A STUDY ON GRIP STRENGTH IN AMATEUR AND PROFESSIONAL YOUNG TENNIS PLAYERS – A CROSS SECTIONAL STUDY

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ABSTRACT

BACKGROUND: The effectiveness of treatment measures must be assessed using a valid and reliable measure of hand strength, and it is generally acknowledged that grip strength serves as an objective indicator of the functional integrity of the upper extremity. The purpose of this study was to compare the grip strengths of young tennis players who were amateurs and professionals.

METHOD: According to inclusion criteria 16 amateur and 16 professional young tennis players participated in the study. The participants' grip strength was assessed using an electronic hand dynamometer. In accordance with recommendations from the American Society of Hand Therapists (ASHT), HGS measurement was carried out with the elbow flexed.

RESULT: Result were statistically analysed using unpaired t-test and chi test by using SPSS version 8, There was no statistically significant difference in the grip strengths of amateur and professional tennis players when the study group as a whole was evaluated. Tennis players who were either amateur or professional had a stronger hand grip in a percentage of 10.93% and 33.33%, respectively. and the percentages for typical grip strength were 10% and 15%.

CONCLUSION: We came to the conclusion that there was no real distinction between professional and amateur tennis players in this instance. Both groups' values do not differ significantly at 0.05 significant levels.

KEY WORDS: Hand Grip Strength(HGS) , Amateur, Professional, American Society of Hand Therapist(ASHT), Hand Dynamometer(HD).

INTRODUCTION:- Hand grip strength is significant as a gauge of general health and as a test for the health of the upper motor neurons and the motor unit as a whole. Hand grip strength testing in comparison to age-corrected norms would be a useful clinical test in the differential diagnosis of neuromuscular disease and in tracking the natural course of acute and chronic diseases affecting the lower motor neuron. [(1)]After hand and upper extremity injuries, surgeries, and other treatments, hand grip strength is a status. The determination of hand disability ratings typically involves using an accurate, quantitative assessment of hand grip strength to enable the doctor set reasonable treatment goals and collect data on treatment outcomes. [(2)]The most accurate clinical measure of human strength is now thought to be grip strength. In adult fitness tests, it is frequently employed as a measure of strength [(3,4)] Consequently, it is regarded as the one thing that most accurately represents the strength of the entire body. [(5,6)] Age centiles for hand grip strength are necessary for the device to be helpful as a bedside and clinical tool in the management of paediatric disorders. Cardiopulmonary reserve and the inability to distinguish between isometric and isotonic function hamper tests currently employed in the surveillance of muscle activity in children with progressing neuromuscular illness. For the purpose of tracking the development of these kids' physical strength through time, an easy-to-use, practical, and objective measurement of isometric muscle

contraction would be helpful. Studies on grip strength (all from the United States) have made use of a variety of dynamometers, including cabal-hemselmerer and pneumatic and hydraulic loaded resistances [7-11] The majority of research have only sampled adults, and none have done so with children under the age of 10. The majority of dynamometers used in clinical settings have relatively small ranges and primarily assess isotonic contraction. Despite their many benefits, cable tensiometers are heavy and not really portable. Hand grip strength can now be measured precisely in children thanks to the recent development of a portable dynamometer that is reliable yet sensitive, measures isometric muscle contraction only, and has linear load response curves at a wide range of loads. In this study, we report hand grip strength norms for Caucasian kids.For evaluating muscle strength, a variety of tests and measurements are available. [12] Hand-grip dynamometry is perhaps the easiest instrumented technique to use. Normative values for hand-grip dynamometry have been published. [13-18] allow determinations to be made about hand-grip strength deficits. Internal consistency of measurements of muscular strength. [19] Encourages the use of hand-grip strength tests to describe overall strength in a practice. [20]

Despite these facts, strength is not a necessary quality. Strength is valuable to measure because of its link to other important factors, such as function, as well as because of its prognostication of consequential events. This succinct review focuses on hand-grip dynamometry's propensity for prognosis. There is a review and discussion of pertinent material provided.With an estimated 87 million participants worldwide, tennis is one of the most popular sports. The International Tennis Federation has pledged to increase the number of players to 120 million by 2030, so participation is only expected to increase. [21]The repetitive nature of the sport places particular demands on the musculoskeletal system, increasing the risk of injury for participants. Lower extremity injuries are more frequent, but upper extremity injuries account for 20–49% of all injuries, with chronic overuse constituting the majority of these [22,23] . The wrist, representing up to 31% of all upper extremity injuries [24], is vulnerable to injury due to both the complicated mechanics and repetitive utilization of backhand and forehand groundstrokes.Tennis is the most well-liked racket sport and is played by a wide variety of people all over the world. In spite of the positive effects that tennis practice has shown on physical and mental fitness, the Increased participation in competitions and tournaments indicates that amateur or young players are highly committed to their training.Players who participate in this rigorous practise risk overtraining and excessive amounts of specialised physical activity [25]. It happens frequently that inexperienced or unqualified supervisors suggest adult training regimens to adolescents because they are unaware of the causes of overuse injuries and, in particular, the improper increase in the training process's progression [26]. Because it is the essential final link in the kinetic chain connecting the body and the racquet, the wrist/hand complex plays several key roles in the production of tennis strokes. [27] For example, the wrist frequently flexes quickly at ball contact during the forehand and serve· [28- 30), High racquet endpoint velocities can be attained owing in large part to how quickly this motion occurs. [28). In contrast, when a player executes a "standard" volley, the upper extremity is limited to acting as a single functional unit. [27], and the wrist needs to be properly supported during and after ball contact. [31] In addition to these demands, the wrist plays a crucial role in racquet face alignment during all tennis strokes to ensure that the ball is launched along the required trajectory and with enough spin to clear the net and settle inside the court's boundaries. [32-34] Tennis players may experience pain and damage as a result of the pressures placed on their wrists during certain tennis strokes, both internally (from the forces and torques generated by their muscles) and externally (from the contact between the ball and racquet) [32]. Grip

tightness may affect the internal torques produced by the hand and wrist muscles. [35-37], the style of grip a player uses [38] Early specialisation in sport can be broadly defined as situations where a person begins playing one primary sport at a young age, is exposed to competition at a young age, and engages in high-intensity training. [39] In tennis, this route is frequently adopted. [40], perhaps as a result of the attraction of fame and wealth that exists at the highest levels of the professional ranks [41]. Elite female junior tennis players have been found to have early adaptations, such as bilateral variances in wrist flexion/extension strength [42]. However, a player's susceptibility to injury is increased when they are physically immature due to the load, repetition, and inadequate recovery. [49, 40, 42, 43] Athletes who were classified as highly specialised in a particular activity had a higher likelihood of suffering major overuse injuries, according to a Wrist Injuries in Tennis Players 123 study that looked at injured athletes (regardless of sport) aged 7 to 18. [43] Elite junior tennis players who solely played tennis have also been demonstrated to be more likely to report suffering a tennis-related injury in the preceding year. [40] Tennis coaches, sports scientists, and clinicians must take this possibility into consideration given the implications for injury prevention and performance enhancement, even though there is currently insufficient evidence to conclusively link early specialisation with wrist pain/injury in young tennis players. [44-46] using unsuitable or excessively repetitive blocked-type training activities with the same stroke [47] may bring to physical adaption problems and overuse injuries. [44, 45, 48,49]. The hand, forearm, and surrounding musculature rehabilitation and strength training programs are of interest to strength and conditioning coaches because they may use these measurements to objectively track development. The hand is a complex anatomical system made up of 27 bones and 15 joints with roughly 30 degrees of rotational and translational freedom designed to grab and exert force on objects of all shapes and sizes as well as carry out a variety of sophisticated, finely controlled movements [50]. Tennis players may experience issues with the use of these values since using a racket during training may result in a neuromuscular adaptation that raises the HGS of the dominant hand.Studies mention asymmetry in tennis players' dominant and contralateral upper limbs.[51,52]. This asymmetry, which prevents the use of the contralateral limb as a reference during therapy, has been attributed to inherent qualities of the sporting gesture. Furthermore, a potential link between HGS and lateral epicondylitis of the humerus has been suggested. [53,54]. It will take a while for this injury to heal. [55] and it is thought that the HGS is a highly helpful tool in evaluating these athletes. [53] However, no precise HGS values for the young tennis players have been discovered. There are two widely used guidelines for assessing the HGS; one suggests the elbow examination in extension (European Test of Physical Fitness – Eurofit) [56] while the other suggests elbow flexion (American Society of Hand Therapists – ASHT) [57]. Due to this discrepancy, [66,58], utilise the elbow in extension in their evaluation methodology, while other studies [59,65,60], use the elbow in flexion. When comparing various studies, this disparity amongst sources makes things challenging. Changes in the flexors' tension/length ratio could affect the test's outcome since the elbow position can affect the HGS because the muscle that moves the wrist also travels through the elbow. [53]. Additionally, it should be observed that in order to boost the HS, more flexor muscles must be recruited as well as more extensor muscles must be activated in order to maintain a modest extension of the wrist. [60]. In order to improve wrist function, the elbow position could potentially change how the flexor and extensor muscles relate to one another. The muscle area of the forearm, for example, can be estimated using the HGS [60] presence of hormones [61], body composition [62] and physical fitness [63]. Therefore, having an HGS reference value for tennis players would be useful for tracking teenage development using this modality.AMATEUR TENNIS

PLAYERS-The International Tennis Federation (ITF) defines an amateur tennis player as "a person who plays tennis for personal enjoyment and without monetary compensation, directly or indirectly, except for the reimbursement of actual and reasonable expenses incurred in playing tennis." Tennis' regulatory body, the ITF, establishes guidelines for both amateur and professional players around the world.Tennis players that participate at the top level of the sport and make their career playing the game are frequently distinguished from amateur players. Professional tennis players compete in high-profile events such Grand Slam competitions like the US Open, Wimbledon, Australian Open, and French Open. They are ranked by the ATP (for men) or WTA (for women [66].DIVISIONS-Non-professional tennis players are frequently divided into groups based on their degree of expertise and prior competitive experience. Depending on the nation, area, or league in which the players are playing, these categories may be set up differently. However, one typical method of dividing amateur tennis players into skill-based categories is as follows: 1) Division 1: Players in this division tend to be the most accomplished and knowledgeable, with high levels of technical proficiency and tactical awareness. These athletes frequently participate in elite tournaments or leagues and have probably been playing tennis for a long time.2) Division 2: While generally competent and seasoned, players here might not possess the same level of technical proficiency or tactical understanding as those in Division 1. They might have played tennis for a number of years and taken part in competitions frequently.3) Division 3 contains tennis players with some experience and talent, albeit they might not have played as long or at the same level as those in Divisions 1 or 2. They are well-versed in the fundamentals of tennis and may compete in regional leagues or competitions.4) Division 4 is usually made up of newer or less seasoned players who are still picking up the fundamentals of tennis strategy and technique. They might only be new to tennis and take part in basic leagues or lessons [66]. YOUNG PROFESSIONAL TENNIS PLAYERS -A player who is relatively new to the professional tennis circuit and has not yet had substantial success or recognition at the highest levels of the sport is often referred to as a young professional tennis player. A young professional tennis player can be any age, but many of those that fall into this group are in their late teens or early twenties.Young tennis professionals may have recently made the switch from junior to professional competition or they may have entered the professional circuit without having substantial prior competitive experience. As they attempt to raise their rankings and get used to the faster tempo and higher calibre of play in professional tournaments, they frequently face a steep learning curve [67].

In contrast to amateur players, professional tennis players are not often separated into divisions. Instead, professional athletes are ranked based on how well they perform in events and contests, with the top athletes being regarded as the greatest in the world.

The Women's Tennis Association (WTA) and the Association of Tennis Professionals (ATP) respectively control the rankings used in professional tennis. The rankings are based on a player’s performance throughout the previous 52 weeks of competition and consider elements including the level of opposition, the quantity of victories, and the sort of tournaments participated [67].The main distinction between professional and amateur tennis players is that the former plays the sport as a means of support while the latter compete only for personal fun and without payment [66].

METHODLOGY:- Selection of subjects into groups-32 participants from various sports academies were split into two equal groups by simple random sampling based on inclusion criteria: GROUP-A Amateur tennis players and GROUP-B Professional tennis players. Before starting brief introduction about the study was given to them and their consent was taken, verbally and written both. The study required both groups to devote a

total of 24 weeks to it.

INCLUSION CRITERIA

Age: between 10-23

Gender- Male and Female amateur and professional tennis players

Tennis players without any history of upper limb trauma and medical illness.

EXCLUSIVE CRITERIA

Subjects with surgical records

Subjects with upper limb trauma and medical illness

previous neurological, cardiovascular, or medical conditions

MATERIAL USED-Assessment form/Grip strength assessment form/ Written consent form/ Handgrip Dynamometer /Stop watch/Chair /Plinth/Pencil/Paper/pen

PROCEDURE-Tennis players must meet the following criteria in order to be included: they must Tennis Players and regularly compete. For at least two months, the subject should not have displayed any upper-limb injuries. 32 participants were included in the study, with 16 amateur tennis players and 16 professional tennis players assigned to groups A and B, respectively. There were 32 tennis players tested, 25 males (aged ten to 23) and 7 females (ten to 14 aged). 10 male players and 6 female players make up group A, while 15 male players and 1 female player make up group B. The amateur tennis players worked out 5.69 (SD = 1.014) hours a week on average and professional tennis players practiced 6.63 (SD =.619) hours each week on average. They were all split up into the groups for the study (table 1). On the ITF roster, each person was split into amateur and professional player categories. These athletes' training time was divided into hours, days, and years. Test protocol and variables-The following information was gathered on an evaluation sheet: the athlete's name, body mass, size, game category, hand dominance, exercise, rank, and hand strength. HS was assessed using an electronic hand dynamometer, and only one assessor administered each test. The tennis players first ran one trial with each hand to get comfortable. The analysis did not include this trial. In accordance with recommendations from the American Society of Hand Therapists (ASHT), HGS measurement was carried out with the elbow flexed. Thus, the athlete was positioned with the shoulder adducted, the elbow flexed at 90 degrees, the forearm in neutral position, and the wrist extended between 0° and 30° [7,15].The test was administered in a random order. The dynamometer was ordered to be squeezed three times as hard as possible by the athlete, with the greatest value being chosen for the analyses [22].

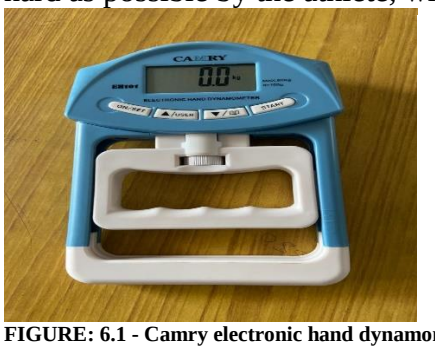


FIGURE: 6.1 - Camry electronic hand dynamometer (ICC:0.815-0.854);
FIGURE:6.2 Showing the HGS measurement was carried out with the elbow flexed in various athletes with the shoulder adducted, the elbow flexed at 90 degrees, the forearm in neutral position, and the wrist extended between 0° and 30°

RESULT

Table:8.1- Showing the Frequency Distribution of Amateur and Professional Players in Group A and Group B

VARIABLES		GROUP A (%)	GROUP B (%)	GROUP A (f)	GROUP B (f)
AMATEUR	AMTR	100.0%	0.0%	16	0

	PRO	0.0%	100.0%	0	16

Figure:8.1- Showing the Frequency Distribution of Amateur and Professional Players in Group A and Group B

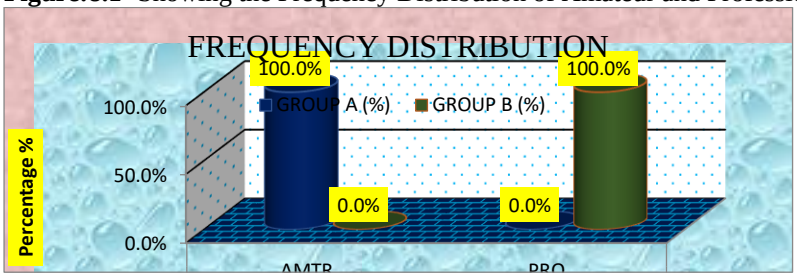
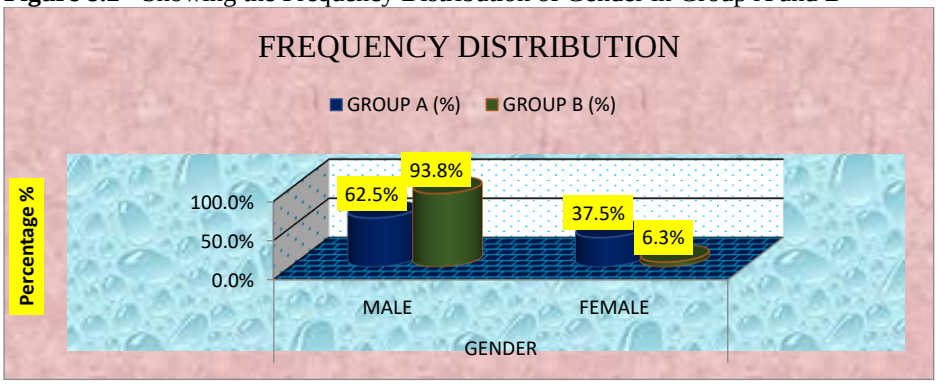


Table:8.2 – Showing the Frequency Distribution of Gender in Group A and B

VARIABLES		GROUP A (%)	GROUP B (%)	GROUP A (f)	GROUP B (f)
GENDER	MALE	62.5%	93.8%	10	15
	FEMALE	37.5%	6.3%	6	1

Figure 8.2 - Showing the Frequency Distribution of Gender in Group A and B



In groups A and B, respectively, 62.5% and 93.8% of the participants are men. Only 6.3% of group B's participants are female, compared to 37.5% of group A's.

Table:8.3. Age and Training experiences of participants

Variables	Amateur Tennis players (n = 16)		Professional Tennis Players (n = 16)	
	mean	SD	mean	SD
Age (years)	11.25	1.065	15.19	3.816
TE (years)	1.12	0.865	5.31	2.243
TE (days/weekly)	5.69	1.014	6.63	0.619
TE (hours/daily)	1.91	0.455	2.63	0.777

TE – Training experience.The average age for tennis players in both amateur and professional leagues, respectively, are 11.25 ±1.065 and 15.19 ±3.816 respectively. Tennis players who were amateurs and those who were professionals had substantial variations in their ages ($P < 0.001$). A training experience (TE) is divided into three categories for athletes: (years), (days/weekdays), and (hours/day)

Table:8.4- Showing the Comparison of BMI Between the Groups

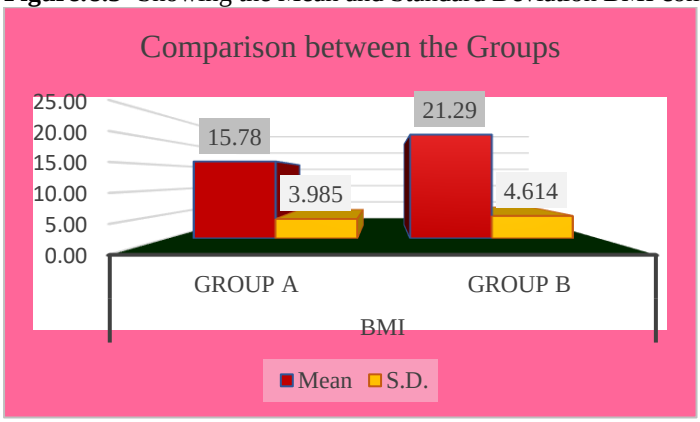
Unpaired T Test	**BMI**	
	Group A	**Group B**
Mean	15.78	21.29
S.D.	3.985	4.614
Number	16	16
Maximum	25.48976529	28.87492168

Minimum	10.72095368	13.25590203
Range	14.76881161	15.61901964
Mean Difference	-5.50	
Unpaired T Test	3.611	
P value	0.0011	
Table Value at 0.05	2.04	
Result	Significant	

Comparison of group A and B

The unpaired Students t-test was employed to compare the values between the groups.

Figure:8.3 -Showing the Mean and Standard Deviation BMI comparison between the groups



As we can see in the table that lists the anthropometric data (BMI) relevant to tennis players. Significant BMI disparities exist between the two analyzed groups ($P < 0.001$).

Unpaired T test value= 3.611. The difference is statically significant.

Table: 8.5 – Demonstrating the Value of The Best Trial Out of The Three Trials Conducted Between the Groups

Unpaired T Test	**BEST OF 3**	
	Group A	**Group B**
Mean	16.88	32.28
S.D.	6.868	13.226
Number	16	16
Maximum	28.3	54.1
Minimum	9.9	14.2
Range	18.4	39.9
Mean Difference	15.39	
Unpaired T Test	4.132	
P value	0.0003	
Table Value at 0.05	2.04	
Result	Significant	

Figure 8.4– Showing the Value Mean and Standard Deviation of The Best Trial Out of the Three Trials Conducted Between the Groups

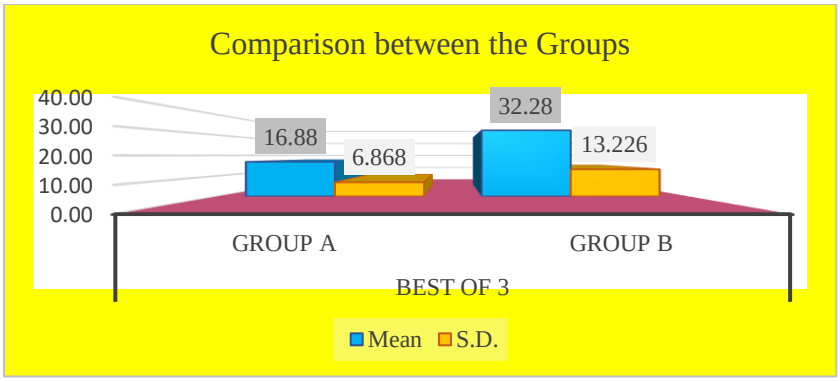


Table:8.6 - Post test values of Group 1 and group 2

CHI SQUARE TEST		**AMTR**			**COMPARISON**				
Variables	**Opts**	NORMAL	STRONG	WEAK	**Chi² Test**	**P Value**	**df**	**Table Value**	**Result**
PRO	NORMAL	7	1	6	1.778	0.777	4	9.488	Not Significant
	STRONG	1	0	0					
	WEAK	1	0	0					

The Chi Square Test was employed to compare the after-intervention values between the groups.
According to our findings, there is no discernible difference in the grip strength of the players in the two groups. Tennis players that play recreationally and professionally produce results that are comparable (p value: 0.777).

DISCUSSION:-To reach the goal of the study, the grip strength of young tennis players was examined.32 participants were selected for this study. Participants were split based on their ranking and experience into Group A (amateur players) and Group B (professional Players) for the convenience sampling. Each test was conducted by a single assessor using an electronic hand dynamometer to measure hand strength. Our results indicate that there is no appreciable difference between the players' grip strength in the two groups. Results between two groups are comparable. This study refuted the idea that there is a substantial difference in grip strength between two groups. In comparing the grip strength of amateur and professional young tennis players, the null hypothesis was supported.Strength must be needed in the muscles and joints for good performance as well as to protect the body from harm (ligaments, tendons, joints, etc.). A solid connection between the racket and the ball is necessary for the best possible stroke execution, and grip strength plays a role in this [68].Our findings show that young tennis players, whether amateur and professional, lack significant hand grip strength was found as a statistically significant difference between the two group of tennis players.After researching grip strength, we discovered that less than 10% of players in both categories had strong grips, leaving more than 90% of them with either normal or weak grips.The findings of Lucki and Nikolay [69] also provided evidence of grip strength asymmetries among tennis players. The way a racquetball player holds the racquet directly affects how the racquet rotates before, during, and after hitting the ball [70]. A racquet sport athlete's capacity to keep the racquet under good control both before and after striking the ball will be influenced by their grip strength [71].
Force transmission to the wrist can be impacted by the ball's impact position on the racquet and grip sturdiness [72,73].Comparing the increased grip pressure to the normal grip condition, racquet rotation in the hand decreased and wrist extension torque increased by 20%. Tennis players should consider their grip tightness and the location of the ball racquet when determining what is causing their wrist or elbow pain.More over three-quarters of the sample population in Tagliafico et al.'s study [74] experienced ulnar-sided wrist pain, and two-thirds of all injuries affected the extensor carpi ulnaris tendon. The authors claimed that if there is a

mismatch between physical capability and the increased demands of contemporary stroke procedures, accidents may arise. It seems unlikely that the relationship between grip strength and the outcomes is causal, even if dynamometer measurements of hand-grip strength predict a variety of outcomes. Grip power most likely reflects a person's health or nutritional status. It is established that grip strength and both physical activity level [75] and dietary status [76,77,78,79] are correlated. Given the handgrip dynamometry's relative simplicity, speed, impartiality, and non-invasiveness, it would seem to deserve wider adoption as a health screening tool. **CONCLUSION**- No differences between amateur and professional young tennis players were found in the hand strength evaluation. Both groups' values do not differ significantly at 0.05 significant levels. Tennis players in their early teens haven't really demonstrated the essential values of grip strength in their hands. The results of this study may be relevant to future research on tennis player talent identification, player selection, and training program creation.

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