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PROJECT PAPER

FOOTWEAR DESIGN AS AN INTERVENTION TO ALLEVIATE POST LONG-DISTANCE RUNNING INDUCED FATIGUE

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SEPTEMBER 3, 2021.

DECLARATION

I, hereby declare that this project is my original work and has not been previously submitted to any other institution, establishment or university other than the University of Nairobi, School of the Arts and Design for academic credit.

Signed: ..... Date: 31/08/2021

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This paper is hereby forwarded for evaluation purposes with my consent as the supervisor.

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DEDICATION

I dedicate my project work to my partner and daughter. I am grateful for having you in my life and your support and love throughout this period of graduate school. I also dedicate this paper to my mother and father. You are my exemplars and thank you for always teaching me the value of hard work and encouraged me to go for the things that I aspire to achieve.

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ABSTRACT

Besides being one of the most participated in leisure sports activities, running is also the cheapest and most accessible, organized sport in the world. More and more people in the last decade have taken up the sport or running both professionally and for recreational or fitness reasons.

Running requires an amount of preparation and most often, consistent training. There are a number of measures and precautions that runners all over the world take to keep their running safe and injury free. About one in every three recreational runners will have a running-related injury at some point in their life. Besides injuries, runners are also wary about fatigue and muscle soreness. Fatigue is a natural consequence of exercise and hard work. If not optimized, fatigue and tired muscles can sabotage performance. Post-run exhaustion can disrupt the overall standard of life and work efficiency. Both professional and recreational runners need a smooth and timely recovery to be ready able to go on with their daily routine with minimum to no pain that may be due to a recent long-distance run.

There has been a great deal of medical and technological advances in running footwear. This study aims to investigate the potential value of recovery footwear in recovery optimization from the exhaustive fatigue that follows the completion of long-distance running. There is evidence that indicated that the specific-made recovery shoes promoted recovery from perceived fatigue. The researcher collected information from a focus group that comprised a team of a product development consulting group of three industrial designers from the Daniel Richard Design (DRD), a factory manager from a performance footwear company and two recreational runners. Questionnaires were also tools used to collect information from both professional and recreational athletes. It is evident in the results of this study that recovery footwear is very useful in conditioning for all types of runners. Recovery from exhaustion/fatigue could likely be accelerated simply by wearing lightweight, heavy cushioned and unbalanced recovery shoes during everyday life for people who run long distances for recreational, medical or professional purposes.

CHAPTER ONE

INTRODUCTION

1.0 INTRODUCTION

1.0.1 THE BACKGROUND

For a long time period of, performance footwear was considered as a characteristic of a luxurious life – both the capacity and technology to spend loose time engaged in sports referred to wealthy people only. Footwear for runners only became popular and accessible after the First World War. Running shoes have since changed from the rubber soled plimsolls to gel filled, air cushioned capsules worn as much for their looks as their sporting performance within the last century. In the 1960s, New Balance, a footwear company, launched what is now popularly referred to as the foremost modern performance footwear. They were the pioneers of technologically engineered shoes that provided better support to the feet. With this, the stage for the revolution that is the basis of the running shoe industry of today was set.

Science and research are now the guiding strengths at the back of all performance shoes. From exclusive designs that conform to every kind of foot shape out there, to specialty shoes that are used to provide care to an athlete's anatomical health, footwear has come a long way from its humble (and uncomfortable) beginnings. Except the general layout and shape, materials that are used to make those shoes have seen major changes, too. Sports fitness (2018)

Sports medicine and exercise science have immensely contributed to the evolution of running shoe design. They have not only allowed us to perceive the nature in which our feet strike the ground but also determined when humans under or over pronates. Most of these improvements now offer important insights into how to better and shape footwear. This is important in functions such as arch, ankle and toe support. Technology has also been responsible to the way we achieve grip in footwear through introduction of better tread layouts. Some shoes can assist in encouraging rectifying running form and aiding beginners towards a better way to run. More study keeps on divulging that all the aspects of footwear can benefit from advancement. Making footwear outsoles firmer or giving

users the option of a built-in air pump that is able to give their feet some additional cushioning is a good example of some of the efforts put in.

The world of footwear is constantly advancing and thanks to continual ebb and flow of creative changes, leaps in science and our comprehension of the human anatomy, they will continue to do so as long humans are lacing up and running for competition and recreation. (Metzler, June 2020)

1.1 BACKGROUND TO THE PROBLEM

About 30,000 to 50,000 strides are taken during a full marathon run. Each single instance that the human foot strikes the ground, pressure or strain 3 to fourfold of the human mass is soaked up by the joints, hips, knees, ankles as well as the lower back. In addition, after every stride, there are muscle contractions that move the body in a forward direction whereas others manage the motion level by being extended. The elongation or the contractions will be responsible for in damaging the infrastructure of the muscle. Therefore, the muscle inflammation as well as damage will last for a period between seven to ten days after an intense long-distance run race. (Hikida et al., !983) the restoration of fibers of the muscle fibers will normally last for a period between three to twelve weeks. It is unsurprising then that data taken from post long distance runs has revealed "stiffness or pain" in sixty-five to ninety two percent of people who run long distances (Satterthwaite, 1999).

According to Nkagawa, (2018) completing a long-distance run causes intense fatigue of the muscles. Post-long distance run fatigue can really cause disruptions in both efficiency in work and the general standard of life. Severity of fatigue has been considered in terms of social and health impacts, for example, injury, work days lost, loss of employment or military career and loss of health impacts due to long term reduction in physical activity for example, level of ability to continue to run or lost running days. Both professional and recreational runners need a smooth and timely recovery to be readily able to go on with their daily routine with minimum to no pain that may be as a result of a recent long run.

The type of footwear used after these long runs is key to promoting recovery from the fatigue induced by the long-distance runs.

1.1.1 STATEMENT OF THE PROBLEM

Complementing athletic shoe attributes with the functional requirements of the wearer is able to boost comfort in footwear, improve physical performance and bring down the risk of overuse injuries. Long-distance running being the most popular sports and physical activity means that more people are picking up running while the professionals continue to line up for long distance running. Fatigue and muscle soreness is very common post these long runs for both professional and recreational runners all over the world. Recovery period after intense physical activities such as long-distance running is highly overlooked and yet recent studies show it is key to performance and well-being. (Christophe Hausswirth, 2011).

For professional runners, they need to be able to recover under certain schedules and while some do, there are a few that have to cancel upcoming races and or competitions as a result of not being able to recover in good time. Recreational runners may face similar recovery problems as some for instance, being career men and women have to put on their normal work shoes after a weekend of long-distance running. This slows down their recovery and may compromise their quality of life. Therefore, a great demand for a simple and effective medium that will aid in recovery optimization from the fatigue and exhaustion that results after completion of long distance runs for all runners exists.

1.2 MAIN OBJECTIVE

This research's main objective is to alleviate post long-distance running induced fatigue through the design of a post-recovery footwear for runners.

1.2.1 SPECIFIC OBJECTIVES

1. To identify the side effects and potential harm of long distance running to the runner.
2. What are the potential interventions in shoe design for the alleviation of post-race stress from race induced fatigue?
3. To probe the benefits of post long-distance run recovery footwear from race induced fatigue
4. To use local materials in the design and development of a post-long distance run recovery shoe.

1.3 RESEARCH QUESTIONS

1. What are the side effects and potential harm of long distance running to runners?
2. What are the potential benefits of post-race recovery shoes from race induced fatigue?
3. What are some of the local materials that can be used in the design and development of a recovery shoe?

1.4 SIGNIFICANCE

This study aims to find out benefits of post-race recovery shoes and suggest their usefulness in conditioning for both professional and recreational runners.

The data collected in this study helps in fabricating a recovery shoe that will assist in recovery optimization from exhaustive fatigue that follows long distance running. This will make it available for a simple and effective method that will aid in recovery optimization from the fatigue and exhaustion that results after completion of long distance runs for all runners.

1.5 KEY WORDS

Footwear, Long distance running, Recovery optimization, Fabricate, Alleviate, Design

1.6 DEFINITION OF TERMS

Endurance - the capacity to withstand a challenging or unpleasant situation or process without giving way.

Fatigue (noun) – Great deal of tiredness that results from physical or mental or exertion or illness.

Alleviate (Verb) - make (suffering, deficiency, or a problem) less severe.

Performance (noun) – the action or process of performing a task or function.

Optimize (Verb) – this refers to making the most effective or best us of a resource or situation.

Recovery (noun) - A return to a normal state of health, mind, or strength

Phenomenon (A noun) – This refers to a situation or fact which is reported to happen or exist, most commonly one that whose explanation or cause questionable.

Fabricate (Verb) – The manufacture or construction of an industrial product and most commonly as assembled components.

Posture (Noun) - This refers to the position taken by someone that is able to hold their body especially when standing, sitting or moving.

Recreational (Adjective) - Relating to or denoting activity done for enjoyment when one is not working.

Biomechanics (Noun) – This refers to research of laws of mechanics that are related to the structure or movement of living things/organisms.

Blister (Noun) – This refers to a small bubble filled with serum on the skin and which is caused by burning/friction or other damage.

Metabolism (Noun) – This refers to a chemical process occurring withing living things/organisms for purposes of maintaining life.

Proprioception (Noun) - perception or awareness of the position and movement of the body.

CHAPTER TWO

REVIEW OF LITERATURE

2.0 REVIEW OF LITERATURE

2.1 INTRODUCTION

Several Books and articles inscribed by other researchers and professionals in this field of study make available for a deeper understanding of long-distance running activity, injuries and recovery from this popular activity. Therefore, this literature review exhibits the ways to commendably apply footwear design as a means of promoting recoveries from long run induced fatigue and injuries.

2.2 Long distance running

Running long distances has molded and refined the brainpower of humans for ages. Human researchers have presupposed that endurance running was used by the early men to seize prey. Through this, our ancestors were supplied with the necessary mating vitality (Reynolds, 2013). Running enables people to fully make use of their anatomic structure as it isa low-cost and high intensity exercise.

Lieberman, (2004) states that from the initial existence of the early man about two million years ago, people have continued acquired some features of the body that have aided them in the activity of running long-distances. Most of the attributes aid people conserve energy. The legs of humans for instance, comprise up of lengthy tendons that are spring-like which are joined to short muscle fascicles. It is this attribute that allows people to save energy every time they lift a foot off of the ground.

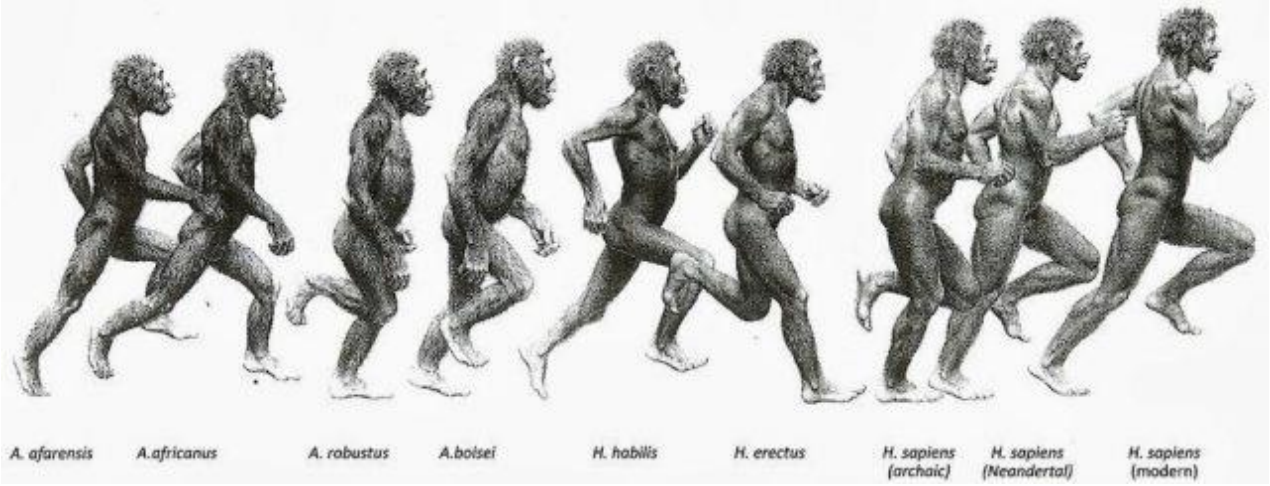


Figure 1: An illustration of running gaits of the early man – source Runner's World

Humans have the tendon of the Achilles which links plantar flexors to the heel in the foot. These longitudinal arches or plantar flexors, give back about seventeen percentage of the energy that is expended by the foot. Those attributes such as the spring-like assist in contributing to the stride lengths of two meters to three and a half meters which human beings are able to make. This then gives them the ability to cover long distances under shorter strides. Long lengths of strides can also be credited to human beings having long legs comparative to their body mass.

Although long-distance running has given human beings plenty of physiological benefits, there are still medical risks although most of them aren't long-term. A recent medical analysis revealed some complications faced by long-distance runners. Fecal incontinence, cramps, bloating, nausea and even blisters are some muscle issues that the runners reported. The same runners also reported experiencing gastrointestinal issues such as cramps, bloating, nausea, and fecal incontinence. The reported problems will mostly be as a result of a decrease in blood flow to the parts while seeing an increase in blood flow to the running muscles. This redirection of blood flow of working muscles is also responsible to reduction of renal perfusion. There is also the possibility of bronchospasm (EIB) that is induced by exercise that runners face. The EIB is a pulmonary problem. Airflow is broken for five to fifteen minutes after the starting out exercise activities.

These issues may become serious concerns for people engaged in physical exercises. Exercise-associated collapse referred to as (EAC) is however the most prevalent complication that is short-term and that long-distance runners have exhibited. A twelve-year study, in fact concluded that about fifty nine percent of post long-distance run medical visits are as a result of the EAC. This exercise-associated collapse is developed from exhaustion from heat. It is highly linked to extreme fatigue, sweating profusely, nausea, vomiting and headaches. (Lieberman, 2004)

According to Sanchez, (2006) being engaged in any type of physical movement can be a bit risky for the body and hence why the short-term problems exist as long-distance running involves an intense movement of the runner's bodies. Therefore, before engaging in long-distance running, runners are cautioned to always be aware of the such short-terms risks so that he or she can be fully prepared and have access for proper medical care in case such problems persist.

Although the short-term issues are not entirely avoidable, there are factors that show why runners can face the risk of experiencing such problems. In a study of medical problems encountered in long-distance running, the kilometers covered by runners who trained in a week correlated inversely with the injury incidence. In any plans aimed for long-distance running, these factors are important to consider. The gravity of these short-term deformities however is low enough and therefore there not enough to worry long distance runners such as marathoners. (DC Tonoli Cumps E, 2010)

Figure 2: Worn out athletes after an intense endurance run – Source: Getty images

In recent times, humans have assumed attributes for instance, longer legs which will help them be better at running for long; however, not faster. Endurance running still remains popular. Sanchez (2006), writes that slow running "became widespread in the 1970s when middle-aged men started running to reduce their risk of chronic diseases such as heart attacks and strokes." Unfortunately, some of the people who took part in this intense activity died. This then prompted questions and doubts as to whether long-distance running endurance was too arduous on the human body. In spite of this ongoing discussion on whether distance running is useful to humans or harmful, it still remains very popular and this continues to increase. Runner's world disclosed that between the year 200 and 2011, marathon participation increased by two-point two percent (Runners'sWorld, 26 February 2013).

Sanchez (2006) states that the impacts of psychology that endurance running has had explains its popularity growth. Maybe it is the advantages that long-distance running brings with it that continues to help in maintaining its prevalence. This has not only been the case since the early 1970's but also for many years prior. Therefore, competitive races

such at five kilometers, ten kilometers, half-marathons and full marathons will always remain popular and this growing trend will still be in effect many years from now.

2.3 The major side effects of long-distance running

2.3. Long-distance running Injuries

The Sports Medicine Journal (2012), in one issue, revealed that the general annual prevalence of injuries developed from long distance running falls between thirty-seven to fifty-six percent with gender- varying rates. There are additional papers and studies that have placed incidences of injury rates going as high as seventy percent. Most injuries resulting from running activities are generally referred to as repetitive motion injuries meaning that they were never brought about by mishaps such as falling down. Lower extremity injuries are the most prevalent injuries according to recent studies. The most common joint injury is the knee while low back pain (LBP) occurrence is similar in both runners and non-runners alike.

Thankfully, just a comparatively few long-distance runners have been injured while running and covering long-distances that prompted them to hunt for medical attention. Three percent of runners who completed the Melbourne Marathon in 1980 are reported to have experienced serious injuries such as hamstring problems, dehydration, knee pains, blisters and quadriceps pain according to a study by Kretsch (1984). In the Twin Cities Marathon within twelve years, the rate of runners getting injured was about two-point one percent. This is about 21.15 per a thousand marathon entrants. The most prevalent injuries recording included; exercise-associated collapse at fifty nine percent, blisters at nineteen percent, muscle pull at fourteen percent, cramps at six percent, and abrasions of the skin at almost two percent (Satterthwaite et al. 1996). There is a research that studied cramping of muscles in endurance runners and determined that electrolyte imbalances and dehydration are not responsible for the same, Maughan et al (1986.). Possible causes of these muscle cramps and strains during and after long-distance running could include irregular stretching, running farther or faster than usually accustomed and lack of proper

recovery. Other experts however feel that dehydration and electrolyte imbalances may play a role, however small especially in harsh conditions such as higher than normal temperatures (Eichner, 1998).

Apart from muscle soreness, some other runners have more health-related concerns especially which involve long-distance running. It was recorded, during the Wonderful Copenhagen Marathon in 1986 that gastrointestinal pain at twenty six percent, joint distress at twenty percent, muscle strains at sixteen percent, blisters and other skin lesions, all these at sixteen percent each, are the other health-related concerns that both professional and recreational elite long-distance runners experience in their practice, Holmich et al (1989).

Running a first long distance, being on full medication, illness in two weeks prior of a run, participating in other games and sports, illness during the two weeks prior, poor recovery post-run and training mileage, are other factors that are responsible for an increased rate of injury, Kretsch (1984) reports. People who ran less than sixty kilometers as pre-run training per week faced a far much higher risk of injury during the long-distance runs. An increased level of training increases the chances of getting injured on the hamstrings and quadriceps and hamstrings but also lowers the risk of getting knee injuries during long-distance runs (Satterthwaite et al. 1999). It is not shocking that twenty-nine to forty-three percent of runners get injured during training or after completion of a run. The number of injuries developed from covering long distances in a run about five to 10 times less whenever a runner trains well before race day. (Chorley, 2002).

Some of these injuries are typically because of variables that can be controlled. A great of them can be prevented. However, runners are less often aware when they are about to make a training mistake that may result to pain and injury. This may end up in losing training days as well as races and ultimately can unachieved goals. (Shatto, 2017). Below are some common injuries related with long-distance running.

2.3.2 Achilles injury

The Achilles tendon links the muscles in the calf to the heel. It is a fibrous band of tissue whose strength and flexibility are crucial for physical movements of the body such as jumping, running, and walking. During everyday physical activities, the Achilles tendon will endure immense pressure and stress. This is may be heightened during more vigorous athletic and recreational activities. It is referred to as tendonitis whenever it gets inflated or swollen. Achilles Tendonitis (AT) is mainly caused by the tightening of calf muscles whenever the Achilles is overworked. This can happen on many grounds. Common causes can be; overworking the calf, running too far too soon, and use of inappropriate footwear that twist the Achilles.

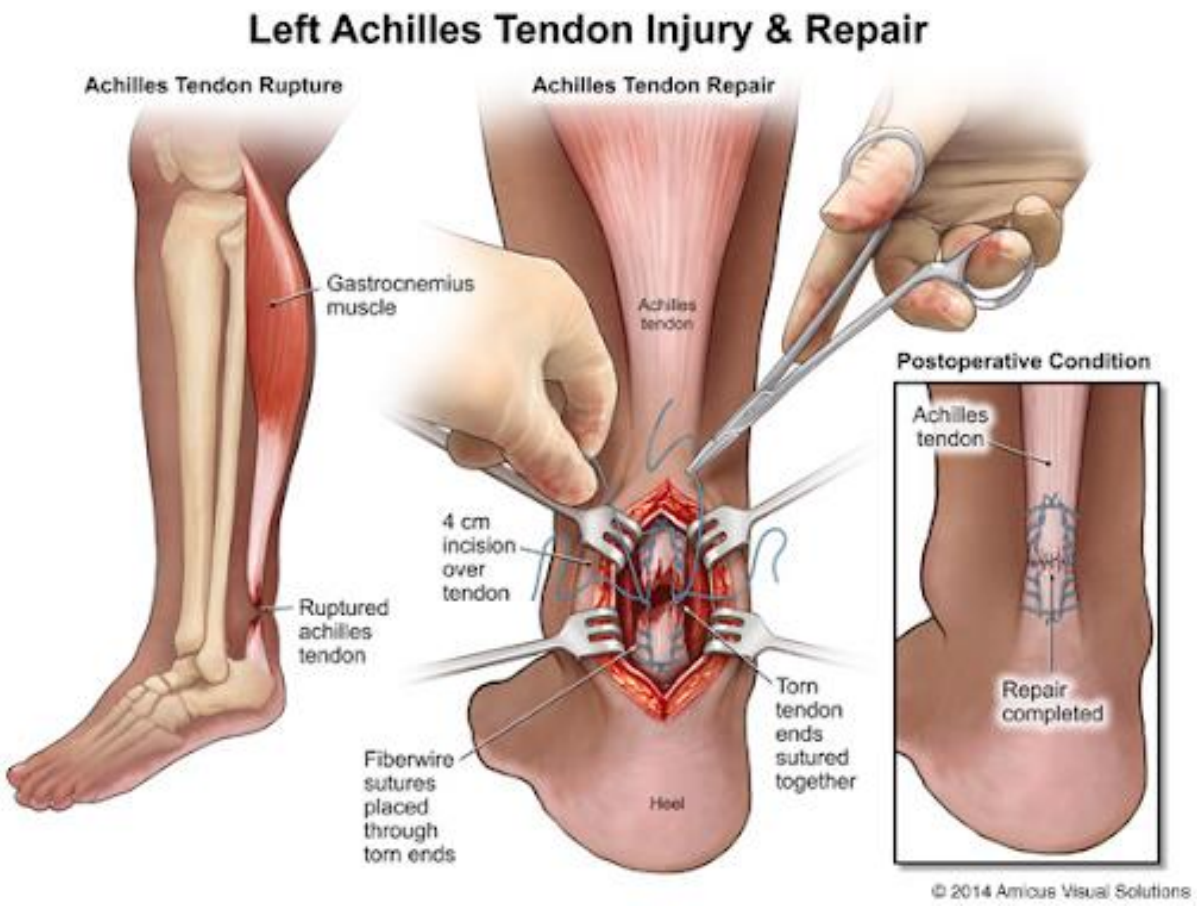


Figure 3:The Achilles tendon injury illustration. Source – Amicus Visual solutions 2014

2.3.3 Osteoarthritis

The link between osteoarthritis and running continues to be insufficient with the overall agreement being that less intense running is not a cause of either knee or hip osteoarthritis especially for healthy people. It is also reported that the joints may even be protected through running. However, there is a direct link between joint injuries and secondary osteoarthritis. Osteoarthritis is a kind of arthritis which occurs after wear-down of flexible tissues located at the ends. The protective tissue at the ends of cartilage wears down gradually but it gets worse over a period of time. The acute pain experienced may be mild or severe. Injuries experienced at the joints are prevalent in people who participate in endurance races or runs. The heaping up of hurt joints regularly can create

damage which after some time, may "deplete the joint of the lubricating glycoproteins, disrupting the collagen network, slowly wearing away the cartilage, and eventually cause numerous micro fractures within the underlying bones" (Tyler Childs Cymet, 2018)

Running while injured may lead to inferior mechanics of the body which ends up in dreadful injury. It is advisable then, for runners to always maintain good form and posture while running. Studies however reveal that using the proper form may prove difficult especially after covering longer distances. Runners with heavy body weights should be especially cautious of this nature of. This is because osteoarthritis in the joints is much more prevalent in people with significant mass of body. (Jake Emmett, 2007)

2.3.4 Pain of the joints

When joint pain is experienced, it is mostly as a result of the joint becoming swollen and this can make it difficult to exercise. Joint pain can be much more prevalent for runners who may choose to run more than usually done. The most common joints to experience pain due to running are the knees and this is because they have to take the majority of a runner's weight. (Connolly, 2017).

2.3.5 Injuries of the muscles

Injuries in muscles mostly come in several forms for runners. The most prevalent among people who run long distances are tears and strains of the muscles. A strain of the muscle is not as serious as a tear. Muscle tears are so serios that they can end one's activities or career in long distance running. Muscle strains can however also hamper one's training as they are very painful. (Connolly, 2017)

Muscle tears and strains are experienced when the fibers of the muscles contract too quickly or are over stretched. Such types of injuries are prevalent in the hamstrings and lower back. The signs may be experienced in pain, swelling, bruising and muscle spasms.

To avoid these tears and strains, medical expert's advice to rest one's body and if a slight pain or strain is felt. (Connolly, 2017)

2.3.6 Cramps

According to Connolly (2017), when muscles extra tighten and stay tight for some longer periods, it can cause serious pain. Cramps normally occur when one exercises more than usual. Calf is the most prevalent type of muscle cramp. It is close to impossible to engage in any physical exercise after experiencing this cramp and normally, the calf is tender for a long period of time after. Adequate rest is recommended after an intense work out such as a long distance run to avoid getting cramps. Sodium deficiency is a cause of muscle cramp and so adequate salt in diet is also recommended as it is an important electrolyte.

2.3.7 Fatigue

Fatigue is can be described as the decline in performance during an intermittent or interrupted physical exercise. When this happens, a runner may experience a decline in his/her performance and hence fatigue.

Either preparing for a long run or actually running a long distance, fatigue or exhaustion can be experienced if the exercise is uninterrupted and energy consuming. Some runners may overtrain or push their limits too far and this can end up in soreness sensations and deficiency of adequate energy. Fatigue can be preventable by not push beyond limits whether in training or during the distance run itself. Underlying conditions may additionally be factors causing unusual exhaustion. It is nearly impossible to fully recover from an intense long-distance run in a day (24 hours).

Figure 4: Zakayo, a Kenyan runner walks past exhausted colleagues after a competitive long-distance run Source: Global times 2019

2.3.8 Other Injuries

Besides overuse injuries, endurance runners may also experience collapse of their muscles, muscle strains, exhaustion or blisters. Many long-distance runners experience some sore sensations of the muscles. Some elite runners have also been reported to experience joint pains and even gastrointestinal distress. Recent reports indicate that twenty-nine to forty three percent of long-distance runners get injured mostly while training for race day. Rate of pre-long distance run and post-long distance running injury increases as weekly mileage increases

Running is known to bring with it profound benefits. It reduces the chances and the risk of diseases such as diabetes, mellitus, mellitus and cardiovascular disease. Running can also help reduce the chances of depression. Bone density reduction which aids in weight control is also another benefit of running. (Jake Emmett, 2007)

We refer to most injuries developed while running as *overuse injuries* and these may be as a result of errors made while training or preparation. The variables may include the following; the frequency of the runs, the speed or tempo, the distance covered and

duration of the run. Lack of proper recovery and flexibility and unfitting running s terrains and incorrect footwear are also some other causes of injury. Majority of injuries developed while running connected with a ‘repetitive motion injury’ and may seem to appear having multiple causes in nature. Because majority of variables are manageable, injuries connected to running should be considered preventable and treatable!

2.4 Injury preventive footwear

Recent studies suggest footwear emerged around thirty thousand years ago. Only until a century ago was footwear revealed to be altering the human foot shape. Earliest performance athletic footwear was made of leather, which unfortunately wore out very quickly and showed proneness in stretching when wet, and was therefore not the best material for making footwear for human wear for long periods. In addition, the earliest running shoes were not designed to support an athlete’s joints and absorb the shock from impact. The risk of injury was therefore really high.

Figure 5: Above footwear is regarded the oldest athletic footwear and dates back to the early 1850s. Source – Bata shoe Museum)

There were several changes when rubber was getting used in industries and humans connected a rubber sole with a canvas upper in the early 1890s. Light-weight, flexible and flat-bottomed, this new footwear let wearers walk in it silently. Its name “sneakers” was taken from the verb “to sneak”. (Hirsch, 2015)

Figure 6: A photograph from 1917 showing converse high-top sneakers. Not much has changed in the overall design of these. (Source - American Federation of Arts)

Since the early 1970s, softer running footwear has been greatly associated with physical exercise. Studies reveal that the skin, nerves, tendons and ligaments of the foot send information to the brain and spinal cord when the feet hit the ground. This may include tension, stretch and pressure. The quality of this knowledge allows the precise management and movement of joints into positions which will help in limiting injury by absorbing immense pressure. (Francis, 2020)

In the early 1970s, the foremost cushioned and mass-marketed running footwear was designed and fabricated. These pairs were circulated as shoes that could prevent injuries sustained in running. In the 1980s, “Better running shoes” were proposed as a cause for the lessening of the occurrence of Achilles tendinopathy in one study and “poor shoes” were suggested as a risk factor for stress fractures in another study. (Francis, 2020)

Francis, (2020) proposed that shoes may limit the nature of information that is conveyed to both the spinal cord and brain. This leads to poorer running mechanics. Footwear allows wearers towards landing in upright body position and extended legs. This leads to

sufficient braking forces. Those running techniques definitely contribute to some of the most common injuries among runners.

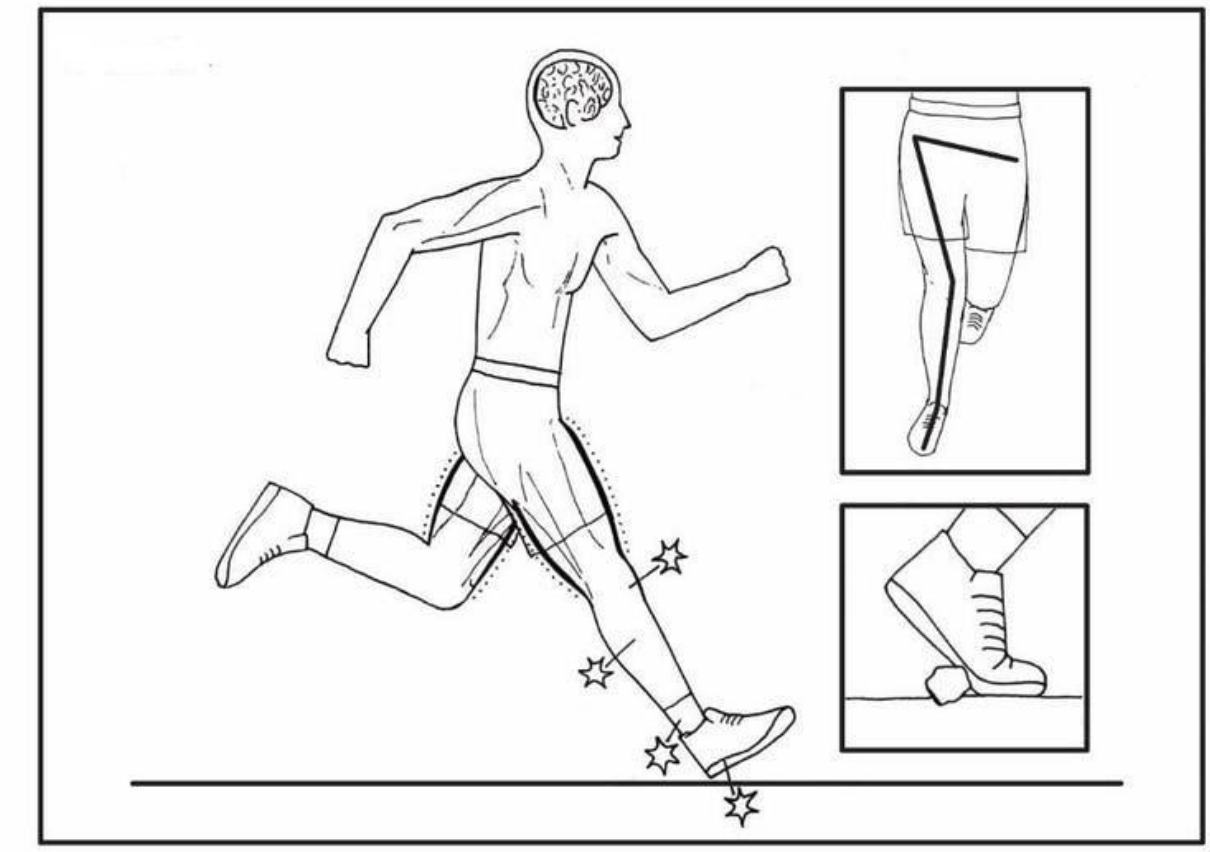


Figure 7: An illustration showing how footwear can lead to blunt running mechanisms. Source – Francis Peter

Occasional and long-term use of the incorrect footwear can lead to weakening of the feet and sometimes, collapsed arch. When we start walking or running in footwear, our feet are not adapted to cope with some of these mechanics. Experts therefore advice appropriate use of footwear for specific purposes.

2.5 Designing to minimize discomfort

Pressure at the human interface has received considerable attention over the years because it can cause injury, pain and discomfort and since it should also improve comfort. After we wear clothes or shoes, sleep on a bed, sit on a chair, use a headset, use hand

tools during manual work, or use arm rests or elbow supports to scale back muscle fatigue, the forces that these altogether sources and implements exert on the body vary but in all cases act on limited areas.

Even though forces on the physical body are unavoidable, comfort in many cases seems to be obscure and definitely is not guaranteed. Comfort can be described in very many ways. (Hertzberg, 1972), describes it the scarcity of discomfort. It has also been described as the sensations of relaxation and well-being. Whenever designers work to create a product, be it a headset, arm-chair, bed or shoes, forces and pressure are key features that each product will hope to distribute effectively. Shoes are no different. Pressure at the human interface get so much heed because it can be responsible for pain, injury and discomfort. A recent study detected inferior biomechanics that can convert comfort into discomfort. (Zhang, 1996)

2.6 Shoe ergonomics

Just like any other product that is designed withing the right ergonomic like bed, chairs and headsets, shoes are also made with correct body symmetry in mind. Different nature of shoes will be designed with the full purpose in mind however. For instance, tennis shoes will have a different feel and look to cycling or running shoes. For running footwear, most brands and manufacturers design with the running or walking gait and posture in mind. They are also made for the sensation of barefoot walking on soft ground rather than on concrete. This is because soft ground mostly matches the conditions that our feet were initially made for. (Morgano, April 2010). Shoe brand and manufactures may produce shoes in different technologies and styles but they all have more or less five basic goals. These are; to relieve any back pain, to improve spinal alignment and posture, to distribute body weight efficiently, and lastly, to tone the lower limb muscles.

2.7 Design intervention for recovery post long-distance running

It was not until the 1970s that shoe designers began to make footwear with the aim of enhancing athletic performance even though humans had been running for many years before then. Footwear with an elevated heel, a stiffened midsole, arch support and heavily cushioned has completely changed biomechanics in running and altered the way humans walk and run. This has taken place in just a span of just forty years. These developments have also seen brands and manufacturers start to view the athletic performance as a result of many stages of an athlete starting from the training, race day and the recovery period. Before some of these advances, traditional footwear had been unable to decrease the incidence injuries from long-distance running.

Effectively using the correct footwear for the right cause has been shown to improve full recovery and enhance comfort while also reducing the incidence of injury. Today's footwear includes a variety of attributes. These are bottom flares, heel counters, crash-pads, and hardness. All these attributes can be fine-tuned or changed individually to match the features of the final footwear. It is therefore possible to design footwear with recovery optimization in mind and this can include several characteristics or features such as the heel-to-toe transition, the stability, cushioning and the energy return.

2.7.1 Parts and material choices in design of recovery footwear

Performance shoes may have as many as 20 parts. These may vary depending on the nature/purpose of the shoe and recovery footwear is no exception. For example, a trail shoe is going to have a completely different look and fit compared to a shoe made for recovery post a long-distance run. Typically, any form of footwear has an upper and bottom. The upper is the topmost part of the shoe and wraps the foot on the sides and the top. The bottom is the part attached to the upper but on which the feet lay on. It is also the part that comes to contact with the ground.

As the upper is a soft part that mostly takes the shape of the human foot, there are only some materials that can be used to make it. These may include; engineered mesh, knit thread uppers etc. Each material is picked because of the features it brings to the footwear

and so different nature of footwear use different type of materials. One important feature is the breathability of a shoe. This refers to the aeration of air to the foot of the wearer. The mesh will provide this feature while a knit upper will bring with it a sensation of chafe-free and a synthetic leather will prove to be durable. Breathability will be a great feature in design and fabrication of a recovery shoe as mostly, the feet of a recovering runner require enough room and sufficient aeration during the entire recovery period.

The vamp is one the parts of the upper and is responsible for giving shape to the footwear. In doing this, it forms the toe box. The throat is attached next to it. This is the part of the shoe that holds the eye stays which then forms the lacing part or section. Under the eye-stay and laces, is a part that looks and out like a human tongue. It is therefore referred to as the tongue and is meant to cushion the feet from the tightness and rubbing off of the lacing just above it. The tongue is also the part that wearers pull up in order to put on the shoes.

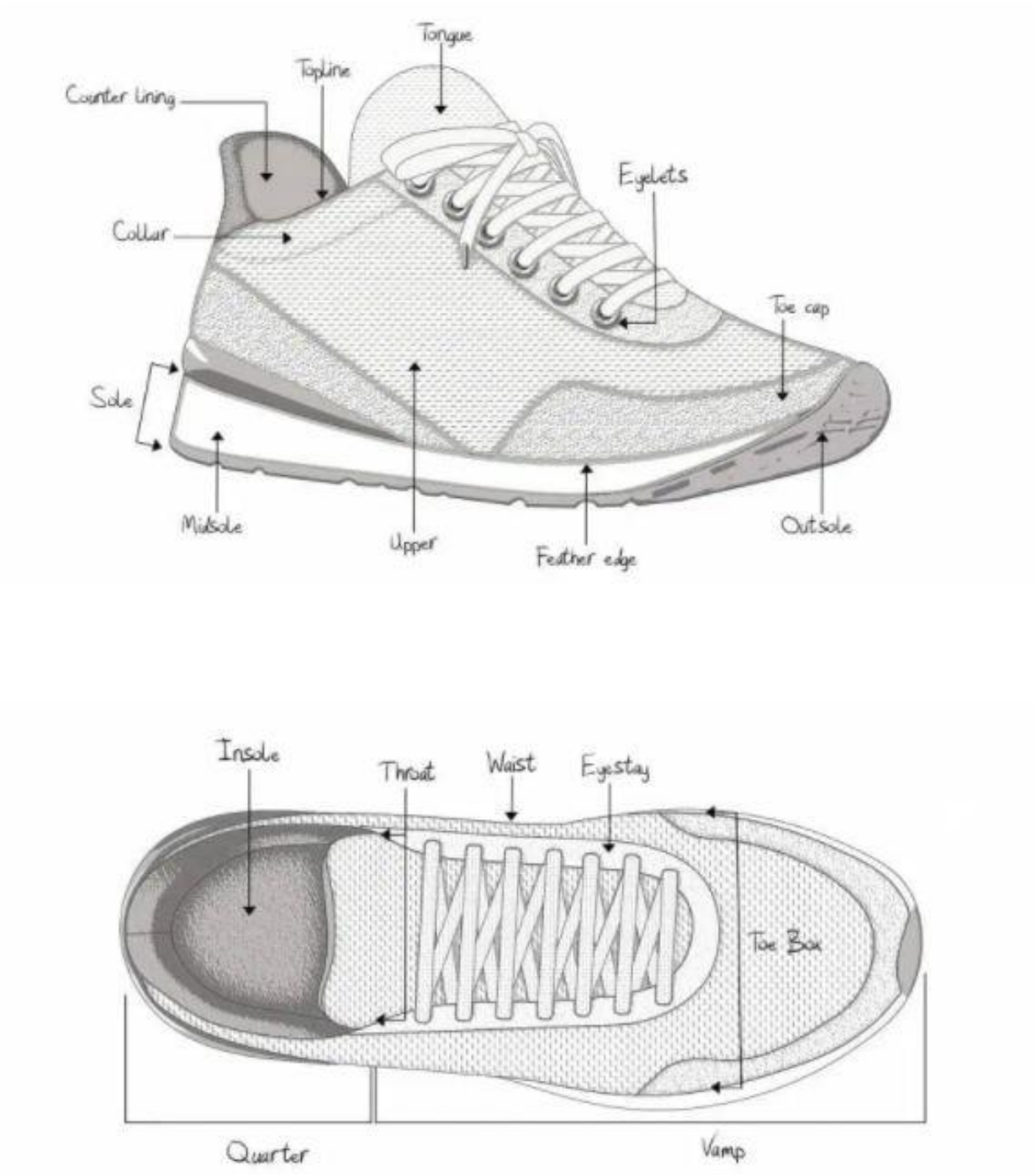


Figure 8: An illustration of the main parts of a shoe – Source Shoe Guide

There are reinforcements attached tio the vamp of the shoe are the sides. These reinforcements are meant to give the upper a definite shape and will be referred to as

saddle if they inside the shoe and arch bandage is they are at the outer side of the shoe. The collar part of the shoe is located at the very back. It is a soft lush padding and is meant to give protection to the Achilles tendon. Beneath the heel collar is a curved rigid part referred to as the heel counter. This part which is not flexible surrounds and wraps the back part of the wearers' foot. It is a very important part of the upper as it offers protection to the feet from impact forces during the wearers movement and especially running.

The bottom part or the shoe is made up of three main layers. These are midsole, insole and outsole. Midsole is generally a layer of rubber or technical foam between the upper and the bottom of the outsole. This is the part that cushions the foot and its features, materials or density will vary among brands and manufacturers. The insole, which is normally a thin layer of foam or rubber, sits on the midsole and can be sometimes removable, depending on the type pf construction of a shoe. It is mostly made from a technical foam referred to as ethylene vinyl acetate (EVA).

The bulk of cushioning and absorption of shock will mostly be provided by these two parts for recovery footwear. Ethylene vinyl acetate is the most common foam used in fabrication of performance or athletic shoe midsoles. Polyurethane is the second most popular compound but it is heavier but more durable than the EVA foam. EVA form compresses and breaks down quicker therefore it may lose its rebound property. There are fewer performance type of shoes in the market with PU compound as the material used in the midsole than EVA. In recent years there has been a development of newer technology for making midsoles such as airbags or GEL. All these advances are aimed at enhancing protection, decreasing the weight of the shoes and increasing their durability.

Figure 9: A daily trainer shoe made of a knit upper and EVA midsole. source: Enda Sportswear

The bottom part of the shoe known as outsole is the one that strikes the ground. Traction and durability are therefore the most important features that shoe designers and brand consider in the making of these parts. The outsole is mostly a layer of carbon rubber with tread. The tread offers traction and therefore it is a key aspect to keep in mind when designing a recovery shoe as this heavily contributes on the stability when walking or jogging during the recovery period.

Figure 10: Photo showing a rubber outsole of a performance shoe. Source: Enda Sportswear

2.8 Shoe cushioning

Shoe cushioning is not a new phenomenon. It has been studied extensively as a footwear feature that can improve the wearers experience and comfort. Studies show that shoe cushioning plays a big role in preventing running injuries especially since there is always a repetitive loading of the musculoskeletal system during this physical activity. The material used in design and fabrication of performance footwear determine the properties for shock absorption for that particular footwear. These properties include; the density, structure, type and combination. The thickness of the midsole and nature of the insole also plays a big role in the cushioning of footwear.

Altering the hardness of the midsole is regarded as a very popular way approach by shoe designers and manufacturers that ultimately determines the level of cushioning for footwear. Most running or athletic shoe will have softer and low-density midsoles and insoles. Generally, researches in the field of footwear probed shoe cushioning consequences on vertical ground reaction force but did not provide results that were consistent. The peak impact forces can be lowered in soft cushioning footwear as confirmed in the researches. A recent research showed that midsoles which are softer were linked with higher vertical force impact peaks. The midsole is therefore a shoe feature that cannot be ignored in any design of a shoe meant to optimize recovery especially from intense physical activity involving the lower part of the body. The shape, density and structure will be key properties considered in the making and fabrication of an ideal recovery footwear.

2.9 Impact and recovery footwear midsoles

Bates (1979), writes that the increasing number of people starting up running has led to an increase in the reported number of running injuries. This has prompted interest in the field of study of injuries and their correlation to shoe design and the running kinematics. The human anatomy during running or walking activities, experiences impact forces. This leads to pain in the lower back and consequently, running injuries especially for long distance runners. (Clement et al., 1981; James et al., 1978). Reduction of impact forces is therefore a very crucial axis of study in the field of recovery footwear design and fabrication. One of the reasons is the necessity to boost tuning of muscles and comfort while walking or running after an intense activity such as long-distance running.

This study's objective is to develop a practical and uncomplicated medium that will help optimize recuperation from long-distance running induced fatigue through the design of footwear. The work also takes into account the impact or strike of the human foot on several surfaces and aims to suggest and use an appropriate midsole for the heel. Examples of footwear and applied techniques that best fit the profile above are described in detail below.

2.9.1 Rocker-sole shoes

Rocker sole or bottom footwear's soles are thicker than the normal flat shoes and have a heel that is rounded. They can be referred to in a variety of names. They may include: toning shoes, round bottomed footwear and round/end sole shoes. They are also known through various brand names. These types of shoes aid in ensuring that the wearer has no flat footing along the proximal-distal axis of their foot. Carter (July 2010),noted at more than five different types of rocker sole footwear and gave them the following names; rocker bar, mild rocker, only-toe rocker, heel-to-toe rocker, negative heel rocker and the double rocker

The rocker footwear's curved sole helps in improving human spine alignment and also reduces pressure. The shoes are constructed with outsoles that are contoured and includes three features; apex position, rocker angle and apex angle. Their curved sole looks like a rocker and that explains the origin of the footwear's name. A previous study revealed many medics prescribe the rocker shoe to help curb in-shoe pressure. (Chapman J, 2013).

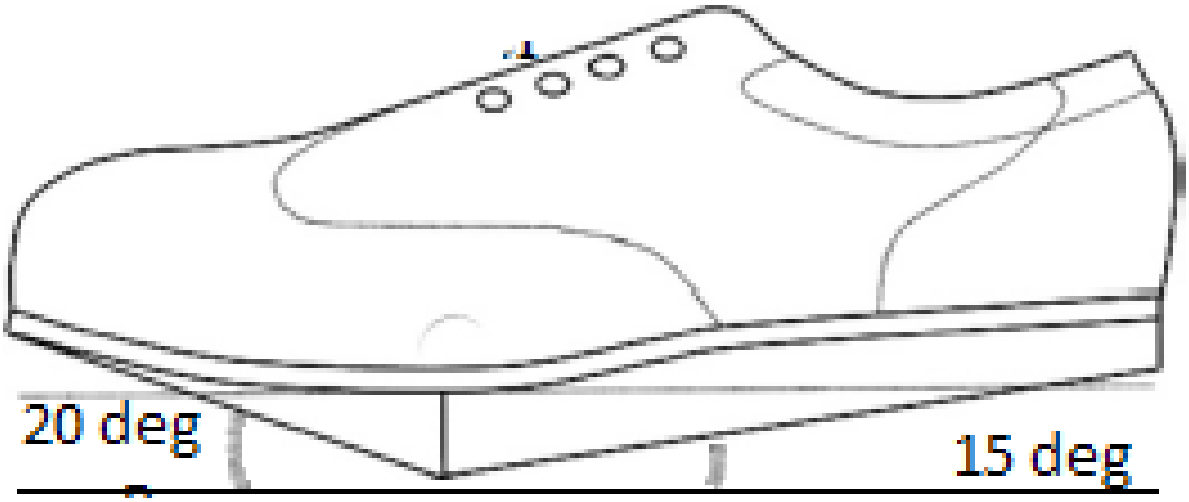


Figure 11: The heel rocker embedded in A rocker shoe. Source: Kayvan

Rocker-sole shoes determine the body weight shift just behind the ankle of the foot. In this case, a wearer of such footwear does slightly more work than in normal flat-soled footwear to remain balance and find their center of gravity. Actually, The Maasai people of North Tanzania and South Kenya, have since many years ago worn simple unbalanced footwear and sandals to walk on several terrains.

Figure 12 A maasai Tribesman in a rocker-sandal – source: Sub-Saharan Africa-History of dress 2010

Madden (2012), suggested wearing in heel rocker shoes reduces greatly the knee adductor moment unlike while wearing the regular shoes. Therefore, internal forces of the knee can be reduced through wearing heel rocker shoes. This is because the effect of rocker sole footwear on the lower limb joints kinematics and kinetics divulged that this type of footwear mostly affects knee and hip joints which are referred as proximal rather than the ankle joints, referred to as distal. The rocker-sole footwear in the market was

made popular by shoe brands such as Shape Ups, Easy Tone and Maasai barefoot technology or MBT, during the early 2000s.

2.9.2 The Maasai Barefoot technology (MBT)

MBT is based on a single concept: that the human foot is created for walking barefoot on soft ground. The shoe features an anterior-posterior curved rocker-bottom sole that has a drastic heel slope and a more graduate forefoot slope. These shoes were originally intended to simulate barefoot walking on uneven surfaces, writes Romkes (2006). The recommended benefits of this type of shoe include promoting a more upright posture during walking, a training of lower extremity muscles and joint proprioception (Romkes, 2006). It is not surprising that this technology draws great inspiration from the Maasai tribesmen. (Hamilton, 2011).

Figure 13: The Maasai tribesmen of East Africa in a ceremony – Source; Wikipedia.org

The East African semi-nomadic tribe have remarkable athletic ability which seems to be as a result from walking on soft, natural ground and having to balance their bodies with each step. A study has shown them to have reduced cadence, stride time and length, dorsiflexion at toe-off and step length, and single support time, walking speed, increased contact dorsiflexion angle during walking. (Romkes, 2006)

The Maasai Barefoot technology footwear was designed as a medical shoe. It is a slightly unsightly, bulky shoe, with a substantial thick sole that is curved from front to back, wich forces a pronounced heel-to-toe walk. The MBT concept has been greatly analyzed in terms of footwear-induced instability. The action from unstable rocking is thought to simulate the natural instability of walking over undulating ground and therefore enhance beneficial muscle strengthening. (Otter, 2010)

Figure 14: The MBT shoes – source Shoe Med 2020

Nkagawa (2018), suggests that wearing MBT shoes increases activity in lower limb muscles, including the triceps surae, quadriceps, tibialis anterior, and other smaller muscles. The forces that could be exerted by the knee extensor and plantar flexor decrease after long distance running. This suggests that, the plantar flexor and knee extensor muscles reveal compromised function and subjective fatigue following long-

distance running. One possibility is that by using the MBT shoes, the activity of the fatigued muscles is enhanced. This activity will mostly aid in an 'active recovery'.

Normally, exercises that require a higher intensity (active recovery) after exhaustive exercise promote better recovery from fatigue as compared with passive recovery, which does not involve specific exercise. Also, since wearing MBT shoes improves the angle of dorsiflexion, a stretching of the plantar flexor muscles might be an occurrence. Therefore, wearing of these shoes would be expected to enhance lower limb muscles stretching and thus promote the activity in these muscles. Recreational activities will also involve exhaustive exercise and can therefore cause strong fatigue. Recent studies show that the MBT shoes are useful in optimizing recovery when they are used during everyday life.

2.10 Barefoot walking & running

According to Nicholas (2013) Barefoot running (fig15) has been shown to give benefits to runners through lay media and also scientific publications. The potential for reduced incidence of risk is one of the most common benefits. The others include more economic running and faster recovery post long-distance running. The interpretation of theories of science into popular lay publications has greatly contributed to running barefoot being a popular topic of discussion not only for clinicians but also for scientists and runners. Recent research indicates connection between running barefoot and enhanced running economy. It is however widely accepted to be the result of a decrease in mass due to absence of footwear. On the other, it is recommended to be as a result of the outcome of elastic acquiescence from the human feet and the impact of footwear design on gait.

Recently, Liberman (2012) supports the theoretical basis for walking or running barefoot, and concludes that human beings evolved adaptations to optimize walking or running barefoot, and that the biomechanics of such a style would highly reduce the impact peaks while increasing proprioception and strength of foot and therefore aid in preventing injury regardless of the choice of shoes. There is no sufficient evidence proving or refuting the recommended advantages of running barefoot, however. Such evidence will

need to be backed by long-term longitudinal studies and further understanding of the biomechanics and implications of running barefoot.

Figure 15: A runner runs barefoot in a marathon - Source: The Washington post

2.10.2 A barefoot recovery

Staying barefoot has become a very popular, this is mainly driven by its increasing prescription as a means of reducing injury risk and optimizing recovery. Proponents of walking or running barefoot report evolutionary theories that endurance running ability was crucial for human survival and proof of the benefits of running natural. Eventually, runners have been advised to stay barefoot after intense physical activity as a treatment mode for strength, injuries and conditioning. (McDoughgal, 2009)

After a long-distance run, most runners such as a marathon race, some runners report swollen feet, minor blisters, and inflamed muscles from the strain of the run. The most conscious action to take is taking their footwear off and staying or walking barefoot. This has been studied as a method for optimizing recovery as the runner's feet can now breathe and make use of their small intrinsic muscles. Rodenburg (2020) writes that being barefoot after an intense physical activity involving the lower part of the human body is a time to train the feet. A well-rounded strength program focusing on all the muscles that are involved in absorbing the forces associated with impact in running should be performed, and that includes the foot.

However, spending all day barefoot, as many may be tempted to do so especially if they work from home, increases stress on the feet. It is also impossible to stay barefoot throughout the recovery period for career men and women as the formal dress code does not condone going barefoot to work. It is therefore not a sustainable way to help with recovery post long-distance running and a better solution should be presented. Some key points from barefoot such as breathability and free movement of toes can however be carried on into the design of post long-distance recovery footwear.

2.11 Conceptual framework

Running induced fatigue and injuries have a societal and individual economic impact through loss of productivity and associated costs of health care and can lead to a reduction in physical activity entirely. As there is a clear link between regular physical activity and increased health and well- being, running- related injury prevention is an important public health issue. Running injuries can also negatively impact professional populations in ways like work days lost, loss of unemployment and unpleasant physical activity experiences. Fig 13 shows a conceptual model indicating that since endurance running must be present for injury to occur, recovery gear and characteristics must be considered a necessary period/tool to optimize a runners' running experience and aid against injury development.

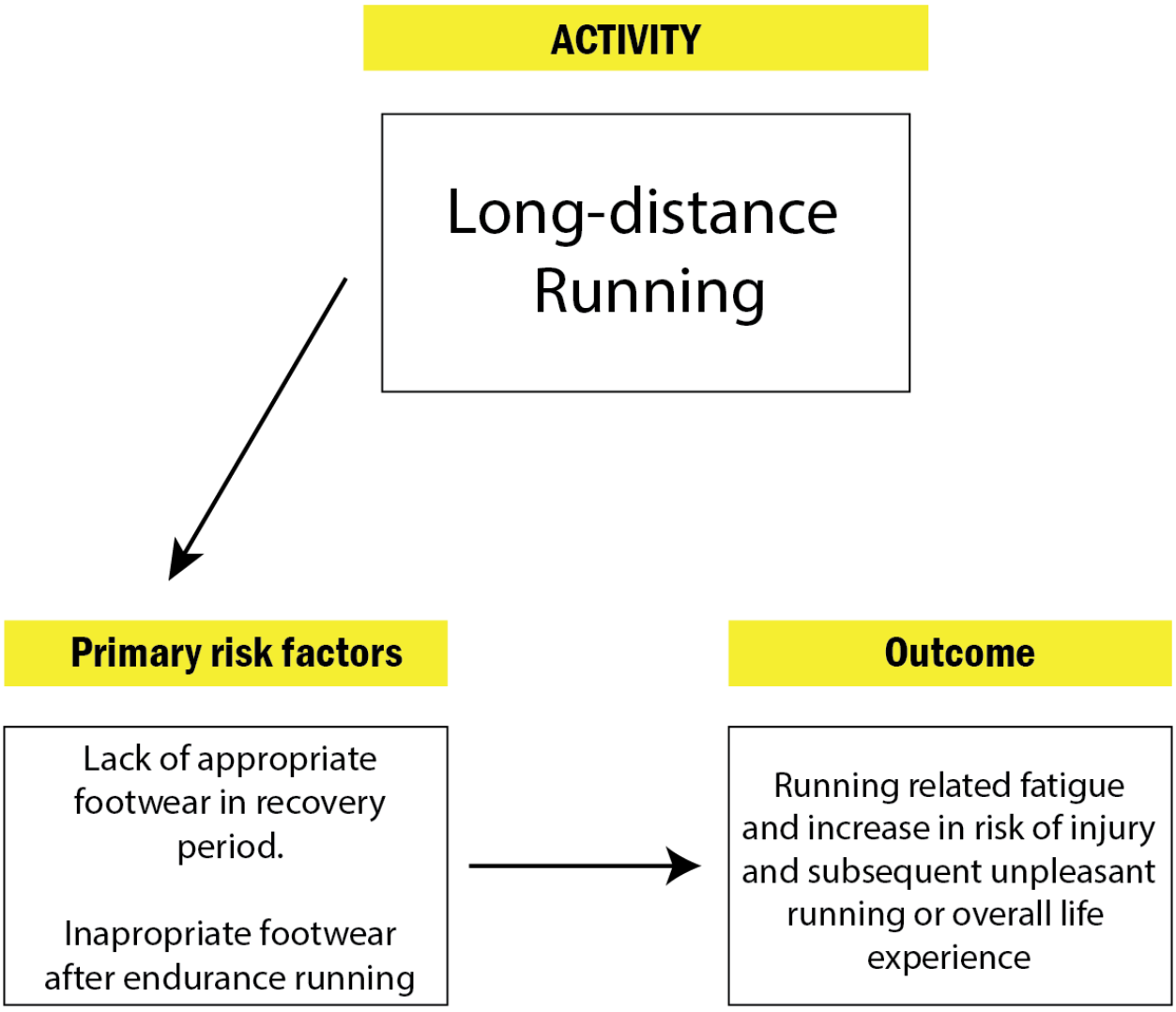


Figure 16: conceptual model showing relation of variables associated with running induced fatigue & injury

CHAPTER THREE

THE RESEARCH METHODOLOGY

3.0 RESEARCH DESIGN

This study used both Qualitative and quantitative methods in collection of data. The main sources of information in the study are both recreational and professional runners as well as experts and professionals in the field of footwear design and development with a focus on the running category. The study also involved wide research in literature in a bid to understand specified topics in endurance running and performance shoes. With the issue in question being recovery from long distance running gear, most specifically, footwear, previous articles and research paper written on similar topic in performance footwear design and development proved helpful as sources of information in the research.

3.1 TARGET POPULATION

The study's population comprised of both professional and recreational or casual runners. Key stakeholders in performance footwear design and manufacturing also contributed to the study through a focus group instrument. They included; a product development consulting group of three industrial designers from the Daniel Richard Design (DRD), a factory manager from CISA and the COO of a Running shoe company (Enda Sportswear).

3.2 METHODOLOGY

The methodology in this study takes a systematic approach, applied to the field in question. It comprised of the theoretical analysis of the body of methods and principles used to study the discipline of endurance running, recovery and shoe design. According to Springer Boston (2005), it encompasses concepts such as paradigm theoretical model, phases and quantitative or qualitative techniques.

3.3 TOOLS & TECHNIQUES USED IN DATA COLLECTION

The collection of data in this study involves the process of amassing information from all the relevant sources i.e., performance footwear industry stakeholders, professional and recreational runners to find answers to the research problem and evaluate the outcomes. The researcher collected information on endurance running, recovery and footwear from both professional athletes (7 athletes signed by Enda sportswear) and 42 recreational runners by use of questionnaires, a quantitative data collection instrument. The qualitative methods applied in this study gives an understanding to the problem while also developing effective ideas and hypotheses.

The researcher also collected information on the subject and problem through a focus group, a qualitative data collection instrument that comprised key performance footwear stakeholders. The qualitative research as practiced here is used understand the underlying opinions, motivations and reasons. A focus group is the primary instrument used in collection of data in this study with the researcher being the data gathering instrument. A focus group was created by the researcher in a bid to collect knowledge on the subject through interaction with experts in the field that included a product development consulting group of three industrial designers from the Daniel Richard Design (DRD), a factory manager from CISA and the COO of a Running shoe company (Enda Sportswear).

Research tools in any scholastic research refer to the mechanisms, which are used for collecting data (information) from respondents. According to Nkpa (1997) the comprehensive and widely applicable methods are Questionnaire, Interview and observation.

With this mixed methods research method, the researcher was able to understand what practices are undertaken by runners after long distance runs and how they positively or negatively affect their recovery from fatigue, with a focus on footwear.

3.3.1 FOCUS GROUP

The researcher used/ created a Focus Group to collect data in a bid to collect knowledge on the subject through interaction with experts in the field. A group of people were selected using convenience sampling to discusses topics in-depth based on a research guide. It was facilitated by the researcher who moderated the discussions (Appendix B). He ensured that all the respondents were given an ample opportunity to speak and that group thinking did not take place. The focus group comprised of a product development consulting group of three industrial designers from the Daniel Richard Design (DRD), a factory manager from CISA and the COO of a Running shoe company (Enda Sportswear). Three of the participants are also active recreational runners. The focus group online meetings were held weekly every Tuesday 4:30 EAT / 11:00 AM USA in five sessions. The first session was conducted on 9th March 2021 with the last one taking place on May 25th 2021. Each Focus group meeting lasted for 60 minutes with further 30 minutes of the researcher gathering notes and points from the recordings. The main aim of the focus group was to find answers to the "why" "what" and "how" questions from key stakeholders in the performance footwear industry. This method proved very useful when it came to market research on new products and testing new concepts.

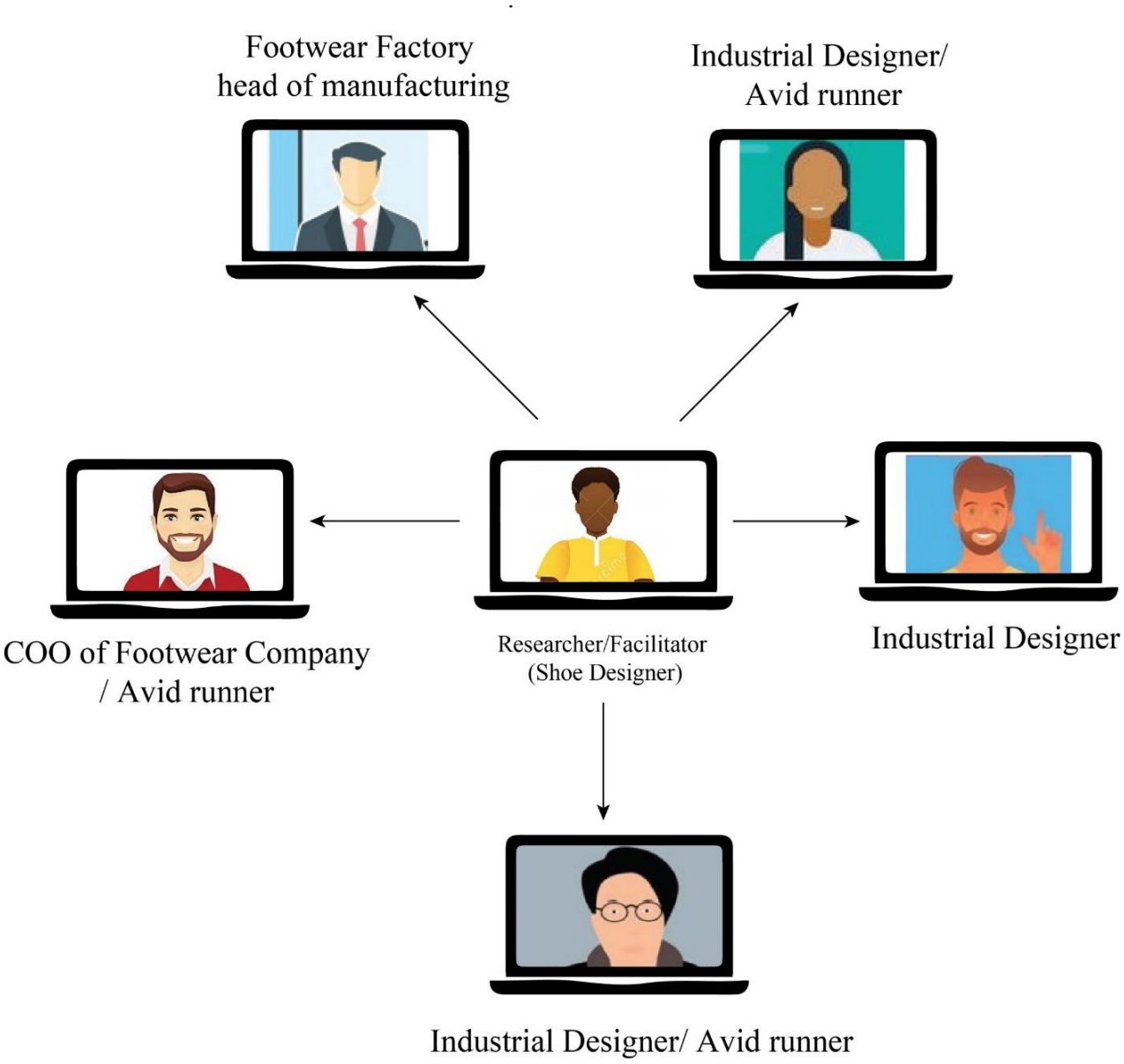


Figure 17: Illustration of the focus group set up

The researcher sought to gain insight from these interactions which is imperative to creating great design. The focus group discussions helped to get the participants' perceptions, experiences, practices and attitudes during the interactions. The technique used helped to identify and clarify shared knowledge among the group, which would be tough to get through individual interviews. The group allowed the researcher to solicit all

the participants' shared views and differences from their own opinions, worldviews and experiences in their fields during the open discussions.

3.3.2 QUESTIONNAIRE

In this study the reason for the use of the questionnaire as an instrument for collecting data was its efficacy in collecting statistically quantifiable information, its simplicity in nature, it provides necessary anonymity, it allowed for gathering of information from larger audiences, gave analysis and predictions. It was also an efficient tool. A large number of respondents can be reached within a relatively short time period. A questionnaire was handed out to seven professional athletes signed by Enda Sportswear company and who are herein referred to as Enda elite athletes. Further online copies were sent out to forty-two (42) runners majorly, recreational from all over the world gathered through a popular running application, *Strava*. This enabled the researcher to gather insights and collect data from a wider population.

3.4 DATA ANALYSIS

The researcher gathered information from the two instruments used after the data and information was collected. Numerical observations were entered into a chart and table, organizing the data in ways that make them easier to work with. From these, the researcher identified patterns, interpreted the runner's choices and experiences or other communication, and spotted trends which assisted in meeting the objectives of the research.

3.4.1 Data Presentation

The researcher after organizing the data collected and interpreting it, came up with presentation methods to explain the findings. This as shown in the next chapter, includes graphs, histograms, tables and pie charts.

CHAPTER FOUR

FINDINGS

4.1 FINDINGS

The quantitative data in the research was collected through the use of questionnaires. Each questionnaire comprised of 10 total questions and printed in two pages for the *Enda* athletes and sent as google forms to runners from *Strava* (an online running app mobile application).

A total of seven (7) hard copy questionnaires were handed to prospective respondents who are herein referred to as Enda elite athletes. All 7 were filled and handed back to the researcher. The researcher also used soft copy questionnaires in form of Google forms. A total of forty-two (42) respondents filled the research questions in the online survey. The researcher thus had a total of forty-nine (49) filled questionnaires from where to collect the necessary information from.

Twenty five (25) out of the forty-nine (49) people who responded to the questionnaire were between 26-35 years of age, sixteen (16) fell under the 36-45 age bracket, eight (8) were between 18-25 years of age and none was 45 years and above.

Only ten (10) out of the forty-nine (49) runners who took the survey are professional runners/athletes while thirty-nine (39) are recreational runners. Out of the total ten (10) professional runner respondents, eight (8) have been running for a period between more than a year to 4 years, none has been running for a year or less while 2 respondents have been running for more than 4 years. Of the thirty-nine (39) recreational runners, fifteen (15) have been running for a year or less, fifteen (15) have been engaged in the sport for a period of more than a year to 4 years while nine (9) have been running for more than 4 years. The researcher found out in a further question that twenty (20) of the runners clock an average distance between 3 to 10 kilometers in a long run while nineteen (19) manage a distance between 11 to 20 kilometers in a long run.

Thirty (30) of the respondent runners do have a recovery routine while nineteen (19) of them do not have any recovery routine. This does not include choice of footwear for fifteen (15) of the thirty (30) runners who do have a recovery routine. Majority of the

total runners responded with a 2 out of 10 rating of fatigue intensity at best and 7 out of 10 rating of fatigue intensity at worst. The results showed the runners with a post recovery routine post long run do experience fairly low scale fatigue intensity after every long run. The intensity was much higher at an average of 6 out of 10 for runners who did not have any post recovery routine.

It can be safely concluded that every single respondent was of equal importance to the research regardless of age bracket and/or profession. This is mainly because the topic of the study transverses across all borders of age and profession.

4.1.1 Quantitative results

The following quantitative results are based on the questionnaire that the data subjects were given (see Appendix 1) and have been arranged in chronological order:

Age Bracket	Number of respondents	Percentage (%)
18-25 years	8	16%
26-35 years	25	51%
36-45 years	16	32%
45 and more years	0	0%

Table 18: Table showing the number of subjects against their age bracket in the study

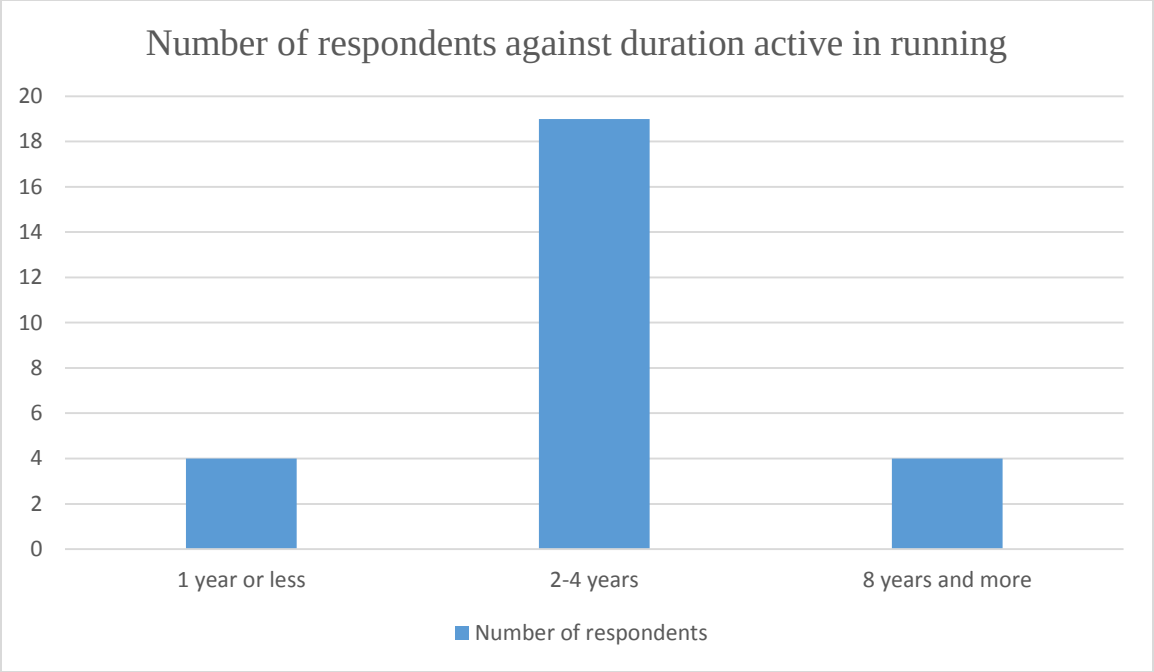


Figure 19: Bar graph showing number of respondents against their how long they have been active in running.

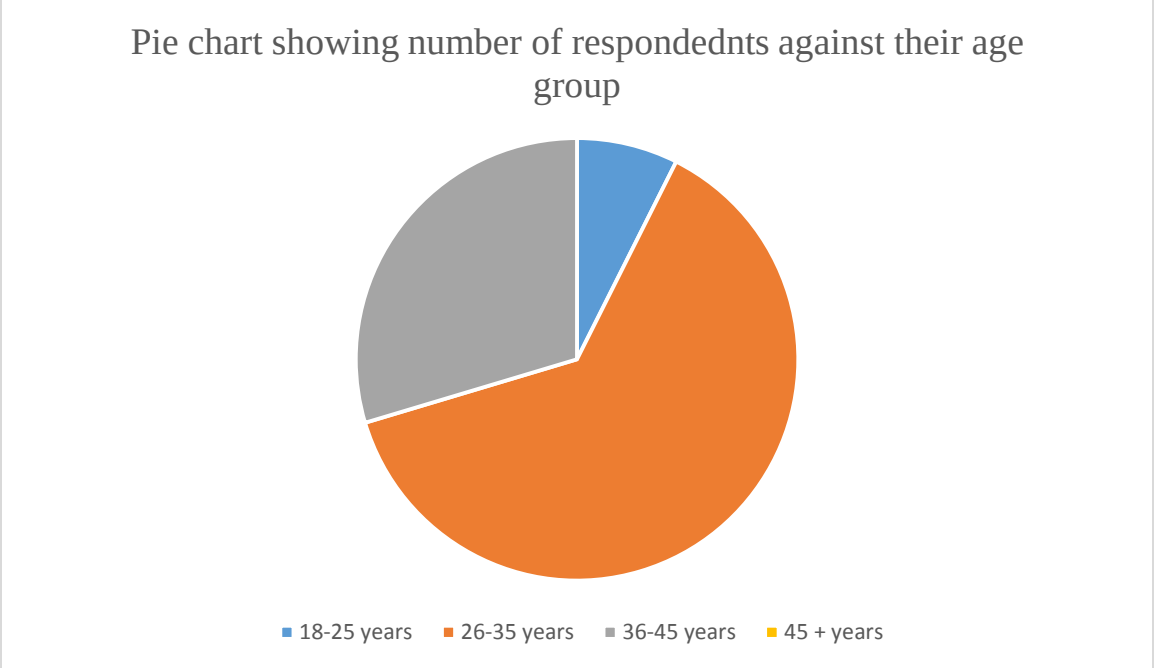


Figure 20: Pie chart showing number of respondents against their age group

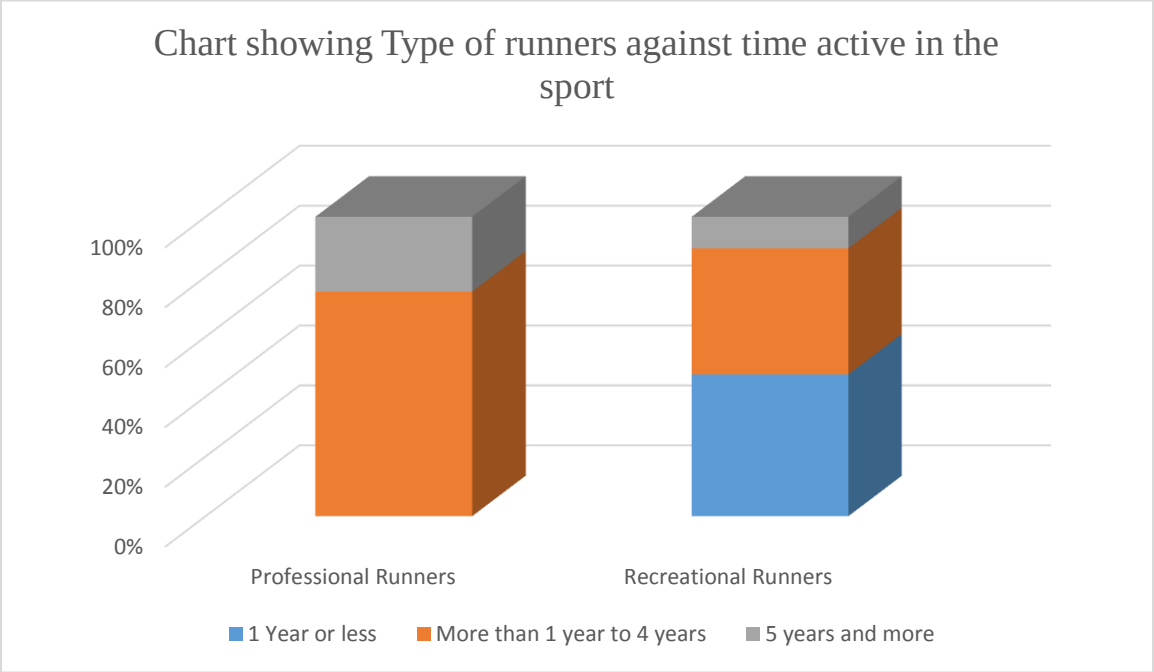


Figure 21: Bar graph showing type of long distance runners against the years they have been active in the sport

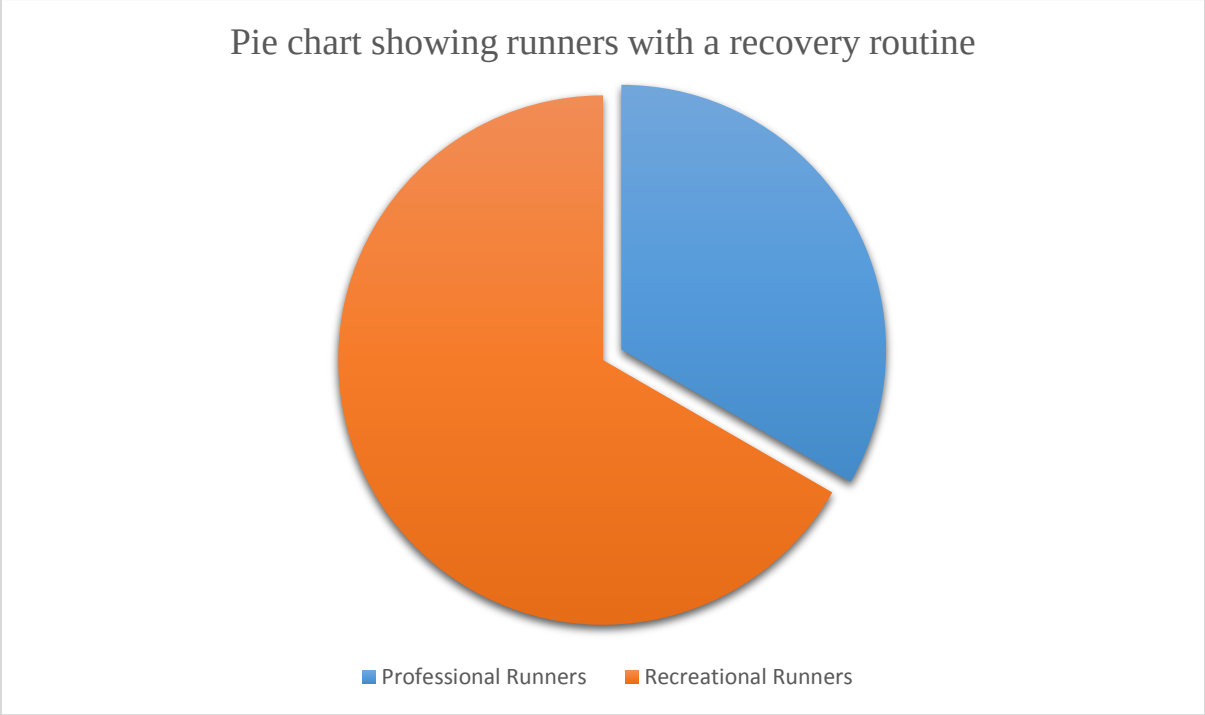


Figure 22: Pie chart showing type of runners who have a recovery routine

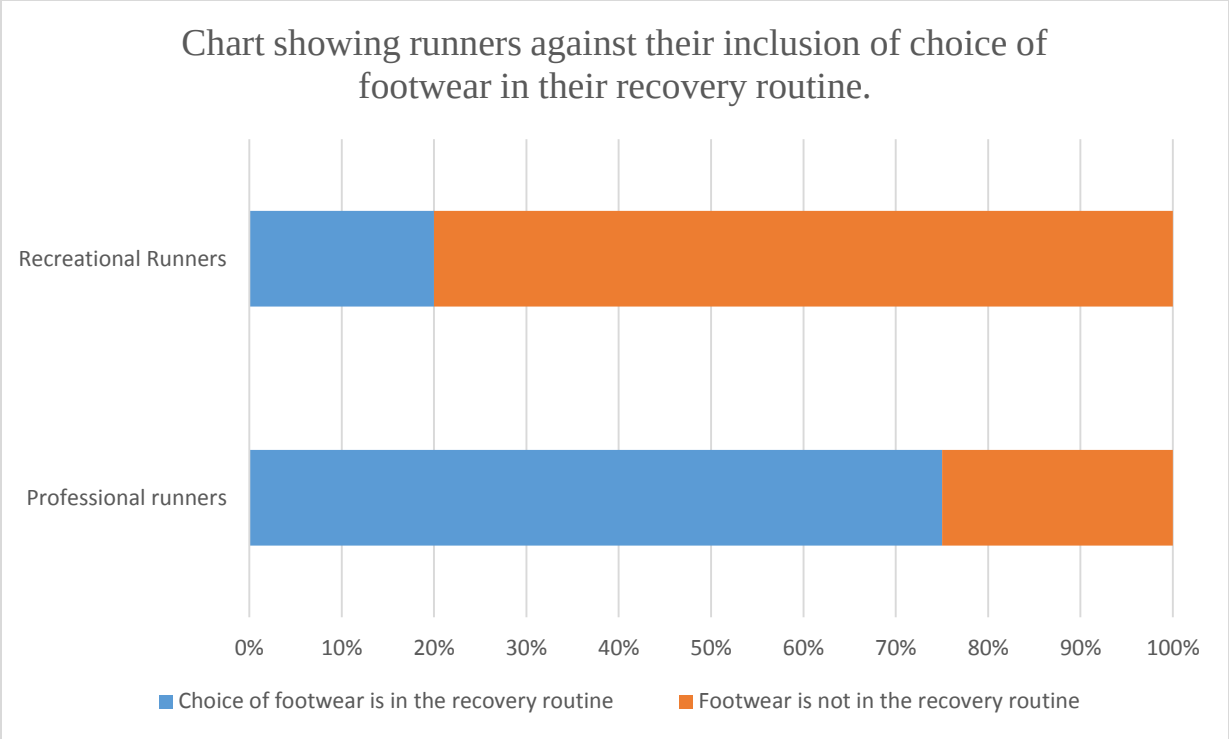


Figure 18: Chart showing runners their inclusion of choice of footwear in their recovery routine.

CHAPTER FIVE

RECOMMENDATIONS AND CONCLUSION

5.1 RECOMMENDATIONS & CONCLUSION

Long gone are the days of throwing on sweat pants, old sneakers and an old tee shirt to go for a run. Now-a-days, entire clothing and footwear brands are dedicated to specific and functional running gear and apparel. Brands, with the help of past studies and advancing technology, have designed and fabricated necessary products to make running, short or long distance more comfortable. A great deal of recent study shows that our feet were designed to walk and or run barefoot just as our ancestors did. It is however impossible to stay barefoot in the current world we live in especially for career men and women as the formal dress code does not condone going barefoot to work. It is therefore not a sustainable way to help with recovery post long-distance running and a better solution should include some form of footwear. Some key points from barefoot such as breathability and free movement of toes can however be carried on into the design of post long-distance recovery footwear.

The results of this study reveal that normal work shoes and neutral shoes lack a reliably significant effect on movement of the rearfoot or tibia, however there is evidence to suggest a well cushioned unstable shoe will enhance lower limb muscles stretching and therefore promote the activity in these muscles especially after long period of intense work outs and most specifically, long-distance running.

Post long-distance exhaustion and pain can cause disruptions to both the standard of life and efficiency of work. Both professional and recreational runners need a smooth and timely recovery to be ready able to go on with their daily routine with minimum to no pain that may be as a result of a recent long run. With this study highlighting the importance of both preparation and post run recovery to the wellbeing and health of long distance runners, there is therefore a need for covering these periods with appropriate gear. The researcher recommends an effective and simple medium that will aid in recovery optimization from fatigue through design of footwear. The researcher proposes the manufacture of a simple, lightweight, cushioned and unbalanced recovery shoe made from locally sourced materials.

The following is the product brief and some of the drawings made by the researcher in the process of design and fabrication of a recovery shoe.

Recovery runner product brief

Concept Definition

Light weight, simple, and comfortable.

It should be an exceptionally simple shoe. An unencumbered minimal upper with a 1-piece sole unit.

This is the shoes positioned as a recovery and easy day shoe. Light-weight, soft, with great toe-spring roll.

Aesthetic Direction

Simple. The upper should be a blank canvas for colors and patterns with no overlays or structure visibly built into the shoe. Repeating geometry on the midsole that creates a tread out of EVA

Shoe Specifics

Upper Features:

a. Flexible and soft. Shoe upper shouldn't stand up on its own.
b. Heel pull tab
c. Minimal heel counter
d. Consideration given to ripstop material or other light but simple material that could make a 1-layer vamp.
e. Consider a two-density collar lining to create more of a plush and premium fit on ankle
f. Minimal top tongue.
g. Heel seam should not be present, or only go half way up back so that it won't hit Achilles.
h. Consideration given if it is possible to cut and sew upper in Kenya

Midsole Features:

a. At least 24mm midsole thickness under ball of foot
b. Geometric pattern that highlights midfoot strike.
c. Geometric pattern that creates tread with EVA, while not grabbing pebbles in notches in tread.
d. Rocker geometry with aggressive toe-spring and heel kick
e. Soft, bouncy EVA
f. Strobel board topper for soft step-in
g. Consideration given if it is possible to mold midsoles in Kenya

Outsole Features:

a. Minimal
b. Rubber placed to communicate midfoot landing
c. Rubber at lateral heel and toe for high-wear areas
d. Ideally rubber portions are die-cut to increase potential of Kenyan moulding for midsole.

Insole

a. Molded EVA

Target weight

a. 7.2 oz

The inspiration

kanzu

/ˈkanzuː/

noun

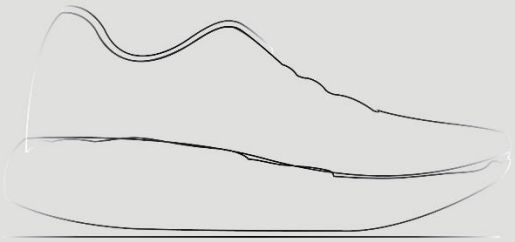
a long white cotton or linen robe worn by East African men.

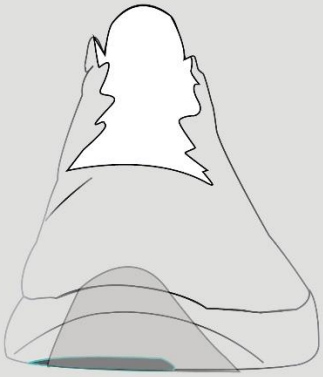
Definitions from Oxford Languages

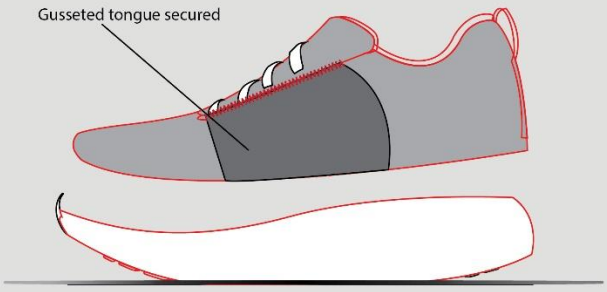
Notable Features

1. Light (lightweight)
2. Local - found in E. Africa
3. Breathable
4. Clean
5. Draping
6. Simple colours

enda







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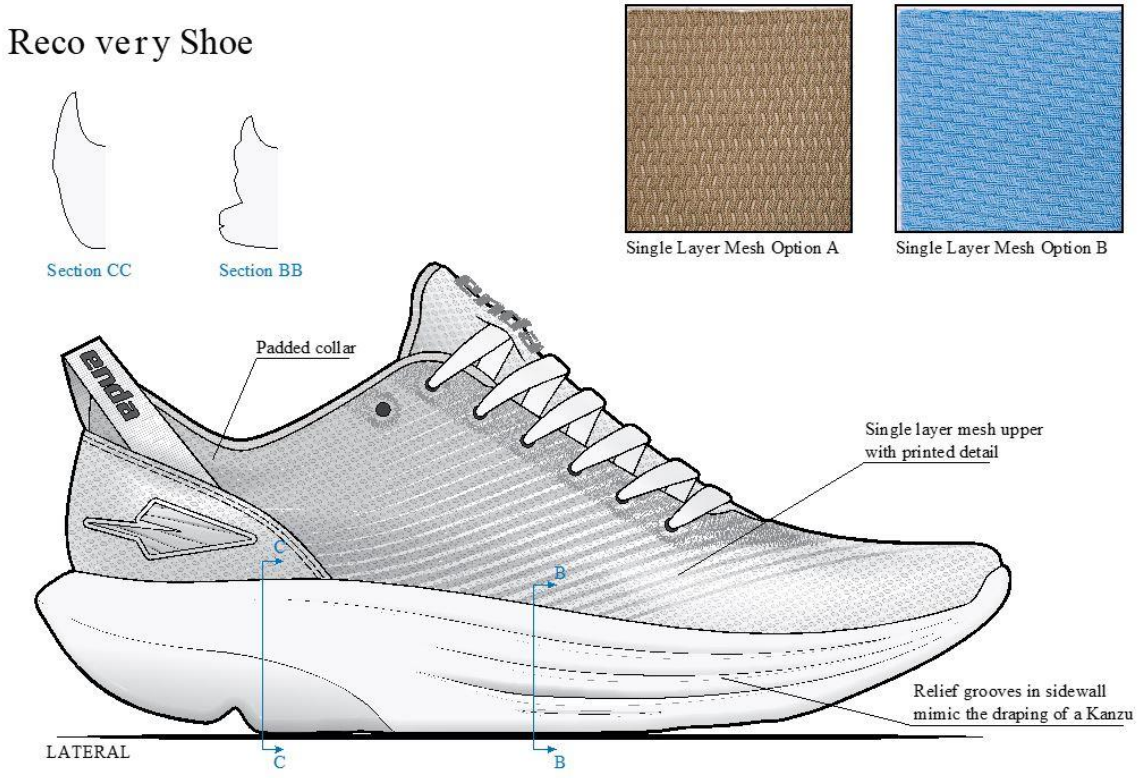

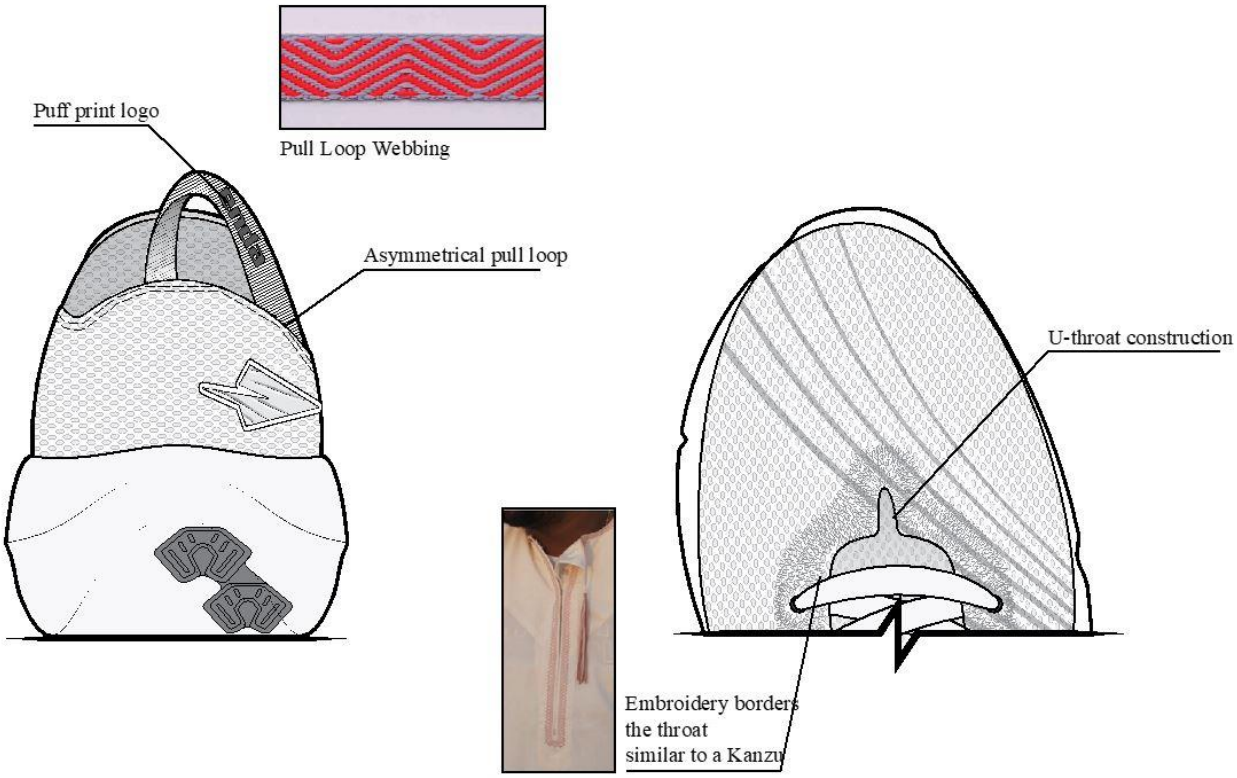
Puff print logo
Pull Loop Webbing
Asymmetrical pull loop
U-throat construction
Embroidery borders
the throat
similar to a Kanzu

APPENDICES

APPENDIX 1
SAMPLE QUESTIONNAIRE

Appreciation for agreeing to take this survey. The answers that you put in this survey are confidential. Please fill in all the questions and cross/tick in the boxes.

1. NAME: _____
2. What age group are you currently in?

18-25	26-35	36-45	45+

3. Are you a professional or Recreational runner?
4. For how long have you been running?

1 year or less	more than 1yr to 4 yrs	More than 4yrs

5. What is your average number of runs completed in a month?

1-5 runs	6-10runs	11-20runs	21 and more

6. Do you have a post-run recovery routine? YES NO
7. What post run footwear are you currently wearing

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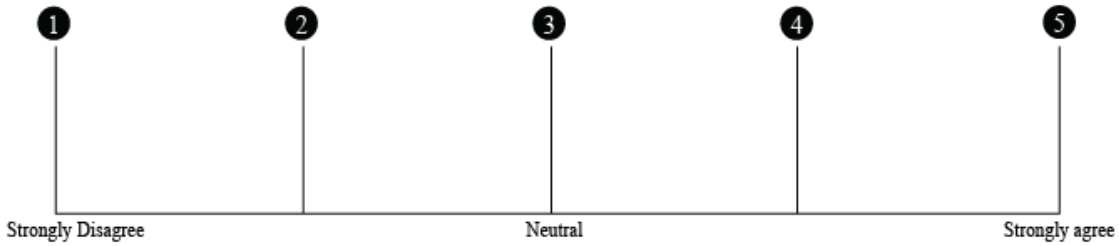
8. Rate you fatigue post a long distance run out on a 10-point scale:

   At best: _____, At worst: _____

9. Rate the following statement: “I feel comfortable walking in them after my runs”



10. What nature of shoes do you put on a day after a long run?

OFFICIAL SHOES	RUNNING SHOES
SANDALS/CROCS/OPEN SHOES	SPECIFIC RECOVERY SHOE

ANY OTHER: _____

What would be your ideal after run choice of footwear? _____

APPENDIX 2

SEMI-STRUCTURED FOCUS GROUP DISCUSSION

This sample below is semi-structured.

Being experts in footwear design and manufacturing. How does the recovery footwear category fair in the footwear industry?

What do you think about the current recovery shoes available on the market?

Probe: What are their pros and cons?

What would be an ideal product specification brief for designing footwear meant for recovery after long runs or intense work-outs?

Probe: For the main parts of the shoe. i.e., upper and midsole and lastly, the complete look, feel and fit.

What are some of the advances in technology that have seen the manufacture of such a technical category?

Probe: What are some of the new materials that footwear makers are incorporating in fabrication of this category of footwear

How have these advancements contributed to bridging the performance footwear accessibility gap?

Most recovery footwear in the market is heavy on toe and heel spring. Why is this so?

The rocker bottom midsole footwear is also a popular phenomenon in this category of footwear.

There are some runners here as well. Do you experience any fatigue or injuries after running for long distances?

How does this fatigue or injuries affect you?

Probe: Does it affect your career or day to day activities?

How do you deal with this post-long-distance fatigue and or injury?

Which interventions to post recovery shoes best address these injuries?

Probe: How do these interventions assist you in recovery?

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