. Carbohydrates that are consumed before training ensure that the blood glucose level stays high and the intensity can be as high as planned. This can be achieved by consuming a meal that includes carbohydrates and protein 1-4 hours before the exercise. (Mero 2016, 204 – 205.)

Good sources of carbohydrates include e.g. rice, pasta, potatoes, bread and fruits. It is recommended that recreational runners should prefer fiber rich carbohydrate sources because they fit for wellbeing purposes also. However, for athletes with

high-energy expenditure, sugars can be used to reach high enough carbohydrate intake level. Sugar rich energy sources are e.g. juices, jams and honey. (Illander, 2014a, 136—137.)

4.2 Fat

Fats are needed to maintain hormonal functions in the body, and to enhance the absorption of vitamins. Fat intake level should be 1,0-1,5 g/kg or 20-30% of total energy intake (Mero 2016, 204). Due to high amount of energy that fats contain, the amount should be limited. The high requirement of carbohydrates and protein also affect to the intake level of fat. Fats that are consumed should mainly be un-saturated fat. Athletes should favor products that include low levels of fat. (Arjanne, Laaksonen & Ojala 2016, 164 – 168.)

Good sources of fat include high amount of un-saturated fats and are low on saturated fats. Un-saturated fats can be found from e.g. nuts, fish and vegetable oils. Saturated fat can be found from e.g. red meat, and thus too extensive use should be avoided. (Illander, 2014b, 229—238.)

4.3 Protein

Proteins are used to build muscle mass, and serve as an energy source during long lasting performances. Protein intake level should be 2-3 g/kg or 15-20% of total energy intake (Mero 2016, 204). A high amount of proteins in the diet ensures, that there is no loss in muscle mass, and that the recovery from the training is optimal. Proteins also help in weight control by giving a feeling of satiety. (Arjanne, Laaksonen & Ojala, 2016, 164 – 168.)

In versatile diet, the amount of protein is covered, but in case additional protein is needed, it can be consumed from supplements or from other sources. For people with special diets e.g. vegetarians and vegans, it is extremely important to make sure that the protein intake level is sufficient. Good sources of protein are e.g. milk, eggs, fish, seeds and nuts. (Illander & Lindblad, 2014, 222—225.)

4.4 Carbohydrate and hydration loading for competitions

Carbohydrate loading is beneficial before long lasting events, because the body's glycogen stores can become a limiting factor for performance. Filling up the glycogen stores will allow one to perform longer with high intensity. There are several strategies for carbohydrate loading, some being riskier than others. In the guide, we introduced a fast and low risk way to do it.

A fast and low risk method for carbohydrate loading starts with a short, but maximal intensity exercise, which is done 48 hours before the competition. After the exercise, a very high carbohydrate intake is maintained for 24 hours. The amount of carbohydrates consumed correspond to 12 g/kg of fat free body mass. During this 24 hours, no training should be done to avoid depletion of the glycogen stores. After the 24 hour period, a normal, high carbohydrate diet (6-10 g/kg) is maintained until the competition. (Fairchild et al 2002.) Good carbohydrate sources for loading purposes are pasta, white bread, rice and sports drinks. During the carbohydrate loading, protein and fat rich food should be avoided as well as low energy foods e.g. vegetables (Collier & O'dea 1983; Fairchild et al 2002).

Dehydration is a risk factor that can ruin a well-planned competition. It can be avoided by consuming additional two liters of liquid for every day for 3-4 days before the competition and by consuming liquids during the competition as well. The competition day should have normal liquid consumption. A sufficient amount of liquids during the competition is 0,5-1 liter per hour. (Juoksijalehti n.d.) However, consuming too much liquid can predispose one to hyponatremia (Mayoclinic 2014).

5 GUIDE CONTENT, OBJECTIVES AND EVALUATION

The most important research task was to produce a scientifically reliable guide. Other research tasks included, how to set frames for the guide, so that it does not branch out too much but includes useful information for beginners and experienced runners, and how to create a clear and practical guide. The guide was published in English and in Finnish to reach wider population, and because Vuokatti Trail Challenge is international event.

The guide follows logical order, starting with the introduction of trail-running. The following chapters are presented in the guide: Introduction, how to get started, setting up goals, training, nutrition and finally event presentation of Vuokatti Trail Challenge.

The introduction includes the definition of trail-running and statistical information. The “How to get started” chapter has information about safety and equipment that are beneficial for people interested to start the sport. “Setting up goals” introduces the main principles of goal setting. The chapter presents the three types of goals: result, performance and process based goals (Liukkonen, 2003, 93—102). Motivation was also discussed briefly in this chapter. The different levels of motivation, internal and external, were introduced from the aspect of reaching goals.

The next chapters deal with training and nutrition. Training is divided into running, strength training and periodization. Strength training included six gym-training movements with technique tips and bodyweight training section. The movements used in the guide support the specific muscles used in running. The periodization chapter consists of an example training week and simple explanation of traditional long-distance running periodization. The example-training week was planned for the 42-kilometer distance. However, the guide explains how to modify the training for different distances. The “Nutrition” chapter gives guidelines for use of macronutrients and suggestion for total energy intake level for endurance athletes.

The final chapter of the guide introduces Vuokatti Trail Challenge event. The content that is used in the chapter is from Kainuun Liikunta webpage and it includes

multiple pictures from the previous years' Vuokatti Trail challenges. Its purpose is to attract people to participate in the event.

The guide was evaluated by using qualitative study method. In qualitative research the objective is to understand a certain phenomenon. The information is often gathered by using e.g. interviews, questionnaires or participant observation. However, the interpretation is ultimately in the hands of the researcher. (Norman & Yvonna 2000, 2—4; Tuomi & Sarajärvi, 2002, 16—29.)

Six evaluators were given a questionnaire with preset and open questions (See appendix 1). The questionnaire dealt with the content and the design of the guide. The collected feedback was used to develop the guide further. The data was analyzed by the authors with inductive method. Inductive method refers to a method where data is analyzed from a specific occurrence or occurrences and then generalized. (Tuomi & Sarajärvi, 2002, 95—100). In this thesis process individuals with different backgrounds in sports gave feedback based on questionnaire (see appendix 1), and based on the feedback, the authors mutually decided what changes were made to the guide. Emphasis was given to commissioning party's feedback because the guide is for their use.

6 PRODUCTION PROCESS

This part of the text introduces the production process of the guide. It goes through people involved in the process, development process, design and marketing. The process was completed between autumn 2016 and spring 2017.

6.1 Producers

The production process of the guide and thesis was equally done by the authors. The other personnel related to production process of the guide included the supervising teacher, Ritva Taipale, from Kajaani University of Applied Sciences and Jukka Liuha from Kainuun Liikunta. The guide was read and evaluated by a group of people with different backgrounds. This group included people with some level of physical activity, as well as people who do not have background in sports.

6.2 Development Process

The production process was based on the instructions of Kajaani University of Applied Sciences, and the process started with the topic selection in the beginning of September 2016 (Kajaani University of Applied Sciences, n.d.). The topic, trail-running, was chosen because of our interests in endurance sports and previous knowledge. Kainuun Liikunta was asked to be the commissioning party, due to reason, that they organize an annual trail-running event, Vuokatti Trail Challenge. One of us did his practical training at Kainuun Liikunta and worked as an organizer in the event.

The process continued throughout the autumn semester 2016. The task was to collect scientifically reliable information about the topic that could be used in the guide. During this time, a sport discipline analysis of ultra-distance trail-running focusing female runners, was made by the authors. The process helped to get more information of the topic.

At the end October and in the beginning of December, the thesis plan was written and presented. The thesis plan set the research tasks and objectives for the thesis and the guide. The thesis plan, and discussions with the commissioning party and the supervising teacher made it clear what things need to be in the guide, and what were unnecessary.

The production of the guide, including writing and photographing, started in the beginning of the January 2017. The first version of the guide was ready at the end of January. The guide was sent to be evaluated by supervising teacher, commissioning party and four other people.

While the feedback for the guide was being collected, the work on the actual thesis report began. After receiving the feedback, the final changes to the guide were made before the end of February. The final stage of the process was the finalization of the thesis, which was done during March.

6.3 Design & Marketing

The aim and objective of the guide was to be a clear and practical. This was emphasized in the design process to ensure that the aims and objectives were achieved. The updated event webpage of Kainuun Liikunta was used as reference to colors. The colors used included dark blue, orange and white. The font style was chosen to be Times New Roman and the font size 12. The font style needed to be clear and easy read. Times New Roman is often used as a study book font style (Painotalo Casper Oy, 2015).

The pictures used in the guide were taken by the authors and Vaarojen Valokuvaajat Ry. Kainuun Liikunta had the permission to use the pictures taken from the event for their own purposes e.g. marketing, and thus they could be used in the guide. The pictures shared the aim and objective with the other content of the guide.

The guide was done by using Microsoft PowerPoint 2016, and published as a PDF file. This was done to reduce the production costs and to increase accessibility.

One benefit of doing the guide with this method is that it can be modified later if necessary.

The length of the guide was discussed between the authors, supervising teacher, and the commissioning party. The unanimous opinion was that the guide should not be too long or branch out too much. Too long guide would not be appealing for the readers. The modern culture has made people impatient and information has to be compact and easy to reach (Herkman & Vainikka, 2012, 144).

The marketing of the guide will be done by Kainuun Liikunta and they have the right to use it freely. However, the guide was made to be attractive in the eyes of potential reader. The colors used in the guide also suits for the marketing purposes of Kainuun Liikunta by previously mentioned reasons. An additional strength of the guide is that it can also be used as marketing tool for Vuokatti Trail Challenge event.

7 DISCUSSION

In this chapter, the following topics are gone through: Evaluation of the feedback, the changes made to guide, reliability and ethics of the guide and the thesis and finally successfulness of the process.

7.1 Evaluation and the development of the guide

Six personnel, including the supervising teacher and one member of the commissioning party, evaluated the guide. The rest four were persons with little to no experience in sports. These people evaluated the guide by answering to a qualitative questionnaire provided by the authors. (See appendix 1)

There were a lot variation in the received feedback, concerning the content and design of the guide. In general, the people liked the content and structure of the guide. They found it fluent and easy to read. However, there were some minor development suggestions concerning the content and the pictures e.g. people asked for good sources of macronutrients for the nutrition chapter.

Modifications to the content related to adding some information and suggestions for new content. The following information and content was still added to the guide: muscle endurance training, more thorough definition of some terms, importance of different nutrients as an energy source in long distances and examples of good macro nutrient sources.

The development ideas concerning the pictures related e.g. adding colors to previously a black and white picture, cropping and adding more pictures to the guide. The training plans were changed to be pictures so that they would stand out more from the text and thus be more attractive. After the modifications, the guide has more color and illustrative, and thus more appealing to reader.

7.2 Reliability and Ethics

Reliability and ethics played vital role in the trail-running guide and thesis, due to the fact we wanted to make a scientifically reliable guide and thesis. The reliability and ethics concerned the following topics in the guide and thesis: Use of pictures, scientific sources, use of self-written text, and anonymity of people who evaluated the guide and the misuse of the guide.

The authors wrote all the information written in the guide or thesis. The information used in the writing process from scientifically reliable sources, and referenced in scientific manner. Finally, it was up to the authors to decide the reliability of the sources. The sources were evaluated by reviewing the background of the authors and publisher, and information was compared to other publications. Kainuun Liikunta has the right to modify the guide. However, this may have an impact to the reliability of the guide.

As previously stated in chapter 6.3. Design, pictures used in the guide were either taken by the authors or provided by Kainuun Liikunta. Pictures from Kainuun Liikunta were taken by Vaarojen Valokuvaajat Ry, and Kainuun Liikunta have right use them for their own purposes. The people in the pictures also have given the right for Kainuun Liikunta to use the pictures taken during the Vuokatti Trail Challenge event when they signed in to the competition.

The data concerning the evaluation of the first version of the guide was collected anonymously, except for the supervising teacher and commissioning party contact person, introduced in chapter 6.1. Producers. The data was collected anonymously to ensure that the individuals could express themselves freely. The data that was used in production process will not be used after this work without the permission from individuals involved.

7.3 Successfulness

The guide and thesis met our aims and objectives. First objective was to produce a scientifically reliable guide and thesis. We were able to find scientifically reliable information and material, which was reviewed during the process.

Another objective was to produce a clear and practical guide without branching out too much. Based on collected feedback, we were able to achieve this objective. Readers thought that the structure was clear, and the guide was easy to read.

We wanted to increase the popularity of the sport through this guide, and give Kainuun Liikunta a unique tool for marketing the future Vuokatti Trail Challenge events. The guide content was designed for beginner and experienced runners. Only time will tell if the guide will find its readers.

This process improved our professional skills and competences. We were able to specialize in endurance sport and coaching, this can be reflected in the competences of physical activity and coaching. Additionally, the process improved skill to plan guidance for diverse target groups, which also can be reflected to competence in health promoting physical activity. Finally, we developed professional communication and project management skills. This reflects to the competence of society and leadership. (Kajaani University of Applied Sciences, 2015.)

The general competences that were developed during the thesis process were learning, ethical, working community, innovation, and internationalization. The learning competence was developed in information retrieval process during the thesis. All information was critically assessed before using them as a source. The ethical competence was reached as the feedback was collected anonymously. The ethical issues were evaluated in detail and were dealt with. Working community competences that were covered included working as a member of work community and successful in communicating with all the people involved in the process. The guide served as a work project where co-operation between the commissioning party and the authors was professional. The fact that the guide was a project matches it also with innovative competence. The authors needed creative problem solving during the process e.g. preventing the branching out. Finally, the

competence in internationalization was met with making the guide in both Finnish and English. In the guide, the readers with international background were taken into consideration. (Kajaani University of Applied Sciences, 2015.)

The guide and this thesis can be used to introduce the basics of trail-running as well as marketing for the sport and Vuokatti Trail Challenge event. The future opportunities are to go deeper in topics, introduce new areas e.g. recovery, and/or to specialize in different distances. Due to the reason that trail-running is relatively new competitive sport, it has not been widely researched yet.

Even though that we felt that this process was generally successful there is always room for improvement. First, we could have done some participant observation by using our training plan from the guide and taking part in a trail-running event. Secondly, the quality of self-taken pictures of the guide could have been improved by using professional equipment and help. Finally, the data analyses before starting thesis process should have been done more extensively. Now we had to find a lot new sources of information during the production process.

8 SOURCES

- Ahtiainen, J. (2014) Anaerobinen Kapasiteetti ja sen Testaaminen [Anaerobic Capacity and Testing] *University of Jyväskylä*. Retrieved 14.2.2017 from <https://jyx.jyu.fi/dspace/bitstream/handle/123456789/45526/ahtaiainen%20anaerobinen%20ja%20testaaminennadraft.pdf?sequence=1>
- Baker, P (n.d.) Stages of Running. Retrieved 11.10.2016 from <http://www.blackhillbounders.com/index.php/training-3/running-form/>
- Born to Run (2015) Muscle Activation. Retrieved 10.4.2017, from: <http://www.borntorun.com/wp-content/uploads/2015/08/BTR-muscle-activation.png>
- Collier, G. & O’dea, K. (1983) The effect of coingestion of fat on the glucose, insulin, and gastric inhibitory polypeptide responses to carbohydrate and protein. *American Journal of Clinical Nutrition*, 37(6) July 1983. Retrieved 22.3.2017 from: https://www.researchgate.net/publication/16854646_The_effect_of_coingestion_of_fat_on_the_glucose_insulin_and_gastric_inhibitory_polypeptide_responses_to_carbohydrate_rate_and_protein
- Denzin, N. K., & Lincoln, Y. S. (2000). *Handbook of qualitative research* (2. ed.). Thousand Oaks (Calif.): Sage.
- Enoka, R. (2008) *Neuromechanics of Human Movement*. (4. ed.). Champaign, Human Kinetics.
- Fairchild, T., Fletcher, S., Steele, P., Goodman, C., Dawson, B. & Fournier, P. (2002) Rapid Carbohydrate Loading After a Short Bout of Near Maximal-intensity Exercise. *Medicine & Science in Sports & Exercise*, July 2002. Retrieved 22.2.2017 from https://www.researchgate.net/profile/Timothy_Fairchild/publication/11325775_Rapid_carbohydrate_loading_after_a_short_bout_of_near_maximal-intensity_exercise/links/00b7d5225dd0385503000000.pdf

- Gastin, P. (2001) Energy System Interaction and Relative Contribution During Maximal Exercise. *Sports Med*, 31(10), 2001. Retrieved 17.2.2017 from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.578.7391&rep=rep1&type=pdf>
- Greagh, U., Reilly, T. & Nevill, A. (1998) Heart Rate Response to "Off-road" Running Events in Female Athletes. *British Journal of Sports Medicine* (32). Retrieved 11.4.2017 from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1756057/pdf/v032p00034.pdf>
- Haff, G. (2004) Roundtable Discussion: Periodization of Training-Part 1. *Strength and Conditioning Journal*, February 2004. Retrieved 20.2.2017 from https://www.researchgate.net/publication/232185002_Roundtable_Discussion_Periodization_of_Training-Part_1
- Herkman, J. & Vainikka, E. (2012) Lukemisen Tavat: Lukeminen Sosiaalisen Median Aikakaudella [Reading Habits: Reading During Social Media Era], Tampere, Tampere University Press,
- Ilander, O. (2014a) Hiilihydraatit – Tehoa harjoitteluun, suorituskykyä kilpailuihin [Carbohydrates – Power to Training, Performance to the Competitions] In: *Liikuntaravitsemus: Tehoa, tuloksia ja terveyttä ruuasta* [Fat – Health and Energy in *Sports Nutrition: Power, Results and Health From Food*] . Lahti: VK-Kustannus.
- Ilander, O. (2014b) Rasva – Terveyttä ja Energiaa. In: *Liikuntaravitsemus: Tehoa, tuloksia ja terveyttä ruuasta* [Fat – Health and Energy in *Sports Nutrition: Power, Results and Health From Food*] . Lahti: VK-Kustannus.
- Ilander, O. & Lindblad, P. (2014) Proteiini – Lihaskehityksen laukaisija [Proteins – Trigger for Muscle development] In: *Liikuntaravitsemus: Tehoa tuloksia ja terveyttä ruuasta* [Fat – Health and Energy in *Sports Nutrition: Power, Results and Health From Food*]. Lahti: VK-Kustannus.

International Trail Running Association (n.d. [a]) Definition of Trail-Running, retrieved 7.9.2016 from http://www.i-tra.org/page/259/Definition_of_trail-running.html

International Trail Running Association (n.d. [b]) Presentation and Objectives. Retrieved 23.3.2017 from http://www.i-tra.org/page/257/Presentation_and_Objectives.html

International Trail Running Association (n.d. [c]) 2017 Trail World Championships. Retrieved 23.3.2017 from http://www.i-tra.org/page/347/2017_TWC_-_Baia_Prataglia.html

Kainuun Liikunta (2017) Strategia 2013-2017 [Strategy 2013-2017] Retrieved 24.2.2017 from <https://www.kainuunliikunta.fi/kainuun-liikunta/strategia-2013-2017/>

Kajaani University of Applied Sciences (n.d.) Thesis Process. Retrieved 2.5.2017 from <http://www.kamk.fi/opari/Opinnaytetyopakki/Opinnaytetyoprosessi/In-English/BSS/Process>

Kajaani University of Applied Sciences (2015) Study Guide. Retrieved 2.5.2017 from <https://www.kamk.fi/loader.aspx?id=6cb28409-ca4a-4b29-b58c-60b6322db9af>

Lucía, A., Hoyos, J., Pardo, J. & Chicharro, J. (2000) Metabolic and Neuromuscular Adaptations to Endurance Training in Professional Cyclists: A Longitudinal Study. *Japanese Journal of Physiology*, 50(3), 2000. Retrieved 17.2.2017 from: https://www.jstage.jst.go.jp/article/jjphysiol/50/3/50_3_381/pdf

Mayoclinic (2014) Diseases and Conditions. Hyponatremia. Retrieved 22.3.2017 from: <http://www.mayoclinic.org/diseases-conditions/hyponatremia/basics/definition/con-20031445>

Mero, A. (2016) Johdanto Ravinto-Ohjelman Laatumiseen Huippu-Urheilussa [Introduction to Nutrition Planning in Top-level Sports] In Mero, A., Nummela, A., and Kalaja S., Häkkinen K. (Eds.), *Huippu-Urheiluvalmennus: Teoria ja*

Käytäntö Päivittäisvalmennuksessa [Top-level Sport Coaching: Theory and Practice of Daily Coaching]. Lahti: Vk-kustannus Oy.

Moilanen, P. (2008) Testausopin perusteet [Principles of Physiological Testing]. *University of Jyväskylä*. Retrieved 20.2.2017 from <http://users.jyu.fi/~pjmoilan/Opiskelujuttuja/Testausopin%20perusteet.pdf>

Mikkola, J. (2014) Suoran Maksimaalisen Hapenottotestin Anatomia [The Anatomy of Direct Oxygen Uptake Measurement]. *Liikunta ja Tiede, 51, 2014* Retrieved 20.2.2017 from http://www.lts.fi/sites/default/files/page_attachment/lt2-314_55-59_lowres.pdf

Nummela, A. & Häkkinen, K. (2016) Kestävyys ja Voimaharjoittelun Yhdistäminen. [Combining Endurance and Strength Training] In Mero, A., Nummela, A., and Kalaja S., Häkkinen K. (Eds.), *Huippu-Urheiluvalmennus: Teoria ja Käytäntö Päivittäisvalmennuksessa [Top-level Sport Coaching: Theory and Practice of Daily Coaching]*. Lahti: Vk-kustannus Oy.

Paavolainen, L., Häkkinen, K., Hämäläinen, I., Nummela, A. & Rusko, H. (1999) Explosive-strength training improves 5-km running time by improving running economy and muscle power. *Journal of Applied Physiology, 86(5), 1999*. Retrieved 17.2.2017 from: <http://jap.physiology.org/content/86/5/1527.full>

Painotalo Casper Oy, (2015) Ohjeita aineiston valmistamisesta painoa varten [Instructions for the Preparation of the Press] retrieved 22.11.2016 from <http://www.painotalocasper.fi/aineisto-ohjeet>.

Pette, D. (1984) Activity-induced Fast to Slow Transition in Mammalian Muscle. *Medicine & Science in Sports & Exercise, 16(6), 1985*. Retrieved 17.2.2017 from: https://www.researchgate.net/profile/Dirk_Pette/publication/17103733_JB_Wolffe_memorial_lecture_Activity-induced_fast_to_slow_transitions_in_mammalian_muscle/links/55225abb0cf2a2d9e1453799.pdf

Saunders, P., Pyne, D., Telford, R., Hawley, J. (2004) Factors affecting Running Economy in Trained Distance Runners. *Sport Med* 34(7), 2004. Retrieved 8.9.2016 from: <https://pdfs.semanticscholar.org/b4c7/d341317555e9dd677f15b222b37413041718.pdf>

Seiler, S. & Kjerland, and G. (2004) Quantifying Training Intensity Distribution in Elite Endurance Athletes: Is There Evidence for an “Optimal” Distribution? *Scandinavian Journal of Medicine & Science in Sports*, 16(1), 2006. Retrieved 14.2.2017 from <http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0838.2004.00418.x/full>

SUL (2002) *Fyysisen harjoittelun perusteet* [The Physical Principles of Training], modified by Brilli, M. (2017) retrieved 19.1.2017 from http://www.fitlandia.fi/wp-content/uploads/2013/09/Kestävyysharjoittelun_harjoitustasot_Fitlandia.0012.png

Taipale, R., Mikkola. J., Nummela. A., Vesterinen. V., Capostagno. B., Walker. S., Gitonga. D., Kraemer. W.J. & Häkkinen. K. (2009) Strength Training in Endurance Runners. *International Journal of Sport Medicine*, 31(7), 2010. Retrieved 22.3.2017, from https://www.researchgate.net/publication/43356076_Strength_Training_in_Endurance_Runners

Tuomi, J. & Sarajärvi, A. (2002) *Laadullinen Tutkimus ja Sisällön Analyysi*. [Qualitative Research Method and Content Analysis] Jyväskylä: Gummerus Kirjapaino Oy.

APPENDICES

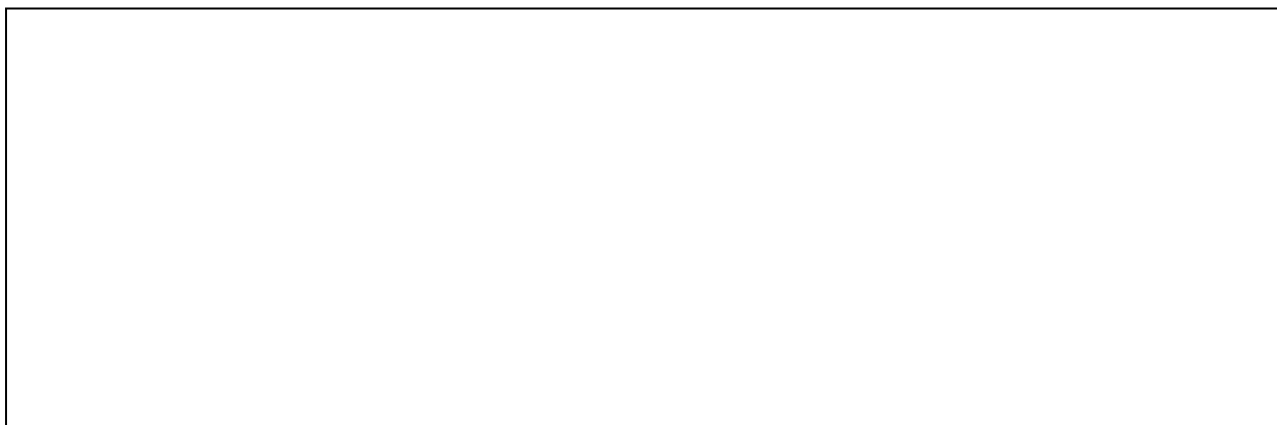
Readers Feedback of the Trail Running Guide

What kind of first impression you got from the guide?

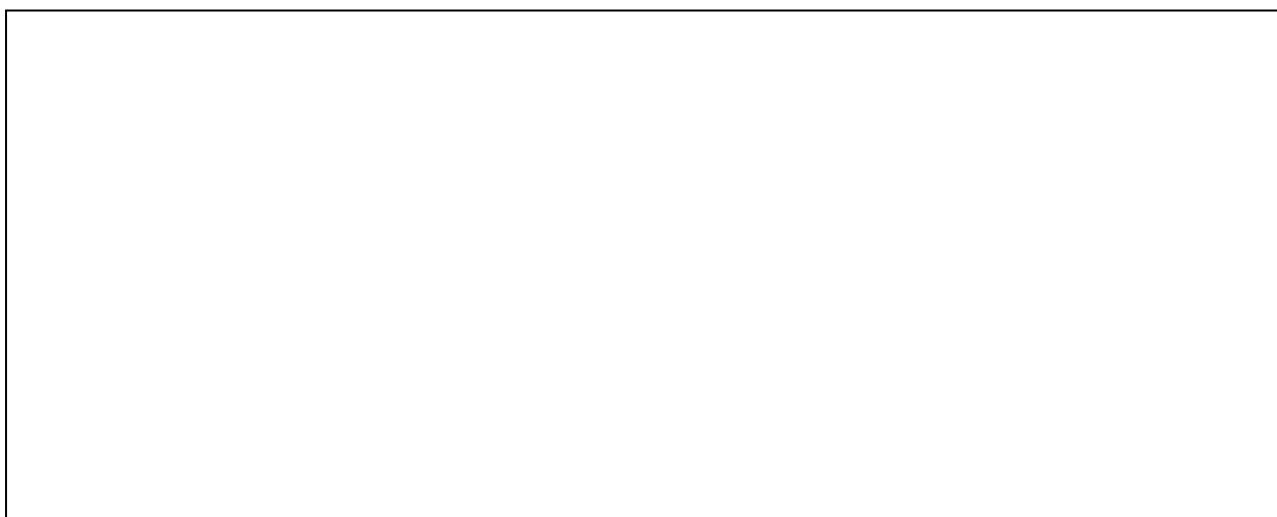
How is the structure of the guide? (E.g. the relation between pictures and text)

Is the guide easy to read?

Was there something you would have liked to learn more?

A large, empty rectangular box with a thin black border, intended for a user to provide a response to the question above.

Open feedback.

A large, empty rectangular box with a thin black border, intended for a user to provide open feedback.

