ANTHROPOMETRIC MEASUREMENT AMONG SEWING MACHINE OPERATORS OF GARMENT WORKERS IN BANGLADESH

By

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

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Abstract

Background: The term "anthropometry" refers to many types of measurements which completely describe the human form. It is the science of measurement of the human body that helps to explain the complexities of the human form and how it interferes with the environment. For designing any product, designers have to rely on scientific anthropometric data which can be used to design spaces that fit the largest number of people. Otherwise the output may turn out to be non-ergonomically designed product. This can contribute to biomechanical stresses and increase the risk of cumulative trauma and carpal tunnel syndrome for workers. So, for the designing and implementing of safe tools, it is essential to use anthropometric data.

Aims and objectives of the study: The study aims was to measure the anthropometry of sewing machine operators of garments workers in Bangladesh. The three objectives were, to measure and summarize about 26 anthropometric body dimensions of sewing machine operators; to compare the dimensions of male from the female operators; and to determine the association between demographic factors and anthropometric body dimensions.

Methodology: A cross sectional study of quantitative design was selected as the research design to fulfill the research aim and objectives. The study was carried out from the garment named "Blue Cap Need Fashion Undergarment Limited" which is situated at Baipaill of Savar thana. 137 sewing machine operators were selected randomly to carry out the research.

Result and discussion: 26 dimensions were measured and summarized by analyzing the data. T-test results show significant differences in all dimensions ($P=.001$; $P<.05$) except in two dimensions (sitting leg length, abdominal depth) between male and female sewing operators and the mean average male body dimensions were higher than the female body dimensions. Paired sample t-test results show that the association between demographic factors and anthropometric body dimensions were ($P=.001$; $P<.05$).

Conclusion: Anthropometry plays an important role for ergonomics intervention. Understanding anthropometry is essential to the application of ergonomics. Anthropometry provides the parameters of human size and shape that allow designers to fulfill the needs of both comfort and function.

Keywords: *Anthropometric measurement, anthropometric body dimension, sewing machine operators in Bangladesh, Bangladesh.*

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BHPI: Bangladesh Health Professions Institute

CRP: Center for the Rehabilitation of the Paralyzed

PPE: Personal Protective Equipment

BGMEA: Bangladesh Garment Manufactures & Exporters Association

RMG: Ready Made Garment

UK: United Kingdom

US: United States

BIDS: Bangladesh Institution of Development Studies

CIA: Central Intelligence Agency

UN: United Nation

SPSS: Statistical Package for Social Science

OT: Occupational Therapy

CHAPTER 1
INTRODUCTION

1.1 Background

The term "anthropometry" refers to many types of measurements which completely describes the human form (Jacobs, 2008). Moreover, anthropometry is an indicator of health (Chao and Wang, 2010; Khadem and Islam, 2014). It is the branch of the human sciences dealing with measurements of the size, weight and proportions of the human body to achieve comfort, fit and usability (Hanson *et al*. 2009). Anthropometric data also provides information on static dimensions of the human body in standard postures (Hsiao, Long and Snyder, 2002; Khadem and Islam, 2014; Chao and Wang, 2010). Anthropometric measurement of human limbs is the basic information for designing workplaces, clothes, hand tools (Mohammad, 2005), furniture, machines & devices (Klamklaya *et al.* 2008), clothing, working environments, environments for disabled persons and many products for human use (Chao and Wang, 2010). In 1890, Richer used the caliper which was the first standard anthropometric tool (Chao and Wang, 2010).

For designing any product, engineers/ergonomists/designers have to rely on scientific anthropometric data (Chao and Wang, 2010; Jacobs, 2008) to develop concrete and scientific information that can be used to design spaces that fit the largest number of the population (Jacobs, 2008; Mohammad, 2005; Chuan, Hartono and Kumar, 2010). Otherwise the output may turn out to be a non-ergonomically designed product (Chao and Wang, 2010) and this contributes to biomechanical stresses and increases the risk of work-related injuries like musculoskeletal disorders (Chuan, Hartono and Kumar, 2010; Mohammad, 2005) and can lead to discomfort, pain and disorders in the neck and shoulder, arm, hand, wrist and back (Hanson *et al*. 2009). It can also lead to the development of work-related psychological discomfort (Khadem and Islam, 2014). Moreover, that can affect job performance quality and productivity, as well as workers' safety and health (Imrhan, Sarder and Mandahawi 2009; Prado-Lu, 2004; Sanders, 2004; Kalinkara *et al.* 2011). For minimizing poor anthropometric correspondence between product or workplace and users, designers have to use validated, correct and updated anthropometric measurements (Prado-Lu, 2004; Hanson *et al*. 2009). For increasing the usability and reduce the negative effects on the user, making the work environment more comfortable, safe and friendly (Prado-Lu, 2007), enabling higher performance (Klamklay *et al*. 2008; Iseria and Arslan, 2009) as well as creating a productive working environment (Khadem and Islam, 2014; Iseria and Arslan, 2009), all products including clothes, consumer products along with systems of products such as office workplaces, vehicles, personal protective equipment need to be adjusted to user anthropometrics (Imrhan, Sarder and Mandahawi, 2009; Prado-Lu, 2004; Sanders, 2004; Garcia-Caceres *et al*. 2012) that can help to increase the usage of the product throughout a person’s lifetime (Nadadur and Parkinson, 2013).

A vast majority of women working in textile and apparel industries serve as sewing machine operators. The physical burden in the sewing process is considerably high (Kalinkara *et al*. 2011). Most manual, sewing machine tasks have been designed to be performed while being seated with head and trunk flexed posture. The task usually requires simultaneous but different motions with the two hands, the continuous operation of foot pedals, pushing the materials forward with the left hand while manipulating and holding materials in the sewing foot with the right hand (Halpern and Dawson, 1997; Li, Haslegrave and Corlett, 1995). Due to the design of the body and needle of the sewing machine, the operator assumes a forward flexed head and torso posture (Halpern and Dawson, 1997). This work activity is maintained throughout the whole work shift, except perhaps for a few ancillary tasks, which may permit occasional changes in the working position (Li, Haslegrave and Corlett, 1995). Therefore, many researchers have showed that the repetitive nature of sewing tasks performed with these static and awkward postures because of inappropriately designed tools, may be the risk factors contributing to the significant incidence of musculoskeletal disorders in the sewing industry (Halpern and Dawson, 1997). In a study of 6 sewing machine operators of Mexican descent working in the United States found that the design of the sewing machine and workstation layout, despite adjustability, did not match the anthropometric proportions of the workers. And, for this reason the operators failed to make appropriate adjustments to the workstation during the working day (Sealetsa and Thatcher, 2011).

A study about the anthropometric measurements related to the workplace design of the women in the clothing industry in the same age group. Kalinkara *et al.* (2011) showed that more than the half (55.5%) of the women have problems arising from the working environment and the equipment. Moreover, female garment workers showed significantly smaller upper arm and upper leg lengths and significantly larger body mass index, bi-iliac breadth, elbow breadth when compared to all occupational groups combined (Hsiao, Long and Snyder, 2010). That study also indicated that female garment workers had larger waist circumferences than those in the other occupations and all occupation categories. A study by Fernandez *et al.* (1989) found that the body dimensions of Korean females differed from western and Japanese females. Korean female garment workers were 45 mm shorter than US females but 50 mm taller than Japanese females. The difference in eye height was more than 90 mm (Liu, Sanchez-Monroy and Parga, 1999)

In industrialized countries, there are a vast number of studies about the anthropometric measurement of different workers in different sectors, but the number of studies about anthropometric measurements of the textile sector is limited (Kalinkara *et al*. 2011). There have a few studies about the anthropometry of garment workers. Among those studies, Prado- Lu (2004) showed the importance of height anthropometry of garment workers in working postures. The study by Imrhan, Sarder and Mandahawi (2009) showed the importance of hand anthropometry for any target population for ergonomically designed tools and equipment, and for manual tasks or access spaces for the hand. Another study by Sealetsa and Thatcher (2011) showed the importance of anthropometry for designing work itself (e.g. work rest cycles and cooperative work), work stations (e.g. work surface height, table shape, work surface angle and adjustable chairs) and sewing equipment ((e.g. needle angle and sewing machine shape). Lin, Wang and Wang (2004) found that there are different anthropometric characteristics in different population groups. Delleman and Dul (1999) stated that workstations of the sewing operators needed to be adjusted in order to improve working posture and reduce the number of complaints.

Thus, Bangladesh is the eighth most populated country in the world, with approximately 160 million people. The age range of 15–64 years is considered the working age in Bangladesh (Khadem and Islam, 2014). At present, approximately 2 million workers (among which 80% is female) are working in the garment sector which is a great source of employment (Nahar and Begum, 2010). But, there has been no publication of anthropometric data for textile and industries serve as sewing machine operators of garment workers in Bangladesh. Which can solve the problems such as reduce the work performance, increase the frequency of work-related injuries, discomfort, pain and disorders in the neck, shoulder, arm, hand, wrist and back (Imrhan, Sarder and Mandahawi, 2009). Moreover, no one hand tool is perfect for every job and no one hand tool is perfect for every user (Jackobs, 2008; Mohammad, 2005). Hand tools and many other equipment which are controlled by means of operator's hand, tools and equipment should be designed separately for both males and females workers (Mohammad, 2005). Both males and females were using the hand tools that are available in the market and these tools are made outside of the country like USA, Japan, UK, Taiwan and China (Imrhan, Sarder and Mandahawi, 2009). So, an appropriate match between people, products and workplaces in these interactions requires users' anthropometry which must be ergonomically adjusted to products and workplaces (Hsu and Yu, 2010).

So, it is essential to establish anthropometric data for Bangladeshi sewing machine operators for best designed equipment, tools and workstation.

1.2 Significance of the study

In a developing country like Bangladesh, Readymade Garment (RMG) sector plays an important role in the overall economic development. Workers in the garment industry work in clothes designing, sewing or cutting services, and clothes selling in the shop. Due to the nature of these jobs, the poor physical workplace and equipment design, administrative problems (inadequate breaks and lack of job control by workers), have most likely contributed to the physical complaints and health related problem. So, it should be considered the human-body dimensions measurement for this group of population to decrease the physical workload, increase the efficacy of the performance and improve health condition.

The purpose of this study is to investigate the anthropometric measurement among sewing machine operators of garment workers in Bangladesh. The anthropometric measures determined in this study will be useful for the design of workplace arrangements, and for the design of ergonomic products and means in the areas like garment sector. The occupational therapy professionals are the specialist of human body factors and they can modify working environment according to personnel needs. So, it will be helpful for any occupational therapist and industry to ensure occupational health and safety by providing standard anthropometric data of sewing machine operator for proper ergonomic sound chair and table for the workers. And if the study will be established, an occupational therapist can get an evidence for prescribing anthropometric data to any garments by telling the importance of anthropometric measurement among the worker and will develop a new sector for occupational therapist in Bangladesh.

1.3 Aim & objectives

Aim

The aim of the study is to measure the anthropometry among sewing machine operators of garment workers in Bangladesh.

Objectives

- To measure and summarize about 26 anthropometric body dimensions among sewing machine operators.
- To compare these dimensions with the corresponding male from the female.
- To determine the association between demographic factors and anthropometric body dimensions.

CHAPTER 2
LITERATURE REVIEW

2.1 Anthropometric measurement

People have always studied and analyzed the human form (Jackobs, 2008). Anthropometric data are measured from childhood and elderly as well as for members of a wide variety of ethnic groups (Jackobs, 2008) that is the indicator of health and nutritional status (P. Lu, 2003). Along with the dimension of human forms (stature, breadth, length), anthropometry also describes the mass of the human form (weight, center of the gravity) (Khadem and Islam, 2014) and the parameters of human strength and motion (Jackobs, 2008) that establishes the physical geometry, mass properties, and strength capabilities of the human body (Prado- Lu, 2007).

Anthropometric data are one of essential factors in designing human, machines, devices and tools, vehicles and personal protective equipment (Kalmkara *et al*. 2011; Iseria and Arslan, 2009; Hsiao, Long and Snyder, 2002) for achieving effective design for high performance and productivity (Klamklay *et al.* 2008). It has been considered as the very basic core of ergonomics in an attempt to resolve the dilemma of "fitting people to machines" (Wang *et al.,* 1999) which must be ergonomically adjusted to products and workplaces (Khadem and Islam, 2014). It is the branch of the human sciences that deals with body measurements (Iseria and Arslan, 2009) which indicates people's health status (Khadem and Islam, 2014).

The economic growth and technological improvements have led to greater demand and development of machines and devices used in industrial settings (Kalmkara *et al*. 2011). Nowadays, the collection of anthropometric had been conducted through a sophisticated technology (i.e. three-dimensional measurement) which even proposing an error detection procedure (Chuan, Hartono and Kumar, 2010).

Designs that are incompatible with anthropometric measurements of a workforce could result in undesired incidents (Hsiao, Long and Snyder, 2002). A 10-year study by Pratt showed that machinery related accidents are the highest leading cause of traumatic injuries and death in US. From these incidents 8,505 civilian workers died and an average annual fatality rate is .80 per 100,000 workers in United States. There is therefore a need to provide efficient and anthropometrically designed equipment to protect workers from fatalities, injuries, and illnesses. The accidental causal factors include use of hand tools and machinery, unsafe mechanical or physical conditions, and unsafe acts (P. Lu, 2003).

Hand anthropometry is useful for determining various aspects of industrial machineries (Mohammad, 2005); hygiene, medicine, and many other applications (Hsu and Yu, 2010) so as to design the equipment and machines for better efficiency and more human comfort (Mohammad, 2005). Quickly and precisely obtaining or estimating this measurement has great importance (Hsu and Yu, 2010).

It is difficult to design products and workplaces because the dimensions of the human body vary by age, sex, race and nationality (Hsiao, Long and Snyder, 2002; Khadem and Islam, 2014; Chao and Wang, 2010). Thus, it is advisable to consider some essential anthropometric dimensions (Chao and Wang, 2010; Chuan, Hartono and Kumar, 2010). One of the most important biological variables that affect the physical characteristics of a human being is the genetic structure. Moreover, gender is a factor that affects physiology, and body ratios show considerable gender differences. The differences between men and women cannot be accounted for in one design (Lin, Wang and Wang, 2004). Statistical analysis (t-test) of the data about anthropometric characteristics of the hand based on laterality and sex among the Jordanian population indicated that there was a significant difference in hand dimensions between males and females ($P<0.01$).

In addition, anthropometric data have made significant contributions to forensic medicine; the data help after a major disaster. However, creating anthropometric databases usually requires considerable resources in terms of workforce, equipment, and funds (Chuan, Hartono and Kumar, 2010).

2.2 Anthropometric body dimension

Body dimension is the measurement of body which provides the basis for the development of information of models mad to measure pattern making (Lee, 1994). Though there are subtle differences between individuals, human body dimension fit within a standard range, which has varied considerably over different periods and regions. Body dimension also provide a suggested list of data requirements for the collection of body measurements (Lee, 1994).

In 2008, Jacobs stated that anthropometry always looks at human dimensions in either sagittal plane or coronal plane. It also maintains two standard postures:

Standing posture: The person stands erect and looks straight ahead with his or her in a relaxed posture (Jacobs, 2008).

Sitting posture: The person sits erect and looks straight ahead. The sitting surface is adjusted so that the person's thigh is parallel to the floor and the knees are bent to a 90º angle with the feet flat on the floor. The upper arm is relaxed and perpendicular to the horizontal plane and the forearm is at a right angle to the upper arm and thus also parallel to the floor. Measurements in sitting are made using a horizontal reference point, either the ground or in the seat. A vertical reference point is an imaginary line that touches the back of the uncompressed buttocks and shoulder blades of the subject. Thus, in the standard seated posture, the person is measured with most joints, the ankle, knees, hip and elbows at 90º angles (Jacobs, 2008).

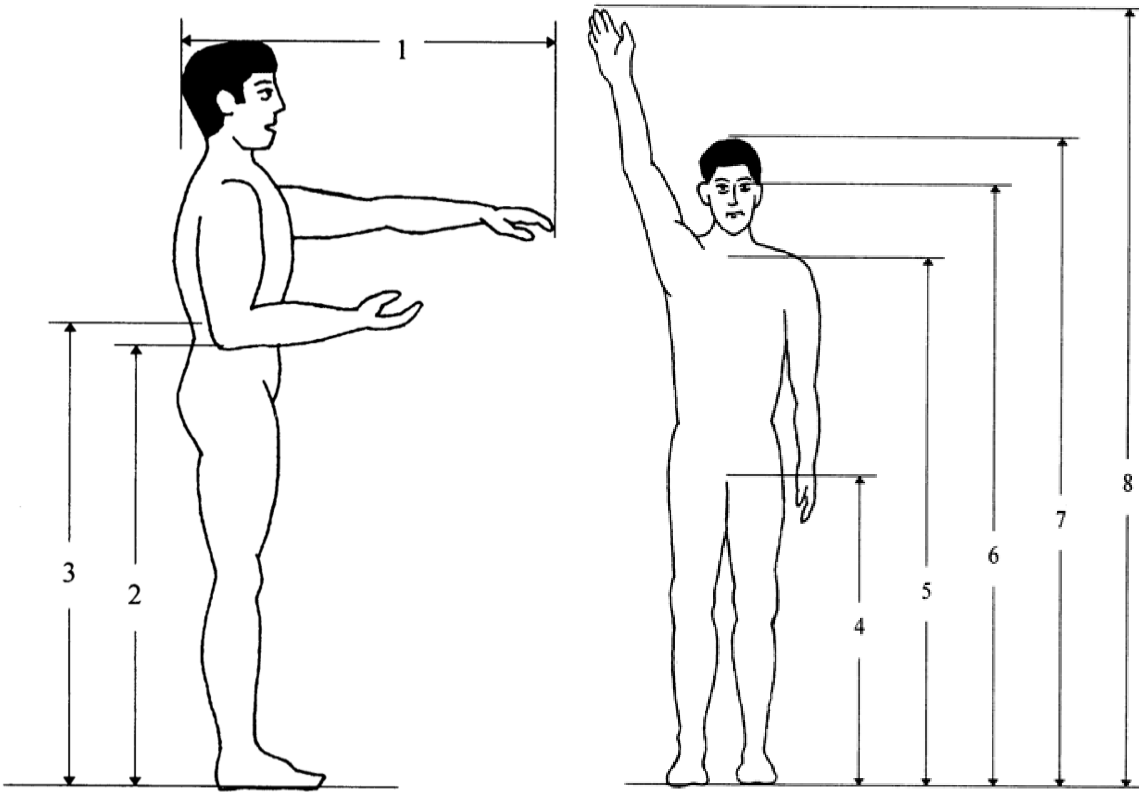
Changes in life styles, nutrition and ethnic groups of populations lead to changes in the distribution of body dimensions and require regular updating of anthropometric data collections (Iseria and Arslan, 2009). Variation in body dimension among people, according to sex and race, can make the product design problematic. So, it is more difficult to design equipment or tools according to all body types and sizes. So, we have to deal at least with the important dimensions (Chuan, Hartono and Kumar, 2010). This study describes 26 body dimensions. The definitions of those dimensions are given below:

Table 1: Body dimensions with their definitions

Body dimensions	Definitions
1. Forward grip reach (standing)	The horizontal distance from the back of the right shoulder blade to the center of a cylindrical rod firmly held in the palm of the right hand.
2. Standing elbow height	The vertical distance from the floor to the lowest point of the right elbow, when standing, with the elbow flexed at 90 degrees.
3. Standing waist height	The vertical distance from the floor to the trochanter landmark on the upper side of the right thigh, when standing.
4. Standing knuckle height	The vertical distance from the floor to the knuckle (metacarpal bone) of the middle finger of the right hand, when standing.
5. Standing shoulder height	The vertical distance from the floor to the tip (acromion) of the shoulder, when standing

6. Standing eye height	The vertical distance from the floor to the outer corner of the right eye, when standing
7. Stature	The vertical distance from the floor to the top of the head, when standing
8. Functional overhead reach (standing)	The vertical distance from the floor to the center of a cylindrical rod firmly held in the palm of the right hand
9. Thigh clearance	The vertical distance from top of the acromion to back of the thigh when sitting.
10. Sitting eye height	The vertical distance from the sitting surface to the outer corner of the right eye, when sitting.
11. Sitting height	The vertical distance from the floor to the top of the head, when sitting
12. Functional overhead reach (sitting)	The vertical distance from the sitting surface to the center of a cylindrical rod firmly held in the palm of the right hand.
13. Elbow to fist length	The distance from the back of the right elbow to the tip of the extended middle finger, with the elbow flexed at 90 degrees.
14. Knee height	The vertical distance from the upper part of the knee to the floor, when sitting with the knee flexed at 90 degrees.
15. Seat height	The vertical distance from lower part of the seat to the floor, when sitting.
16. Buttock-knee length (sitting)	The horizontal distance from the back of the buttocks to the most protruding point on the right knee, when sitting with the knee flexed at 90 degrees.
17. Buttock- popliteal length (sitting	The horizontal distance from the back of the buttocks to back of the right knee just below the thigh when sitting with the knee flexed at 90 degrees.
18. Leg length (sitting)	The horizontal distance from back of the buttock to arch of the foot when sitting with leg straight forwardly.
19. Chest depth	The horizontal distance from the back to the right nipple.
20. Abdominal depth	The horizontal distance from the back to the most protruding point on the abdomen.
21. Arm length	The vertical distance from the tip of the right middle finger to the right acromion, with the arm hanging vertically.
22. Downward grip reach	The vertical distance from the right acromion to the

	center of a cylindrical rod firmly held in the palm of the right hand, with the arm hanging vertically.
23. Hand length	The length of the right hand between the crease of the wrist and the tip of the middle finger, with the hand flat.
24. Hand breadth	The breadth of the right hand across the knuckles of the four fingers.
25. Foot length	The maximum length of the right foot, when standing.
26. Weight	Body weight taken to the nearest tenth of a kilogram.



(a) **(b)**

Figure 1: Anthropometric items for work environment design **(a)** side view standing; **(b)** front view standing

(Wang, E.M. (1999). *Anthropometric items for work environment design*. Available at www.sciencedirect.com/science/.../S0169814197000954 [Accessed 27 May, 2014].)

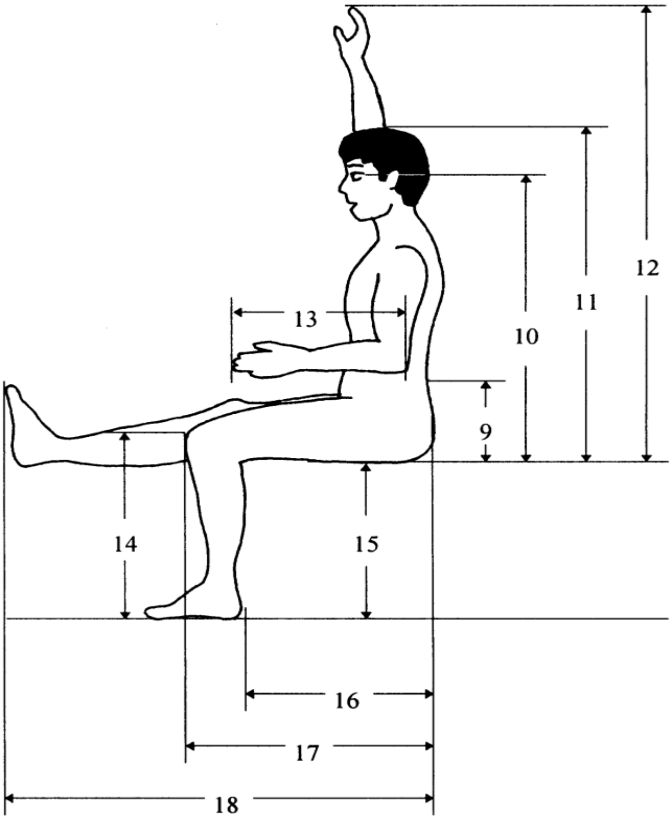


Figure 2: Anthropometric items for work environment design side view sitting (Wang, E.M. (1999). *Anthropometric items for work environment design side view sitting*. Available at www.sciencedirect.com/science/.../S0169814197000954 [Accessed 27 May, 2014].)

A commonly used technique for determining a specific body dimension is to measure the person's stature and multiply it by a given ratio. However, many of these ratios are inconsistent for different groups of people. This likely indicates that stature may not be a good benchmark choice for body ratios (Chao and Wang, 2010; Chuan, Hartono and Kumar, 2010). Human stature is now a well-established indicator for the biological standard of living, positively correlated as it is, along with good health and longevity, with a nutritious diet (Hsiao, Long and Snyder, 2010).

Reach is defined as a sphere around the worker that can be touched by the worker at all points without moving the body from the starting point. The shoulder is the axis or center of the sphere and the length of the arm is equal to the radius. When designing to accommodate reach, consider the smallest user, the 5th percentile woman. If she can reach an object, all larger individual can reach it, too (Jacobs, 2008).

- **Vertical reach-** operating buttons on a control panel and getting objects off high shelves are examples of activities that occur during vertical reach (Jacobs, 2008).
- **Horizontal reach-** horizontal height is usually defined by a tabletop or counter; the worker manipulates objects on its surface (Jacobs, 2008).
    - ✓ Normal work distance is the arc made by the forearm when the body is as close to the table as is comfortable and the elbow is close to the side. This is the area where most precision work is performed (Jacobs, 2008).
    - ✓ Extended working distance is the area is made by the arc of the arm when the elbow is straight. This is best for storing frequently used tools, supplies and heavy objects (Jacobs, 2008).
    - ✓ Maximum work distance is established when the body leans forward. This area is best for infrequently used supplies and tools. It is also the area that is considered for the placement of push-buttons and other controls (Jacobs, 2008).
    - ✓ Most efficient workplace is defined by a 10 inch (250 mm) square directly in front of the worker and about a hand's span from the edge of the table. This is the area where most people prefer to work, as it places material at the most comfortable distance from the body (Jacobs, 2008).
- **Clearance-** Clearance is the space needed to allow free passage of a person or a body segment. Clearance can be as narrow as a hatchway into a submarine or as wide as a doorway in a civic center that allows many people to pass in and out at the same time (Jacobs, 2008).

2.3 Sewing machine operators in Bangladesh

In a developing country like Bangladesh, Readymade Garment (RMG) sector plays an important role in the overall economic development (Nahar, Ali and Begum, 2010) and it has been placed largest export earnings (more than 78% of the country's total foreign earnings) of Bangladesh (BGMEA, 2012) where 4,825 garment factories are running, employing over three million people of which 85% workers are women (Sikdar, Sarkar and Sadeka, 2014). Moreover, RMG industry is considered as the back bone of the country's economy while it plays great role for many people socio-economic wellbeing (Sikdar, Sarkar and Sadeka, 2014). Bangladesh is also the second largest apparel exporter in the world with a total export of USD $17.91 billion in the fiscal year of 2010-11 (Wadud, Huda and Ahmed).

In 2011, BGMEA mentioned that the industry deserves special implication for at least three reasons: (a) it is the single largest earner about 77 % of the yearly foreign exchange earning of the country; (b) it has been the fastest growing industry in the recent years; (c) The industry employees about 3.6 million people and the growth rate of RMG export was over 20% in the last two decades (BGMEA, 2011).

Bangladesh is clearly ahead of other Southeast Asian suppliers in terms of capacity of the ready-made-garment industry with 5,000 factories where employing about 3.6 million workers (of a total workforce of 74 million). It also offers satisfactory levels of quality, especially in value and entry-level midmarket products (Raaz, 2014). Global garment exports are valued at more than US$310 billion a year, of which the world's top 15 clothing exporters account for more than 80%. In 2006, JUKI Bangladesh recorded in the JUKI magazine that 12.17786 billion US$ in exports and 17.15856 billion US$ in imports. By 2004-05 exports had reached US$ 6.4 billion (Bhuiyan, 2012).

Bangladesh has developing as a key player in RMG sector (Ready Made Garment Industry) and 76% of its total textile and clothing export earnings comes from the apparel industry (Apparel Clothing & Garments Companies Directory). They also supplement that the majority of the industry is sewing, and textile products account for 67% of their exports. As such, the country is so much depended on its sewing industry. In the North, cotton is being grown, but the majority of the material of the sewing products for exportation comes from China or the US. When looking at the countries exported to, the major customers are the US and European countries, which amount to 28.8% for the US, 16.8% for Germany and 10.0% for the UK. The sewing industry is expected to grow further based on an ample labor force (JUKI, 2014).

The garments workers are earning their breads by very hard labor .They render to the owners from the beginning to midnight. Sometimes, they have to work even for more than 24 hours without rest (they get breaks for their snacks, which are arranged by the authority) (Bhuiyan, 2012). Bangladesh has a very cheap labor market. Almost 69 percent female workers are getting 3000 to 7000 taka as per month salary and almost 31 percent are drawing more than seven thousands taka in a month. The average salary has been estimated as 6455.94 taka (US$ 78.83) per month (Sikdar, Sarkar and Sadeka, 2014).

According to research monograph 18, BIDS (Bangladesh Institution of Development Studies) (2007) stated that 34% of the workers were sewing operators, while 24% were sewing helpers. Moreover, at least one sewing helper was needed to help two operators. Another 8% of the workers were found to be working as sewing supervisor. Thus, there was one supervisor for 4-5 operators.

In addition to, at least 37% of the sewing helpers and 24% of the finishing helpers are child labor. Majority of the workforce in the garment factories were found to be young: about 73 per cent of all workers were 24 years or younger (BIDS, 2007). According to the present status of Bangladesh garments worker, Zohir and Mojumder (2007) found that 78% were found to be literate and only 22% illiterate, i.e. can at best sign their names and also mentioned that among those workers most of the female are illiterate (male 10% and female 30%). Only 15 percent of all the workers interviewed reported to have previous work experience. Relatively, a greater number of men had previous work experience (29%) than that of women (7%) (Zohir and Mojumder, 2007).

International Labor instruments provide 8 working hours for workers in each work day. In any other industry, the normal working hours in the garment industry is 8 hours a day, usually from 7.30 or 8.00 a.m. to 4.30 or 5.00 p.m. As there is seasonality in its production, work hours varied accordingly. BIDS (2007) showed that the labor requirement increases during the peak season and the workers require working overtime where the peak season is from October to January, while the relaxed season is from March to June.

2.4 Bangladesh

The official name for Bangladesh is the People’s Republic of Bangladesh. In 1947, the country became independent from the British colony of India as Pakistan, and later in 1971, after 9 months liberation war the east half of Pakistan became Bangladesh. Most of the border lines in the West, North and East are shared with India, and there is a short border line with Myanmar to the South (JUKI, 2014). The nationwide reported that 71 million people living in here. In 1980, Bangladesh population had grown to 90.4 million and arises from decade to decade. The nationwide census in the country took place in March of 2011 and preliminary results claimed that the population of Bangladesh at the time was 142.3 million. This was immediately disputed by the UN and was subsequently dismissed by the Bangladesh authorities themselves.

Bangladesh is a large and heavily densely populated country with numbers that have either exceeded or are approaching the 159.5 million mark (World Population review, 2014). Estimates here suggest that the Bangladesh population stood at 148 million while an approximation from the CIA in July of that year indicated that Bangladesh would be the 8th most populous country in the world. In terms of land mass, Bangladesh is only the 94th largest country in the world with a surface area of 147,570 square kilometers (56,977 square miles). For every square kilometer of land there is an average of 964.42 people here. That converts to 2,497.4 per square mile and it makes the country the 9th largest in terms of density alone (World Population review, 2014).

98% of the Bangladesh populations are ethnic Bengalis with the remaining 2% made up from Biharis and other ethnic tribes. Through the 1960’s and 1970’s, the birth rate in Bangladesh was among the highest in the world but that started to slow down considerably in the 1980’s (World Population review, 2014).

In terms of the country’s economy, the growth rate is as high as 6.71% in 2005 and 6.51% in 2006. However, this growth rate is not so high when compared to other countries in fast growing Asia. Some of the reasons are considered to be an insufficient infrastructure, unstable political and social situation and complicated administrative processes for obtaining government approvals. Most of the country is flat, and the southern part is a delta area with many rivers. In the dry season, it is quite dry, however, in the rainy season; many parts of the land are submerged. In other words, they are destined to encounter periodical floods, which contribute to the reasons for the country’s slow development and prevents further economic development (JUKI, 2014).

CHAPTER 3
METHODOLOGY

3.1 Study design

Cross sectional study of quantitative design was selected as research design. Because quantitative methods are appropriate for this study because it establishes relationship between variables, allow prediction and strive for generalizability (Bailey, 1997). Under the quantitative method, the cross sectional methods was used because in this way it is possible to identifying a defined population at a particular point of time (Oslen and George, 2004). A cross sectional study can evaluate a large number of participants at little cost or effort and ways to provide a still picture of outcome and also the characteristics associated with it within a specific period of time (Levin, 2006). To find out the anthropometric measurement among sewing machine operators, it is needed to take a still picture of present condition within a specific period of time. So, the cross sectional study of quantitative research was chosen to complete this study.

3.2 Study settings

The study was carried out from a garment industry named “Blue Cap Need Fashion Undergarment Limited” which is situated at Baipaill of Savar thana.

The distance of this area is about 40 kilometer from Dhaka district. This industry proudly represents the readymade garment industry. In this industry there have some departments such as Quality department (where the worker have no opportunity for sitting except lunch break), sewing department (in this department workers are mostly working in sitting position and have no work for standing), cutting section (in this area workers perform their work in standing position). Among those department, women are more common than men.

The study was held in the sewing department for establishing the aims and objectives of the study. In the sewing department approximately 200 workers are performing their job and most of the workers are female. They do their work in sitting position and they have no opportunity for standing work except lunch break.

3.3 Population and sampling procedure

3.3.1 Participants

Approximately 137 participants were selected conveniently from above mentioned place for holding the study. The participants were sewing machine operators. Participants were both male and female sewing operators aged between 18 to 36 years. In garment industry, participants who met the inclusion criteria were took as a sample in this study.

3.3.2 Sampling procedure

The convenient sampling procedure was used throughout the process of participant's selection. A convenience sample is a group of individuals who are available for the study (Fraenkel and Wallen, 2000) and it also consider the financial or temporal reasons (Bailey, 1997). Convenient sampling was used in the study because it is mostly easier, cheaper, and quickly. Moreover, using this sampling is a practical solution to a very real problem that makes an alert to the variables which can have an impact on the research. Considering this issues, data were collected from 137 participants from the selected area.

3.3.3 Sample size determination

From Hicks (2000), the principle of sample size determination was used for calculating sample size. 90% confidence interval was used for this study where the confidence interval, z = 1.64 and 7% sampling error for this research, thus the sampling error, = 0.07. The anthropometric measurement data among sewing machine operators in Bangladesh was not known by the investigator so the prevalence, p = 50% = 0.5 & q = (1- p) = (1-0.5) = 0.5, so q = 0.5. Then, if investigator calculates the sample size *(n*) it will stand for:

$$n = \frac{(1.64)^2 \times\ 0.5 \times 0.5}{(.07)^2}$$

$$= \frac{.6724}{.0049}$$

$$=137.22449$$

In these regards the investigator chose 137 participants (90% confidence interval and 7% error level) rather than 384 (95% confidence interval and 5% error level) because of the time limitation of academic course curriculum.

3.4 Inclusion criteria

- ✓ Only sewing machine operators was selected for holding the study
- ✓ The age range of the worker was 18-65 years
- ✓ Participants had to spend at least 1 complete year in sewing profession
- ✓ All district people were allowed for this study
- ✓ Both male and female
- ✓ Bangladeshi origin
- ✓ Voluntary participants

3.5 Exclusion criteria

- ✓ Workers who have fracture or any deformity in the body were excluded because if the participant has any deformity, fracture or disability in any area of the body, the data result will not be accurate.
- ✓ During pregnancy, women have to face different types of complication with the change in body structure. For this reason, pregnant women were excluded from the study.

3.6 Field test

A field test was conducted with three participants of different year who have worked in the industry. Before beginning the final data collection, it was necessary to carry out a field test which was helped to refine the data collection plan. During the data collection, permission was taken verbally and informed the participants about the aim and objectives of the study, benefits of the study as well as use unstructured questionnaire to conduct field test. From the field test, the researcher became aware about the condition of the area, participant reaction, to make an assumption about data of male and female participants and which part of the procedure, the participant felt difficulty.

In the field test, the participants were able to know about the aims and objectives of the study, they were cooperative; they followed all of the instructions properly so data were collected appropriately. The result of the field test helped to modify the questions where necessary as well as to structure the questionnaire.

3.7 Ethical consideration

- A research proposal was submitted for approval to the dept. of OT of BHPI.
- Permission was taken from the author of selected article for using some dimensions which he used in his research.
- A written permission for data collection was taken from the authority of BHPI.
- The research activities procedure was submitted to the garment.
- A written application was submitted to the Administrative body of the garment for the involvement of participants, researchers and other facilities needed to complete the study.
- The role of the participants in the study was explained and discussed that the study had ethical approval and its aim did not cause any harm to the participants.
- The researcher ensured the participants that confidentiality will maintain regarding the participant's data, data would not be shared with others outside the study only research supervisor was eligible to know it & not individually identified.
- Informed consent was provided by informing the participant about the research activities, risk and potential benefits of the study.
- Female data was collected by female volunteer.

3.8 Data collection instrument

- ✓ **An adapted anthropometric Body Dimension checklist-** An adapted anthropometric body dimension checklist was used to determine about 26 dimensions. In this questioner, there mentioned about 26 body dimension, measurement procedure and their application. This checklist was made by following the standard questioner of anthropometric body dimension. And 26 body dimensions were selected according to the working posture of sewing machine operators that was used in other sewing machine operators related research and the applications were included from the Kroemer adapted anthropometric table. The adapted anthropometric body dimension checklist was given in detail in the appendix- 4.

- ✓ **Demographic questionnaire**- Demographic questioner was selected by self-administrative demographic questioner which is associated with the study. Demographic questioner include- age, sex, living area, marital status, educational level. See appendix- 4 for details.
- ✓ **Information sheet and consent form-**

  Information sheet and consent form is an essential part of any kind of study, because it is a formal settlement or agreement of participation which is taken from the participants initial the interview. An information sheet including the details information on study aim and objectives, institute affiliation, identity of investigator, participant's confidentiality, participant's rights and responsibilities, potential risk, benefit and further information related to study was prepared for participants to inform them.

  Consent form is a written document outlining the benefits and risk of the study to the participant. The participant was informed about the aim and objectives of the study on this form and it also informed that they have the right to withdraw from the study at any time. Each participant's consent was taken. The consent form has two parts- information sheet and consent form. The researcher will use both Bangla and English consents form which is attached in appendix- 5 (A&B) to appendix- 6 (A&B) section.
- ✓ **Measurement scale-** Two measurement scales were selected for the measurement of body dimension (25 dimensions except weight) among the participants by placing the scale both starting and end point of the measurement to get more accurate data.
- ✓ **Measurement tape-** Measurement tape was used for measuring the body dimension. The measurement tape indicates mm, cm & inch.
- ✓ **Weight machine**- A weight machine was used for collecting the information about participant's weight.

3.9 Data collection procedure

Before starting data collection, ethical permission was taken from BHPI authority and the administrative body of the garments. The measurement was taken from the participant in a fixed date and time, during their free time. At first, the participants were informed about information sheet and consent form so that the participant can understand about the study aims & objectives properly. Participant's anthropometric measurement was assessed by standard measurements questioner which was adapted from different questionnaire about anthropometric body dimension relevant to the working posture of sewing machine operators. The measurements were taken on 26 dimensions of the upper and lower limb of sewing machine operators and access spaces using a standard measurement tape. Before starting the assessment, there was an initial assessment done by the researcher by which she can find out the participant meet the inclusion and exclusion criteria. And then the participants were explained about the procedure of the measurement so that they can contribute with the study by following the instruction accurately.

Five volunteers were taken to collect data and they were trained about the questionnaire and the procedure. The data was collected in a quiet place rather than the work place. The participants had to maintain an upright posture during measurement in both standing and sitting position. The measure was taken in a smooth surface.

CHAPTER 4
DATA ANALYSIS AND RESULT

4.1 Data analysis process

Descriptive statistics are those that describe, organize, and summarize data. They include such things as frequencies, percentages, description of central tendency (mean, mood, median) and descriptions of relative position (range, standard deviation). This procedure allow for the description of all the individual scores in a sample on one variable by using one or two numbers. They can be used to describe each depended variable such as the percentage and mean of each depended variable. It can also be used to give the variation or spread of scores within each group studied (Bailey, 1997).

Inferential statistics are those that allow taking the results from a research project and deciding whether they are likely to occur in the target population. Test of inferential statistics can be used to find out the differences between two sets of scores are significantly different, to find the association between two sets of scores (Bailey, 1997).

In this study researcher has used one checklist of anthropometric body dimension applicable for sewing machine operators with some demographic and socio-economic factors to investigate the objectives of study. After completing data collection data has inputted in the SPSS (Statistical Package for the Social Sciences) software, version 17.0 to reduce the impact of the missing value and increase the reliability of the analysis by following “SPSS manual for Bio 211- General Ecology”. Data has analyzed in the following way:

Step 1: Descriptive analysis of the anthropometric body dimension

Descriptive analysis has to done to investigate the percentages, central tendency (mean), and standard deviation of the data of each dimension. Providing the frequencies, percentages, and mean for all the characteristics under the study so that the reader has a thorough understanding of the subjects and variables. It is customary to present percentages alongside the frequencies both in text and in illustrative tables.

In this study, each study subject was given a code number and each question was accounted as a variable. The SPSS software has data view and variable view. The variable of the study was considered carefully. In this checklist, 26 body dimensions are listed with their definition. Then data input will execute in the data view of SPSS in case of all study subjects. At last the data was established for analysis. The analysis was carried out by following steps:

Step 2: t- test was performed to compare these dimensions with the corresponding male from the female.

Step 3: t- test was performed to show the association between age and anthropometric body dimensions.

4.2 Result of the study

The following chapter details the findings of the aim to measure the 26 anthropometric body dimensions of 137 sewing machine operators of 18-60 years old age group from one selected garments industry. The results of those 26 dimensions of sewing machine operators are reported in this chapter where basic descriptive data are presented. All data results are rounded to the nearest percentage.

It also looks at the respondents’ demographic characteristics and socio-economic background.

Socio-demographic characteristics of the participants

The first set of question was asked to the participants about their socio-demographic characteristics (see Table 1). From 200 sewing machine operators of the industry, 137 participants were taken part of this study. Where 68 (49.6%) participants were male and 69 (50.4%) participants were female. The sewing operators included in the study were between the ages 18 and 36 years. Of these workers, the 72 (52.6%) were at the age 18 to 23 years, approximately 54 (39.4%) were at the age of 24 to 29 years, and the remaining percent 8% (11) were between the age of 30 to 36 years. All of the participants were from urban. Participants were from different educational level: illiterate 8 (5.8%), no formal education 17 (12.4%), primary school level 93 (69.7%), secondary school certificate 19 (13.9%). Maximum participants were single 74 (54.0%) and married 63(46%) and there were no divorced and widow subjects.

Most study subject's that is 28 participant's age were 25 years (20.4%) and the lowest age were 32 and 36 and the percentage is .7%.

Table-2: Summary of socio-demographic characteristics of the participants (n=137)

Demographic characteristics of the participants		**Frequencies**	**Percentage (%)**
Age range	18-23	72	52.6
	24-29	54	39.4
	30-36	11	8.0
Sex	Male	68	49.6
	Female	69	50.4
Educational level	Illiterate	25	18.2
	Primary school	93	67.9
	Secondary school certificate	19	13.9
Marital status	Single	74	54.0
	Married	63	46.0

Anthropometric measurement among male and female sewing machine operators

The descriptive (mean value, standard deviation) and selected percentile values (5th, 50th, and 95th) of the 26 anthropometric measures related to the working environment and the equipment, of the sewing machine operators in garment industry have been determined and presented in Tables-3. The result shows that male sewing operator's mean value is higher than female sewing operator's mean value.

Table-3: Mean, percentile (5th, 50th, 95th) and SD (mm) of female (n=69) & male (n=68) sewing machine operators in a garment industry

Dimensions	Female participants					Male participants				
	Mean	Percentile			SD (±)	Mean	Percentile			SD (±)
		5th	50th	95th			5th	50th	95th	
Forward grip reach	621.15	555.00	620.00	710.00	54.960	683.23	613.50	680.00	742.75	37.194
Standing Elbow Height	917.68	855.00	920.00	980.00	36.738	991.39	910.00	990.00	1086.50	48.767
Standing waist Height	852.24	655.00	860.00	950.00	73.397	906.54	837.25	910.00	957.75	32.943
Standing knuckle height	640.57	560.00	640.00	695.00	38.573	705.66	634.50	690.00	880.00	96.075
Standing shoulder height	1219.13	1120.00	1225.00	1300.00	57.240	1323.66	1224.50	1320.00	1405.50	48.651
Standing eye height	1372.26	1295.00	1370.00	1455.00	48.392	1484.85	1372.25	1485.00	1567.75	80.144
Stature	1489.78	1410.00	1490.00	1580.00	51.907	1605.14	1510.00	1610.00	1670.00	43.046

Functional overhead reach (standing)	1775.14	1657.50	1780.00	1910.00	65.602	1919.58	1796.75	1915.00	2012.75	59.766
Thigh clearance	152.75	110.00	150.00	205.00	31.313	162.72	124.50	160.00	202.75	23.712
Sitting eye height	646.08	575.00	650.00	705.00	33.638	708.89	627.25	715.00	771.00	41.831
Sitting height	749.92	690.00	750.00	805.00	35.856	824.41	747.25	830.00	875.50	38.093
Functional overhead reach (sitting)	1050.50	990.00	1050.00	1125.00	46.385	1129.07	1042.50	1150.00	1237.75	166.879
Elbow to fist length	418.18	382.50	410.00	440.00	59.482	357.10	315.00	360.00	410.00	30.448
Knee height	479.63	430.00	480.00	520.00	25.571	500.36	470.00	500.00	543.75	21.376
Seat height	490.14	490.00	490.00	490.00	1.203	479.11	480.00	480.00	480.00	27.737
Buttock-knee length (sitting)	502.75	462.50	500.00	557.50	26.727	512.13	464.50	510.00	563.75	24.922
Buttock-popliteal length sitting	411.95	377.50	410.00	447.50	22.116	435.73	390.00	430.00	520.00	72.324

Leg length sitting	889.86	820.00	900.00	965.00	66.765	912.23	569.00	930.00	1016.50	137.906
Chest depth	222.39	180.00	220.00	295.00	30.876	196.76	164.50	190.00	230.00	19.389
Abdominal depth	199.13	140.00	200.00	260.00	35.747	193.89	144.50	186.50	263.25	34.982
Arm length	660.65	580.00	670.00	725.00	43.130	715.35	623.00	720.00	775.50	42.799
Downward grip reach	426.81	340.00	400.00	687.50	92.454	643.75	580.00	640.00	735.50	58.783
Hand length	168.11	150.00	170.00	180.00	8.184	178.67	160.00	180.00	195.00	12.301
Hand breadth	77.24	70.00	80.00	85.00	3.979	80.32	70.00	80.00	95.50	6.598
Foot length	222.39	190.00	225.00	242.50	13.842	243.60	224.50	245.00	267.75	14.104
Weight (kg)	45.70	35.90	45.40	56.60	6.395	52.29	41.60	50.90	66.43	7.147

Difference between anthropometric measurement of corresponding male and female sewing machine operators

The t-test results for male female sewing machine operators differences in means shows in Table 4. t-tests for differences in means showed gender differences of sewing machine operator’s data. The results of the t-tests are given in the rightmost columns, respectively in the table 4. The mean and standard deviation for each dimension for both male and female are shown in Table 4. The last column shows the p-value between the two genders and the significance test results for the differences.

The independent sample t- test was performed to find out the significance level of difference between male and female sewing machine operators data in mean result. The result shows statistically strong significant result ($p=.001$; $p<0.05$) in forward grip reach, standing elbow height, standing waist height, standing knuckle height, standing shoulder height, standing eye height, stature, standing functional overhead reach, thigh clearance, sitting eye height, sitting height, functional overhead reach (sitting), elbow to fist length, knee height, seat height, buttock-knee length (sitting), buttock- popliteal length (sitting), chest depth, arm length, downward grip reach, hand length, hand breadth, foot length, weight). Two dimensions: leg length sitting and abdominal depth were not significant ($p>.05$). The percentile (5th, 50th, and 95th) results of both male and female participants for designing the hand tools and control panel in different workstations design for Bangladeshi sewing machine operators in general are also showed in table 4.

Table-4: The Mean, SD, percentile values (mm) for male & female (n=137) sewing machine operators and t-test results for male female differences in means

Body dimensions	Mean	SD (±)	Percentile			Difference between male and female in means	t- value	p- value	95% CI	
			5th	50th	95th				Upper	Lower
Forward grip reach	651.97	56.234	565.00	650.00	735.50	62.07	135.703	.001	75.35	48.80
Standing Elbow Height	954.27	56.700	870.00	950.00	1051.00	73.71	196.992	.001	85.95	61.48
Standing waist Height	879.19	63.013	799.50	890.00	950.50	54.29	163.311	.001	70.41	38.19
Standing knuckle height	672.88	79.736	578.00	660.00	751.00	65.08	98.773	.001	85.93	44.23
Standing shoulder height	1271.01	74.538	1150.00	1280.00	1371.00	104.53	199.587	.001	119.56	89.50
Standing eye height	1428.14	86.761	1309.00	1420.00	1541.00	112.59	192.666	.001	131.39	93.80
Stature	1547.04	74.910	1429.00	1560.00	1651.00	115.36	241.724	.001	128.85	101.88
Functional overhead reach (standing)	1846.83	95.737	1700.00	1840.00	2000.00	144.44	225.792	.001	162.20	126.69
Thigh clearance	157.70	28.147	110.00	155.00	200.50	9.96	65.577	.038	17.82	2.11
Sitting eye height	677.26	49.206	609.00	670.00	760.00	62.81	161.099	.001	73.56	52.06
Sitting height	786.89	52.486	710.00	780.00	860.00	74.48	175.482	.001	84.96	64.01

Functional overhead reach (sitting)	1089.50	127.866	1000.00	1090.00	1211.00	78.56	99.732	.001	113.12	43.62
Elbow to fist length	387.86	56.263	320.00	390.00	430.00	-61.08	80.690	.001	-47.7	-74.46
Knee height	489.92	25.696	440.00	490.00	530.00	20.73	223.164	.001	27.40	14.06
Seat height	484.67	20.257	480.00	490.00	490.00	-11.02	280.040	.002	-5.41	-16.46
Buttock-knee length (sitting)	507.40	26.178	464.50	510.00	555.50	9.37	226.865	.035	16.69	2.07
Buttock-popliteal length sitting	423.75	54.441	380.00	420.00	476.50	23.77	91.106	.011	39.03	8.52
Leg length sitting	900.97	108.277	810.00	920.00	991.00	22.36	97.394	.231	53.18	-8.45
Chest depth	209.67	28.762	170.00	200.00	260.00	-25.62	85.324	.001	-18.33	-32.92
Abdominal depth	196.53	35.337	140.00	200.00	260.00	-5.23	65.097	.388	4.78	-15.24
Arm length	687.80	50.852	580.00	690.00	760.00	54.70	158.310	.001	66.86	42.54
Downward grip reach	534.48	133.520	340.00	600.00	710.00	216.93	46.855	.001	238.85	195.02
Hand length	173.35	11.667	150.00	175.00	190.00	10.56	173.912	.001	13.52	7.60
Hand breadth	78.77	5.634	70.00	80.00	85.00	3.07	163.633	.001	4.62	1.53
Foot length	232.91	17.560	199.50	230.00	256.00	21.21	155.246	.001	25.18	17.24
Weight (kg)	48.97	7.520	36.78	48.60	62.82	6.59	76.217	.001	8.51	4.67

Association between demographic factors and selected anthropometric body dimension of sewing machine operators

Table-5 and Table-6 shows that association between demographic factors and anthropometric data of sewing machine operators with their mean value, standard deviation, and p-value and significance test for age and anthropometric body dimension. In the most left column shows the pair of age and body dimensions, then SD (standard deviation), t value, p-value and significance level of the result and the right most columns shows the upper and lower limit of confidence intervals.

The t-test was performed to find out the level of significance of association between demographic factors and anthropometric body dimensions. The result shows that there have a strong association between demographic factors and forward grip reach, standing elbow height, standing waist height, standing knuckle height, standing shoulder height, standing eye height, stature, standing functional overhead reach, thigh clearance, sitting eye height, sitting height, functional overhead reach (sitting), elbow to fist length, knee height, seat height, buttock-knee length (sitting), buttock-popliteal length (sitting), leg length (sitting), chest depth, abdominal depth, arm length, downward grip reach, hand length, hand breadth, foot length, weight and the p-value is .001 which is <.05.

Table-5: Association between age and anthropometric data with mean, SD (mm) for male & female (n=137) sewing machine operators and t-test significance results

Paired group between age and body dimensions	Mean	SD (±)	t-value	p-value	95% CI	
					Upper	Lower
Age - Forward grip reach	628.941	56.3093	130.734	.001	636.91	620.97
Age - Standing Elbow Height	931.241	55.8305	195.232	.001	939.14	923.34
Age - Standing waist Height	856.168	62.6670	159.912	.001	865.03	847.30
Age - Standing knuckle height	649.854	79.1734	96.072	.001	661.06	638.65
Age - Standing shoulder height	1247.985	73.9369	197.564	.001	1258.45	1237.52
Age - Standing eye height	1405.117	86.4051	190.341	.001	1417.34	1392.89
Age – Stature	1524.015	74.6803	238.860	.001	1534.58	1513.45
Age - Functional overhead reach (standing)	1823.010	95.4820	223.572	.001	1837.32	1810.30
Age - Thigh clearance	134.671	28.5289	55.252	.001	138.71	130.63
Age - Sitting eye height	654.234	49.0163	156.225	.001	661.17	647.30
Age - Sitting height	763.869	52.2268	171.193	.001	771.26	756.48

Age - Functional overhead reach (sitting)	1066.474	128.0060	97.517	.001	1084.58	1048.36
Age - Elbow to fist length	364.839	56.3151	75.829	.001	372.81	356.87
Age - Knee height	466.898	25.8398	211.492	.001	470.55	463.24
Age - Seat height	461.642	20.4517	264.201	.001	464.54	458.75
Age - Buttock-knee length (sitting)	484.380	26.0855	217.343	.001	488.07	480.69
Age - Buttock-popliteal length (sitting)	400.730	54.5986	85.907	.001	408.46	393.00
Age - Leg length sitting	877.942	108.2242	94.951	.001	893.25	862.63
Age - Chest depth	196.642	27.6885	78.899	.001	190.56	182.72
Age - Abdominal depth	173.504	33.7517	60.169	.001	178.28	168.73
Age - Arm length	664.774	51.3807	151.437	.001	672.04	657.50
Age - Downward grip reach	511.460	133.2103	44.940	.001	530.31	492.61
Age - Hand length	150.329	12.0928	145.503	.001	152.04	148.62
Age - Hand breadth	55.744	6.4569	101.050	.001	56.66	54.83
Age - Foot length	209.891	18.3297	134.028	.001	212.48	207.30
Age – Weight	25.943	7.3689	41.207	.001	26.99	24.90

Table-6: Association between sex and anthropometric data with mean, SD (mm) for male & female (n==137) sewing machine operators and t-test significance results.

Paired group between sex and body dimensions	Mean	SD (±)	t-value	p-value	95% CI	
					Upper	Lower
Forward grip reach- sex	650.467	56.5135	134.720	.001	658.46	642.47
Standing Elbow Height-sex	952.766	57.0287	195.548	.001	960.84	944.70
Standing waist Height-sex	877.693	63.2319	162.468	.001	868.64	868.75
Standing knuckle height-sex	671.380	79.9438	98.298	.001	682.69	660.07
Standing shoulder height-sex	1269.511	74.8922	198.408	.001	1280.11	1258.91
Standing eye height-sex	1426.642	87.0784	191.739	.001	1438.96	1414.32
Stature-sex	1545.540	75.2991	240.243	.001	1556.19	1534.89
Functional overhead reach (standing)-sex	1845.336	96.1178	224.715	.001	1858.94	1831.74
Thigh clearance-sex	156.197	28.2410	64.737	.001	160.19	152.20
Sitting eye height-sex	675.759	49.5298	159.693	.001	682.77	668.75
Sitting height-sex	785.394	52.8450	173.958	.001	792.87	777.92

Functional overhead reach (sitting)-sex	1088.000	128.0219	99.473	.001	1106.11	1069.89
Elbow to fist length-sex	386.365	55.9911	80.768	.001	394.29	378.44
Knee height-sex	488.423	25.9033	220.700	.001	492.09	484.76
Seat height-sex	483.168	20.1262	280.993	.001	486.02	480.32
Buttock-knee length (sitting)-sex	505.905	26.2737	225.376	.001	509.62	502.19
Buttock-popliteal length (sitting)-sex	422.255	54.5538	90.596	.001	429.97	414.54
Leg length sitting-sex	899.467	108.3310	97.184	.001	914.80	884.14
Chest depth-sex	208.168	28.5417	85.368	.001	212.21	204.13
Abdominal depth-sex	195.029	35.3037	64.661	.001	200.02	190.03
Arm length-sex	686.299	51.1256	157.121	.001	693.53	679.07
Downward grip reach-sex	532.985	133.9298	46.580	.001	551.94	514.04
Hand length-sex	171.854	11.9037	168.980	.001	173.54	170.17
Hand breadth-sex	77.270	5.7923	156.140	.001	78.09	76.45
Foot length-sex	231.416	17.8695	151.580	.001	233.94	228.89
Weight-sex	47.469	7.7546	71.649	.001	48.47	46.37

CHAPTER 5
DISCUSSION

5.1 Anthropometric characteristics of male and female sewing operators

Anthropometric studies about sewing operators are very limited. Perhaps, the current anthropometric study for sewing machine operators was the first research in Bangladesh perspective that was carried out among Bangladeshi sewing machine operators with a view to 26 body dimensions related to workplace design. And the existing study result has provided some baseline information regarding body dimension measurement related to workplace design. The purpose of the study was to find out the anthropometric estimation for Bangladeshi sewing machine operators aged between 18-60 years old.

When the anthropometric measures related to workplace design of the sewing operators in a garment industry were examined, it was observed that the body weight varies between 34 and 74 kg, and the statures of the sewing operators vary between 1340 and 1700 mm. Whereas, another study by Kalinkara *et al*. (2011) found that the average stature of the worker is 1381 and 1778 mm. In addition, the range of the stature was 368 mm; and the body weight varies between 41 and 115 kg (Kalinkara *et al.*, 2011). A study was conducted by Wang *et al*. (1999) found that male and female worker stature was between 1563.2 mm and 1675 mm. P. Lu (2003) found in a study that measurement of overall height was 160 cm tall (151–165 cm) and weight was between 41 and 55 kg. A total of 157 female sewing machine operators participated in a study and the study result showed that participant’s had an average height of 1620 mm (SD = 66.27 mm) and their average popliteal height stood at 464 mm (SD = 31.2 mm) where the weight averaged 63.44 kg (Sealetsa and Thatcherb, 2009).

5.2 Difference of anthropometric dimensions between corresponding male and female sewing machine operators

In this study, it has concluded that there has a significant difference body dimensions between males and females sewing machine operators. The mean stature for males was higher than the female sewing machine operators at 1605.14 mm and 1489.78 mm respectively. The difference between male and female sewing machine operators was 111.36 mm (p=.001). The mean sitting height for male and female was also different and these were respectively 824.41 mm and 749.92 mm and the difference was 74.48 mm. In a study Prado-Lu (2004) also showed the significance difference in standing height between male and female workers and those were 167 cm and 153.92 cm separately. It also showed significance difference in sitting height where the mean sitting height for male and female workers were 84.84 cm and 79.92 cm respectively. In 2007, Prado Lu mentioned that the workers anthropometry for standing height has significantly different from each male and female worker and that were 167.0 cm (SD = 8.03) and 153.9 (SD =8.08) cm. Meanwhile, the mean sitting height was also varied from male to female workers.

The statistical analysis (t-test) of the data indicated that there was a significant difference in hand dimensions between males and female sewing machine operators ($p<.05$). Hand length is 178.67 mm and hand breadth is 77.24 mm for male sewing machine operators where hand length and hand breadth are 168.11 mm and 80.32 mm respectively for female sewing machine operators. And the difference of hand length and hand breadth was 10.56 mm and 3.07 mm. Mohammad (2005) noted that the percentage difference between hand dimensions of males and females is varied from 0.64% to 3.31% for males and 0.37% to 1.76% for females. There was another study Hsiao *et al.*, (2002) conducted about the anthropometric differences among occupational groups result found that female industrial workers have significantly smaller upper arm than the other occupational groups.

Due to the fact that people differ significantly in their anthropometric characteristics, the percentile values of different body dimensions for males and females have been presented in Table-3. The calculated percentile values (5th, 50th and 95th) used as a guide for designing the hand tools and control panel in different workstations design. According to this study, hand tools and much other equipment which are controlled by means of operator hand. So, tools and equipment should be designed separately for both males and females workers.

5.3 Association between demographic factors and anthropometric characteristics of sewing machine operators

Association between age and anthropometric body dimension was presented in table-5. The statistical analysis (t-test) was performed to show the association between age and anthropometric characteristics. The result showed significant association between age and anthropometric body dimensions ($p=.001$; $p<.05$). Age effect on stature and weight was shown in a study (Iseria and Arslan, 2009) about estimated anthropometric measurements of Turkish adults and effects of age and geographical region. The study shows that stature diminishes with increasing age. Annis (1996) showed the minimum influence of age-related anthropometric change on workplace or product design, but this assumes that designs are regularly updated using the most recent anthropometry and that the design was originally based upon sound ergonomic principles. Most of the studies on aging carry few workspace dimensions as study variables. Typically, stature and weight are the only body size descriptors that are useful for ergonomic design applications.

Table-6 shows the association between sex and selected anthropometric body dimensions. This study stated that there is a strong significance difference between sex and anthropometric body dimensions ($p<.05$; $p=.001$).

CHAPTER 6
LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

5.1 Limitations of the study

There were several limitations to this study. At first, the entire sample consisted of a small number of sewing machine operators from a single organization. These results cannot say anything about the other sewing machine operators at other factories within Bangladesh. Secondly, five data collector volunteers were taken. Collecting the data is varying person to person, so the data can be varied (though the volunteers were trained). Then, there was limited number of literature for sewing machine operators. Finally, this study did not show the association between other demographic factors such as marital status, living area, and work experience.

5.2 Recommendations

As a consequence of this researcher, it is recommended to do further study including a large number of sample groups and with a longer time frame. It is also is recommended to do further study with use of more modern equipment such as slidecaliper, anthropometer, height machine etc. Moreover, it is suggested that to do further study including the association between the association between the demographic factors (marital status, living area, and work experience).

5.3 Conclusion

Twenty six body measurements, essential for the design of workstations, tools, and personal protective clothing of sewing machine operators in garments factory were summarized in this study. The results of the study indicate that male sewing machine operators were significantly higher than female sewing machine operators. The result also shows significant association between age and anthropometric characteristics.

The anthropometric measures determined in this study will be useful for the design of workplace arrangements, and for the design of ergonomic products and means in the areas like health sector, office management, etc. The arrangement of the workplace in accordance with the individual properties will increase the productivity and the life quality by decreasing the tiredness in tasks performed either in standing or sitting positions. As the data obtained with this study is beneficial in the workplace design in textile plant. With these characteristics, the study can establish an anthropometric database for sewing machine operators.

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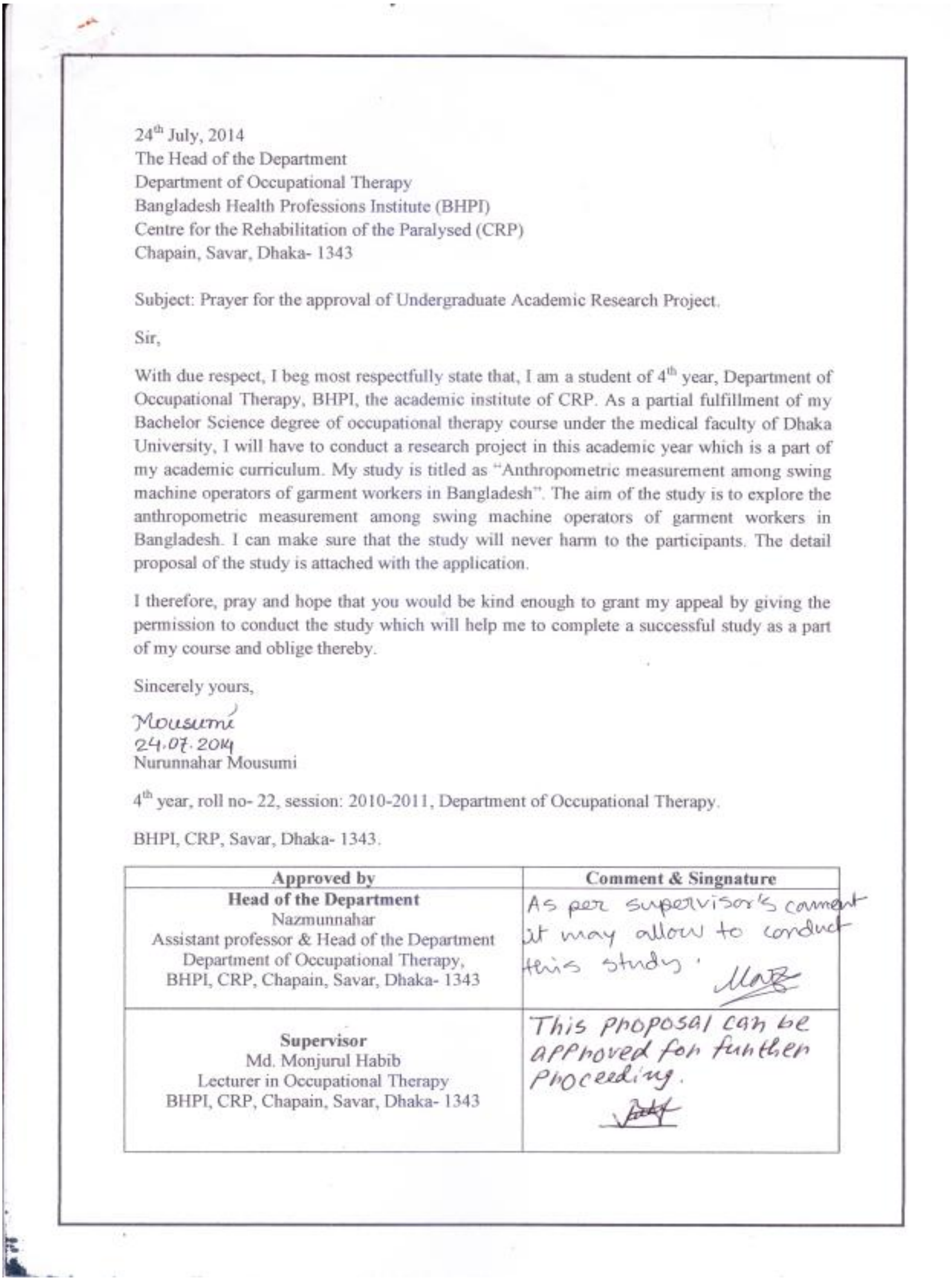
Appendix 1

Permission for conducting research



24th July, 2014
The Head of the Department
Department of Occupational Therapy
Bangladesh Health Professions Institute (BHPI)
Centre for the Rehabilitation of the Paralysed (CRP)
Chapain, Savar, Dhaka- 1343

Subject: Prayer for the approval of Undergraduate Academic Research Project.

Sir,

With due respect, I beg most respectfully state that, I am a student of 4th year, Department of Occupational Therapy, BHPI, the academic institute of CRP. As a partial fulfillment of my Bachelor Science degree of occupational therapy course under the medical faculty of Dhaka University, I will have to conduct a research project in this academic year which is a part of my academic curriculum. My study is titled as "Anthropometric measurement among swing machine operators of garment workers in Bangladesh". The aim of the study is to explore the anthropometric measurement among swing machine operators of garment workers in Bangladesh. I can make sure that the study will never harm to the participants. The detail proposal of the study is attached with the application.

I therefore, pray and hope that you would be kind enough to grant my appeal by giving the permission to conduct the study which will help me to complete a successful study as a part of my course and oblige thereby.

Sincerely yours,

Mousumi
24.07.2014
Nurunnahar Mousumi

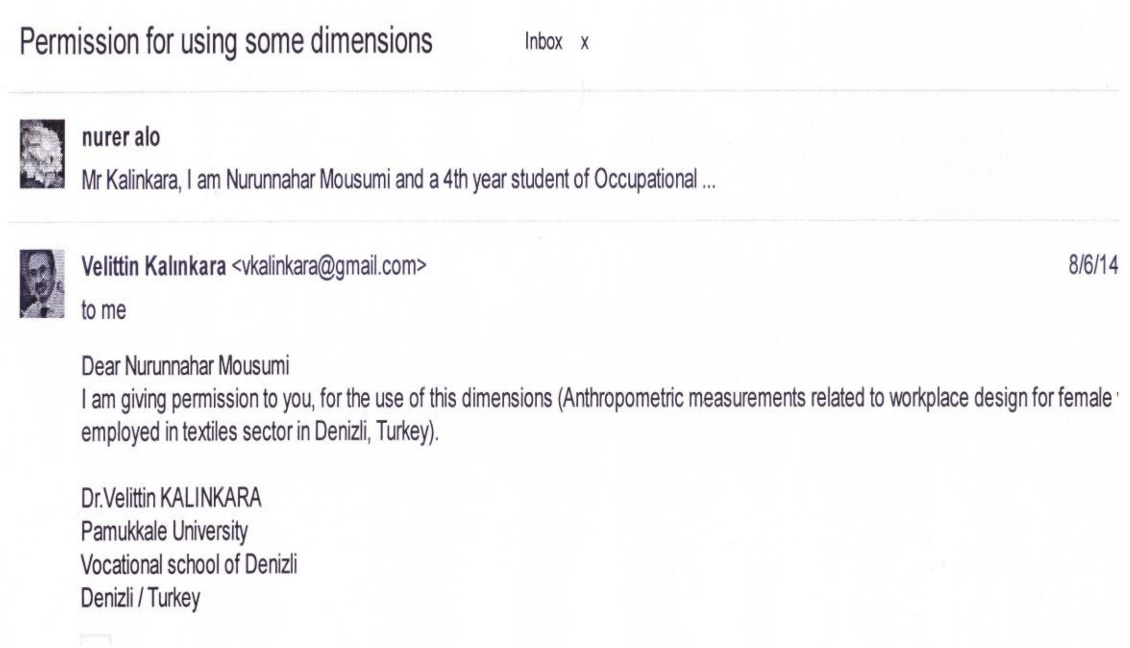
4th year, roll no- 22, session: 2010-2011, Department of Occupational Therapy.

BHPI, CRP, Savar, Dhaka- 1343.

Approved by	Comment & Singnature
Head of the Department Nazmunnahar Assistant professor & Head of the Department Department of Occupational Therapy, BHPI, CRP, Chapain, Savar, Dhaka- 1343	As per supervisor's comment it may allow to conduct this study.
Supervisor Md. Monjurul Habib Lecturer in Occupational Therapy BHPI, CRP, Chapain, Savar, Dhaka- 1343	This proposal can be approved for further proceeding.

Appendix 2

Permission of using Questionnaire



Permission for using some dimensions

nurer alo

Mr Kalinkara, I am Nurunnahar Mousumi and a 4th year student of Occupational ...

Velittin Kalınkara <vkalinkara@gmail.com> 8/6/14

to me

Dear Nurunnahar Mousumi
I am giving permission to you, for the use of this dimensions (Anthropometric measurements related to workplace design for female
employed in textiles sector in Denizli, Turkey).

Dr.Velittin KALINKARA
Pamukkale University
Vocational school of Denizli
Denizli / Turkey

Appendix 3

Permission 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 ঃ ১৩.০৯.২০১৪

প্রতি

ব্যবস্থাপনা পরিচালক

ব্লু কেপ নীড ফ্যাশন আন্ডার গার্মেন্ট লিঃ

বাইপাইল,আশুলিয়া, ঢাকা।

বিষয় ঃ রিসার্চ প্রজেক্ট (dissertation) এর জন্য আপনার প্রতিষ্ঠান সফর প্রসঙ্গে।

জনাব,

আপনার সদয় অবগতির জন্য জানাচ্ছি যে, পক্ষাঘাতগ্রস্তদের পুনর্বাসিন কেন্দ্রে-সিআরপি'র শিক্ষা প্রতিষ্ঠান বাংলাদেশ হেলথ্ প্রফেশনস্ ইনষ্টিটিউট (বিএইচপিআই) ঢাকা বিশ্ববিদ্যালয় অনুমোদিত বিএসসি ইন অকুপেশনাল থেরাপী কোর্স পরিচালনা করে আসছে।
উক্ত কোর্সের ছাত্রছাত্রীদের কোর্স কারিকুলামের অংশ হিসাবে বিভিন্ন বিষয়ের উপর রিসার্চ ও কোর্সওয়ার্ক করা বাধ্যতামুলক।

বিএইচপিআই'র ৪র্থ বর্ষ বিএসসি ইন অকুপেশনাল কোর্সের ছাত্রী নুরুন্ননাহার মৌসুমী তার রিসার্চ সংক্রান্ত কাজের জন্য আপনার সুবিধামত সময়ে আপনার প্রতিষ্ঠানে সফর করতে আগ্রহী।

তাই তাকে আপনার প্রতিষ্ঠান সফরে সার্বিক সহযোগীতা প্রদানের জন্য অনুরোধ করছি।

ধন্যবাদান্তে

নাজমুন নাহার
সহকারী অধ্যাপক ও বিভাগীয় প্রধান
অকুপেশনাল থেরাপী বিভাগ
বিএইচপিআই।

For BLUE CAP KNIT FASHION LTD
Md. Khokon Mondal
Managing Director

Appendix 4

Anthropometric dimension checklist

Code no: **Age:** **Sex:** Female/ male

Educational level: Illiterate/ Primary School/ Secondary School Certificate (SSC)

Year at work:

Living area: Rural/Urban

Marital status: Single/Married/Divorced/Widow

Body dimensions	Definitions	Measurement
01. Forward grip reach (standing)	The horizontal distance from the back of the right shoulder blade to the center of a cylindrical rod firmly held in the palm of the right hand.	
02. Standing elbow height	The vertical distance from the floor to the lowest point of the right elbow, when standing, with the elbow flexed at 90 degrees.	
03. Standing waist height	The vertical distance from the floor to the trochanter landmark on the upper side of the right thigh, when standing.	
04. Standing knuckle height	The vertical distance from the floor to the knuckle (metacarpal bone) of the middle finger of the right hand, when standing.	

05. Standing shoulder height	The vertical distance from the floor to the tip (acromion) of the shoulder, when standing
06. Standing eye height	The vertical distance from the floor to the outer corner of the right eye, when standing
07. Stature	The vertical distance from the floor to the top of the head, when standing
08. Functional overhead reach (standing)	The vertical distance from the floor to the center of a cylindrical rod firmly held in the palm of the right hand
09. Thigh clearance	The vertical distance from top of the acromion to back of the thigh when sitting.
10. Sitting eye height	The vertical distance from the sitting surface to the outer corner of the right eye, when sitting.
11. Sitting height	The vertical distance from the floor to the top of the head, when sitting
12. Functional overhead reach (sitting)	The vertical distance from the sitting surface to the center of a cylindrical rod firmly held in the palm of the right hand.
13. Elbow to fist length	The distance from the back of the right elbow to the tip of the extended middle finger, with the elbow flexed at 90 degrees.
14. Knee height	The vertical distance from the upper part of the knee to the floor, when sitting with the knee flexed at 90 degrees.
15. Seat height	The vertical distance from lower part of the seat to the floor, when sitting.

16. Buttock-knee length (sitting)	The horizontal distance from the back of the buttocks to the most protruding point on the right knee, when sitting with the knee flexed at 90 degrees.
17. Buttock- popliteal length (sitting	The horizontal distance from the back of the buttocks to back of the right knee just below the thigh when sitting with the knee flexed at 90 degrees.
18. Leg length (sitting)	The horizontal distance from back of the buttock to arch of the foot when sitting with leg straight forwardly.
19. Chest depth	The horizontal distance from the back to the right nipple.
20. Abdominal depth	The horizontal distance from the back to the most protruding point on the abdomen.
21. Arm length	The vertical distance from the tip of the right middle finger to the right acromion, with the arm hanging vertically.
22. Downward grip reach	The vertical distance from the right acromion to the center of a cylindrical rod firmly held in the palm of the right hand, with the arm hanging vertically.
23. Hand length	The length of the right hand between the crease of the wrist and the tip of the middle finger, with the hand flat.
24. Hand breadth	The breadth of the right hand across the knuckles of the four fingers.
25. Foot length	The maximum length of the right foot, when standing.
26. Weight	Body weight taken to the nearest tenth of a kilogram.

Appendix 5(A)

Informed consent in English

I am Nurunnahar Mousumi, a final year student of the Occupational Therapy Department in Bangladesh Health Profession Institute (BHPI) the academic institute of CRP. I am continuing the B.Sc. course in Occupational Therapy. In 4th year of study it is mandatory to conduct a research under the research subject to pass the B.Sc. course, I would like to invite you to take part in the research study, titled "Anthropometric measurement among sewing machine operator in Bangladesh". The aim of the study is to explore the anthropometric measurement of swing machine operator in Bangladesh.

Considering the area of research, you have met the inclusion criteria and I would like to invite you as a subject of my study. If you participate in this study, I will measure your 37 body dimensions. The measurements that would be given are safe and will not cause any harm. I want to meet you a sessions during your free time. Your participation in this study is voluntary. You have full right to withdraw yourself from the study at any time without hesitation. It is mentioned that you will not be paid for your participation.

For the study purpose your answer will be recorded. It is important to inform you that confidentiality of all records will be highly maintained. The information will be showed by the investigator, supervisor and by another occupational therapy student who will aid in selecting relevant portions of the document by helping the investigator for taking the information. The information will not be printed for public use but short excerpts will be taken from them and included in the investigator's thesis and in possible future publications.

If you have any query regarding the study, please feel free to ask to the contact information stated below:

Nurunnahar Mousumi
4th year, B.Sc. in Occupational Therapy
Bangladesh Health Professions Institute (BHPI)
Center for the Rehabilitation of the Paralyzed (CRP),
Savar, Dhaka.

Investigator's Signature & Date

Participant's Signature & Date

Appendix 5(B)

Informed consent in Bengali

তথ্যপত্র

আমি নুরুন্নাহার মৌসুমি, পক্ষঘাতগ্রস্থেদের পুনর্বাসন কেন্দ্রের শিক্ষা প্রতিষ্ঠান বাংলাদেশ হেলথ প্রফেশন্‌স ইনিস্টিটিউট এর অকুপেশনাল থেরাপি বিভাগের ৪র্থ বর্ষের ছাত্রী। আমি অকুপেশনাল থেরাপিতে বি এস সি কোর্স করছি। বি এস সি কোর্সটিতে পাশ করার জন্য ৪র্থ বর্ষে একটি গবেষনা করতে হয়। আমি আপনাকে এই গবেষনায় অংশগ্রহন করার জন্য অনুরোধ জানাচ্ছি যার শিরোনাম “বাংলাদেশে সেলাই মেশিন অপারেটরদের আনথ্রপমেট্রিক পরিমাপ” এই গবেষণার উদ্দেশ্য হচ্ছে বাংলাদেশে সেলাই মেশিন অপারেটরদের আনথ্রপমেট্রিক পরিমাপ বের করা।

এই গবেষনাটির জন্য আপনাকে অবশ্যই গবেষনায় অংশগ্রহনের শর্তাবলিগুলো পূরণ করতে হবে। এই গবেষনায় আপনার অংশগ্রহন স্বেচ্ছাকৃত। যে কোন সময় আপনার বিনা দ্বিধায় এই গবেষনা থেকে নিজেকে সরিয়ে নেওয়ার পুর্ন অধিকার আপনার আছে। এখানে আরো উল্লেখ্য যে আপনার অংশগ্রহনের জন্য আপনাকে কন মূল্য পরিশোধ করতে হবে না। আপনার অনুমতি ছাড়া আপনার নাম, পরিচয় এবং কোন রকম সনাক্তকরন তথ্য অন্য কোথাও ব্যাবহার করা হবে না।

গবেষনার উদ্দেশ্যে আপনার পরিমাপ্ টি রেকর্ড করা হবে। এটা আপনাকে জানানো গুরুত্বপূর্ণ যে এই গবেষনায় পাওয়া ফলাফলটি যে কোন প্রকাশনায় গোপন রাখা হবে। আপনার কাছ থেকে পাওয়া তথ্যগুলো গবেষক, নির্দেশক, এবং অন্য কয়েকজন অকুপেশনাল থেরাপিস্ট যারা তথ্য সংগ্রহ করবে তারাই দেখবে। আপনার কাছ থেকে পাওয়া তথ্যগুলো সম্পুর্নভাবে কোথাও প্রকাশিত করা না হলেও ফলাফলের সারাংশটি গবেষকের গবেষনায় এবং প্রকাশনায় ব্যবহার করা হবে।

যদি এই গবেষনা বিষয়ে আপনার আরো কিছু জানার থাকে তবে নিছে নাম দেয়া ব্যক্তির সাথে যোগাযোগ করুন।

নুরুন্নাহার মৌসুমি
৪র্থ বর্ষ, বি এস সি ইন অকুপেশনাল থেরাপি
বাংলাদেশ হেলথ প্রফেশন্‌স ইনিস্টিটিউট (বি এইচ পি আই)
সেন্টার ফর দা রিহাবিলিটিশন অফ দা প্যারালাইজড (সি আর পি)
সাভার, ঢাকা – ১৩৪৩

গবেষকের সাক্ষর ও তারিখ

অংশগ্রহণকারীর সাক্ষর ও তারিখ

Appendix 6(A)

Consent Form (English)

This research is a part of Occupational Therapy and the researcher name is Nurunnahar Mousumi. She is a 4th year student of Bangladesh Health Professions Institute (BHPI). The study title is "Anthropometric measurement among sewing machine operator of garment worker in Bangladesh" and the aim is to explore the anthropometric measurement among swing machine operator in Bangladesh.

I am a participant of this research study and I know about the objectives of the study clearly. I have a right to drop out from the study at any time and for this I am not responsible to answer any question to anyone. This research would be given safe and will not cause any harm. In present and future, this research is not responsible for any medical intervention.

I definitely know that confidentiality of all records will be highly maintained and will not be identified in any publication that may result from the study. The information will be showed by the investigator, supervisor and by another occupational therapy student who will aid in selecting relevant portions of the document by helping the investigator for taking the information.

I give my consent by knowing all those information clearly.

Investigator's Signature & Date

Participant's Signature & Date

Witness's signature & Date

Appendix 6(B)

Consent Form in Bengali

এই গবেষণাটি অকুপেশনাল থেরাপীর একটি অংশ এবং গবেষণাকারীর নাম নুরুন্নাহার মৌসুমি। সে বাংলাদেশ হেলথ প্রফেশন ইন্সটিটিউট এর বি এস.সি ইন অকুপেশনাল থেরাপীর. ৪র্থ বর্ষের ছাত্রী। এই গবেষণাটির শিরোনাম হচ্ছে “বাংলাদেশে সেলাই মেশিন অপারেটরদের আনথ্রপমেট্রিক পরিমাপ” এই গবেষণার উদ্দেশ্য হচ্ছে বাংলাদেশে সেলাই মেশিন অপারেটরদের আনথ্রপমেট্রিক পরিমাপ বের করা।

এই গবেষণাতে আমি একজন অংশগ্রহনকারী এবং আমি পরিস্কার ভাবে এই গবেষণার উদ্দেশ্য সম্পর্কে অবগত। আমার যে কোন সময় এই গবেষণা থেকে নিজেকে সরিয়ে আনার অধিকার আছে। এজন্য আমি প্রশ্নের উত্তর প্রদান করার জন্য কারো কাছে দায়বদ্ধ না। এই গবেষনাটির সাথে আমার কোন সম্পৃক্ততা নেই এবং আমার চিকিৎসার সাথে বর্তমানে এবং ভবিষ্যতে কোনভাবে সম্পৃক্ত না।

আমি আর অবগত আছি যেকথোপকথন থেকে নে এই,ওয়া সমস্ত তথ্যাবলি নিরাপদে এবং গোপন রাখা হবে, আমার নাম এবং ঠিকানা কোথাও প্রকাশ করা হবে না। শুধুমাত্র গবেষণাকারী এবং তার সমন্বয়কারী এই তথ্যাবলী দেখার ক্ষমতা রাখেন।

আমি এই গবেষণাকারীর এবং তার গবেষনার সমন্বয়কারীর সাথে এই গবেষনার পদ্ধতি সম্পর্কে অথবা যে কোন প্রশ্নের উত্তর জানার জন্য কথা বলতে পারব।

আমি উপরোক্ত তথ্যগুলো ভালোভাবে জেনে নিজ ইচ্ছায় এই গবেষণা অংশগ্রহণ করছি।

অংশগ্রহণকারীর সাক্ষর ও তারিখ

গবেষকের সাক্ষর ও তারিখ

সাক্ষ্য প্রদানকারীর সাক্ষর ও তারিখ