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SLEDGE MACHINE RESISTANCE EXERCISE AND ITS IMPACT ON SPRINT AND STRENGTH PERFORMANCE OF UNIVERISTY OF LAHORE RUGBY PLAYERS

[1]Umar Islam, [2]Shagufta Akhtar, [3]Basit Ali, [4]Syed Muhammad Bilal Gillani

[1]Student, Department of Sport Science and Physical Education, Faculty of Allied Health Sciences,The University of Lahore

[2]Lecturer,Department of Sport Science and Physical Education, Faculty of Allied health Sciences, The university of Lahore

[3]Lecturer, Department of Sport Science and Physical Education,Faculty of Allied Health Sciences,The university of Lahore

[4]Assistant Professor, Department of Sport Science and Physical Education,Faculty of Allied Health Sciences,The University of Lahore

[1]umarislam960@gmail.com, [2]shagufta.akhtar@sps.uol.edu.pk, [3]basit.ali@sports.uol.edu.pk, [4]muhammad.bilal@sps.uol.edu.pk

Abstract

The aim of this study was to evaluate male rugby players at the University of Lahore's sprint and strength performance under an eight-week Sledge machine resistance training programme.Thirty participants between the ages of eighteen and twenty-five were randomly assigned to a control group and an experimental group in equal measure. Both the one-repetition maximum (1RM) squat test and the 30-meter sprint test were the main outcome measures; both are accurate markers of sprinting and strength performance. Whereas the control group followed their normal training schedule, the experimental group engaged in a methodical intervention of four 40-minute sessions of moderate-intensity interval training (70–80% of maximum heart rate) on a Sledge machine each week. The results showed clear improvements in the experimental group: sprint speeds dropped from a mean of 4.5587 to 4.4633 seconds (p = 0.000) and 1RM squat performance rose from a mean of 4.6127 to 4.2040 units (p = 0.000). These gains highlight enhanced activation of fast-twitch muscle fibers, better efficiency of the anaerobic energy system, and lower body strength arising from the specificity and neuromuscular adaptations the intervention encourages. The randomized controlled trial design, controlled variables, and lack of missing data enhance its validity. The findings are constrained by the restricted sample size, brief length, and exclusion of female participants. This study highlights the efficacy of Sledge machine resistance workouts in improving rugby performance and establishes a basis for incorporating such specialized training into sport-specific conditioning regimens. Subsequent research should investigate bigger, more heterogeneous groups, extended intervention periods, and comparisons with various resistance training techniques to enhance the generalizability of these results.

Keywords: Sledge machine, Resistance Training, lower body strength.

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Corresponding Authors*:

INTRODUCTION

One of the accepted methods for accelerating running speed is resisted sprint (RS) training. Along with hill or sand dune training, this type of instruction might entail the participant running with an additional burden using a weighted Sledge, vest, or speed parachute. The basic idea of RS training is that, by building power and strength, it finally resulted in longer strides in normal unresisted running (Zafeiridis et al., 2005). Although RS training is extensively applied in many sports, a study of the literature shows that there is little scientific data to justify its use as a technique of speed development. While few studies have been done to look at the long-term effects of an RS training program on strength and running speed performance, several have concentrated on the effect of RS training on sprint kinematics. Most studies on RS training thus far have concentrated on the transient effects on running speed, joint kinematics, and force production in sprinting (Zabaloy et al., 2023).Some studies have looked at the long-term effects of RS training on sprint performance, few have looked at the effects of RS training interventions on dynamic aspects of force production such as reactive strength index, rate of force development, and ground CTs during jumping. Flanagan and Harrison have previously shown that these parameters can be measured effectively using a force Sledge apparatus. The aim of this work was to assess the effects of a 6-week RS training intervention on 30-m sprint times and maximum speed reached in 30-m sprints from a stationary start and flying 30-m sprints. Using a force Sledge device, Harrison and Bourke (2009) examined how RS training affected the dynamics of force production in squat jumps, drop leaps, and rebound jumps. Improving maximal sprint performance is first training goal for conditioning coaches from numerous sports and disciplines. The rate of change in running velocity is what defines sprint acceleration. Positive instantaneous acceleration throughout time denotes a sprint velocity increase. The maximal velocity phase is defined as the period of time during which acceleration approaches zero by means of which the highest sprint velocity is obtained.

The difference between the acceleration and peak velocity phases is what defines transition velocity. Any sprint-based athlete may boost their whole performance by working on their acceleration and/or maximal velocity phases. Moreover, measurements of physical performance in field sports competition and training generally rely on capacity for acceleration and maximum velocity. Usually, sprint and strength coaches concentrate on two main strategies to raise sprint performance. Programs are aimed to either increase the efficiency and application of a given physical output or boost an athlete's force and power production. Usually, the later method asks for sprint training including "high-knee," "ankling," and "heel kicks." With relation to improving force and power output, several training strategies have shown a good transfer of training to sprint performance with gains in maximum strength, maximal power, reactive strength (plyometric training), and combinations of these approaches. The latter approach usually consists of sprint technique workouts like "high-knee," "ankling," and "heel kicks," even if the previously stated approaches demonstrate rather gains in maximum velocity or sprint acceleration. With relation to improving force and power output, several training methodologies have shown a favourable transfer of training to sprint performance with improvements in maximum strength, maximal power, reactive strength (plyometric training), and combinations of these approaches. While the above described methods demonstrate significant gains in maximum velocity or sprint acceleration, it is accepted that sprinting is the fastest human mobility free from aid. People have used it for survival since the dawn of humanity. In many different sport disciplines, including individual sports like athletics and team sports like soccer, rugby, American football, basketball, futsal, and field hockeye (Taylor, Wright, Dischiavi, Townsend, & Marmon, 2017), it also significantly influences the development and result of competitions. For example, straight running is the most often used tactic in professional soccer during goal situations. Moreover, regardless of age or gender, professional soccer players—whose sprinting is crucial—have become quicker with time. But among the largest athletic events worldwide in terms of social media and media coverage, the Olympic 100-meter dash final captures the height of sprinting. Consequently, sprinting from a biomechanical and physiological standpoint has attracted a lot of attention in study. Among the most often utilized supplementary ways to improve sprint performance is resistant sledge training (RST). This is mostly because, in comparison to tertiary methods, which have a higher vertical direction of resistance forces (Pavillon et al., 2021), RST influences horizontal forces more strongly. Sports have long employed RST; it began with the pull of a wheel and has subsequently developed to electromechanical devices controlling the load to provide the athlete the necessary loss of speed (like 1080 MotionTM). Usually driven by the idea of specificity, conventionally the most often used manuals and training guides have advocated that when utilizing RST, normal unresisted (UR) sprint biomechanics should be kept. Petrakos, Morin, & Egan, 2016) Therefore, loads have to be chosen considering the sport and the physical state of the athlete.

Track and field athletes, for example, may use loads not less than 10–12% of body mass (BM), which does not slow down running pace. In contrast. When they overcome external resistance during blocking and tackling, field sport players might use loads 20–30% of BM to maximize early acceleration. This theory has become somewhat popular as it is believed that when the load rises mechanical power generation decreases. Hughes & technology, 1987 This drop in mechanical power is connected to an increase in the CT, an improper configuration of the athlete's levers (containing many motor units or even muscle groups), and an incapacity to use the SSC to its full potential. Consequently, there has been a lot of discussion over recent studies aiming at elucidating the load in RST maximizing mechanical power. Hughes and technologies, 1987 Cross et al. found that loads approaching 80% BM attain the highest power production; Monte et al. found that the maximum power generated when employing RST occurred with loads close to 20% BM, without significantly changing the sprint technique when this load was used. This subsequent research had the disadvantage of not looking at the impact on kinematic parameters and evaluating the horizontal power when the athletes achieved the maximum velocity of the sprint, even if the strongest power output in sprinting is known to usually occur in the early stages. Though in separate stages and different sports (soccer players vs sprinters), the horizontal force and power reduced by 82.0% and 62.5%, respectively, during the 20-meter sprint with Sledge towing. Using spatio-temporal data, these researchers indirectly estimated the anterio-posterior (horizontal) (Alcaraz, Carlos-Vivas, Oponjuru, & Martinez-Rodriguez, 2018)force of the sprint, so computing the horizontal power generation. Within the past 10 years, researchers have investigated the use of complicated training to boost power output. First in complex training is a severe resistance exercise; next, a complicated pair with comparable biomechanical characteristics is executed in an explosive movement. Two theories—neuronal excitability and phosphorylation of the light myosin chain—have been proposed to enhance explosive performance following a heavy contractile activity. Hodgson, Docherty, & Robbins, 2005: The force the muscle can generate after previous contraction depends on the net balance of fatigue and potentiation. Restoring phosphocreatine supplies is a good goal; the appropriate level of recuperation depends on the person and follows the heavy contractile activity. This offers a quite small 4–12 minute window of opportunity to maximize the potentiating impact before it dissipates. Research indicates that heavy Sledge pulls are the most often used strongman-style workout equipment by coaches for strength and conditioning; nonetheless, no study has investigated the use of heavy Sledge pulls as a sophisticated training strategy to improve sprint performance. Many sports depend on fast sprinting performance, hence it appears natural that vigorous Sledge pulling might produce a PAP reaction. By use of such data, practitioners might be better aware of the possible long-term advantages and modifications in this kind of training. Hosson et al., 2005 this investigation aimed to investigate the acute potentiating effects on sprint performance resulting from intense sprint-style Sledge pulls. Two training loads (75 and 150% body mass) were employed to find if Sledge load influences the potentiating response and whether Sledge load and rest interval may be optimum to elicit a PAP effect. This study is significant as it shows that larger Sledge towing weights negatively affect acceleration kinematics, thereby perhaps negating the training benefit that increases it.

Given PAP effects have usually been observed with heavy loads, it was expected that the heavy Sledge pull condition (150% body mass) with the 8-minute rest period would induce a greater potentiating effect (i.e., faster sprint times) than the lighter Sledge condition (75% body mass). Rugby union is a physically demanding intermittent sport where players regularly clash with significant power independent of playing position. Players thus have to show extraordinary speed, force, and power. A lot of high-intensity activities (like maximal sprints and accelerations) broken up by low-intensity efforts also define the game. Aiming to boost speed and power, resisted sprint training (RST) is becoming increasingly important in the research on sports training. (Magrum, 2017) Sledge-based RST studies are growing, yet more study is needed to guarantee adequate load prescription. Harrison and Bourke investigated lower limb strength and speed of rugby players utilizing 13% of body mass (BM) and 30-meter sprints. They concluded that RST techniques could aid to improve acceleration capacity. According to Behrens & Simonson, the administration of a suitable load is very necessary to create favourable adaptations without appreciably altering sprint technique. Although absolute loads (kg) or % of BM have historically been used to estimate the load in RST, these methods ignore subject variability, velocity loss, or the planned performance reduction in connection to the unloaded sprint. Therefore, it has been proposed that a better approach to standardize the stimulus supplied to every athlete is to find the percentage of Vloss with respect to the unloaded sprint. When practitioners evaluate the effect of the Sledge weight and the coefficient of friction of the running surface on an athlete's sprint time during a Sledge-towing workout, load gets more complex for them. The ability of skeletal muscle to generate -power, which is the outcome of movement speed and strength, is one of the most important traits of it in sports and daily activities. (Frontera and Ochala, 2015) Studies have found a strong relationship between field sports participants, strength, and 20-meter sprinting and leaping performance. A separate study found that half-squat maximal strength, 30-meter sprint time, and jump height of soccer players are somewhat closely associated. Furthermore, a recent study found a significant correlation between rugby union players' strength, agility, and sprint and isometric mid-thigh pull (IMTP) factors researcher also concluded that supportive coaching styles has more positive impact upon field hockey player's performance (Queshi et al., 2022). Conversely, the researchers of observed no noteworthy correlation between the 20-meter sprint timings of rugby players' good effect of squat training on sprint performance of football players (Ali et al., 2022). To maximize speed when sprinting, nevertheless, it is clear that force creation is necessary. Whereas the absolute force in the later phase of explosive-isometric squats was most significantly correlated with jump height, the proportion of maximal force achieved in the first phase of isometric squats was most significantly correlated with rugby players' (Tillin, Pain, & Folland, 2013) short sprint performance (5 m). One important factor is rugby union players' performance; strength both absolute and in respect to BM has been found to be crucial. Larger athletes should focus on raising their power to body mass ratio to improve their jumping and running performance, the authors counsel. Through appropriate resistance training, rugby players may increase the strength, power, and muscle mass of their lower limbs, therefore developing the essential performance attributes required to compete at the top level. Retaining or enhancing their speed will help them to do this.

OBJECTIVES

- Effect of Sledge machine resistance exercise on sprint performance of rugby players
- Effect of Sledge machine resistance exercise on strength performance of rugby players

HYPOTHESIS

H1: Sledge machine resistance workout improves sprint and strength performance of rugby players.

H2: Sledge machine resistance workout improves sprint and strength performance of rugby players.

LITERATURE REVIEW

One physically demanding activity requiring a mix of strength, power, speed, agility, and endurance is rugby. Enhancement of these qualities depends much on resistance training, hence it is a necessary component of rugby training schedules. In tackles, scrums, rucks, and mauls as well as across short distances, rugby players must provide great power. Structured resistance training increases muscle strength, explosive power, and general athletic performance to satisfy these needs. Through weightlifting, plyometric, and Sledge training especially, resistance training improves muscle growth, neuromuscular efficiency, and movement mechanics. Research indicates that compared to those who do not follow a methodical strength training, rugby players who include resistance exercises into their training schedules show improved acceleration, speed, and injury resilience. In rugby, essential performance elements include strength and sprinting ability. Sledge training has grown as a must-have equipment. The dynamic and pragmatic character of Sledge training is one of its biggest advantages. Sledge training demands athletes to use more varied motions, thereby offering a multi-dimensional challenge to the body unlike conventional resistance training, in which motions normally follow a defined and predictable course. Apart from construction of the Sledge, these actions forward Sledge pushing, backward Sledge pulling, or dragging are claimed to promote speed, endurance, and agility. Using a Sledge has several physiological advantages. Athletes overcoming the resistance of a weighted Sledge have to engage multiple muscle groups needed to raise upper and lower body strength. Crucially also is the involvement of core muscles as they give stability and control during intense motions. For individuals needing extraordinary stamina for their particular activity, sledge training increases cardiovascular endurance. Furthermore readily modified to Sledge training is the fundamental strength training idea, the progressive overload theory. Regular body testing and weighting the Sledge helps people over time build strength and power. Apart from strength, Sledge training helps especially to increase speed and agility. Football, soccer, rugby, track and field sportsmen especially benefit from this as sudden bursts of speed and quick direction changes are vital. The Sledge's resistance training generates muscle strength straight forward into more explosive actions on the field or court. Another great benefit comes from using Sledge training for recuperation and injury avoidance. Those recuperating from ailments or those who wish to boost strength without too much joint strain are suited for low-impact Sledge training. Moreover, the controlled character of Sledge sessions permits a longer delayed recovery to develop following an injury. It can help to build muscle groups supporting joint stability, therefore improving long-term joint health and mobility.

The diversity of Sledge workouts makes it a flexible training tool for athletes in several fields. Forward Sledge pushes, reverse pulls, lateral Sledge drags, and high-resistance sprints are several often used Sledge workouts. Every exercise seeks for distinct movement patterns, which enables athletes to modify their training to meet their particular requirements. To maximize these workouts, they might also be included into CrossFit or high-intensity interval training among other training courses. All things considered, Sledge training is a great replacement for those who like general fitness and not only for athletes trying to increase performance. Sledge training provides a complete solution regardless of the objectives: speed growth, endurance enhancement, or strength strengthening. Its usage in rehabilitation programs and its ability to provide functional strength for daily activities define its value; so, it is a useful instrument for everyone trying to raise their physical capacity. A holistic strategy for developing general fitness, functional strength, and athletic performance is sledge training. With so many advantages, Sledge training is obviously becoming the pillar of strength and conditioning techniques. Whether your criteria call for rehabilitation, fitness, or top athlete, One successful and flexible method to improve physical performance is sledge training. Particularly for athletes trying to increase lower body strength and power output, sledge training has grown to be a popular strength conditioning tool. The basic idea of sledge training is to create resistance by pushing or dragging a sledge across a distance, therefore taxing the muscles more than in a normal exercise. With an eye toward the main lower body muscles—the quadriceps, hamstrings, glues, and calves this high-resistance exercise emphasizes During sledge training, muscles used in both concentric and eccentric motions acquire strength and explosive power. Studies suggest that sledge training could greatly increase the maximum strength and power production during lower body activities including sprints and squats. Greater muscular activation and fast-twitch muscle fibers which are very vital for increasing explosive power—are encouraged by the resistance the sled offers. Usually, sledge training helps an athlete's sprinting speed, vertical leap height, and general lower body strength to develop. The sled's varying resistance allows athletes to change the intensity of their sessions depending on their training objectives. A heavier sled calls more force to move, so strength might be raised. Lighter sleds, on the other hand, can help increase agility and speed—qualities especially important for sports requiring fast direction changes. The capacity of a muscle or set of muscles to maintain repeated contraction for a given length of time is known as muscular endurance. Since it requires constant muscular activity—especially when utilizing moderate to lighter resistance—sledge training may greatly increase muscular endurance. Rugby, football, and soccer are among the sports and occupations involving repeated movements where this kind of training is best for increasing the endurance needed. The extended effort needed to push or pull the sled over long distances or periods accounts much of the rise in muscular endurance brought about by sled training.

The slow build-up of tiredness tests the muscles' capacity to sustain force output, hence gradually increasing muscular endurance. Like in endurance-based sports, the sled's continuous resistance causes the muscles to operate below their greatest capability. Moreover, sled training could raise the general neuromuscular system's efficiency. This implies that muscles can operate continuously using less energy, therefore enhancing an athlete's capacity to perform at high levels for prolonged periods of time without tiredness. Since sled training is continuous, it has also been shown to raise aerobic capacity in a training program. Athletes therefore develop their cardiovascular endurance as well as their physical endurance. One special and efficient approach to boost muscle endurance and lower body strength is sledge training. Whether their training is to boost strength, power, or endurance, the flexible nature of the sled resistance allows athletes to match their efforts to particular performance goals. Including sledge training with regular conditioning programs can greatly improve general sports performance. Sledge training is generally known to have greatly improve lower body strength, explosive power, and general athletic performance. Thanks to the increased resistance and dynamic character of the training, athletes may target specific muscle regions and enhance their athletic talent in many different ways. Sledge training offers flexibility as one benefit. Athletes that have performance goals can easily change the degree of intensity of their workouts. While smaller sleds may improve agility, sprinting speed, and general cardiovascular endurance, larger sleds are perfect for increasing raw strength and power. Because of its flexibility, sledge training is appropriate for players from a range of sports including football, rugby, soccer, track and field. Furthermore, the kind of motion needed to draw or drive the sled interacts. To participate at the greatest level in the high-intensity, contact sport rugby requires a special mix of strength, agility, anaerobic, and aerobic development. Fundamental techniques to improve rugby performance are sprint and strength training as they immediately affect an athlete's capacity to accelerate, decelerate, and deliver power during pivotal times in a game. Mostly, these qualities are required to burst through defensive lines, keep balance during tackles, and surpass opponents. Important abilities in rugby include sprint training improves an athlete's capacity to accelerate rapidly, maintain speed over longer distances, and swiftly reverse direction. Conversely, strength training sharpens the force needed for tackling, scrambling, and maintaining high degrees of performance all through the game. Improving an athlete's performance on both offensive and defensive plays calls both speed and strength. Resistance sprint training (RST) is a good training approach for rugby players trying to improve their sprint performance. RST is running employing external resistance bands, parachutes, sleds, etc. Faster, more powerful sprints are produced by this resistance building the neuromuscular system in ways that translate to improved stride length and force generation. Research on how RST influences rugby performance especially sprint speed, acceleration, and strength has been conducted abound. One research found RST significantly raised first step acceleration, which improved rugby players' 10- and 30-meter sprint timings. Another research looked at how sled training affected explosive strength and acceleration of rugby players. Especially in short sprints, the study found that sled sprints enhanced on-field performance by raising lower-limb power and peak velocity. These results imply that including RST into a rugby training program might improve a player's capacity to move fast while preserving strength during crucial game events.

Most of these studies support the efficacy of resisted sprint training (RST) in enhancing rugby players' sprinting mechanics and general agility, indicating that RST should be integrated into an athlete's conditioning programme together with consistent strength training and sprint workouts. One highly intense sport that strains the aerobic and anaerobic systems greatly is rugby. Players who wish to perform effectively during a game must strike a mix between these two energy sources. Anaerobic conditioning is essential for brief bursts of strength and speed—that is, during tackles, scrums, or breaks—while aerobic fitness guarantees that players may maintain their efforts for longer lengths of time. In rugby, especially for preserving performance for the complete 80-minute contest, aerobic fitness is absolutely vital. Rugby players travel great distances throughout a game, hence they require a robust aerobic system to maintain constant exertion. Among other training strategies, interval training, tempo runs, and long-distance running can all raise aerobic capacity. To maximize performance, nevertheless, anaerobic conditioning has to be included to continuous aerobic exercise as rugby is sporadic. Conversely, anaerobic conditioning emphasizes explosive power—necessary for line breaks, scrums, tackles, and sprints—by means of which Among the best approaches to boost anaerobic power is high-intensity interval training (HIIT). The stop-start character of rugby is represented in quick spurts of intense effort broken off by small breaks. This type of training helps athletes build both their aerobic and anaerobic systems as well as provide them the explosive power they need at crucial times and endurance for continuous efforts. Still another crucial component of rugby training is agility. It defines a player's capacity for rapid direction shift that still preserves control and balance. Often times, players have to evade foes or respond quickly to changes in play. Exercises such ladder drills, cone drills, and shuttle runs that assist athletes increase their response speeds and rapid on-field mobility might constitute agility training. Through enhancing joint stability and range of motion, mobility exercises enhance agility. Players should be ready for the demands of rugby by means of dynamic stretches, foam rolling, and mobility circuits, which also help to lower injury risk. One has to consider periodizing in an efficient training program. Per iodizing training, is the intentional preparation done to maximize performance at the appropriate moment. Periodized rugby players are certain to peak at the ideal moment for competition, therefore preventing overtraining and injury. Usually three stages—off-season, pre-season, and in-season—are needed for periodizing. Athletes concentrate on laying a basis of strength and cardiovascular endurance during the off-season. While the in-season phase concentrates on preserving peak performance levels and recuperation, the pre-season stage stresses growing intensity and sport-specific training. Apart from physical development, rugby performance depends much on mental toughness.

Athletes may control stress, keep focus under duress, and perform generally better by use of mental conditioning strategies including visualization, goal-setting, and mindfulness. For athletes to keep their physical condition all through the season, recovery is also absolutely vital. Preventing tiredness and lowering the risk of damage depend on good recovery plans including rest, food, water, and active recovery sessions. Any sort of training starts with nutrition. To drive their bodies for practice and competition, rugby players must eat a healthy diet. While protein helps muscles develop and heal, carbohydrates give the endurance-related energy needed. Good fats, minerals, and vitamins help general performance and wellness. In sports like rugby where players sweat a lot from intense activity, hydration is extremely crucial. Maintaining enough hydration during sports guarantees best muscular function, helps with recuperation, and helps avoid dehydration and cramping. If rugby players want to perform at their best, they have to adopt a complete conditioning program including sprint and strength training, aerobic and anaerobic conditioning, agility training, and mental conditioning. Understanding the demands of the game and combining several training elements helps athletes to perform at their best on the rugby field. Especially resistive sprint training should be part of a rugby player's toolkit as it has been demonstrated to greatly improve sprint mechanics and power.

METHODOLOGY

PROPOSED PLACE OF WORK AND FACILITIES AVAILABLE

Data was collected from male rugby players of The University of Lahore rugby team. The exercise program was performed at The University of Lahore Rugby ground. Sledge machine, Training cones, stop watch, whistles were provided at the time of using interventions.

PLAN OF WORK AND METHODOLOGY ADOPTED

Men from the University of Lahore's rugby team gathered data. The rugby players from University of Lahore who have been there at least once year. The study comprised rugby players whose ages should lie between 18 and 25 years. Based on experimental research methodology, this study was a randomized control trail in nature control and experimental group with 30-meter sprint test and one RM squat test.

INTERVENTIONS

- **Duration**: The training program was last for 8 weeks.
- **SESSION:** 4 session of Sledge machine exercise per week.
- **Exercise:** 40 minutes of moderate intensity exercise

(Interval training).

- **Intensity:** 70-80% of MHR

30 METER SPRINT TEST

Warm up. Understanding the warm-up is a critical first step for each player to take. The warm-ups are designed to prepare players to perform successfully and efficiently while also reducing the chance of injury. The warm-up should take between 10 and 20 minutes, depending on the activities to come. It must be versatile enough to fulfill the demands of a competitive game or a training session. The warm-up should begin at a low intensity and develop gradually via a series of motions from a broad and simple level to a more precise and intense level. This is allow players to prepare their muscles and joints to move at the optimum tempo.

General Warm up = Jogging/ fun activity 10 mints and dynamic warm up 10 minutes

Sr No	Exercise Name	With body weight	With jump	With weight	With weight and jump
1	Squats	8 reps	8 reps	4 reps	4 reps
2	Lunges	8 each side	6 each side	4 reps	3 reps
3	Box Jumps	8 reps		4 reps	

Note: Rest time is 1 minute between each set and 2 minutes between next exercises, Designed by Umar Islam.

Certified “LEVEL 1 & LEVEL 2 STRENGTH AND CONDITIONING” By World Rugby.

Certificates are attached below with kind regards.

TREATMENTS TO BE STUDIED

Effect of Sledge machine resistance exercise on sprint and strength performance of university of Lahore rugby players

RESEARCH LAYOUT PLAN

The study was (RCT) randomized control trail study design.

PARAMETERS/VARIABLES TO BE STUDIED

Independent Variable: Sledge machine resistance exercise

Dependent Variable: Sprint and Strength

METHODS OF DATA COLLECTION

- Participants' consent was obtained and then demographic and data related to the history of any medical condition were collected.
- Within 3 to 5 days after base training pre-test was conducted in the morning by using Sledge machine of both control group and experimental group.
- Post-test was conducted after completion of Sledge machine exercise training sessions.

SAMPLING TECHNIQUE AND PROCEDURE

Universal population technique was used.

SAMPLE SIZE

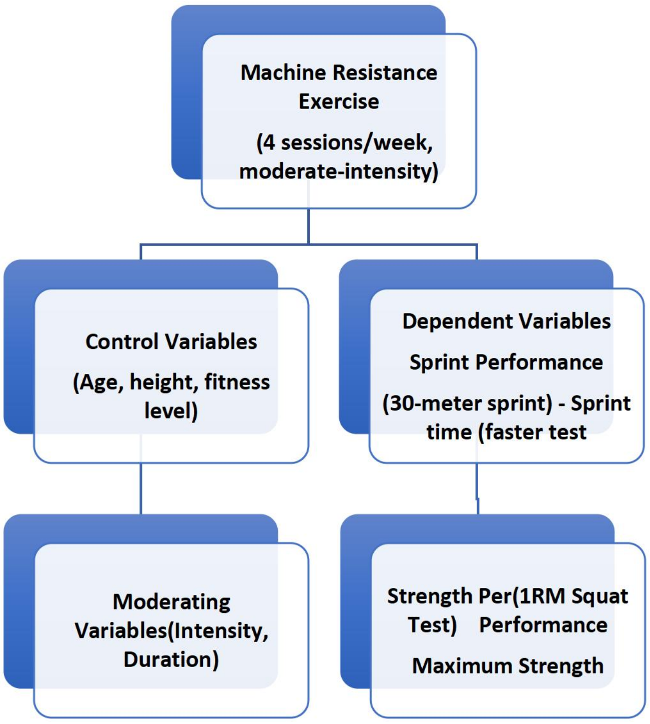
All male rugby players were recruited in the study.

VALIDITY AND RELIABILITY TEST

Statistical analyses, including paired t-tests and correlation coefficients (e.g., $r = 0.804$ for pre-test and post-test squat scores), ensure that the statistical procedures used in the study are appropriate and valid for drawing conclusions. The significant results (e.g., $p = 0.000$ for the sprint test) support the study's conclusions about the effectiveness of the intervention.

This study utilized rigorous measures to ensure both **reliability** and **validity** of the data, strengthening the credibility of the findings. The randomized controlled trial design, coupled with well-established tests for sprint and strength performance, ensures that the conclusions drawn about the effectiveness of Sledge machine resistance exercise are both consistent and meaningful.

RESEARCH MODEL/FRAMEWORK TO BE USED
CONCEPTUAL FRAMEWORK DIAGRAM



This research model provides a comprehensive framework to investigate the effects of Sledge machine resistance exercises on the sprint and strength performance of rugby players. It incorporates all key aspects of study design, methodology, data analysis, and implications for practice.

STATISTICAL ANALYSIS TEST

PAIRED SAMPLED T TEST WERE USED.

The Statistical Package for the Social Sciences (SPSS) was used in all statistical computation. Alpha level less than or equal to 0.05 was the maintained statistical significance. To observe whether the Sledge machine resistance workout program affected the sprint performance of the students. Furthermore used were pre-post training effect analysis of training program 30-meter sprint test and 1RM squat test.

RESULTS

TABLE 1: ***TESTS OF NORMALITY***

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-testing	.108	30	.200*	.972	30	.588
Post-testing	.113	30	.200*	.961	30	.325

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note: The pre-testing and post-testing data of the normality tests more especially, the Kolmogorov-Smirnov and Shapiro-Wilk tests show follow a normal distribution. The Kolmogorov-Smirnov test shows no appreciable departure from normality with the p-values for pre-testing (0.200) and post-testing (0.200) higher than 0.05. Likewise, the Shapiro-Wilk test produces p-values of 0.588 for pre-testing and 0.325 for post-testing, both of which are likewise above 0.05, therefore confirming the conclusion that the data does not notably deviate from a normal distribution. Small sample sizes are adjusted for using the Lilliefors Significance Correction used to the Kolmogorov-Smirnov test; the caveat on a "lower bound of the true significance" indicates that the test may somewhat underestimate the significance degree. These findings imply generally that both the pre- and post-testing data may be regarded as regularly distributed.

TABLE 2: ***PAIRED SAMPLES STATISTICS[A]***

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-testing	4.5587	15	.17812	.04599
	Post-testing	4.4633	15	.13552	.03499

a. Group of Players = Control Group

Note: Descriptive data for the control group's pre- and post-testing scores are offered by the Paired Samples data table. Based on 15 individuals, the pre-testing mean score is 4.5587; the standard deviation of 0.17812 suggests some significant variation. With a pre-testing standard error of the mean of 0.04599, the mean is quite precisely estimated. With a standard deviation of 0.13552, which represents less variability in the post-testing results, the mean score for post-testing is much lower at 4.4633. With a standard error of 0.03499, post-testing shows a far more accurate estimate of the mean than pre-testing. These findings generally imply that, although the mean score dropped somewhat from pre-testing to post-testing, the two time points had somewhat similar variability and accuracy of the scores.

TABLE 3: ***PAIRED SAMPLES CORRELATIONS[A]***

		N	Correlation	Sig.
Pair 1	Pre-testing & Post-testing	15	.956	.000

a. Group of Players = Control Group

Note: The table Paired Samples Correlations displays the control group's pre-testing and post-testing score connection. The quite strong positive link between the two sets of scores is indicated by the correlation coefficient, 0.956. This implies that those who did well on the pre-test usually did similarly on the post-test, and vice versa. Indicating that the connection is statistically significant, the p-value for this one is 0.000, much below the usual significance level of 0.05. Stated differently, there is a definite link between the two sets of measures and it is improbable that the great positive correlation between pre-testing and post-testing scores results from random chance.

TABLE 4::

		Paired Differences							Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	
Pair 1	Pre-testing - Post-testing	.09533	.06289	.01624	.06051	.13016	5.871	14	.000

a. Group of Players = Control Group

PAIRED SAMPLES TEST[A]

Note: The results of the Paired Samples Test indicate a statistically significant difference between the pre-testing and post-testing scores for the control group. The mean difference between the two sets of scores is 0.09533, with a standard deviation of 0.06289, suggesting some variability in the changes. The standard error of the mean difference is 0.01624, reflecting the precision of the estimated difference. The 95% confidence interval for the mean difference ranges from 0.06051 to 0.13016, indicating that we can be 95% confident that the true difference lies within this range. With a t-value of 5.871 and a p-value of 0.000, which is well below the typical significance threshold of 0.05, the test results show that the difference between the pre- and post-testing scores is highly significant. This suggests that the observed changes in scores are unlikely to be due to random chance and may reflect a true effect.

TABLE 5: ***PAIRED SAMPLES STATISTICS***[A]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-testing	4.6127	15	.18725	.04835
	Post-testing	4.2040	15	.17175	.04434

a. Group of Players = Experimental Group

Note: The table of paired samples statistics for the experimental group displays pre- and post-testing descriptive statistics. With a standard deviation of 0.18725, the pre-testing mean score of 4.6127 shows some participant variability. Reflecting a decent accuracy in the mean estimation, the pre-testing standard error of the mean is 0.04835. With a standard deviation of 0.17175, the post-testing mean score is somewhat lower at 4.2040, implying less variability in post-testing results than in pre-testing. With a standard error of the mean for post-testing of 0.04434, the mean is estimated quite precisely. With similar variance across the two phases of testing, these findings reveal a general small drop in the mean score from pre-testing to post-testing.

TABLE 6: ***PAIRED SAMPLES CORRELATIONS[A]***

		N	Correlation	Sig.
Pair 1	Pre-testing & Post-testing	15	.804	.000

a. Group of Players = Experimental Group

Note: Pre-testing and post-testing scores exhibit a 0.804 association according to the Paired Samples association table for the experimental group. This substantial positive association suggests that those who performed well on the pre-test typically scored similarly on the post-test, and vice versa. This connection is statistically significant as the p-value of 0.000 is well below the usual significance level of 0.05. Stated differently, the great correlation between pre-testing and post-testing results indicates a significant link between the two sets of observations and is rather improbable to be the result of random chance.

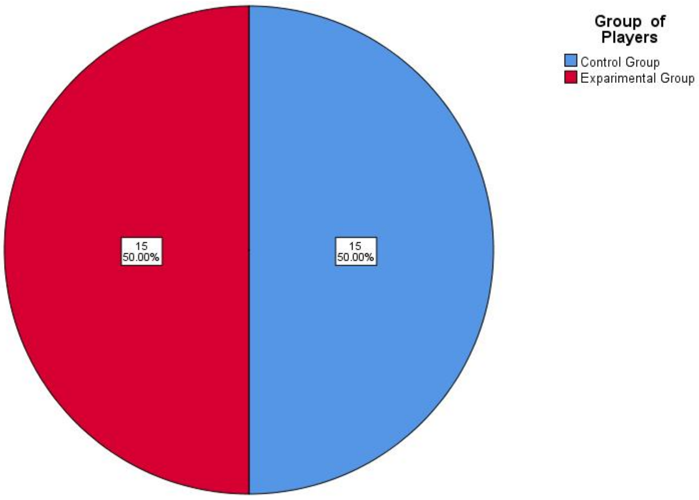
TABLE 7: ***PAIRED SAMPLES TEST[A]***

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre-testing - Post-testing	.40867	.11344	.02929	.34584	.47149	13.952	14	.000

a. Group of Players = Experimental Group

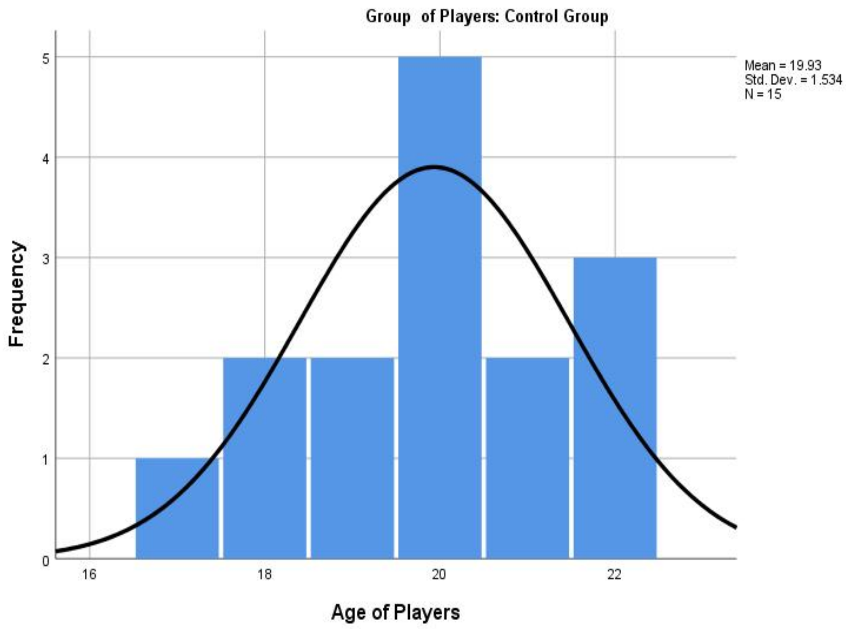
Note: Pre-testing and post-testing scores of the experimental group show statistically significant variations according to the Paired Samples Test. With a mean difference of 0.40867, pre-testing scores clearly rise relative to post-testing results. With some variation in the changes between the two testing stages, the standard deviation of the variations is 0.11344. Reflecting the estimated difference's accuracy, the mean difference's standard error is 0.02929. With 95% confidence, the 95% confidence interval for the mean difference spans 0.34584 to 0.47149, implying that the actual mean difference falls inside this interval. With a t-value of 13.952 and a p-value of 0.000 much below the usual significance level of 0.05 the results reveal that pre-testing and post-testing score differences are quite significant. This suggests that the noted variations are probably a real result rather than the outcome of chance.

FIGURE 1



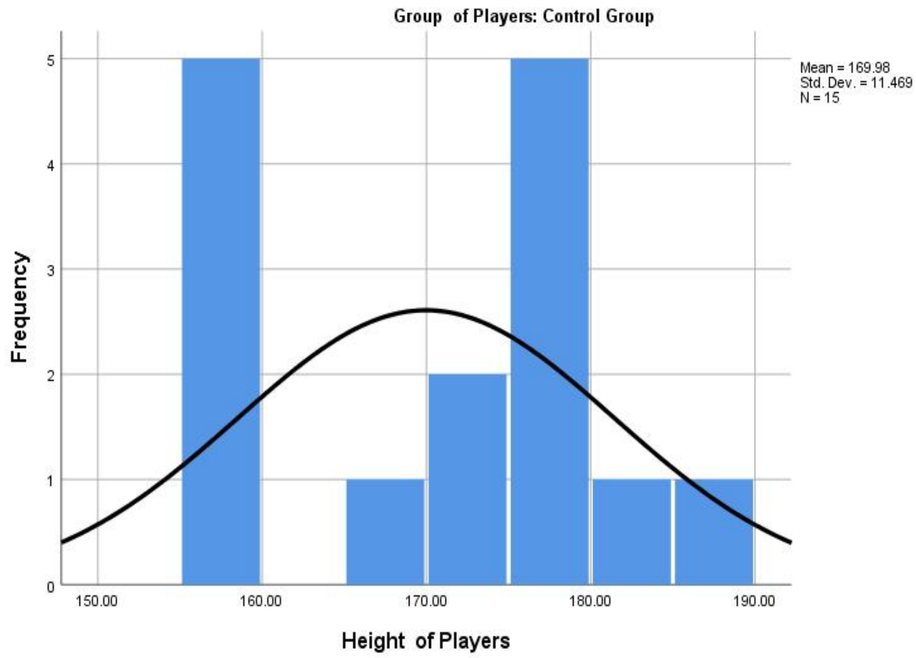
Note; Participants' distribution between the Experimental Group (red) and the Control Group (blue) is shown in Figure 1 by the pie chart. Each group consists of fifteen players; half of all the participants come from each one. There are therefore thirty participants overall, with equal engagement between the two groups such that each gives 50%. This implies under observation or in an experiment a harmonic design between the two groups under investigation.

FIGURE 2



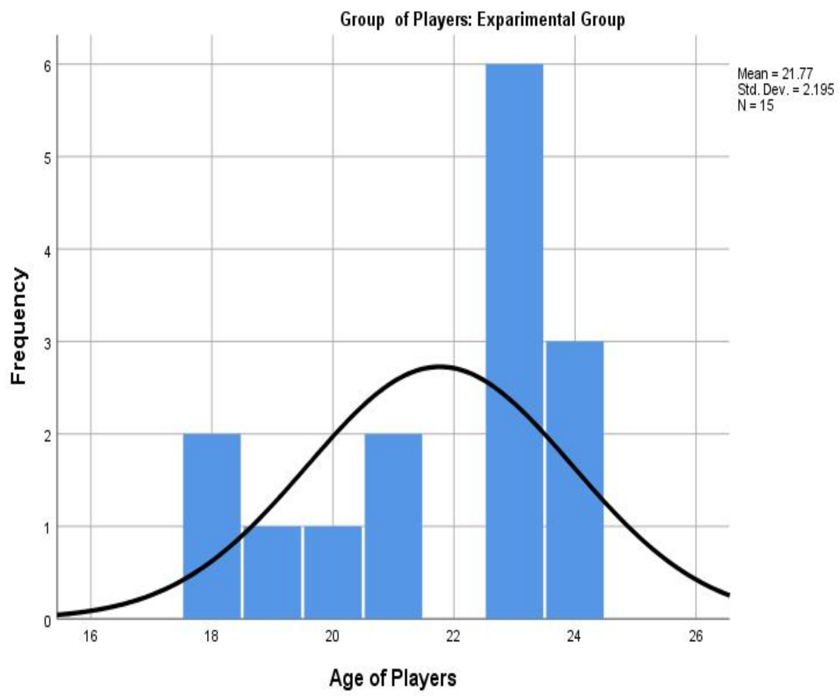
Note; The x-axis, which covers 16 to 22, shows the age range of players in the Control group; the y-axis shows the frequency of participation in every age range. Having five participants, the top bar shows that about twenty is the most often occurring age. Based on their very bell-shaped distribution, the ages seem to follow a typical range. With a standard deviation of 1.534 years, the players in the Control Group average 19.93 years. There are fifteen players in all inside the group. A black line denoting a normal distribution curve is overlapped over the data to show even more how closely the players' age distribution approximates a normal curve.

FIGURE 3



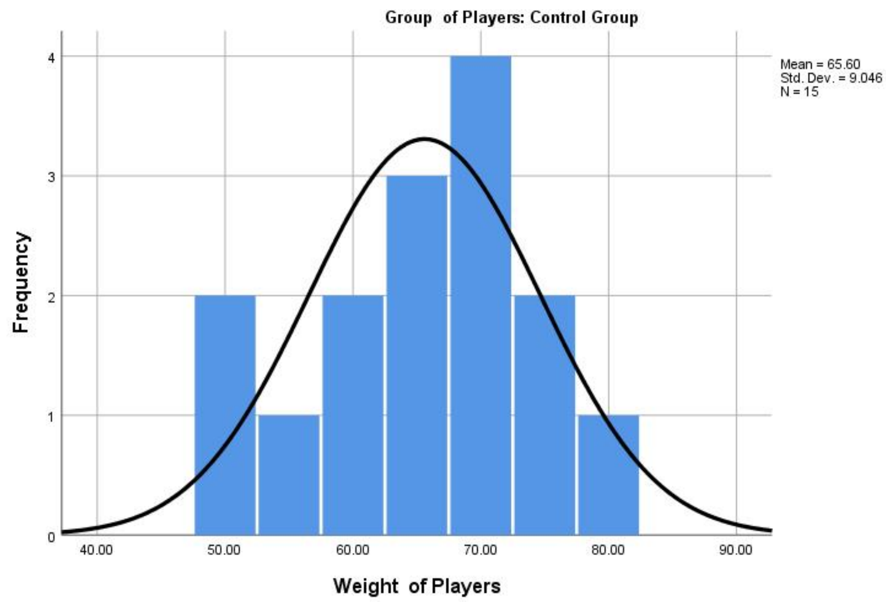
Note; Figure 3 illustrates the height distribution of the Control Group participants; the x-axis indicates heights between 150 and 190 cm and the y-axis displays the frequency of players in every height category. The most often occurring height at which the highest bar shows—about 160 cm suggests a frequency of five participants. The distribution shows a clear peak in the 160 cm height range. The approximative bell form of the distribution indicates that the height data appears to be normal. With a standard deviation of 11.49 cm and a mean height of 169.98 cm, the Control Group players were The group boasts fifteen players total. Data overlapping is a black line representing a normal distribution curve. Given less players as the height deviates from the mean, this indicates that the height distribution is somewhat typical.

FIGURE 4



Note; Figure 4 shows the age distribution of the players in the Experimental category; the x-axis runs from 16 to 26 while the y-axis shows the frequency of participation in each age category. Six players a high frequency indicates that the most often occurring age group is probably about 22 years old. The distribution looks to be very bimodal with notable peaks at ages 22 and 24, indicating that participants in the Experimental Group are probably grouped around these ages. The Experimental Group's average age is 21.77 years, with a standard deviation of 2.195 years. The group consists of fifteen players generally. A black line illustrating a normal distribution curve overlays the data. The absence of a perfect bell curve in this population suggests a somewhat distorted or bimodal distribution of ages, despite significant clustering.

FIGURE 6



Note; Figure 6 shows how the weights of the Control Group are distributed. While the x-axis represents the players' weight, which spans 40 kg to 90 kg, the y-axis displays the frequency of players within every weight range. Important results: • The bell-shaped curve of the apparently generally symmetric distribution points to a normal distribution. There is a high frequency of four players and a most often occurring weight range of roughly seventy kg. With a standard deviation of 9.486 kg, the Control Group's members average 65.60 kg. The group's overall N count is fifteen players. The data usually follows the normal distribution curve depicted by the black line; most players have weights around 70 kg.

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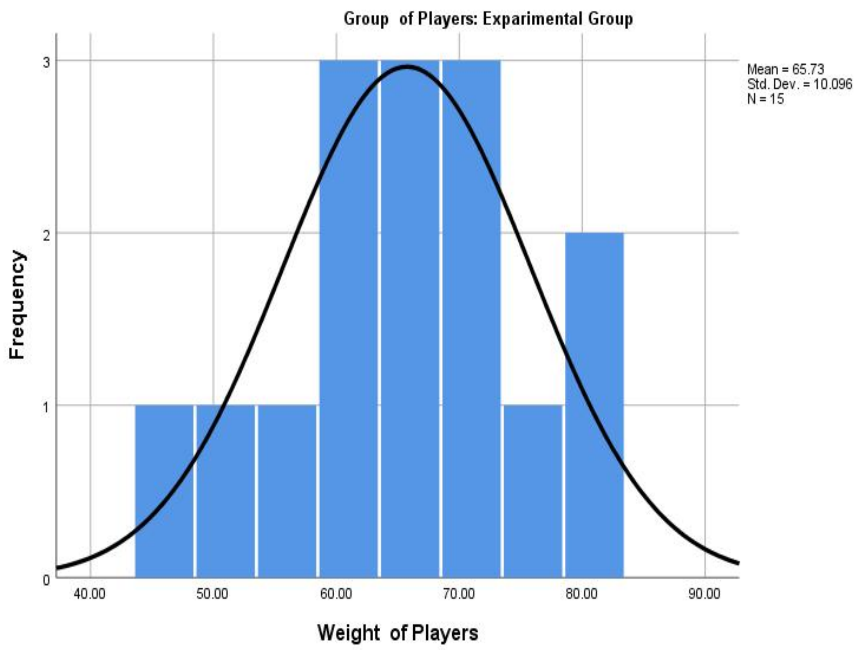
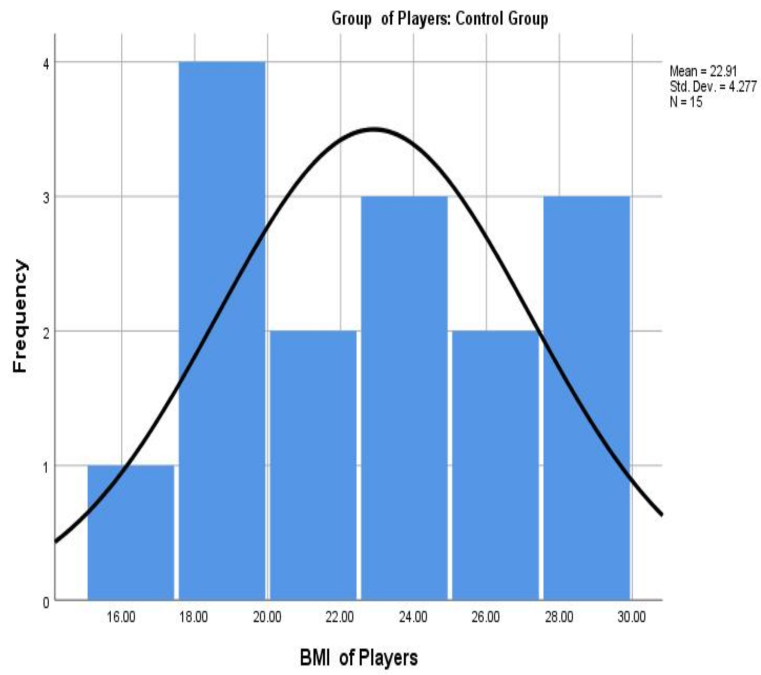
FIGURE 7



Note; Figure 7 shows the weight distribution for the Experimental Group participants; the x-axis shows weights between 40 and 90 kg and the y-axis shows the frequency of players in every weight category. With three players in this range, the weight range with most frequency falls between 60 and 70 kg. The bell-shaped curve indicates that the weight distribution in this group somewhat closely follows a normal distribution. With a standard deviation of 10.096 kg, the players in the Experimental Group average 65.73 kg. The group comprises fifteen players total. As the black line overlying the data shows—a normal distribution curve the weight distribution in the experimental group is somewhat symmetric around the mean of 65.73 kg.

FIGURE 8



Note; Figure 8 displays the Control Group players' Body Mass Index (BMI) distribution; the x-axis shows BMIs between 15 and 30 and the y-axis indicates the frequency of players in every BMI category. With four players somewhat frequently, the most often occurring BMI range tends to be between eighteen and twenty-one. The near symmetry of the distribution and bell-shaped curve show that the BMI data follows a normal distribution very closely. With a standard deviation of 4.277, the Control Group members had a mean BMI of 22.91. The group boasts fifteen players total. The black line showing a normal distribution curve placed on the data indicates that the BMI of the players in the Control Group is roughly normally distributed, as suggested by the tight fit of the BMI distribution in this group with the normal distribution curve.

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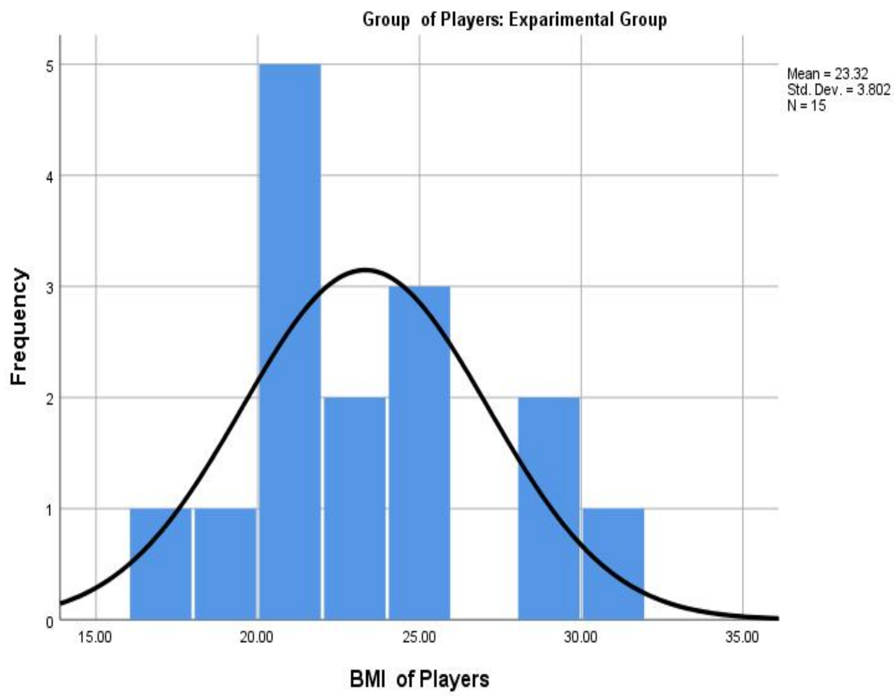
FIGURE 9



Note; Figure 9 shows the body mass index (BMI) distribution for players in the Experimental Group. The x-axis shows BMIs between 15 and 35 while the y-axis shows the frequency of players within each BMIs range. Given five players' high frequency, the most often occurring BMI range is probably 20. Though there is some slant, the distribution usually shows a normal pattern with more players in the lower BMI range—around 20. With a standard deviation of 3.802 and an average BMI of 23.32, the players in the Experimental Group The group consists of fifteen players in all. The slight skew shows a higher concentration of players in the lower BMI range even if the BMI distribution rather conforms to a normal distribution. A black line marking a normal distribution curve overlays the data.

CONCLUSION

The findings let one infer that Sledge machine resistance training improves sprint and strength performance in rugby players rather successfully. The notable gains seen in physical performance tests show that including Sledge machine training into a rugby-specific conditioning program can provide in real advantages for athletic performance. For rugby, this intervention can especially help to increase the explosive power and speed needed. Considering the encouraging results, strength and conditioning experts as well as coaches might think about including Sledge machine resistance workouts into their rugby players' training schedules. Larger and more varied participant groups, longer training sessions, and a wider spectrum of performance assessments in future research would aid to validate the findings even more and assist to improve training strategies.

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