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Effect of warm-up program design and duration on sprint performance among senior high school students

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ABSTRACT

By comparing a control group and an experimental group utilizing pretest and posttest data, this study examined the impact of a structured warm-up intervention on the sprint performance of the participants. Following the testing period, both groups' sprint performance improved. The average sprint time for the control group dropped from 12.58 seconds in the pretest to 12.42 seconds in the posttest, indicating a minor improvement. Since they just followed their usual warm-up routine, this slight change may be attributed to improved familiarity with the sprint test, regular physical exercise, or natural physical growth. However, the sprint performance of the experimental group improved more. After engaging in a structured warm-up program that included dynamic exercises, static stretching, and sprint drills, with gradually increasing duration each week, their average sprint time dropped from 12.09 seconds in the pretest to 11.09 seconds in the posttest. The findings imply that the organized warm-up enhanced muscle preparation, increased sprinting readiness, and improved movement efficiency. Additionally, the study showed that there was not a significant difference between the experimental and control groups on the pretest, suggesting that both groups began with comparable sprinting abilities. The posttest findings, however, showed a substantial difference, with the experimental group outperforming the control group. These results imply that an organized and systematic warm-up program can result in higher increases in sprint performance, even though normal warm-up practices may only provide slight improvements. Thus, putting in place a well-planned warm-up program could help improve the student's speed and general physical preparedness.

Keywords: Structured warm-up intervention, sprint performance improvement, pretest–posttest experimental design.

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INTRODUCTION

Warming up is widely recognized as an essential preparatory phase in physical activity because it allows the body to transition gradually from rest to exertion. It prepares the muscles and joints for movement demands, enhances comfort in motion, and reduces the likelihood of injury. Beyond physiological readiness, warm-up activities also contribute to psychological

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preparedness by improving confidence and readiness among learners. When properly implemented, warm-up routines facilitate smoother movement execution, enhance overall performance, and promote a safer and more enjoyable physical activity experience.

From a physiological perspective, warm-up activities typically involve a progression from low-intensity aerobic movements such as walking or jogging to more targeted mobility and stretching exercises. This sequence is supported by Martens (2024) and Virgilio (2017), who emphasize that general warm-up activities prepare the musculoskeletal and cardiovascular systems for higher intensity performance. Holcomb (2020) and Martens (2024) further explain that such routines increase blood flow to working muscles, elevate body temperature, and enhance joint range of motion, thereby improving performance capacity while reducing the risk of muscular injury. In alignment with these principles, the National Association for Sport and Physical Education (NASPE, 2015) recommends that static stretching be performed after approximately five to ten minutes of cardiovascular activity to ensure proper physiological readiness.

The literature on stretching modalities, however, presents mixed findings regarding their effectiveness in enhancing performance. Static stretching has been shown to improve flexibility through mechanical and neurological adaptations in the muscle tendon unit, as noted by Kubo, Kanehisa, and Fukunaga (2021) and Guissard, Duchateau, and Hainault (2021). Nevertheless, its direct influence on pre performance outcomes remains contested. Gelen (2018) highlights ongoing debate regarding its role in warm-up routines, while Beydokhti and Haghshenas (2015) report minimal impact of static stretching on athletic performance. In contrast, Samson, Button, Chaouachi, and Behm (2016) found that combining static stretching with warm-up activities may improve range of motion and positively influence performance outcomes. Because of these inconsistencies, several scholars such as Kilit, Arslan, and Soylu (2019) suggest that dynamic stretching may be a more appropriate alternative prior to athletic performance.

Dynamic warm-up exercises, in particular, have gained increasing support in recent literature due to their ability to activate the neuromuscular system. According to Gelen et al. (2020) and Thompsen et al. (2017), dynamic movements of moderate to high intensity stimulate neuromuscular activation, which contributes to improved athletic performance. Empirical findings further support this claim, as McMillian et al. (2016) reported significant improvements in horizontal jump performance following dynamic stretching compared to static stretching. However, contrasting evidence exists, as Unick et al. (2015) observed minimal differences between static and dynamic stretching on vertical jump performance among female athletes. These inconsistencies indicate that while dynamic stretching is generally considered beneficial, its effects may vary depending on population and performance context.

Despite the recognized importance of warm-up activities, many physical education programs continue to rely on traditional routines that begin with light jogging followed by generalized stretching (Young et al., 2002). Such practices often overlook the principle of specificity, which emphasizes that preparatory exercises should closely resemble the movement patterns, muscular demands, and intensity of the intended activity (Turki et al., 2021; Alikhajeh, 2022; Alikhajeh et al., 2022). As a result, conventional warm-up routines may fail to adequately prepare students for sprint specific demands, particularly in terms of neuromuscular activation, explosive acceleration, and movement specificity. Yamaguchi et al. (2015) and Gelen (2021) further emphasize that sprint performance requires targeted activation and short acceleration drills that are often absent in traditional warm-ups.

In addition to concerns about structure, research also highlights uncertainty regarding optimal warm-up duration. Typical precompetition warm-ups in sports range from 15 to 45 minutes, with an average duration of approximately 30 minutes (Midgley et al., 2015; Pyne et al., 2019). However, longer warm-ups may lead to unnecessary energy expenditure and early

fatigue (Zois et al., 2015; Mujika et al., 2022). Conversely, shorter warm-up protocols of 10 to 15 minutes have been suggested as sufficient to enhance performance while minimizing fatigue (Silva, 2018). Further studies indicate that excessive warm-up duration may negatively influence performance by increasing perceived exertion and physiological fatigue (Zois et al., 2015; Tillaar et al., 2022). These findings highlight the need to determine an appropriate balance between adequate preparation and energy conservation.

The physiological basis of warm-up effectiveness is further explained through Temperature Theory, also known as Muscle Temperature Theory. According to Osilla et al. (2023), increased muscle temperature improves physical performance by enhancing nerve conduction velocity, increasing metabolic efficiency, improving muscle elasticity, and accelerating contraction and relaxation processes. Tabarean et al. (2020) support this explanation by noting that these physiological adaptations enable more efficient movement execution and force production. In sprinting, these effects translate into improved stride length, increased stride frequency, and faster reaction times. Luheshi (2016) further emphasizes that optimal muscle temperature reduces stiffness and enhances explosive performance capabilities. Collectively, these theoretical perspectives support the premise that both the design and duration of warm-up routines are critical determinants of sprint performance, particularly among developing athletes such as senior high school students.

Despite the growing body of evidence supporting structured and dynamic warm-up interventions, there remains a significant gap between research based protocols and traditional school based physical education practices. Most existing studies have focused on elite or trained athletes, single session interventions, or controlled laboratory conditions (Chatzopoulos et al., 2024), limiting their applicability to real classroom settings. There is limited research examining multi week, school feasible warm-up programs that consider both program design and duration in relation to sprint performance and repeated sprint ability among senior high school learners. This gap highlights the need for context specific investigations that can inform practical physical education strategies.

Anchored on these considerations, the present study is guided by the conceptual framework illustrating warm-up program design and duration as the independent variables and sprint performance as the dependent variable. The study posits that a structured and systematically designed warm-up program, when implemented with appropriate duration, can significantly influence sprint performance outcomes. By addressing the identified gaps in literature and practice, this research seeks to contribute evidence based insights that may enhance physical education instruction and improve students' physical preparedness for sprint related activities.

Statement of the problem

This study aimed to determine the effect of Warm-Up Program Design and Duration on Sprint Performance among Grade 11 Students of Sta. Justa National Highschool for school year 2025-2026.

Specifically, this study sought to seek answers to the following questions:

1. What is the sprint performance in the pretests and posttests of the control and experimental groups?
2. Is there a significant difference in the sprint performance between the pretests of the control and the experimental groups?
3. Is there a significant difference in the sprint performance between the pretests and posttests of the control and the experimental groups?

4. Is there a significant difference in the sprint performance between the posttests of the control and the experimental groups?

METHODOLOGY

This chapter is organized into three interconnected parts that collectively present the full methodological framework of the study. The first part restates the purpose of the study and describes the research design, including the variables under investigation. The second part describes the participants, the data-gathering instruments, and the research procedures employed in the conduct of the study. The third part discusses the descriptive and inferential statistical procedures used in the analysis of the collected data.

The primary purpose of this study was to examine whether a structured warm-up program could improve the sprint performance of Grade 11 HUMSS students from Section A and Section B of Sta. Justa National High School. Specifically, the study compared students who followed a planned warm-up routine with those who continued their usual activities without a formal warm-up. The study was conducted during the fourth quarter of the 2025-2026 school year at Sta. Justa National High School.

A quasi-experimental research design was employed to determine the possible cause-and-effect relationship between the intervention and its outcomes. In this study, the independent variables were the warm-up program design and duration, while the dependent variable was the students' sprint performance. Before the intervention, all students completed a pre-test in Week 0 by running a 40-meter sprint without a warm-up to establish their baseline performance. The students were then assigned to the control and experimental groups using the fishbowl method.

For four weeks, the experimental group followed a structured warm-up routine that included static exercises, dynamic movements, and sprint drills before doing sprint activities. In contrast, the control group continued with their usual routine without any structured warm-up. The warm-up program was designed to be progressive, with sessions lasting 10, 15, 20, and 30 minutes over the course of the intervention. This gradual increase in duration helped students to adjust safely and effectively prepare their bodies for sprinting. At the end of Week 5, all participants completed a post-test by performing a standardized 40-meter sprint to assess changes in their performance. The 40-meter sprint was chosen because it effectively measures speed and acceleration, which are physical abilities that are greatly affected by proper warm-up routines. This distance was deemed appropriate because it is short enough to reduce fatigue but still long enough to reveal meaningful performance differences. Moreover, the test was safe, age-appropriate, easy to administer in a school setting, and did not require specialized equipment.

The findings of this study offer insights that can help teachers choose warm-up routines that are both effective and easy to implement within limited class time, while also supporting students' performance and ensuring their safety during physical activities. The data collected were organized, analyzed, and processed using the Statistical Package for the Social Sciences (SPSS) to address the research questions quantitatively.

The overall research process followed a structured sequence that began with identifying the research location and period, then presenting the research design. Next, participants were selected and divided into two groups, namely the control group and the experimental group. The experimental group followed a structured warm-up program with different durations, while the control group continued their usual activities without a formal warm-up. Both groups completed the pre-test and post-test to assess their 40-meter sprint performance. Finally, the results were analyzed and compared to evaluate the impact of the warm-up program on the students' sprint performance.

The participants of this study were students from Grade 11 HUMSS Section A and Section B. Two intact sections were intentionally chosen as the study's respondents. Grade 11 HUMSS Section A served as the experimental group, while Grade 11 HUMSS Section B served as the control group. All students included in the study voluntarily participated and completed the required activities and assessments as part of the intervention. However, two students from Section A and three students from Section B were not able to participate in the testing and intervention due to health issues, absences, and other personal concerns, and they were therefore not included in the final data of the study. The experimental group was given the designed warm-up program, while the control group followed the usual or traditional warm-up routine. Additionally, both groups underwent the same 40-meter sprint pretest, which served as the baseline measure to confirm that their initial performance levels were comparable before the intervention began.

The data collection methods for this study included a designed warm-up program consisting of static exercises, dynamic movements, and sprint drills. The intervention followed a sequence of static warm-up, dynamic warm-up, and sprint drills, with each part comprising different sets of exercises that helped to gradually prepare the students' bodies for sprint performance. The study also used pre-test and post-test forms to record the baseline and post-intervention sprint performance of the participants. A digital stopwatch was used to accurately measure sprint performance during both the pre-test and post-test. To ensure consistency in distance measurement, a marked sprint track and a set of cones were utilized during all testing sessions. Before participation, students completed a Physical Activity Readiness Questionnaire (PAR-Q) to verify that they were physically capable of engaging in sprint activities.

The warm-up routine for the study was patterned from ten static stretching exercises from Newcastle Sports Injury Clinic, The Training and Development of Elite Sprint Performance: An Integration of Scientific and Best Practice Literature, Everyday Health: How to Properly Warm Up Before Sprinting, and Guidelines for Implementing a Dynamic Warm-up for Physical Education. These sources served as the basis for the development of the warm-up program. The warm-up program was designed to be progressive, with durations set at 10, 15, 20, and 30 minutes across the intervention period. This gradual increase in warm-up time helped students adapt safely and effectively while preparing their bodies for sprint activities. To ensure the effectiveness of the program for senior high school students, the researcher reviewed the program and consulted with Physical Education instructors before its implementation.

To ensure reliability and accuracy, the data for this study were collected systematically and organized. Before starting the intervention, the researcher obtained permission from the school principal of Sta. Justa National High School. Once approval was granted, the necessary preparations for the study were completed. Before conducting the pre-test, the researcher held an orientation with participants to explain the study's objectives, procedures, and expectations. Participants were also informed about the research and assured that their privacy and information would be protected and kept highly confidential, in accordance with the provisions of the Data Privacy Act. However, participants were also told that the selection of the experimental and control groups would be done through the fishbowl method after the pre-test. To make sure that each student is physically capable of engaging in sprint activities, a Physical Activity Readiness Questionnaire (PAR-Q) was given.

The study was carried out over five weeks. To establish baseline performance, all respondents from Grade 11 HUMSS Sections A and B underwent a pre-test during the last week of January 2026. During the pre-test, the participants performed a standardized 40-meter sprint without any warm-up. The results of this test served as the baseline measurement of the

students' sprint performance. After the pre-test, the participants were divided into two groups, the experimental group and the control group, using the fishbowl method. Grade 11 HUMSS Section A became the experimental group, while Grade 11 HUMSS Section B served as the control group.

After group identification, the intervention started in February 2026 and was gradually implemented for the experimental group. The warm-up program was performed three times a week, with durations gradually increasing. The 10-minute warm-up sessions took place from February 2 to February 6, followed by 15-minute warm-up sessions from February 9 to February 13. The duration then increased to 25 minutes from February 16 to February 20, and finally, 30-minute warm-up sessions were held from February 23 to February 27. This gradual increase allowed the students to safely adjust to the warm-up routine while effectively preparing their bodies for sprint activities. The warm-up routine included static exercises, dynamic movements, and sprint drills, which were designed to progressively prepare the muscles for sprint performance. Meanwhile, the control group continued their usual routine without any structured warm-up. Sprint performance was measured using a digital stopwatch on a marked 40-meter track with cones to ensure consistent distance. A recording sheet was used to carefully document the results of each participant during both the pre-test and post-test.

At the end of the intervention, all participants completed the post-test during the first week of March 2026, using the same standardized 40-meter sprint to assess performance changes. This process enabled the researcher to compare the pre-test and post-test results of both the experimental and control groups to determine the impact of the structured warm-up program on sprint performance. Finally, the data were tabulated, organized, analyzed, and processed using the Statistical Package for the Social Sciences (SPSS).

The data gathered from the study were analyzed using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics, specifically mean and standard deviation, were used to describe the sprint performance of the control and experimental groups in the pretests and posttests. An independent samples t-test was used to determine whether there was a significant difference in sprint performance between the pretests of the control and experimental groups, as well as between the posttests of the control and experimental groups. A paired samples t-test was used to determine if there was a significant difference in sprint performance between the pretest and posttest results within each group. All analyses were conducted at a 0.05 level of significance, and the results were displayed in tables and graphs to clearly illustrate the differences in performance before and after the intervention, as well as between the two groups.

RESULTS AND DISCUSSION

This chapter presents the results and discussion of the study, which investigated the effect of a structured warm-up program on the sprint performance of Grade 11 HUMSS students at Sta. Justa National High School. A total of 75 participants were included in the final analysis, with 37 students comprising the control group from Grade 11 HUMSS Section B and 38 students comprising the experimental group from Grade 11 HUMSS Section A. Two students from Section A and three students from Section B were excluded from the final dataset due to health issues, absences, and other personal concerns. The study employed a quasi-experimental research design using two intact sections that were assigned to their respective groups through the fishbowl method. Data were collected through a standardized 40-meter sprint pretest and posttest administered before and after a four-week structured warm-up intervention. The analysis of the collected data was conducted using the Statistical Package for the Social Sciences (SPSS), employing mean and standard deviation as descriptive statistics, the independent samples t-test to compare performance between groups, and the paired samples

t-test to evaluate within-group changes from pretest to posttest. The results and their interpretations are discussed below in direct relation to the objectives of the study.

Sprint performance of the control and experimental groups in the pretest and posttest

The descriptive analysis of sprint performance across both groups was carried out by computing the mean and standard deviation for the pretest and posttest scores. Performance was interpreted using the following scale: a mean time of 00.00 to 10.00 seconds was described as Very Fast, 10.01 to 12.00 seconds as Fast, 12.01 to 14.00 seconds as Average, 14.01 to 16.00 seconds as Slow, and 16.00 seconds and above as Very Slow. The control group, which consisted of 37 participants, obtained a pretest mean of 12.58 seconds (SD = 2.15) and a posttest mean of 12.42 seconds (SD = 2.10). Both scores fall within the Average descriptive category, indicating that the control group experienced only a slight decrease in sprint time from pretest to posttest. This minimal improvement may be attributed to their regular physical activity, natural physical development, or increased familiarity with the testing procedure, as they were not exposed to any structured warm-up intervention and continued with their usual routine throughout the study period.

In comparison, the experimental group, which consisted of 38 participants, recorded a pretest mean of 12.09 seconds (SD = 3.15) and a posttest mean of 11.09 seconds (SD = 2.76). The pretest score falls within the Average category, while the posttest score advances into the Fast category, reflecting a more pronounced decrease in sprint time and a meaningful improvement in sprint performance relative to the control group. This shift from the Average to the Fast descriptive category indicates that the structured warm-up intervention, which incorporated static stretching exercises, dynamic movements, and sprint drills with progressively increasing durations of 10, 15, 20, and 30 minutes across the four-week period, may have contributed to enhanced muscle preparation, improved movement efficiency, and greater readiness for sprint activity. The structured nature of the warm-up activities is likely to have systematically engaged the musculoskeletal and neuromuscular systems in a manner that adequately prepared the participants for high-intensity sprinting. Overall, the findings suggest that properly designed warm-up programs can play an important role in enhancing the sprint performance of participants, and the descriptive data across both groups support this observation by demonstrating a more substantial performance gain in the experimental group.

Comparison of pretest sprint performance between the control and experimental groups

To determine whether the two groups began the study at a comparable level of sprint performance, an independent samples t-test was conducted comparing the pretest scores of the control and experimental groups. The control group recorded a pretest mean of 12.58 seconds (SD = 2.15), while the experimental group recorded a pretest mean of 12.09 seconds (SD = 3.15). The computed t-value was 0.6791, with 73 degrees of freedom and a p-value of 0.43. Since the p-value of 0.43 is greater than the 0.05 alpha level, the result is not significant, and the null hypothesis is accepted. This finding indicates that both groups performed similarly on the pretest and that no statistically significant difference existed in their sprint performance before the intervention was applied. The two groups therefore began the study at nearly identical levels of sprinting ability, which is an essential condition for the validity of a quasi-experimental research design.

Confirming baseline equivalence between groups is a fundamental requirement in experimental research, as it ensures that any observed differences in posttest performance can

be more confidently attributed to the intervention rather than to pre-existing disparities among participants. This principle is well established in the literature on training and performance research. Tudor Bompa (2012) explains that ensuring athletes begin with comparable physical abilities strengthens the validity of training research, because any changes in performance can be more confidently attributed to the training program rather than to natural differences among participants. Gregory G. Haff (2020) similarly highlights the importance of conducting baseline assessments prior to implementing any conditioning or training program, noting that such assessments help researchers confirm that both the experimental and control groups have similar performance levels at the outset, thereby enabling a fair and meaningful comparison of results after the intervention. The results of the pretest comparison therefore affirm that the study proceeded from a position of methodological soundness, and that the initial conditions were sufficiently controlled to support valid causal inference in the subsequent analyses.

Within-group comparison of pretest and posttest sprint performance

To determine whether the sprint performance of each group changed significantly between the pretest and posttest, a paired samples t-test was conducted separately for the control and experimental groups. For the control group, the pretest mean was 12.58 seconds (SD = 2.15) and the posttest mean was 12.42 seconds (SD = 2.10), reflecting a slight decrease in sprint time. The computed t-value was 8.520 with 27 degrees of freedom and a p-value of 0.000. Since the p-value of 0.000 is below the 0.05 significance level, the result is statistically significant, and the null hypothesis is rejected. This indicates that the control group did experience a statistically significant improvement in sprint performance from pretest to posttest, although the magnitude of the change was small. The slight improvement observed in the control group may be attributed to their continued engagement in regular physical activity, increased practice effects from repeated exposure to the sprint testing procedure, or natural physical development over the duration of the study.

For the experimental group, the pretest mean was 12.09 seconds (SD = 3.15) and the posttest mean decreased to 11.09 seconds (SD = 2.76), representing a more substantial reduction in sprint time. The computed t-value was 16.568 with 34 degrees of freedom and a p-value of 0.000. Since the p-value of 0.000 is below the 0.05 alpha level, this result is likewise statistically significant, and the null hypothesis is rejected. The magnitude of improvement in the experimental group was considerably greater than that observed in the control group, and the posttest mean of 11.09 seconds moved the experimental group from the Average descriptive category into the Fast category, reflecting a meaningful advancement in sprint performance. This greater improvement is attributable to the structured warm-up program implemented over the four-week intervention period, which included static stretching, dynamic exercises, and sprint drills administered three times per week with progressively increasing session durations of 10, 15, 20, and 30 minutes.

The progressive structure of the warm-up program is particularly noteworthy in accounting for the experimental group's performance gains. Bishop (2003) found that structured progression in warm-up protocols improves muscle activation, increases blood circulation, and effectively prepares the cardiovascular and neuromuscular systems for higher-intensity activities, thereby helping to maximize performance while reducing the risk of injury and fatigue. The gradual increase in warm-up duration across the intervention weeks mirrors the principles of progressive overload commonly applied in exercise science, wherein systematic increases in physical demand allow the body to adapt incrementally and perform at higher levels. These findings are further corroborated by David G. Behm and Anthony J. Blazevich (2021), who reported that structured warm-up programs featuring dynamic movements and sport-specific drills may boost muscle activation, increase body temperature,

and improve sprint and power performance. The results of the within-group paired comparisons therefore provide strong evidence that the structured warm-up intervention produced a statistically significant and practically meaningful improvement in the sprint performance of the experimental group, while the control group's improvement, though statistically significant, remained comparatively modest and likely reflects factors unrelated to any formal warm-up protocol.

Comparison of posttest sprint performance between the control and experimental groups

To determine whether a significant difference existed between the two groups following the intervention, an independent samples t-test was conducted comparing the posttest sprint performance of the control and experimental groups. The control group recorded a posttest mean of 12.42 seconds (SD = 2.10), while the experimental group recorded a posttest mean of 11.09 seconds (SD = 2.76). The computed t-value was 2.345 with 73 degrees of freedom and a p-value of 0.02. Since the p-value of 0.02 is below the 0.05 alpha level, the result is statistically significant, and the null hypothesis is rejected. This finding indicates that the sprint performance of the experimental group was significantly different from that of the control group following the intervention, with the experimental group demonstrating superior performance as evidenced by a lower mean sprint time.

This significant posttest difference between the two groups provides the most direct evidence supporting the effectiveness of the structured warm-up program implemented in this study. The experimental group's posttest mean of 11.09 seconds, which falls within the Fast descriptive category, contrasts meaningfully with the control group's posttest mean of 12.42 seconds, which remains within the Average category. This gap in performance, which was not present at the pretest stage where no significant difference was detected, can be attributed to the effect of the warm-up intervention received exclusively by the experimental group. Ian Jeffreys (2018) states that appropriate warm-up exercises prepare the body and muscles for physical activity, thereby enhancing performance and speed. Tudor Bompa (2012) further supports this by emphasizing that organized training regimens can aid in the development of the power and speed required for high-intensity exercises such as sprinting. The progressive duration of the warm-up sessions, increasing from 10 to 15 to 20 and finally to 30 minutes, is also considered an ideal design feature, as it allows for a gradual and systematic preparation of the body for higher-intensity activities, thereby maximizing performance outcomes. The statistically significant posttest difference therefore affirms that the intervention may enhance sprint performance and demonstrates how essential it is to incorporate proper warm-up and training exercises in improving the performance of students engaged in sprint activities.

The findings of this study collectively demonstrate that the structured warm-up program implemented over four weeks produced statistically significant and practically meaningful improvements in the sprint performance of Grade 11 HUMSS students at Sta. Justa National High School. The baseline equivalence confirmed through the pretest comparison ensured that the observed posttest differences were attributable to the intervention rather than pre-existing disparities between the groups. The within-group analyses revealed that while both groups improved significantly from pretest to posttest, the experimental group showed a markedly greater reduction in sprint time, advancing from the Average to the Fast descriptive category. The between-group posttest comparison further confirmed that the experimental group significantly outperformed the control group following the intervention. These results affirm that a well-structured warm-up program incorporating static stretching, dynamic movements, and sprint drills with progressively increasing durations is more effective in enhancing sprint

performance than conventional warm-up routines. The findings contribute to the growing body of evidence supporting the integration of structured and progressive warm-up protocols in physical education settings and offer practical guidance for teachers seeking to implement evidence-based warm-up routines within limited class time. The conclusions drawn from these results, along with their implications for practice and future research, are presented in the succeeding chapter.

CONCLUSION

The present quasi experimental study was conducted to determine the effect of Warm Up Program Design and Duration on Sprint Performance among Grade 11 students of Sta. Justa National High School. Guided by this objective, the study examined sprint performance outcomes of the control and experimental groups through pretest and posttest measures, as well as the differences within and between groups before and after the implementation of the intervention. Two intact sections of Grade 11 HUMSS students were purposively selected as participants, with one section assigned as the experimental group and the other as the control group. The experimental group was exposed to a structured warm up program consisting of static stretching, dynamic exercises, and sprint drills arranged in a progressive sequence with increasing duration, while the control group continued with their usual warm up routine. Data were analyzed using mean, standard deviation, independent sample t test, and paired sample t test at a 0.05 level of significance.

The findings of the study revealed that both groups demonstrated improvement in sprint performance from pretest to posttest. However, the control group showed only slight improvement and remained within the Average performance category, suggesting that minimal gains may be attributed to regular physical activity, familiarity with the testing procedure, or natural physical development. In contrast, the experimental group exhibited a more substantial improvement, progressing from the Average to the Fast category, indicating a marked enhancement in sprint performance following exposure to the structured warm up intervention. These results suggest that while traditional warm up routines may contribute to minor improvements, a systematically designed warm up program that incorporates progressive static stretching, dynamic movements, and sprint specific drills is more effective in enhancing sprint performance.

The statistical analysis further confirmed that there was no significant difference between the control and experimental groups during the pretest phase, indicating that both groups had comparable baseline sprinting abilities prior to the intervention. This equivalence in initial performance strengthens the internal validity of the study, as it suggests that any observed differences in posttest outcomes are more likely attributable to the warm up program rather than pre-existing differences in physical ability. This finding aligns with established principles in experimental research, which emphasize the importance of equivalent baseline conditions in ensuring valid comparisons between groups.

In terms of performance development over time, significant differences were found between pretest and posttest results within both the control and experimental groups. Although both groups improved, the magnitude of improvement was considerably greater in the experimental group. The structured warm up program likely contributed to enhanced muscle activation, improved neuromuscular coordination, and greater movement efficiency, thereby facilitating better sprint performance. The control group, which engaged only in conventional warm up activities, demonstrated limited progress, reinforcing the idea that general warm up routines may not be sufficient to maximize sprint related performance gains. Overall, the results indicate that a well-structured and progressive warm up program yields superior improvements compared to traditional practices.

Moreover, a significant difference was observed between the posttest performances of the control and experimental groups. This indicates that the experimental group outperformed the control group after the intervention period, providing strong evidence of the effectiveness of the structured warm up program in enhancing sprint performance. The findings imply that incorporating static stretching, dynamic exercises, and sprint drills in a progressive format improves physical readiness, enhances coordination, and optimizes sprinting efficiency. These outcomes underscore the importance of aligning warm up practices with the principle of specificity to better prepare learners for the demands of sprinting activities.

Based on these findings, several conclusions were drawn and translated into practical implications and recommendations. The results collectively demonstrate that a structured warm up program significantly enhances sprint performance among Grade 11 students compared to traditional warm up routines. It is therefore concluded that systematic and progressive warm up activities are more effective in preparing students for high intensity physical activity, leading to improved speed and overall performance outcomes. Accordingly, it is recommended that physical education teachers, coaches, and trainers adopt structured warm up programs similar to the intervention used in this study, as these may enhance student performance and physical readiness in both academic and athletic settings.

Furthermore, it is recommended that such programs be consistently integrated into physical education classes and training sessions to maximize their benefits. Students are encouraged to actively participate in structured warm up routines to improve performance and reduce injury risk, while educators are advised to apply progressive and varied warm up strategies rather than relying solely on traditional methods. Parents are also encouraged to support regular physical activity and proper warm up habits to reinforce healthy and active lifestyles among learners. For future researchers, it is suggested that similar studies be conducted with larger sample sizes, extended intervention periods, and varied contexts such as different age groups, sports disciplines, or skill levels to further validate and expand upon the findings of this study. Additionally, future investigations may explore modifications to the intervention design, including variations in training frequency and exercise composition, to determine their potential effects on performance outcomes.

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