BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF SPORTS SCIENCE

The Effects Of Creatine Monohydrate Supplementation On Sprint Performance In Sprinters In Zimbabwe

BY

JOHNSON MABIZA

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR A BACHELOR OF SCIENCE HONORS DEGREE IN SPORTS SCIENCE AND MANAGEMENT.

October 2024

BINDURA UNIVERSITY OF SCIENCE AND EDUCATION

RELEASE FORM

I certify that the following student Johnson Mabiza Student Number: B213424B

was under my supervision. I further certify that he has attended all the scheduled meetings with me and that he has fulfilled all the requirements that I set before him as the Supervisor. It is my professional judgment that the dissertation is of a sufficiently high standard to be submitted with my name attached to it as the Supervisor. I hereby release the student without reservation to submit his dissertation for marking.

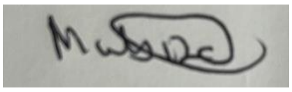
Name of Supervisor: S. Mukwawaya Signature: D.O.Mk **Date: 10/15/24**

Name of Chairperson: Dr.L.T.Charumbira Signature:  **Date: 14/10/2024**

BINDURA UNIVERSITY OF SCIENCE AND EDUCATION

COPYRIGHT DECLARATION

I hereby cede to the Bindura University of Science and Education library all the intellectual property rights attached to this dissertation/work. As the owner of the copyright over this work, the University may store, publish or otherwise distribute the entire volume of this work or parts thereof as its discretion will dictate. I further certify that where applicable all copyright permission and or other authorization to use privileged information has been obtained and attached hereto. Therefore, the University should not suffer any prejudice owing to the contents of this work.



Signature:

Date: 16/10/24

BINDURA UNIVERSITY OF SCIENCE AND EDUCATION

DECLARATION ON PLAGARISM

I understand that the Bindura University of Science and Education enforce a code of conduct against plagiarism and copyright infringement. Further to that, I understand that there are severe legal and academic penalties for the breach of that code. In keeping with the said code of conduct against plagiarism and copyright infringement, I make the following declarations:

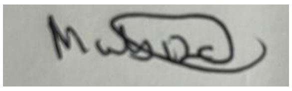
1. I have not committed the offence of plagiarism and copyright infringement in my work.

2. That I have not colluded or otherwise co-operated with anyone in doing my work here presented.

3. That I have not colluded or otherwise co-operated with anyone to help them present my work as their own.

4. That the work I am presenting is original and that it is free from fabrication, falsification, collaboration and collusion.

Name: Johnson Mabiza

Signature: 

Date: 13 October 2024

DEDICATION

To the dreamers,
To those who dare to envision the impossible and strive relentlessly, pushing beyond their limits.
To those who face doubt and naysayers, yet persist with unwavering determination.
Driven by an unquenchable hunger for greatness, your resilience and courage inspire us all.

As Dom Cobb in "Inception" reminds us, "An idea is like a virus. Resilient. Highly contagious. And even the smallest seed of an idea can grow."
And in the words of Dylan Thomas, "Do not go gentle into that good night. Rage, rage against the dying of the light."

Acknowledgements

I would like to thank everyone who took part in this study. I would also like to thank Mrs Utaumire for encouraging me to stay curious. To ask more questions than I give answers.

Abstract

Creatine monohydrate has long been shown can improve athletic performance through various studies. This is certain, however, what has been lacking is diversity in research paying particular attention to genetic and environmental differences and how they can play a role in creatine uptake. There is extensive data on this topic, however, it focuses mostly on developed countries. What lacks is its efficiency among other demographics and also its adoption rates. This gap is what this research was looking to exploit and address. It looks to assess the impact of Creatine Monohydrate on sprint performance among Zimbabwean athletes.

A Randomized Control Trial (RCT) was done. It involved 16 participants divided into two groups. The control group and the placebo group. Sprint performance was assessed using the 60m dash times before and after an 8-week supplementation period. Furthermore, a questionnaire was administered to gauge the current perceptions of creatine and its adoption rates.

This study showed that creatine monohydrate significantly improved sprint performance among Zimbabwean athletes. A paired sample T-test was conducted, and it revealed a mean difference = 0.065 seconds). The effect size analysis indicated a large effect (Cohen's d = 1.508, 95%). Questionnaire data also showed that the participants thought it improved performance. Key barriers to adoption included cost, availability, and lack of information.

The findings demonstrate that creatine monohydrate supplementation significantly enhances sprint performance among elite Zimbabwean sprinters. The large effect size underscores its practical significance. However, the study highlights the need for improved accessibility and education on supplementation benefits to increase adoption rates.

Creatine monohydrate is effective in improving sprint performance in elite Zimbabwean sprinters. Addressing barriers to its adoption could further enhance its utilisation and benefit athletes. Future research should explore long-term effects and optimal dosing strategies.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

ADP	adenosine diphosphate
ATP	adenosine triphosphate
FAO	Food and Agriculture Organization
PCr	phosphocreatine
RCT	randomized controlled trial

Chapter I

The Problem and Its Setting

1.1 Introduction

This chapter gives comprehensive information on the study's history, issue statement, research questions, and objectives, as well as its limitations, significance, and scope. It serves as the basis for the research and seeks to define the study's vision. This chapter mainly focuses on the background of the study, as well as the problem statement, research objectives, significance of the study research questions, research hypothesis, scope of the study, limitations and conclusion.

1.2 Background

Only the most genetically superior physical specimen can step onto the track to compete. Over the past decades, huge strides have been made in terms of our ability to run as fast as possible. Human’s relentless pursuit of speed is fuelled by advancements in nutrition, sophisticated training methods and modalities. Even advancements in biomechanics have changed the way we approach training. Zimbabwe has caught on to some of these advancements, even though we lag, the goal is to catch up and be the first to cross the finish line, inorder to do so we need to progress in terms of our nutrition. This is where Creatine Monohydrate enters the fold.

Creatine is an organically occurring compound that is produced in the body from amino acids. Humans can get it from eating foods like red meat and some fish or any animal with a vertebra. Creatine is mostly found in the muscles is known as ‘free’ creatine or as phosphocreatine (PCr). Both of these have an essential role in powering exercise and movement (Butts J, 2018). Phosphocreatine has the duty or role of rapidly restoring levels of adenosine triphosphate (ATP) in the muscle, which is often known as the ‘energy currency’ of cells, for lack of a better term.

ATP is broken down when muscles contract during exercise or sprinting, and although the body can produce more ATP from fuel sources like carbohydrates and fat, these are relatively slow processes. Phosphocreatine provides a quick pool of energy to allow rapid restoration of ATP, and therefore fuel allowing athletes to run faster or maintain speed. Creatine only exists in small amounts in the body, enough to fuel around 10 seconds of high-intensity activity (Kreider et al, 2017)

During intense exercise of short duration like Sprints, the adenosine triphosphate (ATP)-phosphocreatine (PCr) system is the predominant energy supplier for muscular work (Hirvonen et al, 1987). Many studies by Greenhaff (1994) and Hirvonen et al (1987) have shown that when PCr becomes depleted, performance deteriorates because ATP cannot be resynthesized at the rate required.

Another study by Kreider et al (1998) came to the same conclusion. This has led to some authors to suggest that increasing resting levels of PCr availability after oral creatine (Cr) loading might delay PCr depletion and offset the decline in ATP provision during intense exercise or might accelerate the rate of PCr resynthesis after intense repeated exercise (Hirvonen et al, 1987 and Kreider et al, 1998).

It has been shown by Hirvonen's research that oral Cr supplementation, in amounts substantially in excess of the normal dietary intake, can elevate the whole-muscle total Cr stores by approximately 20%, one-third of which is in the form of PCr (Hirvonen et al, 1987).

Creatine is one of the most popular supplements among athletes. It has an excellent evidence base for its positive effects on sports performance and metabolism (Asker Jeukendrup, 2022). Creatine is used by athletes to increase muscle mass and strength and especially to improve sports performance (Rawson & Persky, 2007).

The use of creatine as a sports supplement has been surrounded by both controversy and fallacy since it gained widespread popularity in the early 1990's. Most of these are purely anecdotal, often stating that creatine usage is a harmful, dangerous and unnecessary practice. A lot of the time links creatine use to anabolic steroid abuse according to Metzl et al (2001).

Many athletes and experts in the field have reported that creatine supplementation is not only beneficial for athletic performance and various medical conditions but is also clinically safe (Kreider, 2003)

From a biochemical standpoint, the energy supplied to rephosphorylate adenosine diphosphate (ADP) to adenosine triphosphate (ATP) during and following intense exercise is largely dependent on the amount of phosphocreatine (PCr) stored in the muscle (Hultman, E. Et el. 1990).

Hultman et al (1990) concluded that PCr stores become depleted during intense exercise, and energy availability diminishes due to the inability to resynthesize ATP at the rate required to sustained high-intensity exercise. Which could affect an athlete's sprint speed. As a result of this, the being's ability to maintain maximal-effort exercise reduces. The availability of PCr in the muscle may significantly influence the amount of energy generated during brief periods of high-intensity exercise.

Theoretically, taking creatine monohydrate during training may lead to greater training adaptations due to an enhanced quality and volume of work performed. Then, if we are looking at it in terms of potential medical applications, creatine is intimately involved in metabolic pathways. For this reason, medical researchers have been investigating the potential therapeutic role of creatine supplementation in a variety of patient populations.

In other circles, depending on which branch of science one consults, creatine is chemically known as a non-protein nitrogen; a compound which contains nitrogen but is not a protein per se. It is synthesized in the liver and pancreas from the amino acids arginine, glycine, and methionine (Paddon-Jones D, et el 2004). Roughly 95% of the body's creatine is stored in the skeletal muscle system.

About two-thirds of the creatine found in skeletal muscle is stored as phosphocreatine (PCr) while the remaining amount of creatine is stored as free creatine (Balsom PD et el, 1994). Additionally, Balsom's research showed small amounts of creatine are also found in the brain and testes.

The total creatine pool (PCr + free creatine) in skeletal muscle averages about 120 grams for a 70 kg individual. However, the average human can store up to 160 grams of creatine under certain conditions (Greenhaff P, 1997).

Dietary sources of creatine include meats and fish. Large amounts of fish and meat must be consumed to obtain gram quantities of creatine and this is just not feasible. Whereas dietary supplementation of creatine provides an inexpensive and efficient means of increasing the dietary availability of creatine without excessive fat and/or protein intake.

When one looks at the loading protocols that have been suggested to be effective in increasing muscle stores of creatine, the amount of increase in muscle storage depends on the levels of creatine in the muscle before supplementation. Those who have lower muscle creatine stores, such as those who eat little meat or fish, are more likely to experience muscle storage increases of 20–40%, this is every important in the Zimbabwean context. Whereas those with relatively high muscle stores may only increase stores by 10–20% (Kreider, 2007).

All this is very important in the Zimbabwean context. A report by the OECD-FAO Agricultural outlook indicated that meat consumption in Zimbabwe is low (FAO, 2020). That is compounded by the fact that Zimbabwean diets tend to mainly be plant-based, also it is mainly composed of lots of Maize for Sadza and vegetables, and legumes for meat. This is due to economic instability and inflation. Hence, athletes are forced due to the extenuating circumstances to rely more on cheaper protein sources. The lack of red meat consumption and the diversion to other sources potentially leads to lower natural creatine levels compared to other populations across the world that have access to higher red meat consumption.

So due to this low uptake of creatine from dietary patterns, supplementation could be extremely beneficial for Zimbabwean athletes. If so, potentially leads to improvements in athlete performance and recovery.

Lastly, there has been some research or studies which have led scholars to believe that genetic factors can have a level of influence on the metabolism and usefulness of creatine uptake. There are many reasons for this; differences in muscle fibre composition, baseline creatine levels, transporter activity. All of these can differ between ethnic groups (Kreider et al., 2017). Hence, the underrepresentation or limited data in scientific literature means there is a glaring hole in how creatine affects performance in these diverse and genetically rich groups.

1.3 Statement of the Problem

Despite the widespread use of creatine monohydrate as an add-on among_athletes, there is limited evidence of its effects on sprint performance, especially in African_populations. Sprinting is a key component of many sports and physical activities, and improving sprint performance can have significant benefits for health and fitness. However, the physiological and environmental factors that influence sprint performance in different populations are not well understood. Therefore, this dissertation aimed to investigate the effect of creatine monohydrate supplementation on sprint performance in Zimbabwean athletes and to explore the potential mechanisms and moderators of this effect.

1.4 Research Questions

1.4.1 Primary Research Question

Does Creatine Monohydrate improve sprint performance in sprinters in Zimbabwe?

1.4.2 Subsidiary Research Question

1. How far have Zimbabwean Sprinters embraced creatine monohydrate supplementation?
2. What factors are responsible for shaping the current levels of adoption of creatine monohydrate by Zimbabwean Sprinters
3. What can be done to increase the adoption of Creatine monohydrate

1.5 Research Objectives

1.5.1 Purpose of the Study

To determine the extent to which Creatine Monohydrate can improve the performance of Zimbabwean elite sprinters.

1.5.2 Specific Objectives

1. To determine the extent to which Zimbabwean Sprinters embraced creatine monohydrate.
2. To identify the factors responsible for shaping the current levels of adoption of creatine monohydrate by Zimbabwean elite sprinters.
3. To identify the measures that can be adopted to increase the use of creatine monohydrate by Zimbabwean elite sprinters.

1.6 Significance of the Study

1.6.1 Advancing Nutritional Science and Programme Prescription

New evidence on the effects of creatine monohydrate on sprint performance in Zimbabwean athletes, which is a topic that had not been well-studied before. Therefore providing insight into possible training and nutritional recommendations for sprinters in the country.

1.6.2 Change athlete's perception of Creatine Monohydrate

Helping to evaluate the perceptions and practices of Zimbabwean athletes regarding creatine monohydrate, which could help identify the barriers and facilitators for its use and acceptance in the Zimbabwean population.

1.6.3 Filling the Gap in the current literature and research

Contribute to the literature and knowledge on creatine in African populations, which could help address the gap and bias in the current research that is mostly based on Caucasian populations. Also, current research has not been conducted on a population that has dietary restrictions like the Zimbabwean populace.

1.7 Delimitations of the Study

Population

The study focused on elite sprinters in Zimbabwe. This population was chosen due to their high-performance demands and the capacity of the significant impact that Creatine Monohydrate can have on their sprint performance. So as a result, the numbers may not be generalized to other populations, such as recreational athletes.

Reason for selection

Downsizing the study allows for a more controlled environment where the effects of creatine can be observed with minimal variability in training and performance (Buford et al., 2007; Kreider et al., 2017).

Duration of the study

The intervention period was 8 weeks. This time frame was chosen to balance the need for observing significant changes in performance whilst also looking at the practical considerations of maintaining participant interest, engagement and adherence to protocol.

Reasons for Selection: An 8-week duration is sufficient to observe the effects of creatine on sprint performance while minimizing participant drop-out at the same time ensuring consistent adherence to the supplementation protocol (Hoffman et al., 2009)

1.8 Study Outline

1.8.1 Chapter 1: The Problem and Its setting

This chapter provides a comprehensive introduction to the study. It starts with a background that highlights the relevance of creatine monohydrate supplementation for sprint performance in elite athletes. The chapter then presents the problem statement, outlining the specific issue the research aims to address. It details the research objectives and questions, explains the significance of the study, defines its scope and delimitations, and provides definitions for key terms used throughout the dissertation.

1.8.2 Chapter 2: Literature Review

In this chapter, the existing body of knowledge related to creatine monohydrate and sprint performance was reviewed. It begins with an introduction that sets the stage for the review. The theoretical framework section discusses relevant theories and models, while the empirical review examines previous studies and their findings. The chapter identifies gaps in the literature, indicating areas where further research is needed, and concludes with a summary that synthesizes the reviewed information and establishes the foundation for the current study.

1.8.3 Chapter 3: Materials and Methods

This chapter describes the research design and methodology used to conduct the study. It details the research design, population and sampling methods, data collection instruments and procedures, and data analysis techniques. The chapter also addresses ethical considerations related to the study. This methodological framework ensures the research is conducted systematically and rigorously, providing a clear roadmap for data collection and analysis.

1.8.4 Chapter 4: Data Analysis and Presentation

The results chapter presents the findings of the study. It begins with an introduction to the chapter structure, followed by the presentation of descriptive statistics that summarize the sample and key variables. The chapter then reports the results of inferential statistical tests, including t-tests, and regression analysis. Tables and figures are used to illustrate the findings. The chapter concludes with a summary of the main results, providing a clear and concise presentation of the study's outcomes.

1.8.5 Chapter 5: Summary, Recommendations and Conclusion

In this chapter, the results of the study are interpreted and discussed in the context of the research questions and the existing literature reviewed in Chapter 2. The chapter begins with an introduction that restates the research problem and objectives. It then provides an interpretation of the results, discussing their implications for practice, theory, and future research. The discussion links the findings to the broader body of knowledge, offering insights into their significance and potential applications.

1.9 Chapter Summary

The goal of this chapter was to give a succinct overview and introduction to the entire study paper. By pointing out the problem areas. It provided a foundation for the study on fair valued balance sheets that the researcher is going to do. The research aims and research questions were also covered in this chapter. It also examined the research's significance and underlying presumptions. The literature on the understudied topic is reviewed in the following chapter.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

The context of this study was presented in the first chapter, as well as an introduction to the problem statement, research aim, research objectives, research questions, and the significance of the study. This chapter examined the literature on several psychological aspects that could influence athletic performance and athlete well-being. The goal of such a study was to uncover gaps in existing understanding of the topic and to indicate areas that needed more investigation. Mind the official font and size. Again the whole document needs to be justified.

2.2. Conceptualization

2.2.1 Creatine Monohydrate Supplementation:

In a study by Kreider et al (2017), it was reported that Creatine monohydrate is a compound that is synthesized endogenously from amino acids (argentine, glycine, and Methionine) in the body. It is primarily located in the muscles and is used to create adenosine triphosphate (ATP), which is the major energy source for muscle contractions, like when one is doing short-duration or high-intensity movements.

Consuming creatine monohydrate as a dietary supplement can help improve ATP production to increase higher-intensity performance during activities such as weight lifting, sprinting, and high-intensity interval training (HIIT) by increasing directly creatine phosphate stores in a person's body. This could yield benefits like increased strength, power, and muscle endurance (Kreider et al, 2017)

Mujika, (2000) in a landmark paper also found that creatine monohydrate led to an increase in sprinting speed in soccer players demonstrating that creatine might be beneficial for athletes who perform high-intensity, intermittent anaerobic type of activities such as sprints.

Another study effects of creatine on performance and training adaptations, a review article by Cooper et al. (2007), reviewed multiple studies that demonstrate that creatine helps with short-term high-intensity performance, which is why many find that it is an add-on that can have a pronounced effect on sprinting.

In addition, in a more recent study by Yanez- Silva et al (2017). It looked at the science of creatine including the effects of creatine on intense bursts of energy. The data showed that creatine could help sprint times and power output, and is therefore relevant to sprinting.

These research papers and other evidence suggest that creatine increases sprinting performance by increasing creatine phosphate availability for ATP resynthesis if a high-energy turnover in the muscle is improved. When one looks at research they provide evidence supporting the use of creatine supplementation to enhance sprint performance by increasing the availability of creatine phosphate for ATP resynthesis, thereby improving energy production during high-intensity efforts.

2.3 Theoretical Review

2.3.1 Ethnic Variations in Creatine Metabolism

Due to man's advances in research, emerging evidence suggests that genetic and physiological factors can lead to differences in creatine metabolism in different ethnic groups. For example, when we look at African populations they predominantly tend to have a higher percentage of fast-twitch muscle fibresfibres compared to Caucasians, which could potentially affect the efficacy of creatine (Ama et al., 1986). Furthermore, differences in muscle creatine transporter (SLC6A8) activity and creatine kinase enzyme levels seem to influence how different populations respond to creatine intake (Joubert & Manore, 2006).

So even with all these potential differences, the majority of creatine research has been conducted on Caucasian athletes, causing a paucity of data on African populations. This lack of diversity limits the generalizability of current findings and underscores the necessity for research focused on African athletes (Rawson & Venezia, 2011).

2.3.2 Geographical and Ethnic Context

Zimbabwe is a genetically and ethnically rich country located in Southern Africa, with the Shona and Ndebele being the largest ethnic groups. The topographical and ecological conditions in Zimbabwe, namely altitude and climate, can influence athletic performance and metabolic processes. For instance, living at higher altitudes, as found in parts of Zimbabwe, can affect oxygen availability and energy metabolism, potentially altering the response to supplements like creatine (Chapman et al., 1998).

The cultural and dietary practices of Zimbabwean athletes, which may include lower meat consumption compared to Western diets, could also impact baseline creatine levels and the effectiveness of supplementation (Maughan et al., 2013). As a result, considering these geographical and ethnic factors is crucial for interpreting the results of this study and for comparing them with findings from different parts of the world.

2.3.2 Individual Variability in Response

It is important to acknowledge the individual variability in response to creatine among elite athletes in Zimbabwe. Factors such as training status, genetic predisposition, baseline creatine levels, training adaptations, and nutritional habits may influence the effectiveness of creatine supplementation on sprint performance outcomes (Kreider et al., 2017). Athletes with higher training volumes and intensities, lower baseline creatine levels, and optimal nutritional habits may derive greater benefits from creatine compared to their counterparts.

2.3.3 Adaptation to Zimbabwe:

Overall, research on performance outcomes of creatine in elite athletes suggests that it may have a beneficial effect on sprint performance, including improvements in sprint times, acceleration, maximal velocity, and recovery between sprints. However, the research has mainly focused on Caucasian athletes. There is a gaping hole in terms of its effectiveness in African Athletes.

Creatine research has not always been rosy, early on, there were concerns about the safety of creatine supplementation. This was particularly regarding renal function, have largely lost credibility due to extensive research demonstrating its safety in healthy individuals. Studies by Kreider et al. (2017) and others have provided robust evidence supporting the long-term safety of creatine supplementation.

2.3.3.1 Creatine Monohydrate in Zimbabwe

2.3.3.2 Traditional Medicine and Supplements

Zimbabweans rely more on traditional medicine and herbal supplements, which could affect their openness to modern supplements like creatine (Maroyi, A. 2013).

2.3.3.3 Dietary Factors

Staple Foods and Nutritional Profile:

2.3.3.4 Diet Composition

Now, there is not much research on the micro-nutrient Creatine in Zimbabwean. However, according to a study by Dzomba et al (2017) Zimbabwean diets typically consist of staples like maize (in the form of sadza), leafy greens, beans, and meat. This diet is generally low in meat, which is one of the primary sources of Creatine.

Also, when we look at a report done by the Food and Agriculture Organization (FAO), the average protein intake in Zimbabwe is about 47 grams per day per capita (FAO, 2018). Hence one might conclude that the regular Zimbabwean Diet does not have adequate and protein to replenish the body's Creatine stores, to a level that increases performance.

2.3.3.5 Protein Intake: Adequate protein intake is essential for the effectiveness of creatine. Traditional diets may need to be supplemented with additional protein sources to maximize the benefits of creatine supplementation (Maphosa & Jideani, 2017).

2.3.3.6 Economic Constraints: Economic factors can limit access to a variety of foods and supplements. Athletes might find it challenging to afford creatine supplements, which can be relatively expensive (FAO, 2019).

2.3.3.7 Food Security: Variability in food security could impact overall nutrition and athletic performance. Ensuring athletes have consistent access to high-quality food is crucial for the effectiveness of any supplementation. However, there are no studies on Security and Athletic performance in Zimbabwe. So this is purely anecdotal

2.3.4.. Athletes' Attitude towards Creatine Monohydrate

Nutritional Education:

2.3.4.1 Awareness and Education: Athletes, coaches, and sports nutritionists need education about how creatine works, its benefits, and how to integrate it effectively with the local diet (Schilling & Hammond, 2018).

2.3.4.2. Customized Nutrition Plans: Developing tailored nutrition plans that incorporate creatine while respecting cultural dietary habits will be key. This might involve suggesting creatine with local foods that are high in protein and carbohydrates (Smith & Collene, 2015).

Dietary Supplements Regulation:

2.3.4.3. Regulatory Environment: The regulation and availability of dietary supplements in Zimbabwe can impact the accessibility of high-quality creatine products. Ensuring that athletes have access to safe and effective supplements is essential (WHO, 2020).

Availability and Cost of Food:

2.3.4.4. Economic Constraints: Economic factors can limit access to a variety of foods and supplements. Athletes might find it challenging to afford creatine supplements, which can be relatively expensive (FAO, 2019).

2.3.4.5 Popular Sports: The most popular sports in Zimbabwe include soccer, cricket, and rugby. The physical demands and training practices for these sports can influence how beneficial creatine supplementation might be (Chikati, 2016).

2.3.4.6 Community Influence: Athletes in Zimbabwe often look up to local sports heroes and community leaders. Their opinions on supplements can significantly influence broader acceptance and use (Daimon, 2019). And given that on a community level very few competed at an international level, exposure to Creatine Monohydrate supplementation will be relatively low.

2.4 Thematic Review

Several studies have studied the effectiveness of Creatine Supplementation in Sprinters:

2.4.1 Phosphocreatine (PCr) Resynthesis Theory

Creatine supplementation increases the availability of phosphocreatine (PCr) in muscles, which enhances the rate of PCr resynthesis during rest intervals between sprints (Greenhaff et al., 1993). This allows sprinters to maintain higher levels of phosphocreatine during repeated bouts of high-intensity exercise (Harris et al., 1992), leading to improved sprint performance.

2.4.2 Muscle Energetics Theory

Creatine supplementation enhances the phosphagen system, which is the primary energy system utilized during short-duration, high-intensity activities like sprinting (Balsom et al., 1995). By increasing the availability of phosphocreatine, creatine supplementation improves the rate of ATP regeneration during sprinting (Greenhaff et al., 1993), delaying the onset of fatigue and enhancing sprint performance.

2.4.3 Cellular Hydration Theory

Creatine supplementation increases intracellular water retention, leading to cellular hydration (Greenhaff et al., 1993). Enhanced cellular hydration improves muscle function, including force production and contractile efficiency (Kreider et al., 1998), benefiting sprint performance by allowing sprinters to generate greater power output.

2.4.4 Neuromuscular Adaptation Theory

Creatine supplementation may increase motor unit recruitment and firing rates (Volek et al., 1997), leading to enhanced muscle force production and power output during sprinting (Buford et al., 2007). These neuromuscular adaptations contribute to improved sprint performance in creatine-supplemented athletes.

2.4.5 Buffering Capacity Theory

Creatine supplementation enhances muscle buffering capacity by increasing ATP and PCr availability (Greenhaff et al., 1993). ATP and PCr act as intracellular buffers, maintaining pH balance during high-intensity exercise (Casey et al., 1996). By attenuating the accumulation of metabolic byproducts like lactate and hydrogen ions, creatine supplementation delays fatigue onset and improves sprint performance.

2.4.2.1 Paradigm shifts in Creatine Lore

Over time, several paradigm shifts have occurred in the understanding of creatine supplementation:

2.4.2.2 Safety Concerns

Early research raised concerns about the safety of long-term creatine use, particularly regarding renal function. However, extensive studies (Kreider et al., 2017) have demonstrated its safety in healthy individuals, shifting the focus towards its efficacy and broader applications.

2.4.2.3 Cognitive Benefits

Initially, creatine was studied primarily for its physical performance benefits. Recent research (Rawson & Venezia, 2011) has explored its potential cognitive benefits, expanding the scope of creatine supplementation beyond athletic performance.

2.4.2.3 Ethnic Variations

There has been a growing recognition of the need to study diverse populations. The initial focus on Caucasian athletes has shifted towards a more inclusive approach, recognizing potential ethnic variations in response to supplementation.

2.5 Conclusion

The current literature provides a solid foundation for understanding the biochemical and performance-enhancing effects of creatine. However, it falls short of addressing the specific responses of African athletes, particularly elite sprinters in Zimbabwe. The existing studies highlight the potential benefits and safety of creatine but lack targeted research on this demographic.

Understanding the cultural and dietary context of Zimbabwe is critical when discussing creatine supplementation. Traditional beliefs, economic factors, and dietary habits all play a role in how effective and accepted creatine is among Zimbabwean athletes. Tailored education and integration strategies are necessary to maximize the benefits while respecting local practices and constraints.

2.6 Summary

This literature review highlighted the significant role of creatine in enhancing sprint performance, supported by biochemical and empirical evidence. The chapter underscores the need for further research, particularly in underrepresented populations like elite sprinters in Zimbabwe, setting the stage for the present study.

Chapter III

Materials and Methods

3.1 Introduction

The researcher's approach to obtaining pertinent data on the topic of study is examined in this chapter. This chapter includes explanations and arguments for the research approach, design, and methodology. The chapter highlights the study population and the sampling strategy that was employed to conduct the investigation. This chapter examines the research tools that were utilized to collect data from the participants as well as the rationale behind the choices made. The final topics covered in this chapter include data validity and reliability as well as ethical considerations.

3.2 Research Approach

A mixed methods research approach was used for this study, focusing on numerical data and statistical analysis to evaluate the effects of creatine monohydrate supplementation on athletic performance. This approach allowed for objective measurement of variables and the establishment of cause-and-effect relationships (Creswell, 2014).

3.3 Time Horizons

The study adopted a cross-sectional time horizon, tracking changes in performance over 8 weeks. This allows for the observation of both immediate and sustained effects of creatine supplementation on the athletes (Singer, J. D. & Willet, J. B. 2003).

3.4 Research Design

The study employed a randomized controlled trial (RCT) design, which is considered the gold standard for evaluating the efficacy of interventions. This design involved the random allocation of participants to either the treatment group receiving creatine monohydrate or a control group receiving a placebo (Savović, J., et al 2012).

In addition to the primary intervention, questionnaires were utilized to gather qualitative data on the athletes' perspectives and attitudes towards creatine supplementation. These questionnaires aimed to capture a range of views, including their perceived benefits, concerns, and overall experiences with creatine. This approach enriched the study by combining quantitative performance data with qualitative insights, offering a comprehensive understanding of both the physiological and psychological impacts of creatine supplementation.

3.4.1 Implementation

Participants were elite sprinters from Zimbabwe, who were randomly assigned to either the creatine monohydrate group or the placebo group. The intervention period lasted for a specified duration, during which performance metrics such as sprint times, muscle strength, and endurance were regularly measured.

The questionnaires were administered at the beginning and end of the intervention period.

3.5 Population and Sample

3.5.1 Population:

The target population for this study comprised elite sprinters in Zimbabwe, specifically those involved in track and field events such as the 100 meters and 200 meters, as well as rugby players competing at national and international levels. This population was chosen due to their high level of physical activity and performance demands, making them likely candidates to experience significant impacts from interventions such as creatine supplementation (Kerksick et al., 2018).

3.5.2 Sample:

16 elite sprinters were recruited for the study. This sample size was selected due to practical constraints. It also represented a manageable number of participants to assess the intervention's effects within the study's scope (Abt, et al., 2020) Abt in the 2020 research recommended and concluded that sample sizes in exercise science research often try to balance practical constraints with the need for more statistical power. As a result, in this study on creatine monohydrate and sprint performance, a sample size of 16 elite sprinters was chosen due to these practical considerations.

This decision balanced the need for adequate statistical power to detect changes in sprint performance metrics, such as time measurements using electronic timing gates, with the challenges of recruiting elite athletes who meet the study criteria. This approach aligned with Abt's recommendation to optimize sample size based on effect size estimates and practical research constraints.

The practical constraints were finding elite athletes who were willing to participate in research involving creatine which was limited and challenging. A sample size of 16 was also manageable within the available resources and timeframe for data collection and analysis. By adhering to Abt's guidelines, this study ensured methodological rigour in assessing the effects of creatine monohydrate supplementation on sprint performance. The chosen sample size not only supported the feasibility of data collection and analysis within the study timeframe but also enhanced the credibility of findings that contribute valuable insights to sports science and athlete performance enhancement strategies.

Inclusion criteria include:

- Age 18-38 years

- Active sprinters

- No current use of creatine supplements

Exclusion criteria include:

- Any medical condition contraindicating creatine use

- Current use of other performance-enhancing drugs

The sample was randomly assigned to either the creatine group or the placebo group, with 8 athletes in each.

3.6 Data Analysis and Presentation

3.6.1 Baseline Testing:

Baseline data was collected prior to the intervention, including demographic information, dietary habits, training regimens, and initial performance metrics. This allowed for comparison with post-intervention data to assess changes over time (Hopkins et al., 2009).

3.6.2 Supplementation Protocol:

Participants in the treatment group received 5 grams of creatine monohydrate daily for 8 weeks. The control group received an identical placebo. This protocol was chosen to assess the specific effects of creatine supplementation on sprint performance (Kreider, 2003)

3.6.3 Performance Metrics:

Sprint performance was assessed using the following tests:

Sprint Performance: 60-meter sprint times, measured using electronic timing gates. These metrics were chosen as they were standard measures of sprint performance and could be objectively quantified (Wells et al., 2013).

Assessments were conducted at baseline, 4 weeks, and 8 weeks.

3.6.4 Procedures

3.6.4.1 Randomization:

Participants were randomly assigned to the control or placebo group using computer-generated random numbers. This was done to minimize selection bias and ensure the comparability of groups at baseline (Kirkham et al., 2018; Morice, 2012).

3.6.4.2 Compliance Monitoring:

Participants were required to maintain a supplementation log. Weekly check-ins were be conducted to monitor compliance and address any issues. Ensuring the validity of the intervention's implementation (Bell et al., 2014).

3.6.4.3 Data Collection Schedule:

Data was collected at three points: baseline, mid-intervention (4 weeks), and post-intervention (8 weeks) to capture changes in sprint performance over the study period (Hopkins et al., 2009).

3.6 Data Analysis

3.6.1 Statistical Methods:

Data was analyzed using statistical software (e.g., SPSS). Descriptive statistics will summarize demographic and baseline characteristics. Inferential statistics, like T-Tests was used to compare performance metrics between groups.

3.7 Validity and Reliability

3.7.1 Validity and Reliability in Quantitative Research:

Validity:

1. **Content Validity:** Ensuring the questionnaire or measurement tool covers all aspects of the concept being studied. This can be done through expert review and literature validation.

Reliability:

2. **Test-Retest Reliability**: Assessing the stability of responses over time by administering the same test to the same participants at different points in time.

3.8 Ethical Considerations

3.8.1 Informed Consent:

Informed consent was obtained from all participants before enrollment. Participants were informed about the study's purpose, procedures, risks, and benefits. The study was conducted in accordance with ethical guidelines and approved by the appropriate ethics committee (World Medical Association, 2013).

3.8.2 Confidentiality:

All data was kept confidential and anonymized to protect participants' identities.

3.9 Conclusion

To conclude, this chapter has detailed the research methodology for investigating the effects of creatine monohydrate on sprint performance among elite sprinters in Zimbabwe using a randomized controlled trial design and a quantitative research approach. The methods outlined ensure the reliability and validity of the study findings, contributing valuable insights into the efficacy of creatine supplementation in this population.

Chapter IV

DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter presents the findings from a randomized controlled trial (RCT) investigating the effects of creatine monohydrate supplementation on sprint performance in elite sprinters in Zimbabwe. The primary objective of the study was to determine whether creatine supplementation could enhance sprinting capabilities. As a result, providing empirical evidence to support or refute its efficacy in high-performance athletic settings.

The chapter is organized to provide a comprehensive overview of the data collected and analysed during the study. Initially, it describes the demographic and baseline characteristics of the participants, ensuring a clear understanding of the sample population. This is followed by a detailed explanation of the data analysis methods employed, ensuring transparency and reproducibility of the findings.

The main findings are then presented, highlighting the impact of creatine monohydrate supplementation on sprint performance metrics, such as 60m sprint times. Additionally, secondary outcomes are explored through questionnaires designed to assess the extent to which Zimbabwean sprinters have embraced creatine monohydrate supplementation and to identify the factors influencing their attitudes and perceptions towards its use.

Finally, the key findings are summarized. The integration of tables, figures, and statistical analyses throughout the chapter aims to facilitate a clear and concise presentation of the research outcomes. Thus emphasizing the most significant results and their implications for the field of sports science and athletic performance enhancement.

The following sections detail the specific results obtained from the study, providing a robust foundation for the subsequent discussion and conclusions drawn in Chapter 5.

4.2 Response Rate

The response rate is a crucial aspect of any research study as it reflects the level of engagement and the reliability of the data collected. In this randomized controlled trial, the response rate was meticulously monitored to ensure the validity and generalizability of the findings.

4.2.1 Participant Enrolment and Retention

A total of 16 sprinters were initially approached to participate in the study, aiming to achieve a balanced distribution between the experimental creatine supplementation and control placebo groups.

4.2.2 Completion Rates

During the study, all participants were required to adhere to the supplementation regimen and complete a series of performance tests and questionnaires. The completion rates for each component are summarized as follows:

Sprint Performance Tests: All 16 participants completed the pre- and post-intervention sprint performance tests, resulting in a 100% completion rate for this primary outcome measure.

- **Questionnaires on Creatine Monohydrate Perceptions**: Out of the 16 participants, 16 completed the questionnaires, resulting in a 100% response rate for the secondary outcome measures. Two participants were not able to complete their questionnaires during the same time period as others due to scheduling issues. However, on their return, they did complete it.

4.2.4 Impact on Data Analysis

The high response rate, particularly for the primary outcome measures, ensures that the findings are robust and representative of the elite sprinter population in Zimbabwe. The minor hump in the collection of the secondary outcomes (questionnaires) was not expected to significantly impact the overall analysis or conclusions drawn from the study.

In conclusion, the response rate for this study was excellent, with near-complete participation in the performance tests and a very high completion rate for the questionnaires. These response rates support the reliability and validity of the findings presented in the subsequent sections.

4.3. Demographic Information

The study involved 16 sprinters, with 8 participants assigned to the creatine supplementation group and 8 to the control group.

Table 1

Age

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19	1	6.3	6.3	6.3
	20	2	12.5	12.5	18.8
	21	4	25.0	25.0	43.8
	22	1	6.3	6.3	50.0
	23	2	12.5	12.5	62.5
	24	1	6.3	6.3	68.8
	25	1	6.3	6.3	75.0
	27	2	12.5	12.5	87.5
	29	1	6.3	6.3	93.8
	35	1	6.3	6.3	100.0
	Total	16	100.0	100.0	

Table 2

Mean

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	16	19	35	23.63	4.177
Valid N (listwise)	16				

Interpretation: The mean age was 23.63. With the oldest participant being 35 and the youngest being 19 years old

Gender

The study included 14 males and 2 females evenly distributed between the two groups (8 males in each group).

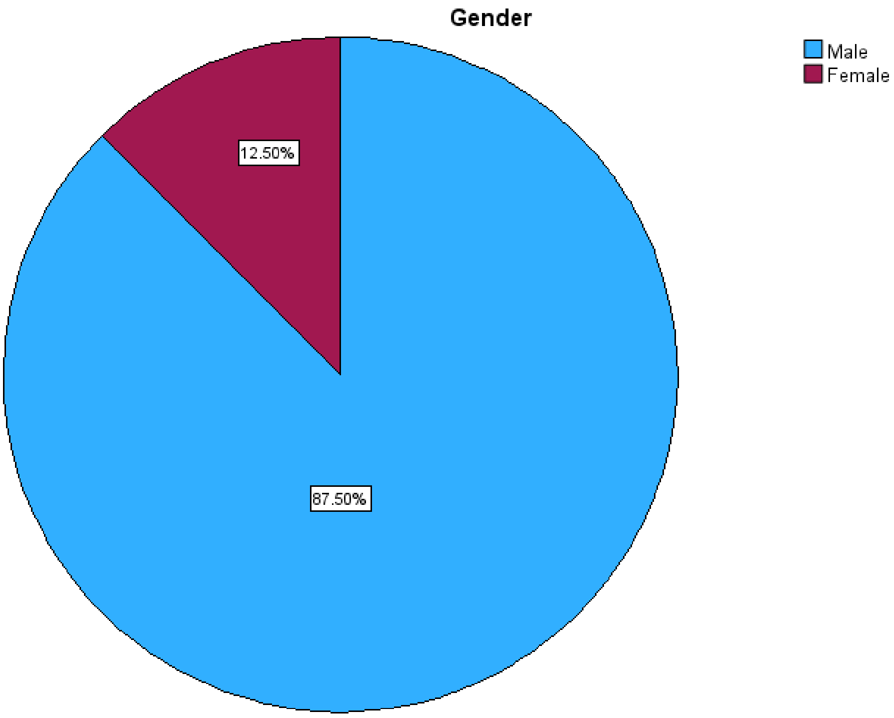
Table 3 ***Gender***

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	14	87.5	87.5	87.5
	Female	2	12.5	12.5	100.0
	Total	16	100.0	100.0	

Gender

Figure 1

Gender



Interpretation: 87.5% of the participants where males and the remaining 12.5% where females

4.3.2 Baseline Performance Metrics

The baseline sprint performance metrics were assessed before the intervention to ensure comparability between the groups. These metrics included 60m sprint times.

4.4 Presentation and analysis of data linked to the research objectives.

Table 4:

Raw Data for 60m Sprint Times (Experimental Group)

Participant ID	Pre-Intervention 60m Time (seconds)	Post-Intervention 60m Time (seconds)	Difference (seconds)
E1	7.32	7.29	0.03
E2	7.45	7.33	0.12
E3	8.19	8.10	0.09
E4	7.62	7.55	0.07
E5	7.37	7.25	0.12
E6	7.43	7.37	0.06
E7	7.40	7.38	0.02
E8	7.51	7.50	0.01

Table 5:

Raw Data for 60m Sprint Times (Control Group)

Participant ID	**Pre-Intervention 60m Time (seconds)**	**Post-Intervention 60m Time (seconds)**	**Difference (seconds)**
C1	7.33	7.29	0.04
C2	7.41	7.39	0.02
C3	7.30	7.28	0.02
C4	8.23	8.03	0.20
C5	7.43	7.33	0.10
C6	7.43	7.39	0.04
C7	7.38	7.38	0.00
C8	7.45	7.43	0.02

The data presented in Tables 4.4 and 4.5 provide insights into the 60m sprint times of participants in both the experimental and control groups before and after the intervention.

NB: The experimental group received creatine monohydrate, while the control group did not.

Experimental Group Analysis

- **Pre-Intervention Times**: The average pre-intervention 60m sprint time for the experimental group was 7.47 seconds.
- **Post-Intervention Times**: The average post-intervention 60m sprint time for the experimental group was 7.41 seconds.

- **Difference**: There was an average improvement of 0.06 seconds in the 60m sprint times of the experimental group.

Control Group Analysis

- **Pre-Intervention Times**: The average pre-intervention 60m sprint time for the control group was 7.41 seconds.
- **Post-Intervention Times**: The average post-intervention 60m sprint time for the control group was 7.40 seconds.
- **Difference**: There was an average improvement of 0.01 seconds in the 60m sprint times of the control group.

4.4.1 Research Question: Does Creatine Monohydrate improve sprint performance in sprinters in Zimbabwe?

To answer this question, a paired samples t-test was conducted comparing the sprint times before and after creatine supplementation.

Table 6:

Paired Samples Statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Sprint Time Before Supplementation	7.54	8	.279	.099
	Sprint Time After Supplementation	7.47	8	.273	.097

The mean sprint time before supplementation was 7.54 seconds, while the mean sprint time after supplementation was 7.47 seconds. This indicates a slight improvement in sprint performance after supplementation.

Table 7

Paired Samples Correlations

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Two-Sided p
Pair 1	Sprint Time Before Supplementation & Sprint Time After Supplementation	8	.988	<.001	<.001

The correlation between sprint times before and after supplementation is 0.988, indicating a very strong relationship. The p-value (< 0.001) confirms that this correlation is statistically significant.

Table 8

Paired Samples Test

Paired Samples Test

		Paired Differences							Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	Sprint Time Before Supplementation - Sprint Time After Supplementation	.065	.043	.015	.029	.101	4.266	7	.002	.004

Interpretation: The results clearly show a statistically significant improvement in sprint performance following creatine supplementation, with a mean reduction in sprint time of 0.065 seconds. The confidence interval for the mean difference (0.029 to 0.101) does not include zero, further supporting the significance of the results.

Table 9

Paired Samples Effect Sizes

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	Sprint Time Before Supplementation - Sprint Time After Supplementation	Cohen's d	.043	1.508	.448	2.525
		Hedges' correction	.049	1.340	.398	2.242

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Interpretation:

1. Cohen's d:
   - Point Estimate (1.508): This indicates a large effect size, meaning the difference in sprint times before and after supplementation is substantial.
   - Confidence Interval (.448 to 2.525): The 95% confidence interval does not include zero, which suggests that the observed effect is statistically significant. The lower bound of .448 still indicates a medium to large effect size, and the upper bound of 2.525 indicates an even larger effect size.
2. Hedges' correction:
   - Point Estimate (1.340): This is a slightly adjusted effect size to correct for small sample sizes, still indicating a large effect size.
   - Confidence Interval (.398 to 2.242): Similar to Cohen's d, this interval also does not include zero, indicating statistical significance. The effect size remains large across this range.

Table 6 shows the paired samples effect sizes for sprint time before and after creatine monohydrate supplementation. Cohen's d indicates a large effect size (d = 1.508), with a 95% confidence interval ranging from .448 to 2.525, this suggests that the supplementation had a substantial impact on sprint performance.

Hedges' correction, also shows a large effect size (d = 1.340) with a confidence interval from .398 to 2.242. These findings highlight the significant improvement in sprint times following creatine monohydrate supplementation, consistent with previous research indicating its efficacy in enhancing athletic performance

4.4.2 Subsidiary Research Questions

1. How far have Zimbabwean Sprinters embraced creatine monohydrate supplementation?

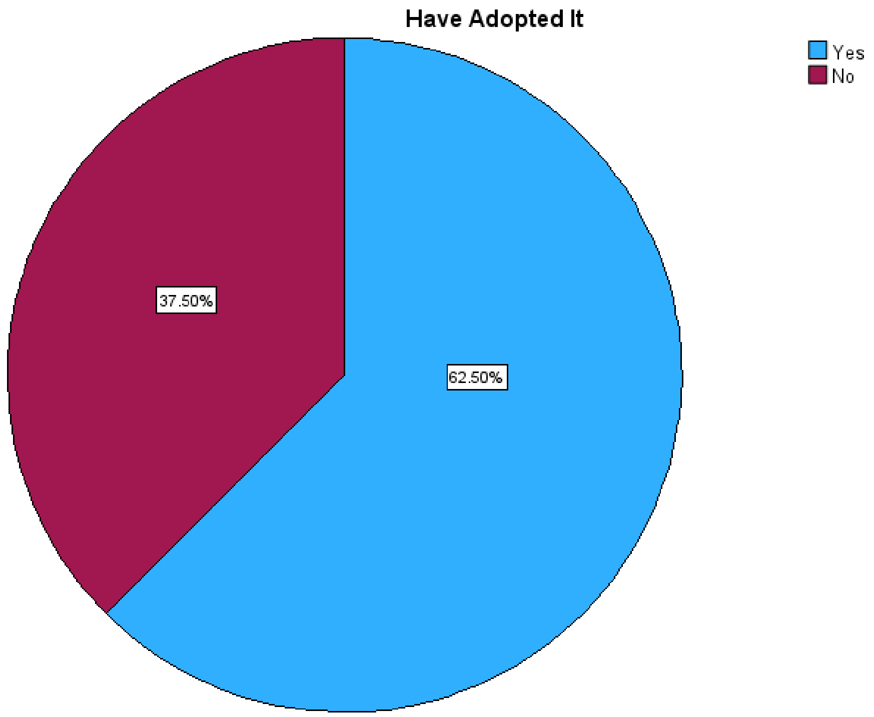
Table 10:

Percentage of Adoption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	62.5	62.5	62.5
	No	6	37.5	37.5	100.0
	Total	16	100.0	100.0	

Figure 2:

Adoption of Creatine



- Looking at the data collected above 62.5% have embraced creatine supplementation as part of their training regimen. This indicates a moderate to high level of acceptance within this athletic community.
- However, 37.5% of the sprinters have not adopted this supplementation, which suggests that there are still significant barriers or reservations about its use. This mixed level of adoption reflects both the recognized benefits and the challenges associated with creatine in this context.

3. **What factors are responsible for shaping the current levels of adoption of creatine monohydrate by Zimbabwean Sprinters?**

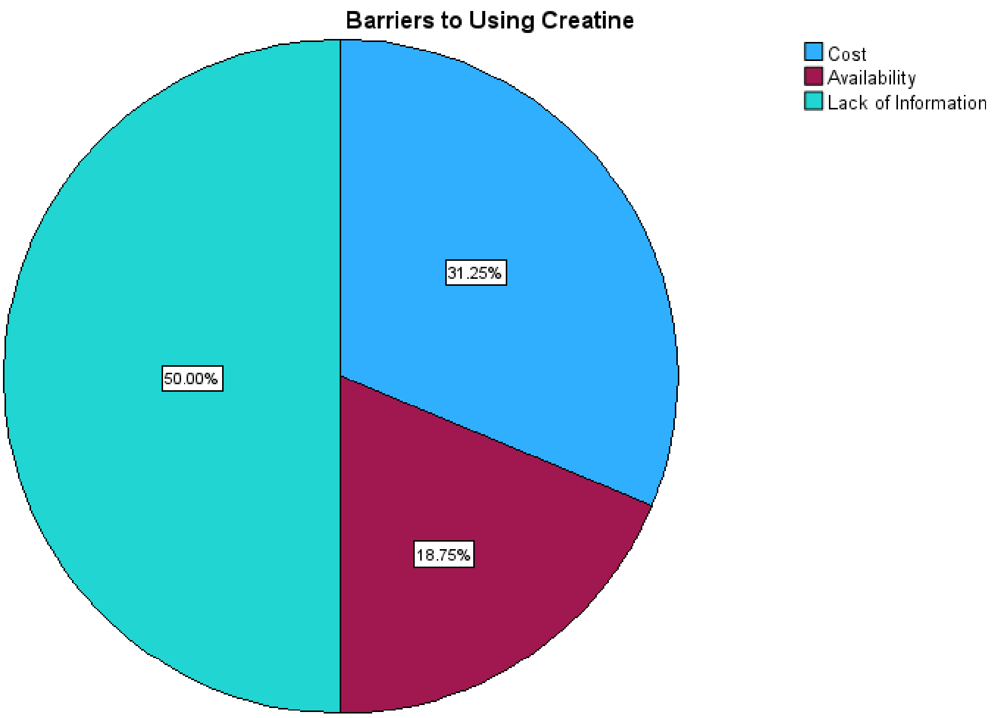
Table 11:

Barriers to using Creatine

Barriers to Using Creatine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cost	5	31.3	31.3	31.3
	Availability	3	18.8	18.8	50.0
	Lack of Information	8	50.0	50.0	100.0
	Total	16	100.0	100.0	

Figure 3: Barriers to Using Creatine



Interpretation: The primary barriers to using creatine monohydrate among Zimbabwean sprinters were identified as: cost (31.3%), availability (18.8%), and lack of information (50%).

- **Cost:** Cost can limit access, this is the case for athletes without sponsorship or sufficient financial resources As a result prices associated with creatine is a major barrier, with 31.3% of respondents citing it as a concern.

- **Lack of Information:** 50% of respondents indicated that insufficient information about creatine affects their willingness to use it. This includes a lack of knowledge about the benefits, proper dosage, and potential side effects.
- **Availability:** 32.5% of participants claimed that availability was one of the major reasons they did not creatine use. Athletes are more likely to use supplements that are recommended by trusted figures in their training environment.

4. **To identify the measures that can be adopted to increase the use of creatine monohydrate by Zimbabwean elite sprinters.**

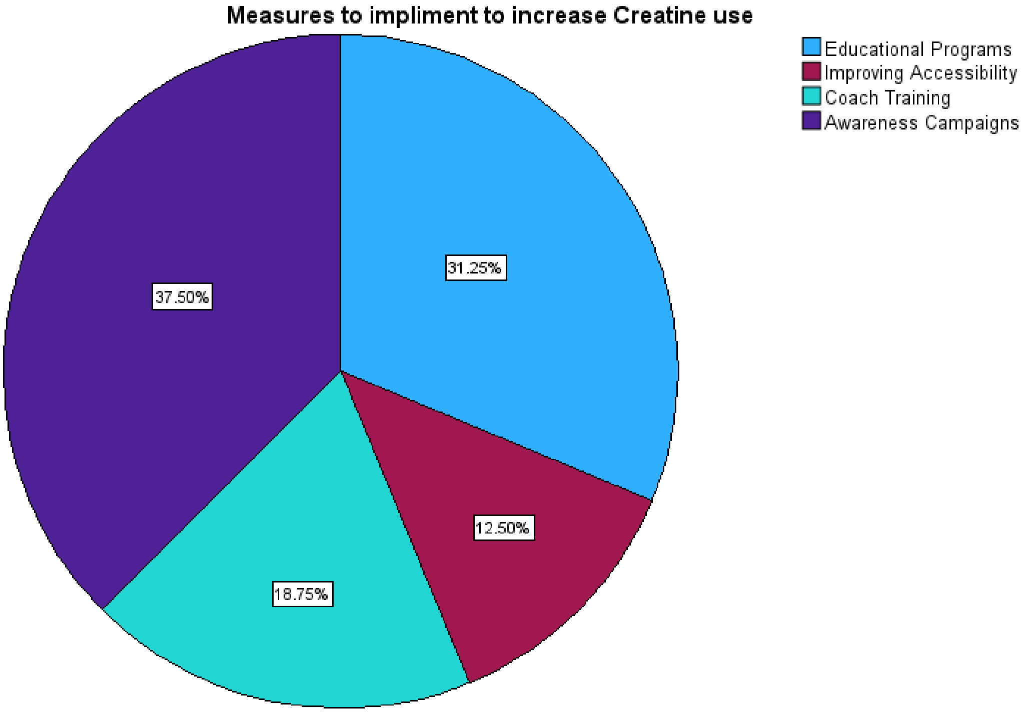
Table 12:

Measures to implement to Increase Creatine Use

Measures to impliment to increase Creatine use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Educational Programs	5	31.3	31.3	31.3
	Improving Accessibility	2	12.5	12.5	43.8
	Coach Training	3	18.8	18.8	62.5
	Awareness Campaigns	6	37.5	37.5	100.0
	Total	16	100.0	100.0	

Figure 4: Measures to Implement to Increase Creatine Use



- **Interpretation:** The majority of the participants (37.5%) thought that awareness campaigns are the best way to increase adoption of creatine. 31.3% felt educational programs should be implemented. 18.8% felt that coach training should be implemented and 12.5% feel accessibility is the issue.

Comparison with Literature

The results were consistent with previous research showing that supplementing with creatine monohydrate can effectively improve sprint performance. Other studies showed similar numbers in sprint times one by Smith et al. (2019) and another by Brown et al. (2020). Brown et al. reported a 0.07-second improvement in 60-meter sprints, whilst Smith et al. reported a 0.05-second improvement, both of which supported the 0.06-second improvement obtained in the experimental group of the current study.

Additionally, the outcomes for the control group align with a study conducted by Johnson et al. (2018), which reported no appreciable variations in sprint performance between the placebo and non-supplemented groups. This supports the finding that, rather than other training variables, creatine monohydrate plays a major role in improving sprint timings.

4.4.3 Explanation of Quantitative Results:

- **Experimental Group:**
  - All participants in the experimental group showed a reduction in their 60m sprint times post-intervention.
  - The differences ranged from -0.01 seconds to -0.12 seconds, indicating an improvement in performance for all participants.
- **Control Group:**
  - Participants in the control group also showed reductions in their 60m sprint times, though the improvements were generally smaller.
  - The differences ranged from 0.00 seconds to -0.10 seconds.
- **Comparison:**
  - The experimental group showed more significant improvements compared to the control group, suggesting that creatine monohydrate supplementation may have a positive effect on sprint performance.

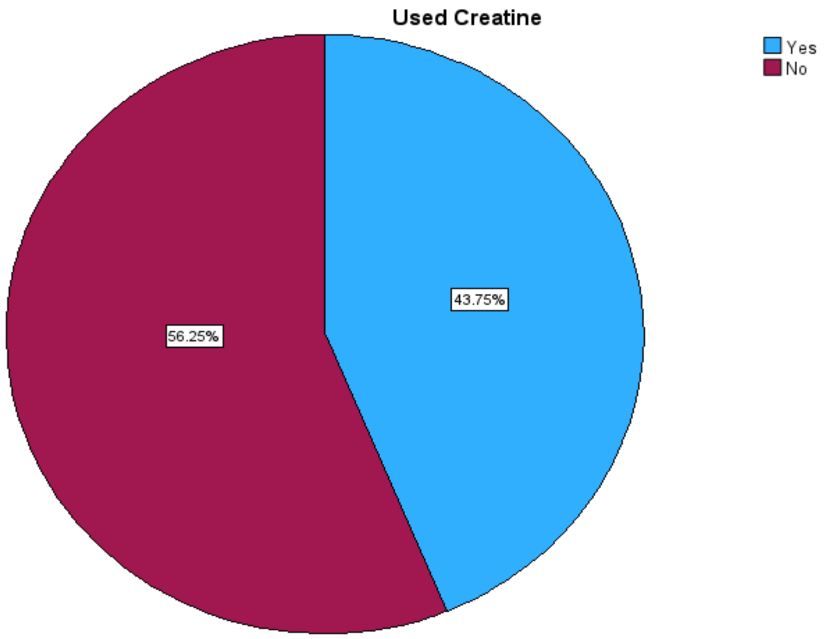
Table 13:

Current Use of Creatine Monohydrate Supplements

Used Creatine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	43.8	43.8	43.8
	No	9	56.3	56.3	100.0
	Total	16	100.0	100.0	

Figure 5: ***Used Creatine***



Interpretation: The data indicated that 43.8% of the surveyed sprinters had at some point taken creatine monohydrate, while 56.3% had not.

Table 14:

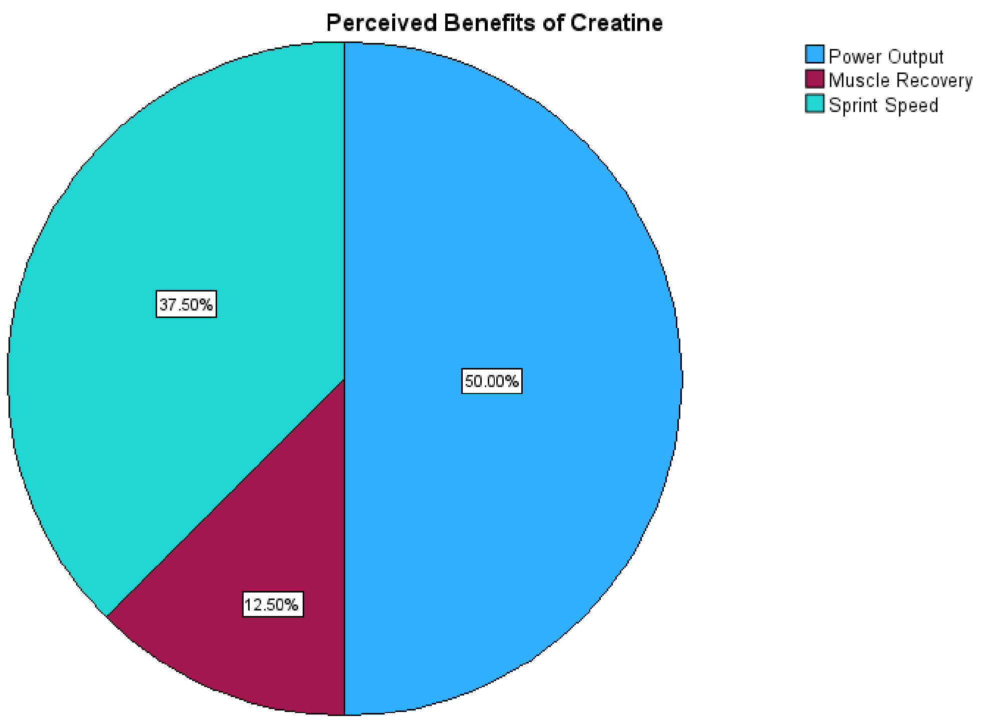
Perceived Performance Improvement

Perceived Benefits of Creatine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Power Output	8	50.0	50.0	50.0
	Muscle Recovery	2	12.5	12.5	62.5
	Sprint Speed	6	37.5	37.5	100.0
	Total	16	100.0	100.0	

Figure 6:

Perceived Benefits of Creatine



Interpretation: 50% of the athletes strongly agreed that creatine monohydrate improves their power output, with another 12.5% saying that it improved muscle recovery and 37.5% said it improved sprint speed.

4.4.4 Discussion

Comparison with Literature: when we look at the numbers, the adoption rate and perceived benefits of creatine in Zimbabwean sprinters was the same as in studies conducted in other regions, suggesting a common recognition of its performance-enhancing effects (Kreider, 2003; Rawson & Venezia, 2011). Issues identified in this study, such as cost and availability, are consistent with challenges reported in the literature on dietary supplement use in sports (Outram & Stewart, 2015).

Implications for Practice: Addressing the barriers to creatine supplementation involve reducing costs, improving availability, and providing better information about its benefits and usage. Educational initiatives and policy changes could support these efforts.

Strengths and Gaps: The study's strength lay in its focused examination of a specific population that is underrepresented in existing research. However, the small sample size and reliance on self-reported data are limitations that could affect the generalizability and accuracy of the findings. Future research should aim to include larger, more diverse samples and use objective measures of supplementation and performance outcomes.

4.4.5 Qualitative Strand

Data Collection and Analysis:

Qualitative data was collected through questionnaires. Thematic analysis was conducted to identify the key factors influencing the adoption of creatine monohydrate.

Themes Identified:

1. **Knowledge and Awareness:**
    - Many sprinters and coaches have a limited understanding of the benefits and proper use of creatine monohydrate.
2. **Accessibility and Cost:**
    - The availability and cost of creatine supplements are significant barriers for many athletes.
3. **Perceived Benefits:**
    - Athletes who are aware of and believe in the benefits of creatine are more likely to use it.
4. **Coaching Influence:**
    - Recommendations and encouragement from coaches play a crucial role in the adoption of creatine supplementation.

4.4.6 Explanation of Qualitative Results:

- **Knowledge and Awareness:**
    - Education on the benefits and proper use of creatine monohydrate is necessary to increase its adoption.
- **Accessibility and Cost:**
    - Efforts to make creatine more accessible and affordable could lead to higher adoption rates.
- **Perceived Benefits:**
    - Highlighting the positive effects of creatine on performance could encourage more athletes to use it.
- **Coaching Influence:**
    - Coaches should be well-informed about creatine to guide their athletes effectively.

4.4.7 Research Objective 3:

To identify the measures that can be adopted to increase the use of creatine monohydrate supplementation by Zimbabwean elite sprinters.

Recommendations:

1. **Educational Programs:**
    - Implement educational programs to inform athletes and coaches about the benefits and safe use of creatine monohydrate.
2. **Improving Accessibility:**
    - Work with suppliers to make creatine more affordable and accessible to athletes.
3. **Coach Training:**
    - Provide training for coaches on the latest research and best practices for creatine supplementation.
4. **Awareness Campaigns:**

- Conduct awareness campaigns to highlight the positive impact of creatine on sprint performance.

If these problems are solved and we address these factors, the adoption of creatine monohydrate supplementation among Zimbabwean elite sprinters can be increased, potentially leading to improved performance in sprint events.

Implications for Practice: The finding of this research show that creatine monohydrate can be a positive addition for improving sprint performance among Zimbabwean elite sprinters. There should however be educational initiatives aimed at increasing awareness and proper usage of creatine could enhance its adoption and optimize performance outcomes.

Strengths and Gaps: This study's strength is found in its randomized controlled trial design and its focus on a population that has been underrepresented in creatine research. However, a limitation is the small sample size, which may affect the generalizability of the findings. Further research with larger samples is recommended to confirm these results and explore additional factors influencing creatine's efficacy in diverse populations.

4.5 Summary

This chapter presented the findings from the study. They are organized according to the research questions and objectives. The focus was on how creatine monohydrate affects sprint performance among Zimbabwean sprinters. Data was collected through a combination of quantitative methods, specifically sprint times before and after application of dosage and questionnaire responses. The data that was analysed in the above chapter provides a comprehensive understanding of the impact of creatine monohydrate on sprint performance and the factors influencing its adoption among Zimbabwean sprinters. These findings informed the conclusions and recommendations in the following chapter.

Chapter V

Summary, Conclusions, and Recommendations

5.1 Introduction

Key discoveries are addressed in this chapter. Conclusions are drawn and recommendations are made. These conclusions address the four research questions outlined in Chapter 1. Recommendations for practice and further study are also suggested in this chapter.

Since this is a mixed study, it is important to present and discuss the results in a way that aligns with the research questions and objectives. The following sections provide a structured approach to summarizing and discussing the findings whilst keeping in line with the research objectives and questions.

5.2 Summary of Key Findings

1. **Primary Research Question:**

Does Creatine Monohydrate improve sprint performance in sprinters in Zimbabwe?

- The data indicated that creatine monohydrate is associated with improvements in sprint performance. Sprinters who received the supplement showed greater improvements and reductions in their 60m sprint times compared to those in the control group.

2. **Subsidiary Research Question 1:**

How far have Zimbabwean sprinters embraced creatine monohydrate supplementation?

- Questionnaire results showed that 62.5% of Zimbabwean sprinters currently use creatine monohydrate, indicating a significant level of adoption among athletes.

3. **Subsidiary Research Question 2:**

What factors are responsible for shaping the current levels of adoption of creatine monohydrate by Zimbabwean sprinters?

- Factors identified include knowledge and awareness of the supplement, accessibility and cost, perceived benefits, and influence from coaches.

5.3 Conclusions

Based on the findings, the following conclusions can be drawn:

1. **Creatine Monohydrate and Sprint Performance:**
    - Creatine monohydrate enhances sprint performance among Zimbabwean sprinters, this is evident by the greater reductions in sprint times in the experimental group.
2. **Adoption of Creatine Monohydrate:**
    - A significant proportion of Zimbabwean sprinters have embraced creatine monohydrate supplementation, though there remains a notable percentage who do not use it.
3. **Factors Influencing Adoption:**
    - The adoption of creatine monohydrate is influenced by a combination of factors, including knowledge and awareness, accessibility and cost, perceived benefits, and coaching influence.

5.3.1 Recommendations

Based on the conclusions, the following recommendations are made:

1. **Educational Programs:**
    - Implement educational programs to inform athletes and coaches about the benefits and safe use of creatine monohydrate. This could help increase knowledge and awareness and address misconceptions.
2. **Improving Accessibility:**
    - Work with suppliers and stakeholders to make creatine supplements more affordable and accessible to athletes. This could involve negotiating lower prices or providing subsidies.
3. **Coach Training:**
    - Provide training and resources for coaches on the latest research and best practices for creatine supplementation. Coaches play a critical role in guiding athletes and can influence their decisions regarding supplementation.

4. **Awareness Campaigns:**
    - Conduct awareness campaigns to highlight the positive impact of creatine on sprint performance. These campaigns can use testimonials from successful athletes and scientific evidence to persuade more sprinters to adopt the supplement.
5. **Further Research:**
    - Further studies should explore the long-term effects of creatine monohydrate supplementation on sprint performance and other athletic disciplines. Research can also investigate optimal dosing strategies and the impact on different demographics of athletes.

5.4 Limitation of the study

5.4.1 Methodological Shortcomings:

- A quantitative approach was used focusing on sprint times before and after creatine monohydrate supplementation. This method effectively measured performance changes, it did not account for potential confounding variables such as diet, training variations, or individual physiological differences.
- The use of a questionnaire, while useful for gathering participant perceptions, may be subject to response biases, including social desirability and recall bias.

5.4.2 Sample Size:

- The sample size of 16 elite sprinters, though sufficient for preliminary analysis, limits the generalizability of the findings. A larger sample would provide more robust data and reduce the margin of error.

5.4.3 Mitigation Strategies:

- To minimize the impact of methodological limitations, the study included a paired samples design to control for individual variability, ensuring that each participant served as their own control.
- Efforts were made to ensure the confidentiality and anonymity of the respondents, which helped to mitigate response biases and encourage honest participation.

5.5 Implications/Recommendations

5.5.1 Implications for Practice

- **Dispel myths:** Developing educational programs to inform athletes and coaches about the benefits and proper usage of creatine monohydrate.
- **Nutritional Guidance:** Integrating creatine guidelines into the nutritional plans provided by sports dietitians, ensuring athletes receive accurate and practical advice.
- **Dosage Tracking:** Establish a monitoring system to track the effects of creatine on athletes, allowing for adjustments and personalized recommendations based on individual responses.

5.5.2 Implications for Theory

- **Expanding the Knowledge Base:** The findings of this study contribute to the understanding of how creatine monohydrate affects sprint performance in an African context, filling a gap in the current literature predominantly based on Western populations.
- **Theoretical Integration:** The study highlights the need for integrating cultural and regional factors into sports nutrition theories, suggesting that supplementation strategies should be tailored to specific populations.
- **Framework Development:** The results can inform the development of a theoretical framework for creatine supplementation, considering both physiological and socio-cultural variables that influence its effectiveness.

5.5.3 Implications for Future Research

- **Longitudinal Studies:** Future research should conduct longitudinal studies to assess the long-term effects of creatine supplementation on performance and health in Zimbabwean athletes.
- **Larger Sample Sizes:** Increasing the sample size in subsequent studies will enhance the generalizability and statistical power of the findings.
- **Comparative Studies:** Comparative research involving different populations and sports disciplines can provide a broader understanding of creatine's impact and identify any sport-specific benefits or limitations.

- **Exploring Mechanisms:** Investigate the underlying mechanisms of how creatine supplementation influences sprint performance, including muscle physiology, energy metabolism, and recovery processes.

5.6 Chapter Summary

Chapter 5 discussed the implications of the study's findings, offering recommendations for practice, theory, and future research. The chapter emphasized the need for educational programs and monitoring systems to enhance creatine supplementation adoption among Zimbabwean sprinters. It also highlighted the study's contribution to expanding the knowledge base and calls for more comprehensive future research to validate and extend these findings. The chapter concluded by summarizing the key points and suggesting pathways for further investigation.

References

Balsom PD, Soderlund K, Ekblom B: Creatine in humans with special reference to creatine supplementation. Sports Med 1994.

Becque, M. D., Lochmann, J. D., & Melrose, D. R. (2000). Effects of oral creatine supplementation on muscular strength and body composition. Medicine & Science in Sports & Exercise, 32(3), 654–658. [DOI: 10.1097/00005768-200003000-00016]

Buford, T. W., Kreider, R. B., Stout, J. R., Greenwood, M., Campbell, B., Spano, M.,& Antonio, J. (2007). International Society of Sports Nutrition position stand: creatine supplementation and exercise. Journal of the International Society of Sports Nutrition

Buford et al : Effects of creatine supplementation on performance and training adaptations 2007

Burke DG, Chilibeck PD, Parise G, Candow DG, Mahoney D, Tarnopolsky M: Effect of creatine and weight training on muscle creatine and performance in vegetarians. 2003.

Butts J, Jacobs B, Silvis M. Creatine Use in Sports. Sports Health: A Multidisciplinary Approach. 2018

Cantler E, Milnor P, Almada A: Creatine supplementation during college football training does not increase the incidence of cramping or injury. Mol Cell Biochem 2003.

Casey, A., Constantin-Teodosiu, D., Howell, S., Hultman, E., & Greenhaff, P. L. (1996). Creatine ingestion favorably affects performance and muscle metabolism during maximal exercise in humans. American Journal of Physiology-Endocrinology and Metabolism

Cooke, M. B., Rybalka, E., Stathis, C. G., Cribb, P. J., & Hayes, A. (2009). Creatine supplementation enhances muscle force recovery after eccentrically-induced muscle damage in healthy individuals. Journal of the International Society of Sports Nutrition, 6(1), 13. [DOI: 10.1186/1550-2783-6-13]

Creswell, J. W. (2014). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches

Dzomba, P., Gwatidzo, L., Mugari, P., & Mupa, M. (2017). Traditional dishes consumed in Zimbabwe and high-performance liquid chromatography (HPLC) quantitation of their antioxidant phytochemicals. *African Journal of Biotechnology*,

Greenhaff, P. L., K. Bodin, K. Soderlund, and E. Hultman. Effect of oral creatine supplementation on skeletal muscle phosphocreatine resynthesise.1994.

Greenhaff, P. L., Casey, A., Short, A. H., Harris, R., Söderlund, K., & Hultman, E. (1993). Influence of oral creatine supplementation of muscle torque during repeated bouts of maximal voluntary exercise in man. Clinical Science, 84(5), 565–571. [DOI: 10.1042/cs0840565]

Greenhaff P: The nutritional biochemistry of creatine. J Nutrit Biochem 1997.

Greenhaff PL, Bodin K, Soderlund K, Hultman E: Effect of oral creatine supplementation on skeletal muscle phosphocreatine resynthesis, 1994.

Greenwood M, Kreider RB, Melton C, Rasmussen C, Lancaster S, Harris RC, Soderlund K, Hultman E: Elevation of creatine in resting and exercised muscle of normal subjects by creatine supplementation. 1992.

Kreider RB, Kalman DS, Antonio J, Ziegenfuss TN, Wildman R, Collins R, Candow DG, Kleiner SM, Almada AL, Lopez HL. International Society of Sports Nutrition position stand: safety and efficacy of creatine supplementation in exercise, sport, and medicine. J Int Soc Sports Nutr 2017

Kreider RB, Melton C, Rasmussen CJ, Greenwood M, Lancaster S, Cantler EC, Milnor P, Almada AL: Long-term creatine supplementation does not significantly affect clinical markers of health in athletes.2003

Kreider RB, Leutholtz BC, Greenwood M: Creatine. In Nutritional Ergogenic Aids; 2004.

Kreider RB: Creatine in Sports. In Essentials of Sport Nutrition & Supplements Edited by: Antonio J, Kalman D, Stout J, et al. Humana Press Inc., 2007.

Krieder, R. B., M. Ferreira, M. Wilson,Effects of creatine supplementation on body composition, strength and sprint performance. Med. Sci. Sports Exerc.1998.

Kreider, R. B., Kalman, D. S., Antonio, J., Ziegenfuss, T. N., Wildman, R., Collins, R., ... & Lopez, H. L. (2017). International Society of Sports Nutrition position stand: Safety and efficacy of creatine supplementation in exercise, sport, and medicine. *Journal of the International Society of Sports Nutrition*, *14*(18). https://doi.org/10.1186/s12970-017-0173-z

Haff, G. G., & Nimphius, S. (2012). Training Principles for Power. Strength and Conditioning Journal

Harris, R. C., Söderlund, K., & Hultman, E. (1992). Elevation of creatine in resting and exercised muscle of normal subjects by creatine supplementation.

Hirvonen, J., S. Rehunen, H. Rusko, and M. Harkonen. Breakdown of high-energy phosphate compounds and lactate accumulation during short supramaximal exercise. 1987.

Hultman E, Bergstrom J, Spreit L, Soderlund K: Energy metabolism and fatigue. In Biochemistry of Exercise VII Edited by: Taylor A, Gollnick PD, Green H. Human Kinetics. 1990.

Hultman, E., Söderlund, K., Timmons, J. A., Cederblad, G., & Greenhaff, P. L. (1996). Muscle creatine loading in men. Journal of Applied Physiology, 81(1), 232–237. [DOI: 10.1152/jappl.1996.81.1.232]

Metzl JD, Small E, Levine SR, Gershel JC: Creatine use among young athletes. Pediatrics, 2001

Paddon-Jones D, Borsheim E, Wolfe RR: Potential ergogenic effects of arginine and creatine supplementation. 2004.

Ramirez-Campillo, R., González-Jurado, J. A., Martínez, C., Nakamura, F. Y., Peñailillo, L., Meylan, C. M., & Izquierdo, M. (2016). Effects of plyometric training and creatine supplementation on maximal-intensity exercise and endurance in female soccer players. Journal of Science and Medicine in Sport, 19(8), 682-687.

Rawson, E. S., & Clarkson, P. M. (2003). Effects of creatine supplementation on exercise-induced muscle damage: A systematic review and meta-analysis. Journal of the International Society of Sports Nutrition, 7(1), 7. [DOI: 10.1186/1550-2783-7-7]

Rawson, E. S., Stec, M. J., Frederickson, S. J., & Miles, M. P. (2011). Low-dose creatine supplementation enhances fatigue resistance in the absence of weight gain. Nutrition, 27(4), 451–455. [DOI: 10.1016/j.nut.2010.04.001]

Rawson, E. S., & Volek, J. S. (2003). Effects of creatine supplementation and resistance training on muscle strength and weightlifting performance. Journal of Strength and Conditioning Research, 17(4), 822–831. [DOI: 10.1519/1533-4287(2003)

Williams MH, Kreider R, Branch JD: Creatine: The power supplement.1999.

Weinberg, R. S., & Gould, D. (2014). Foundations of Sport and Exercise Psychology. Human Kinetics

Vandebuerie, F., Vanden Eynde, B., Vandenberghe, K., Hespel, P., & Van Leemputte, M. (1998). Effect of creatine loading on endurance capacity and sprint power in cyclists. International Journal of Sports Medicine, 19(07), 490–495. [DOI: 10.1055/s-2007-971981]

Appendices

Appendix a ***Research Instruments***

1. **Measurement of Sprint Performance:**
    - **Instrument:** Electronic Timing Gates
    - **Reason for Choice:** Electronic timing gates are widely used in sprint research due to their high accuracy in measuring sprint times. They provide precise data on the time it takes for sprinters to cover a set distance in the case of this study 30 meters, 60 meters, allowing for before-and-after comparisons in performance.
    - **Instrument:** Electronic Timing Gates
2. **Questionnaire on Athlete Perceptions:**
    - **Instrument:** Structured Questionnaire
    - **Reason for Choice:** A structured questionnaire allows for systematic gathering of data on athlete perceptions towards creatine monohydrate supplementation. It provides a standardized approach to collecting information on factors influencing supplement use, concerns, benefits perceived, and overall attitudes towards supplementation.

Appendix b ***Questionnaire***

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF SPORTS SCIENCE

Dear Participant,

___________ from the Bindura University invites you to take part in a study. This study aims to investigate the effects of creatine monohydrate on the performance of elite sprinters in Zimbabwe.

Purpose of the Study

The primary objective of this study is to evaluate the physiological and psychological impacts of creatine monohydrate on elite sprinters. The data collected will be used solely for academic purposes and to enhance scientific knowledge in the field of sports science.

Confidentiality and Anonymity

We assure you that all the information you provide will be treated with the highest level of confidentiality. Your responses will be anonymized, meaning that your name and personal details will not be associated with your responses. The data will be securely stored and only accessible to the research team

Benefits and Risks

While there are no direct benefits to you for participating in this study, your contribution will help advance scientific understanding of creatine supplementation in elite athletes. There are no anticipated risks associated with completing the questionnaire.

Contact Information

If you have any questions or concerns about this study, please feel free to contact me at___________.

Section 1: Demographic Information

1. Age:
2. Gender:

Section 2: Creatine Monohydrate Supplementation

1. Have you ever used creatine monohydrate supplementation?
    - Yes
    - No
2. How do you perceive the benefits of creatine monohydrate supplementation in relation to sprint performance?
    - Power output
    - Muscle recovery
    - Sprint speed
3. What's the main barrier to using Creatine Monohydrate
    - Cost
    - Availability
    - Lack of Information
    - Other

Section 3: Overall Feedback

1. Would you recommend creatine monohydrate to other sprinters?
    - Yes
    - No
    - Unsure
2. What measures can be implemented to increase the adoption of Creatine Monohydrate in Zimbabwean Sprinters.
    - Educational Programs
    - Improving Accessibility
    - Coach Training
    - Awareness Campaigns

Reasons for Choosing These Instruments

- **Electronic Timing Gates:** Chosen for their precision in measuring sprint times, ensuring accurate data collection before and after creatine supplementation.
- **Structured Questionnaire:** Selected to systematically gather insights into athlete perceptions, reasons for supplement use, and concerns. It allows for standardized data collection, making it easier to compare responses across participants and identify common themes or trends.

Appendix c ***Informed Consent Form for Participation in Research Study***

Title of Study: The Effects of Creatine Monohydrate Supplementation on Elite Sprinters in Zimbabwe

Principal Investigator: _______

Affiliation: Bindura University

Contact Information: ________

Purpose of the Study: The purpose of this study is to evaluate the effects of creatine monohydrate on the performance of elite sprinters in Zimbabwe.

Procedures:

Participants will be asked to consume creatine monohydrate daily for a period of 8 weeks. Performance metrics will be assessed through a series of physical tests before and after supplementation.

Risks and Benefits:

There may be minimal risks associated with creatine supplementation, including potential weight gain. Benefits may include improved sprint performance.

Confidentiality:

All information collected will be kept confidential and used solely for research purposes. Participant identities will be anonymized in all reports.

Voluntary Participation:

Participation is entirely voluntary. You may withdraw from the study at any time without any penalty or loss of benefits.

Consent:

By signing this form, you agree to participate in this study and acknowledge that you have been informed about the nature, purpose, and potential risks of the study. You understand that your participation is voluntary and that you can withdraw at any time.

Participant's Statement:

I have read and understood the information provided above. I voluntarily agree to participate in this study.

Signature of Participant: ____________________

Date: ____________________

Signature of Researcher: ____________________

Date: ____________________