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Effects of Alternative Wrist Grip Techniques on Pain, Strength, and Function in the Wrists of Novice Weightlifters

Efectos de técnicas alternativas de agarre de muñeca sobre el dolor, la fuerza y la función de las muñecas en levantadores de pesas principiantes

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Declaration of interests
The authors have declared that there is no conflict of interest.

Data availability
All relevant data is in the article. For futher information, contact the corresponding author.

Abstract

Introduction. The wrist, with its composite anatomical composition, is deemed the most complex joint in the human body, vital for multifaceted hand movements. However, diseases or injuries can significantly impair wrist function, necessitating a comprehensive understanding of its anatomy and biomechanics. Concurrently, weightlifting, a popular exercise regimen, demands precise wrist functionality for optimal performance.

Objective. This study investigates the influence of alternative wrist grip methods and wrist strength on wrist function among novice weightlifters.

Method. Through a cross-sectional observational design, data was collected from 88 participants, aged 16 to 35 years, encompassing wrist pain, strength, and functionality. Bench and shoulder press exercises were performed, with grip methods discreetly noted. Wrist strength was measured using a dynamometer, while functionality was assessed through the Patient Rated Wrist Evaluation (PRWE) questionnaire, and goniometer-assisted range of motion assessments were done.

Results. Descriptive statistics unveiled diverse characteristics among participants, including age, wrist strength, BMI, pain ratings, PRWE scores, and wrist range of motion, underscoring individual differences in wrist functionality. Average wrist strength values further highlighted these variations.

Conclusion. These findings provide valuable insights into the intricate relationships between grip methods, wrist strength, and overall wrist functionality among beginner weightlifters, offering a foundation for targeted interventions to optimize wrist health and enhance performance. This literature found out that the overall wrist function and strength of both dominant and non-dominant wrists were better in participants of neutral wrist group. Participants of extended wrist group were experiencing more pain as compared to neutral wrist group.

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Keywords

Wrist; grip strength; pain; weightlifting; wrist grip; resistance training; wrist function; range of motion; novice bodybuilders; weightlifters.

Resumen

Introducción. La muñeca, con su intrincada composición anatómica, se considera la articulación más compleja del cuerpo humano, vital para los movimientos multifacéticos de la mano. Sin embargo, las enfermedades o lesiones pueden afectar significativamente su función, lo que requiere una comprensión integral de su anatomía y biomecánica. Al mismo tiempo, el levantamiento de pesas, un régimen de ejercicio popular, exige una funcionalidad precisa de la muñeca para un rendimiento óptimo.

Objetivo. Este estudio investiga la influencia de los métodos alternativos de agarre de muñeca y la fuerza de la misma y su función en levantadores de pesas.

Método. A través de un diseño observacional transversal, se recopilaron datos de 88 participantes de 16 a 35 años, que tomaron en cuenta el dolor de muñeca, la fuerza y la funcionalidad. Se realizaron ejercicios de press de banca y de hombros, con métodos de agarre discretamente anotados. La fuerza de la muñeca se midió con un dinamómetro, mientras que la funcionalidad se evaluó a través del cuestionario Patient Rated Wrist Evaluation (PRWE) y se realizaron evaluaciones del rango de movimiento asistido por goniómetro.

Resultados. Las estadísticas descriptivas revelaron diversas características entre los participantes, incluida la edad, la fuerza de la muñeca, el IMC, las calificaciones de dolor, las puntuaciones PRWE y el rango de movimiento de la muñeca, lo que subraya las diferencias individuales en la funcionalidad de la muñeca. Los valores medios de fuerza de la muñeca destacaron aún más estas variaciones.

Conclusión. Estos hallazgos proporcionan información valiosa sobre las intrincadas relaciones entre los métodos de agarre, la fuerza de la muñeca y la funcionalidad general de la muñeca entre los levantadores de pesas principiantes, ofreciendo una base para intervenciones específicas para optimizar la salud de la muñeca y mejorar el rendimiento. Esta literatura descubrió que la función general de la muñeca y la fuerza de las muñecas dominantes y no dominantes fueron mejores en los participantes del grupo de muñeca neutral. Los participantes del grupo de muñeca extendida experimentaron más dolor en comparación con el grupo de muñeca neutral.

Palabras clave

Muñeca; fuerza de agarre; dolor; levantamiento de pesas; agarre de muñeca; entrenamiento de resistencia; función de muñeca; rango de movimiento; culturistas novatos; levantadores de pesas.

Introduction

Context

The wrist is thought to be the most complex joint in the human body due to its intricate anatomical composition. Some diseases or injuries can readily decrease wrist

function physiologically. For this reason, treating wrist diseases effectively requires an understanding of the anatomy and biomechanics of the wrist. There are eight distinct carpal bones that make up the di-arthrodial wrist joint. They are positioned in between the five metacarpal bones and the forearm (radius and ulna). Because some finger muscles, referred to as extrinsic, originate in the forearm and insert via extended tendons on distal phalanges, the unique anatomical design of the hand requires a significant coupling between the wrist and the finger joints [1]. There are numerous useful activities using the wrist. It is exposed to a high number of traumatic injuries and degenerative diseases. The wrist is a complicated joint that permits multidirectional hand movement. It is essential to comprehend both the fundamental science and the practical implications of wrist joint functional kinematics, which are the motions required to perform demanding daily tasks [2].

Weightlifting is a coordinated training regimen that uses weights, such as barbells, dumbbells, or even body weights, to compel the muscles in the body to contract under tension. The goal is to increase muscle mass, strength, endurance, and power. However, if the exercise is done incorrectly by the trainees, it may also be hazardous and futile. Incorrect posture is a prevalent problem for all gymnasts, regardless of experience level [3]. An ongoing pursuit for a healthy way of living encourages people to try out various workout regimens. Weightlifting is a popular choice that may be done alone as a solo workout or as a component of a group like CrossFit. These workouts are also used by professional athletes to go along with their main goals. Weightlifting employs more complicated motions, with many muscle groups being stimulated, without the limitations and protection of a machine, in contrast to the typical gym bodybuilding training that isolates each muscle part to be stimulated at the time [4]. To demonstrate symmetric bodies and promote muscle hypertrophy, bodybuilders carry out strength exercises [5].

Background

A popular exercise in strength and conditioning regimens for a range of sports is the bench press (BP). It is used to create the maximum strength and power in the upper body as well as the hypertrophy of the primary movers, the anterior deltoid, triceps brachii, and pectoralis major [6].

High levels of activation in the flexor muscles of the hands and forearms are necessary for these activities and events to occur [7].

This range of motion combined with the application of increasing loads may cause injuries if the exercise is not performed appropriately [4]. In the late 1970s and early 1980s, bodybuilding athletes used a combination of muscle training techniques and weightlifting or powerlifting as their primary training methods. Since the sport's commencement in 1977, bodybuilding competitions have grown in recognition across the globe among athletes and spectators alike [8]. Musculoskeletal pain in the shoulders, elbows, wrists, hands, upper and lower back, neck, knee, and hip joints occurs significantly more frequently in weightlifters [9]. Low resistance, high repetition workouts are commonly employed in bodybuilding, and although the type of grip utilized is important, an athlete's grip strength also has a big impact on their performance. Muscular strength, or the greatest force or tension produced by the forearm muscles, is measured by grip strength. It is defined as the force used with the hand to grasp, draw, or hang something [10]. According to a study, weightlifting athletes had greater dominant and non-dominant handgrip strength, upper arm circumference, and forearm circumference length values than those who were inactive [11]. Weightlifters' grip strength is stronger than normal population but it could not be as strong as that of athletes in other

sports where force application or grabbing is required. Compared to the reduction in power-intensive weightlifting performance, the age-related decline in grip strength as a measure of total muscular strength is slower [12].

The assessments of grip strength in the left and right hands were considered in an investigation as well as association with asymmetry of musculature in bodybuilders and several martial arts competitors. The musculature of bodybuilders was found to be more symmetrical. Contestants in jiu-jitsu were less asymmetrical than judokas [13].

Handgrip strength is frequently utilized as a measure of upper extremity and overall health functionality. The dynamometry method is a straightforward, non-invasive, low-cost way to test handgrip strength [7]. Sports requiring a strong grip are bodybuilding, powerlifting, boxing, and calisthenics [10]. Handgrip strength (HGS), being one of the roles of the hand and forearm muscles, is an isometric strength [7]. It has been proposed that grip strength, a gauge of bodily function, is a biomarker of aging [10]. Gripping activities are intrinsically connected to the wrist's mechanical stability since these muscles are used to apply forces to the object while also producing motion at the wrist. On the other hand, with regard to the wrist joint, it is unusual that subjects deliberately choose a particular wrist position when applying their strongest grip force, even though the wrist may move freely in a variety of configurations. Surprisingly, when compared to other positions, this spontaneous posture produced the strongest grip force. It has been proposed that this spontaneous wrist posture corresponds to a more optimal configuration for the extrinsic flexor muscles, given that they function at the wrist and provide the grip force simultaneously [1]. In a study of healthy, sedentary young females, grip strength demonstrates a significant positive association with height ($p = 0.001$), fat-free mass ($p = 0.004$), and VO2 peak ($p = 0.023$). These findings suggest that increases in height, fat-free mass, and VO2 peak are associated with greater grip strength. Conversely, grip strength does not exhibit a significant correlation with body weight, body mass index (BMI), or body fat percentage. Furthermore, both BMI ($p = 0.045$) and body fat percentage ($p = 0.016$) are negatively correlated with VO2 peak, indicating that higher BMI and body fat percentage are associated with reduced VO2 peak [14]. Grip strength (GS) was assessed in 164 competitors taking part in the 2022 World Master Weightlifting Championships in a cross-sectional study. The amount of grip strength loss related with aging in weightlifters and the relationship between grip strength and lifting performance were the study's main goals. The findings demonstrated that the age-related decrease in grip strength was less severe than the fall in power-dependent weightlifting ability. Weightlifters' grip strength was shown to be weaker than that of sportsmen participating in other sports which require for force application or grabbing [12].

Another study found that when the wrist was at a 15° extension angle, the least traumatic symptom was seen to occur statistically. The joints in the wrists, elbows, and shoulders may need to be in the appropriate range of motion in order to disperse the additional pressure on the body while lifting the weight. The wrist joint was found to be in a 15° extension in this investigation, and there were very little signs of pain or restriction ($p<0.05$) [15]. Another study measured the handgrip strength of men and women in two age groups —young adolescents and older adults— in two different elbow positions: elbow extension and 90° flexion. It also examined if the handgrip strength was affected by these varied circumstances. Adolescents and older adults in both age groups demonstrated a noticeably stronger handgrip in both sexes when their elbows were fully extended [16].

Problem

Numerous studies evaluating hand grip strength values in a variety of sports for elite and non-elite, elite and sub-elite athletes, people participating in sports and people who do not participate in sports have been published in the literature [7]. A study focused into how lifting weights affected the wrist joint's angle and the acute impact on traumatic symptoms. The wrist joint position of 15 degrees' extension was found to have statistically less pain than other wrist joint positions, according to the results [15]. Numerous additional body composition or fitness tests, such as the waist-hip ratio, BMI, and the age biomarker, have been associated with the hand grip measurements. Although there are some favorable associations, studies show that further research is desperately needed to prove that there is a meaningfully positive correlation with other body metrics [10].

There has been a lack of research focusing on the relationship between the two most commonly used wrist grip angles (neutral and extended) in weightlifting or other resistance exercises. Additionally, studies often have not considered how wrist strength contributes to maintaining pain-free wrist function during these activities.

Justification

This study focuses on studying the association of wrist dysfunctions as well as slight pain or discomfort with different alternative wrist grip method during weightlifting. This might help novice bodybuilders and resistance trainers to have a better understanding of the significance of wrist strength whether it can be helpful in preventing any injury during their training sessions or not. Furthermore, which grip angle could be most suitable for appropriate training and will be least susceptible for causing any abnormality in normal function of wrist. The existing literature provides valuable insights into various aspects of wrist function and strength among athletes, particularly weightlifters. However, a notable gap emerges regarding the specific exploration of how alternative wrist grip methods and wrist strength impact wrist function, particularly in novice weightlifters. While studies have examined hand grip strength and its association with anthropometric characteristics and performance in weightlifting, there is limited research focusing on the relationship between wrist grip methods, wrist strength, and wrist function during weightlifting activities. Thus, a comprehensive investigation into these dynamics is warranted to provide novice weightlifters with evidence-based guidance on optimizing training techniques and minimizing the risk of wrist-related injuries or discomfort.

Objective

- To find out wrist pain, strength, and wrist function in beginner weightlifters using different grip methods.
- To find out the difference in wrist pain, strength, Range of motion, and wrist function in beginner weightlifters using different grip methods.

Method

This study employed an observational cross-sectional research design to comprehensively investigate the influence of alternative wrist grip methods on wrist strength and wrist function among beginner weightlifters. Observational studies provide valuable insights into associations between variables without interfering with the natural behavior of participants. The

cross-sectional design enables the simultaneous collection of data on exposure (wrist grip methods) and outcome variables (wrist pain, strength, and function) at a single point in time, offering a snapshot of the relationship between these factors. Ethical letter was duly signed by Research Ethical Committee and office of research and commercialization with reference number RE-011-2024. Consent was taken from each individual before performing exercises.

Participant Selection and Description

The sample size was 88 calculated by WHO calculator. Non-probability by convenience sampling was done. Participants from age ranging 16-35 years, both males and females, doing any weightlifting or resistance training from at least 1 month with 4 times per week frequency were included. Those who were familiar with bench and shoulder press exercises and also those exercises that were part of their normal routine of training were included in the study. Anyone who was weightlifting for more than 8 months was excluded from our sample size. Any history of trauma or injury to the wrist joint, Liver impairment, CTS and pregnant women were excluded from the study.

Technical Information

Data collection was conducted through survey questionnaires by approaching participants at several gyms of Nishtar and Johar town Lahore. This allowed for in-depth exploration of participants' experiences, perceptions, and any existing wrist pain or discomfort. Survey questionnaires were utilized to gather quantitative data on, pain levels, and wrist function. Consent was taken before from each individual. They were explained the whole process as well. General demographics including name, age, weight and height were verbally asked from each participant and were written by hand on the questionnaire.

Numeric pain rating scale was used for any pain perception during or after performing bench and shoulder presses. Participants were asked verbally to rate their pain on a scale of 0-10, which was recorded manually on questionnaire. For the bench press exercises, the equipment used included an adjustable backrest weight bench, variable weight plates, and a barbell weighing 10 kg at tare weight. For the purposes of the bench press workouts, grip width was defined as the upper arm's length times two plus the shoulder width. This is the standardized definition of grip width in weight lifting [17]. A shoulder machine was used for shoulder press exercises.

Participants were asked to perform 8 repetitions of each exercise with 60% weight (resistance) of each individual's 1 RM [18]. Wrist grip methods used by each participant were noted, whether they were performing bench and shoulder presses using Neutral or Extended wrists (e.g., Figure 1). Participants were unaware of the fact that we were going to assess their grip method to prevent any biasness in their performance.

An analogue wrist dynamometer was used to measure wrist strength. Participants were handed over the wrist dynamometer one by one in each hand and were instructed to press powerfully as much as they could in elbow extension and wrist in supinated position. The meter needle showed the maximum strength in each wrist in kgs which was recorded manually on the questionnaire.

Lastly, participants were asked to fill up a Patient Rated Wrist Evaluation (PRWE) questionnaire for the evaluation of their wrist functions. For patients with wrist and hand injuries, the PRWE provides a valid and dependable anatomical region-specific assessment of pain and disability [19].

Figure 1. Wrist Position: Neutral (Left) and Extended (Right).

Wrist flexion, Extension, Ulnar deviation, and radial deviation ROMs were measured using a Goniometer. A common tool for measuring wrist ROM is a goniometer [20].

Statistics

SPSS software was used for data analysis. Mean, frequencies and p values were obtained with each variable for two groups (One using extended wrist and the other neutral). Independent sample t test was used to find out between group differences.

Results

The descriptive statistics provide a detailed look at the diverse characteristics present among our sample of 88 beginner weightlifters. One notable aspect is the wide age range, spanning from 16 to 35 years, indicating participants are at various stages of athletic development. Wrist strength, crucial for weightlifting, varied considerably, with average values of 56.23 ±20.86 on the dominant side and 51.35 ±19.62 on the non-dominant side. The body mass index (BMI) ranged widely from 15.20 to 40.90 (average = 23.89±4.57), highlighting the diverse physiological compositions within the group. Pain ratings for both dominant and non-dominant wrists ranged from 0 to 6, with average values of 0.49±1.26 and 0.65±1.45 respectively, indicating varying levels of perceived strain. The patient-rated wrist evaluation scores ranged from 0 to 72.50 (average = 10.82±14.79), reflecting differences in participants' subjective assessment of wrist functionality.

The PRWE and its subscales have outstanding test-retest reliability (ICC>0.75). When compared to upper extremity, region-specific PROs (DASH and Modern Activity Subjective Survey of 2007) and generic health-status PROs (Medical Outcomes Study 36-Item Short-Form Health Survey, Nottingham Health Profile), in a study the PRWE demonstrated moderate to good concurrent validity across a range of wrist/hand conditions. The PRWE's primary advantage over other health-status and upper extremity-specific measures is its examination of the features of disablement that are specifically linked to wrist and hand injuries. Large (more than 0.8) effect sizes in multiple investigations indicate that the PRWE's responsiveness was very good. For patients with wrist or hand injuries, the PRWE is simple to administer, comprehend, and finish as a PRO. The PRWE responds well to a variety of wrist and hand situations and is valid and reliable [21]. Measurements of wrist range of motion, including flexion, extension, ulnar deviation, and radial deviation, further revealed individual differences in wrist mobility among participants. These descriptive findings offer a comprehensive understanding of the various aspects of wrist function among beginner weightlifters, providing a strong foundation for exploring the relationship between alternative wrist grip methods, wrist strength, and overall wrist functionality (e.g., Table 1).

Table 1. Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation	P value (Between groups)
Age	88	16.0	35.0	24.466	4.5737	NA
Body Mass Index	88	15.20	40.90	23.8852	4.57373	NA
Wrist strength Dominant side	88	1.00	103.00	56.2273	20.86394	0.064
Wrist strength non-Dominant side	88	8.00	92.00	51.3523	19.61705	0.039
Numeric Pain Rating Dominant	88	.00	6.00	.4886	1.25940	0.001
Numeric Pain Rating Result Non-Dominant	88	.00	2.00	.2955	.62806	0.001
Patient Rated Wrist evaluation	88	.00	72.50	10.8182	14.78917	0.04
Flexion ROM dominant side	88	26.00	85.00	64.5227	13.73558	0.758
Extension ROM dominant side	88	22.00	90.00	66.7500	16.59612	0.702
Ulnar deviation ROM dominant side	88	13.00	57.00	33.9205	7.66275	0.053
Radial Deviation ROM dominant side	88	15.00	49.00	27.7045	5.36090	0.969
Flexion ROM Non dominant Side	88	22.00	92.00	66.7841	11.77124	0.094
Extension ROM Non dominant side	88	20.00	86.00	66.5682	14.93187	0.419
Ulnar Deviation ROM Non dominant side	88	19.00	63.00	34.2159	9.06864	0.000
Radial Deviation ROM Non dominant side	88	10.00	68.00	29.6591	8.18449	0.737

The results reveal that among the 88 participants, 76.1% were male, while 23.9% were female. The majority of participants fell within the age range of 21-25 years (50.0%), followed by 16-20 years (18.2%), 26-30 years (18.2%), and 31-35 years (13.6%). Regarding hand dominance, 81.8% indicated right-sided dominance, while 18.2% reported left-sided dominance. In terms of body mass index (BMI), 63.6% of participants had a normal BMI, with smaller proportions falling under categories such as overweight (23.9%), underweight (4.5%), and various levels of obesity. Participants equally utilized neutral wrist and extended wrist grip methods for bench press and shoulder press exercises (both 50.0%). Wrist strength assessments revealed that 68.2% of participants exhibited strong wrist strength on their dominant side and 58.0% on their non-dominant side. (e.g., Table 2) They were categorized into three classes of Weak (result on dynamometer 20 kgs or less), Normal (result on dynamometer ranging from 21 to 40 kgs) and Strong (result on dynamometer more than 40 kgs). Self-reported

Table 2. Wrist strength Dominant and Non-Dominant side Results.

Strength	Dominant	Non-Dominant
	N (%)	N (%)
Weak	8 (9.1)	11 (12.5)
Normal	20 (22.7)	26 (29.5)
Strong	60 (68.2)	51 (58.0)
Total	88 (100.0)	88 (100.0)

numeric pain ratings indicated that the majority reported no pain in both dominant (81.8%) and non-dominant (79.5%) wrists, while some reported mild (14.8% dominant, 11.4% non-dominant) or moderate pain (3.4% dominant, 9.1% non-dominant) (e.g., Table 3).

Table 3. Numeric Pain Rating Results Dominant and Non-Dominant.

Pain	Dominant	Non-Dominant
	N (%)	N (%)
No Pain	72 (81.8)	70 (79.5)
Mild Pain	13 (14.8)	10 (11.4)
Moderate Pain	3 (3.4)	8 (9.1)
Severe Pain	0 (0)	0 (0)
Total	88 (100.0)	88 (100.0)

A study stressed that for general purposes, the NPRS has good sensitivity and produces data that can be analyzed for audit purposes. Another study reported that when compared with the VAS (Visual Analogue Scale) and VRS (Verbal Rating Scale), NPRSs had better compliance in 15 of 19 studies reporting this, and were the recommended tool in 11 studies [22].

Out of all participants using neutral wrist there were 20% females and 79% males. Out of all using extended wrist there were 27% females and 72% males.

Age ranging from 21-25 years were in higher percentage in both groups. Following this age ranging from 26-30 was 2nd highest in both groups. Within each age group, the percentage distribution of participants using the neutral wrist grip method ranged from 18.8% to 66.7%, while those using the extended wrist grip method ranged from 33.3% to 81.3%. Overall, the neutral wrist grip method was more prevalent among younger participants, with a slight decrease in usage among older age groups. Conversely, the extended wrist grip method showed a slight increase in usage among older age groups.

Majority of the participants were falling in the normal range and in overweight class after that in terms of BMI scale (e.g., Figure 2).

The percentages of different wrist strengths for dominant side among neutral and extended wrist group showed that majority was falling in the strong category. Although there were slight less number in strong category of participants using extended wrist. The majority of participants with weak wrist strength predominantly utilized the extended wrist grip method

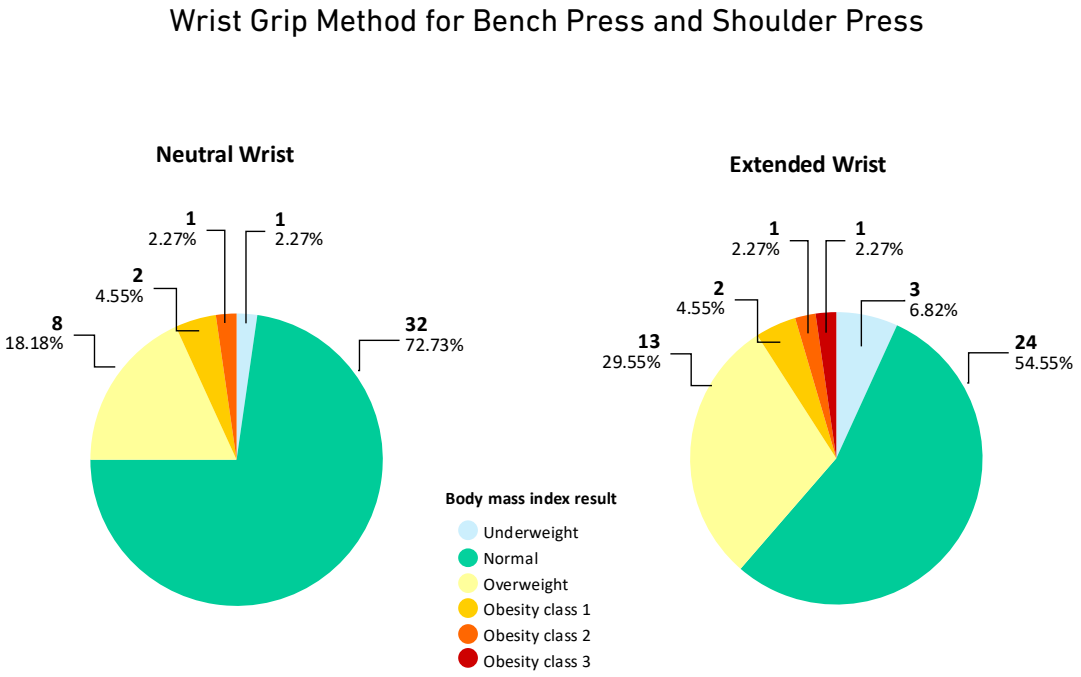

Figure 2. Comparison of Body Mass Index (BMI) Between Both Groups.

(75.0%), whereas those with normal and strong wrist strength showed more balanced distributions between the neutral and extended wrist grips. Overall, participants with strong wrist strength were more prevalent, with a higher proportion using the neutral wrist grip method compared to the extended wrist grip method (e.g., Figure 3).

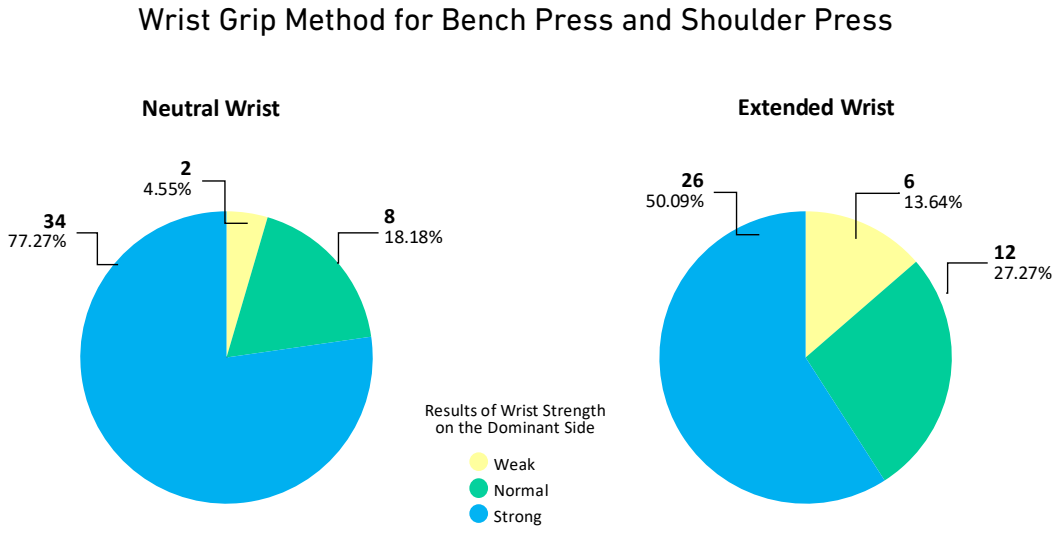

Figure 3. Comparison of Wrist Strength on the Dominant Side Between Both Groups.

The percentages of different wrist strengths for non-dominant side among neutral and extended wrist groups showed that majority was falling in the strong category. Although there were slight less number in strong category of participants using extended wrist. Participants with weak wrist strength predominantly favored the extended wrist grip method (63.6%), while those with normal and strong wrist strength displayed more balanced distributions between the neutral and extended wrist grips. Overall, participants with strong wrist strength were more prevalent, with a higher proportion using the neutral wrist grip method compared to the extended wrist grip method (e.g., Figure 4).

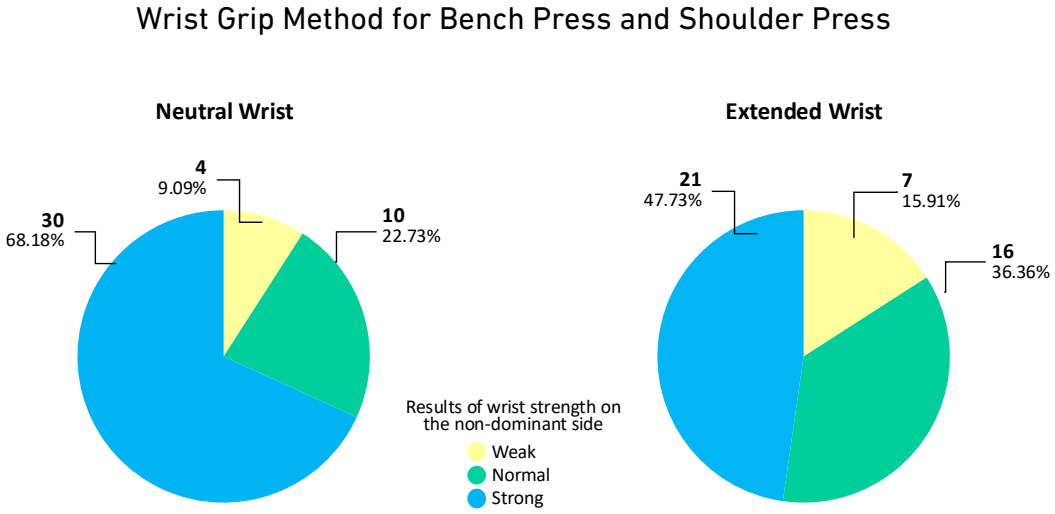

Figure 4. Comparison of Wrist Strength on the Non-Dominant Side Between Both Groups.

The number of participants experiencing pain in dominant wrist showed that majority felt no pain in both groups. Although the percentage was slight less in the extended group as compared to the neutral ones (e.g., Figure 5).

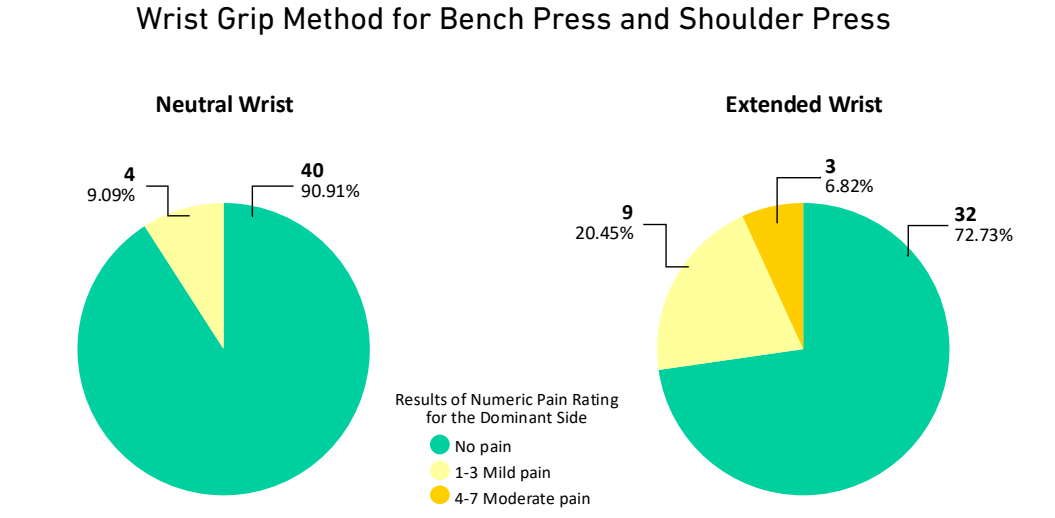

Figure 5. Comparison of Numeric Pain Ratings on the Dominant Side Between Both Groups.

The number of participants experiencing pain in non-dominant wrist showed that majority felt no pain in both groups. Although the percentage was slight less in the extended group as compared to neutral ones (e.g., Figure 6).

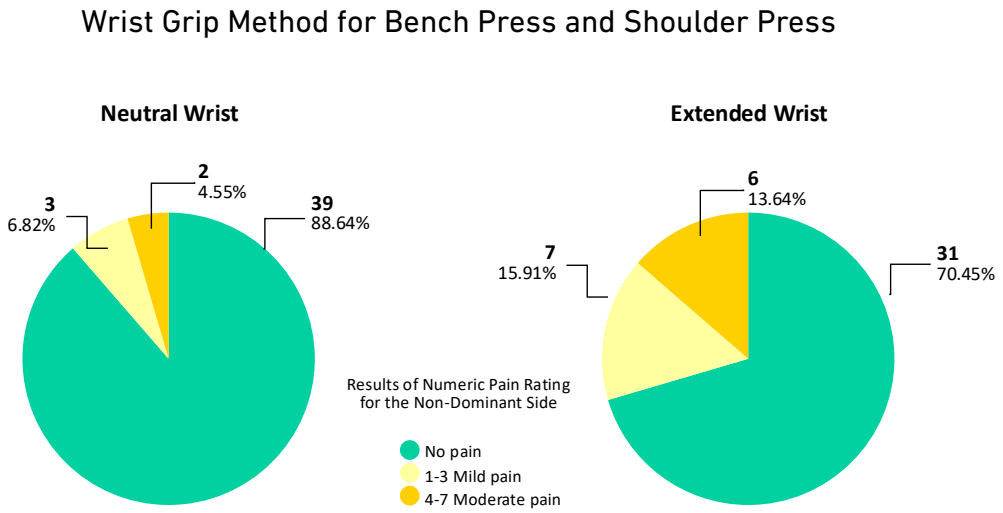

Figure 6. Comparison of Numeric Pain Ratings on the Non-Dominant Side Between Both Groups.

The results of independent samples t-tests, revealing the significance level (p-value) for each variable tested. Among the variables, the Patient Rated Wrist evaluation and Wrist Strength Non-Dominant side show statistically significant differences with p-values of .004 and .039 respectively, indicating disparities in patient-rated wrist functionality (Extended wrist group) and strength between non-dominant sides (neutral wrist group). Variables such as Flexion ROM dominant side, Extension ROM dominant side, and Radial Deviation ROM Non-dominant side exhibit p-values greater than .05, suggesting non-significant differences in range of motion between dominant and non-dominant sides. These findings offer valuable insights into the significant disparities in wrist functionality and strength among participants, while also highlighting areas where differences were not observed, providing a nuanced understanding of wrist characteristics in novice weightlifters. (e.g., Table 1)

Discussion

The complexity of the wrist as a joint is emphasized by its intricate anatomy and biomechanics, highlighting the importance of understanding its function to address diseases and injuries effectively. Participating in weightlifting, a popular training method, offers numerous benefits for muscle growth and overall fitness; however, incorrect technique and posture can lead to potential risks, causing injuries and impaired wrist function. The role of grip strength is important in weightlifting and is often used to measure upper extremity functionality. The angle of the grip during weightlifting exercises can affect muscle activation patterns and joint stability, which can impact wrist function and the risk of injury. However, there is a lack of research on the relationship between different wrist grip methods and wrist function, especially among novice weightlifters. The study provides valuable insights into wrist function and strength among beginner weightlifters, expanding on previous research. An important aspect of the study is the varied age range of participants, which corresponds with past studies on age-re-

lated differences in wrist strength and functionality (e.g., Table 1) This diversity in age within our participant group is a reflection of the different phases of athletic progress, which aligns with the outcomes of prior research examining the influence of age on grip strength and weightlifting performance [12,23]. The study found differences in wrist strength between dominant and non-dominant sides. Participants had stronger wrist strength on the dominant side, confirming previous research on grip strength and wrist function in athletes, especially in weightlifting [13,16]. Additionally, our findings suggest that individuals with weak wrist strength prefer the extended wrist grip method during bench press and shoulder press exercises as a compensatory strategy to improve stability. (e.g., Figure 2 and 3) Our research aligns with previous studies which highlight the connection between wrist strength and pain perception. Participants with stronger wrists experienced lower levels of pain, (e.g., Table 3, Figure 5 and 6) emphasizing the significance of wrist strength in reducing discomfort and potential injury risk during weightlifting activities. These results are consistent with studies investigating the relationship between grip strength and pain perception [24]. Our study findings revealed a majority of individuals with a BMI within the normal range, followed by those classified as overweight. This aligns with previous studies on BMI and grip strength, which found that higher BMI is associated with lower grip strength, possibly due to increased fat and decreased muscle mass [14]. The co-relation analysis of age ranges and wrist grip methods revealed interesting trends, with younger participants showing a slight preference for the neutral wrist grip method, while older participants tended to favor the extended wrist grip method. The findings require more research since it refers to a possible age-related adaptation in grip technique that may be influenced by alterations in wrist strength and flexibility throughout time. The pain perception results illustrated in Figure 5 and 6 demonstrate that a greater number of participants encountered no pain in their dominant and non-dominant wrists. Moreover, there was a slightly lower percentage of individuals who reported no pain when using the extended wrist grip method compared to the neutral wrist grip method.

The results of this study provide evidence-based recommendations on grip techniques and wrist health in weightlifting training regimens, which have practical consequences for beginning weightlifters, coaches, and fitness professionals. Subsequent investigations can look deeper into the most effective grip methods and proactive approaches to reduce wrist strains and improve efficiency. We add to a deeper knowledge of the parameters impacting wrist function in weightlifting by placing our findings within the framework of the existing literature. We also emphasize the significance of customized training programs to maximize performance and reduce the risk of injury in this population.

Limitations and Recommendations

While this research endeavors to contribute to the understanding of wrist function and strength among novice weightlifters, it is essential to acknowledge limitation inherent in the study. The exclusion of certain demographic factors, such as socioeconomic status or occupational background, may limit the comprehensiveness of the analysis. Recognizing this limitation is crucial for contextualizing the findings and guiding future research efforts in this area.

The following recommendations are suggested:

- Conduct longitudinal studies to investigate the long-term effects of grip methods and wrist strength training on wrist function and injury incidence.
- Collaborate with sports medicine professionals to develop evidence-based guidelines for wrist injury prevention and rehabilitation in weightlifting and other sports disciplines.

Conclusions

Understanding the correlation between techniques of the wrist, physical strength, and functionality is of great significance for individuals engaged in weightlifting. This literature finds out that the overall wrist function and strength of both dominant and non-dominant wrists were better in participants of neutral wrist group. Participants of extended wrist group were experiencing more pain as compared to neutral wrist group.

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