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# Contribution Of Hand Grip Strength In Badminton Players

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***Abstract***
***Background*** *- Grip strength is a reliable parameter for hand and upper extremity function. As badminton requires more movements and agility there is a need of strong muscles in order to get less injured. Badminton, as a racket sports require strong grip it serves as a indicator of total body strength and overall health of a person, it require good motor coordination between upper extremity, lower extremity and trunk.*
***Purpose -*** *This review aims to explore the contribution of hand grip strength in badminton players, focusing on its role in performance, stroke execution, and injury prevention.*
***Methodology*** *- A systematic search was carried out across major databases including SCOPUS, PubMed, Embase, Science Direct, Google Scholar, and Springer Nature. Studies published between January 2010 and January 2025 were considered. The review focused on research related to the role of hand grip strength, its effect on badminton strokes, finger force distribution, and its relationship with smash accuracy.*
***Results*** *- Out of 1078 initially identified studies, 9 met the eligibility criteria. Evidence suggests that enhanced grip strength improves shuttle velocity, forehand smash speed, and the accuracy of attacking strokes for badminton players.*
***Conclusion*** *- The findings indicate a clear association between grip strength and badminton performance parameters. Stronger finger force is linked with greater shuttle acceleration. Additionally, left-handed players often demonstrate higher forearm smash speeds, likely due to stronger grip strength compared to right-handed players.*
***Implication*** *- Targeted grip strengthening should be considered in badminton training programs to improve shot accuracy and smash power. Since a smash is both a high-speed and high-precision stroke, improved grip strength may provide players with a competitive advantage.*
***Keywords*** *- Hand grip strength, badminton, smash, finger strength*

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## I. Introduction

Badminton is one of the most played racket sports in the world, played indoors or outdoors under calm conditions. The shuttlecock, traditionally made of goose feathers but now often plastic for durability, can travel at remarkable speeds. Professional rallies begin with a serve, and elite players frequently attempt to win points with a single attacking stroke. The shuttle may leave the racket at speeds approaching 50 meters per second, while forearm motion during smashes can exceed 20 meters per second, underlining the sport's high physical demands.[1,2]

The functional capacity of muscles is an important factor in athletic performance, and grip strength provides a simple yet powerful way to evaluate this capacity. Grip strength is widely regarded as a dependable measure of overall muscular performance, reflecting the coordinated effort of the extrinsic and intrinsic muscles that enable finger flexion. Among healthy individuals, age and gender are the primary factors influencing grip strength. However, in clinical contexts, several additional factors—including severity of illness, medical treatment, immobilization, and comorbid conditions—can lead to muscle weakness. For example, research has shown that malnourished patients exhibit about 25% lower grip strength compared to well-nourished counterparts, and this effect remains evident even when controlling for body mass index. Interestingly, no significant variation in grip strength has been found between obese and lean individuals, although obese individuals often demonstrate greater fat-free mass and lower-limb muscle function. A decline in grip strength is often correlated with greater post-surgical complications and extended recovery periods in hospital, reduced functional independence, and even short-term survival rates, further underlining its value as a predictor of overall health. [3,8]

From an anatomical perspective, several muscles are involved in grip and wrist function. The flexor digitorum profundus (FDP) and flexor pollicis longus (FPL) contribute to flexion and gripping ability, whereas

the extensor digitorum communis (EDC) plays a role in wrist extension and release of grip. These muscles originate in the forearm and extend across the wrist to insert on the phalanges, enabling coordinated hand movements. Additional wrist muscles indirectly influence grip, and the intrinsic muscles of the hand, although not directly controlling the wrist, enhance grip force through the extensor mechanism. This coordinated system ensures that grip force is dynamically controlled and adaptable to different sport-specific actions. [5]

Grip strength results from the combined activity of the flexor muscles, together with contributions from the palmar, thenar, and hypothenar regions of the hand. According to biomechanical principles, such as Newton's law of action and reaction, grip force is distributed across the digits to stabilize and control hand function. The extensor mechanism provides additional support, albeit contributing less compared to the flexor system. In sporting contexts, especially in badminton, these biomechanical factors are critical, as grip is directly related to precision, control, and power in stroke execution. [9]

Recent studies have compared normative grip strength values across age and sex, incorporating anthropometric features such as hand length and breadth. These findings confirm that grip strength is one of the most consistent indicators of hand function. [9]

In badminton, the fine control of the shuttlecock is achieved not only through grip posture but also through finger-specific contributions. Evidence shows that the middle finger generates the highest grip force, with the ring and little fingers providing additional support, while the thumb and index finger contribute less overall but remain essential for precision and control. If inadequate force is applied through the metacarpophalangeal joints of the index and ring fingers, stroke power and shuttle velocity may be compromised[24]. Moreover, the flexion force generated by the middle finger shows a strong correlation with anthropometric measures, reinforcing its central role in grip mechanics. [9,10,11]

Proper grip technique is essential for optimal performance in badminton. An incorrect grip not only decreases shot accuracy and power but also increases the risk of injury. Two fundamental grips are commonly used: the forehand and backhand grips. In the forehand grip, the index finger applies forward pressure on the racket handle to guide the stroke, while in the backhand grip, the thumb is placed on the wider surface of the handle, with the index finger relaxed and positioned closer to the middle finger. The thumb's movement is especially important in generating power for backhand strokes. Mastering these grips allows players to improve shot precision, optimize racket control, and reduce injury risk.[24]

The wrist also plays a major role in generating power during strokes, especially smashes. Research indicates that wrist extensor muscles undergo eccentric contraction before impact during smashes, concentric action during clears, and continued activity after impact in drop shots. Comparative studies of four basic badminton strokes—forehand, backhand, smash, and net roll—have shown that grip force peaks during smashes, reflecting the high power demands of this stroke.[4]

Strengthening the hand grip muscles can therefore directly enhance smash performance, as smashes rely on rapid shuttle velocity and steep downward trajectory to outmaneuver opponents. The ability to consistently deliver accurate and powerful smashes depends not only on grip and wrist strength but also on coordination, jumping ability, leg strength, and refined footwork[12,13].

There have been a number of studies carried out in relation to attempts to enhance the accuracy of smashers. Smash has to be accurate, proper coordination and grip power are needed. Good smash ability depends on the high jump of the player when performing a smash, and footwork and leg muscle power also closely depend on the capability of the player to smash. In order to enhance the smash accuracy, it can also be achieved by giving different types of training, since with numerous exercises, consistency of smash accuracy will be achieved, found that smash ability can be enhanced by drill practice and practice with the playing method. [13]

Overall, badminton requires an intricate balance of strength, accuracy, and coordination. While powerful strokes like the smash demand high grip force and muscular contribution, precision shots require controlled, lighter grips that allow for fine wrist mobility. This dynamic interaction between muscular strength, motor coordination, and technique underscores the central role of grip strength in the sport[14,15].

## II. Methods

This review has followed the Preferred Reporting articles for Systematic Reviews and Meta-Analyses extentsion for Scoping Reviews (PRISMA-ScR) framework.

***Search strategy***

A comprehensive database search was conducted using - PubMed, SCOPUS, Embase, Google Scholar, Science Direct, and SpringerLink. The search covered publications between January 2010 and January 2025. Keywords and Boolean operators were applied in various combinations, such as *"hand grip strength," "badminton," "smash," "finger force,"* and *"stroke accuracy."* Additional filters were applied to identify studies conducted on badminton players that examined grip strength in relation to performance variables. In

addition, specific focus was given to studies exploring grip strength in badminton players and its impact on performance among individuals aged 18 to 30 years, as this age group represents the most competitive and physically demanding stage of athletic development.

***Eligibility Criteria***

The inclusion criteria were defined as follows:

- Studies published between the year 2010- 2025.
- Studies with articles assessing Grip strength.
- Studies with articles assessing Badminton player's grip strength.
- Studies with articles assessing Healthy individual grip strength.
- Studies with articles advising the importance of Grip strength.
- Studies with articles informing the role of grip strength in badminton players and racket sports.
- Studies with articles how effectively grip strength affect a badminton player's performance.
- Studies with articles which digit contributes the most in grip strength.
- Studies with articles how Hand strength training is effective for badminton players.

**Exclusion criteria included:**

- Articles not published in English.
- Conference abstracts, case reports, theses, short communications and editorials.
- Studies with articles informing the role of grip strength in other sports than badminton.
- Studies which did not provide open access.
- Studies with articles not discussing the role of grip strength in badminton players.
- Studies with articles including unhealthy or elderly population for measuring grip strength.

***Data Extraction***

From each eligible study, key information was systematically extracted. This included:

- First author and year of publication
- Country of origin
- Study design and sample size
- Participant characteristics (age, sex, competitive level)
- Methods used for grip strength assessment
- Outcome measures related to badminton performance (e.g., shuttle velocity, stroke accuracy, finger force contribution)

## III. Literature Review

| AUTHOR AND YEAR | OBJECTIVE OF THE STUDY | STUDY VARIABLE | STUDY POPULATION | STUDY DESIGN | OUTCOME MEASURES | CONCLUSION |
|---|---|---|---|---|---|---|
| KUANG-MIN PAN1 , FU KAO2 , CHIEN-LU TSAI3 *(2024) | To find the grip force and finger pressure distribution during overhead strokes in badminton across 18 regions | Shuttlecock velocity, contact height | Male and Female University students | A case study | The outcome measures are shuttlecock velocity, contact height, peak finger force and time. | Smash velocity is more for males than females. The contact height is same for both. The total finger force is more for male than female. The GFF is generated by the middle finger. |
| Ardianto Rifki Purnama., Kardjono | To find out the relationship between wrist flexibility and arm muscle strength with the accuracy and speed of smash in badminton athletes | Wrist flexibility, arm muscle strength, smash accuracy, smash speed | Male badminton athletes | Co-relational study | Speed radar was used for smash speed, Specific target areas for smash accuracy, Sit-and- reach test for wrist flexibility, Push and pull dynamo-meter for arm muscle strength | Arm muscle strength supports better coordination and stability during a smash, which helps to maintain form and focus, improving both smash power and accuracy. |

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| Nilay V Dave and Dr. Aniket Solanki(2022) | To compare the explosive leg strength and hand grip strength between badminton and tennis players in college. | Explosive leg strength, Grip strength, Type of sport (Badminton\ Tennis) | 30 Badminton Players and 30 Tennis players aged18-25 years | Comparative cross-sectional study | Standing broad jump test for explosive leg strength and Hand grip by Jamar handgrip dynamo-meter. | The mean right HGS of badminton players was 32.70 ± 5.64 kg and for left hand it was 30.43 ± 5.50 kg." It was more for left due to hand dominance. lesser HGS in badminton players might be due to the nature of the sport, which relies more on wrist and finger movement rather than full grip engagement. |
| Shreyashi Saha1, Prajakta Nande1 (2022) | To find out how hand anthropometry and nutritional status affect handgrip strength in young adults. | Hand length, Hand breadth, Body Mass Index (BMI), Mid-upper arm circum-ference (MUAC), Hand Grip strength | Young adults both male and female age 18-25 years. | Cross-sectional study | Hand grip dynamo-meter for Hand grip, Hand length, Hand breadth, BMI and MUAC | Hand size nutritional status affect handgrip strength. Bigger hand size and better nutrition (higher BMI and MUAC) are linked |
| Tegar Galih Novan Priambudi, Agam Akhmad Syaukani (2022) | To see how handgrip and dumb-bell exercises helps to improve grip strength in badminton players. | Types of exercises (Dumbell/ Handgrip), Hand grip strength | Badminton players aged 18-25 years | Experi-mental study done for 6 weeks, exercise for 5 days a week and it was between two groups. | Handheld dynamo-meter for HGS and measuremen t taken before and after 6- week program. | It concluded that both exercises increased grip strength but Handgrip exercises showed better improvement and are more effective than dumbbell exercises. |
| Jeki Haryanto1, Zulfikal Zulfikal11, Donie Donie1, Eval Edmizal (2021) | To find out if grip strength and footwork are related to smash accuracy in badminton players. | Grip strength, Footwork and Smash accuracy. | Badminton players aged 18-25 years both male and female | Cross-sectional study | The outcome measures are Grip strength, Footwork and Smash Accuracy. | There is a positive correlation exists between Grip strength and Footwork with smash ability in badminton players. |
| Kriti Singh1, Nanda Kumar.S2 (2019) | To compare handgrip strength between right-handed and left-handed badminton players. | Hand grip strength, Right hand and Left hand | Badminton Players aged 18-25years | Cross-sectional comparative study | Hand grip strength was measured using Handheld Jamar dynamo-meter | Right-handed players had stronger handgrip strength in their dominant hand compared to left-handed players. However, left-handed players showed better grip strength in their non-dominant hands than right-handed players. |
| Soo Min Cha, MD, Hyun Dae Shin, MD, PhD, Kyung Cheon Kim, MD, PhD, Jung Woo Park, MD(2014) | To measure grip strength using various grip methods by sequentially excluding one or two fingers and to assess the contribution of each finger to overall grip strength, thereby aiding in the prediction of clinical or functional outcomes. | Grip method, Grip strength, Anthro-pometric measures | 200 healthy males aged 25 - 30 years. | Experi-mental study | All 6 grip strength correlates with Anthro-pometric measures. The contribution of each finger is Middle-31% Ring+little-29% Index-22% Thumb-17% | Middle finger contributes |

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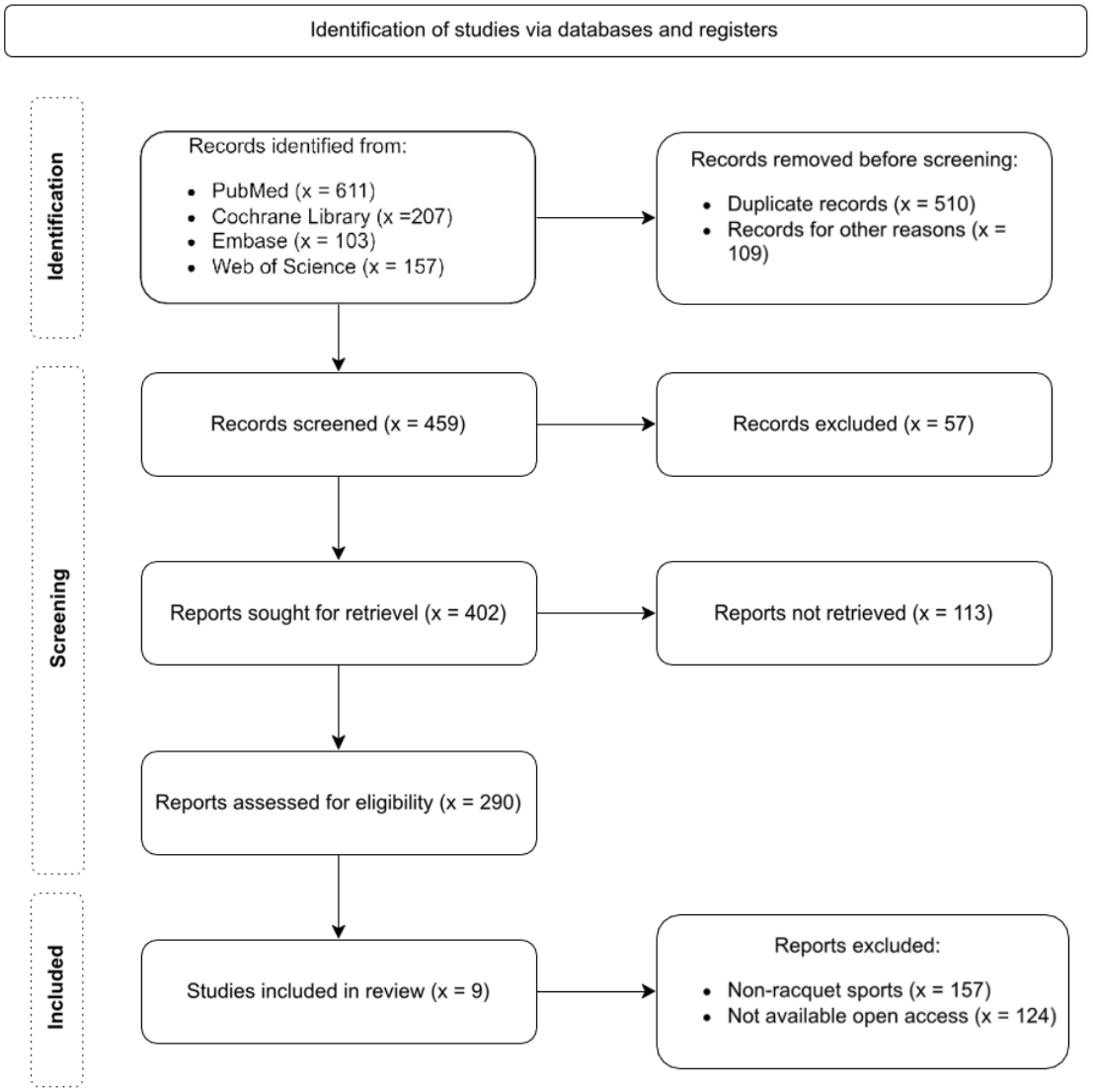
|---|---|---|---|---|---|---|
| Kristina Norman a,*, Nicole Stobäus c, M. Cristina Gonzalez b, Jörg-Dieter Schulzke c, Matthias Pirlich(2010) | To find relevance of grip strength in various clinical and epidemiologic settings and investigates its suitability as marker of nutritional status. | Hand grip strength, nutrtional status, age , gender, muscle function and body mass | Clinical patients, elderly individuals, and healthy adults in both epidemiological and clinical settings. | Cross-sectional study | Hand grip strength is considered to be an outcome for upper body strength. A person can have impaired HGS in case of long hospitalization and even elderly people loose HGS. | HGS reflect the maximum strength by intrinsic and extrinsic hand muscles.and also correlate with knee extension strength. Age and gender influence HGS.Obese people have low HGS due to higher fat mass. HGS is an indicator for hand BMD |

## IV. Results

***Search strategy and study selection***

The initial database search yielded **1,078 articles**. After duplicate removal, 568 studies were screened by title and abstract. Following detailed full-text evaluation and application of inclusion/exclusion criteria, **nine studies** were finally included in the qualitative synthesis.



## V. Discussion

This review explored the contribution of hand grip strength in badminton players, emphasizing how it influences stroke performance, shuttle velocity, and coordination. Consistent evidence indicates that athletes with stronger grip strength exhibit superior smash speed, improved shuttle acceleration, and enhanced shot precision. Regular grip training can therefore contribute significantly to overall skill development and reduced injury risk.

Dynamic balance and forearm muscle engagement play vital roles in effective stroke execution. Players with better balance and coordinated footwork tend to deliver more powerful and accurate smashes. Enhanced arm and hand muscle strength translates into higher racket-head velocity, resulting in faster shuttle speed and better control during offensive play.

Finger-specific strength distribution further supports stroke efficiency. The middle finger generates the highest proportion of grip force, followed by the ring and little fingers, whereas the thumb and index finger mainly provide fine control and stability. Proper grip technique—particularly the distinction between forehand and backhand grips—optimizes power generation while minimizing wrist strain.

Moreover, improved eye-hand coordination, coupled with efficient grip control, is essential for timing and target accuracy during fast rallies. A positive correlation between grip strength, footwork, and smash accuracy was consistently observed across studies. Collectively, these findings highlight the overall importance of grip strength in enhancing both power and precision for badminton athletes.

## VI. Key Findings

The reviewed studies consistently revealed that badminton players possess greater hand grip strength than athletes of other racket sports, reflecting the sport's higher physical and technical demands. Among different strokes, the smash strokes (SH) required the maximum grip force (~209 N), followed by forehand and backhand strokes, whereas the net roll (NR) involved the least (~84 N). The wrist extensor muscles were most active during smashes, emphasizing their role in generating explosive power and maintaining racket stability during rapid swings. [4,15]

All players possessed a distinct grip pattern, but demonstrated consistency between stroke types.[15] Finger-specific analysis showed that the middle finger contributes the greatest share of total grip force, followed by the ring and little fingers, while the thumb and index finger aid in fine control and coordination. Right-handed players demonstrated stronger grip in their dominant hand due to repetitive unilateral activity, whereas left-handed players exhibited a more balanced distribution of strength, likely due to their playing mechanics. [12,13]

A moderate to strong positive correlation was also found between grip strength, footwork, and dynamic balance. Players with superior grip control displayed greater accuracy, faster shuttle speeds, and better positional stability during smashes. These results highlight that grip strength functions as both a key performance determinant and an essential factor in minimizing upper-limb strain and injury among competitive badminton players. [9,10,24]

***Gap in literature***

Current research exploring the association between grip strength and badminton performance remains limited in scope and methodological consistency. Many available studies involve small, homogenous groups of athletes and lack standardized protocols for assessing grip strength or stroke performance. As a result, comparisons across studies are often unreliable. Furthermore, the long-term impact of systematic grip-strength training on motor control, stroke precision, and injury resilience has not been thoroughly examined. Few investigations have integrated biomechanical, neuromuscular, and performance parameters within a single framework. To bridge these gaps, future studies should employ larger, more diverse cohorts and adopt unified testing procedures that combine physiological and kinematic assessments for a more comprehensive understanding of grip function in badminton.

***Implications***

The synthesized evidence highlights the importance of incorporating grip-strength evaluation and targeted training into badminton-specific conditioning and rehabilitation programs. Coaches and sports medicine professionals should design exercises that strengthen both the wrist flexors and extensors while improving finger dexterity and coordination. Such training can enhance racket stability, accuracy, and overall stroke efficiency. Regular monitoring of grip force can also help identify early signs of muscle fatigue or overuse, enabling preventive adjustments before injuries occur. In clinical settings, individualized grip-strengthening routines may facilitate faster recovery and safer return-to-play outcomes for athletes recovering from upper-limb conditions. Integrating these strategies within regular training cycles may therefore contribute to sustained athletic performance and reduced injury incidence.

## VII. Conclusion

Hand grip strength emerges as a decisive factor influencing technical performance, power generation, and injury prevention in badminton players, particularly among individuals aged 18 to 30 years. A stronger and more coordinated grip enables higher shuttle velocities, improved stroke precision, and better control during high-intensity rallies. The interplay between finger strength, wrist stability, and neuromuscular coordination forms the foundation of efficient racket handling. Structured training programs that emphasize progressive grip conditioning can thus enhance both competitive output and long-term musculoskeletal health. Future investigations should validate these outcomes through longitudinal and interventional research, establishing clearer guidelines for integrating grip-strength development into elite badminton-training.

## References


[1]. Physiology_Of_Sports/ME6SAgAAQBAJ?Hl=En&Gbpv=1&Dq=Badminton+Sport+Racquet&Pg=PA299&Printsec=Frontcover
[2]. Tan, D. Y. W., Ting, H. Y., & Lau, S. B. Y. (2016). A Review On Badminton Motion Analysis. 2016 International Conference On Robotics, Automation And Sciences
[3]. Hand Grip Strength: Outcome Predictor And Marker Of Nutritional Status Kristina Norman A,*, Nicole Stobäus C , M. Cristina Gonzalez B , Jörg-Dieter Schulzke C , Matthias Pirlich Article History Received 7 July 2010 Accepted 23 September 2010
[4]. Characterization Of Grip Force During Badminton Strokes-Rossi J*, Foissac M, Baly L, Vigouroux L, Grelot (2010)
[5]. Factors Affecting Grip Force: Anatomy, Mechanics, And Referent Configurations – Satyajit Ambike, Florent Paclet, Vladimir M Zatsiorsky, Mark L Latash
[6]. Hand-Grip Strength As A Predictor Of Muscular Strength And Endurance - Trosclair, D[1]; Bellar, D[1]; Judge, L W[2]; Smith, J[1]; Mazerat, N[1]; Brignac, (Add Reliability Of Hand Dynamometer From This )
[7]. A Correlational Analysis Of Shuttlecock Speed Kinematic Determinants In The Badminton Jump Smash
[8]. Influence Of Hand Anthropometry And Nutrient Intake On Hand Grip Strength: A Correlational Study Among Young Indian Badminton Players Shreyashi Saha , Prajakta Nande, Ravi Nimonkar
[9]. A Brief Review Of Handgrip Strength And Sport Performance- John Cronin, Trent Lawton1,3, Nigel Harris1,2, Andrew Kilding1, Daniel Travis Mcmaster4
[10]. Helliwell P, Howe A, Wright V. Functional Assessment Of The Hand: Utility, Reproducibility And Acceptability Of A New System For Measuring Strength. Ann Rheum Dis. 1987;46(3):203e208
[11]. A Review Of The Measurement Of Grip Strength In Clinical And Epidemiological Studies: Towards A Standardised Approach.
[12]. Comparison Of Handgrip Strength Between Right-Handed And Left-Handed Badminton Players Kriti Singh1, Nanda Kumar.S2
[13]. Footwork And Grip Strength: Is It Related To Smash Accuracy Jeki Haryanto1, Zulfikal Zulfikal11, Donie Donie1, Eval Edmizal, Program Studi Pendidikan Kepelatihan Olahraga,Universitas Negeri Padang, Indonesia
[14]. Correlation Between Dynamic Balance, Grip Strength And Eye-Hand Coordination With Smash Performance In Elite Badminton Players: An Observational Study Dr. Aditi Dashondi, Dr. Yagna Shukla And Madhav Katara.
[15]. Grip Force And Pressure Distribution Analysis Of Three Badminton Forehand Overhead Strokes Of Male And Female Players: A Case Study KUANG-MIN PAN1, FU KAO2, CHIEN-LU TSAI3*Department Of Physical Education And Sport Sciences, National Taiwan Normal University, TAIWAN
[16]. Grip Strength Measurements At Two Different Wrist Extension Positions In Chronic Lateral Epicondylitis-Comparison Of Involved Vs. Uninvolved Side In Athletes And Non- Athletes: A Case-Control Study Arti S Bhargava1, Charu Eapen2, Senthil P Kumar
[17]. Footwork And Grip Strength: Is It Related To Smash Accuracy Jeki Haryanto1, Zulfikal Zulfikal11, Donie Donie1, Eval Edmizal1
[18]. Comparison Of Explosive Leg Strength And Hand Grip Strength Among Collegiate Badminton And Tennis Players Nilay V Dave And Dr. Aniket Solanki.
[19]. The Relationship Between Wrist Flexibility And Arm Muscle Strength With The Accuracy And Speed Of Smash For Badminton Athletes Universitas Pendidikan Indonesia (UPI) Ardianto Rifki Purnama1., Kardjono2 , Yopi Kusdinar3 , Mulyana4
[20]. Perbedaan Pengaruh Latihan Handgrip & Dumbell Terhadap Peningkatan Kekuatan Genggaman Jari Pada Pemain Bulu Tangkis Tegar Galih Novan Priambudi *1, Agam Akhmad Syaukani2
[21]. Influence Of Hand Anthropometry And Nutrient Intake On Hand Grip Strength: A Correlational Study Among Young Indian Badminton Players Shreyashi Saha1*, Prajakta Nande1 , Ravi Nimonka
[22]. Assessment Of Hand Grip In Badminton And Table-Tennis Players Ksh Birbal Singh, Kh. Lojit Singh, Kh. Rajen Singh
[23]. Comparison Of Grip Strength Among 6 Grip Methods- Soo Min Cha, MD, Hyun Dae Shin, MD, Phd, Kyung Cheon Kim, MD, Phd, Jung Woo Park, MD
[24]. Characterization Of The Fine Hand Movement In Badminton By A Smart Glove Xian Song, Yuxin Peng, Bingcheng Hu & Wenming Liu