Quest Journals
Journal of Medical and Dental Science Research
Volume 8~ Issue 9 (2021) pp: 67-80
ISSN(Online) : 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

Comparative Study of Handgrip Strength In North Indian Population

Hina Fatima[1], Kamil Khan[2], Harmeet Kaur [3], M Asif Khan[4], Hamid Ansari[5], Nidhi Singh [6]

1. Tutor, Department of Anatomy, Hind Institute of Medical Sciences, Sitapur, U.P., India.
2. Associate professor, Department of Anatomy, Hind Institute of Medical Sciences, Sitapur, U.P., India.
3. Associate Professor, Department of Anatomy, Jaipur National University for Medical Sciences and Research Centre, Jaipur, Rajasthan, India
4. Assistant Professor, Department of Anatomy, Rama Medical College Hospital & Research Centre, Kanpur, U.P., India.
5. Associate Professor, Department of Anatomy, Rama Medical College Hospital & Research Centre, Kanpur, U.P., India.
6. Embryologist, Maulana Azad Medical College, New Delhi, India.

Abstract: *The hand is a tortuous anatomical system of static and dynamic structures. For most the lives we tend to take the grip strength of hand for concede. It gives indication about general muscle strength, endurance and power and is mandatory to maintain the integrity of handgrip. Handgrip Strength can also provide a simple, coast effective as well as a useful weapon in occupational health research; determine the loss of muscle strength, nutritional status and in prevention or intervention strategies. A total of 300 Subjects of both sexes having age limit between 18 to 45 years has been participated in the study. In the present study we compared the handgrip strength of both dominant and non-dominant hand between the 2 group i.e., heavy manual labourers & students. Data was collected for Right hand as well as for Left hand. The data was collected by the help of Digital hand dynamometer. The variables declared were Age, Weight, Gender, BMI, Occupation, Hand Dominance and mean SD of Students and Heavy Manual Labourers. In our study we conclude that all the parameters except height are significantly stronger and faster in right hand. On the other hand left hand grip strength of heavy manual labourers showed significantly stronger hand power strength than all the parameters which we have taken. It is important that physical characteristics and health status support well preserved body energy, protein stores and muscle strength. The purpose of the investigation here was to develop an attitude of self-health appraisal & consciousness/awareness in subjects and assessed their fitness status.*
Keywords: *Handgrip Strength, Digital Hand Dynamometer, Height, Weight, BMI*

Received 25 August, 2021; Revised: 07 September, 2021; Accepted 09 September, 2021

I. INTRODUCTION

The hand is a tortuous anatomical system of static and dynamic structures. Hand could be a crucial and inescapable organ for humans, and is merely designed for holding and gripping the specific movements for serving as a tactile organ.[1] Adequate strength forms the basis for normal hand functions, it capacities begin from a fine to net motor activities. [2]

1.1ANATOMY OF HAND :-

The skin of the palm is abundant for protection of underlying tissues, immovable because of its firm attachment to the underlying palmer aponeurosis. All these features raised the efficiency of the grip.

Aponeurosis is defined as pearly-white appearance of fibrous tissue deep fascia that sticked on muscles like a sheet spread in a wide area of attachment.

The Hand consists of 27 bones within the wrist and hand. The wrist itself contains 8 small bones named carpals. Additionally, the carpal bones attached with the metacarpals into the palm. Each one of the metacarpal associates to each fingers and thumb. Small bones shafts called phalanges line up to form each finger and thumb.

1.1.1. JOINTS There are 30 joints present in the human hand. The carpals unite with the forearm bones namely the radius and ulna establishes the wrist joint. The principle knuckle joints are formed by the connection of the phalanges to the metacarpals, and these joints are called as Metacarpophalangeal joints [MCP Joints]. The MCP joints acts like a hinge, when you flex and straighten your fingers and thumb. The three phalanges in each finger are separated by two joints, called as interphalangeal joints. The one which is adjacent to the MCP joint [knuckle] is called is called the proximal IP joint.

The two vital structures found on either side of each finger and thumb joints are the Collateral ligament''- there work is to prevent against abnormal sideways bending of each joint. Amongst all, in the PIP joint is the well-built ligament is the volar plate. This ligament keeps the PIP joint from falling back beyond its normal range i.e; hyperextension. This happens whenever there is a finger deformity, road traffic accidents, disease i.e; OA, RA in such cases plate loosens.

1.1.2. TENDONS The tendons which allow each finger to align are called as Extensor Tendons. The Extensor tendons of the fingers start up as muscles that arise from the backside of the bones of forearm. These muscles proceed towards the hand, where they eventually connect to the extensor tendons before decussate over the back of the wrist joint. When the extensor muscles contract, they pull on the extensor tendon and straighten the finger. Problems can happen, when the central slip is ruptured as can occur with a muscle tear.

1.1.1.3. MUSCLES There are 33 muscles in human hand including forearm compartment. The muscles that control the hand, begins at the elbow or forearm. They run downwards in the forearm and cross the wrist and hand. Some muscles control only the bending or straightening of the wrist, others influence motion of the fingers or thumb. Many of these muscles help position and hold the wrist along with the hand while the thumb and fingers grip execute the fine motor actions.

The smallest muscles that originate in the wrist and hand are called the extrinsic muscles. The intrinsic muscles guide the fine motions of the fingers by getting the fingers positioned and holding them steady during hand activities. [3]

1.2. INTRINSIC MUSCLES OF HAND :-

There are 20 muscles in the Hand-

- ✓ Abductor pollicis brevis
- ✓ Flexor pollicis brevis
- ✓ Opponens pollicis .

Adductor of the thumb-

- ✓ Adductor pollicis

Four hypothenar muscles-

- ✓ Palmaris brevis
- ✓ Abductor digiti minimi
- ✓ Flexor digiti minimi
- ✓ Opponens digiti minimi.

Four Lumbricals-

Four Palmar interossei-

Four Dorsal interossei [4]

All nerves that travel to the hand and fingers begin together at the shoulder, the radial nerve, the median nerve, and the ulnar nerve. These nerves convey signals from the brain to the muscles and also carry signals back to the brain about sensations such as pain, touch and temperature from hand. The radial nerve runs along the thumb-side edge of the forearm. It supplies the back of the thumb and just beyond the main knuckle of the back surface of the ring and middle fingers. The median nerve control the thenar muscles of the thumb and touch pads of the thumb to the tips of each finger on the same hand, a motion called opposition. The ulnar nerve supply the small muscles in the palm and the muscles that pulls the thumb towards the palm. [5]

Finally, the bones, muscles, ligaments, tendon, blood vessels are protected by skin.

Skin is divided into 2 categories- Dorsal skin & Palmar skin. [6]

1.3. FUNCTIONS OF HAND :-

- For holding and grasping.
- Clapping after a great performance.
- Several daily activities, sports events require higher involvement of hands activity.

1.3.1 GRIPPING Refers to the position of hand when we hold or grasp the things securely and firmly, and how substantial the objects you can grip. [7]

1.3.2. HAND GRIP: Hand and forearm muscles contributes to a vital role in grip strength. These muscles give immense strength to the hands when a person squeeze or hold something when needed. [8] The muscle plays a significant role in several daily functions and sports events as they required energetic involvement of hands. [9]

An individual may use their hands in certain ways, they used to grip objects in different aspects of normal day to day life such as using tools, raising a chair from one place to another. Eating, maintaining hygiene, playing piano or tennis. Transferring objects and using hand in writing or typing anything, different position requires grip strength. [10]

Three types of power grip: - Cylindrical Grip, Spherical Grip & Hook Grip [11]

1.3.3. MAXIMAL HAND GRIP STRENGTH Maximal hand Grip is a worldwide commonest phenomenon used as a part of physical examination of human among various ailments that affects the neuromuscular, musculoskeletal disorders, elderly, critically ill subjects, bed ridden subjects and also obese population. [12] The Handgrip Strength is affected by multiple factors such as age factor, body – built, gender, nutrition, smoking, psychological factor , temperature and many more. [13]

There are numerous physiological factors that contribute to a grip strength-

✓ **Hand Size** Grip strength is the ability to firmly grip an object. As a result, hand size is a physiological factor of strength .Someone with large hand & long fingers will generally have a greater strength as compared with smaller hand or shorter fingers.

✓ **Forearm Strength** The strength in forearm is a utmost factor contributing to a level of grip strength. It can improve the strength of forearm muscles to enhance grip strength through specific resistance training exercise.

✓ **Body Weight** similar to hand size, body is directly correlated to the grip strength than someone who is skinny and light weight.

✓ **Dexterity** Level of dexterity is another physiological factor of grip strength. For majority of population the dominand hand or the hand preferred for considerable daily activity- is the hand found with most grip strength. [14]

1.3.4. THE SIGNIFICANCE OF HAND GRIP STRENGTH For most the life we tend to take the grip strength of hand for concede. It gives indication about general muscle strength, endurance and power and for many functions, it is mandatory to maintain the integrity of handgrip. Since the day we born, we began our life with holding pencil , and certain things and finish over the pen , so we realize that how much important our handgrip is , that almost independent work is merely depends on handgrip strength.

We perform several activities in normal day to day to life i.e;- turning the handles, vacuuming, lifting heavy objects, opening jars of bottles, turning a doorknob, household work, official work , grasping steering wheel. As we reached into the senile age group, the handgrip as well as overall muscle power declines.

Some researchers has believed that the weaker your handgrip is, the greater the risk of having a cardiac arrest or stroke. [15]

1.3.5. DIGITAL HAND DYNAMOMETRE Grip of the hand is inspected by special equipment called Digital dynamometer. It is an instrument which is used for measuring the maximum isometric strength of the forearm muscles. It is a medical device that is used for rule out an individual strength, measuring the output of power and \ or the forces that the muscles are use during contraction. Hand dynamometer is used to access a patients grip, and overall body strength. Testing is generally attain by having patients squeeze the digital dynamometer as hard as they can, and the results are needed .They are used for purpose of comparative measurement of both right and left hands .Any kind of hand disorder, trauma or dysfunction, can be easily judged by the help of these devices. [16]

1.4. MODIFICATION OF EVOLUTION OF HUMAN HANDS

The Hand of a chimpanzee will be considered as a model similar for the hand of a primate family. There were great apes who lives with their families and after millions of years, they transform and convert into human being [Sibley, 1992 [17] The hand of a chimpanzee are long, fingers, metacarpal and carpal bones are elongated. Their thumb is relatively delicate, stout and immovable in quality. The handgrip of chimpanzee's is closely resembles to those of humans (Napier, 1960) [18] .Their thumb may touch the support but does not hold it properly and squeeze as human does against the palm. Chimpanzee's thumb is short, weak, due to which the distal phalanx is relatively not movable much, so that the distal pad cannot be opposed to those of the fingers.

That's why they cannot grasp or pinch something or hold it tightly as humans. Their hand symmetry is not well – built and progressive as they lacking fibro fatty cushions and absence of curvature.

❖ [19] In Napier's portrayal of the exactness hold (Napier, 1956, 1965, 1993), the terminal cushion of the thumb structures one jaw of a cinch, the other being shaped by the fingertip cushions. Enormous items held along these lines include all the fingers, yet littler ones require just the thumb, record and center fingers with the fourth and fifth fingers giving sidelong security. Marzke (1992) [20] considers this the 'finger-dynamic palm press' hold, represents it with a sledge and expresses that it utilizes all the fingers to make sure about a tube shaped apparatus against the palm, so the instrument capacities as an expansion of the hand and lower arm.

These depictions clarify that the 'exactness hold' is a tossing grasp, and the 'power grasp' is a clubbing hold. 'Exactness' and 'force' recommend run of the mill utilizes for the grasps. 'Three-jaw hurl' and 'finger-dynamic

palm crush' allude to the situation of the hand when it shapes the holds. They could be known as the 'circle hold' and 'chamber grasp' in view of the shape they are best ready to get a handle on. The terms tossing hold and clubbing grasp stress the developmental setting wherein these grasps advanced by determining the practices that represent them. The one of a kind highlights of the human hand can be seen as adjustments for tossing and clubbing.

1.4.1. Adjustments of the hand for tossing :-

For productive tossing the hand must have the option to hold the rocket while vitality is transmitted to it, at that point precisely control its discharge. [21] This requires a fingertip grasp. The thumb must be sufficiently long and adequately versatile to contradict at the tip of its finger cushion to the rocket on one side while the fingers restrict their distal cushions to the contrary side and change themselves to abnormalities in normally happening rock spheroids.

These adjustments are completely found in the human hand. The thumb has stretched and can be completely contradicted to the fingers, which have abbreviated. The thumb and the initial two fingers, which assume the significant job in the tossing hold, are solid and powerful. Thumb resistance is improved by expansion of a muscle that flexes the terminal phalanx, and is coordinated by turn of the fingers as they flex: supination on the ulnar side, pronation on the spiral side – precisely varying for a fingertip hold of a circle. Wide apical phalangeal tufts bolster delicate, meaty fingertip cushions that adjust to sporadic spheroids and give a huge grinding surface. [22] Stress goes down the phalanges through the metacarpals in the palm to the carpal bones where it is disseminated. The power of the second and third fingers which ingest pressure, the styloid procedure and ligamentous adjustment of the third metacarpal which forestall hyperextension, and the profound palmar fat cushion which shields the ulnar nerve all add to ensuring the hand against tossing injury.

1.4.2. Adjustments of the hand for clubbing:-

Successful clubbing requires a protected grasp, particularly during sway, with the goal that the time during which power is applied is augmented, redirection of vitality into flexible force is limited and the clubber may utilize the weapon again right away. Fingers and thumb structure a bad habit, pressing the club handle against the palm. For included power and hold quality, two hands might be utilized.

A few highlights that add to the tossing grasp likewise encourage the clubbing hold. Supination of the fourth and fifth fingers during flexion helps the grasp of a huge spheroid and acts to apply the palmar surface of these fingers to a clubhandle orientated at a slant over the palm (Marzke and Shackley, 1986; Marzke et al. 1992. The flexor pollicis longus muscle is viable in the two holds, similar to the profound palmar fat cushion. [23]

Different adjustments are explicit to the clubbing grasp. One of these is the inclination of the metacarpal–phalangeal explanations. At the point when the fingers are halfway flexed, they structure an angled line. Along with the in part flexed thumb, a passageway is framed – a round and hollow depression lying corner to corner over the palm. [24]

The thumb is basic for 'holding tight close' (House, 1994; Ohman et al. 1995; Welch et al. 1995). Its heartiness and strength are adjustments for power clubbing. [25]

1.4.3. The wrist :-

Inferred changes in the human wrist can be clarified as adjustments for tossing and clubbing. In tossing, the wrist moves from expansion to flexion. During clubbing, it moves from outspread to ulnar deviation. These developments in people far surpass the capacities of the chimpanzee wrist (Napier, 1960) [26]

1.4.4. The Common Factors Responsible for Hand Grip Strength:-

1.4.4.1. STANCE An examination inspected the grasp qualities were diverse when estimated in both posture what's more, sitting positions and the examination uncovers that there is no distinction in hold quality in various position, Richards [3] however Teraoka [4] found that hold quality estimation for standing is more grounded than recumbent. Shyam kumar [5] appeared a distinction in hold quality in various stances because of progress long of the muscle.

1.4.4.2 SEXUAL ORIENTATION AND HANDEDNESS Most of the specialists mean estimation of hand hold quality of grown-up male and female subject was higher in right hand contrasted with left hand in various stance and joint point. [27] Anyway crafted by Reikeras [8] and Roberts [9] detailed that there is no critical contrast in hold quality of predominant and non-dominant hand. Aside from the prevailing or non-dominant hand the sex plays a significant job. The male subjects indicated more noteworthy hold quality than female partner. [28] Shepherd [10] expressed that women are 40-60% more vulnerable in upper lumbar and 25-30% more vulnerable in lower limb contrasted with men. [29]

1.4.4.3. NOURISHING STATUS It additionally has been corresponded to handgrip quality. Guo et al [11] and Kenjile et al [12] saw hold quality as a solid indicator of a person's nourishing status. These discoveries attract corresponding to the discoveries of the anthropometric estimation considers. [30] Wang et all [13]

recommended for assessing hold quality as a dietary marker, hand hold quality not just demonstrates the slender weight yet in addition utilized in combination with serum egg whites. [31]

1.4.4.4. WRIST AND LOWER ARM POSITION A biomechanical point of view, the length strain relationship (LTR) of the muscles is the fundamental when testing the grasp quality. For instance the flexor digitorum superficialis is crossing both the elbow and wrist, so the flexion of elbow and wrist will influence the scope of finger flexion because of its abbreviated position. [32] Davide [14] guaranteed that wrist position fundamentally influence the hand grasp quality and diminished quality might assume a significant job in inclining rehashed over-burden.

1.4.4.5. ARM SUPPORT Arm position additionally influences the hold quality. Different examinations indicated that the flexed shoulder positon had a more noteworthy grasp and even squeeze hold in 0 degree position. [33] Su [15] with 180 degree flexed shoulder has a most noteworthy grasp quality than 0 degree flexion.

1.4.4.6. AGE Hand hold quality diminishing when age propels. [34] Kamarul [17] the most grounded hold in the right side predominant gathering old enough 25-35 years while left hand predominant gathering hering old enough between 35-44 years. Be that as it may, the vast majority of the analysts accepted that correct hand is similarly more grounded than left hand of any age.

1.4.4.7. TIME FACTOR Grip quality performed on different time has a diurnal variety. [35] Martin [18] expressed that variety in hold quality of the people, hold is more noteworthy between 6.00 am to 9.00 am and diminished hold quality between 8.00 pm to 4.00am.

1.4.4..8. HAND OUTLINE Hand periphery likewise a significant factor in grasp quality. [36] Anakwe [19] proposed that distinction in lower arm circuit of in excess of 2 cm may reduce grasp quality among moderately aged subjects. [37] Vikram [20] expressed that hand grasp quality can be anticipated by utilizing lower arm perimeter also, hand length for prevailing and non-predominant and among Malaysian population.

1.4.4.9. MENTAL FACTOR Various analysts assessed the impact of trance close by hold quality. [38] Hadfield [23], proposed that trance can deliver harmful just as ameliorable impact on hold quality. Mental variables seem to influence inability (understanding detailed wellbeing status) more than they influence execution based proportions of capacity. [39] Jung [25], were critical contrasts in stature weight, BMD, DASH, GSD-K, and SF36-MCS scores among people on hold quality among old populace in Korea.

1.4.4.10. TEMPERATURE Most of the specialist utilized warmth furthermore; cold as a helpful and assessment of muscle hold quality [40]. Imprint [26] that next to zero change in muscle quality happened with muscle temperature changes somewhere in the range of 27 and 40C. [41] Deepak [27], found that high temp water builds hand grasp quality when contrasted with cold temperature in typical person.

1.4.4.11. OXYGEN Oxygen and glucose are the fundamental vitality hotspot for the muscles. [42] Consolazio [30], hand hold quality will diminish to diminish in oxygen and increment in carbon dioxide level. [43] Cortopassi [32] expressed that the Patients with COPD had diminished lung work, static hyperinflation, diminished HGS and 6MWD contrasted with the controls on both assessments because of low oxygen level.

1.4.4.12. WEARINESS Fatigue is unavoidable part in any action; it might influence the individual execution. Physical exhaustion has been recognized as a hazard factor related with the beginning of word related injury. [44] Fernandes [34] critical decrease in quality levels happens in course of the evaluation. The best outcome is every now and again acquired at the first preliminary, which shows that the most elevated worth acquired ought to be considered as the last result.

1.4.4.13. NOURISHMENT Nutritional status is a basic part of wellbeing and the way that ailing health can happen in a created nation with great principles of human services is facing. Hand grasp quality (HGS) has been found to react to nourishment hardship and repletion yet not many examinations have explored its utilization as a free sustenance appraisal instrument.

1.4.4.14. SMOKING Current smokers were found to have higher danger of diminished grasp quality analyzed with non-smokers. [45] Saud [38], smokers shown decreased hold quality and quick fatigability in contrast with non-smokers. Diminished skeletal muscle contractile perseverance in smokers may result from disabled oxygen conveyance to the mitochondria and capacity of the mitochondria to create ATP because of collaboration of carbon monoxide with hemoglobin, myoglobin and segments of the respiratory chain.

1.4.4.15. LIQUOR The impacts of liquor can rely upon the sum expended, the ecological setting, and on the person. Day by day utilization of up to four beverages may have a defensive impact on the cardiovascular framework In any case, individuals most regularly drink for liquor's anxiolytic less-lessening) property. Alternately, liquor has a wide range of negative impacts, from cultural to physiological, representing around 100,000 passings yearly in the United States. [46]

II. MATERIALS AND METHODS

The present study will be conducted in the department of Anatomy IIMS&R, Lucknow.
The study will be conducted after obtaining approval from the institutional research and ethical committee of IIMS&R.

2.1. STUDY DESIGN:-
Cross sectional study of North Indian Population.

2.2. DURATION:-
1 Year.

2.3. SAMPELING TECHNIQUE:-
Random sampling technique was used in this study for collection of data.

2.4. SAMPLE SIZE:-
300 Adult Subjects (150 Students and 150 Heavy Manual Labourers Male and Female both)

2.5. MATERIALS:-
Digital Hand Dynamometer
Pen
Consent Form
Table
Chair

2.6. INCLUSION CRITERIA:-
Subjects belonging to North India.
Subjects above 18 years of age group.
Subjects ready to participate willingly.
Subjects should follow the instructions for the measurement of grip straight by dynamometer.

2.7. EXCLUSION CRITERIA :-
Subjects with history of trauma to upper limb.
Deformity of upper limb – acquired or congenital.
Subjects who use to do Gym.

2.8. METHOD OF COLLETION OF DATA :-

- Explaining the whole procedure to each subject individually the written consent will be obtained.
- A total of 300 Subjects of both sexes having age limit between 18 to 45 years has been participated in the study. Data was collected for Right hand as well as for Left hand.
- During the procedure, the subject asked to seat comfortably with back, arm and for arm should be at 90 degree.
- The data was collected by the help of Digital hand dynamometer.
- The subject was asked to take a deep breath and stay relaxed.
- Further the Digital hand dynamometer was handed over to the subject and was asked to squeeze bar of toll as much as he/she can, and asked to hold it for 6 seconds with dominant and non-dominant hand thrice.
- The relaxation time of 5 seconds was given to the individuals in between these trials to relief stress.
- The first reading of right and left hand were recorded with the Digital hand dynamometer, and used for calculating the grip strength ratio and comparing it with dominant and non-dominant side of the subject.
- The obtained data will be tabulated and statistically.

III. RESULTS

In the present study the variables declared were Age, Weight, Gender, BMI, Occupation, Hand Dominance and mean SD of Students and Heavy Manual Labourers.

3.1. Comparison of Variables in Students and Heavy Manual Labourers :-
As depicted in table 1.1, the mean height of heavy manual labourers ± SD of control group was 162.60 ± 4.61
The mean weight ± SD in control group was 64.63 ± 5.80
The mean BMI ± SD in control group was 24.57 ± 1.88
The mean grip strength of Right hand ± SD in control group was 75.65 ± 24.86
The mean grip strength of Left hand ± SD in control group was 66.00 ± 27.62
As depicted in table 2, the mean height of students ± SD of control group was 162.53 ± 9.12
The mean weight ± SD in control group was 60.32 ± 8.71
The mean BMI ± SD in control group was 22.95 ± 3.40
The mean grip strength of Right Hand ± SD in control group was 46.11 ± 24.35
The mean grip strength of Left Hand ± SD in control group was 44.31 ± 25.73

3.2. Correlation of Hand Grip Strength Among Different Population :-
As shown in table 3, height shows negative correlation with ($t=0.036$) & ($p<0.972$) which is not statistically significant.

Weight shows positive correlation with (t=2.260) & (p<0.028) which is statistically significant.
BMI shows positive correlation with (t=2.280) & (p<0.026) which is statistically significant.
Grip Strength of Right Hand shows positive correlation with (t=4.649) & (p<0.000) which is statistically significant.
Grip Strength of Left Hand shows positive correlation with (t=0.003) & (p<0.003) which is statistically significant.~ 73 ~

3.3. Correlation of Handgrip Strength Between Dominant and Non-Dominant Hand :-

As shown in table 4, height shows positive correlation with (t=-0.286) & (p>0.777) which is statistically significant.
Weight shows positive correlation with (t=-2.145) & (p>0.041) which is statistically significant.
BMI shows positive correlation with (t=-1.445) & (p>0.160) which is statistically significant.
Grip Strength of Right Hand shows positive correlation with (t=-1.358) & (p>0.185) which is statistically significant.
Grip Strength of Left Hand shows negative correlation with (t=-3.567) & (p>0.001) which is not statistically significant.

3.4. Data Analysis

Descriptive Statistics were measured for Age, Height, Occupation, Gender and Hand Dominance.

P Value <0.05 was taken to be significant difference of quantitative variables between the study groups was done using Student t_ test. For comparing categorical data, Chi Square (X^2) test was performed and exact test was used when expected frequency is less than 5.

IV. DISCUSSION

Grip Strength is the force applied by hand to pull on or suspend from objects and is a specific part of hand strength. [7] The Handgrip Strength plays on essential role in the daily lives of people and serves as a reliable proxy indicator of an individual's hand motor abilities.

Occupation is considered to be a strong predictor of an individual's handgrip strength. Hand Grip Strength can be influenced by various physiological & anthropometric parameters such as Age, Occupation, Gender, Weight, Height and BMI. Hand Grip Strength can be measured by a medical device named Digital Hand Dynamometer and useful for as a diagnostic toll to assess the musculoskeletal disorders of the upper extremities, nutritional status and to determine the loss of handgrip strength.

The present study was conducted on 60 subjects and categorized into 2 groups i.e., heavy manual labourers & students. (30 Heavy manual labourers, males and females) (30 Students males & females) respectively between the age group of 18-45 among the North Indian Population. The Hand Grip Strength were taken and analyzed to know the greater grip strength on which side and stronger in which group.

Results of this study demonstrate that amongst 2 groups, the grip strength of Heavy Manual Labourers of left hand is more than right hand. Whereas in Students the Grip Strength was greater is dominant hand than non-dominant hand. In our study side of hand dominance was and important variable to check the difference between, students grip strength and heavy manual labourers grip strength and also find out the loss of strength from dominant to non-dominant hand.

Grip strength of heavy manual labourers of left hand shows positive difference with (t=3.567) & (p>0.001) which is statistically significant.

And in students the right hand shows positive difference with (t=4.649) & (p<0.000) which is statistically significant.

A study by Shyamal Koley et. al (2012) correlated the dominant hand grip strength and selected anthropometric & physiological characteristics. Results of this study showed significant (p<.004 - .000) differences with positive correlations found between right and left hand grip strength and all the variable studies except percent body fat (where the correlation were significantly negative) further relating their results to our study, no of subjects with right hand dominance and left hand dominance were not specified in the study.

Conducted by Shyamal Koley at. al. as in our study side of hand dominance was in variable to check the difference in loss of strength from dominant to non-dominant side.

A study by Muhammad Rafique et. al. (2014) had an objective to describe normative data and compare BMI and hand grip strength of dominant hand of students of 2 different universities. They resulted in stating that female who had normal BMI calculated based on their height and weight; and more grip strength than those who were overweight and obese. Relating this result with our study; we had subjects having BMI with minimum of 15 and maximum of 35. But, in our study we did not classify this data on the basis of gender as they did and did not correlate gender, BMI and Hand grip ratio among each other.

A study by S Koley at. al (2008) stated that Handgrip Strength is positively correlated with nutritional status. Handgrip strength used as a functional index in every human life and is of great value of nutritional status.

Improved nutritional level can build up the hand power of an individual.

The results of this study demonstrates between younger and senile female labourers were statistically significant differences ($p<-0.05$) in all the parameters which was considered. Hence the differences were found between younger and order female labourers in respect to Handgrip Strength, hand dominance, age factors, occupational status.

V. CONCLUSION

In the present study we compared the handgrip strength of both dominant and non-dominant hand between the 2 group i.e., heavy manual labourers & students (60 subjects in which 30 students & 30 heavy manual labourers, males and females respectively in North Indian Population).

Handgrip Strength can also provide a simple, coast effective as well as a useful weapon in occupational health research, determine the loss of muscle strength, nutritional status and in prevention or intervention strategies.

The right hand grip strength is found more than left hand in students. In our study we conclude that all the parameters including height, weight, BMI, right and dominance and left hand dominance. Except height, all the parameters were found significantly stronger and faster in right handed.

On the other hand left hand grip strength of heavy manual labourers showed significantly stronger hand power strength than all the parameters which we have taken.

In our study, the Handgrip strength was significantly higher in heavy manual labourers as compared to students. Reason is this that student are not indulge in any occupational atmosphere or any heavy intensive field work, they studying at a particular institute and return back to their rooms after school or college hours. That's why their handgrip strength is normal or below of dominant & non-dominant side.

Heavy manual labourers, who does one of the constructional field trade work from teenage to adulthood life, daily wage labourers and specialist in electricians, carpenters, plumbers and employed in labour intensive primary work.

Men and women who work in different constructional sites or field they are doing strenuous physical work, transferring and pulling heavy objects and constriction material.

Repetitive or monotonous tasks, physical work wad, the hand muscles will have to work more and in daily use and that's the reason their handgrip strength is more than normal.

It is important that physical characteristics and health status support well preserved body energy, protein stores and muscle strength.

The purpose of the investigation here was to develop an attitude of self-health appraisal & consciousness/awareness in subjects and assessed their fitness status. The study innovative was encouraging and the subject participant's attitude towards the health activities was positive.

Conflict of Interest: Nil

Fig no. 1 Photograph Showing the Digital Hand Dynamometer

Fig no. 2 Photograph Showing the Measurement of Handgrip Strength by the help of Digital Hand Dynamometer

Fig no. 3. Photograph Showing the Subject Holding the Digital Hand Dynamometer

Table-1 Demographic Parameters

		GROUP		Total	Chi-square value	p-value
		Heavy Manual Labourers	Students			
Age group	< 25	70	100	170	28.708	0.000
	> 25	80	50	130		
Gender	Female	50	70	120	0.000	1.000
	Male	100	80	180		
Dominant	Right	110	110	220	0.000	1.000
	Left	40	40	80		
Total		150	150	300		

Table-2 Parameters in Heavy Manual Labourers

	Heavy Manual Labourers	
	Mean	SD
Height (cm)	162.60	4.61
Weight (kg)	64.63	5.80
BMI	24.57	1.88
Grip Strength Right	75.65	24.86
Grip Strength Left	66.00	27.62
Grip Ratio	1.24	0.35

Graph Showing the Handgrip Strength in Heavy Manual Labourers

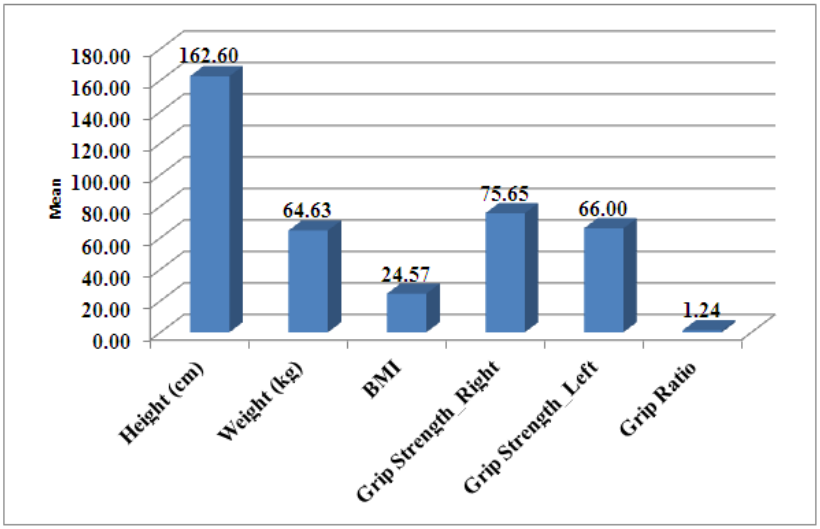


Table-3 Parameters in Students

	Students	
	Mean	SD
Height (cm)	162.53	9.12
Weight (kg)	60.32	8.71
BMI	22.95	3.40
Grip Strength Right	46.11	24.35
Grip Strength Left	44.31	25.73
Grip Ratio	1.10	0.29

Graph Showing the Handgrip Strength in Students

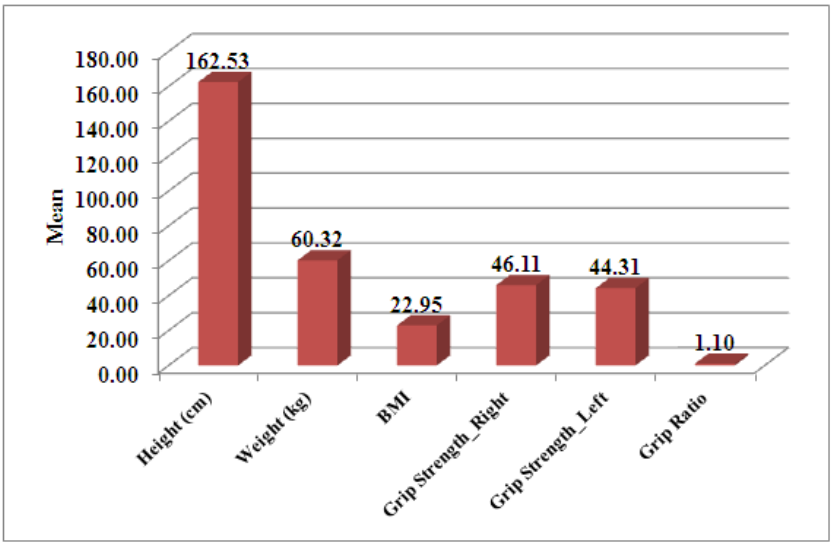


Table-3 Handgrip Strength in Different Population

	Heavy Manual Labourers		Students		t	p-value	Difference		95% Confidence Interval of the Difference	
	Mean	SD	Mean	SD			Mean	SD	Lower	Upper
Height (cm)	162.60	4.61	162.53	9.12	0.036	0.972	0.07	1.87	-3.67	3.80
Weight (kg)	64.63	5.80	60.32	8.71	2.260	0.028	4.32	1.91	0.49	8.14
BMI	24.57	1.88	22.95	3.40	2.280	0.026	1.62	0.71	0.20	3.04
Grip Strength Right	75.65	24.86	46.11	24.35	4.649	0.000	29.54	6.35	16.82	42.26
Grip Strength Left	66.00	27.62	44.31	25.73	3.147	0.003	21.69	6.89	7.89	35.49
Grip Ratio	1.24	0.35	1.10	0.29	1.655	0.103	0.14	0.08	-0.03	0.31

Graph Showing the Handgrip Strength in Different Population

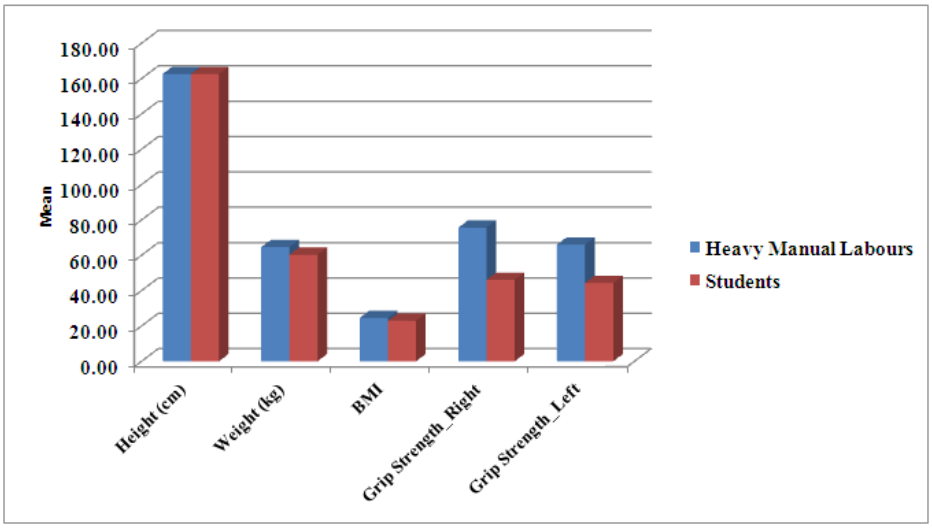


Table-4 Handgrip Strength in Dominant and Non-Dominant Hand of Students

Students	Right		Left		t	p-value	Difference		95% Confidence Interval of the Difference	
Non-Dominant	Mean	SD	Mean	SD			Mean	SD	Lower	Upper
Height (cm)	162.29	9.23	163.50	9.44	-0.286	0.777	-1.21	4.23	-9.88	7.46
Weight (kg)	58.71	8.71	66.75	5.36	-2.145	0.041	-8.04	3.75	-15.72	-0.36
BMI	22.51	3.47	24.72	2.66	-1.445	0.160	-2.20	1.53	-5.33	0.92
Grip Strength Right	43.14	21.15	58.02	34.21	-1.358	0.185	-14.88	10.96	-37.32	7.57
Grip Strength Left	37.24	18.25	72.60	33.30	-3.567	0.001	-35.36	9.91	-55.66	-15.06
Grip Ratio	1.19	0.25	0.76	0.19	3.896	0.001	0.43	0.11	0.20	0.65

Graph Showing the Handgrip Strength in Dominant and Non-Dominant Hand of Students

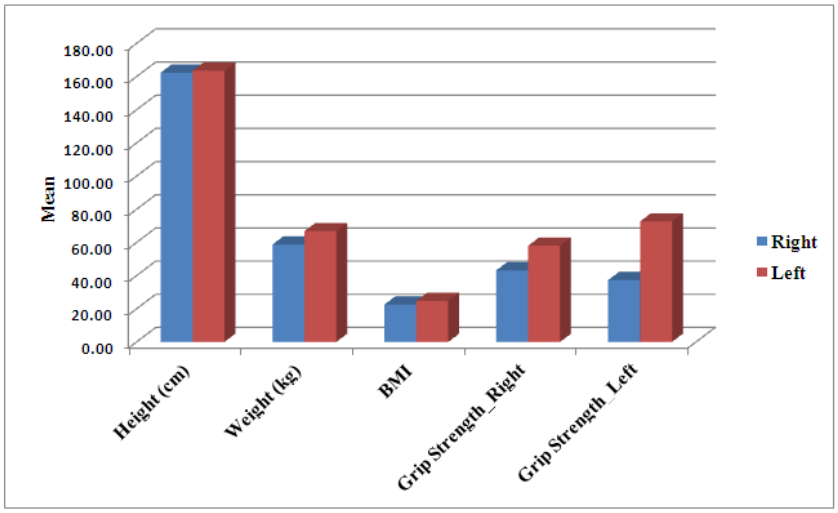
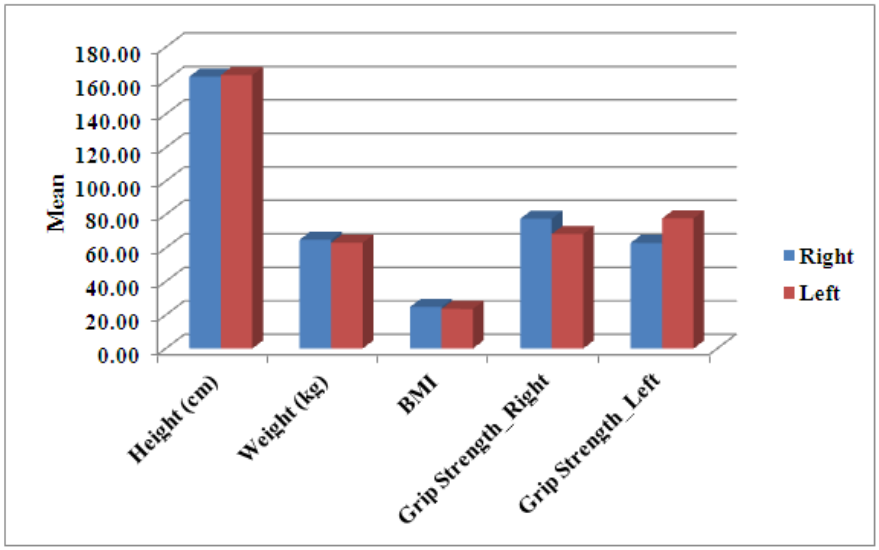


Table-5 Handgrip Strength in Dominant and Non-Dominant Hand of Heavy Manual Labourers

Heavy Manual Labourers	Right		Left		t	p-value	Difference		95% Confidence Interval of the Difference	
Non-Dominant	Mean	SD	Mean	SD			Mean	SD	Lower	Upper
Height (cm)	162.42	4.83	163.33	3.88	-0.430	0.671	-0.92	2.13	-5.28	3.45
Weight (kg)	65.00	4.99	63.17	8.80	0.686	0.498	1.83	2.67	-3.64	7.30
BMI	24.81	1.65	23.62	2.59	1.414	0.168	1.20	0.85	-0.54	2.93
Grip Strength_Right	77.48	24.28	68.37	28.16	0.798	0.432	9.11	11.42	-14.29	32.50
Grip Strength_Left	63.08	27.01	77.72	29.41	-1.169	0.252	-14.64	12.53	-40.31	11.02
Grip Ratio	1.34	0.34	0.87	0.07	3.298	0.003	0.46	0.14	0.17	0.75

Graph Showing Handgrip Strength in Dominant and Non-Dominant Hand of Heavy Manual Labourers



REFERENCES

[1]. Chaurasia's, B D. Forearm and Hand. In: Jain K. Satish and Jain. Vinod (Seven edition) - Human Anatomy. Upper Limb and Thorax Volume 1. (2018) Pg 111. New Delhi: CBS Publisher abd Distributers Pvt. Ltd.
[2]. Kumar, P. Hand anatomy [online] Pg 1. (2001) New Delhi: abd distributers. eorthopod.com [Accessed : 9/7/2020]
[3]. Kumar, P. Hand anatomy [online] Pg 1. (2001) New Delhi: abd distributers. eorthopod.com [Accessed : 9/7/2020]
[4]. Kumar, P. Hand anatomy [online] Pg 1. (2001) New Delhi: abd distributers. eorthopod.com [Accessed : 9/7/2020]
[5]. Kumar, P. Hand anatomy [online] Pg 1. (2001) New Delhi: abd distributers. eorthopod.com [Accessed : 9/7/2020]
[6]. Thompson D Bimechanics of hand. In: Gwenda Sharp OTR. Last update 8/7/2020 © Dave Thompson. (2001) Pg 2-3.
[7]. Wikipedia for Grip Strength- Available from : http://crwnwiki.staffs.ac.uk/subjectwiki/GripStrength . [Accessed: 7/7/2020]
[8]. Chris jeuseu hanne christenseer vol. 30, issue 4-5 oct: 2002, pages 265-275. (international journal of industrial ergonomics)
[9]. Jason, S. The Importance of Grip Strength. In: PES. (2000) Pg 1.
[10]. Skelton DA, Greig CA, Davies JM and Young A: Strength, power and related functional ability of healthy people aged 65±89 years. Age & Ageing; 1994; 23: 371-377.
[11]. Vernier D. (2005) Grip Strength. –Human Physiology.
[12]. Chopra, D. Hand Grip Dynamometer. (2002) Pg 1. New Delhi: topendsports.
[13]. Koley S, Pal Kaur S. Correlations of handgrip strength with selected hand-arm-anthropometric variables in Indian interuniversity female volleyball players. Asian J Sports Med. 2011; 2(4): 220-6.
[14]. Physiological factors of grip strength copyright © 2015 demand media, inc. use of this website constitutes acceptance of the livestrong.com terms of use and privacy policy. the material appearing on livestrong.com physiological factors of grip strength July 5, 2020 by jeremy hoefs pg. 1-2
[15]. Jason, S. The Importance of Grip Strength. In: PES. (2000) Pg 1.
[16]. Chopra, D. Hand Grip Dynamometer. (2002) Pg 1. New Delhi: topendsports.
[17]. Sibley CG. DNA-DNA hybridisation in the study of primate evolution. In: Jones S, Martin R, Pilbeam D, editors. The Cambridge Encyclopedia of Human Evolution. Cambridge: Cambridge University Press; 1992. pp. 313–315. [Google Scholar] [Ref list]
[18]. Napier JR. Studies of the hands of living primates. Proc. Zool. Soc. London. 1960;134:647–657. [Google Scholar] [Ref list]
[19]. The form and function of the carpo-metacarpal joint of the thumb. *NAPIER JRJ Anat. 1955 Jul; 89(3):362-9.* [PubMed] [Ref list]
[20]. Evolution of the power ("squeeze") grip and its morphological correlates in hominids. *Marzke MW, Wullstein KL, Viegas SF Am J Phys Anthropol. 1992 Nov; 89(3):283-98.* [PubMed] [Ref list]
[21]. Errors in the control of joint rotations associated with inaccuracies in overarm throws. *Hore J, Watts S, Tweed D J Neurophysiol. 1996 Mar; 75(3):1013-25.* [PubMed] [Ref list]
[22]. Marzke MW, Shackley MS. Hominid hand use in the Pliocene and Pleistocene: evidence from experimental archaeology and comparative morphology. J. Human Evol. 1986;15:439–460. [Google Scholar] [Ref list]
[23]. Joint remodelling and the evolution of the human hand. *Lewis OJ J Anat. 1977 Feb; 123(Pt 1):157-201.* [PubMed] [Ref list]
[24]. Joint remodelling and the evolution of the human hand. *Lewis OJ J Anat. 1977 Feb; 123(Pt 1):157-201.* [PubMed] [Ref list]
[25]. Thumbs, tools, and early humans. *Ohman JC, Slanina M, Baker G, Mensforth RP Science. 1995 Apr 28; 268(5210):587-9.* [PubMed] [Ref list]
[26]. Napier JR. Studies of the hands of living primates. Proc. Zool. Soc. London. 1960;134:647–657. [Google Scholar] [Ref list]
[27]. Richards LG. Posture effects on grip strength, Arch Phys Med Rehabil. 1997; 78: 1154-6. Teraoka, T. Studies on peculiarity of grip strength in relation to body positions and aging, Kobe Journal of Medicine Science. 1979; 25: 4-17.
[28]. Shyam kumar AJ, Parmar V, Ahmed S, Kar S, Harper WM. A study of grip endurance and strength in different elbow positions, J Orthop Traumatol Invest. 2008; 9: 209-11.
[29]. Shepard RJ. Exercise and training in women, Part I: influence of gender on exercise training Responses, Canad. J. Appl. Physio. 2000; 25: 19-34.
[30]. Guo CB, Zhang W, Ma DQ, Zhang KH, Huang JQ. Hand grip strength: an indicator of nutritional state and the mix of postoperative complications in patients with oral and maxillofacial cancers, Br J Oral Maxillofac Surg. 1996; 34: 325-7. Kenjle K, Ghurge P, Udipi S. Grip Strength as an Index for Assessment of Nutritional Status of Children Aged 6-10 Years, Journal of Nutrition and Science Vitaminol (Tokyo). 2005; 51: 87-92.
[31]. Wang AY, Sea MM, Ho ZS, Lui SF, Li P, Woo J. Evaluation of handgrip strength as a nutritional marker and prognostic indicator in peritoneal dialysis patients, Am J Clin Nutr. 2005; 81: 79-86.

[32]. Su C, Lin JH, Chein TH, Cheng KF, Sung YT. Grip strength in different position of elbow and shoulder, Arch Phys Med Rehabi. 1994; 21: 812-5.
[33]. Kamarul T, Ahmad TS, Loh WY. A novel and improved method of predicting hand grip strength in the adult population, Med J Malaysia. 2006; 61: 37-44.
[34]. Su C, Lin JH, Chein TH, Cheng KF, Sung YT. Grip strength in different position of elbow and shoulder, Arch Phys Med Rehabi. 1994; 21: 812-5.
[35]. Martin S, Neale G, Elia M. Factors affecting momentary grip strength. Human Nutrition: Clinical Nutrition. 1985; 39C: 137-47.
[36]. Anakwe RE, Huntley JS, Mc Eachan JE. Grip strength and forearm circumference in a healthy population, J Hand Surg Eur. 2007; 32: 203-9.
[37]. Vikram M, Noor Shafiqah S, Muhammad J, Nor Y, Leonard JH, Ida O. Forearm circumference and hand length predict maximal hand grip strength among Malaysian population, Middle-East J. Sci. Res. 2014; 21: 634-9.
[38]. Hadfield JA. The psychology of power. New York, Macmillan Company, 1923; 9-18.
[39]. Jung EL, Ki WK, Nam-Jong P, Hak C J, Chong BC, Goo HB, Young HL, Hyun S. Evaluation of Factors Influencing Grip Strength in Elderly Koreans, J Bone Metab. 2012; 19: 103–10.
[40]. Mark WC. Effect of temperature on muscle force and rate of muscle force production in men and women, JOSPT. 1994; 20: 74-80.
[41]. Deepak BA, Tejashree B, Ashish JP. Effect of cold & hot temperature on hand grip strength in normal individuals: Cross sectional study, VIMS Health Sci Journal. 2015; 2: 13-15.
[42]. Consolazio WV. The effect on personnel of various concentrations of carbon dioxide and oxygen under conditions of submarine operations. Research project X1945-349.
[43]. Cortopassi F, Celli B, Divo M, Pinto-Plata V. (). Longitudinal changes in hand grip strength, hyperinflation and 6-minute walk distance in COPD patients and a control group, Chest. 2015 May 21. doi: 10. 1378/chest. 14-2878.
[44]. Fernandes A, Brito J, Vieira C, Marins J. Effect of peripheral muscle fatigue during the testing of handgrip strength, Fisioter Mov. 2014; 27: 407-12.
[45]. Flood A, Chung A, Parker H, Kearns V, O'Sullivan TA. The use of hand grip strength as a predictor of nutrition status in hospital patients, Clin Nutr. 2014; 33: 106-14.
[46]. Saud O, Nowall S, Mohammed N. Smoking Impact on Grip Strength and Fatigue Resistance: Implications for Exercise and Hand Therapy Practice, JPAH. 2014; 11: 1025-31.