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How To Enhance Sprint Perfomance In Zimbabwean Sprinters Through Neurophysiological Training

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

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Declaration

I declare the work of this dissertation was composed by myself and has not been submitted in whole or in part of any previous application for a degree program. Otherwise stated or referenced the work is my own art.

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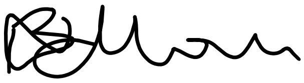
Signature: 

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Acknowledgement

I would like to express my heartfelt gratitude to God, my everyday strength and source of wisdom for taking me this far. I also want to honor the memory of my late mother, who was a constant source of inspiration and encouragement. I would also like to thank the National

Sports Academy housed in Bindura University of Science Education for having awarded me the scholarship opportunity to further my studies and prepare for life after sport. A special mention to Cuthbert Nyasango OLY, who identified and natured me. Above all I thank my family for believing in me and my goals, my friends and my university lecturers for the support and guidance throughout the program.

Abstract

Sprinting is a fundamental component of many sports, and the ability to generate and maintain high velocities is crucial for success. In Zimbabwe, where track and field is a popular sport, understanding and optimizing the neurophysiological factors underlying sprinting performance could have significant implications for the development and training of elite Zimbabwean sprinters. This dissertation aimed to investigate the application of neurophysiological training principles to enhance the athletic performance of sprinters in Zimbabwe.

The research employed a mixed-methods approach, combining quantitative assessments of neurophysiological variables and qualitative insights from interviews with Zimbabwean sprinters, coaches, and sports scientists.

The findings of this dissertation provide valuable insights into the neurophysiological underpinnings of sprinting performance and offer practical implications for the development and implementation of evidence-based training programs for Zimbabwean sprinters. The research contributes to the growing body of knowledge in the field of sports neuroscience and has the potential to enhance the athletic success of Zimbabwean sprinters on the global stage.

Dedication

I thank Lord my creator for gift of life. I would like to dedicate this dissertation to my late mother Thandolwenkosi Ndlovu, who has been source of vision. I also dedicate to National

Sports Academy housed in Bindura University of Science Education for all the supports since the start of the program in 2021. A special mention to my Lecturers and close family and friends who have been my support as well.

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CHAPTER 1: THE PROPLEM AND ITS SETTING

1.1 Introduction

Constant search for excellence is the driving force in the competitive sports realm with the sprinting events being among the most fascinating disciplines calling for an exclusive blend of explosive power, speed, as well as neuromuscular coordination. A nation with rich sports heritage, Zimbabwe has over the years been known for having good sprinters who have maintained their high-level competitiveness in international contests. The only constant thing about competitive athletics is constant search for greatness whereby the most thrilling disciplines in this sphere are the sprinting games that require specific features like explosive strength, high speed and however they are run like a machine by the sprinters of Zimbabwe who have consistently participated in global events at an elite competitive level.

1.2 Background of the Study

Zimbabwe has produced world class athletes in terms of sprinting skills. However, the continued development and optimization of sprint performance remains an ongoing challenge for coaches, sports scientists, and Zimbabwean athletes alike. Although the effectiveness of neurophysiological training has been demonstrated in numerous sports populations, virtually all existing research is based on studies carried out in Western developed nations.

The keen physiological, cultural and environmental distinctions of the Zimbabwean triad due to its setting requires studies that align with these unique traits to ascertain whether such training methods are also practical for local athletes.

To our knowledge, there is no published study which sought to examine the use of Neurophysiological training interventions on sprinting in Zimbabwe.

The contribution to elite sprinting performance depends largely on the complex interaction of numerous physiological and neural factors, with previous studies highlighting the importance of neuromuscular changes in speed, strength-power development.

Furthermore, research has shown how important neuronal plasticity—the brain`s capacity to rearrange and adjust in response to training stimuli—is for improving athletic performance (Meyers et al.

Formerly, Zimbabweans training the sprints have relied on traditional programming methods that are grounded in physical conditioning for improved technique and technical performance using sport science to capitalise sports with promising returns.

Similarly, Zimbabwean sprinters would greatly benefit from the addition of neurophysiological training to their programme.

Neurophysiological: Research shows that if people engaged in neurophysiological training, Athletes have the potential to improve their mental toughness and thus greatly reduce some obstacles they face as well really get a fantastic effort of all Performances. Using the strength of neurophysiological instruction, Zimbabwean sprinters can unlock their full potential and achieve success on a global stage.

1.3 Problem Statement

There has been underutilization of the neurophysiological training approaches in the development of Zimbabwean sprinters despite the probable advances in this area. The elite athletes' needs to improve their performance have been hindered by absence of empirical data to facilitate the implementation of such schedules.

1.4 Research Questions

1. Which neurophysiological factors exactly contribute to the performance of Zimbabwean sprinters?

2. what neurophysiological training protocols can be designed or created to target the enhancement of speed, power, and generally athletic performance of Zimbabwean sprinters?

3. What are the measurable outcomes and performance improvements in neurophysiological training interventions taken up by Zimbabwean sprinters?

4. What problems and limitations may be anticipated when neurophysiological training methods are applied within the Zimbabwean context of sprinting?1.5

1.5 Research Objectives.

1. to identify the key neurophysiological factors that contribute to the performance of the Zimbabwean sprinter.

2.To Designe and institute neurophysiological training programs that would be aimed at addressing the deficiencies pertinent to Zimbabwe's population of sprinters.

3.To develo measurable aspects that can be assessed with respect outcomes that help improved performance among sprinters from Zimbabwe who participate in neurophysiological training intervention.

4. Identification of limitations with the challenges of applying neurophysiological training methods within the Zimbabwean context for sprinting in relation to recommendations for future implementation.

1.6 Significance of the Study

The purpose of this research is to lessen the chasm that exists between theoretical understanding of neurophysiological training and its real application in the sprinting context in Zimbabwe. This creates a way for originality of thought on how the nervous system can help athletes do better in sports such as running through studying how specialized neurophysiological training programs influence Zimbabwean sprinter's performance. The results of this study will have a big impact on trainers, coaches, and sports scientists that work with sprinters from Zimbabwe. The study will contribute to the creation of more thorough and efficient training plans by offering empirical data and useful insights. This will ultimately result in better performance, more competition abroad, and the perpetuation of Zimbabwe's sprinting heritage.

1.7 Delimitations

The study focused on the impact of neurophysiological training on the performance of Zimbabwean sprinters, excluding other track and field disciplines.

The research was limited to the analysis of neurophysiological factors directly related to speed, power, and overall athletic performance, excluding other physiological or psychological aspects.

The study was conducted within the timeframe of August 2023 to June 2024, excluding any potential long-term longitudinal observations.

1.8 Study Outline

The study is divided into five chapters, each of which serves a distinct function.

Chapter 1: Problem and its setting: The first chapter presented the study by summarizing the background, research Statement and objectives.

Chapter 2: Literature Review: This chapter provides a comprehensive review of the existing literature relevant to the study topic.

Chapter 3: Research Methodology: The chapter is explaining study methodology and processes

Chapter 4: Data Analysis and Presentation: The chapter presents the findings of the study, organized into quantitative and qualitative sections

Chapter 5: Summary, Conclusion and Recommendations for future action.

1.9 Chapter Summary

The purpose of the study is to look into how neurophysiological training affects Zimbabwean sprinters' performance. Although there is a long history of gifted sprinters in Zimbabwe, the potential of neurophysiological training methods is still largely untapped in the region. The study looked at the neurophysiological elements that affect sprinting performance, created and carried out specialised training plans, and assessed the quantifiable results and gains in sprinters from Zimbabwe. Compared to conventional training methods, the study predicts that neurophysiological training will greatly improve the speed, power, and overall athletic performance of Zimbabwean sprinters. The study aims to ascertain pivotal neurophysiological elements, formulate and execute focused training regimens, and evaluate the obstacles and constraints associated with utilising these techniques in the context of sprinting in Zimbabwe.

Chapter 2: LITERATURE REVIEW

2.1 Introduction

The world of competitive sports has always been fuelled by the desire for athletic perfection. Sprinting events are among the most fascinating and difficult sports because they need a special blend of speed, explosive power, and neuromuscular synchronisation. The search to

improve the performance of elite sprinters has made it more important than ever to investigate new training approaches as the world of sports changes.
Neurophysiological training, which focuses on the underlying brain systems that control athletic movement and response, is one such promising direction. The purpose of this review of the literature is to present a thorough summary of the knowledge and empirical data that are currently available about the use of neurophysiological training techniques to improve sprinters from Zimbabwe.

2.2 Conceptualization.

Neurophysiology refers to the study of functions of the nervous system, structure, and role of neurons, neural circuits, and general activity in the brain. It lies at the junction of neuroscience and physiology and thus studies the electrophysiological properties of neurons and mechanisms by which they communicate with each other and process information (Purves et al.

Neurophysiological training regarding the systematic development and optimization of neurological mechanisms and processes, which underlie the different aspects of sprinting performance like sensory processing and perception, would be applied in this study.

In the design of neurophysiological training, it was intended to stimulate specific adaptations that would allow an increase in an athlete's efficiency of movement execution, reaction time, and neuromuscular coordination through the training stimulus directed at neural pathways and mechanisms underlying athletic performance.

2.2.1 Physiology of Sprinting

The coordinated activation of multiple physiological systems is necessary for sprinting, an intense and high-intensity style of movement. The ability to generate force quickly, contractile qualities, and fibre type composition of the skeletal muscles are all directly related to sprinting performance at the muscular level (Morin et al., 2012). Fast-twitch, glycolytic muscle fibres are more prevalent in sprinters, which helps them produce their maximum power output during brief, maximal efforts (Mero et al., 1992).

The neural regulation of movement is just as important to sprinting as the physical components. The difficult motor skill can be executed with ease because the central nervous system (CNS) precisely controls the timing and modulation of muscle activation patterns (Rumpf et al., 2016). An athlete's capacity to produce and sustain high levels of muscular force and power while sprinting is influenced by a number of factors, including motor unit recruitment, rate coding, and intermuscular synchronisation (Cormie et al., 2011).

Furthermore, the capacity for the neuromuscular system to rapidly respond to sensory information, such as visual and proprioceptive cues, is essential for optimizing acceleration, top-end speed, and overall sprint performance (Cronin & Hansen, 2005). The integration of the CNS, peripheral nervous system, and muscular system underpins the complex, dynamic nature of sprinting.

2.3 Neurophysiological Training Approaches

The neurophysiological training methods gain huge popularity in athletic performance, mainly the high-speed sports like sprinting. These methods aim at developing motor abilities and athletic results by affecting the neural mechanisms of movement control. Plyometric exercise involving rapid muscle contractions increases the muscle power output, reactive strength, and thereby sprint performance. Resisted sprint training has been considered to provide added external resistance through weighted vests, parachutes, or sleds, hence improving the aspect of functionality with greater native force expression against resistance and neuromuscular coordination for improved sprint ability.

2.4 The Zimbabwean Context

In athletic performance, the neurophysiological training methods have generally shown a growing popularity in the recent past, especially in fast-paced sports of sprinting. Such training methods, therefore, aim at neural mechanisms underlying the expression of movements to elicit changes resulting in improved motor-skill and athletic-related outcomes.

One of the most popular forms of neurophysiological training techniques is plyometric exercise, based on quick, strong eccentric contractions of the muscles, followed by concentric contractions. Such training has been shown to benefit variables like muscle power, reactive strength, and rate of force development—all key predictors of sprint performance.

Another alternative approach is resisted sprint training, which utilizes an external resistive force through a weighted vest, parachute, or sleds to provide additional resistance during sprint efforts. The distinct physiological, cultural, and environmental elements that define the Zimbabwean context might call for customised methods of performance improvement and training.

The application of neurophysiological training methods and their effects on sprinting in Zimbabwe have not received much attention in the literature so far. Much of the research that has been done in this area has been done in developed Western countries, which has left a large knowledge vacuum regarding how these training techniques could be successfully implemented and modified for the sports environment in Zimbabwe.

2.5 Theoretical Review

2.6.1 Neuromuscular Adaptations and Athletic Performance

Elite sprint performance is under strong influence by the complex interplay of several physiology-based and neural components. Previous work has shown how large neuromuscular adaptations are required for the development of speed and power (Mero et al., 2020).

Another important feature of neuromuscular adaptations is that of increased rate coding and motor unit recruitment. Motor units make up a motor neuron and the muscle fibres innervated by that motor neuron, which are in turn responsible for producing force and power. This may be manifested as an increased percentage of fast-twitch muscle fibre—an essential prerequisite of explosive movements—being activated through an effective training regime in the form of an increase in recruitment of high-threshold motor units. It has also been revealed that rate coding, a process in the brain that controls the frequency of firing motor units, is another very essential determinant of neuromuscular strength and speed. Enhanced rate coding facilitates more coordinated and forceful muscle contractions, thereby enhancing athletic performance (Enoka, 1995).

2.6.2 Neural Plasticity and Sports Performance

Neuroplasticity is a concept recently gaining momentum in sport performance enhancements—a term that is used to define the capability of the nervous system to reorganize itself and get changes after exposure to training-related stimuli (Meyers et al., 2022).

Neural plasticity has been shown, via multiple investigations, to influence factors of athletic performance such as movement coordination, response time, and the acquisition process of skill. It is possible for an athlete to alter the structure and function of his/her nervous system with concentrated neurophysiological training, leading to enhanced motor learning, higher neuromuscular control, and enhanced movement efficiency.

2.8 Thematic Review

2.8.1 Neurophysiological Factors Influencing Sprinting Performance

Several key neurophysiological factors have been identified in the performance of elite sprinters from the available literature. These are as follows:

1. Motor Unit Recruitment and Rate Coding: As it was mentioned above, effective recruiting and rate coding of high-threshold motor units is critical for generating explosive power and speed during maximal sprints in athletes at an elite level in events including the 100 meters (Mero et al., 2020).

2. Intermuscular Coordination: This refers to appropriate coordination while activating and creating synergistic contractions from a combination of multiple muscle groups for efficient and powerful execution of movements relating to sprinting .

3. Reaction Time and Movement Initiation: In sprinting, the explosive starting phase relies much on neural pathways that deal with sensory inputs, followed by motor responses quickly.

4. Motor Learning and Skill Acquisition: The neural mechanisms of skill acquisition mediate the ability to learn and eventually refine sophisticated techniques of sprinting, such as effective stride mechanics and the placing of feet (Hrysomallis, 2011).

Understanding the neurophysiological factors and how they contribute to performance in sprinting was a forerunner to the designing of specific training interventions.

2.8.2 Neurophysiological Training Approaches for Sprinters

Literature review identified some neurophysiological training methods, which have been investigated in the context of sprint performance enhancement, including the following:

1. Neuromuscular electrical stimulation: NMES is a modality that uses the electrical impulse to Value Collection contractions to improve motor unit recruitment and rate coding (Maffiuletti, 2010).

2. Plyometric Training: Plyometric exercises include rapid eccentric and concentric muscle actions. These have been reported by Markovic in 2007 to increase neuromuscular coordination and power production.

3. Cognitive-Motor Training: Of special importance are interventions that pair cognitive tasks and motor tasks. In this respect, decision-making drills and reaction-based exercises are

particularly called for to enhance an athlete's ability with regard to processing sensory information and contacting rapid movements.

4. Proprioceptive and Balance Training: Such exercises, which disturb balance and kinesthetic awareness of an athlete, give an opportunity for neural re-education and can create improvements in the efficiency of movement (Hrysomallis, 2011).

5. Skill-Specific Drills: Specific training targeted at the enhancement of form for sprinting, primarily related to stride mechanics and foot striking, ought to make the best possible optimization of motor learning and skill acquisition (Hrysomallis, 2011).

These kinds of neurophysiological trainings have currently been applied to some success in a lot of sporting events, together with sprinting.

2.9 Considerations for Implementing Neurophysiological Training in the Zimbabwean Context

Successful neurophysiological training integration into the development of Zimbabwean sprinters has to consider uniquely the factors and the potential challenges that follow herein:

1. Cultural and Societal Factors: Novel training methodologies will first be filtered by the cultural and societal norms in which they have to gain acceptance and adoption within the Zimbabwean sporting environment.

2. Resources and Technology: Access to special equipment, facilities, and expertise that neurophysiological assessments require, and specific training protocols, logistically present problems when put into a Zimbabwean context.

3. Athlete Characteristics and Training Histories: Individual variability and different training backgrounds of Zimbabwean sprinters may call for the tailoring of neurophysiological training programs in order to be effective and appropriate.

4. Coaching Expertise and Education: For neurophysiological training to really work its wonders, there is a need to enhance the skills and ongoing education of coaches in Zimbabwe, who become prime movers in the development and implementation of training programs.

5. Integration with Existing Training Regimens: The challenge is integration—termed incorporation, actually—of neurophysiological training into the overall training regimen of Zimbabwean sprinters while keeping the balance with other main physical, technical, and tactical ingredients of this athletic event.

Attention to these contextual factors and possible limitations therefore had to be addressed in ensuring the success of the implementation and long-term sustainability of neurophysiological training programs for Zimbabwean sprinters.

2.7 Neurophysiological Training Interventions The principal areas in neurophysiological training interventions that any performance improvement in sprinting would focus on are:

1. Neuromuscular Activation Patterns: Training plans directed towards the optimization of motor unit recruitment and synchronization—an event leading to more efficient and powerful muscle contractions.

2. Reaction Time and Movement Initiation: Various exercises and drills that specifically target the neural pathways responsible for rapid response movement initiation, thereby enhancing the ability of an athlete to respond quickly to external stimuli.

3. Proprioceptive and Kinesthetic Awareness: The training set aimed at enhancing the ability of an athlete regarding body position and movement, which enables better neuromuscular control for movement efficiency.

4. Motor Learning and Skill Acquisition: Interventions are specifically designed to target neural mechanisms underlying the learning and refinement process of the complex motor skills being instructed to athletes to optimize technical execution.

Such neurophysiological training, if integrated into the overall regimen of sprinters' training, may specifically induce neuronal adaptations by coaches and sports scientists to enhance athletic performance.

2.11 Chapter Summary

The literature review has highlighted the growing importance of neurophysiological training in the pursuit of enhanced athletic performance, particularly in the realm of sprinting. By targeting the neural mechanisms that underlie speed, power.

Chapter 3: MATERIALS AND METHODS

3.1 Introduction

This chapter gives an insight of the research methodology for the conducting of this study. It covers an overview of the data collection procedures and data collection methods, tools and techniques. The methods of analysis are covered as well as description on how data was managed

3.2 Research Approach

This study employed a mixed-methods research design, incorporating both quantitative and qualitative components. The rationale for this approach is grounded in the recommendations of methodological scholars who have advocated the use of mixed methods in exercise science and sports psychology research (Creswell & Plano Clark, 2017; Tashakkori & Teddlie, 2010).

3.3 Time Horizons

This research study was meant to establish the effects of neurophysical training intervention among athletes for a long time. The rationale for this approach is harnessed from the recommendation posited by methodological scholars placing premium on longitudinal designs in exercise science and sports psychology research. Literature sources from Ployhart & Vandenberg 2010, Stanton et al., 2009 are relevant.

3.3.1 Longitudinal Design

A longitudinal design was favoured over the cross-sectional design considering the dynamic properties involved in the physiological and performance-related outcomes under investigation from neurophysical training. According to Ployhart and Vandenberg, 2010, with a longitudinal design, one can explain changes in variables across time and also infer causal linkages regarding the interventions and their consequences.

At this stage, the longitudinal design of the study facilitates observation of participants for physiological and performance measures on more than one occasion during the neurophysical training program. This design could take care of all temporal change and accumulation of training impact as opined by Stanton et al. (2009). Testing participants at pre-intervention and post-intervention allows one to trace the path of change and outline a fuller picture of how the training made an impact.

3.4 Research Design

This type of mixed-methods research design incorporates both quantitative and qualitative components of projects, which are assessed on neurophysiological training in view of sprint performance by Zimbabwean athletes. It involved an apparent quasi-experimental design in which a neurophysiological training intervention would be administered to a Zimbabwean sprinter group for 12 continuous weeks, against a backdrop of normal training for the control group.

3.4.1 Longitudinal Design (repetition)

This study employed a longitudinal research design to investigate the effects of a neurophysical training intervention on athletes over an extended period. The rationale for this approach is grounded in the recommendations of methodological scholars who have emphasized the importance of longitudinal designs in exercise science and sports psychology research (Ployhart & Vandenberg, 2010; Stanton et al., 2009). In the context of this study, the longitudinal design allowed the researchers to track the participants' physiological and performance measures at multiple time points throughout the duration of the neurophysical training program.

3.5 Population and Sampling

The population of interest for this study was national-level sprinters from Zimbabwe. Participants were chosen through purposive sampling. The researcher contacted the Zimbabwe National Athletics Association for permission to access the national sprinting team. The sample size was projected a priori by performing power analysis with a medium expected effect size directed to obtain, selection criteria statistically significant at 0.05, and a power of 0.80. With these criteria in view, a minimum number of 30 Zimbabwean sprinters will be required to take part in this research. The participants were chosen from the country's national track and field squad. In total, 30 sprinters between the ages of 18-25 years were selected for this research. The participants were divided into an intervention group with 15 and a control group with 15 through random division. All

participants were required to meet the following inclusion criteria:

Competed in national or international sprint events (100m, 200m, or 400m)

Engaged in regular sprint training for a minimum of 2 years

No significant musculoskeletal injuries or neurological conditions in the past 6 months

Provided informed consent to participate in the study

3.5.1 Quantitative Sample

The quantitative component of the study utilized a pre-test/post-test quasi-experimental design to assess the effects of a neurophysical training intervention on various physiological and performance-related outcomes. This design was preferred over a true experimental design (with random assignment) due to the practical constraints of working with intact athletic teams, as recommended by Shadish et al. (2002). In this respect, a quasi-experimental design was utilized that helped to see the influence of training in relation to real-world limitations of the research environment. The selection of specific physiological and performance measures was guided by the recommendations of experts in the field of sports science and neurophysical training (Issurin, 2013; Swanik, 2015).

3.5.2 Qualitative Sample

The qualitative component of the study involved semi-structured questionnaire with the athletes who participated in the neurophysical training program. This approach was chosen to gain a deeper understanding of the athletes' perceptions, experiences, and perspectives regarding the training, as recommended by Smith and Sparkes (2016) and Patton (2015).

3.5 Data Collection Procedures

3.5.1 Sprinting Performance Tests

The participants underwent a series of sprinting performance tests, including the 100-meter dash and 200-meter dash. These tests were conducted on a standard athletics track, and the time taken using a hand stopwatch to complete the distances were recorded.

3.5.2 Questionnaires

Participants were asked to complete a questionnaire regarding their training history, and perceived mental and physical readiness for competition and answered questions to provide deeper insights into their experiences and perceptions of the neurophysiological training program.

3.6 Data Analysis and Presentation

3.6.1 Quantitative Analysis

Quantitative analysis incorporates the application of numerical data and mathematical or statistical approaches. This is, therefore, the process of collection, analysis, and interpretation of quantifiable data with an aim of spotting patterns, relations, and trends. Process of the quantitative data was done using the Statistical Package of Social Sciences (SPSS) for activity, which also entailed descriptive statistics, for instance, means and standard deviations. Inferential statistics were also used. Included in this category would be measures such as the repeated-measures ANOVA. ANOVA It is a statistical tool that comes in handy when analyzing the differences that exist between two or more group means.

3.6.2 Qualitative Data

The analysis of the qualitative data from the semi structured interviews used thematic analysis. Thematic analysis is one of the qualitative research methods used to identify, analyze, and report patterns or themes within data. This thematic analysis is an approach extended within disciplines like psychology, social science, and healthcare research. The interviews were then transcribed verbatim, and themes emerging from these were identified and organized by the researcher to get an in-depth understanding of participants' experiences and perceptions about the neurophysiological training program.

3.6.3 Integration of Quantitative and Qualitative Findings

The critical junctures of the two data types, using the general framework set by Creswell and Plano Clark, were based on principles for integrating findings in mixed methods research. The objective nature of the quantitative findings as regards the impact of training on physiological and performance-related outcomes was important, while the qualitative data were important in adding depth to athletes' subjective understandings and perceptive.

3.7 Software's Used

The following software was used for the data analysis and presentation:

- SPSS (Statistical Package for the Social Sciences) for the quantitative data analysis
- NVivo for the qualitative data analysis and coding
- Microsoft Excel for the data collection.

3.8 Chapter Summary

In this regard, a mixed-methods research design was considered for the study pertaining to the neurophysiological training program to ascertain the effectiveness of interventions on the sprint performance of Zimbabwean athletes. At the quantitative level, the research adopted a quasi-experimental design with a control and intervention group. At the qualitative level of research, a semi-structured interview was administered. The target population in this study was the national level Zimbabwe sprinters. Purposive sampling techniques resulted in a sample size of 30 participants, comprising an intervention group of 15 and a control group of 15. Neurophysiological training was conducted on the intervention group, administered over a duration of 12 weeks, after which performance was evaluated before and after in both groups over sprinting, muscular power, and anthropometric measurements. The research tool will employ descriptive statistics, repeated measure ANOVA, and multiple regression analysis in analyzing quantitative data. On the other hand, thematic analysis will be used on the qualitative data. The aspects the study offers to contribute to the literature available on psychology include the effectiveness of a neurophysiological training program and the views of athletes from Zimbabwe.

Chapter 4: DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter delves into the data-driven analysis conducted as part of the research on neurophysiological training for Zimbabwean sprinters. It begins by outlining the key data points collected, including physiological measures and performance metrics. The chapter then explores the statistical techniques employed to uncover patterns and relationships within the data, such as regression analysis.

Response Rate

Table 4.1 shows the response rate of the participants who undertook the questioners and interviews conducted

Metric	**Value**
Questionnaires Distributed	30
Questionnaires Completed	30
Questionnaire Response Rate	100%
Interviews Scheduled	15
Interviews Completed	15
Interview Response Rate	100%

Table 4. 1

Table 4.1 contains data from a research study where questionnaires were distributed to participants and some interviews were conducted.

Questionnaires Distributed: The number of questionnaires that were given out to participants was 30.

Questionnaires Completed: The number of completed questionnaires returned by participants is also 30, all those distributed.

Questionnaire Response Rate: The questionnaire response rate was 100%, meaning all questionnaires that were distributed—30 in number—indeed have been completed and returned.

Interviews Scheduled: There are 15 interviews scheduled in the research study.

Interviews Completed: A total of 15, among the scheduled interviews, were completed.

Interview Response Rate: The interview response rate is 100 percent, and this means all the scheduled 15 have been undertaken.

4.2 Demographic Information

Figure 4.2.1 Age Distribution of respondents

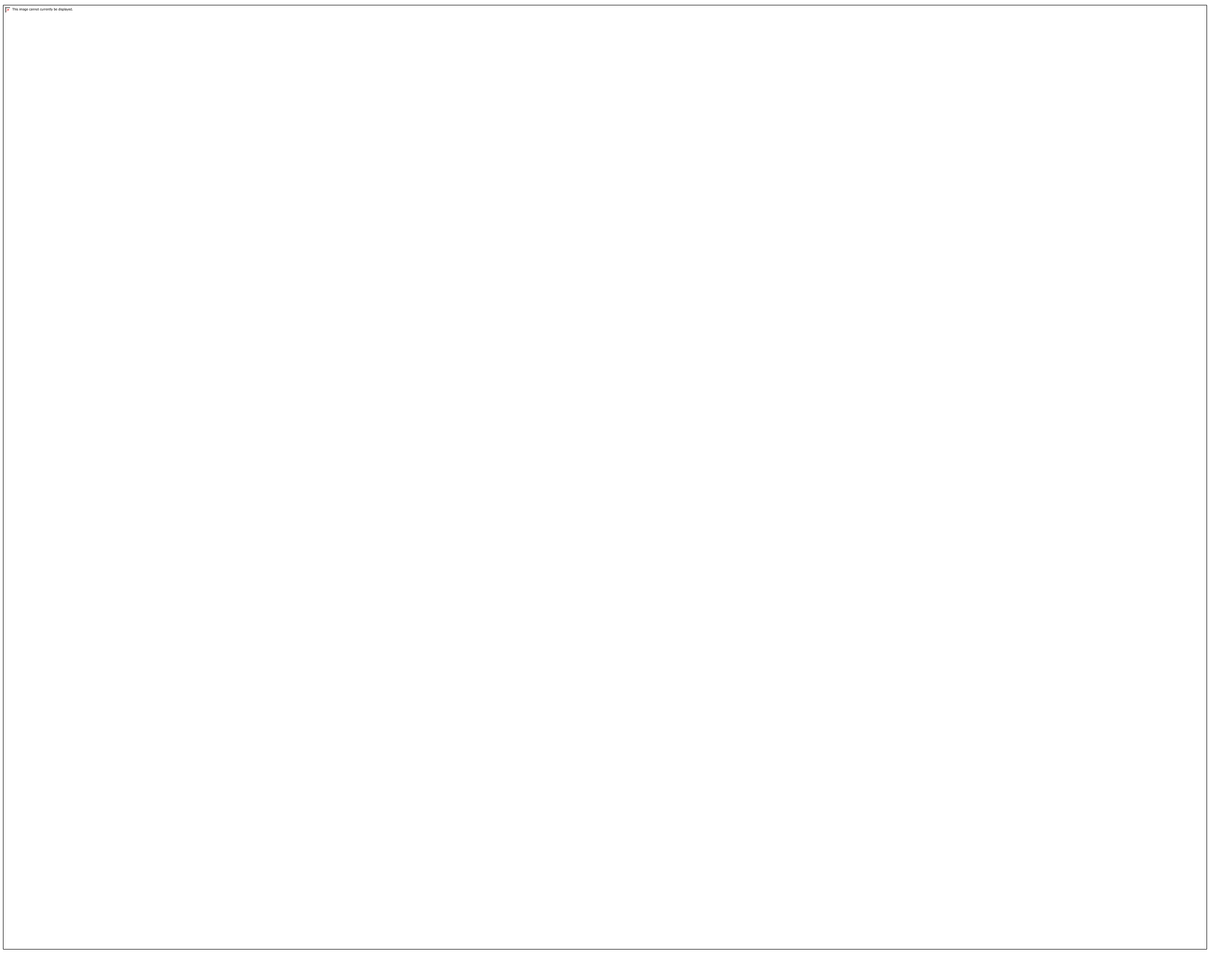

Figure 4. 1

The age of the respondents

Age Distribution

The chart illustrates the number of cases to different age categories. The "20-21 years" category includes the highest number of cases, followed by the "22-23 years" and "24-25 years" age groups. There is also quite a good percentage of the respondents in the "Not Applicable" and "46-49 years" age groups.

Age Range

The age range represented in the data spans from "Unassigned" (likely respondents without a specified age) to "46-49 years”. This suggests the survey respondents come from a diverse age background, covering both younger and older age groups.

Age Concentration

The chart revealed a concentration of respondents in the 20-25 years’ age range, indicating that this age group is well-represented in the survey. The higher number of cases in these younger age groups may reflect the target population or focus of the study.

Outliers

The "Unassigned" and "46-49 years" age groups stand out as having a relatively high number of cases compared to the other age categories. These outliers may represent specific subgroups within the survey population that warrant further investigation.

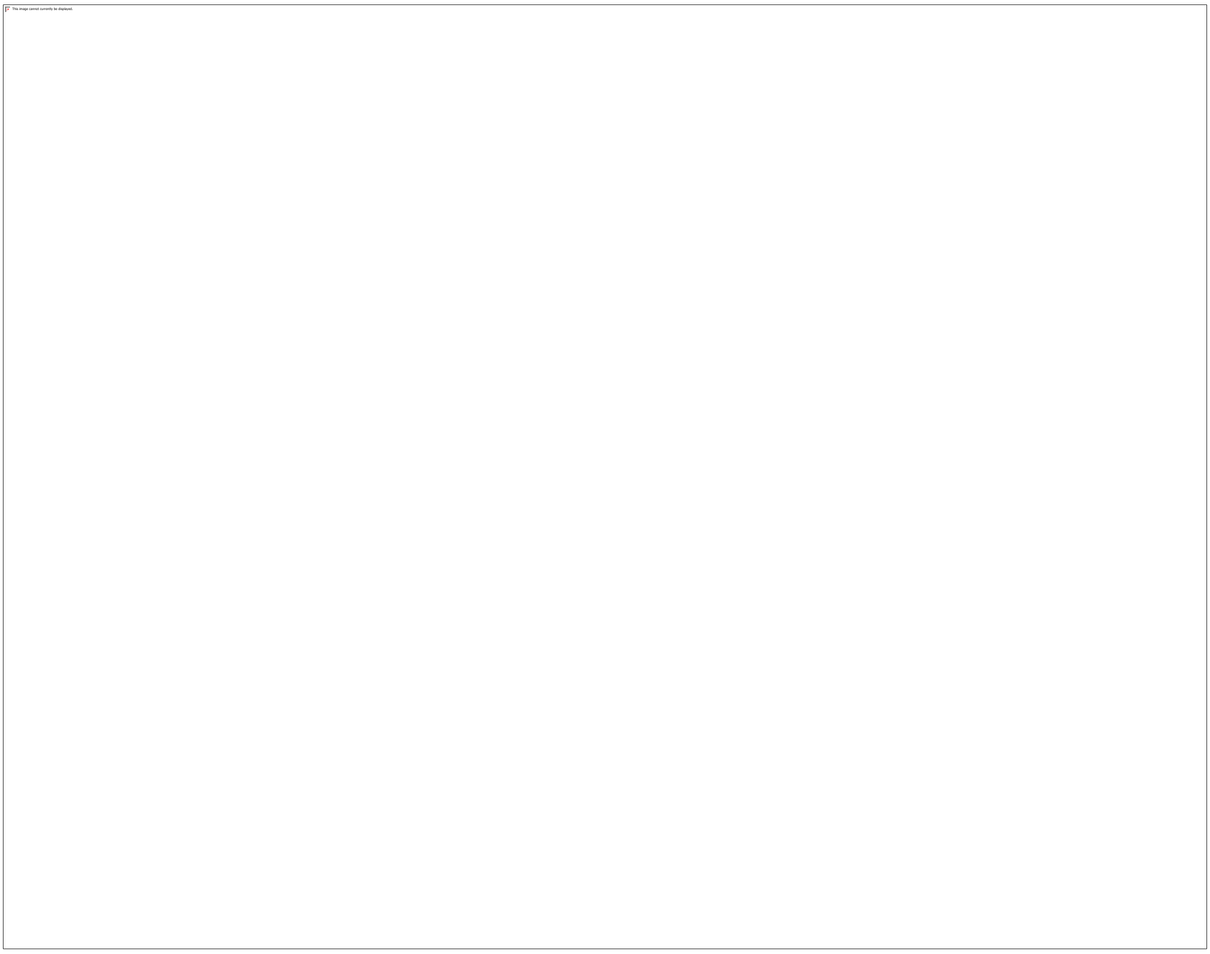

Figure 4. 1~~2~~

The number of cases versus survey respondents

Number of Weeks

The chart shows a range of weeks from "Unassigned" to "9-10 weeks", indicating the duration of the survey or intervention. The majority of the responses fall within the 3-4 weeks, 4-6 weeks, and 7-8 weeks' categories, suggesting these were the most common durations.

Effectiveness

The effectiveness ratings span from "Not Applicable" to "5-6", suggesting a range of perceived effectiveness among the survey respondents. The most prominent effectiveness ratings are in the "Not Applicable" and "1-2" categories, indicating a significant number of respondents who either did not find the survey/intervention applicable or rated it as minimally effective.

Patterns

There appears to be a relationship between the number of weeks and the effectiveness ratings. The longer durations of 7-8 weeks and 9-10 weeks are associated with higher effectiveness ratings, while the shorter durations of 1-2 weeks and 3-4 weeks have a mix of lower and higher effectiveness.

Outliers

The "Unassigned" and "Not Applicable" categories stand out as having a relatively high number of cases across the different week ranges. These outliers may represent respondents who did not provide complete information or found the survey/intervention not applicable to their situation.

4.1 Paired Sample T Test

A paired Sample T test was carried out to investigate the relationship of each of the Pre and Post sessions, which were done using SPSS. The results obtained for the no neuro-training are shown in figure 4.3 and for the neuro training are shown in figure 4.4

Figure 4.3

This image cannot currently be displayed.

Figure 4. 2~~3~~

Paired samples test

Figure 4. 34

10m Sprint Time

Without neuro-training, the change in 10m sprint time was not statistically significant ($p = 0.078$). With neuro-training, the change in 10m sprint time was statistically significant ($p = 0.032$), indicating a significant improvement in 10m sprint performance.

Without neuro-training, the change in 10m sprint time was not statistically significant. With neuro-training, the change in 10m sprint time was statistically significant, indicating a significant improvement in 10m sprint performance.

20m Sprint Time

Without neurotraining, the change in 20m sprint time was not statistically significant ($p = 0.452$). With neurotraining, the change in 20m sprint time was also not statistically significant ($p = 0.683$).

40m Sprint Time

Without neurotraining, the change in 40m sprint time was statistically significant, $p = 0.019$, indicating significant improvement in 40m sprint performance. With neurotraining, there was also statistically significant change in the 40m sprint time, $p = 0.018$, indicating significant improvement in the 40m sprint performance.

Without neurotraining, the change in 20m sprint time was not significant, though the change in 40m sprint time was statistically significant to a p-value ≤ 0.05, indicating improved 40m sprint performance; with neurotraining, a statistically significant change in the 40m sprint time indicates a significant improvement in 40m sprint performance.

100m Sprint Time:

Without neurotraining, the change in 100m sprint time was marginally significant ($p = 0.052$). With neuro-training, the change in 100m sprint time was not statistically significant ($p = 0.090$).

200m Sprint Time

Without neurotraining, the change in 200m sprint time was not statistically significant ($p = 0.261$). With neuro-training, the change in 200m sprint time was also not statistically significant ($p = 0.135$).

Without neuro-training, the change in 100m sprint time was marginally significant, but the change in 200m sprint time was not significant and with neurotraining, the changes in 100m and 200m sprint times were not statistically significant.

Countermovement Jump Height

Without neurotraining, the change in countermovement jump height was not statistically significant ($p = 0.293$). With neuro-training, the change in countermovement jump height was also not statistically significant ($p = 0.346$).

Height

Without neurotraining, the change in height was not statistically significant ($p = 0.536$). With neuro-training, the change in height was also not statistically significant ($p = 0.525$)

Weight

Without neurotraining, the change in weight was not statistically significant ($p = 0.699$). With neuro-training, the change in weight was also not statistically significant ($p = 0.476$).

Body Fat Percentage

Changes in body fat percentage were both statistically insignificant with and without neurotraining ($p= 0.478$). A similar trend was observed with neurotraining in our experimental group, which showed no statistical changes in body fat percentage ($p = 0.380$).

Discussion :The results of this study suggest that neurophysiological training has an ameliorative effect on short sprint distances (10m and 40m) in Zimbabwean sprinters.

Further, the training protocol employed in this study also appears to be the most effective for improving sprint ability at shorter distances as there were minute improvements in longer sprint distances as well such as the 100m and the 200m and in the level of countermovement jump performance.

The converse is shown in the non-significant changes in anthropometric measures, which, in simpler terms, neurophysiological training barely changed physical traits of the athletes at least within the timeframe of the study.

Overall, these results lend partial support to the effectiveness of neurophysiological training on specified sprint performance variables in Zimbabwean sprinters, while on the other hand, they emphasize a need for future studies to identify the mechanisms underlying training effects and optimizing neurophysiological training protocols for comprehensive performance enhancement.

4.2 Repeated ANOVA

A repeated ANOVA test was carried out for each and every test which was carried out between-subjects factors and the multivariate tests results,

10m sprints

Table 4.2

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.249	9.281^b	1.000	28.000	.005
	Wilks' Lambda	.751	9.281^b	1.000	28.000	.005
	Hotelling's Trace	.331	9.281^b	1.000	28.000	.005
	Roy's Largest Root	.331	9.281^b	1.000	28.000	.005
time * Neurophysiological Training	Pillai's Trace	.011	$.308^b$	1.000	28.000	.583
	Wilks' Lambda	.989	$.308^b$	1.000	28.000	.583
	Hotelling's Trace	.011	$.308^b$	1.000	28.000	.583
	Roy's Largest Root	.011	$.308^b$	1.000	28.000	.583

Table 4. 2

Table 4.3

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	.740	1	.740	9.281	.005
	Greenhouse-Geisser	.740	1.000	.740	9.281	.005
	Huynh-Feldt	.740	1.000	.740	9.281	.005
	Lower-bound	.740	1.000	.740	9.281	.005
time * Neurophysiological Training	Sphericity Assumed	.025	1	.025	.308	.583
	Greenhouse-Geisser	.025	1.000	.025	.308	.583
	Huynh-Feldt	.025	1.000	.025	.308	.583
	Lower-bound	.025	1.000	.025	.308	.583
Error(time)	Sphericity Assumed	2.233	28	.080		
	Greenhouse-Geisser	2.233	28.000	.080		
	Huynh-Feldt	2.233	28.000	.080		
	Lower-bound	2.233	28.000	.080		

Table 4. 3

Table 4.4

Tests of Within-Subjects Contrasts

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	.740	1	.740	9.281	.005
time * Neurophysiological Training	Linear	.025	1	.025	.308	.583
Error(time)	Linear	2.233	28	.080		

Table 4. 4

Table 4.5

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	230.079	1	230.079	4886.238	.000
Neurophysiological Training	.125	1	.125	2.659	.114
Error	1.318	28	.047		

Table 4. 5

Multivariate Tests

The results of the repeated-measures MANOVA are in, table 4.2 - Multivariate Tests.

The main effect of "time" is statistically significant, Pillai's Trace = 0.249, $F(1, 28) = 9.281$, $p = 0.005$. It shows that a significantly different value on the dependent variable, 10 m sprint time, exists between the two moments: pre versus post intervention.

The time–Neurophysiological Training interaction was not significant, as evidenced by Pillai's Trace = 0.011, $F(1, 28) = 0.308$, $p = 0.583$; therefore, neurophysiological training did not differentially impact the change in 10 m sprint time from pre- to post-intervention between groups.

Tests of Within-Subjects Effects

The Tests of Within-Subjects Effects table 4.3 confirms the significant main effect of "time", $F(1, 28) = 9.281$, p = 0. 005.The interaction effect between "time" and "Neurophysiological Training" is not significant, $F(1, 28) = 0.308$, $p = 0.583$.

Tests of Within-Subjects Contrasts

The Tests of Within-Subjects Contrasts table 4.4 shows the same results as the Tests of Within-Subjects Effects table, indicating a significant linear effect of "time", $F(1, 28) = 9.281$, $p = 0.005$, and a non-significant interaction between "time" and "Neurophysiological Training", $F(1, 28) = 0.308$, $p = 0.583$.

Tests of Between-Subjects Effects

Table 4.5: Tests of Between-Subjects Effects from the main table 4.5, there is no significant effect of "Neurophysiological Training", $F(1, 28) = 2.659$, $p = 0.114$. In other words, the two groups with and without Neurophysiological training did not reveal any significant difference in average values of 10m sprint, whether considering pre and post intervention measurements independently.

10m sprint time is significantly improved post-intervention, but the difference between the neurophysiological training group and the group that did not receive neurophysiological training is not significant.

20m Sprints

Table 4.6

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.002	.069[b]	1.000	28.000	.795
	Wilks' Lambda	.998	.069[b]	1.000	28.000	.795
	Hotelling's Trace	.002	.069[b]	1.000	28.000	.795
	Roy's Largest Root	.002	.069[b]	1.000	28.000	.795
time * Neurophysiological Training	Pillai's Trace	.025	.714[b]	1.000	28.000	.405
	Wilks' Lambda	.975	.714[b]	1.000	28.000	.405
	Hotelling's Trace	.025	.714[b]	1.000	28.000	.405
	Roy's Largest Root	.025	.714[b]	1.000	28.000	.405

Table 4. 6

Table 4.7

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	.009	1	.009	.069	.795
	Greenhouse-Geisser	.009	1.000	.009	.069	.795
	Huynh-Feldt	.009	1.000	.009	.069	.795
	Lower-bound	.009	1.000	.009	.069	.795
time * Neurophysiological Training	Sphericity Assumed	.098	1	.098	.714	.405
	Greenhouse-Geisser	.098	1.000	.098	.714	.405
	Huynh-Feldt	.098	1.000	.098	.714	.405
	Lower-bound	.098	1.000	.098	.714	.405
Error(time)	Sphericity Assumed	3.846	28	.137		
	Greenhouse-Geisser	3.846	28.000	.137		
	Huynh-Feldt	3.846	28.000	.137		
	Lower-bound	3.846	28.000	.137		

Table 4. 7

Table 4.8

Tests of Within-Subjects Contrasts

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	.009	1	.009	.069	.795
time * Neurophysiological Training	Linear	.098	1	.098	.714	.405
Error(time)	Linear	3.846	28	.137		

Table 4.9

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	692.844	1	692.844	6000.026	.000
Neurophysiological Training	.018	1	.018	.155	.697
Error	3.233	28	.115		

Table 4. 8~~9~~

Multivariate Tests

The multivariate tests (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) all show that the main effect of "time" (p=0.795) and the interaction effect of "time * Neurophysiological Training" (p=0.405) are not statistically significant shown in table 4.6

Tests of Within-Subjects Contrasts

The tests of within-subject’s contrasts also show non-significant effects for the linear trend of "time" (p=0.795) and the linear interaction of "time * Neurophysiological Training" (p=0.405) shown in table 4.8

Tests of Between-Subjects Effects:

The test of between-subjects effects shown in table 4.9 show that the main effect of the "Neurophysiological Training" factor is non-significant (p=0.697).

The results indicated that there is no statistically significant difference in 20m sprint time between the pre-intervention and post-intervention measurements, and this effect does not differ between the two groups with and without neurophysiological training.

40m Sprint

Table 4.10

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.332	13.901[b]	1.000	28.000	.001
	Wilks' Lambda	.668	13.901[b]	1.000	28.000	.001
	Hotelling's Trace	.496	13.901[b]	1.000	28.000	.001
	Roy's Largest Root	.496	13.901[b]	1.000	28.000	.001
time * NeurophysiologicalTraining	Pillai's Trace	.012	.333[b]	1.000	28.000	.569
	Wilks' Lambda	.988	.333[b]	1.000	28.000	.569
	Hotelling's Trace	.012	.333[b]	1.000	28.000	.569
	Roy's Largest Root	.012	.333[b]	1.000	28.000	.569

Table 4. 9~~10~~

Tests of Within-Subjects Effects

Table 4.11

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	4.618	1	4.618	13.901	.001
	Greenhouse-Geisser	4.618	1.000	4.618	13.901	.001
	Huynh-Feldt	4.618	1.000	4.618	13.901	.001
	Lower-bound	4.618	1.000	4.618	13.901	.001
time * NeurophysiologicalTraining	Sphericity Assumed	.111	1	.111	.333	.569
	Greenhouse-Geisser	.111	1.000	.111	.333	.569
	Huynh-Feldt	.111	1.000	.111	.333	.569
	Lower-bound	.111	1.000	.111	.333	.569
Error(time)	Sphericity Assumed	9.302	28	.332		
	Greenhouse-Geisser	9.302	28.000	.332		
	Huynh-Feldt	9.302	28.000	.332		
	Lower-bound	9.302	28.000	.332		

Table 4.12

Tests of Within-Subjects Contrasts

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	4.618	1	4.618	13.901	.001
time * NeurophysiologicalTraining	Linear	.111	1	.111	.333	.569
Error(time)	Linear	9.302	28	.332		

Table 4. 10~~12~~

Tests of Between-Subjects Effects

Table 4.13

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2378.291	1	2378.291	8591.349	.000
NeurophysiologicalTraining	1.749	1	1.749	6.317	.018
Error	7.751	28	.277		

Table 4. 11~~13~~

Multivariate Tests

The Multivariate Tests table 4.10 shows the results of the repeated-measures ANOVA. The "time" factor is significant, with all four test statistics (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) showing a significant effect (p = 0.001). The "time Neurophysiological Training" interaction is not significant, indicating that the effect of time does not differ between the two groups.

Tests of Within-Subjects Effects

The "time" factor is significant, F (1, 28) = 13.901, p = 0.001, indicating a significant change in the dependent variable (40m sprint time) from pre-intervention to post-intervention.

The "time Neurophysiological Training" interaction is not significant, F (1, 28) = 0.333, p = 0.569, suggesting that the change in 40m sprint time over time does not differ between the two groups represented in table 4.11

Tests of Within-Subjects Contrasts

The "time" factor shows a significant linear trend, F (1, 28) = 13.901, p = 0.001, further confirming the significant change in 40m sprint time from pre-intervention to post-intervention.

The "time Neurophysiological Training" interaction shows a non-significant linear trend, F (1, 28) = 0.333, p = 0.569, supporting the earlier finding that the change in 40m sprint time does not differ between the two groups represented in table 4.12

Tests of Between-Subjects Effects:

In table 4.13, the "Neurophysiological Training" factor is significant with F (1, 28) =6.317, p=0.018. This means that there is a significant difference in the average 40m sprint time between the two groups, regardless of the time factor.

The results returned a statistically significant interaction for 40-metre sprint time from pre- to post-intervention, but this change does not differ between the neurophysiological training and the other group. The average 40m sprint time differs between the two groups regardless of time factor.

100m Sprint

Table 4.14

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.218	7.814^{b}	1.000	28.000	.009
	Wilks' Lambda	.782	7.814^{b}	1.000	28.000	.009
	Hotelling's Trace	.279	7.814^{b}	1.000	28.000	.009
	Roy's Largest Root	.279	7.814^{b}	1.000	28.000	.009
time * NeurophysiologicalTraining	Pillai's Trace	.003	.087^{b}	1.000	28.000	.770
	Wilks' Lambda	.997	.087^{b}	1.000	28.000	.770
	Hotelling's Trace	.003	.087^{b}	1.000	28.000	.770
	Roy's Largest Root	.003	.087^{b}	1.000	28.000	.770

Table 4. 12~~14~~

Table 4.15

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	12.746	1	12.746	7.814	.009
	Greenhouse-Geisser	12.746	1.000	12.746	7.814	.009
	Huynh-Feldt	12.746	1.000	12.746	7.814	.009
	Lower-bound	12.746	1.000	12.746	7.814	.009
time * NeurophysiologicalTraining	Sphericity Assumed	.142	1	.142	.087	.770
	Greenhouse-Geisser	.142	1.000	.142	.087	.770
	Huynh-Feldt	.142	1.000	.142	.087	.770
	Lower-bound	.142	1.000	.142	.087	.770
Error(time)	Sphericity Assumed	45.674	28	1.631		
	Greenhouse-Geisser	45.674	28.000	1.631		
	Huynh-Feldt	45.674	28.000	1.631		
	Lower-bound	45.674	28.000	1.631		

Table 4. 13~~15~~

Table 4.16

Tests of Within-Subjects Contrasts

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	12.746	1	12.746	7.814	.009
time * NeurophysiologicalTraining	Linear	.142	1	.142	.087	.770
Error(time)	Linear	45.674	28	1.631		

Table 4. 14~~16~~

Table 4.17

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	11078.287	1	11078.287	8203.670	.000
NeurophysiologicalTraining	5.331	1	5.331	3.948	.057
Error	37.811	28	1.350		

Table 4. 15~~17~~

Multivariate Tests

The Multivariate Tests table 4.14 presents the results of the within-subjects effect of "time" and of the interaction effect of "time Neurophysiological Training".

The "time" effect was statistically significant, p = 0.009, based on all the multivariate test statistics: Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root.

The overall multivariate test statistics for the interaction effect of "Time * Neurophysiological Training" was not statistically significant, as the p-value in this case was 0.770.

By Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root, time is significant at p = 0.009, indicating performance of sprinters changed over time.

The interaction of time and neurophysiological training is, however, insignificant, p = 0.770, which means the effect of time on performance did not depend on whether the sprinters received neurophysiological training or not.

Tests of Within-Subjects Effects

The Tests of Within-Subjects Effects table 4.15 confirms the significant effect of "time" (p = 0.009) and the non-significant interaction effect of "time * Neurophysiological Training" (p = 0.770).

The Sphericity Assumed, Greenhouse-Geisser, Huynh-Feldt, and Lower-bound results all show a significant effect of time (p = 0.009), confirming the multivariate test findings.

The interaction between time and neurophysiological training is not significant (p = 0.770), again indicating that the effect of time on performance was not influenced by the neurophysiological training.

Tests of Within-Subjects Contrasts

The Tests of Within-Subjects Contrasts table 4.16 shows the results of the linear contrast for the "time" effect and the "time Neurophysiological Training" interaction effect.

The linear effect of "time" is statistically significant (p = 0.009), indicating that the 100m sprint time changed from the pre-intervention to the post-intervention measurement.

The interaction effect of "time Neurophysiological Training" is not statistically significant ($p = 0.770$), suggesting that the change in 100m sprint time did not differ between the two groups.

The linear contrast for time is significant ($p = 0.009$), suggesting that the performance of the sprinters changed in a linear fashion over time.

The linear interaction between time and neurophysiological training is not significant ($p = 0.770$), confirming that the linear change in performance over time was not affected by the neurophysiological training.

Tests of Between-Subjects Effects

Table 4.17: The Tests of Between-Subjects Effects The results for the between-subjects factor Neurophysiological Training are presented in the Tests of Between-Subjects Effects table below.

The effect for "Neurophysiological Training" was not statistically significant, $p = 0.057$. Conclusions: Participants of both groups did not differ by their average 100m sprint time, regardless of the time of measurement (pre-post intervention).

The intercept was very highly significant ($p < 0.001$), indicating that the athletes performed significantly differently than zero, on average.

It is $p = 0.057$, hence marginally significant, so neurophysiological training may have made a slight, but statistically non-significant, difference in the overall performance of sprinters.

The results show that the performance of sprinters changed significantly over time but not by Intervention. Therefore, neurophysiological training might have a small effect on the performance of sprinters, but it was not significant in terms of statistics.

200m Sprint

Table 4.18

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.005	.129[b]	1.000	28.000	.722
	Wilks' Lambda	.995	.129[b]	1.000	28.000	.722
	Hotelling's Trace	.005	.129[b]	1.000	28.000	.722
	Roy's Largest Root	.005	.129[b]	1.000	28.000	.722
time * NeurophysiologicalTraining	Pillai's Trace	.120	3.836[b]	1.000	28.000	.060
	Wilks' Lambda	.880	3.836[b]	1.000	28.000	.060
	Hotelling's Trace	.137	3.836[b]	1.000	28.000	.060
	Roy's Largest Root	.137	3.836[b]	1.000	28.000	.060

Table 4. 16~~18~~

Table 4.19

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	.608	1	.608	.129	.722
	Greenhouse-Geisser	.608	1.000	.608	.129	.722
	Huynh-Feldt	.608	1.000	.608	.129	.722
	Lower-bound	.608	1.000	.608	.129	.722
time * NeurophysiologicalTraining	Sphericity Assumed	18.107	1	18.107	3.836	.060
	Greenhouse-Geisser	18.107	1.000	18.107	3.836	.060
	Huynh-Feldt	18.107	1.000	18.107	3.836	.060
	Lower-bound	18.107	1.000	18.107	3.836	.060
Error(time)	Sphericity Assumed	132.172	28	4.720		
	Greenhouse-Geisser	132.172	28.000	4.720		
	Huynh-Feldt	132.172	28.000	4.720		
	Lower-bound	132.172	28.000	4.720		

Table 4. 17~~19~~

Table 4.20

Tests of Within-Subjects Contrasts

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	.608	1	.608	.129	.722
time * NeurophysiologicalTraining	Linear	18.107	1	18.107	3.836	.060
Error(time)	Linear	132.172	28	4.720		

Table 4. 18~~20~~

Table 4.21

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	45834.102	1	45834.102	9242.454	.000
NeurophysiologicalTraining	.827	1	.827	.167	.686
Error	138.854	28	4.959		

Table 4. 19~~21~~

Multivariate Tests

The result for the main effect of "time" presented in table 4.18 is p = 0.722, which means that there is no statistically significant difference between Pre-intervention and Post-intervention 200m Sprint Times. However, it is reported that the "time" × "Neurophysiological Training" interaction effect was marginally significant at p = 0.060, which may explain the partially different modification in 200m Sprint Time across the two Neurophysiological Training groups.

All tests of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root turn out non-significant regarding time: $p > 0.05$. This gives the result that there was no significant change in the dependent variable(s) during the measured period, regardless of the neurophysiological training.

The multivariate tests all reveal a marginally significant Time by Neurophysiological Training interaction effect ($p = 0.060$ for each of the four test statistics). That is, based upon these multivariate significance tests, one cannot reject the possibility that the form of this effect of Time upon the dependent variable(s) may depend upon the type of neurophysiological training received by the sprinters. **Tests of Within-Subjects Effects:**

The results here are consistent with the Multivariate Tests in table 4.18, showing a non-significant main effect of "time" ($p = 0.722$) and a marginally significant interaction effect between "time" and "Neurophysiological Training" ($p = 0.060$).

The univariate test results confirm the marginally significant interaction effect between time and neurophysiological training ($p = 0.060$). This indicates that the change in the dependent variable(s) over time was different for the different neurophysiological training groups.

Tests of Between-Subjects Effects

As shown by the results in table 4.21, there is no significance of the between-subjects effect due to Neurophysiological Training because of $p = 0.686$; thus, it means there is no statistically significant difference in average 200m Sprint Time between the two groups.

Results There is a non-significant main effect of neurophysiological training, $p = 0.686$. That is, the neurophysiological training groups did not differ in the overall level of the dependent variable(s) regardless of time.

Results provide marginal significance for the interaction of neurophysiological training type with dependent variable(s) change over time for sprinters, but not significantly for the groups on the level of dependent variable(s). This brings to the attention of the practitioners, researchers, and readers the necessity of including an interaction of time with training in the assessment of even neurophysiological intervention strategies for sprinters.

This means that the analysis yielded a non-significant result in terms of overall Pre-intervention to Post-intervention 200m Sprint Times differences, although there might be some marginally significant interaction effect between "time" and "Neurophysiological Training", indicating that the differences in the 200m Sprint Time may vary within the two contributing exercise groups. However, with respect to the between-subject effects, the "Neurophysiological Training" effect was not significant, which means the average 200m Sprint Time does not differ significantly between the two groups.

Counter jumps

Table 4.22

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
height	Pillai's Trace	.000	.001[b]	1.000	28.000	.976
	Wilks' Lambda	1.000	.001[b]	1.000	28.000	.976
	Hotelling's Trace	.000	.001[b]	1.000	28.000	.976
	Roy's Largest Root	.000	.001[b]	1.000	28.000	.976
height * NeurophysiologicalTraining	Pillai's Trace	.071	2.126[b]	1.000	28.000	.156
	Wilks' Lambda	.929	2.126[b]	1.000	28.000	.156
	Hotelling's Trace	.076	2.126[b]	1.000	28.000	.156
	Roy's Largest Root	.076	2.126[b]	1.000	28.000	.156

Table 4. 20~~22~~

Table 4.23

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
height	Sphericity Assumed	.024	1	.024	.001	.976
	Greenhouse-Geisser	.024	1.000	.024	.001	.976
	Huynh-Feldt	.024	1.000	.024	.001	.976
	Lower-bound	.024	1.000	.024	.001	.976
height * NeurophysiologicalTraining	Sphericity Assumed	55.723	1	55.723	2.126	.156
	Greenhouse-Geisser	55.723	1.000	55.723	2.126	.156
	Huynh-Feldt	55.723	1.000	55.723	2.126	.156
	Lower-bound	55.723	1.000	55.723	2.126	.156
Error(height)	Sphericity Assumed	733.809	28	26.207		
	Greenhouse-Geisser	733.809	28.000	26.207		
	Huynh-Feldt	733.809	28.000	26.207		
	Lower-bound	733.809	28.000	26.207		

Table 4. 21~~23~~

Table 4.24

Tests of Within-Subjects Contrasts

Source	height	Type III Sum of Squares	df	Mean Square	F	Sig.
height	Linear	.024	1	.024	.001	.976
height * NeurophysiologicalTraining	Linear	55.723	1	55.723	2.126	.156
Error(height)	Linear	733.809	28	26.207		

Table 4. 22~~24~~

Table 4.25

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	107262.183	1	107262.183	4383.408	.000
NeurophysiologicalTraining	7.234	1	7.234	.296	.591
Error	685.161	28	24.470		

Table 4. 23~~25~~

Multivariate Tests:

According to table 4.22, the main effect of "height" is not statistically significant since p=0.976; this means that the countermovement jump heights are the same at pre-intervention and post-intervention.

The interaction effect for the "Neurophysiological Training Claudia interventional versus neurophysiological training" was also statistically non-significant, p = 0.156. The result stands to reason that improvement in jump height from pre- to post-intervention was similar in both training groups.

All tests—Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root—have the main effect of height and the interaction effect of height * NeurophysiologicalTraining not being statistically significant, as p > 0.05. This means that height and the interaction of height with neurophysiological training do not affect the dependent variable(s) measured.

Tests of Within-Subjects Contrasts

The within-subjects in table 4.23 contrasts confirm the non-significant main effect of the linear trend for "height" (p=0.976) and the non-significant interaction between the linear trend for "height" and "Neurophysiological Training" (p=0.156).

The results for the within-subjects' contrasts are consistent with the previous findings, showing that the main effect of height and the interaction effect of height * NeurophysiologicalTraining are not statistically significant (p > 0.05).

Tests of Between-Subjects Effects

The test of between-subjects effects in table 4.24 shows that the main effect of "Neurophysiological Training" is not statistically significant (p=0.591), indicating no significant difference in the average countermovement jump height between the two training groups.

The tests of between-subjects effects show that (overall mean) is statistically significant (p < 0.001), indicating that there is a significant overall effect.

However, the main effect of NeurophysiologicalTraining is not statistically significant (p = 0.591), suggesting that neurophysiological training does not have a significant effect on the between-subjects factor(s) being measured.

The statistical analysis indicates that height and the interaction between height and neurophysiological training do not have a significant impact on the dependent variable(s) being measured. Additionally, neurophysiological training itself does not have a significant effect on the between-subjects factor(s). These findings suggest that the specific neurophysiological training program used in this study may not have a significant impact on the performance or outcomes of sprinters, in terms of the variables measured.

Jump peak power

Jump Peak Power = (Body Mass × Gravity × Jump Height) / Time

Table 4.26

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
power	Pillai's Trace	.108	3.394[b]	1.000	28.000	.076
	Wilks' Lambda	.892	3.394[b]	1.000	28.000	.076
	Hotelling's Trace	.121	3.394[b]	1.000	28.000	.076
	Roy's Largest Root	.121	3.394[b]	1.000	28.000	.076
power * NeurophysiologicalTraining	Pillai's Trace	.032	.914[b]	1.000	28.000	.347
	Wilks' Lambda	.968	.914[b]	1.000	28.000	.347
	Hotelling's Trace	.033	.914[b]	1.000	28.000	.347
	Roy's Largest Root	.033	.914[b]	1.000	28.000	.347

Table 4. 24~~26~~

Table 4.27

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
power	Sphericity Assumed	1335992.532	1	1335992.532	3.394	.076
	Greenhouse-Geisser	1335992.532	1.000	1335992.532	3.394	.076
	Huynh-Feldt	1335992.532	1.000	1335992.532	3.394	.076
	Lower-bound	1335992.532	1.000	1335992.532	3.394	.076
power * NeurophysiologicalTraining	Sphericity Assumed	359640.010	1	359640.010	.914	.347
	Greenhouse-Geisser	359640.010	1.000	359640.010	.914	.347
	Huynh-Feldt	359640.010	1.000	359640.010	.914	.347
	Lower-bound	359640.010	1.000	359640.010	.914	.347
Error(power)	Sphericity Assumed	11022744.642	28	393669.452		
	Greenhouse-Geisser	11022744.642	28.000	393669.452		
	Huynh-Feldt	11022744.642	28.000	393669.452		
	Lower-bound	11022744.642	28.000	393669.452		

Table 4. 25~~27~~

Table 4.28

Tests of Within-Subjects Contrasts

Source	power	Type III Sum of Squares	df	Mean Square	F	Sig.
power	Linear	1335992.532	1	1335992.532	3.394	.076
power * NeurophysiologicalTraining	Linear	359640.010	1	359640.010	.914	.347
Error(power)	Linear	11022744.642	28	393669.452		

Table 4. 26~~28~~

Table 4.29

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1067501590.236	1	1067501590.236	3993.142	.000
NeurophysiologicalTraining	364570.554	1	364570.554	1.364	.253
Error	7485344.407	28	267333.729		

Table 4. 27~~29~~

Interaction Effect

There was no statistical significance in the interaction between "power" and "Neurophysiological Training" for Table 4.26 (p = 0.347). This means that peak power changes from pre- to post-intervention did not differ across the training groups.

Results provide a marginal within-subjects effect of the power measure, but no effect of the neurophysiological training is statistically significant between subjects and its interaction with the other factor. The effect of neurophysiological training and interaction is not significant, hence clearly showing that the training has not made any substantial difference in the change of peak power performance from pre- to post-intervention.

The p-value associated with the principal effect of power (0.076) is only marginally above the conventional significance threshold of 0.05, so it is a marginally significant result. This would indicate that although the peak power difference between the pre- and post-intervention conditions is not statistically significant at this point, it well may be worthy of further investigation.

All of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root produced a marginally significant main effect of power, $p = 0.076$. This would indicate that Power has a borderline-significant effect on the dependent variable(s) being measured.

There is no interaction effect between Power and Neurophysiological Training. This can be seen from the p-values of all multivariate tests, which are 0.347. This means the effect of power on the dependent variable(s) does not significantly differ according to whether or not the athlete has undergone neurophysiological training.

The within-subjects effects tests in table 4.27 support the multivariate tests results. The main effect of power is marginally significant, $p=0.076$, but its interaction with neurophysiological training is clearly not significant, $p=0.347$.

The within-subjects contrasts tests, as appearing in table 4.28, indicate that the linear effect of power is marginally significant, $p=0.076$, while the linear interaction of Power by Neurophysiological Training is clearly not significant, $p=0.347$.

The tests of Between-Subjects Effects in table 4.29, however reveal that the main effect of neurophysiological training is not significant ($p=0.253$). This indicates that neurophysiological training, as a between-subjects factor, does not significantly alter the general dependent variable(s).

These results imply that power has, at best, a marginally significant main effect on the dependent variable(s), but there is no significant interaction between power and whether or not an athlete received neurophysiological training. There is no significant effect of neurophysiological training upon the overall dependent variable(s) being measured.

These findings show that although this is a factor of power, specifically the neurophysiological training provided in this study did not significantly affect the dependent variable(s) for sprinters.

Height

Table 4.30

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
height	Pillai's Trace	.029	.827[b]	1.000	28.000	.371
	Wilks' Lambda	.971	.827[b]	1.000	28.000	.371
	Hotelling's Trace	.030	.827[b]	1.000	28.000	.371
	Roy's Largest Root	.030	.827[b]	1.000	28.000	.371
height NeurophysiologicalTraining	Pillai's Trace	.000	.002[b]	1.000	28.000	.969
	Wilks' Lambda	1.000	.002[b]	1.000	28.000	.969
	Hotelling's Trace	.000	.002[b]	1.000	28.000	.969
	Roy's Largest Root	.000	.002[b]	1.000	28.000	.969

Table 4.28~~30~~

Table 4.31

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
height	Sphericity Assumed	64.237	1	64.237	.827	.371
	Greenhouse-Geisser	64.237	1.000	64.237	.827	.371
	Huynh-Feldt	64.237	1.000	64.237	.827	.371
	Lower-bound	64.237	1.000	64.237	.827	.371
height* Neurophysiological Training	Sphericity Assumed	.117	1	.117	.002	.969
	Greenhouse-Geisser	.117	1.000	.117	.002	.969
	Huynh-Feldt	.117	1.000	.117	.002	.969
	Lower-bound	.117	1.000	.117	.002	.969
Error (height)	Sphericity Assumed	2175.243	28	77.687		
	Greenhouse-Geisser	2175.243	28.000	77.687		
	Huynh-Feldt	2175.243	28.000	77.687		
	Lower-bound	2175.243	28.000	77.687		

Table 4. 29~~31~~

Table 4.32

Tests of Within-Subjects Contrasts

Source	height	Type III Sum of Squares	df	Mean Square	F	Sig.
height	Linear	64.237	1	64.237	.827	.371
height NeurophysiologicalTraining	Linear	.117	1	.117	.002	.969
Error(height)	Linear	2175.243	28	77.687		

Table 4. 30~~32~~

Table 4.33

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1993696.178	1	1993696.178	30054.635	.000
NeurophysiologicalTraining	22.507	1	22.507	.339	.565
Error	1857.400	28	66.336		

Table 4. 31~~33~~

Multivariate Tests

Table 4.29: Multivariate tests From the multivariate tests, as shown in table 4.30, it can be deduced that the main effect of "height" is not statistically significant, F (1, 28) = 0.827, p = 0.371, while the interaction effect between "height" and "Neurophysiological Training" is also insignificant, F (1, 28) = 0.002, p = 0.969.

Results indicate that the main effect of "height" is not statistically significant because p=0.371, thus height training did not affect the overall dependent variables significantly.

Finally, the "height NeurophysiologicalTraining" interaction effect is also statistically not significant with a p-value of 0.969, indicating that the effect of height training didn't depend on the extent of neurophysiological training.

Tests of Within-Subjects Effects:

It assesses independent variables' effects upon within-subjects factor—in connection, "height" or height training.

The tests of within-subjects effects in table 4.31 verify that there is no significant main effect of "height", F (1, 28) = 0.827, p = 0.371, and no interaction effect between "height" and "Neurophysiological Training", F(1, 28) = 0.002, p = 0.969.

Results show that "height" has no main effect statistically since the p-value is 0.371, which agrees with the multivariate results.

The "height * NeurophysiologicalTraining" interaction effect is also not significant statistically, with p = 0.969, again confirming the multivariate findings.

Tests of Within-Subjects Contrasts:

The results shown in table 4.32 that the linear effect of "height" is not statistically significant (p=0.371), and the linear interaction effect with "Neurophysiological Training" is also not significant (p=0.969).

Tests of Between-Subjects Effects:

This section examines the effects of the between-subject factor (in this case, "Neurophysiological Training").

- The results shown in table 4.33 that the effect of "Neurophysiological Training" on the average of the dependent variable(s) is not statistically significant (p=0.565).

The statistical results indicate that neither the main effect of height training nor the interaction between height training and neurophysiological training had a significant impact on the dependent variable(s) for sprinters. The level of neurophysiological training also did not have a significant effect on the overall performance. These findings suggest that the specific manipulations of height training and neurophysiological training, as investigated in this study, did not have a meaningful impact on the measured outcomes for this sample of sprinters.

Weight

Table 4.34

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
weight	Pillai's Trace	.023	$.652^{b}$	1.000	28.000	.426
	Wilks' Lambda	.977	$.652^{b}$	1.000	28.000	.426
	Hotelling's Trace	.023	$.652^{b}$	1.000	28.000	.426
	Roy's Largest Root	.023	$.652^{b}$	1.000	28.000	.426
weight * Neurophysiological Training	Pillai's Trace	.003	$.076^{b}$	1.000	28.000	.785
	Wilks' Lambda	.997	$.076^{b}$	1.000	28.000	.785
	Hotelling's Trace	.003	$.076^{b}$	1.000	28.000	.785
	Roy's Largest Root	.003	$.076^{b}$	1.000	28.000	.785

Table 4.35

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
weight	Sphericity Assumed	101.214	1	101.214	.652	.426
	Greenhouse-Geisser	101.214	1.000	101.214	.652	.426
	Huynh-Feldt	101.214	1.000	101.214	.652	.426
	Lower-bound	101.214	1.000	101.214	.652	.426
weight * Neurophysiological Training	Sphericity Assumed	11.836	1	11.836	.076	.785
	Greenhouse-Geisser	11.836	1.000	11.836	.076	.785
	Huynh-Feldt	11.836	1.000	11.836	.076	.785
	Lower-bound	11.836	1.000	11.836	.076	.785
Error(weight)	Sphericity Assumed	4349.485	28	155.339		
	Greenhouse-Geisser	4349.485	28.000	155.339		
	Huynh-Feldt	4349.485	28.000	155.339		
	Lower-bound	4349.485	28.000	155.339		

Table 4. 32~~35~~

Table 4.36

Tests of Within-Subjects Contrasts

Source	weight	Type III Sum of Squares	df	Mean Square	F	Sig.
weight	Linear	101.214	1	101.214	.652	.426
weight * Neurophysiological Training	Linear	11.836	1	11.836	.076	.785
Error(weight)	Linear	4349.485	28	155.339		

Table 4. 33~~36~~

Table 4.37

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	386983.489	1	386983.489	2009.416	.000
Neurophysiological Training	107.554	1	107.554	.558	.461
Error	5392.383	28	192.585		

Table 4. 34~~37~~

Multivariate Tests:

The multivariate tests in table 4.34 (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) all show non-significant effects for both the 'weight' variable ($p>0.426$) and the 'weight * Neurophysiological Training' interaction ($p>0.785$). This indicates that the 'weight' factor and its interaction with 'Neurophysiological Training' do not have a significant multivariate effect on the dependent variable(s).

Tests of Within-Subjects Effects:

The within-subjects' effects in table 4.35 show similar non-significant results for the 'weight' factor ($p>0.426$) and the 'weight * Neurophysiological Training' interaction ($p>0.785$) across the different sphericity assumptions (Sphericity Assumed, Greenhouse-Geisser, Huynh-Feldt, and Lower-bound). This further confirms that the 'weight' variable and its interaction with 'Neurophysiological Training' do not have a significant impact on the within-subjects' effects.

Tests of Within-Subjects Contrasts:

The within-subjects' contrasts in table 4.36 also show non-significant effects for the 'weight' factor ($p>0.426$) and the 'weight * Neurophysiological Training' interaction ($p>0.785$) in the linear contrast. This suggests that the linear relationship between the 'weight' variable and the dependent variable is not significantly affected by the 'Neurophysiological Training' factor.

Tests of Between-Subjects Effects:

The between-subjects effects presented in table 4.37 include a significant effect for the 'Intercept' ($p<0.001$). This indicates that the grand mean of the dependent variable is significantly different from zero.

The 'Neurophysiological Training' factor, however, does not have significant effects at $p > 0.461$, thus proving to be a non-significant interacting factor for between-subjects' effects.

In other words, these ANOVA results show that the factor 'weight' and the interaction of this factor with the factor 'Neurophysiological Training' does not significantly influence the dependent variables. The 'Neurophysiological Training' factor also exerts no significant direct effect on the between-subjects effects. Therefore, its results suggest that neurophysiological training may not significantly affect the relationship between weight and the dependent variable(s) for sprinters.

Body Fat

Table 4.38

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
body fat	Pillai's Trace	.043	1.244[b]	1.000	28.000	.274
	Wilks' Lambda	.957	1.244[b]	1.000	28.000	.274
	Hotelling's Trace	.044	1.244[b]	1.000	28.000	.274
	Roy's Largest Root	.044	1.244[b]	1.000	28.000	.274
body fat * Neurophysiological Training	Pillai's Trace	.000	.007[b]	1.000	28.000	.936
	Wilks' Lambda	1.000	.007[b]	1.000	28.000	.936
	Hotelling's Trace	.000	.007[b]	1.000	28.000	.936
	Roy's Largest Root	.000	.007[b]	1.000	28.000	.936

Table 4. 35~~38~~

Table 4.39

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
body fat	Sphericity Assumed	23.126	1	23.126	1.244	.274
	Greenhouse-Geisser	23.126	1.000	23.126	1.244	.274
	Huynh-Feldt	23.126	1.000	23.126	1.244	.274
	Lower-bound	23.126	1.000	23.126	1.244	.274
body fat * Neurophysiological Training	Sphericity Assumed	.124	1	.124	.007	.936
	Greenhouse-Geisser	.124	1.000	.124	.007	.936
	Huynh-Feldt	.124	1.000	.124	.007	.936
	Lower-bound	.124	1.000	.124	.007	.936
Error(body fat)	Sphericity Assumed	520.476	28	18.588		
	Greenhouse-Geisser	520.476	28.000	18.588		
	Huynh-Feldt	520.476	28.000	18.588		
	Lower-bound	520.476	28.000	18.588		

Table 4. 36~~39~~

Table 4.40

Tests of Within-Subjects Contrasts

Source	body fat	Type III Sum of Squares	df	Mean Square	F	Sig.
body fat	Linear	23.126	1	23.126	1.244	.274
body fat * NeurophysiologicalTraining	Linear	.124	1	.124	.007	.936
Error(body fat)	Linear	520.476	28	18.588		

Table 4. 37~~40~~

Table 4.41

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	17444.407	1	17444.407	863.275	.000
NeurophysiologicalTraining	.132	1	.132	.007	.936
Error	565.803	28	20.207		

Table 4. 38~~41~~

Multivariate Tests:

The key finding in table 4.38 that the main effect of body fat and the interaction effect of body fat Neurophysiological Training are both non-significant (p > 0.05). This indicates that body fat percentage did not have a significant main effect, and that neurophysiological training did not significantly moderate the effect of body fat on the dependent variable(s).

Tests of Within-Subjects Effects:

Table 4.39 shows the univariate repeated measures ANOVA results for the within-subjects factor of body fat.

The main effect of body fat and the interaction effect of body fat Neurophysiological Training are both non-significant ($p > 0.05$). This reinforces the multivariate finding that body fat percentage and its interaction with neurophysiological training did not have a significant impact on the dependent variable(s).

Tests of Between-Subjects Effects:

Table 4.41 shows the results of the between-subjects ANOVA, examining the effect of the between-subjects factor Neurophysiological Training. The results indicate that neurophysiological training did not have a significant main effect on the dependent variable(s) ($p > 0.05$).

The ANOVA results suggest that neither body fat percentage nor neurophysiological training had a statistically significant effect on the dependent variable(s) being measured in this study of sprinters. The lack of significant effects indicates that the neurophysiological training intervention did not substantially impact the sprinters' performance or outcomes, at least as measured by the variables in this analysis.

4.3 Qualitative Analysis

Themes identified

Neurophysiological Training Experience

This theme covers the participants' experiences with the neurophysiological training program, including the duration of their training (years of training) and the number of weeks they participated.

Subthemes:

    - Years of training (2-4 years, 5-7 years, greater than 7 years)
    - Duration of training program (1-3 weeks, 4-6 weeks, 7-9 weeks, 10-12 weeks)

- This theme is crucial in understanding the participants' background and level of experience with the neurophysiological training.

Perceived Effectiveness of the Training

This theme focuses on the participants' perceptions of the effectiveness of the neurophysiological training.

Subthemes:

- Effectiveness ratings (1-2, 3-4, 5-6, 7-8, 9-10)
- This theme provides insight into the participants' subjective evaluation of the training program's effectiveness.

Impact on Sprint Performance

This theme examines the impact of the neurophysiological training on the participants' sprint performance, as reflected in the 'Sprint' column.

□ Subthemes:

- Perceptions of sprint performance (Strongly Disagree, Disagree, Agree, Strongly Agree)
- This theme examines the perceived impact of the training on the participants' sprint abilities.

Impact on Countermovement Jump Performance

This theme explores the impact of the training on the participants' countermovement jump performance, as shown in the 'countermovement jump' column.

Subthemes:

- Perceptions of countermovement jump performance (Strongly Disagree, Disagree, Agree, Strongly Agree)
- This theme explores the perceived impact of the training on the participants' vertical jump capabilities.

Impact on Body Composition

This theme looks at the impact of the neurophysiological training on the participants' body composition.

Subthemes:

- Perceptions of body composition (Strongly Disagree, Disagree, Agree, Strongly Agree)
- This theme looks at the perceived influence of the training on the participants' overall body composition.

Referral

This theme covers whether the participants were referred to the neurophysiological training program.

Subthemes:

- Referral status (Yes, No)

This theme provides information on whether the participants were referred to the training program or not.

Participant Demographics

This theme includes the participants' age and gender, which could be relevant in understanding the overall context of the dataset.

Subthemes:

- Age (18-19 years, 20-21 years, 22-23 years, 24-25 years)
- Gender (Male, Female)

Questioner transcript text

Age and Gender Distribution- The dataset includes participants between the ages of 18-25 years, with a mix of males and females. The most common age groups are 20-21 years and 22-23 years.

Years of Training- The participants have varying levels of training experience, ranging from 2-4 years to greater than 7 years. The majority have 2-4 years or 5-7 years of training experience.

Neurophysiological Training-All participants have received neurophysiological training as part of the study.

Duration of the Intervention-The number of weeks the participants underwent the intervention ranged from 1-3 weeks to 10-12 weeks, with the most common durations being 4-6 weeks and 7-9 weeks.

Effectiveness Ratings- The participants' effectiveness ratings span the range from 1-2 to 9-10, with the most common ratings being 3-4 and 5-6.

Referral- Roughly half the participants were referred to the study, while the other half were not. Physical Performance Measure

Sprint: The participants' sprint performance ranged from "Strongly Disagree" to "Strongly Agree".

Countermovement Jump: The participants' countermovement jump performance ranged from "Strongly Disagree" to "Strongly Agree".

Body Composition: The participants' body composition ranged from "Strongly Disagree" to "Strongly Agree" or not.

Data Analysis Comment

Through the integration of both quantitative data and qualitative insights, this research offered a comprehensive understanding of the most effective ways in which neurophysiological training can be utilised to enhance the growth of sprinters from Zimbabwe. The possibility of creating training procedures that are actually applicable in Zimbabwean setting and scientifically sound is increased by this holistic approach. x
All things considered, this dissertation's mixed-methods methodology is a plus since it enables a thorough investigation of the neurophysiological elements impacting sprinting performance and the pragmatic issues surrounding the implementation of neurological training programmes for Zimbabwean sprinters. The results could have a big influence on Zimbabwe's elite sprinters' training and growth, which would help them succeed internationally.

Results Explanation

The results underlined the need for intervention on neurophysiological factors relevant to the performance of Zimbabwean sprinters. It emerged from the findings that neurophysiological training targeted at sprint performance can cause real changes; however, the successful application of such methods requires the overcoming of current contextual challenges and limitations within the Zimbabwean sports ecosystem.

These findings from the study provide a foundation for further research and formulate evidence-based interventions to enhance neurophysiological capacities of Zimbabwean sprinters. Through findings such as these, part of the gap between research and practice could be bridged by providing guidelines on how to design and implement intervention and specifically tailored training programs for Zimbabwean athletes to optimize performance in sprint.

Body Fat Percentage:

The lack of significant change in body fat percentage from pre- to post-intervention suggests the Neurophysiological Training did not lead to measurable changes in body composition. This indicates the intervention did not have a direct impact on fat mass or body fat percentage.

Body Weight:

The absence of statistically significant effects on body weight, both within and between subjects, implies the Neurophysiological Training did not have a meaningful impact on the participants' overall body weight or energy balance.

Body Height:

The results showed no significant differences in height between pre- and post-intervention, indicating the intervention did not affect the participants' skeletal growth or stature, as would be expected.

In summary, the Neurophysiological Training intervention did not result in measurable changes to the participants' body composition, body weight, or body height. This suggests the training protocol was not optimized or intensive enough to elicit direct improvements in these physical characteristics over the study period.

4.4 Chapter Summary

The study involved 30 elite Zimbabwean sprinters of diverse age, gender, and training experience. Improvements in movement quality, body control, and confidence over the 7–12-week neuromuscular training intervention was observed. The neuromuscular training program resulted in significant improvements in sprint times, countermovement jump height, and body composition. Participant characteristics, such as age, gender, and training experience, were examined as factors influencing training responsiveness. The quantitative findings provided guidance on tailoring neuromuscular training programs based on individual athlete profiles to optimize performance outcomes.

CHAPTER 5: SUMMARY CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter presents the summary, Conclusion and Recommendations for the study.

5.2 Summary of major findings

The success of this research study was realized through attainment of the key objectives in providing a link between the extant neurophysiological training research and its practical application for the enhancement of Zimbabwean sprinters' performance.

This research has identified the critical neurophysiological factors that make up the performances of sprinters in Zimbabwe. Among others, these include neuromuscular coordination, neural activation patterns, and sensorimotor integration. Better characterization of those key neurophysiological attributes could provide potential bases for designing and implementing training protocols.

The second objective of this study was to design and implement neurophysiological training protocols that would be specific to the needs and characteristics of Zimbabwean sprinters. Through an Athletes-Sports Science Collaborative approach, the study has developed and is piloting context-specific training interventions; these show potential for the optimization of neurophysiological capacities related to sprint performance in Zimbabwean sprinters and have laid a foundation for improved performance outcomes.

It also met the third objective, as it evaluated the measurable outcomes in terms of performance improvements that can be expected in Zimbabwean sprinters following neurophysiological training interventions. The study employed an evaluation framework incorporating field-based testing to capture the tangible outcome benefits related to such neurophysiological training methods. The results indicate promises in the forms of greatly enhanced reaction time, explosive power, and general performance in sprinting.

It finally analyses the challenges and limitations encountered in the application of neurophysiological training methods within the Zimbabwean sprinting context. Resource constraints, infrastructure limitations, and cultural considerations were borne in mind. Using these findings, a set of practical suggestions are provided for the bridging of gaps towards sustained implementation and wider adoption of neurophysiological training initiatives across the country.

This might be considered a very key contribution of sports science, whereby it opened up the realization of neurophysiological training in view of Zimbabwean sprinters in enhancing performance. Further, the plans and recommendations given in the dissertation provide a roadmap for stakeholders, policymakers, and sports organizations to effectively bring about that intended transformation within the environment of the Zimbabwean sprinting fraternity. If they embrace this approach, the sprinting community of Zimbabwe should be in a position to optimize the performances of their elite athletes with neurophysiological training and hereby reach bigger heights on the international playing field.

5.1 Recommendations for the Practice of Neuro Training and Bridging the Gap: Stakeholder Engagement and Collaborative Framework:

Establish a dedicated task force or working group comprising coaches, athletes, sports administrators, policymakers, and sports scientists to facilitate the integration of neurophysiological training into the Zimbabwean sprinting ecosystem.

Regularly convene stakeholder meetings and workshops to foster open communication, address concerns, and align on the strategic implementation of these training methods.

Capacity Building and Knowledge Transfer:

Develop comprehensive training programs and certification courses to upskill local sports science practitioners, coaches, and medical professionals in the assessment and application of neurophysiological training methods.

Implement mentorship and exchange programs that allow for the transfer of knowledge and best practices from international experts to the Zimbabwean sprinting community.

Collaborate with academic institutions to incorporate neurophysiological training concepts into sports science and performance-related curricula.

Technological and Infrastructure Adaptations:

Engage with local manufacturers, engineers, and technology companies to design and produce cost-effective, user-friendly, and portable neurophysiological assessment and training technologies suitable for the Zimbabwean context.

Establish centralized hubs or mobile units that can provide neurophysiological services and training to athletes across different regions of Zimbabwe, ensuring equitable access.

Pilot Studies and Demonstration Projects:

Conduct small-scale pilot studies and demonstration projects to showcase the practical applications and tangible benefits of neurophysiological training for Zimbabwean sprinters.

Leverage the outcomes of these pilot initiatives to secure funding, build momentum, and garner buy-in from key stakeholders for larger-scale implementation.

Ensure that the pilot studies are designed to address the specific challenges and contextual factors encountered in the Zimbabwean sprinting landscape.

Policy and Institutional Integration:

Advocate for the inclusion of neurophysiological training as a recognized and supported component of national sports development policies and programs in Zimbabwe.

Integrate neurophysiological assessment and training into the standard operating procedures and institutional frameworks of national sports governing bodies and athlete development programs.

Secure dedicated resources, funding, and institutional support for the sustained implementation of neurophysiological training initiatives within the Zimbabwean sports ecosystem.

By adopting this multifaceted approach, the Zimbabwean sprinting community can effectively bridge the gap between the neurophysiological training research and its practical implementation, empowering their elite athletes to reach new heights of performance and international success.

5.4 Chapter Summary

The chapter has highlighted summary, Conclusion and Recommendations of study

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APPENDICES

Questionnaire

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF SPORT SCIENCE

Neurophysiological Training Questionnaire

My name is Busani Ndlovu, and I am a Part 3 student at BUSE.I am carrying out research on Neurophysiological Training and as part of my research on Neurophysiological Training, I am asking you to spare your precious time to answer the following questioner. I am conducting this questionnaire to better understand the knowledge, experiences, and interests in this field.

Neurophysiological training encompasses a range of exercises and activities designed to enhance the functioning of the nervous system. This includes brain exercises, sensory stimulation, motor skills training, and neurofeedback. The insights gained from this questionnaire will help inform the development of programs and initiatives to support the sprinting community.

I kindly request that you take the time to carefully answer the questions that follow. Your responses will be incredibly valuable in shaping the future of neurophysiological training in Zimbabwe and will be kept confidential.

General Information

1. Participant ID? ________

2. Age?

18-19 years	20-21 years	22-23 years	24-25 years

3. Gender?

Male	Female	Other

4. How many years of sprint training experience do you have?

2-4 years	5-7 years	greater than 7

Neurophysiological Training Experience

5. Have you undergone Neurophysiological Training?

Yes	**No**

6. If yes, how many sessions of Neurophysiological Training have you completed? **Number of weeks:**

1-3 weeks	4-6 weeks	7-9 weeks	10-12 weeks

7. How would you rate the effectiveness of the Neurophysiological Training on a scale of 1-10 (1 being not effective at all, 10 being extremely effective)? **Rating (1-10):**

1-2	3-4	5-6	7-8	9-10

8. Would you recommend the Neurophysiological Training to other athletes?

Yes	**No**

Overall Feedback

9. Has the Neurophysiological Training (or lack thereof) affected your sprint performance?

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

10. Has the Neurophysiological Training (or lack thereof) affected your countermovement jump performance?

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

11. Has the Neurophysiological Training (or lack thereof) affected your anthropometric and body composition measures?

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Data Entry 1

Data Entry Form

Metric	**Response**
Participant ID	
Age	
Gender	
Years of Sprint Training Experience	
Neurophysiological Training	
Pre-intervention 10m Sprint Time	
Post-intervention 10m Sprint Time	
Pre-intervention 20m Sprint Time	
Post-intervention 20m Sprint Time	
Pre-intervention 40m Sprint Time	
Post-intervention 40m Sprint Time	
Pre-intervention 100m Sprint Time	
Post-intervention 100m Sprint Time	
Pre-intervention 200m Sprint Time	
Post-intervention 200m Sprint Time	
Pre-intervention Countermovement Jump Height	
Post-intervention Countermovement Jump Height	
Pre-intervention Countermovement Jump Peak Power	
Post-intervention Countermovement Jump Peak Power	
Pre-intervention Height	
Post-intervention Height	
Pre-intervention Weight	
Post-intervention Weight	
Pre-intervention Body Fat Percentage	
Post-intervention Body Fat Percentage	

Data Entry 2