MEASUREMENT OF HAND GRIP STRENGTH AMONG HEALTHY ADULTS BY MODIFIED SPHYGMOMANOMETER: A NORMATIVE STUDY IN BANGLADESH

By

Ashraful Jannat Rima

April, 2019

This thesis is submitted in total fulfillment of the requirements for the subject RESEARCH 2 & 3 and partial fulfillment of the requirements for degree:

Bachelor of Science in Occupational Therapy

Bangladesh Health Professions Institute (BHPI)

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Statement of Authorship

Except where is made in the text of the thesis, this thesis contains no materials published elsewhere or extracted in whole or in part form a thesis presented by me for any other degree or diploma or seminar.

No others person's work has been used without due acknowledgement in the main text of the thesis.

This thesis has not been submitted for the aware of any other degree or diploma in any other tertiary institution.

The ethical issues of the study has been strictly considered and protected. In case of dissemination the finding of this project for future publication, research supervisor will highly concern and it will be duly acknowledged as undergraduate thesis.

Signature: _____ **Date: _____**

Ashraful Jannat Rima
4th year, B.Sc. in Occupational Therapy

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Dedication

Self-efforts as well as guidance of elders especially with whom we have very close relation make us able to overcome every challenging situation. Their affection, love and pray of day and nights make me successful in completion of this study. My humble effort I dedicate to my beloved and honorable parents and husband.

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LIST OF ABBREVIATIONS

ASHT: American Society of Hand Therapist

BHPI: Bangladesh Heath Professions Institute

CRP: Centre for the Rehabilitation of the Paralysed

GS: Grip Strength

HGS: Hand Grip Strength

MST: Modified Sphygmomanometer Test

UL: Upper Limb

UE: Upper Extremity

BMI: Body Mass Index

OT: Occupational Therapy

OTs: Occupational Therapists

SPSS: Statistical Package for the Social Science

ABSTRACT

Background and objective: Hand grip strength is a useful measurement for individuals. Grip strength is an essential prerequisite for good performance of the upper limb, hence it is important to evaluate it correctly. However, one of the main difficulties in evaluating the grip strength is the absence of valid norms. Therefore, the objective of this study was to develop normative value for maximum grip strength of persons aged 18 years and older. Furthermore, this study explores correlation between dominant Hand Grip Strength with demographic factors and anthropometric measurements.

Methodology: This study was done by quantitative method. The nature of the study is cross sectional study. The sampling technique was quota sampling. The study participants' age were 18 years and above. For HGS analysis, the 350 participants were divided into seven categories based on age: (a) 18–24 years; (b) 25–31 years; (c) 32–38 years; (d) 39-45 years; (e) 46-52 years; (f) 53-58 years and above 58 years. Each group included equal number (n=50) participants with 25 males and 25 females. The data was collected by using modified sphygmomanometer, consent form, information sheet, stadiometer, weighing scale and tape measure.

Result: In this present study there were 350 participants were selected. Where the male participants were 175 and female participants were 175. Result from the study peak level of grip strength is shown among middle aged people and GS diminishes curvilinearly with age, and men are consistently stronger than women. In addition to age and gender, hand length & breadth, body height and weight proved to be the best indicators of grip strength.

Conclusion: HGS is used widely in clinical practice and research to assess the impact of a variety of disorders on hand function. This study provides a large sample of normative value for clinical use in hand and upper limb rehabilitation, and possible screening for other health issues. It explores the relationship of grip strength with demographics & anthropometric measurements and found significant relationships with some factors.

Key words: Hand Grip Strength, Modified Sphygmomanometer, Normative data.

CHAPTER 1: INTRODUCTION

1.1 Background

In everyone's daily life upper limbs play an important role. A number of sensori-motor parameters, including grip strength, are essential for their optimum and satisfactory performance (Desrosiers et al., 1998). Hand is a complex organ which has various functions. Handgrip strength is one of the basic and significant elements of handling, strength and movement abilities of the hands, this abilities improve performance in activities of daily living (ADL). Hand Grip Strength is important as because about, 45% of all ADLs performed by this strength, except loco motor activities (Durward et al., 2001). Activities of daily living like eating, bathing, brushing, combing hair, ironing clothes, getting medicines primarily require minimum holding capacity of the hand. Without enough grip force, person will not be able to perform his daily living tasks (Mitsions et al., 2009).

According to George et al. 2018, hand grip strength is a fundamental procedure that therapists and physicians used to assess client's status following injury, surgical techniques, and treatment procedures to the hand and UE. Measurement of grip strength (GS) is an important element in the rehabilitation of hand because it helps to assess the patient's initial limitation as compared with norms. The utility of measurement continues throughout the intervention process because of providing a rapid reassessment of client's progress (Manjula et al., 2014). An accurate, quantifiable assessment of hand grip strength assists the health professionals to establish realistic treatment goals, provides treatment outcome data, and is frequently used during evaluation of hand disability ratings (George et al., 1992/2018).Hand grip strength can be quantified by measuring the amount of static force of the hand around a grip strength measurement tools. Most commonly the force has measured in kilograms and pounds, but also in millimeters of mercury and in Newton (Massy-Wetropp et al., 2011).

Mitsions et al., (2009) reported that HGS could be influenced by the gender, age, handedness, health status and level of physical activity of person. Several studies also indicated various factors that influenced HGS, these are- age; gender; height, weight, BMI, hand length, hand breadth, posture and hand size (Shim et al., 2012). Poor grip

strength is prognostic of increased mortality from cardiovascular disease (Kamarul, Ahmad, & Loh, 2016). Normal hand GS is positively associated with normal BMI in case of postmenopausal women, in addition, several researchers revealed GS as a screening tool for women at risk of osteoporosis (Kamarul et al., 2016).

Over the years, there have been developed several devices and methods for measuring HGS (George et al., 2018). Bechol introduced Jamar Dynamometer in 1954. Jamar Dynamometer is the classic and gold standard methods for measuring grip strength which records the amount of pressure being placed on the device. It provides objective strength values and has good sensitivity (Hebert et al., 2011). Brewer et al discussed two methods for the measurement of GS. In the Lansbury method, used a sphygmomanometer cuff folded twice and inflamed to 20 mmHg. The Winthrop torque meter was used for measuring hand grip and rotational ability.

Martins et al., (2015) stated that the modified sphygmomanometer test (MST) is a method for muscle strength and functional capacity assessment in clinical settings. The MST is used by a simple adaptation of very common, portable, low-cost equipment; the conventional sphygmomanometer, which is generally used for blood pressure measurement by health professionals (Kaegi et al., 1998). Adequate measurement properties has been shown in MST for the measurement of the strength of various muscle groups and populations (Souza et al., 2013).Martins et al., (2013) established the validity of sphygmomanometer for strength measurement through comparison with the attained values using the research-validated Jamar dynamometer.

Normative data for HGS using jamar dynamometer is available and published from many countries. But there had not been any study that established the reference value of hand grip strength by Modified Sphygmomanometer. During rehabilitation of hand following injury or fracture or other complication that influence strength, therapists measure the hand function based on this normative value of HGS. Therapists measure grip strength commonly to determine a client's strength relative to a normative standard (Mathioetz, 1991). As there is no study in Bangladesh, so health professionals would not get any evidence for normative value of HGS.

This dissertation established baseline of normal HGS values for Bangladeshi adult population (Phillips et al., 2013). The aim of this study was to develop normative reference values for maximum grip strength of Bangladeshi healthy adults aged 18

years and above measured with the Modified Sphygmomanometer, and explore possible associations with demographic factors and anthropometric measurements.

1.2 Justification of the study

Worldwide, evidence based practice is of crucial importance in the practice of Occupational Therapy. It provides Opportunity to enhance clinical and academicals knowledge in respective discipline thus promote patient care. It can ease the way to improve therapeutic intervention through ensuring appropriate guideline and evidence based intervention and evaluation. This research emphasized the health professional evidence based practice (Kamarul et al., 2006).

Grip Strength is evaluated as a component of hand function and grip strength is one of the best indicators of the overall strength of the upper limb (Rice, Peterson & Rechnitzer., 1998). HGS helps the person to perform meaningful activity and that's why Occupational Therapist (OTs) measure a person's GS (Cuesta-Vargas & Hilgenkamp, 2015). HGS is a fundamental procedure that occupational therapists used to evaluate clients' status following injuries, and treatment procedures to the hand and upper extremity. It also assists health professionals to assess the progress of injured individual by identifying the improvement or deterioration of condition (Daniel et al., 1998).

Most of the Occupational therapy assessment tools have been developed outside of Bangladesh and have not been adapted and not established norm for Bangladeshi people (Debra et al., 2016). A variety of studies have established normative data of hand GS for different populations applying different measurement methods (Boatright et al., 1997; Crosby et al., 1994; Desrosiers et al., 1995; Hanger et al., 2002). But there had no study on measuring normal values of grip strength using sphygmomanometer and we have lack of knowledge about the process and specific measurement protocol, that's why health professionals would not use sphygmomanometer to measure hand grip strength. Therefore, one of the major difficulties in assessing the grip strength is the absence of valid norms using modified sphygmomanometer. For this reason Researcher wanted to select this topic.

The modified sphygmomanometer test proved to be a valid and reliable instrument for obtaining hand grip strength measurement (George et al., 1992/2018). It is a low-cost

instrument with easy handling that would be available in any drugstore or a store specialized in medical equipment. This instrument provides accurate, quantifiable assessment of HGS and helps the OTs to establish realistic treatment goals (Flinn et al., 2008). It provides treatment outcome data, and is normally utilized for hand disability ratings. So, it is appropriate for the study and health professionals will also be benefited from this dissertation. Modified Sphygmomanometer is applicable for this thesis as because of several studies proved the reliability and validity of this tool (Martoins et al., 2015; Lucareli et al., 2010).

This study will guide health professionals in clinical sectors of Bangladesh with specific measurement protocol and age basis GS norms for both male and female. After completing the study health professionals will find a table of normal reference values of grip strength in healthy adults, that may help them to determine the deviation from the normal in patients and also helps in evidence based practice. Researcher is also curious to know the association of HGS with demographic factors. This is also an essential facility in various sectors. Such as- ergonomics sector, Patient satisfaction level, medical side, Health professionals.

Furthermore, this study improves the level of confidence in discussing the distinct value of Occupational Therapy interventions. Therefore, it will provide the best evidence for the Occupational therapy professionals, academicians and students.

1.3 Research Question

What is the normative value of HGS among Bangladeshi healthy adults population on the basis of age and gender by using modified sphygmomanometer?

1.4 Study Aim and Specific Objective

1.4.1 Aim: To establish the normative value of HGS among healthy adult people in Bangladesh.

1.4.2 Specific objectives:

- ✓ To establish a age and gender specific preliminary HGS values from normal, healthy adults population.
- ✓ To explore the correlation of HGS with demographic factors.
- ✓ To evaluate possible correlations of GS with anthropometric values.

1.5 Operational definition

Normative data: Normative data is data from a reference population that establishes a baseline distribution for a score or measurement, and against which the score or measurement can be compared. Normative data is typically obtained from a large, randomly selected representative sample from the wider population. (Springer Link., 2013)

Normative Study: Normative generally means relating to an evaluative standard. Normative research differs from descriptive studies because the target is not only to gather facts but also to point out in which respects the object of study can be improved. Normative research aims at improvements, which means that it includes evaluation of the present state of things and also of the direction of future development (UIAH, 2007).

Hand Grip Strength: HGS is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength. Optimum-sized objects permit the hand to wrap around a cylindrical shape with a diameter from one to three inches. (Massy-Westropp, Gill, Taylor, Bohannon & Catherine, 2011)

Modified sphygmomanometer: The modified sphygmomanometer (MS) is an alternative instrument that is currently used to assess muscle strength. A MS is built when a conventional device is adapted, with removal of its external Velcro, and folding of the cuff in three parts followed by placement into an inelastic bag. (Delgado et al., 2004; Heintz et al., 2007; Noreau & Vachon., 1998; Kaegi et al., 1998)

Parameter of Hand Grip Strength: A set of facts or a fixed limit that establishes or limits how something can or must happen or be done. A limit or boundary which defines the scope of a particular process or activity such as: variables (Cambridge Dictionary., 2019).

This study includes two types of variables:

- **Independent variable:** Age, Gender, Height, Weight, Hand length, Hand breadth, BMI.
- **Dependent variable:** Measurement of HGS (Right & Left).

Occupation: Any task or activity in which one engages. According to ISCO-08, Occupation refers to the kind of work performed in a job. The concept of occupation is defined as a "set of jobs whose main tasks and duties are characterized by a high degree of similarity".

The ISCO-08 divides jobs into 10 major groups:

1. Managers
2. Professional (Health professional, teaching, business)
3. Technicians and associate professionals
4. Clerical support workers
5. Service and sales workers
6. Skilled agricultural, forestry and fishery workers
7. Craft and related trades workers
8. Plant and machine operators, and assemblers
9. Elementary occupations (cleaner, labourer)
10. Armed forces occupations

CHAPTER II: LITERATURE REVIEW

2.1 Hand Grip Strength

Hand is a fundamental and essential organ for humans. HGS is the force that is applied by the hand to pull on or suspend from objects and is a specific part of hand strength (Massy-Westropp, Gill, Taylor, Bohannon & Catherine, 2011). Optimum-sized items allow the hand to wrap around a cylindrical shape with a diameter from one to three inches. Hand and forearm muscles are important in HGS (Martins, Aguiar, Lara, Teixeira-Salmela & Faria, 2014). The evaluation of HGS is crucial for the determination of upper limb impairment, finding the effectiveness of various treatment modalities, and assessment of work ability of patients with either local hand injuries or other conditions that affect hand strength such as muscular dystrophy (Flinn et al., 2008). GS measurement is an essential prerequisite for better performance of UL (Desrosier., 1998). GS measurement facilitates health professionals to assess limitations, to set realistic goal; and assess a patient's ability to return to work (Kamarul et al., 2016).

There are several methods of positioning for GS measurement and calculation from repeated readings. Variation examiners' training, experience and standards may cause differences in testing results. The standardized positions should be used in order to eliminate differences in measurements that occurs due to body positions and corresponding joint angles. So, the American Society for Surgery of the Hand and the American Society of Hand Therapists developed satandardized positioning, instruction and calculation of grip strength. The American society of hand therapist (ASHT) suggested testing procedure in which the subject is seated upright against the back of a chair.

From sports like cricket, hockey, tennis, football, basketball, and baseball to daily activities such as carrying, turning a doorknob, and vacuuming, required some extent of GS to be successful. Weak GS golf players might have the risk of developing medial epicondylitis or golfer's elbow (Dodds et al., 2014). Hand Grip Strength plays an important role in prevention of injury and strength development. Studies of GS usually examine maximum strength during a single repetition, but such type of effort

is relatively rare in the workplace. Tasks required repeated forceful dynamic grasping or prolonged static holding (Massy et al., 2011). The dominant hand was significantly stronger than the opposite hand and also cause fatigued more rapidly. This trend was more intended and common in females than in males (Martins et al., 2014). The older subjects have lower GS than the younger ones (Bassey & Harries., 1993) and the males' grip strength were consistently stronger than females (Desrosiers et al., 1998). HGS training can also be useful in various professions where people must work with their hands. The hand can be used to grip objects in several different positions that required different types of GS which are typically quantified based on the way the hand is being used (Massy et al., 2011). For developing GS it is important to train three types of HGS. Such as: crush, pinch and support.

Crush grip: The crush grip is most commonly thought of as a handshake-type grip, where the object being gripped between the palm and all fingers. A strong crush grip is useful in bone-crushing, handshakes or for breaking objects with pressure. Training focuses on working out the areas between fingers and palm such as, fat-grip exercises, towel pull-ups, shelf or mountain climber pull-ups, rope climbing, rope pulling and **hex dumbbell lifting** exercises (Breaking Muscle.com., 2016).

Pinch grip: The pinch grip is the grip between fingers and thumb where fingers are on one side of an object, and the thumb is on the other. Typically, in a pinch grip the object does not touch the palm it is considered as a weaker grip position. The pinch grip is used when grabbing something like a weight plate or lifting a sheet of plywood by the top edge. Pinch grip can be trained by working out each finger and thumb separately (Breaking Muscle.com., 2016).

Support grip: A support grip typically involves holding something for long periods of time. This is commonly used when doing pull-ups, wall hang, or even carrying kettle bells or holding the handle of a bucket filled with sand or water for long periods of time. A great deal of muscular endurance is necessary for a good carrying grip. (Cross Fit Invoke., 2016)

Measuring HGS is important for many reasons, including:

- GS is the simple way to assess overall strength
- Indicates overall upper extremity muscle strength.
- GS is good indicator of overall strength
- Can be used to evaluate progression of wasting conditions.
- Valid screening tool for overall fitness
- Identify potential deficits
- Progress pathway for effective rehabilitation process.

Factor influencing Grip Strength

Various factor of might be visible during GS. Such as- Age, Gender, Height, Weight, Muscle strength, Occupation, BMI, Health Status, Hand length, Hand breadth. (Lee et al., 2012)

Age: Age has an inverse relation with GS and thus it influence grip strength. Bassey & Harries, (1997) showed that Older subjects have lower grip strength scores than the younger subjects.

Gender: Males and females are intrinsically different in many ways. These two aspects of gender differences are relevant to the performance of GS tests with sphygmomanometer. Males are consistently stronger than female (Desrisier et al., 1998)

Anthropometric difference of the hand: There is significant difference in the size of male and female hands develop. Hand size naturally relates to GS (Sengupta et al., 2011).

Hand length: Hand length is defined as the direct linear distance between the distal wrist crease and the distal end of the most anterior projecting point, tip of the middle finger. The subject were asked to place their hands supine on a flat hard horizontal surface with fingers extended and adducted, following which the hand length was measure carefully to see that there was no abduction or adduction at the wrist joint, i.e., the forearm was directly in line with the middle finger. Hand lengths were taken independently on left and right sides of each individual using a sliding caliper capable of measuring the nearest 0.01 mm (Dodds et al., 2014).

Hand breadth: Measure the straight distance between the metacarpal radialis to metacarpal ulnaris. Hand breadth will measured between radial side of the second metical head and ulnar side of the fifth metacarpal head (Sengupta et al., 2011).

Hand GS can be quantified by measuring the amount of static force that the hand can squeeze around the inflamed cuff of a modified sphygmomanometer (Roush et al., 2017). Strength is a muscle's power to exert maximal effort or counter maximal opposing force. GS is correlated with the strength of the upper extremity, general strength of the body and some anthropometric measurements (Rantanen et al., 1994). It confirmed that men showed significantly better maximal hand grip force in both dominant and non-dominant hands than women. A number of studies have shown that HGS is both extremely important and related to anthropometric measurement (Liao et al., 2016).

2.2 Modified Sphygmomanometer:

The modified sphygmomanometer (MS) is an alternative instrument that is currently used to assess muscle strength (Delgado et al., 2004)

Two studies used the bag and cuff adaptations for the assessment of strength of individuals with rheumatoid arthritis and found no significant differences between the measurements provided by the two methods (Delgado et al., 2004). The MST investigation also using the non-adapted sphygmomanometer aimed to raise the potential clinical use of the equipment, because it does not require any extra cost or any time demand from the professional to perform certain adaptations (Lucareli et al., 2010).

Lucareli et al., (2010) also stated one disadvantage of the use of the non-adapted sphygmomanometer was the greater difficulty in stabilizing the equipment, most likely due to its larger contact area in relation to the assessed segment and the examiner's hand, requiring more training for the evaluator to perform the test. This method required a greater need for training and more repetitions, because the loss of the necessary stabilization occurred more frequently.

Delgado et al., (2004) The cuff adaptation is a simple, quick, and low cost method that uses readily available materials and can be easily used by professionals.

Moreover, it is easily stabilized by the examiner, unlike the non-adapted sphygmomanometer. An important disadvantage of this method was that many individuals exceeded the readability of the equipment, limiting its use on stronger individuals.

The bag adaptation is the most commonly employed method in the literature (Souza et al., 2013) and studies reported that it is able to provide more consistent measurements, compared with the cuff adaptation. Among the three methods, this adaptation showed to be the easiest to be trained and stabilized. Although it requires the fabrication of a cotton bag, this bag facilitates the stabilization of the equipment and the containment of the inflatable part. However, this adaptation showed a lower ability to assess strength of stronger individuals compared to the other two MST methods (Lucas et al., 2014).

Here use an aneroid sphygmomanometer, bag method adaptation. For that adaptation, the inflatable part of the outer velcro constituting the cuff of the equipment will remove, and that structure will be folded into three equal parts and placed in a cotton bag with a zipper (Helewa & Goldsmith, 1981).

Protocol

HGS was measured according to a standard protocol based on the recommendations of the ASHT (Ibegbu, David, Hamman, Umana, & Musa, 2015).

The subject position in ASHT testing protocol is seated upright against the back of a chair with feet flat on the floor. The shoulder adducted and neutrally rotated, the elbow flexed at 90° and the forearm in neutral and wrist between 0° and 30° of extension (Fess et al., 1992). In the sitting position, the testing position recommended by the ASHT was used.

Before testing, the examiner demonstrated how to hold the cuff of the modified sphygmomanometer. The same instructions were given for each trial. After the subject was positioned with the modified sphygmomanometer, the examiner instructed the subject to squeeze it maximally and to sustain this for 3–5 seconds with a rest of 15–20 seconds between measurements (Tsang et al., 2005).

The examiner told the subject to squeeze it as hard as possible and gave verbal encouragements to squeeze harder during the test (Richards et al., 1997).

Three successive measurements were taken for both hand and the maximum of the three grips recorded, as the dominant hand has a 10% stronger grip than the non-dominant hand (Roy et al., 2009) for right handed people.

The maximum value was taken instead of the average value for many reasons; to avoid problem could arise due to fatigue of the muscle (Haidar et al., 2004), also the maximum value used to test reliability of handgrip as well as the maximum method has commonly been used by other investigators (Roberts et al., 2011). The forearm muscles are easily fatigued, so the best scores are usually achieved in the first or second trial (Ibegbu et al., 2015).

Proper GS Testing Procedures with the Modified Sphygmomanometer

HGS will measure according to a standard protocol based on the recommendations of the ASHT (Ibegbu, David, Hamman, Umana, & Musa, 2015).

- The subject will be instructed to be seated with shoulder adducted and neutrally rotated, elbow flexed 90°, forearm in mid-prone and wrist in neutral to 30° extension (wrist in slightly extended position), with neutral radioulnar deviation for optimal performance in power grip ASHT (Fess et al., 1992).
- The sphygmomanometer will be inflated to 100 mm Hg and its valve will be kept closed to remove the folds from the inflatable portion. Then, the pressure will reduce to 20 mm Hg, and the valve will be closed again to prevent leakage (Kaegi, et al, 1998), providing a measurement range between 20-304 mm Hg.
- Each subject will be instructed to breathe in through her nose and blow out through pursed lips as a maximum grip effort was made. At this time, a verbal command of "Squeeze! Harder! Harder! Relax!" will be given by the examiner.
- The subject will be asked to hold each contraction for 5 seconds, and then a rest period of 20 seconds will be allowed between measurements of the same arm (Fess, 1992 & Figueiredo et al, 2007).

- The test will be performed bilaterally four times, with the first measurement being performed to familiarize the subject with the device. The maximum value of the last three measurements will be used in the study.
- Subsequently, the same procedure will perform on the other hand.

The objective of this test is to measure the most isometric strength of the hand. HGS is important for any sport in which the hands are used for catching, throwing or lifting. In addition as a general rule people with strong hands tend to be strong elsewhere, so this test is often used as a general test of strength (Lam et al., 2016).

It is also helpful to record whether the athlete is left or right handed, as this may help in the interpretation of results. The non-dominant hand frequently scores about 10% lower (Gerodimos et al., 2012).

Results are expected to differ between male and females, between left and right (dominant and non-dominant) hands, and with age. The results can also be affected by the position of the wrist, elbow and shoulder, so these should be standardized. There are many other factors to consider (Roberts et al., 2011)

2.3 Normative data

Normative data, data that describe a defined population at a specific point or period of time, are of enormous importance to primary care physicians (De et al., 2011). For some purposes, normative data may be quickly obtained in cross-sectional studies. Normative research differs from descriptive studies because the target is not only to gather facts but also to point out in which respects the object of study can be improved (Martins t al., 2014).Usually the project even includes planning an approach for carrying out the necessary improvements. Conforming to a standard of correctness through prescribed norms, rules, or recommendations, as opposed to mere description or statement of facts; evaluative, not descriptive (Leyk et al.,2006). For example, normative data is collected not just to describe ("What is this?") but to understand ("What is going on?") the underlying phenomenon (Dodds et al., 2014). In all studies designed to obtain normative data, methodological issues need careful attention (Massy et al., 2011). For some purposes, normative data may be quickly obtained in cross-sectional studies.

Especially important in studies which seek normative data are precise characterization of the study population, clear definition and measurement of phenomena, and appropriate interpretation and generalization of results (Miler et al., 2013).

The primary goal of normative data is to allow the comparison of an individual client, to a large group of people, matched for their age, gender and level of education, allowing for something to be said about the individual's level of impairment at a particular time point (Sengupta et al., 2011). The aim of normative data is to find out not only how things are, but how they should be, which means that it will be important to define the subjective point of view so that to select the people who shall evaluate the proposals which aim at improving the object of study (Han et al .,2011). In all studies designed to obtain normative data, methodological issues need careful attention. Normative data may be rapidly obtained in several cross-sectional studies (Dodds et al., 2014).

CHAPTER III: METHODOLOGY

Research Methodology is the logic through which a researcher address the research questions (Mason, 2002) and collect data for the study (Denzin & Lincoln., 2000). According to Brynard & Hanekom, 1997 research methodology is that, which explain how data will be collected and processed. Therefore, it is essential to determine the methods of data collection and associated factors that influence the quality of collected data.

Table 1: Variables of the Study

Variables	Measures	Data points	Scale
Age	Age calculator	Years	Nominal
Gender	Identified	1 or 2	Ordinal
Education level	Identified	1-9	Ordinal
Occupation	Identified	1-7	Nominal
Height	Stadiometer	Cm	Scale
Weight	Weight machine	Kg	Scale
BMI	BMI calculator	Kg/m^2	Scale
BMI Category	BMI calculator	1-8	Nominal
Hand dominance	Identified	1 or 2	Ordinal
Hand length	Tape measure	Cm	Scale
Hand breadth	Tape measure	Cm	Scale
Hand Grip Strength	Modified Sphygmomanometer	mmHg	Scale

3.1 Conceptual Framework

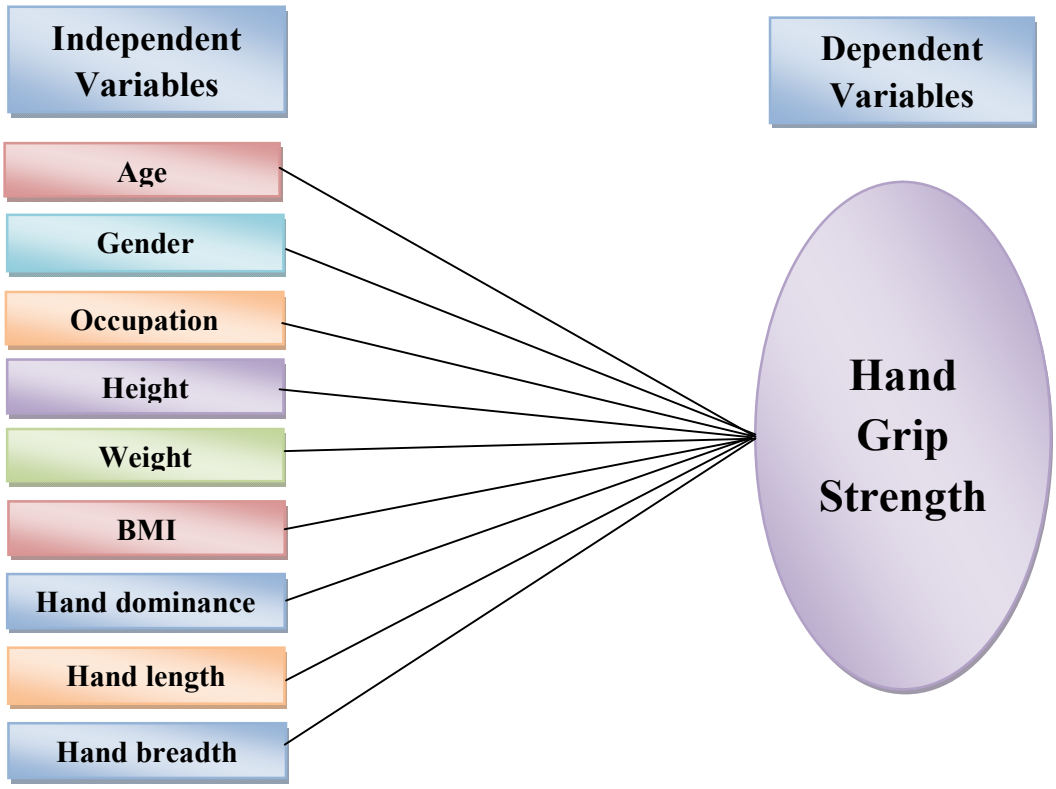

Figure 1: Conceptual Framework

3.2 Study Design

The study was done by using quantitative method. Data were collected from participants through a face to face interview by using socio-demographic questionnaire and measurement tools. The nature of the study is cross sectional study. A cross-sectional study is an observational study that involves the analysis of data collected from a population, or a representative subset, at one specific point in time. It is an easy way to collect information among the large number of population within a short time.

3.3 Study Population

Normal adult people of CRP, Savar and Manikganj community who meets the inclusion criteria.

3.4 Study Setting

The study was conducted in CRP (Savar), Savar and Manikganj community.

3.5 Study Period

The period of this study was from October 2018 to April 2019. The Study was conducted through data collection, data analysis and overall thesis writing. In particular data collection was conducted from January 2019 to February 2019.

3.6 Sample Size

The investigator used the principle of sample size determination for calculating Sample size. Sample size was estimated for this study according to the following criteria- 95% confidence interval and 5% error level. The formulation of sample size determination:

$$(n) = \frac{z^2 \text{ x } pq}{r^2}$$

Here,

z= 1.96 (confidence interval 95%)

r= 0.05 (error level 5%)

p= 0.5 (50% prevalence)

q= (1-0.5)=0.5 (1-p)

Then the sample size (n) is stand for:

$$(n) = \frac{(1.96)^2 \text{x } 0.5\text{x } 0.5}{(0.05)^2}$$

$$= \frac{0.9604}{0.0025}$$

$$= 384.16$$

The total sample required to conduct this study is 384. If this standard measurement as per the above formula was used to find out the sample size, it would be a little difficult to collect data. However, the researcher collected data from 350 participants (175 males and 175 females) due to time limitations and some other difficulties.

3.8 Inclusion and exclusion criteria

3.8.1 Inclusion criteria

- ✓ Normal and healthy adult people whose age is 18 years and above.
- ✓ People who have five fingers without any deformity in both hands.
- ✓ People who are able to follow instruction.

3.8.2 Exclusion criteria

- ✓ Person who have the history of any musculoskeletal disease, previous hand surgery, pain, functional limitation or hand deformity, severe burn and other hand injury.
- ✓ People who are bed bounded or unable to stand.
- ✓ Those who are unwilling to participate in the study.

3.9 Sampling techniques

The Researcher had used purposive quota sampling method. Participants were selected purposively and sampling technique was quota sampling. A purposive sample is a type of non-probability sample that is selected based on characteristics of a population and the objective of the study. Participants were selected according to the needs of the study; who do not meet the inclusion was rejected.

3.10 Data collection tools/materials

- **Modified Sphygmomanometer:**
  In this study use an aneroid ALPK2 sphygmomanometer (made in China), bag method adaptation. For that adaptation, the inflatable part of the outer Velcro constituting the cuff of the equipment was removed, and the cuff was folded twice into three equal parts and placed in a cotton bag with a zipper (Helewa & Goldsmith, 1981). The modified sphygmomanometer test proved to be a valid and reliable instrument for obtaining hand grip strength measurement (George et al., 1992/2018). Several studies also proved the reliability and validity of this tool (Martins et al., 2015; Lucareli et al., 2010).

Figure 2: Modified Sphygmomanometer

- **Stadiometer:**

  A stadiometer is a piece of medical equipment used for measuring human height. It is usually constructed out of a ruler and a horizontal headpiece which is adjusted to rest on the top of the head. Baharuddin et al. 2017, stated that the portable stadiometer is reliable and valid for height measurement. This study examined the reliability and validity of height measurements using a portable stadiometer as compared to a mechanical scale (Baharuddin et al. 2017).

Figure 3: Stadiometer

- **Tape Measure:**

A tape measure is a strip of metal, plastic or cloth which has numbers marked on it as inches, centimetres, etc and is used for measuring. Pellecchia (2003) examined the reliability and validity of a new method of measuring hand size in which a tape measure is wrapped around the hand in a figure-of-eight pattern. However, several studies determined the reliability and validity of tape measure for measuring length (Jamaluddin et al., 2011; Neelly, Wallmann & Backus., 2013). In this study it was used for measuring hand length and hand breadth.

Figure 4: Tape Measure

- **Digital Weighing Scale:**

For measuring body weight in this study researcher used a Digital Weighing Scale of Camry brand. Kumar et al. (2014) revealed that he measurements obtained with DWSs are valid and in agreement with Mat Scan measurements. Hence, DWSs could be used interchangeably with Mat Scan and would be able to provide clinicians an objective measurement of limb loading suitable for clinical setting (Kumar et al., 2014)

Figure 5: Glass Electronic Weighing Scale

- **Pen, pencil and paper to collect notes.**
- **Information sheet &Consent form**
- **Data collection form.**

3.11 Data collection methods

After the approval of the IRB and confirming the eligibility (who meets the inclusion criteria), the researcher completed the consent related paper work with the participants. In this process there was an information sheet and a consent form. The information sheet was written in Bangla which explained the aim and background of the study, the method and procedure, including the risks and benefits for the participants. After gaining clear concept of the study each participant gave his/ her signature/ left thumb impression on the consent form. Then the data collector was recorded their socio-demographic information and also collected information on the participants' height, weight, hand dominance, hand length, hand breadth and HGS.

3.11.1 Participants:

The study included 350 normal, healthy people (175 males and 175 females). To ensure equal distribution across age range, 25 male and 25 female were included in each of the seven age categories: 18-24, 25-31, 32-38, 39-45, 46-52, 53-58 and above 58 years. Thus each age group contains 50 participants including 25 male and 25 female volunteer. Most of the participants were patients' family members from people at CRP. Since the rehabilitation center provides services to people from all over the country, patients and their family members represent people of whole Bangladesh.

3.11.2 Tester:

In this study all the measurements were administered and scored by one rater (the researcher ownself)

3.11.3 Testing procedures:

Prior to each test, each participant was briefed on how test would be done and how he/she would be performed. Subsequently, the participants were allowed to practice before actual measurement.

1. HGS measurement by Modified Sphygmomanometer:

HGS was measure according to a standard protocol based on the recommendations of the ASHT (Ibegbu, David, Hamman, Umana, & Musa, 2015).

- The subject was instructed to be seated with arm adducted and neutrally rotated, elbow flexed 90°, forearm in mid-prone and wrist in neutral to 30° extension (wrist in slightly extended position), with neutral radio-ulnar deviation for optimal performance in power grip (ASHT; Fess et al., 1992).
- The sphygmomanometer was inflated to 100 mm Hg and its valve was kept closed to remove the folds from the inflatable portion. Then, the pressure was reduce to 20 mm-Hg, and the valve was closed again to prevent leakage (Kaegi, et al, 1998), providing a measurement range between 20-300 mm Hg.

Figure 6: Position during measurement of Grip Strength

- Each subject was instructed to breathe in through their nose and blow out through pursed lips as a maximum grip effort can be made. At this time, a verbal command of "Squeeze! Harder! Harder! Relax!" was given by the data collector.

- The subject was asked to hold each contraction for 5 seconds, and then a rest period of 20 seconds was allowed between measurements of the same hand (Fess, 1992 & Figueiredo et al, 2007).
- The test was performed four times for each hand. The first measurement was performed to familiarize the subject with the device. The maximum value of last three trial was taken instead of the average value.
- Subsequently, the same procedure was performed on the other hand

2. Measurement of Height with Stadiometer:

Participants' height was measured according to a standard protocol based on the recommendations of the FEHES (Viet &Verschuren, 2008).

Exclusion criteria: Height was not measured for people in a wheelchair, persons who have difficulty to stand straight, and participants with a hairstyle (e.g. Puff hair) that prevents proper use of the height equipment.

Equipment: Stadiometer

Figure 7: Position during height measurement

Protocol for measuring height:

- Place the base of the stadiometer on the floor. Slot the measurement rods into the base of the stadiometer in the correct order. Make sure it is inserted fully.
- Participants were asked to remove their shoes, heavy outer garments, and hair ornaments and head dress.
- The participant was then asked to stand on the centre of the base with his/her back to the height rule. Instructed them to put their feet together and move back until their heels touch the bottom of the stadiometer upright. Their buttocks and upper part of their back should also be touching the stadiometer upright. Their head does not have to touch the stadiometer.
- Each participant was asked to Stand up straight and look straight ahead.
- When the respondent was in the correct position, asked them to take a deep breath and hold it. Lower the headboard until it is in contact with the head. Hold the headboard firmly at its final position and take the reading to the nearest 0.1 cm.
- The participants those were excluded from height measurement, the reasons were recorded in the data collection form).

(**NB.** If any person is taller than the maximum height of the stadiometer, the self reported height is acceptable and recorded on the form but during data collection researcher did not meet that type of participant)

3. Measurement of weight by Digital Weighing Scale (DWS):

HGS will measure according to a standard protocol based on the New Zealand Health Monitor (NZHM) Surveys (Marfell-Jones, 2008)

- Place the scales on a hard flat surface. If carpet is the only floor covering in the measurement location, put a board down on the carpet and place the scales on the board.
- Press firmly on the centre of the scales to turn them on. Once the zeros appear.

Figure 8: Position during weight measurement

- Ask the subject to stand on the centre of the scales without support, with their arms loosely by their sides, head facing forward and with their weight distributed evenly on both feet.
- A reading will appear in a few seconds. The numbers will change, and then stop. Once the numbers have stopped, take the reading to the nearest 0.1 kg.
- Ask the subject to step off the scale. Record the reading.

Hand length: Measure from the top of middle finger to wrist joint. The subject were asked to place their hands supine on a flat hard horizontal surface with fingers extended and adducted, the forearm was directly in line with the middle finger. Hand lengths were taken independently on left and right sides of each individual using a sliding caliper capable of measuring the nearest 0.01 mm (Dodds et al., 2014).

Figure 9: Hand length measurement

Hand breadth: A linear measurement approximating the width of the palm of the hand. Measure the straight distance between the metacarpal radialis to metacarpal ulnaris. Hand breadth will measured between radial side of the second metacarpal head and ulnar side of the fifth metacarpal head (Sengupta et al., 2011).

Figure 10: Hand breadth measurement

3.12 Data management and analysis

Data Management: The researcher had a detail planning for data management- accumulate the resources for data collection, data entry and data processing. Developing a coding system for identification participants' records due to reduce overlap and missing data. All data were incorporated in the data view in statistical software after completing the variable view for analysis. Analysis of data were done by using SPSS version 20.0.

Data Analysis: Due to the normal distribution of data, Pearson correlation coefficient was done to analyze the data. Descriptive analysis were used to found Descriptive information of demographic characteristics .The study findings were analyzed by finding the frequency, mean, standard deviation and range of each item individually. The correlation between dependent and independent variables was analyzed by Pearson correlation coefficient. The result will be presented as sex specific reference

values, stratified by age. All analysis was performed using SPSS for windows (SPSS Inc., Chicago, IL, USA). Result is presented in frequency tables.

3.13 Quality control & quality assurance

All data collection should be accurately done with the concern of respective supervisor as well follow all instructions. Researcher carried out a field test before collecting the final data because it helps the researcher to refine the data collection plan and find out the limitation. Then the researcher got chance to rearrange the demographic questionnaires to make it more understandable, clear and enough for the participants and the study. Procedure of data collection and ethical consideration of the thesis was highly maintained to ensure quality.

3.14 Ethical Consideration

- At first the ethical approval had been taken from the Institutional Review Board (IRB) for conduction of the study.
- The researcher was taken permission from the research supervisor and Occupational Therapy Department in BHPI.
- All the participants were informed about the purpose, aim and objective of the study and it was ensured that the study will not be harmful for them.
- Informed consent was collected from the participants.
- Confidentiality was maintained as the student investigator will keep the participants name, address and personal information.
- Participants were allowed to withdraw themselves or refuse to perform any task at any time during the study.

Ethical consideration parts also included by information sheet and consent form, which are given below:

3.14.1 Information sheet

Researcher used an information sheet to inform about study aims and rights of the participant. The information sheet was written in Bangla which also explained background of the study, the method and procedure, including the risks and benefits for the participants. Confidentiality of all participants must be highly maintained. Through the Information sheet participants were able to known of the study goal and why it is done. Participant also concerned that his participation is voluntary and he or she will not get any financial advantage in future for his participation.

3.14.2 Consent form

A consent form was also used to take written consent from the participant. It was very important to take consent from participants who were interested to participate in the study. If they were concern about the aim and objective of the study then they give signature or left thumb impression in the consent form with volunteer participation.

CHAPTER IV: RESULTS

This section focuses on the findings which explore the association of variables. This study has done by using quantitative method. The socio-demographic background of the participants in this study was also identified. Each of the table represents the collected data.

4.1 Descriptive characteristics of the participants

Table 2: Descriptive characteristics of the participants (n=350)

Variables		n	Mean±SD
Age	18-24	50	
	25-31	50	
	32-38	50	**42.38±15.03 Years**
	39-45	50	
	46-52	50	
	53-58	50	
	>58	50	
Gender	Male	175	----------
	Female	175	
Education	Illiterate	37(10.6%)	
	Signature	30(8.6%)	
	Primary	44(12.6%)	----------
	Secondary	37(10.6%)	
	SSC	46(13.1%)	
	HSC/Diploma	61(17.4%)	
	B.Sc/ BA/ Honors	73(20.9%)	
	M.Sc/ MA/ Masters	22(6.3%)	

Occupation	Student	42	
	Housewife	68	
	Managers	21	----------
	Professional	78	
	Service and sales workers	18	
	Skilled agricultural, forestry and fishery workers	55	
	Plant and machine operators, and assemblers	25	
	Armed forces occupations	16	
	Retired/ No occupation	27	
Height	----------	350	**158.72±8.96 cm**
Weight	----------	350	**61.18±10.40 cm**
BMI	Underweight	13	
	Normal	194	**24.27±3.43 kg/m^2**
	Overweight	124	
	Obese	19	
Hand Length	Right	350	**17.24±1.01 cm**
	Left	350	**17.24±1.02 cm**
Hand Breadth	Right	350	**7.65±0.82 cm**
	Left	350	**7.66±1.00 cm**
Hand Dominance	Right	301	----------
	Left	49	
Dominant Hand Grip Strength	----------	350	**220.98±46.79 mmHg**
Non-dominant Hand Grip Strength	----------	350	**210.63±48.54 mmHg**

Demographic data of participant are listed in **Table 2**. The Table showed that among 350 participants, there are 14.3% (n=50) participants in each group and the number of male and females were also equal. Most of the participant 86% (n=301) were right

handed and rest of the participant only 14% (n=49) were left handed. The participant's age ranges were from 18 to above 58 years.

In this table, among all the participants 10.6% (n=37) were illiterate, 8.6% (n=30) could signature, 12.6% (n=44) were primary, 10.6% (n=37) secondary, 13.1% (n=46) SSC, 17.4% (n=61) HSC/ Diploma, 20.9% (n=73) B.sc/ BA/Honors, 6.3% (n=22) were M.Sc/ MA/Masters. With regard to their occupation among the participants 12% (n=42) were students, 20.6% (n=72) were housewife, 15.7% (n=55) were involve in skill level 1, 14.3% (n=50) were skill level 2, 14.9% (n=52) were in skill level 3, 14.3% (n=50) were skill level 4 and rest of the participant 8.3% (n=29) were retired or they had no occupation. Table 2 again show that maximum 55.4% (n=194) participant's BMI is normal, 35.4% (n=124) were overweight and rest of the participants were underweight or obese. Hand length of participants were between 16.2-18.2 cm and hand breadth were between 6.6-8.6 cm.

4.2 Normative values of HGS

Table 3: Hand Grip Strength Norms according to Gender and Age (6-year Categories)

		Males			
Age	**N**	**Dominant Hand**		**Non-dominant Hand**	
		Mean±SD	Norm Range	Mean±SD	Norm Range
18-24	25	257.24±16.93	240.31-274.17	252.16±19.87	232.29-272.03
25-31	25	258.20±22.01	236.19-280.21	244.40±22.11	222.29-266.51
32-38	25	249.92±31.31	218.61-281.23	246.12±32.43	213.69-278.55
39-45	25	251.92±23.77	228.15-275.69	243.28±34.30	208.98-277.58
46-52	25	241.04±37.82	203.22-278.86	233.20±40.86	192.34-274.06
53-58	25	252.48±22.12	230.36-274.48	235.24±24.15	211.09-259.39
>58	25	219.68±39.09	180.69-258.77	207.68±42.08	165.60-249.76
Total	175	247.44±30.89	216.55-278.33	237.44±34.18	203.26-271.62

Females					
Age	**N**	**Dominant Hand**		**Non-dominant Hand**	
		Mean±SD	Norm Range	Mean±SD	Norm Range
18-24	25	206.32±43.67	162.65-249.99	199.36±42.94	156.42-242.30
25-31	25	214.80±35.69	179.11-250.49	206.88±37.93	168.95-244.81
32-38	25	220.24±35.49	184.75-255.73	208.00±38.19	169.81-246.19
39-45	25	190.32±54.65	135.67-244.97	180.72±53.81	126.91-234.53
46-52	25	198.08±31.43	166.65-229.51	186.80±36.46	150.37-223.23
53-58	25	173.04±38.14	134.90-211.18	160.24±28.22	132.02-188.46
>58	25	158.88±41.68	117.20-200.56	144.80±44.20	100.60-189.00
Total	175	194.53±45.03	149.50-239.56	183.82±45.96	137.86-229.78

Table 3 shown that the maximum range of grip strength is among the middle aged population. Then the GS is gradually decreased with age. Researcher also observed that males are relatively stronger than females. The peak level of grip strength is observed in (32-38) years age group for both males and females. That table means the GS increasing with age up to middle age and then gradually became weaker. There are also observed that dominant HGS is relatively stronger than non-dominant HGS. But this difference is not significant in all age group.

4.3 Correlation of Dominant Hand Grip Strength with their Demographic Factors and anthropometric measurement

Table 4: Correlation of Dominant HGS with variables

Variables	Dominant Hand Grip Strength		
	r value	p value	Remarks
Age	-.294	.000	Significant
Gender	-.566	.000	Significant
Occupation	.011	.832	Non significant
Height	.551	.000	Significant
Weight	.411	.000	Significant
BMI	.043	.423	Non significant
Hand Length	.460	.000	Significant
Hand Breadth	.447	.000	Significant
Hand Dominance	-.033	.536	Non significant
***P<0.05 (significant level)**			

A pearson correlation coefficient was done to show the relationship of dominant HGS with demographic factors and anthropometric values. The Table 4 exhibited significant correlation of HGS with some variables. The researcher found a weak negative relationship of age with GS of the dominant hand (r = -.294, p = 0.000). That means GS is decreasing with age. The negative association was more prominent in analysis by group of gender (r = -.566, p =.000). The researcher observed a moderate positive association of height and weight with dominant hand (r = 551, p = .000; r = .411, p =.000). This researcher also found moderate positive correlation of BMI with HGS (r= 0.43, p=.423). But this correlation is not significant. Researcher also observed moderate positive correlation of hand length and breadth with HGS of dominant hand (r = .460; p = .000; r = 447, p = .000).

CHAPTER V: DISCUSSION & CONCLUSION

5.1 Discussion

Hand is very important and essential part of human being. It complete several complicated detailed operations that permit humans to complete such tasks as writing, computing, and other activities (Blomkvist et al., 2010). Grip strength has been explained as the power of the combined contraction of the extrinsic muscles of the hand which flex the joints of the hand (Han et al., 2011). For grip strength evaluation there are several devices available. The modified sphygmomanometer is inexpensive easy to administer and to provide correct measurements in clinical settings as well as for research purposes (Lam et al., 2006).

The final study population comprised 350 participants (175 males and 175 females) ranging in age from 18 to above 58 years. For hand grip strength analysis, the 350 participants were divided into seven categories based on age: (a) 18–24 years; (b) 25–31 years; (c) 32–38 years; (d) 39-45 years; (e) 46-52 years; (f) 53-58 years and above 58 years. Each group included equal number (n=50) participants with 25 males and 25 females. Table 1 shows descriptive analysis of height, weight, hand length, hand breadth, Occupation and BMI of all the participants expressed as mean and standard deviation.

This study established gender stratified normative value of HGS on the basis of age. Researcher observed maximum norms among middle aged population.

Many factors have been documented to be related to GS in the literature. It is generally believed that hand GS reaches a peak between the ages of 25 and 50 years (Mathiowetz et al., 2002). Before that age there is a progressive increase of hand strength and especially GS. After the age of 50, most individuals experience aecline in their GS with increasing age, so that a curvilinear relationship between age and hand strength could be formed. In this study researcher also found the similar results.

There are many studies used the Modified Sphygmomanometer to carry out the intra-rater reliability (Perossa et al., 1998; Daniel et al., 2001). Some study was conducted

on validity and reliability of the tools (Martins et al., 2015; George et al., 2018). There was no study on the normative value of grip strength by using sphygmomanometer. So, researcher could not found any related literature to compare results in discussion.

Several studies have confirmed that GS is significantly higher in men than in women in all age groups studied. In recent years, an improvement in GS of the female population has been documented. It is strongly believed that the dominant hand is 10% stronger compared to the nondominant

Due to the normal distribution of data, in this study association was done by using Pearson Correlation coefficient(r) test. A recent study in the Chinese population has found a correlation between GS and anthropometric factors such as forearm circumference, body height, and weight (Lam et al., 2016). Correlation is significant when the P value is 0.01. In this study perspective, weakly negative relationship of age with GS of the dominant hand ($r = -.294$, $p = 0.000$). The negative association was more prominent in analysis by group of gender ($r = -.566$, $p = .000$). The researcher observed a moderate positive association of height and weight with dominant hand ($r = 551$, $p = .000$; $r = .411$, $p = .000$). It explores the relationship of grip strength with elevated BMI and found no significant correlation. Researcher found moderate positive correlation BMI with HGS ($r= 0.43$, $p=.423$). This relationship is not significant because most of the participants' had normal BMI. Researcher also observed moderate positive correlation of hand length and breadth with HGS OF dominant hand ($r = .460$; $p = .000$; $r = 447$, $p = .000$). Same results were found in other study where there is weak relationship with BMI (Kamarul et al., 2006). In other study found HGS is negatively associated with physical weakness even when the effect of Body mass index (BMI) and arm muscle circumference are removed (Han et al.,2011).

5.2 Limitation of the study

During the research work it is observed that some limitations and barriers. So the researcher acknowledges in these limitations and barriers investigation. These include:

- There are very limited published literatures available in Bangladesh regarding hand grip strength.
- There are no another raters were included in this study, researcher ownself was the rater of the study. So, there was a possibility of memory bias.
- For a normative study it is important to test inter-rater reliability. As researcher collected all data by ownself, so it was not possible to test inter-rater reliability.
- Majority of sample was right-handed, so these norms should be used with caution for left handed persons.

5.3 Conclusion

Grip strength is a clinical measure that is frequently used to estimate sensorimotor deficits and monitor how they evolve over time. It is an important prerequisite for good hand function. As specialists of hand function evaluation and treatment, occupational therapists must evaluate grip strength correctly and use valid grip strength norms for comparing patients to the normal population. This study provides a large sample of normative data for clinical use in hand and upper limb rehabilitation, anad possible screening for other health issues. In this study, it was shown that the grip strength of persons over 58 years aged and older varies negatively and curvilinearly with age and that the loss seems more marked among the older subjects. This study demonstrated the importance of taking into account hand circumference and body height, in addition to age and gender, when comparing grip strength to that of a population without disability. Therapists will benefit from the results of this study by better assessing the hand of the patients, developing better goals for their patients and providing better education to their patients on this aspect of upper limb rehabilitation. Based on results information of the normative data on hand grip strength will be very helpful for the evaluation and treatment of hand or upper extremities injuries.

5.4 Recommendation

In spite of these limitations, this study contributes the standardized assessment tool for the clinical settings. Based on the given limitation of the study here focused on the possible recommendation and further studies regarding the measurement of grip strength of population are incorporate below-

There are many factors that may influence the measurement of HGS; however, this study primarily focused on norms of grip strength according to age and gender and showed the association of dominant hand grip strength with variables in the study. The further study should include the association of both hands grip strength with other influential factors.

Recommendation for health professional-

They should be started to assess GS with Modified Sphygmomanometer.

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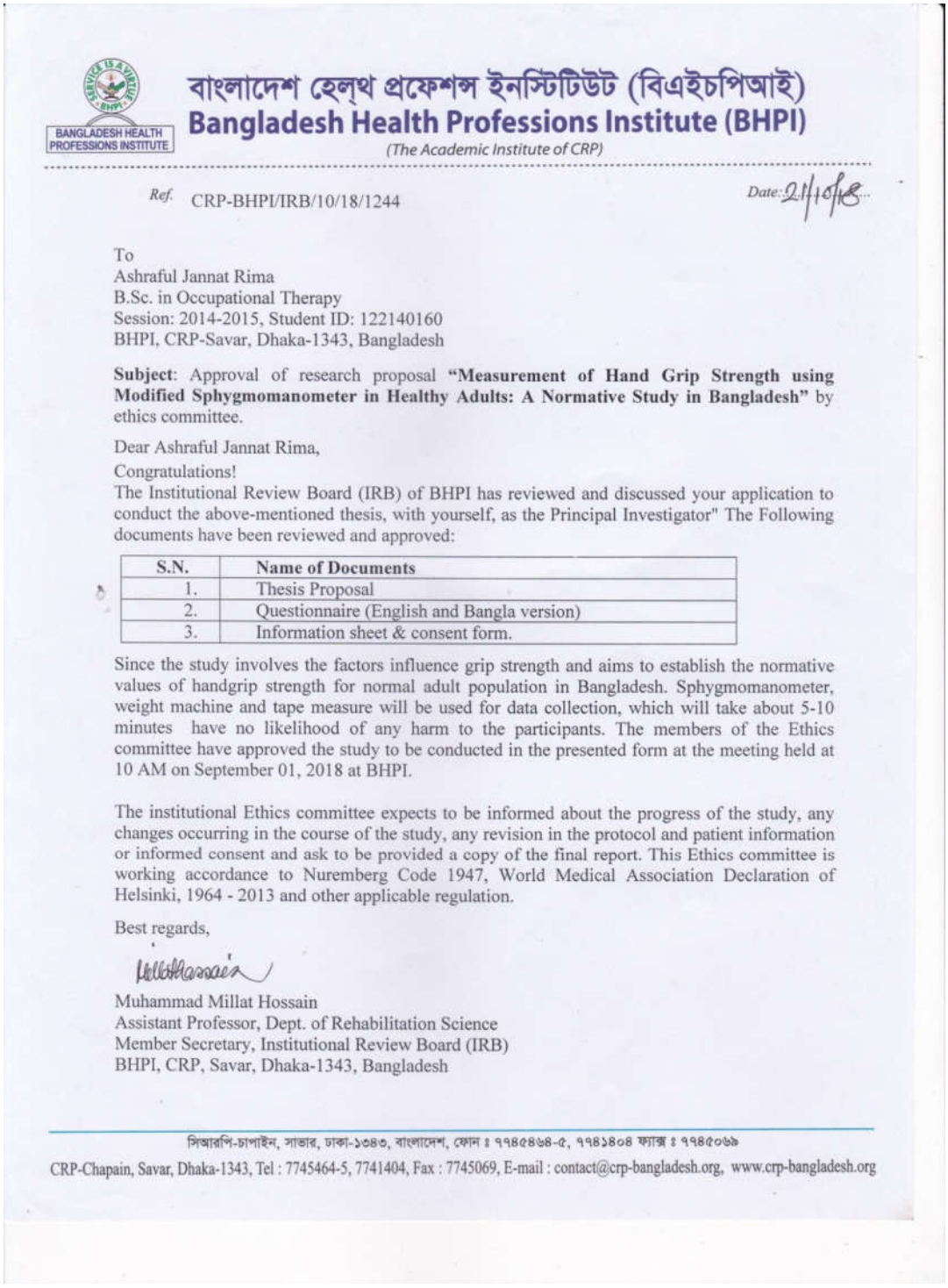
Appendix I

Permission Letter of Institutional Review Board



বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

BANGLADESH HEALTH PROFESSIONS INSTITUTE

Ref. CRP-BHPI/IRB/10/18/1244

Date: 21/10/18

To
Ashraful Jannat Rima
B.Sc. in Occupational Therapy
Session: 2014-2015, Student ID: 122140160
BHPI, CRP-Savar, Dhaka-1343, Bangladesh

Subject: Approval of research proposal **"Measurement of Hand Grip Strength using Modified Sphygmomanometer in Healthy Adults: A Normative Study in Bangladesh"** by ethics committee.

Dear Ashraful Jannat Rima,

Congratulations!

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned thesis, with yourself, as the Principal Investigator" The Following documents have been reviewed and approved:

S.N.	Name of Documents
1.	Thesis Proposal
2.	Questionnaire (English and Bangla version)
3.	Information sheet & consent form.

Since the study involves the factors influence grip strength and aims to establish the normative values of handgrip strength for normal adult population in Bangladesh. Sphygmomanometer, weight machine and tape measure will be used for data collection, which will take about 5-10 minutes have no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 10 AM on September 01, 2018 at BHPI.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,

Muhammad Millat Hossain
Assistant Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

সিআরপি-চাপাইন, সাভার, ঢাকা-১৩৪৩, বাংলাদেশ, ফোন ঃ ৭৭৪৫৪৬৪-৫, ৭৭৪১৪০৪ ফ্যাক্স ঃ ৭৭৪৫০৬৯
CRP-Chapain, Savar, Dhaka-1343, Tel : 7745464-5, 7741404, Fax : 7745069, E-mail : contact@crp-bangladesh.org, www.crp-bangladesh.org

Appendix II

Permission letter for data collection

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনষ্টিটিউট (বিএইচপিআই)
BANGLADESH HEALTH PROFESSIONS INSTITUTE (BHPI)
(The Academic Institute of CRP)
CRP-Chapain, Savar, Dhaka, Tel: 7745464-5, 7741404 , Fax: 7745069
BHPI-Mirpur Campus, Plot-A/5, Block-A, Section-14, Mirpur, Dhaka-1206. Tel: 8020178,8053662-3, Fax: 8053661

তারিখ ঃ ০৮.০১.২০১৯

প্রতি
হেড অব মেডিকেল সার্ভিসেস উইং
সিআরপি, সাভার, ঢাকা।

বিষয় ঃ রিসার্চ প্রজেক্ট (dissertation) প্রসঙ্গে।

জনাব,

বিএইচপিআই'র ৪র্থ বর্ষ বিএসসি ইন অকুপেশনাল থেরাপি কোর্সের ছাত্রী আশরাফুল জান্নাত রিমা তার রিসার্চ সংক্রান্ত কাজের জন্য আগামী ১৫.০১.২০১৮ তারিখ থেকে ১৫.০২.২০১৯ তারিখ পর্যন্ত সময়ে আপনার নিকট প্রেরন করা হলো। তার রিসার্চ শিরোনাম

" Measurement of hand grip strength by using sphygmomanometer in healthy adult people: A normal study."

তাই তাকে সার্বিক সহযোগীতা প্রদানের জন্য অনুরোধ করছি।

ধন্যবাদান্তে

08.01.2019
শেখ মনিরুজ্জামান
সহকারী অধ্যাপক ও বিভাগীয় প্রধান
অকুপেশনাল থেরাপি বিভাগ
বিএইচপিআই।

Appendix III

Consent form and Information Sheet

Bangladesh Health Professions Institute (BHPI)

Department of Occupational Therapy

CRP, Chapain, Savar-1343, Bangladesh

Informed Consent Form for the Health Professions Students

Title: "Measurement of Hand Grip Strength among Healthy Adults by Modified Sphygmomanometer: A Normative Study in Bangladesh".

Investigator: Ashraful Jannat Rima, Student of B.Sc. in Occupational Therapy, Bangladesh Health Professions Institute (BHPI), CRP- Savar, Dhaka- 1343

Supervisor: Julker Nayan, Associate professor, Occupational Therapy Department, Bangladesh Health Professions Institute

Place: CRP, Savar and Manikganj community.

Part I: Information Sheet

Introduction

I am Ashraful Jannat Rima, B.Sc. in Occupational Therapy student of Bangladesh Health Professions Institute(BHPI), have to conduct a thesis as a part of this Bachelor course, under thesis supervisor, Julker Nayan. You are going to have details information about the study purpose, data collection process, ethical issues. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research. If this consent form contains some words that you do not understand, please ask me to stop. I will take time to explain.

Background and Purpose of the study

You are being invited to be a part of this research because this thesis provide the normative value of hand grip strength of normal adult people by Sphygmomanometer which allowed the Health Professionals to use this tools. Researcher can identify the standard value of hand grip strength with sphygmomanometer through your voluntary participation in this study. The aim of the study is to identify the normative value/data of hand grip of Bangladeshi healthy adults' population. The purpose of the study is to identify the descriptive data of hand GS and explore association between anthropometric measurements.

Research related information

The research related information will be discussed with you throughout the information sheet before taking your signature on consent form After that researcher will measure the participant's hand grip strength, height, weight, hand length& breadth by using sphygmomanometer, tape measure & weight machine which take approximately 5-10 minutes. The information recorded is confidential, your name is not being included on the forms, only a number will identify you, and no one else except Julker Nayan, Supervisor of the study will have access to this study.

Voluntary Participation

The choice that you make will have no effect on your job or on any work-related evaluation Or your personal life. You can change your mind at any time of the data collection process even throughout the study period. You have also right to refuse your participation even if you agreed earlier**.**

Risks and benefits

We are asking to share some personal and confidential information, and you may feel uncomfortable talking about some of the topics. You do not need to take part in the study if you don't wish to do so, and that is also okay. You do not have to give us any reason for not responding to any question, or for refusing to take part in the interview. On the other hand, you may not have any direct benefit by participating in this research, but your valuable participation is likely to help us find out the normative

value of Bangladeshi healthy adults population. Information about you will not be shared to anyone outside of the research team. The information that we collect from this research project will be kept private. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will lock that information up with a lock and key. It will not be shared with or given to anyone except Julker Nayan, study supervisor.

Sharing the Results

Nothing that you tell us today will be shared with anybody outside the research team, and nothing will be attributed to you by name. The knowledge that we get from this research will be shared with you before it is made widely available to the public. Each participant will receive a summary of the results. There will also be small presentation and these will be announced. Following the presentations, we will publish the results so that other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask me now or later. If you wish to ask questions later, you may contact any of the following: Ashraful Jannat Rima, Bachelor science in Occupational Therapy, Department of Occupational Therapy, e-mail: jannatrima.jr@gmail.com, Cell phone- 01616375757. This proposal has been reviewed and approved by Institutional Review Board (IRB), Bangladesh Health Professions Institute (BHPI), CRP-Savar, Dhaka-1343, Bangladesh, which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find about more about the IRB, contact Bangladesh Health Professions Institute (BHPI), CRP-Savar, Dhaka-1343, Bangladesh. You can ask me any more questions about any part of the research study, if you wish to.

Can you withdraw from this study:

You can cancel any information collected for this research project at any time. After the cancellation, we expect permission from the information whether it can be used or not.

Withdrawal Form

Participants Name: ……

ID number: …….....

Reason of Withdraw:

……

……..

. Participants Name: ……

Participants Signature: ……..

Day/Month/Year: ……

Part II: Certificate of Consent

Statement by Participants

I have been invited to participate in research titled Measurement of Hand Grip Strength by Modified Sphygmomanometer in Healthy Adults: A Normative Study in Bangladesh. I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked & have been answered to my satisfaction. I have given consent voluntarily to be a participant in this study

Name of Participant_____

Signature of Participant _____ Date _____

Statement by the researcher taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1.

2.

3.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Name of Researcher taking the consent_____

Signature of Researcher taking the consent_____

Date _____

Appendix IV

তথ্য এবং সম্মতিপত্র

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনষ্টিটিউট (বিএইচপিআই)

অকুপেশনাল থেরাপি বিভাগ

সিআরপি– চাপাইন, সাভার, ঢাকা–১৩৪৩. টেলি: ০২-৭৭৪৫৪৬৪–৫,৭৭৪১৪০৪, ফ্যাক্স: ০২-৭৭৪৫০৬

কোড নং:

অংশগ্রহণকারীদের তথ্য এবং সম্মতিপত্র

গবেষনার বিষয়: "স্ফীগমোম্যানোমিটারের মাধ্যমে বাংলাদেশের প্রাপ্ত বয়স্ক মানুষের মুষ্ঠিবদ্ধ হাতের শক্তির পরিমাণ নির্ণয় করা: বাংলাদেশের এশটি আদর্শ গবেষণা।"

গবেষক: আশরাফুল জান্নাত রিমা, বি.এস.সি ইন অকুপেশনাল থেরাপি (৪র্থ বর্ষ),সেশন:২০১৪-২০১৫ ইং, বাংলাদেশ হেলথ্ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই), সাভার,ঢাকা- ১৩৪৩

তত্ত্বাবধায়ক: মোঃ জুলকার নাঈন, বিভাগীয় প্রধান এবং সহযোগী অধ্যাপক, অকুপেশনাল থেরাপি বিভাগ, বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট।

গবেষনার স্থান: বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই), পক্ষাঘাতগ্রস্থদের পুর্নবাসন কেন্দ্র (সিআরপি), সাভার এবং মানিকগঞ্জ এলাকা।

পর্ব ১ তথ্যপত্র:

ভূমিকা:

আমি আশরাফুল জান্নাত রিমা, ঢাকা বিশ্ববিদ্যালয়ের চিকিৎসা অনুষদের অধীনে বাংলাদেশ হেল্‌থ প্রফেশনস ইনস্টিটিউটে বি.এস.সি.ইন অকুপেশনাল থেরাপি বিভাগে ৪র্থ বর্ষের ছাত্রী হিসেবে স্নাতক শিক্ষাকার্যক্রম (২০১৪-২০১৫ ইং) সেশনে অধ্যয়নরত আছি। বিএইচপিআই থেকে অকুপেশনাল থেরাপি বি.এস.সি শিক্ষাকার্যক্রমটি সম্পন্ন করার জন্য একটি গবেষনা প্রকল্প পরিচালনা করা বাধ্যতামূলক। এই গবেষণা প্রকল্পটি অকুপেশনাল থেরাপি বিভাগের সহযোগী অধ্যাপকমোঃ জুলকার নাঈন এর তত্ত্বাবধায়নে সম্পন্ন করা হবে । এইঅংশগ্রহনকারী তথ্যপত্রের মাধ্যমে গবেষণার প্রকল্পটির উদ্দেশ্য, উপাত্ত সংগহের প্রণালী ও গবেষণাটির সাথে সংশ্লিস্ট বিষয় কিভাবে রক্ষিত হবে তা বিস্তারিতভাবে আপনার কাছে উপস্থাপন করা হবে। যদি এই গবেষণায় অংশগ্রহন করতে আপনি ইচ্ছুক থাকেন, সেক্ষেত্রে এই গবেষণার সম্পৃক্ত বিষয় সম্পর্কে স্বচ্ছ ধারনা থাকলে সিদ্ধান্ত গ্রহন সহজতর হবে। অবশ্য এখন আপনার অংশগ্রহন আমাদের নিশ্চিত করতে হবে না। যে কোন সিদ্ধান্ত গ্রহনের

পূর্বে, যদি চান তাহলে আপনার আত্মীয়-স্বজন, বন্ধু অথবা আস্থাভাজন যেকারো সাথে এই ব্যাপারে আলোচনা করে নিতে পারেন। অপরপক্ষে,অংশগ্রহনকারী তথ্যপত্রটি পড়ে,যদি কোন বিষয়বস্তু বুঝতে সমস্যা হয় অথবা যদি কোন কিছু সম্পর্কে আরো বেশি জানার প্রয়োজন হয়, তবে নির্দ্বিধায় প্রশ্ন করতে পারেন।

গবেষনার প্রেক্ষাপট ও উদ্দেশ্য:

এই গবেষনাতে বাংলাদেশ হেলথ্ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই) এর সকল শিক্ষক,শিক্ষার্থী ও অন্যান্য কর্মকর্তা, পক্ষাঘাতগ্রস্থদের পুর্নবাসন কেন্দ্রে কর্মরত সকল থেরাপিস্ট এবং নির্দিষ্ট কিছু এলাকা যথা: সাভার (চাপাইন), মানিকগঞ্জ (শেওতা) এবং জামালপুর (মিরাপুর, নরুন্দি ও গোপালপুর) এর সকল সুস্থ ও সাধারণ মানুষদের অন্তর্ভূক্ত হবার জন্য আমন্ত্রন জানানো হবে। এর অংশ হিসাবে, আপনাকেও উক্ত গবেষনা প্রকল্পে অংশগ্রহনের জন্য আমন্ত্রণ জানানো হলো। সিআরপি এর অধিনস্থ অকুপেশনাল থেরাপিস্টগণ, রোগীদের মুষিঠবদ্ধ হাতের শক্তি পরিমাপ করার জন্য বিভিন্ন ধরনের পরিমাপক ব্যবহার করে থাকেন, এর মধ্যে স্ফীগমোম্যানোমিটার একটি অন্যতম ও সহজলভ্য পরিমাপক যা বিভিন্ন দেশে ব্যবহার করা হচ্ছে। কিন্তু বাংলাদেশে স্ফীগমোম্যানোমিটার প্রচলিত না হওয়ায় স্ফীগমোম্যানোমিটারের মাধ্যমে মুষ্ঠিবদ্ধ হাতের শক্তির আদর্শ মাণ যেমন অজানা তেমনি কিভাবে স্ফীগমোম্যানোমিটারের মাধ্যমে শক্তি পরিমাপ করতে হয় সেটাও অজানা। কিন্তু কোন পুর্নবাসন কেন্দ্রে অবস্থানরত সেবাগ্রহীতাদের চিকিৎসার ফলাফল পরিমাপ করার জন্য অবশ্যই একজন অকুপেশনাল থেরাপিস্টকে সেটার আদর্শ মান জানতে হবে। এই কারনেই গবেষক তার গবেষনা প্রকল্পটিতে, স্ফীগমোম্যানোমিটারের মাধ্যমে বাংলাদেশের প্রাপ্ত বয়স্ক মানুষের মুষ্ঠিবদ্ধ হাতের শক্তির আদর্শ মাণ নির্ণয় করার সিদ্ধান্ত গ্রহণ করেছেন। গবেষণাটির সাধারণ উদ্দেশ্য হল: স্ফীগমোম্যানোমিটারের মাধ্যমে বাংলাদেশের প্রাপ্ত বয়স্ক মানুষের মুষ্ঠিবদ্ধ হাতের শক্তির আদর্শ মাণ স্থাপন করা এবং তার সাথে শারীরিক গঠণ ও হাতের কাঠামোর সম্পর্ক বের করা। আপনার কার্যকারী অংশগ্রহণ গবেষণার উদ্দেশ্য পূরণে সহায়তা করবে বলে আমরা আশাবাদী।

এই গবেষনা কর্মটিতে অংশগ্রহনের সাথে সম্পৃক্ত বিষয়সমূহ কি সে সম্পর্কে জানা যাক।

আপনার থেকে অনুমতিপত্রে স্বাক্ষর নেবার আগে, এই অংশগ্রহনকারী তথ্যপত্রের মাধ্যমে গবেষনা প্রকল্পটির পরিচালনা করার তথ্যসমূহ বিস্তারিত ভাবে আপনার কাছে উপস্থাপন করা হবে। আপনি যদি এই গবেষনায় অংশগ্রহন করতে চান, তাহলে সম্মতিপত্রে আপনাকে স্বাক্ষর করতে হবে। আপনি অংশগ্রহন নিশ্চিত করলে, আপনার সংরক্ষনের জন্য সম্মতিপত্রটির একটি অনুলিপি দিয়ে দেয়া হবে। পরবর্তীতে গবেষক কর্তৃক গঠিত তথ্য-উপাত্ত সংগ্রহের একটি দলের প্রতিনিধি আপনার কাছে যাবে। আপনার থেকে চেয়ে নেওয়া যে কোন একটি নির্দিষ্ট সময়ে একটি স্ফীগমোম্যানোমিটার, ওজন ও উচ্চতা পরিমাপক যন্ত্রের মাধ্যমে তথ্য সংগ্রহ করা হবে যার জন্য আনুমানিক ৫-১০ মিনিট সময় লাগবে। এই গবেষনার প্রকল্পে আপনার অংশগ্রহণ ঐচ্ছিক। যদি আপনি সম্মতি প্রদান না করেন তবে আপনাকে অংশগ্রহন করতে হবে না। আপনি সম্মতি প্রদান করা স্বত্ত্বেও যে কোন সময় গবেষককে কোন ব্যাখ্যা প্রদান করা ছাড়াই নিজের অংশগ্রহন প্রত্যাহার করতে পারবেন।

অংশগ্রহনের সুবিধা ও ঝুঁকিসমূহ কি ?

গবেষনা প্রকল্পটিতে অংশগ্রহনের জন্য আপনি সরাসরি কোন সুবিধা পাবেন না। এই গবেষণায় অংশগ্রহনে আপনার দৈনিন্দন কাজে সাময়িক অসুবিধা হতে পারে। তবে আমরা আশাবাদী যে, এই গবেষণার মাধ্যমে প্রাপ্ত উপাত্ত পরবর্তিতে রোগীদের চিকিৎসা কার্যক্রমকে আরো গতিশীল করতে সাহায্য করবে এবং গবেষনার ফলাফল থেকে প্রাপ্ত উপকারীতা এই অসুবিধাকে অতিক্রম করবে। যেসমস্ত প্রশ্নের মাধ্যমে আপনার পরিচয় সর্ম্পকে অন্যরা জানতে পারে, সেই বিষয়ে উদ্বিগ্ন না হবার জন্য অনুরোধ করা হচ্ছে। অংশগ্রহণকারীর নাম, ঠিকানা উপাত্ত বিশ্লেষণের সফ্টওয়্যারে উল্লেখ না করে পরিচয় উন্মুক্ত হবার ঝুঁকি কমানো হবে।

তথ্যের গোপনীয়তা কি নিশ্চিত থাকবে?

এই সম্মতিপত্রে স্বাক্ষর করার মধ্য দিয়ে, আপনি এই গবেষনা প্রকল্পে অধ্যয়নরত গবেষনা কর্মীকে আপনার ব্যক্তিগত তথ্য সংগ্রহ ও ব্যবহার করার অনুমতি দিয়েছেন। এই গবেষনা প্রকল্পের জন্য সংগৃহীত যেকোন তথ্য, যা আপনাকে সনাক্ত করতে পারে তা গোপনীয় থাকবে। আপনার সম্পর্কে সংগৃহীত তথ্যসমূহ সাংকেতিক উপায়ে উল্লেখ থাকবে। শুধুমাত্র এর সাথে সরাসরি সংশ্লিষ্ট গবেষক ও তার তত্ত্বাবধায়ক এই তথ্যসমূহে প্রবেশাধিকার পাবেন। সাংকেতিক উপায়ে চিহ্নিত উপাত্ত সমূহ পরবর্তী উপাত্ত বিশ্লেষনের কাজে ব্যবহৃত হবে। তথ্যপত্রগুলো তালাবদ্ধ ড্রয়ারে রাখা হবে। বিএইচপিআই এর অকুপেশনাল থেরাপি বিভাগে ও গবেষকের ব্যক্তিগত ল্যাপটপে উপাত্তসমূহের ইলেকট্রনিক ভার্সন সংগৃহীত থাকবে।

প্রত্যাশা করা হচ্ছে যে, এই গবেষণা প্রকল্পের ফলাফল বিভিন্ন ফোরামে প্রকাশিত এবং উপস্থাপিত হবে। যে কোন ধরনের প্রকাশনা ও উপস্থাপনার ক্ষেত্রে তথ্যসমূহ এমন ভাবে সরবরাহ করা হবে, যেন আপনার সম্মতি ছাড়া আপনাকে কোন ভাবেই সনাক্ত করা না যায়। তথ্য-উপাত্ত প্রাথমিক ভাবে কাগজপত্রে সংগ্রহ করা হবে ।

ফলাফল প্রচার সর্ম্পকিত তথ্য

এই গবেষনার ফলাফল বিভিন্ন সামাজিক মাধ্যম, ওয়েবসাইট, সম্মেলন, আলোচনাসভায় এবং পর্যালোচিত জার্নালে প্রকাশ করা হবে।

অংশগ্রণকারীর পারিশ্রমিক

এই গবেষণায় অংশগ্রহনের জন্য কোন উদ্দীপনা ও পারিশ্রমিক দেবার ব্যবস্থা নেই।

গবেষণা পরিচালনার ব্যয়কৃত অর্থের উৎস

এই গবেষণাটির খরচ সম্পূর্ণ গবেষকের নিজস্ব তহবিল থেকে ব্যয় করা হবে। এই গবেষণাটি ছোট পরিসরে করা হবে এবং এখানে কোন অর্থ বহিরাগত উৎস থেকে আসবে না।

অংশগ্রহণ থেকে প্রত্যাহার সর্ম্পকিত তথ্যসমূহ

আপনি সম্মতি প্রদান করা স্বত্তেও যে কোন সময় গবেষককে কোন ব্যাখ্যা প্রদান করা ছাড়াই নিজের অংশগ্রহন প্রত্যাহার করতে পারবেন। বাতিল করার পর তথ্যসমূহ কি ব্যবহার করা যাবে কি যাবেনা

তার অনুমতি অংশগ্রহণকারীর প্রত্যাহারপত্রে (শুধুমাত্র স্বেচ্ছায় প্রত্যাহারকারীর জন্য প্রযোজ্য) উল্লেখ করা থাকবে।

গবেষকের সাথে যোগাযোগের মাধ্যম

গবেষনা প্রকল্পটির বিষয়ে যোগাযোগ করতে চাইলে অথবা গবেষনা প্রকল্পটির সর্ম্পকে কোন প্রশ্ন থাকলে,এখন অথবা পরবর্তীতে যে কোন সময়ে তা জিজ্ঞাসা করা যাবে। সেক্ষেত্রে আপনি গবেষকের সাথে উল্লেখিত ০১৬১৬৩৭৫৭৫৭ (আশরাফুল জান্নাত রিমা) নাম্বারে যোগাযোগ করতে পারেন।

অভিযোগ

এই গবেষনা প্রকল্প পরিচালনা প্রসঙ্গে যেকোন অভিযোগ থাকলে প্রাতিষ্ঠানিক নৈতিকতা পরিষদের সাথে এই নাম্বারে (৭৭৪৫৪৬৪-৫) যোগাযোগ করবেন। এই গবেষনা প্রকল্পটি বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট, সাভারের প্রাতিষ্ঠানিক নৈতিকতা পরিষদ থেকে সিআরপি-বিএইচপিআই/আইআরবি/১০/১৮/১২৪৪ পর্যালোচিত ও অনুমোদিত হয়েছে।

অংশগ্রহণকারীর প্রত্যাহার পত্র

(শুধুমাত্র স্বেচ্ছায় প্রত্যাহারকারীর জন্য প্রযোজ্য)

অংশগ্রহনকারীর নাম: .....

প্রত্যাহার করার কারন:

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পূর্ববর্তী তথ্য ব্যবহারের অনুমতি থাকবে কিনা?

হ্যাঁ/না

অংশগ্রহনকারীর নাম:

অংশগ্রহনকারীর স্বাক্ষর: তারিখ:

* যিদ নিরক্ষর হয়

আঙ্গুলের ছাপ অংশগ্রহনকারীর

স্বাক্ষীর নাম:

স্বাক্ষীর স্বাক্ষর: তারিখ:

কোড নং:

পর্ব ২সম্মতিপত্র :

"স্ফীগমোম্যানোমিটারের মাধ্যমে বাংলাদেশের প্রাপ্ত বয়স্ক মানুষের মুষ্ঠিবদ্ধ হাতের শক্তির পরিমাণ নির্ণয় করা: বাংলাদেশের এশটি আদর্শ গবেষণা " - শীর্ষক গবেষনায় অংশগ্রহনের জন্য আমাকে আমন্ত্রন জানানো হয়েছে। আমি পূর্বলিখিত তথ্য পত্রটি পড়েছি বা এটা আমাকে পড়ে শোনানো হয়েছে। এই বিষয়ে আমার প্রশ্ন জিজ্ঞাসা করার সুযোগ ছিল এবং যে কোন প্রশ্নের আমি সন্তোষজনক উত্তর পেয়েছি। এই গবেষনায় একজন অংশগ্রহনকারী হবার জন্য আমি স্বেচ্ছায় সম্মতি দিচ্ছি।

অংশগ্রহনকারীর নাম:

অংশগ্রহনকারীর স্বাক্ষর: তারিখ : .....

*যদিনিরক্ষর হয়
অংশগ্রহনকারীর আঙ্গুলের ছাপ

স্বাক্ষীর নাম:

স্বাক্ষীর স্বাক্ষর: তারিখ:

<u>গবেষক ও সম্মতিকারীর বিবৃতি:</u>

আমি অংশগ্রহনকারীকে অংশগ্রহনকারীর তথ্যপত্রটি পড়ে শুনিয়েছি এবং আমার সর্বোচ্চ সামর্থ অনুযায়ী নিশ্চিত করেছি যে, অংশগ্রহনকারীর বোধগম্য হয়েছে যে, নিম্নোক্ত বিষয়সমূহ করা হবে।

১) সকল তথ্য গবেষণার কাজে ব্যবহৃত হবে।

২) তথ্যসমূহ সম্পূর্ণভাবে গোপনীয় করা হবে।

৩) অংশগ্রহনকারীর নাম ও পরিচয় প্রকাশ করা হবে না।

আমি নিশ্চিত করেছি যে, এই বিষয় সর্ম্পকে অংশগ্রহনকারীকে প্রশ্ন জিজ্ঞাসা করার সুযোগ দেয়া হয়েছে এবং অংশগ্রহনকারী যে সকল প্রশ্ন জিজ্ঞাসা করেছে আমার সর্বোচ্চ সামর্থ অনুযায়ী, সেগুলোর

সঠিক উত্তর প্রদান করা সম্ভব হয়েছে। আমি নিশ্চিত করেছি যে, কোন ব্যক্তিকে সম্মতি দান করতে বাধ্য করা হয়নি। তিনি অবাধে অথবা স্বেচ্ছায় সম্মতি দিয়েছেন।

অংশগ্রহনকারীকে অংশগ্রহনকারীর তথ্য ও সম্মতিপত্রের একটি অনুলিপি দেওয়া হয়েছে।

গবেষকের নাম:

গবেষকের স্বাক্ষর: তারিখ:

Appendix V

Data Collection Form

Socio-Demographic Information

Date: ……. /……. / 2018 **Code No:…….**

Age (in years)		
Age Range	1= 18-24 2= 25-31 3= 32-38 4= 39-45 5= 46-52 6=53-58 7= >58	
Sex of the Participant	1= Male 2= Female	
Level of Education	1= Illiterate 2= Signature 3= Primary 4= Secondary 5= SSC 6= HSC/ Diploma 7= B.Sc/ BA/ Honors 8= M.Sc/ MA/ Masters 9= Others	
Occupation of the Participant	1= Student 2= Housewife 3= Managers 4= Professional 5= Clerical support workers 6= Service and sales workers 7= Skilled agricultural, forestry and fishery workers 8= Craft and related trades workers 9= Plant and machine operators, and assemblers 10= Elementary occupations 11= Armed forces occupations 7= Retired/No Occupation	

Weight (in kg)	
Height (in cm)	
BMI	

Hand anthropometric measurement

Hand length:

- ✓ Right:
- ✓ Left:

Hand breadth:

- ✓ Right:
- ✓ Left:

Measurement of Grip Strength by Modified Sphygmomanometer

Dominant Hand:

1. Right
2. Left

Grip Strength	Dominant hand (mm Hg)	Non-dominant hand (mm Hg)
01.		
02.		
03.		
Mean		

Appendix VI

Instruction Sheet

Hand Grip Strength with Modified Sphygmomanometer:

HGS will measure according to a standard protocol based on the recommendations of the ASHT (Ibegbu, David, Hamman, Umana, & Musa, 2015).

- The subject position in ASHT testing protocol is seated upright against the back of a chair with feet flat on the floor. The shoulder adducted and neutrally rotated, the elbow flexed at 90° and the forearm in neutral/ mid-prone position and wrist between 0° and 30° of extension with neutral radio-ulnar deviation (Fess et al., 1992).
- The subject will be then instructed to be seated with shoulder adducted and neutrally rotated, elbow flexed 90°, forearm in mid-prone and wrist in neutral to 30° extension (wrist in slightly extended position), with neutral radio-ulnar deviation for optimal performance in power grip (ASHT;Fess et al., 1992).
- The sphygmomanometer will be inflated to 100 mm Hg and its valve will be kept closed to remove the folds from the inflatable portion. Then, the pressure will reduce to 20 mm-Hg, and the valve will be closed again to prevent leakage (Kaegi, et al, 1998), providing a measurement range between 20-300 mm Hg.
- Each subject will be instructed to breathe in through her nose and blow out through pursed lips as a maximum grip effort can be made. At this time, a verbal command of "Squeeze! Harder! Harder! Relax!" will be given by the examiner.
- The subject will be asked to hold each contraction for 5 seconds, and then a rest period of 20 seconds will be allowed between measurements of the same hand (Fess, 1992 & Figueiredo et al, 2007).
- The test will be performed four times for each hand. The first measurement will be performed to familiarize the subject with the device. The mean value of the last three measurements will be used in the study.
- Subsequently, the same procedure will perform on the other hand

Measurement of Height:

Subjects' height was measured according to a standard protocol based on the recommendations of the FEHES (Viet &Verschuren,2008).

Exclusion criteria: Height is not measured for people in a wheelchair, persons who have difficulty to stand straight, and participants with a hairstyle (e.g. Puff hair) that prevents proper use of the height equipment.

Equipment: Stadiometer

Protocol for measuring height:

- Place the base of the stadiometer on the floor. Slot the measurement rods into the base of the stadiometer in the correct order. Make sure it is inserted fully.
- Participants are asked to remove their shoes, heavy outer garments, and hair ornaments and head dress.
- The participant is asked to stand on the centre of the base with his/her back to the height rule. Ask them to put their feet together and move back until their heels touch the bottom of the stadiometer upright. Their buttocks and upper part of their back should also be touching the stadiometer upright. Their head does not have to touch the stadiometer.
- The participant is asked to Stand up straight and look straight ahead.
- When the respondent is in the correct position, ask them to take a deep breath and hold it. Lower the headboard until it is in contact with the head. Hold the headboard firmly at its final position and take the reading to the nearest 0.1 cm.
- If the person is taller than the maximum height of the stadiometer, the self reported height is acceptable and recorded on the collection form.
- If a participant is excluded from height measurement, the reason should be recorded in the data collection form.

Measurement of weight by Weighing Machine:

Weight measurement was conducted according to a standard protocol based on the New Zealand Health Monitor (NZHM) Surveys (Marfell-Jones, 2008)

- Place the scales on a hard flat surface. If carpet is the only floor covering in the measurement location, put a board down on the carpet and place the scales on the board.
- Press firmly on the centre of the scales to turn them on. Once the zeros appear.
- Ask the subject to stand on the centre of the scales without support, with their arms loosely by their sides, head facing forward and with their weight distributed evenly on both feet.
- A reading will appear in a few seconds. The numbers will change, and then stop. Once the numbers have stopped, take the reading to the nearest 0.1 kg.
- Ask the subject to step off the scale. Record the reading.

NB: Our scales weigh to a maximum of 200 kilograms. If a respondent weighs more than this, the scales will display _ _ _ _. If this happens, record the weight as "200+ kg".