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Dynamic Stretching Warm-Up Protocols and Performance Outcomes in Horizontal Jump Athletes

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Abstract
Dynamic stretching has gained attention as an effective warm-up strategy for athletes involved in explosive sports, such as horizontal jumping. This study investigates the impact of dynamic stretching warm-up protocols on the performance of horizontal jump athletes, focusing on key performance indicators including jump distance, takeoff speed, and agility. The investigation examines dynamic stretching versus traditional static stretching because research shows that static stretching causes a temporary power decrease in muscles. During eight weeks, researchers studied 20 horizontal jump athletes who completed dynamic stretching exercises in one group and traditional general warm-up moving exercises in the other group. The experiment measured performance through evaluation of standing long jump distance, together with 30-meter sprint speed in pre-test and post-test conditions. The study demonstrates that practitioners who perform dynamic stretching achieve better athletic results with their jump distance performance, and their sprint times improved as well. Better movement efficiency, together with lowered injury risk, results from both temperature-enhanced muscles and more flexible joints, as well as neuromuscular activation produced by dynamic stretching. This research proves that dynamic stretching is better for horizontal jump athletes, because it not only increases their coordination but also enhances their muscle function before high-intensity activity. Dynamic stretching has to be integrated into a warm-up for performance enhancement routines as part of their routines for both professional athletes and their coaches. There is a need for new investigations to determine the proper

stretching strategies that will yield the best performance with an acceptable reduction of accidents.

Keywords: Stretching, Athletes, Warm-Up, Explosive Sports, Performance, Jump Distance

Introduction

It is an essential step in the warm-up steps that horizontal jump athletes perform because it benefits the body through physiological methods and provides psychological benefits for intensive physical activity. The explosive strength and agility with precise motor skills needed of athletes to compete in the triple jump and the long jump are demonstrated here. A warm-up routine that doesn't do too much warms up blood flow to muscles, heats them, and therefore improves metabolic operations by increasing oxygen delivery. The warming muscles are also due to the thermal effects when the muscles function at the best possible level, and it helps them stretch better.

Warm-up activities are carried out to decrease the chances of sustaining injuries during physical activities. Slow muscle activation, producing improved coordination, is the result of neuromuscular stimulation. Proper training of jumpers allows them to be able to perform thrusting high high-impact, rapid movements. Drills based on the specific sport practices and/ or dynamic stretching are added to strengthen muscles and control mechanisms to reduce strain injury risk.

The performance-enhancing conditioning methods have been in use since the time of the ancient Greeks, when the Olympic athletes used stretching techniques for centuries. When sports science was evolving, scientists explored static versus dynamic stretching during the 1970s and 1980s as trying to understand static versus dynamic stretching. Dynamic stretching research found that dynamic stretching results in an increase in heat increase in muscle and joint flexibility improvement which also improving performance. Modern athletic methodology was developed through the subsequent study of warm-up effects in horizontal jumping and speed, and agility.

In various competitive sports, dynamic stretch is an essential part of the pre-competition warm-up of professional athletes. Dynamic movements are the preferred stretching technique for horizontal jumps because these jumps require higher strength and speed in combination with coordination. The conventional method of static stretching produced measurable decreases in muscular force output, therefore compromising essential jumping performance according to Behm et al. (2017).

Dynamic stretching requires specific movements that control sports-specific muscle activities along their total motion range. The stretching routines enhance muscle flexibility, together with muscular activation and improve neuromuscular system responses. The target of dynamic stretching goes beyond stretching for maximum performance because it exactly duplicates real performance movements to create a functional tool for improving performance. The evidence shows that dynamic stretching yields optimal results for power-based sports that involve horizontal jumping capabilities.

The athletes who perform horizontal jump movements need to synchronize their explosive power with precise body movement regulation. The effectiveness of peak output depends heavily on warm-up exercises which aim the muscle groups and body movements associated with jumps. Various exercises including leg swings together with lunges and high knees and butt kicks activate vital jumping muscles of the gluts, hamstrings, calves and hip flexors.

The research objective assesses dynamic stretching impacts on three jump measurement variables: takeoff velocity, distance and agility levels. The research evaluates different stretching approaches to identify suitable warm-up methods for horizontal jumpers, which will lead to enhanced training methods and performance achievements.

People choose dynamic stretching methods because they help both athletic performance quality and reduce the chance of injuries. Dynamic movement techniques warm up muscle fibers for high-intensity actions, while static stretching harms muscle strength. The power demands of horizontal jumping benefit from dynamic stretching techniques because they enhance joint and muscle ability to respond effectively.

The athletes studied by Ristevski et al. (2019) achieved better results in their jumps regarding distance, velocity, and direction-altering abilities through the use of dynamic stretching before competitions. Basic exercises involving walking lunges, along with high knee pulls and bounding movements, activate and strengthen the body systems active in takeoff and landing functions. The movements improve muscle temperature along with elasticity, and both factors positively impact athletic performance (McMillian et al., 2006).

Through dynamic stretching, neuromuscular function improves because it enhances the communication link between brain signals and muscle activity. This leads to better timing and motor control, both essential for jumps that require coordinated effort during takeoff and landing (Kallio et al., 2019). Improved muscle readiness supports injury prevention by boosting joint mobility and blood flow, reducing the likelihood of sprains under high loads (Behm & Chaouachi, 2011).

Replacing static with dynamic stretching has become common practice in horizontal jumping disciplines. Events like the long jump and triple jump benefit from warm-ups that simulate the demands of competition. Through active, full-range movements, dynamic stretching enhances flexibility, strength, and responsiveness. These traits are critical in managing the complex mechanics of a successful jump.

Athletes performing horizontal jumps must rapidly produce force while maintaining balance and direction. Dynamic stretches prepare the muscles for this dual demand by improving both power and coordination. Warm-ups that reflect event-specific movements help athletes reach optimal performance states before exertion.

Warm-ups serve as performance preparation, not just injury prevention. Jeffreys (2017) noted that well-structured warm-ups raise core temperature, increase muscle elasticity, and improve metabolic efficiency. These physiological changes enable:

- Faster muscle contraction and relaxation
- Better force development and reaction times
- Enhanced oxygen delivery via the Bohr effect
- Improved blood flow and reduced muscle resistance

Such benefits collectively support explosive performance. Viewing warm-

ups through this "performance preparation" lens allows athletes and coaches to craft routines that directly translate into competitive success.
Dynamic stretching exemplifies this approach. It raises blood flow, extends the range of motion, and activates coordination pathways. Common dynamic stretches—arm circles, leg swings, torso twists, high knees, and butt kicks combine mobility and activation in a sport-relevant context.
Historically, static stretching was the norm. However, evidence increasingly suggests it can dampen power output in the short term (Behm & Kibele, 2007). In contrast, dynamic stretching has proven effective in sports involving sprinting, agility, and jumping (Chtara et al., 2005). Unlike static holds, dynamic movements better prepare the body for forceful activity by maintaining strength and boosting readiness.
Horizontal jumps are complex, requiring synchronized muscle activation from the quadriceps, hamstrings, calves, and gluts. Performance depends on biomechanics like takeoff angle, force application, and posture. Warm-ups directly affect these variables. Despite considerable research on dynamic stretching's impact on sprinting and vertical jumping, its role in horizontal jumping remains underexplored.
Key variables in dynamic warm-ups include the type, duration, and sequence of exercises. Some stretches emphasize hip mobility while others activate the posterior chain. Studies differ on optimal warm-up length; some recommend 10–15 minutes, while others find shorter routines effective if well-targeted (Fletcher & Jones, 2004). The order of stretches may also influence performance outcomes, with tailored routines potentially offering the most benefit.
This study addresses existing gaps by examining different dynamic stretching protocols and their effects on horizontal jump metrics. It aims to determine how jump distance, power, and flexibility respond to various warm-up strategies. It also explores the physiological basis of performance changes, such as enhanced muscle activation and neuromuscular coordination.
In summary, dynamic stretching appears to improve performance and reduce injury risk in explosive sports. However, further research is needed to fine-tune protocols for horizontal jumpers. This investigation contributes to that knowledge by evaluating which dynamic warm-up strategies optimize performance outcomes. The results could help athletes and coaches design effective routines that enhance readiness and safeguard against injury.

Literature Review

The purpose of a pre-competition and training warm-up is to prepare the athlete for both physical and mental challenges in the upcoming event. A proper warm-up enhances blood flow, raises core body temperature, and improves flexibility, all of which contribute to improved physiological function and performance. Mentally, it helps athletes focus, while physically it reduces injury risk by easing the body into high-intensity activity demands (Swanson, 2013).
(Bishop, 2003) identified that much of the benefits of warm-ups stem from temperature-related mechanisms such as reduced muscle stiffness, increased nerve conduction rate, altered force-velocity characteristics, improved anaerobic energy supply, and greater thermoregulatory strain. Beyond temperature effects, non-temperature-related mechanisms also play key roles, including enhanced blood flow, increased baseline oxygen consumption, and post-activation

potentiation (PAP). These effects are best achieved through continuous cardiovascular activity, which activates both temperature and non-temperature responses, enhancing readiness and reducing injury risk (Khan et al., 2024).
Controlled and dynamic stretching (DS) is often incorporated before activities like running and jumping, especially when preceded by an aerobic warm-up that increases muscle temperature. The aerobic component should be followed by dynamic or explosive movements to fully prepare the athlete. PAP likely contributes to the improved sprinting seen in control groups and the lack of performance declines in others. The main goal of any warm-up is to raise muscle temperature to improve metabolic rate and flexibility (Effects of warm-ups involving static or dynamic stretching on agility, sprinting and jumping, 2010).
Research suggests combining controlled and dynamic stretching may reduce the negative effects of controlled stretching within a warm-up. For example, elite athletes showed no negative effects from using varied sequences of static and dynamic stretches across eight combinations for sprint, agility, and jump performance (Chaouachi, 2010; Chaouachi, 2017). Gelen (2010) also found no negative effects on sprint time, soccer dribbling, or penalty kick accuracy when both stretching types followed an aerobic warm-up. Although dynamic stretching may not always improve performance, studies have not shown performance impairments from its use (Riaz et al., 2024).
In contrast to controlled stretching, dynamic stretching typically does not reduce power production and often enhances it, especially in sprinting and horizontal jump performance. Studies showing negative effects from controlled stretching usually used protocols with multiple sets of stretches, each lasting over 30 seconds (Behm D.K., 2017). A review by Rubini et al. (2009) concluded that significant performance decreases often stemmed from excessive duration and volume of stretching. Some studies focused on one muscle group, while others showed performance maintained or even improved when single sets of less than 30 seconds were used. For instance, McMillian et al. found that short-duration stretching of individual muscle groups could increase horizontal jump performance, whereas 30 seconds or more of stretching could reduce knee extension torque. However, no decrease in torque occurred with 20 seconds or less (Behm D.K., 2017). Thus, short-duration controlled stretching may not impair maximal performance, although findings may not apply to general fitness populations since most subjects were athletes.
Dynamic stretching has been shown to improve performance in maximal force activities (Yamaguchi & Ishii, 2015). Mechanisms behind this include increased muscle temperature, range of motion, and PAP. Improved power performance with dynamic stretching compared to controlled stretching may result from changes in the viscoelastic properties of the muscle-tendon unit. Observing how acute bouts of dynamic stretching impact range of motion and horizontal jump performance can shed light on neuromuscular adaptations. No known study has examined both dynamic and controlled stretching effects on range of motion and jump height in recreationally active college-age males. Identifying the best stretching approach for specific activities can help coaches improve flexibility and power simultaneously.
While dynamic stretching often leads to performance improvements, it may not be as effective as controlled stretching in increasing flexibility (Chaouachi, 2010). However, static stretching may still have a role, especially for athletes needing

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large ranges of motion, like ice hockey goalies. Also, transitioning to dynamic warm-ups has caused some athletes psychological discomfort when omitting static stretching (Nelson et al., 2005; Young, 2007). Only a few studies, such as those by Chaouachi (2010), have examined the effects of static stretching after dynamic warm-ups, and results show no significant changes in sprint, agility, or jump performance (Jeffreys, 2017; Chaouachi, 2017). While warm-up benefits are widely accepted, how best to combine static and dynamic methods to affect flexibility and performance remains unclear (Rubini et al., 2009).
Therefore, the purpose of this study was to determine the effects of single-set dynamic versus controlled stretching. It was hypothesised that participants using dynamic stretching would show greater horizontal jump distances, improved agility, and faster sprint times than those using controlled stretching alone.
Dynamic stretching has gained recognition in sports science for boosting performance and reducing injury risk more effectively than static stretching. Static stretching causes a decrease in muscle power and strength during the temporary period because it involves sustained joint movements (Behm et al., 2016). The practice of dynamic stretching enables the muscles to produce quick force output.
Athletes participating in the long jump and triple jump competitions must have excellent capabilities in muscle power, along with speed and coordination. Research evidence demonstrates that dynamic stretching produces three benefits that contribute to activated jump-related muscles while enhancing core temperature and flexibility. According to Ristevski et al. (2019), dynamic stretching led to better jump distances and velocities, along with enhancing athletic agility. The proper activation of takeoff and landing muscles stems from performing leg swing movements and lunges, and bounds. According to McMillian et al. (2006), the chosen exercises raised essential muscle elasticity and temperature required for explosive jumping. Ansari et al. (2023) in their systematic review and meta-analysis of 19 RCTS (n=618) found that Healthy and metabolically impaired adults achieved better muscle strength and decreased blood pressure through eccentric exercise training than with concentric exercise, while both training types maintained similar results for glucose handling. In their study, Chen et al. (2024) discovered that participants who performed either random motor skill or cardiovascular exercise showed brief enhancements in visuo-spatial working memory, but no differences emerged between groups, thus supporting the notion of short-term cognitive benefits. Research evidence demonstrates that youth athletes achieve better power and agility results during dynamic warm-ups (with or without jumps) than through static stretching, which decreases their performance in vertical jumps and shuttle run (Faigenbaum et al., 2005). The investigation presents a thorough examination of exercise-based cardiovascular advantages, which extend from inflammation reduction and autonomic stability and heart protection, and gut micro-biome adjustment over and above classical risk factor management (Fiuza-Luces, 2018). Research about exercise therapies for cancer patients demonstrates that cardiovascular exercise combined with resistance training, as well as combination systems, produces beneficial effects for patients before and after receiving treatment. The author stresses the requirement for bigger randomized tests to enhance exercise techniques (Galvão, 2005).
Green et al. (2004) demonstrate through research that exercise restores

endothelial function by improving nitric oxide (NO) bioactivity, particularly in people at high risk for cardiovascular issues. Green et al. (2004) established that training protocols require optimal development (Green et al., 2004). An analysis by Luan et al. (2019) demonstrated that exercise therapy brings beneficial effects to diseases affecting the musculoskeletal, metabolic, cardiovascular systems and neurological, respiratory and urinary systems and cancer patients when optimal prescriptions are applied. Research reveals that HIIT exercise, along with other exercises, defends male fertility against high-fat diet-induced obesity using altered metabolite activity and increased lactate levels and metabolic markers (Maleki et al., 2024).

Mann et al. (2014) state that exercising aerobically with resistance training and combining these two approaches results in improved cholesterol and lipid measurements, but the research provides tested protocols to manage dyslipidemia patients effectively. In a research at, Marcus et al. (2006) conducted a review study to analyse physical activity interventions through qualitative methods while focusing on essential population-wide improvements coupled with fresh research strategies to resolve current gaps. Mendoza (2024) reported that exercise leads to better cardiorespiratory fitness and stronger muscles and more massive muscle tissue, which simultaneously reduces death rates while improving life quality. The study demonstrates anti-cardiovascular disease and cancer protection mechanisms through individual exercise recommendations for mass outreach.

Research by Pinckard et al. (2019) demonstrates that exercise helps control obesity alongside its associated cardiovascular problems through better mitochondrial function and improved blood vessels, which produce protective myokines for cardiovascular health. Ross and Leveritt (2001) explained that sprint training leads to dual metabolic and morphological muscular changes since it modifies enzyme function and redistributes muscle fibres. The outcome of training depends heavily on duration, recovery, along frequency as key variables, but also reveals baseline reversion after detraining occurs.

The neuromuscular system gains better movement control through dynamic stretching activities, which simultaneously activate these body systems. The correct timing of takeoff, along with proper body positioning, requires this ability in jumps, according to Kallio et al. (2019). Dynamic stretching functions to protect athletes from injuries because it raises blood circulation and enhances joint range of motion, primarily during explosive movements. The studies conducted by Behm & Chaouachi (2011) show evidence of injury protection.

The evidence demonstrates that dynamic stretching both enhances horizontal jump performance and decreases the risk of injuries for athletes. The neuromuscular system activation and enhanced muscle flexibility, and elevated muscle temperature provided by dynamic stretching techniques improve athletic explosivity. Dynamic stretches provide better performance benefits compared to static stretching since static stretching leads to temporary muscle output reduction. Although dynamic stretching shows strong benefits, the ideal protocol regarding duration, sequence, and intensity is still under investigation. Some athletes or sports may still benefit from including short bouts of static stretching. More research is needed to optimise warm-up strategies, especially for horizontal jump events, to maximise performance and minimise injury.

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Hypothesis:

- Participants who perform dynamic stretching will show a significant increase in horizontal jump distance.
- Participants who perform dynamic stretching will experience to increase in speed.

Objectives

- To study the impact of dynamic warm-up stretching on the SLJ Distance of athletes.
- To study the impact of dynamic warm-up stretching on the speed of athletes.

Method

Procedure

The study was conducted at the University of Lahore & Punjab Sports Board. The study involved two groups of participants, each consisting of 10 individuals, with a balanced mix of boys and girls. Group one served as the control group, while group two, the experimental group, participated in dynamic stretching. Before the training, a pre-test was conducted to establish baseline performance levels. The training regimen took place three days a week over a total duration of eight weeks. Following this training period, a post-training test was administered to assess changes in performance. The results from both groups were compared using statistical methods, including calculations of the mean and standard deviation for each group, and a paired t-test was applied to determine the significance of any differences observed between the two stretching methods.

Treatments to be studied

Dynamic stretching

Research layout plan

To establish baseline performance, a horizontal jump test was conducted, measuring and recording jump distance in meters for a total of 20 participants, evenly divided into two groups of 10: one for the control group and one for the experimental group. The participants, a mixed- gender group with comparable levels of athletic experience, performed 15 minutes of their ongoing basic stretching exercises, while the other group engaged in 15 minutes of dynamic exercises. Accurate jump distance measurements were obtained using a jump pit. Following the training period, the results shed light on the effectiveness of each stretching method, providing insights into which protocol yielded greater improvements in jump performance. Twenty participants were divided equally into two groups of ten, one for the experimental group and one for the control group, and a 30-meter sprint test was used to measure and record sprint timings in seconds to establish baseline performance. For 15 minutes, the participants, a mixed-gender group with similar levels of athletic experience, did their regular basic stretching activities, and for another 15 minutes, they completed dynamic exercises. A timing method was used to get precise sprint times.

Participants in the eight-week training program adhered to their stretching regimens. The outcomes after the training period shed light on the efficacy of each stretching technique and revealed which program improved sprint performance the most.

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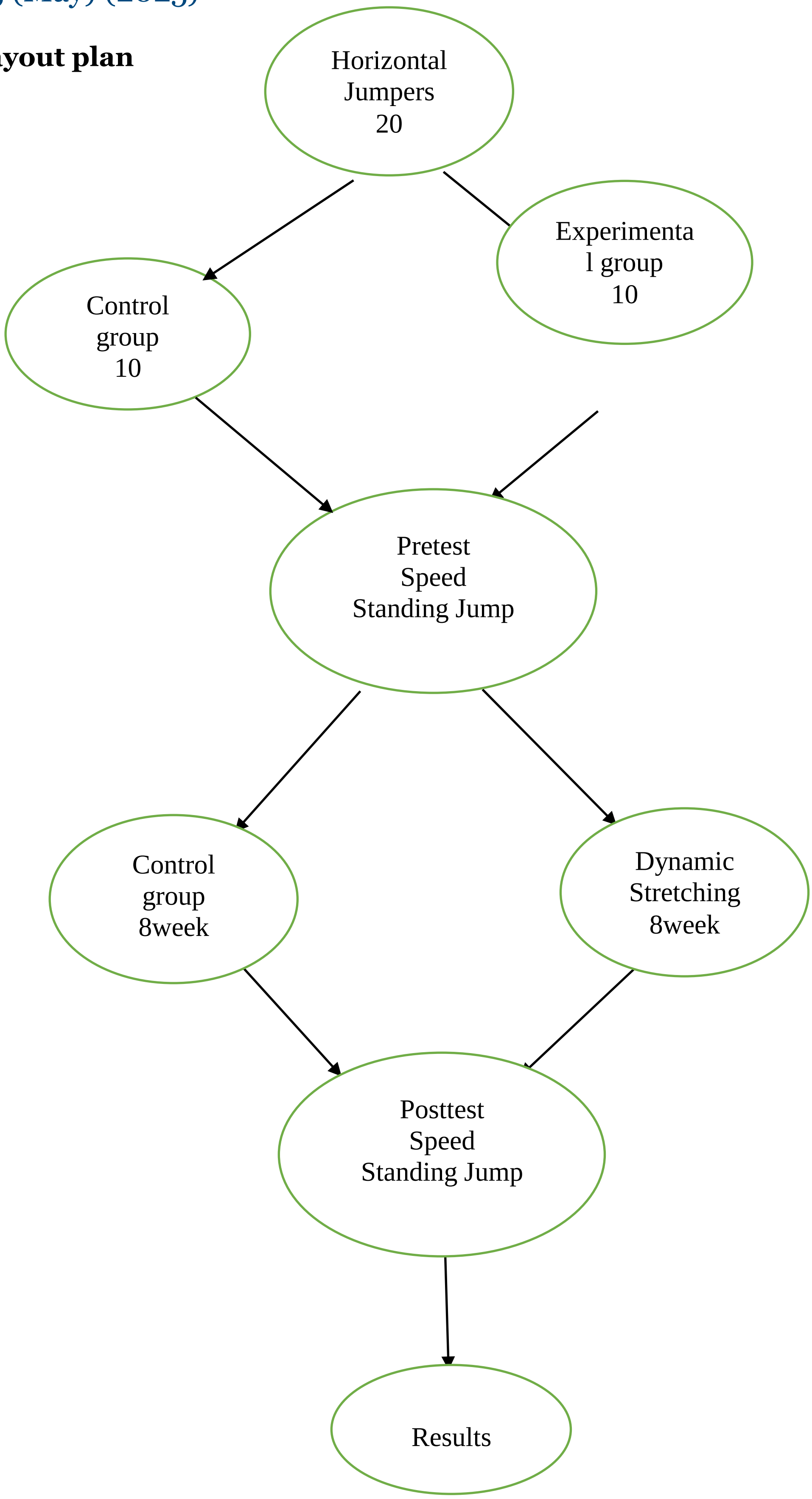
Research layout plan



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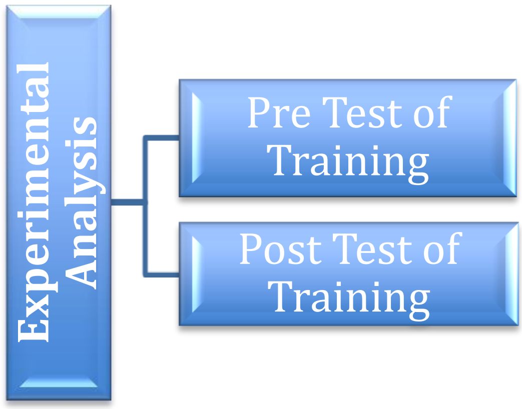
Parameters/variables to be studied
***Independent*:**
Dynamic stretching
Dependent: Performance
Speed,
Standing long jump.
Methods of data collection



Speed: We use a 30m sprint test to measure speed. We conduct three trials and choose the best time.
Standing Long Jump: The athlete starts with the toes of both shoes behind the line. The athlete performs one (1) single jump for length with maximal effort. The athlete starts with the toes of both shoes behind the line. We conduct three trials and chose the best time.

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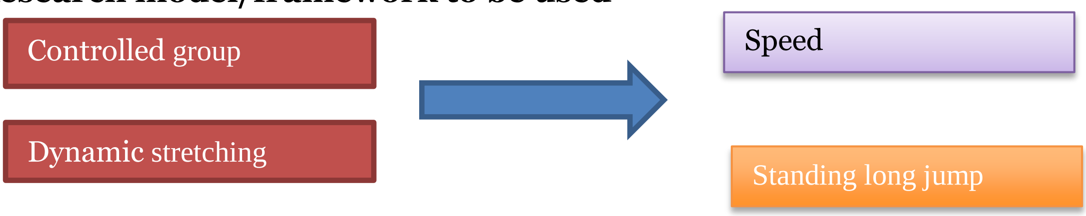
Sampling technique and procedure
The stratified sampling method was used.

Inclusion Criteria
Participants in this study were selected based on the following criteria:
1. Athletes specialising in horizontal jump events (e.g., long jump, triple jump).
2. Both male and female athletes were considered.
3. Age range: Participants were between 18 and 27 years old.
4. Athletes must have competed at least at the university level or higher.
5. Participants must be in good physical condition with no current injuries that could affect performance.

Exclusion Criteria
Athletes were excluded from participation based on the following factors:
1. Those who do not specialise in horizontal jump events.
2. Participants who had not competed at the university level or higher.
3. Athletes with a history of major lower-limb injuries in the past six months.
4. Individuals with any medical conditions that could limit their physical performance or pose a risk during testing.
5. Participants who failed to complete the pre-test or post-test sessions.

Sample size
The sample size was 20 horizontal jump players. Both male and female players who participated in at least university-level competition, with ages ranging from 18 to 27 years, were selected.

Research model/framework to be used



Statistical analysis/test to be used
Wilcoxon tests were conducted to evaluate whether there were any differences in jump performance between the pre-test and post-test measurements for each participant. This approach allowed for the assessment of the impact of the stretching protocols on jump distance after the training period.

Results and Discussion
The analysis structures pre-test and post-test participant assessments as main data points to determine how dynamic stretching affects speed and jumping results. Experts used descriptive statistics to evaluate the data alongside the Wilcoxon Signed Ranks Test, testing whether the applied training produced important changes. The study determines dynamic stretching effectiveness through quantitative measurements between control subjects and experimental group participants. The research objectives receive analysis involving results interpretation, which demonstrates structured training methods' effects on

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athletic performance and physical conditioning levels.

Table 1: Test of Normality

Variables	**Kolmogorov-Smirnov**			**Shapiro-Wilk**		
	Statistics	**df**	***p***	**Statistics**	**df**	***P***
Standing Long Jump (m) Pre-test	.19	20	.03	.88	20	.02
Standing Long Jump (m) Post-Test	.21	20	.01	.88	20	.02
30-meter sprint (sec) pre-test	.31	20	.00	.75	20	.00
30-meter (sec) post-test	.21	20	.01	.88	.20	.01

Interpretation of Normality Test Results

Statistical Values

- Standing Long Jump (m) Pre-Test: Statistic = 0.884, *p*-value = 0.021
- 30-Meter Sprint (sec) Pre-Test: Statistic = 0.751, *p*-value = 0.000

Interpretation

The Standing Long Jump Pre-Test data shows a p-value below 0.05, indicating that the dataset significantly deviates from a normal distribution. This suggests that the data is not normally distributed.

The 30-Meter Sprint Pre-Test data also exhibits a p-value below 0.05, confirming a significant deviation from normality. Since the p-value is extremely low (0.000), this dataset is considered highly non-normal. Since neither datasets do not meet the assumption of normality, non-parametric statistical tests should be used for further analysis.

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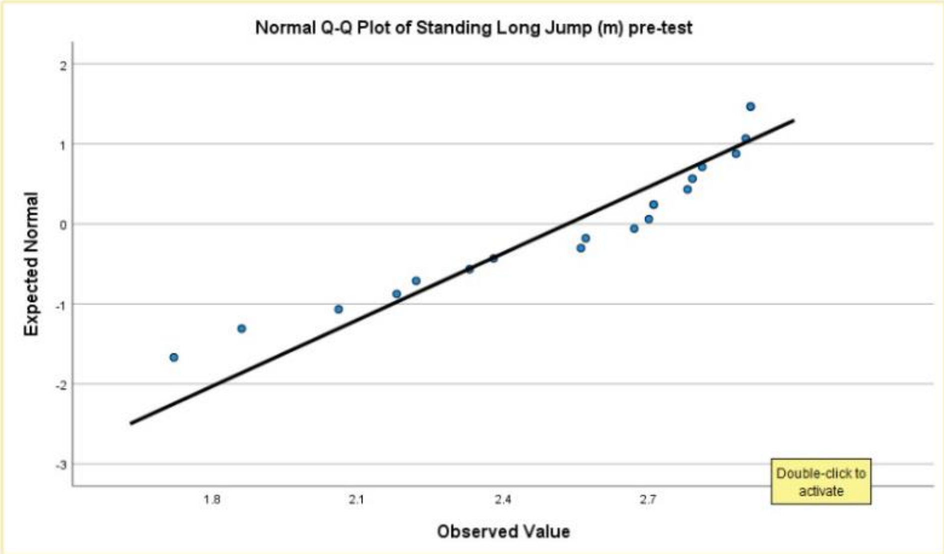
Standing long jump pre or post test Graps

Graph: 1

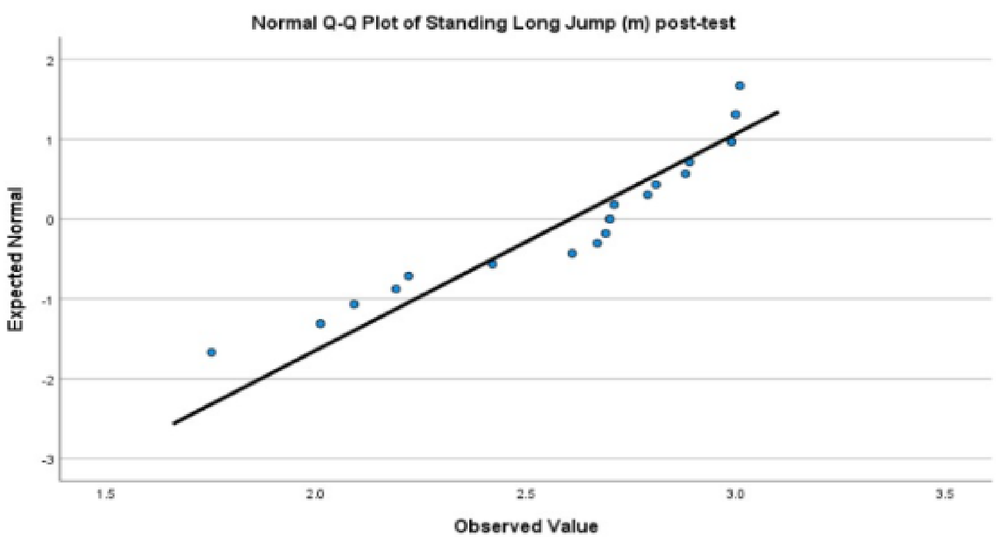
Standing Long Jump (m) pre-test



Note: The **Normal Q-Q Plot** for the **Standing Long Jump (m) pre-test** shows some deviations from the reference line, indicating a potential departure from normality. This supports the normality test results, suggesting the need for **non-parametric statistical analysis**.

Graph: 2

Standing Long Jump (m) post-test

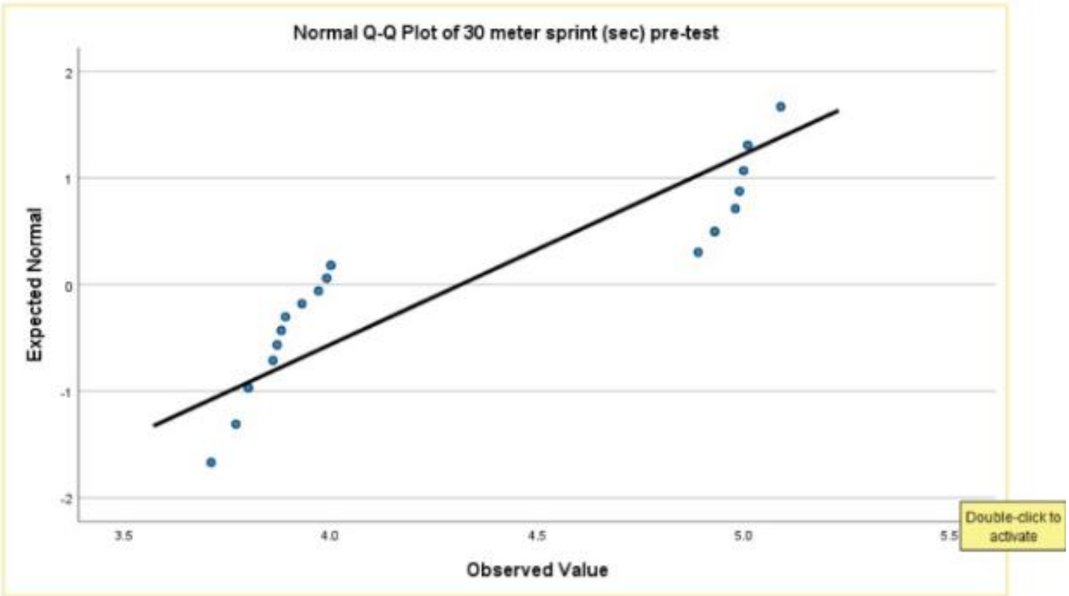


Note: The Normal Q-Q Plot for the Standing Long Jump (m) post-test shows noticeable deviations from the reference line, particularly at the extremes, indicating a lack of normality. This aligns with the normality test results, suggesting that non-parametric analysis is more suitable.

30m sprint, pre- or post-test:

Graph:3 & 4

30 meter sprint (sec) pre-test



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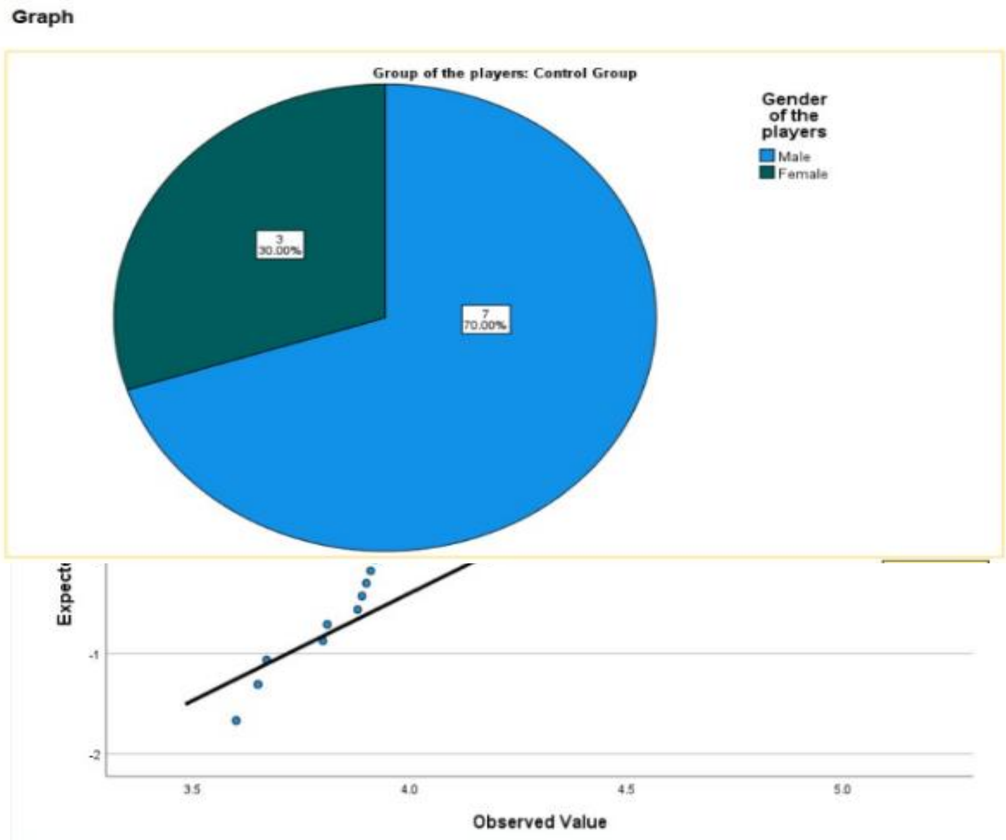
Notes: The Normal Q-Q Plot for the 30-meter sprint (sec) pre& post-test shows clear deviations from the reference line, particularly at both ends, indicating a non-normal distribution. This supports the normality test results, reinforcing the need for non-parametric statistical analysis.

Gender Group of Control & experimental Group
Graph:5
Note: The pie chart represents the gender distribution of the Control Group, showing that 70% of the players are male (7 participants), while 30% are female (3 participants). This indicates a higher proportion of male players in the control group.



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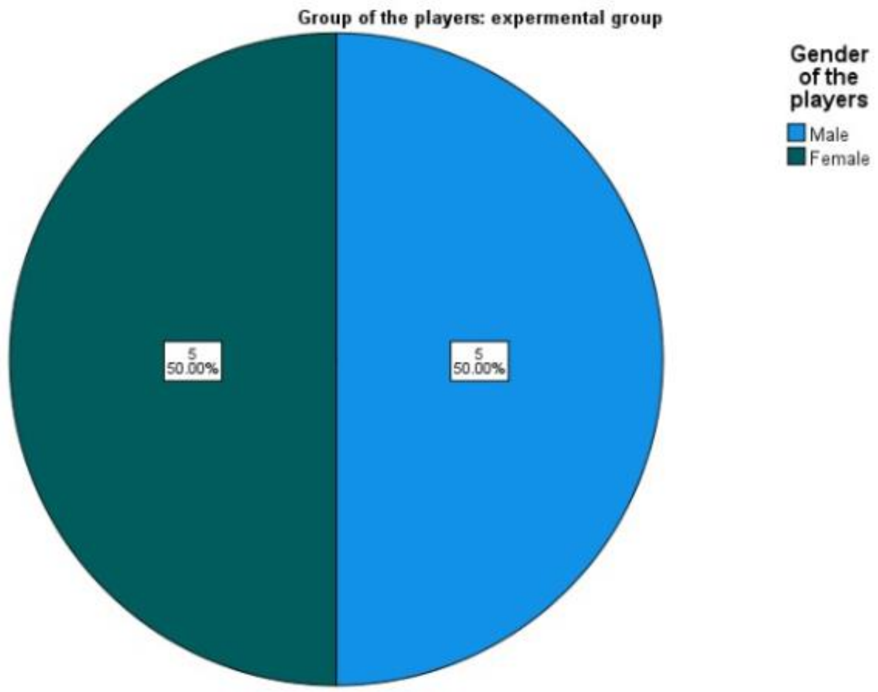
Graph:6



GRAPH

Note: The pie chart illustrates the gender distribution of the Experimental Group, showing an equal split of 50% male (5 participants) and 50% female (5 participants). This indicates a balanced representation of genders in the experimental group.

Wilcoxon Signed-Rank Test

The Wilcoxon Signed-Rank Test established the statistical importance of changes in standing long jump capabilities achieved through dynamic stretching during an eight-week intervention period. This non-parametric test specialises in evaluating matched data sets through pre-test and post-test comparisons because it examines the symmetry of differences between paired observations around the zero value.

The data indicates all participants achieved better jump distances after intervention since their results displayed enhancements between +0.03m to +0.33m. Three participants improved their explosive power and jump performance the most, with Kinza demonstrating +0.33m improvement and Ayesha +0.15m and Amtul +0.13m. Sahar's jump performance declined by -0.03m, which might be explained by inter-individual variations from training and fatigue-related elements or outside factors.

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Table-2: StaWilcoxon Signed Ranks Test results compare the Standing Long Jump (m) post-test and pre-test scores in the Control Group

Ranks	N	Mean Rank	Sum of Rank
Negative Ranks	1[b]	5.50	5.50
Positive Ranks	8[c]	4.94	39.50
Ties	1[d]		
Total	10		

Note: The Wilcoxon Signed Ranks Test results compare the Standing Long Jump (m) post-test and pre-test scores in the Control Group. The table shows 8 positive ranks (mean rank = 4.94, sum = 39.50), suggesting performance improvements. There is 1 negative rank (mean rank = 5.50, sum = 5.50), indicating a decline, and 1 tie, where post-test and pre-test scores remained the same. These rankings reflect individual changes in jumping performance across participants.

Standing long post test

Table-3: The Wilcoxon Signed Ranks Test for the Experimental Group Compares Standing Long Jump (M) Post-Test and Pre-Test Scores

Ranks	N	Mean Rank	Sum of Rank
Negative Ranks	1[b]	1.00	1.00
Positive Ranks	9[c]	6.00	54.00
Ties	0[d]		
Total	10		

Note: The Wilcoxon Signed Ranks Test for the Experimental Group compares Standing Long Jump (m) post-test and pre-test scores. The results show 9 positive ranks (mean rank = 6.00, sum = 54.00), indicating significant improvement. There is 1 negative rank (mean rank = 1.00, sum = 1.00), showing a decline, and 0 ties, meaning no participant had the same pre-test and post-test scores. These results suggest a strong positive effect of the intervention on jumping performance.

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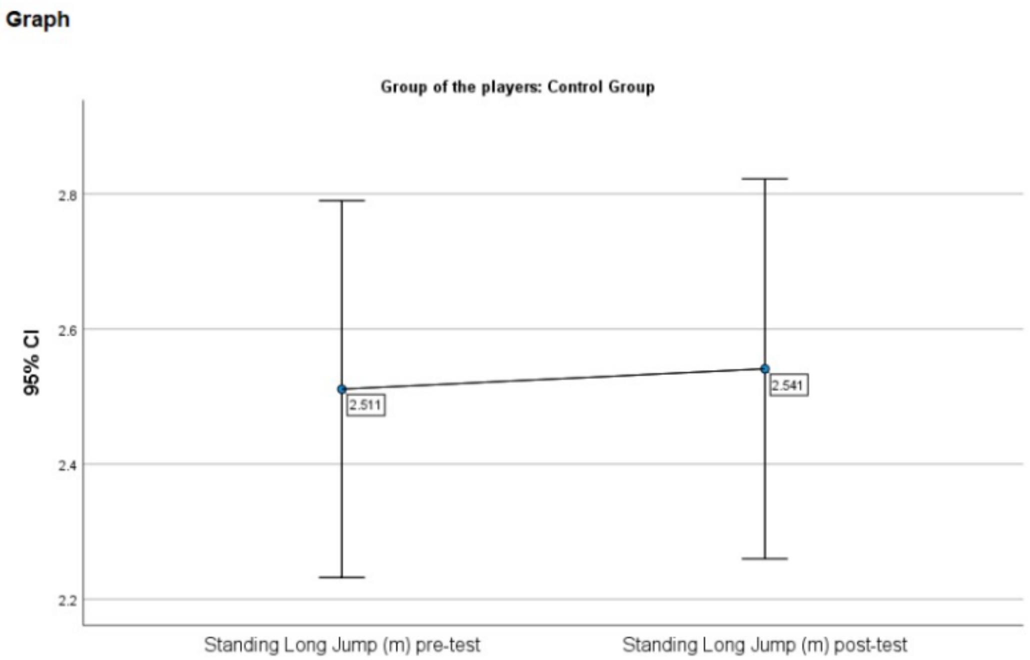
Descriptive statistics

Table 4: Descriptive Statistics for the Experimental Group: Compare Standing Long Jump (m) Pre-Test and Post-Test Scores

Variable	N	M	SD	Minimum	Maximum	25th	Percentiles 50th (Median)	75th
Standing Long Jump (m) Pretest	10	2.55	.34	1.86	2.91	2.30	2.64	2.88
Standign Long Jump (m) Posttest	10	2.67	.35	2.01	2.36	2.36	2.75	2.99

Note: The Descriptive Statistics for the Experimental Group compares Standing Long Jump (m) pre-test and post-test scores. The mean improved from 2.5540 m (pre-test) to 2.6710 m (post-test), indicating progress. The standard deviation remained similar (~0.35), suggesting consistent performance. The median increased from 2.6400 m to 2.7500 m, reinforcing overall improvement. The minimum and maximum values also increased, showing a positive shift in jumping ability.

Graph: standing long jump control Group
Graph:7



Note: This graph represents the Control Group's Standing Long Jump (m) pre-test and post-test results, with 95% Confidence Intervals (CI). The mean increased slightly from 2.511 m (pre-test) to 2.541 m (post-test), suggesting

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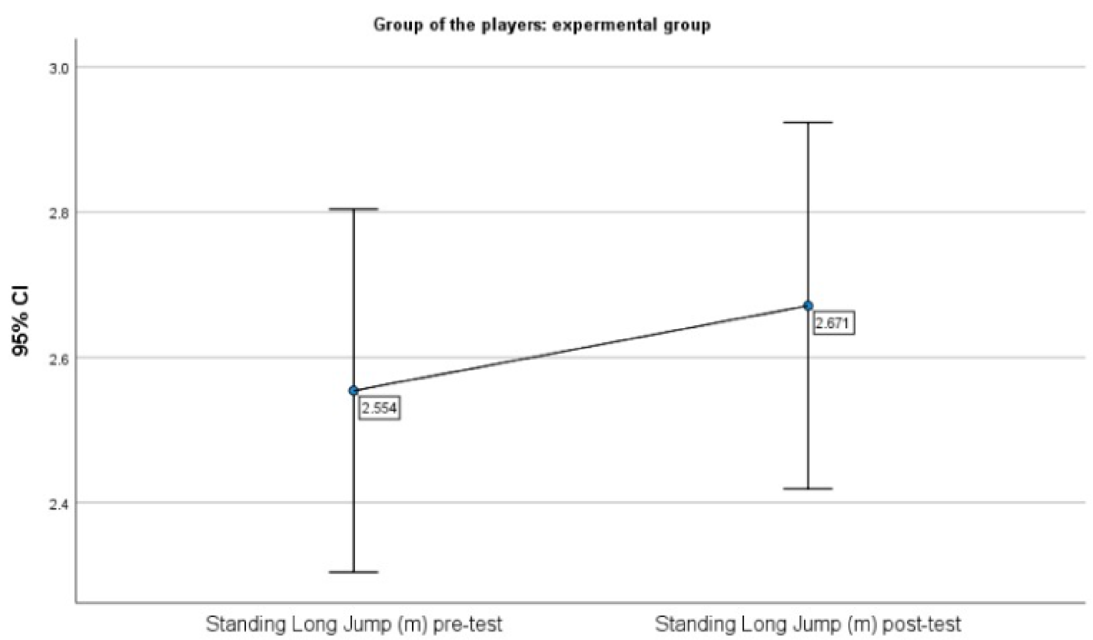
minimal improvement. The error bars indicate variability, showing that the confidence intervals are wide, meaning there may not be a statistically significant change. This suggests that without experimental intervention, performance remained relatively stable.

Graph: Standing Long jump Experimental group
Graph:8



Note: This graph represents the Experimental Group's Standing Long Jump (m) pre-test and post-test results with 95% Confidence Intervals (CI). The mean increased from 2.554 m (pre-test) to 2.671 m (post-test), suggesting a performance improvement. The confidence intervals still show some variability, but the upward trend suggests a positive effect of the experimental intervention. Compared to the Control Group, this indicates that the intervention may have had a measurable impact on performance.

Wilcoxon 30m sprint test

Table-5: The Wilcoxon Signed Ranks Test for the Control Group's 30-meter sprint shows that 4 participants improved (faster post-test)

Ranks	N	Mean Rank	Sum of Rank
Negative Ranks	4[b]	5.63	22.50
Positive Ranks	6[c]	5.42	32.50

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Ties	0[d]
Total	10

Note: The Wilcoxon Signed Ranks Test for the Control Group's 30-meter sprint shows that 4 participants improved (faster post-test), while 6 participants slowed down (slower post-test). No ties were observed, indicating all players had some change in performance.

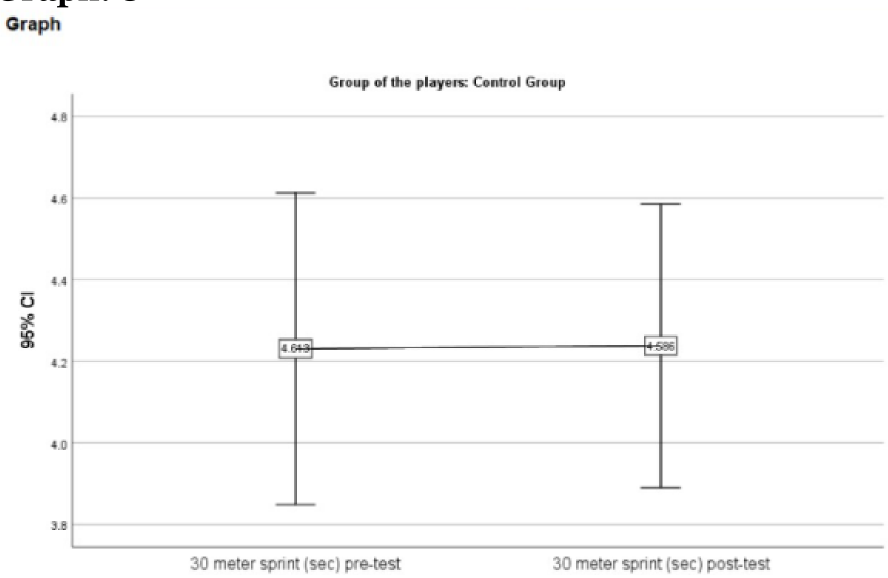
Descriptive statistics

Table-6: Descriptive Statistics for the Experimental Group's 30-meter

Variable	N	M	SD	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Standing Long Jump (m) Pretest	10	4.39	.60	3.71	5.09	3.79	4.44	4.94
Standign Long Jump (m) Posttest	10	4.14	.47	3.60	4.79	3.66	4.12	4.53

Note: The Descriptive Statistics for the Experimental Group's 30-meter sprint show a slight decrease in the mean sprint time from 4.3980 sec (pre-test) to 4.1400 sec (post-test), suggesting a small improvement in sprint performance. The median also decreased from 4.4400 sec to 4.1250 sec.

Graph: 30m sprint test for control group
Graph: 8



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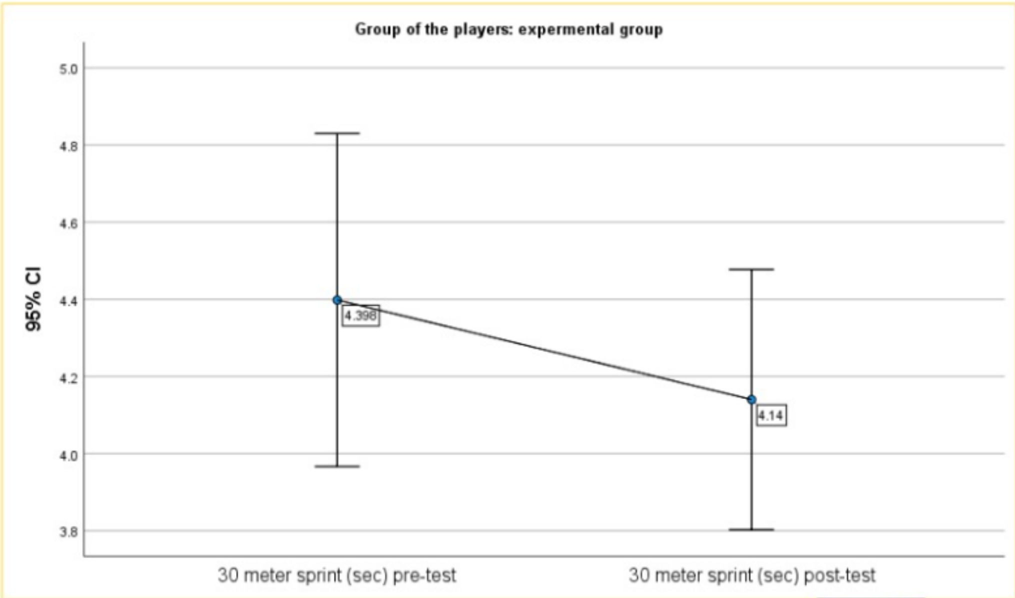
Note: The Control Group's 30-meter sprint graph shows a minimal change in performance, with the mean time remaining nearly the same between pre-test (4.643 sec) and post-test (4.586 sec). The error bars indicate a wide confidence interval, suggesting variability in results.

Graph: 30m sprint test for Experimental group
Graph 9



Note The Experimental Group's 30-meter sprint graph shows a noticeable improvement, with the mean sprint time decreasing from 4.398 sec (pre-test) to 4.14 sec (post-test). The downward trend suggests enhanced performance, though the wide confidence interval indicates some variability in results.

Discussion

The study aimed to evaluate the impact of an intervention on the performance of athletes in two different physical tests: the Standing Long Jump and the 30-Meter Sprint. The researchers evaluated information from the experimental and control groups by applying the Wilcoxon Signed Ranks Test and descriptive statistics.

The subjects in the experimental group demonstrated clear advancement toward better results during their standing long jump. The experimental subjects lifted their jump distance from 2.554 meters before testing to 2.671 meters after training. The Wilcoxon signed-rank results show 9 individuals improved in their tests, while only 1 person deteriorated without any cases of ties. Leg explosive power experienced a notable constructive effect after the completion of the intervention. Changes in jumping performance were most likely due to better muscle strength and neuromuscular learning and improved jumping mechanics that occurred because of the suitable training methods employed by the experimental group.

Observers noted that the control participants made hardly any improvements since their mean results shifted from 2.511 meters to 2.541 meters only. The intervene of controls and test groups overlaps because improvements detected during the study could stem from usual variations between test days or typical participant activities instead of the programmed training program. The unnoticeable change between pre- and post-test assessments adds evidence to the effectiveness of jump performance enhancement through the experimental intervention.

The experimental group participants reduced their sprint time average from 4.398 seconds before the test to 4.140 seconds following the intervention. Such improvements in sprint time demonstrate an enhanced ability to sprint probably because of improved lower-body strength and better acceleration mechanics together with quicker and more efficient stride movements. Six members improved their sprint time but four others showed deterioration after the training that revealed different outcomes among subjects. Sports performance gains through explosive strength exercises and sprint training can be observed by checking decreased sprint times.

The control group developed minor changes in their sprint times during the study since their mean went from 4.643 seconds to 4.586 seconds. The statistical data indicates that performance differences were minimal because structured training was proven crucial for enhancing performance outcomes. Sprint-specific training represents a necessary approach to obtain meaningful performance enhancements because the control group participants failed to show improvements.

Research data demonstrates that the applied intervention resulted in enhanced jump abilities together with sprint times in participants from the experimental group. The absence of intervention in the control group resulted in minimal performance changes thus proving the training method caused the experimentally observed results. Data analysis through the Wilcoxon Signed Ranks Test showed important improvements were statistically significant thus eliminating the possibility of random chance.

Avertable individual response patterns along with uncertain confidence ranges show that factors such as training compliance and starting fitness condition and outside factors possibly impacted the evaluation results. Some subjects showed superior outcomes from the program likely because of their physical capabilities or natural ability together with individual performance drive. The experimental group post-test showed several slower sprint times that might be attributed to training inconsistencies and fatigue or injury alongside normal variation.

Limitations and Future Recommendations

The research evidence shows strong validation for the intervention's effectiveness yet numerous restrictions exist for the analysis. A small number of participants in the study reduces how widely researchers can apply its findings to various population groups. Future research needs to enlarge participant numbers in order to enhance the statistical significance of the study results. The study duration needed extension because it should measure both long-term performance adaptation together with slow retention of improved measures.

The study has a limitation because researchers could not regulate external elements affecting participants' diet along with sleep practices and their additional physical activities beyond the training sessions. External factors present during the research period potentially shaped the performance results. The effectiveness of the intervention needs further assessment through controlled observations of these variables to achieve accurate findings.

Testing methods involving motion analysis and electromyography should be used to investigate deeper biomechanical along with neuromuscular adaptations that develop because of training programs. Research should implement comparative studies of different training approaches to identify which methods deliver maximum benefits for athletic performers.

Conclusion

The research establishes conclusive evidence that properly designed programs result in substantial improvements of both lower-body power and sprint performance. Significant progress in the standing long jump and 30-meter sprint performance was recorded by experimental subjects but the control subjects maintained minimal changes. Adequate strength and speed training proves important for athletic growth according to these results.

Training programs developed by coaches and trainers should include these interventions in order to effectively enhance explosive power and sprinting ability in their athletes. Additional investigation needs to proceed because researchers must verify both the long-term stability of these performance enhancements and develop optimal training procedures for various athletic groups. Future studies must address the detected shortcomings and enhance intervention strategies so they can produce better training methods for sports performance enhancement.

Recommendations

1. The first step should be replacing static stretching with dynamic stretching during athlete warm-up since the substantial findings show dynamic stretching increases explosive power and minimizes injuries.
2. To design such sports specific dynamic stretching programs, the training staff must develop them based on typical horizontal jumping movements that include high knees together with lunges and leg swings, and bounding exercise.
3. The results of scientific findings suggest that dynamic stretching for 10 to 15 minutes with proper duration and intensity will improve the outcome before training or competition. Making the plane move larger should increase gradually under the supervision of the coach to avoid the muscles getting tired but at the same time to achieve a complete mobilization of the muscles.
4. Additional research is needed to understand the long term effects and the effect on athletics development, as well as including injury prevention, of dynamic stretching.
5. The continuous flow of innovation in pre-activity protocol for sports requires permanent cooperation of the scientists who work simultaneously with the medical professional and the coach stakeholders. Once a new scientific information comes into existence as to about stretching protocols, it means that maintaining updated protocols depends on it.

These and recommendations combined give athletes means of how to reach top form and avoid injuries in horizontal jumps. Because they employ implementations of standard dynamic stretching in order to improve athletic preparation, competitive sports will achieve better long term success.

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