Faculty of Medicine

**University of Dhaka**

# "CARDIORESPIRATORY EFFECT OF WHEELCHAIR BASKETBALL PLAYERS WITHSPINAL CORD INJURY PEOPLE AT CRP"


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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled

**CARDIORESPIRATORY EFFECT OF WHEELCHAIR BASKETBAL PLAYERS WITH SPINAL CORD INJURY PEOPLE AT CRP**

Submitted by

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## Declaration

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of information of the study, I would be bound to take written consent of my supervisor and Vice principal, Department of Physiotherapy, Bangladesh Health Professions Institute (BHPI).

Kulsum Akter ..... 30.11.19 .....

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# Acknowledgement

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## Acronyms

| | |
|---|---|
| **ASIA** | American Spinal Injury Association |
| **BHPI** | Bangladesh Health Professions Institute |
| **BMRC** | Bangladesh Medical Research Council |
| **CRP** | Centre for the Rehabilitation of the Paralysed |
| **IRB** | Institutional Review Board |
| **IS** | Incentive Spirometry |
| **PFR** | Peak Flow Rate |
| **PO** | Pulse Oximetry |
| **PT** | Physiotherapist |
| **SCI** | Spinal Cord Injury |
| **SPSS** | Statistical Package for Social Sciences |
| **TSCI** | Traumatic Spinal Cord Injury |
| **VO2 MAX** | Maximal Oxygen Consumption |
| **WB** | Wheelchair Basketball |
| **WHO** | World Health Organization |

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# ABSTRACT

***Introduction***: Cardio-respiratory complications are one of the most evident secondary complications in Spinal cord lesion (SCL) survivors. The steady decline of cardio-respiratory fitness in the wheelchair users impacts upon function, livelihood and psychological issues. ***Objectives:***The study aimed to evaluate the cardio-respiratory effect of wheelchair basketball sports in the rehabilitation phase of SCL. ***Methods:*** A quantitative one arm parallel prior and post-experimental study design has been employed to 43 admitted SCL patients in the largest rehabilitation facility in Bangladesh. Respondents were randomly selected from the first time exposure to wheelchair basketball (WB) in a specific time frame. The International Wheelchair Basketball Federation classification system has been used as an inclusion criterion. The Cardio-respiratory outcome has been evaluated by a Peak flow meter,Sphygmomanometer, Pulse oximeter, Incentive Spirometry, and measurement tape before and after 3 weeks WCB sports for an hour a day with 1-day rest per week.***Results:***Significant changes has been noted in systolic blood pressure [MD 5.57±11.39, 95% CI (1.39, 9.92), t 3.09, P <.005] with effect size *d* .49; oxygen saturation [MD .725±1.12, 95% CI (.370, 1.08), t 4.13, P <.001, *d* .65] ; Pulse [MD 6.10±17.32, 95% CI (.56, 11.64), t 2.23, P <.05, *d* .03] ; speed of expiration [MD 102.37±42.27, 95% CI (82.26, 117.49), t 13.60, P <.001, *d*2.16] ; vital capacity [MD 365.25 ±287.60, 95% CI (264.27, 448.23), t 7.83, P <.001, *d* 1.27] ; and Vo2Max [MD .194±.515, 95% CI (.081, .359), t 2.38, P <.05, *d* .38]. There were no significant changes in chest diameter (inspiration and expiration) [MD .050 ±.189 and .037 ±.17, 95% CI (.011 and .018, .111 and .093), t 1.67 and 1.36, P <.005]; ***Conclusion:***Wheelchair basketball have significant effect in cardio-respiratory functions in patients with Spinal cord lesion in their rehabilitation phase.



***Key Word****:* Spinal Cord Lesion, Wheel chair, Basketball, Cardiorespiratory effect.

# CHAPTER-I INTRODUCTION

## 1.1 Background

In South-Asia, Bangladesh is a poor and developing country bear a lots of socio-economic problem appearance from spinal cord injury (SCI) and other health related complications which is found from the annual rate of admission at the specialized center like Centre for Rehabilitation of the Paralyzed (CRP) (Rahman et al., 2017). There are 16 million people in Bangladesh who lives in handicap (Disability in Bangladesh, 2016). In Bangladesh SCI is the main reason for disability(Islam et al.,2011).Inphysicaldisabilities, SCI is severe in health related sector (Ramakrishnan et al., 2011). The untimely event of spine injuries can lead to the dramatic change in the persons, family, and activities of daily living of the individual with SCI (Kang et al., 2014).

SCI is probably the most disorderly and deadly incident that can happen to someone else's life and the person with spinal cord injury has present huge challenges in the form of cooping processes as well as rehabilitation., Although through the rehabilitation process some person recover partial ability to perform daily life activities' but some activities are permanently altered (Kumar & Gupta, 2016).So the main goal of SCI rehabilitation program is not only the inhibition of death and disability but also to improve the standard of living of people with SCI (Ramakrishnan et al., 2011).SCI patients faced so many complications which is life threatening for them self(Islam et al., 2011).

However after World War II, the rate of mortality in developed countries decreased dramatically and primarily this mortality rates can be decreased by the development of SCI treatment unit including well-trained, specialized teams for rehabilitation and regular follow-up (Razzak et al., 2011). Now a days the survival rate and life expectancy of SCI people is increased and also increased participation in physical activities and entertaining sports as well as their higher quality of life (Lee et al., 2017).Literature shows that the life expectancy was improved than the previous years where 60% of deaths are reported as high as ± 80%, 30% decrease in the 1960s, 15% in the 1970s and 6% in the 1980s (Razzak et al., 2011). There is no government hospital for the treatment and rehabilitation for SCI patients in Bangladesh (Islam et al., 2011). There is a general agreement in literature that in developing countries like

Bangladesh, unavailability of preventionprograms, unorganized and improper facilities andmanagement protocol for spinal cord injury persons are responsible for high morbidity and mortality rates; where these rates have significantly reduced and gradually decreased over the past five decades (Razzak et al., 2011).

The SCI can be caused by trauma, infection, ischemia, tumor, or congenital disease, which implants both nerve impulses and voluntary and unintended motor controls (Gomes et al., 2018). SCI occurs traumatic or non-traumatic, is a sudden destructive and weak nervous condition is restrained throughout history (Rahman et al., 2017).Traumatic Spinal Cord Injury(TSCI) is a terrible incident that is occur abruptly and unexpectedly which is lead to demoralizing costly in terms of human and social life (Lee et al., 2014).Generally, the trauma of the various methods is acknowledged as the main cause of the SCI and the causesof TSCI including fall from height, road traffic accident, injury, sports injury occur around the world and the non -traumatic cause are backbone of the tumor, tuberculosis, TM (Rahman et al., 2017).

The American Spinal Injury Association's (ASIA) score is used to measure the extent of the disorder and the impairment level, which changes from paraplegia to Tetraplegia (Kirshblum et al., 2011).

Physical ability can be defined as a level of physical activity such as cardiovascular system, respiratory system & muscles group and it also has been shown that physical skills related to risk of lower level medical complications which can contribute to reducing the quality of life (Yanci et al., 2015). Sedentary life style lead to respiratory alteration, to improve the health of people with disabilities encourage participation in physical activity and sports. (Pereira et al., 2016). Physical ability is related to various components such as oxygen uptake, muscle strength, pulmonary function where muscle weakness, reducing activity and the next change in metabolic and flexible function is decreasing the physical capacity of the human with the SCI (Haisma et al., 2006).

Epidemiology of SCI differ from developed to developing countries, so to know the epidemiology require different and extensive research in different countries (Rahman et al., 2017). Prevalence and incidence is necessary not only for better perceived the

rate of occurrenceand describe the ways of prevention but also to enhance the SCI management (Singh et al., 2014).

In worldwide, internationally the prevalence of SCI is about 15 - 40 people among one million and the ranges of incidence rate between 10.4 and 83 cases per million in one year, whereas in Europe, the prevalence rate is from 10.4 per million in one year to 29.7 per million, while 27.1 was reported in Asia and also found from a recently published data, the incidence of SCI is 10.5 million per year in Tehran, Iran (Moghimian et al., 2015).

On the other hand, according to Rahimi et al (2013), in developing countries the occurrence of SCI is 25.5 million per year and ranges from 2.1 to 130.7 million per year.

One of the most disruptive categories of injuries are the TSCI because in TSCI, a patient face different type of paralysis, also loss their sensory function and bladder/bowel function (Ning et al., 2012). SCI is a disturbing state in which the yearly incidence of TSCI occurs in 12.1-57.8 cases per million (Rahimi et al., 2013). In comparison to the European TSCI incidence was between 10.4 and 29.7 per million and the prevalence rate in North America is ranged from 27.1 to 83 per million (Ning et al., 2012).

According to a journal on “Epidemiology of Spinal Cord Injury in Bangladesh: A Five Year Observation from a Rehabilitation Center (2017)”- SCI patients was admitted with spinal injuries at CRP, Bangladesh from January 2011 to June 2016, those were selected as the study population. Among all the 2184 participants, male were 86.8% (n=1897) and rest of the 13.1% (n=287) were female.

Wheel chair basketball (WB) are used as a part of rehabilitation programs for SCI people (Moreno et al., 2012). WB is widely known group sports for who are paraplegic SCI patients (Frez et al., 2015). WB is a team sports and there is a differences in rules between wheel chair and able bodied basketball(Perez et al., 2007). WBhas been developed last 20 years by professionally (Gil et al., 2010). Recently WB is the most popular sports for disable person among the competitive sports (Yanci et al., 2015). WB sports is one kind of exercise and this type of exercise keep fit commonly the wheelchair users activities of daily living (Goosey et al., 2010).Some authors said that when SCI people playing wheelchair basketball for

rehabilitation purpose is not only improved physical activity but also useful for socialization, improved quality of life and recovery of self-esteem(Gomes et al., 2018).Some studiesalso show that who are played in WB andperform physical activity have improved muscle strength thus improved healthy lifestyle (Moreno et al., 2012).Few articles demonstrate that regular exercise also improved autonomic control and sleep quality of SCI (Gomes et al., 2018).

The basic skills of WB is similar between able and disable basketball's competent body game and also necessary for WB sports players have to the skills of upper limb impulsion, initiating,discontinuing, and way changes of the wheelchair as well as shooting, fleeting, dripping, and recoiling(Uzun et al., 2012). Whereas the basketball players has some restriction in functional activity and also limit the trunk function which directly disturb the performance of various sports fundamental skill (Yanci et al., 2015).So the repetitive action of these operations requires a balance between the upper body muscle strength and patience (Uzun et al., 2012). Especially, the basis for specifying a player in a particular category depending upon the trunk movement and stability during basketball playing (Yanci et al., 2015).

Sports activities where introduce as a part of rehabilitation for disable person (Molik et al., 2010). To measure the benefits of sports, functionality is used as parameters (Frez et al., 2015). To assess WB merits and dangers for players with various physical disabilities, it requires complete confirmation of physical stress throughout the global competition (Perez et al., 2007). The first spinal cord injured peoples' sports competition named Paralyzed Stock Mandeville Games', was held in 1948., University of Illinois in the United States in 1949 organized a WB championship match around in 1949 (Molik et al., 2010).

The main physical properties of WB performance include prevention, energy, speed, coordination and mobility,especially aerobic fitness is also important because an ideal match lasts about 65 minutes (dos et al., 2017). A reduced physical ability plays an vigorouspart in the health status of SCI issues because it increases the risk of their complications and relates to increasing levels of functioning and living conditions (Haisma et al., 2006). Basketball is astandard that demands great speed in part of wheelchair athletes and requires fast and high body strength as well as quick change (Frez et al., 2015). The games held for a prolong period of time frame and in this

frame, the time is divided into short period where high intensity exercise is practice and runs are categorized by several small phases of action (Yanci et al., 2015).So the procedure of WB playing involves repetitive short, vigorous exercise, which includes rapid acceleration and deceleration, dynamic position change, and accepting its position in court (Molik et al., 2010).

Among common developmental disability along with physical disability is the third most common and the disability is unable to perform such a specific role and as a limitation to accomplish the task that the society expects to perform a person (Yanci et al., 2015). Disability of SCI patients which related to motor, sensory deficit and cardiovascular disturbance (Gomes et al., 2018). Vulnerable results of SCI often limit the ability to perform daily activities, mobility and community participation (Frez et al., 2015). Sports wheelchair minimize the gap between sports and players with different disabilities (Gil et al., 2010).In order to know the demand and effectiveness of sports on training session, there is need to arrange physical competitive sporting events (Croft et al., 2010).So that to analysis wheelchair basketball players should evaluate the at least aerobic power,anaerobicability and specific WB skills (Gil et al., 2010).

SCI patients have respiratory dysfunction occurs due to weakness or paralysis of respiratory muscles which lead to pneumonia, collapse of lung and respiratory tract infection (Moreno et al., 2012). Rib cage motion and pressure difference occurs by postural control and trunk muscle which help to the air flow in and an out of lungs during breathing (Pereira et al., 2016). The respiratory muscles are more affected when the lesion occur in the cervical and upper thoracic region resulting major reduction in inspiratory and expiratory function (Sheel et al., 2008).For evaluate the health status of the physically enable people respiratory muscles strength is a significant variable, particularly who are experienced with some form of muscle dysfunction resulting from trunk instability (Pereira et al., 2016). Muscle wasting, alteration of tone, autonomic dysfunction, hormonal changes and reduced lung volume, blood flow in merged with inactive physically and mentally which conduct to cardiorespiratory disease (Moreno et al., 2012).

Cardiovascular disorders are the primary cause of patients with brain injury and brain mortality (Gomes et al., 2018). Heart rate is the most frequently asses for monitoring

the severity of training at most sports (Yanci et al., 2014). Evidence shows that exercise training enhancescardiovascular health and prevent secondary complications, such as cardiovascular disease, obesity, diabetes and osteoporosis (Sheel et al., 2008).

WB is a major international multi-sports event, involving athletes with a range of physical disable people (dos et al., 2017). Evidence shows that when WB match is running players heart rate increase highly (Yanci et al., 2014). Exercise training also enhances breathing control, minute ventilation and tidal volume (Sheel et al., 2008).

SCI has a great effect on respiratory muscle because in SCI, neural control is damage, resulting impaired respiratory function and developing respiratory complication which is the common causes of death in SCI people (Sheel et al., 2008). Fitness structure can be defined as the physical ability of a muscular group to perform aerobic exercise in a chronic fashion, so to meet the increased level of physical activity, fitness includes both large muscle groups and both cardiovascular and respiratory system strengths program (Stewart et al., 2000). The respiratory system, consist of the lungs, respiratory muscles and associated neuronal controls which runs coordinately to lead a life and there are so many various respiratory training which isimproved respiratory function in people with SCI(Sheel et al., 2008).The aerobic performance of high-trained athletes is described as a limited factor in the respiratory system (Pereira et al., 2016). Exercise training and inspiratory muscle training which are used for measuring the outcome of respiratory function in people with SCI (Sheel et al., 2008).

Literature proved that who are propel wheelchair by using upper body weight, the respiratory muscles activated structurally and metabolically and thus the respiratory action enlightened(Moreno et al., 2012). It also found that the able athletes who perform respiratory training that increase respiratory muscle strength , delays muscle fatigue and the onset of dyspnea and it is similarlyproved that the respiratory muscle training is beneficial for people with SCI during the early rehabilitation stage (Goosey et al., 2010). The greatest number of the condition that are impending in WB players like SCIlead to a reduction of circulatory, lung and metabolic capacities (Perez et al., 2007).

When SCI peoples playing basketball, there are many sports injury occurs due to repetitive wheelchair propulsion, strain injuries and pressure sores are commonly seen inthe upper limb of wheelchair sports participants (Huzmeil et al., 2017). Although

the researchers have suggested a growing number of exercises that can increase the physicalfitness of SCI people, but there are currently no strictly advanced, clinical guidelines for determining the exercise of this population.Except for guidance, exercise is prescription and promotion challenging (Hicks et al., 2011). It is found in the study that the daily living work without any additional training is not strong enough to continue and upgrade the cardiovascular and physical well -being of the rehabilitated people with paraplegia (Perez et al., 2007).Trainers and examiners are extremely concerned about the development of best training routines to screen and improve the performance ofWB players where recently, it has been shown that endurance training programs are best designed to improve muscle strength in wheelchairs athletes (Uzun et al., 2012).

## 1.2 Rationale

Spinal cord injury is damage to the spinal cord. The spinal cord is responsible for sending message from the brain to all parts of the body consequently also send message from the body to the brain. It is an extremely serious type of physical trauma that's likely to have a lasting and significant impact on most aspects on daily life.

SCI persons have various physical problem and complication on body system (Hoque et al., 2018). Among them cardiorespiratory problem is one of the commonest. According to Hoque et al (2018), one of the essential but infrequently unnoticed region of the cardiorespiratory fitness. A person with SCI is reflected to be the most inactive fragment of society who faces many challenges and barriers to physical activity participation (Ginis et al., 2012). The physically inactive persons with SCI has relatively low anaerobic work capacity, peak aerobic work capacity and isometric strength (Van et al., 2015).

During acute stage they are mostly bed bound and need low level of activity but in rehabilitation stage their demand is increased for example mobilizing wheelchair in outside the home require more cardiorespiratory fitness (Hoque et al., 2018). Cardiorespiratory fitness seems additionally significant during their rehabilitation as well as their quality of life (Nooijen et al., 2012).

Now a days WB is the most popular team sports for physically disable people. Significant benefits on the physical well-being and psychosocial well-being of persons with SCI, the systemic efforts to increase exercise as well as sports participation, where exercise means planned, structure and repetitive physical activity intended to enhance or sustain fitness whereas basketball is characteristically a competitive type of physical activity administrated by rules (Ginis et al., 2012).

In Centre for the Rehabilitation of the Paralyzed (CRP), SCI patients who are paraplegic, can turn on wheelchair. They are playing WB as a part of their rehabilitation. In Bangladesh there is no research about the effect of WB on cardiorespiratory area. As cardiorespiratory function is important for SCI patient, so we need to know any effect of WB on cardiorespiratory area. That's why I want to do this research.

## 1.3 Hypothesis

The hypothesis of the experimental study was one tailed hypothesis because it was predicting a specific direction to the result. The 'p' value was <.05 that was accepted by the researcher to show the significance of the study**.**

## Null hypothesis

Wheelchair basketball have no effect on cardiorespiratory fitness among the patients with SCI.

$H_0 = \mu_1 - \mu_1 = 0$ or $\mu_1 = \mu_2$, where the posttest and pretest initial and final mean difference is same.

## Alternative Hypothesis

Wheelchair basketball have effect on cardiorespiratory fitness among the patients with SCI.

$H_\alpha = \mu_1 - \mu_1 \neq 0$ or $\mu_1 \neq \mu_2$, where the posttest and pretest initial and final mean difference is not same.

## 1.4Objectives

### 1.4.1 General Objective:

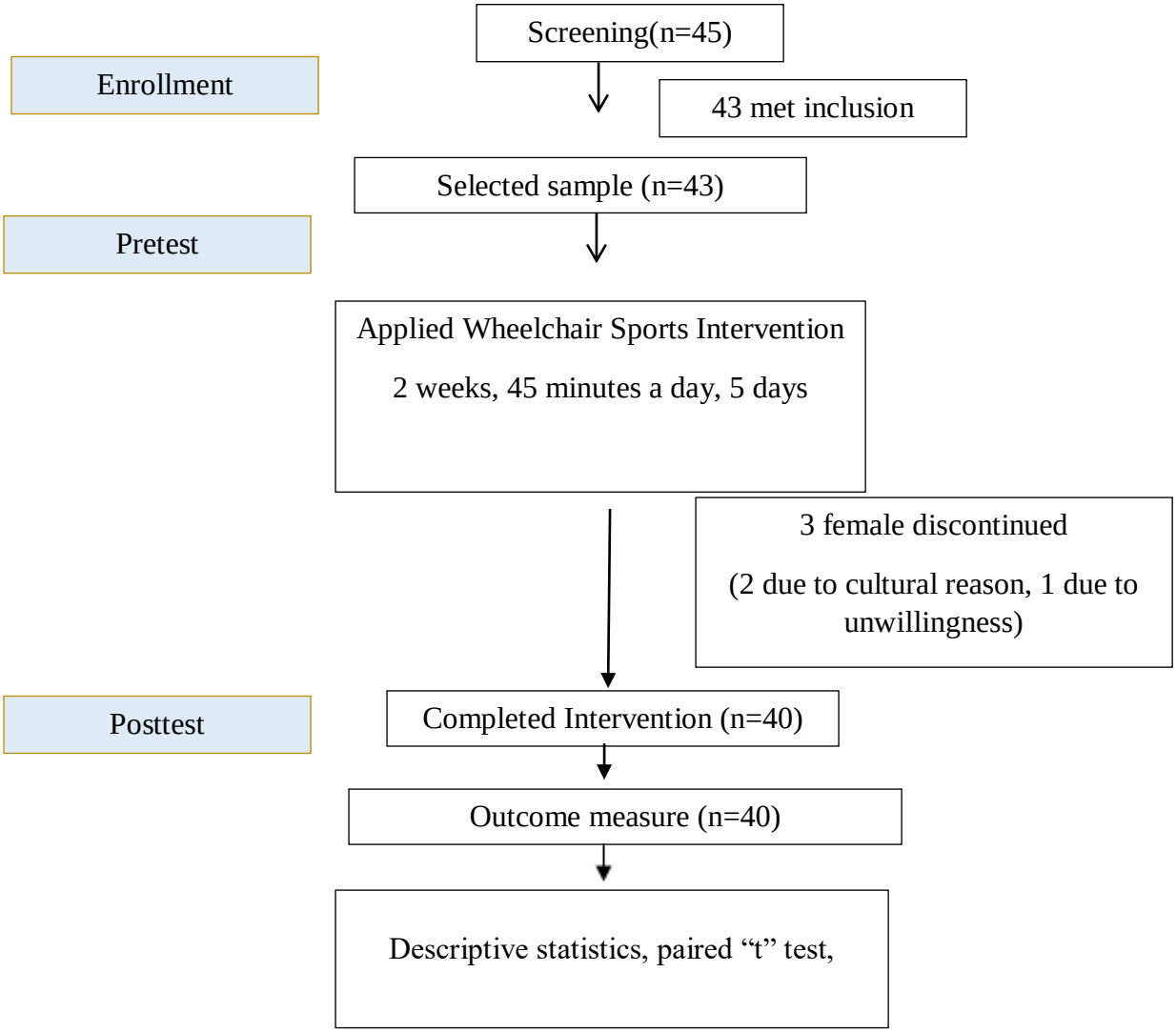
I. To identify the cardiorespiratory effect of wheel chair basketball in SCI.

### 1.4.2 Specific objective:

I. To obtain the socio-demographic information (Age, Sex, Occupation, Marital status etc.)
II. To evaluate the changes in oxygen saturation rate followed by WB sports.
III. To measure the changes in the lung capacity after wheelchair basketball sports.
IV. To quantify the improvements in chest diameter followed by WB.
V. To document the changes in the Blood pressure and pulse followed by WB.
VI. To obtain the differences in the VO2 max after WB.

## 1.5Conceptual Framework

**CONSORT Flowchart**



## 1.6 List of variables

**Independent variables:**

- Sociodemographic information (Age,Gender,Occupation,Income,Family type, educationalstatus, Residential area)
- Conventional Physiotherapy
- Wheelchair Basketball
- Sports

**Dependent variables:**

- **Cardiorespiratory**
  - Peak Expiratory Flow Rate of paraplegic spinal cord injury peoples
  - Inspiratory capacity of paraplegic spinal cord injury peoples
  - Maximal Oxygen Consumption of paraplegic spinal cord injury peoples
  - Oxygen saturation of paraplegic spinal cord injury peoples

- **Cardiovascular**
  - Blood pressure of paraplegic spinal cord injury peoples
  - Pulse of paraplegic spinal cord injury peoples
  - Chest Expansion of paraplegic spinal cord injury peoples

## 1.7 Operational Definition

**Spinal Cord Injury:**

According to (Kirshblum& Waring 2014) SCI is an insult to the spine that results in short-term or permanently changing the cord's normal motor, sensory or automatic function and patients with SCI suffered from neurologic deficit which lead to disability.

**Paraplegia:**

According to ASIA (2011) “Paraplegia means loss of motor or sensory function in the thoracic, lumber or sacral segment of the spinal cord, especially affects in the lower limb.

**Wheelchair:**

Wheelchair is one kind of mobility device which helps disable people to move from one place to another.

**Basketball:**

Basketball is a team sports where 5 players attend each court, there is a hoop at each end. The ball is moved down the court toward the basket by passing or dribbling.

**Cardiovascular fitness:**

Cardiovascular fitness is the capacity to supply oxygen-rich blood to the heart, lung and blood cells and also working muscles which produce energy for movement(Hoque et al., 2018).

# CHAPTER-II LITERATURE REVIEW

Motor and sensory damage occurs when the spinal cord is injured and as a result of these the people with SCI are suffer from lifelong disability (Tomasone et al., 2013). Due to lethargic life style the antagonistic properties of SCI recurrently occur on their performance, health status and fitness (Tweedy et al., 2017). Physical fitness means cardiorespiratory fitness, body component, elasticity and muscular strength which is consists of a traditional features that the people have or attain and also linked with the capacity to complete their ADL (Tiu et al., 2017). According to Bucher "physical fitness is the capacity of an individual to maintain healthy and balanced life" (George et al., 2014). Among the barrier of SCI peoples pulmonary barrier is the main reason of illness and then death in both acute and chronic stages (Roth et al., 2010). Physical events including game and sports are continued for improve physical fitness and health status from primordial times (George et al., 2014).

TSCI can occur instantly resulting from tetraplegia and paraplegia where paraplegia means weakness of the trunk or lower limbs; due to immobility paraplegic person have decreased their exercise capability and also lessen their working out stroke volume (Tweedy et al., 2017). Skeletal muscles of the body who are helps in body movement provide adequate flow according to their demand when cardiac output are raised (Lee et al., 2017).Physical ability means any form of body motion which is originated by skeletal muscles of the body resulting energy spending (Tweedy et al., 2017). Exercise in one kind of physical movement which is well designed, organized and repeated performance to enhance the appropriateness of the body (Tiu et al., 2017). Evidence strongly said that exercise can develop muscle strength, progress cardiorespiratory fitness, effective individuality and thus standard living of persons with SCI (Tweedy et al., 2017).

Globally SCI is one of the imperative health issue and among all the traumatic happenings it is the utmost overwhelming condition, where the yearly prevalence of 15 to 52.5 in every millions of people (Popa et al., 2010). On the other hand, according to Ning et al (2012), the range of incidence was between 12.06 and 61.6 per million. The worldwide occurrence ratio of SCI is predictable in 23 cases each million even though there is a significant local difference from North America (40 per

million) to Australia (15 per million) (Tweedy et al., 2017). But in Asia the total number of unindustrialized country is bigger than North America where stated that frequency rate of TSCI in unindustrialized country have lesser than the industrialized country (Ning et al., 2012). Recently near about 2.1 million persons are existing with traumatic or non –traumatic SCI in Canada and United States. (Tomasone et al., 2013).Comparison to North America the frequency of TSCI is inferior in Asia and this variation occurs due to financial and community development (Ning et al., 2012).

Amongst all SCI persons 42% are suffering from paraplegia (Popa et al., 2010). But in case of western country like Norway falls associated accidents are the usual source where in Asian countries these falls related events are rises day by day because in Asia region there are a number of underdeveloped country where motor vehicle Collison are no most available compare to Europe and North America (Ning et al., 2012). Internationally SCI maximally occurs among male person, where their age group reported between 18-32 years and in over populated country SCI also occurs above 65 years of old (Lee et al., 2014). Another study shows that among all spinal cord inured people nearby 80% are young men, age group between 15 to 35 years (Popa et al., 2010). Literature proved that persons with SCI are extremely lethargic (Tweedy et al., 2017).

There is a general agreement that the resting blood pressure of the SCI person is inversely associated with the injury level and if the persons injured highly their resting Systolic BP lesser about 15-20 mmHg than the healthy individual (Lee et al., 2017). Ning et al. (2012) discovered that in Bangladesh among the causes of SCI fall from height, carrying heavy weight on the neck or back are the most standard cause.

SCI can be categorized by complete or incomplete depend upon on the preservation of sacral segment. Here detect the presence of motor or sensory function in the caudal sacral segment which is determined by the testing of each dermatome, light touch and pinprick sensations, voluntary anal sphincter contraction and ten key muscles on each side of the body. Complete injury is the term is used when there is an absence of motor and sensory function in the lowest sacral segments (S4-S5), whereas incomplete injury is used when there is preservation of motor and sensory function below the neurological level that includes the lowest sacral segments S4-S5 (Haque et al., 2018).

Blood pressure is monitored regularly by the body and familiar to meet the body's needs (Herawati&Azizah, 2016). A standard mercury sphygmomanometer is used to measure the blood pressure of the participant in a seated position (Papathanasiou et al., 2015). Cuff pressure is exhibited as a simulated mercury column with an array of light emission diodes or digital display (Staessen et al., 2016). This observation is performed by the baroreceptors and these are the special receptors which notice the changes in blood pressure and originate within the wall of the blood vessel (Herawati&Azizah, 2016).

Classification of blood pressure established by the new guide line of the European Society of Hypertension and European Society of Cardiology where Systolic BP (SBP) ≥140 mmHg and diastolic BP (DBP) ≥90 mmHg are defined as hypertensive (Grade I and II) (Papathanasiou et al., 2015).

Furthermore normal (130/85 mm Hg) and optimal (120/80 mm Hg) (Herawati&Azizah, 2016). Cardiovascular hazards occur when BP level at least down to 115 mmHg systolic or 75 mmHg diastolic (Staessen et al., 2016). Small rank of physical activity and cardiovascular disease are inversely related with each other and strong analytical catalogs of mortality, every year 1.9 million deaths are responsible for this (Papathanasiou et al., 2015).

Physical growth of BP arises during acute exercise (Kokkinos et al., 2014). During exercise, the significant cardiovascular alterations are present and the peripheral blood flow to the inactive area is fairly decrease so to improve the metabolic demands of the working muscle, redistribution of blood focused near the active areas (Thijssen et al., 2009).But excessive increase in blood pressure during exercise can be modified by the person's fitness status (Kokkinos et al., 2014). Cardiovascular variation depending on the type of physical exercise and the level of training and their intensity (Scharhag et al., 2013). There are many sports including widespread team- based activity such as basketball, football, hockey and field hockey are the important components of both strength and endurance exercise (Baggish& Wood, 2011).

Dynamic exercises increase systolic blood pressure, which relates to the amount of the exercise when the diastolic pressure is only slightly changed (Scharhag et al., 2013). Study shows that repetitive performance of dynamic physical exercise has resulted in substantial variations in myocardial structure and function

(Baggish&Wood, 2011). On the other hand, static exercise particularly physical exertion or maximal intensity dynamic exercise cause a greater increase in both systolic and diastolic BP (Scharhag et al., 2013). Sports can play an important role in cardiac remodeling of certain hemodynamically conditions (Baggish& Wood, 2011). Dynamic exercise mostly rises the hearts volume load, where static exercise mainly enhance its pressure work (Scharhag et al., 2013).

According to Thijssen et al (2009), during arm cranking exercise, the paraplegic person exhibits blood pooling in the affected lower limb which contributes to the partial increase in stroke volume in individuals with SCI.

Pulse Oximetry (PO) is used as a non-invasive procedure to monitor arterial oxygen saturation (Kohyama et al., 2015). PO is universally used for observing oxygenation in critical intensive care situation and it represents a value that indicate oxygen saturation level in the peripheral blood (Jubran et al., 2015). Another study also said that PO detect oxygen saturation and it is globally used in critical care situation, surgery and in outpatient department where cases have a risk of developing hypoxia (Kohyama et al., 2015). PO calculate oxygen saturation by using spectrophotometric method and penetrating the skin and determining alterations in light absorption of arterial and venous blood where diverse light wavelength ranging from 600 to 950 nanometer are utilized (Jubran et al., 2015). PO can be used in the finger, nose, ear lobe and forehead because these area has a much concentration of blood rather than the skin of the chest wall (Chan et al., 2013). The tool is appropriate to use on the finger, toe or earlobe but in case of limited perfusion or hypoxic condition using sensors on fingers are mostly appropriate and feasible for accurate results (Jubran et al., 2015). The major types of pulse oximeter probes are reusable clip probe (ear nose and finger) and single patient adhesive probes (finger, forehead) (Chan et al., 2013).

The development of the tool has been supported and initiated by projects from WHO and her allies in a direction to save lives in emergency situations (Enoch et al., 2016). For instinct, in case of low blood pressure the ear and forehead sensors are appropriate because these area has less chances to have obstruction in blood (Chan et al., 2013). In case of major deterioration in oxygen saturation level, the tools enhance the clinician manage condition in empirical life situation and evaluate the outcome of usual care (Jubran et al., 2015).

The sensitivity of the tool proven to have approximately 90% in critical situations to avoid hypoxia (Kohyama et al., 2015). Conventional approaches of the oximetry measurement tool works as reflecting and recognizing intensity of lights on the human tissue (Jubran et al., 2015). The acceptability, usefulness and resonance has placed a vital role to place the tool as like as one of the vital sign of the body (Chan et al., 2013). The proportion of imitation is designed and regulated besides the monitoring of oxygen saturation (SaO2) in the artery to determine the arterial pressure of oxygen and the equipment is sensitive to unidirectional point measurement of the peripheral oxygen saturation, hence sometimes can't investigate oxygen saturation definitively in critical care setting (Jubran et al., 2015).

In non-gravid cases, the rate of oxygen saturation in peripheral blood is considered to be normal at rest, activities and exertion, but as a reference value the rate should not be lower than 95% and this is defined as a normal value for the tool (Langford et al., 2010). The pulse oximeter has developed update approach of treatment with its capacity to concurrent monitoring of the effective oxygen saturation in the blood vessel (Chan et al., 2013). Peripheral pressure of oxygenated blood sometimes may not be represented as per the value of the tool in case of extreme cases of hypotension or vascular collapse where the rate falls down 70% (Langford et al., 2010). The tool have been designed to use in the limited resource situation, as use in the emergency medical kit with a lighter battery operated unit (Enoch et al., 2016).

Hence, cases with hypoxia and lake of instability in consistency of blood regulation, respiratory insufficiency or problems in arterial blood gases, PO is a suitable tool to measure the rate of saturation of peripheral oxygenated blood (Kohyama et al., 2015). In case of coldness, there is further chance to congestion of blood in vessels and in these cases forehead sensors are more appropriate than putting probes to fingers (Chan et al., 2013). Moreover, in vigorous exercise the rate of saturation may be lower as per expected values, but generally upraises in case of aerobic exercise (Langford et al., 2010).Transcutaneous pulse oximetry can ultimately replicate definite arterial O2 saturation during exercise (Fang et al., 2014).

The way of process of deep breathing exercise with incentive spirometer (IS) is well-known as incentive spirometry (Narayanan et al., 2016). Spirometry is a one kind of pulmonary function test which is measured the amount of air that can be exhale and

inhale (Moore et al., 2012). Van de Water et al first recognized incentive spirometry seems as a treatment technique (Do et al., 2014). The main aim of this technique is to rise the pulmonary volume and increase the action of the respiratory muscles so that the whole lung inflates (Corn et al., 2010). This type of highest inhalational exercise helps to prevent respiratory complication and thus increase pulmonary function (Goldstein et al., 2012).

An IS is a one kind of hand held maneuver which is consist of a mouthpiece and two column with portable pistons that changes the position when the stimulus response (Armstrong et al., 2017). IS designed to exposed alveoli through constant maximal inspiration (Eltorai et al., 2019). One column contains a flow-based piston that manages the power or speed of inhalation and another column, piston measure deep breathing volume (Armstrong et al., 2017). This spirometry deliberate to inspire deep breathing and lung extension which provide visual feedback during exercise when they breathe in for at least 5 seconds and determinate the outcomes for following the patient's improvement (Restrepo et al., 2011). The visual pattern of this column are consistent with patient's best inspirational effort which should be quick and strong versus slow and steady (Armstrong et al., 2017). IS can be useful to assist recovery and preserve the lung in good physical shape (Do et al., 2014). Patients is in most suitable position so that they easily performed deep breathing and also based on their physical condition (Armstrong et al., 2017).

In upright sitting position instruct the patients to place the IS mouthpiece into the mouth, exhale normally and then asked to breathe in slowly (Restrepo et al., 2011). Some models have a permanent marker in this column to specify the patient's inspirational volume goals (Armstrong et al., 2017).When the patients inhale slowly a piece of this device gradually increases and the physician detect how long a breath the person should take (Do et al., 2014). After maximal inspiration, the mouthpiece is detached, monitored by a breath hold and then normal expiration (Restrepo et al., 2011). It also documented the number of efficacious breathing exercise (Do et al., 2014).When the method is achieved, the smaller airway continuously exposed which has been established to lessen atelectasis also extensive clinical use (Eltorai et al., 2019).

After physical exercise Enright et al (2011), shows that increase in vital capacity and also total lung capacity. Approximately IS are the most important for bed-ridden patients specially who are paralyzed and developed weakness in the respiratory muscles and are consequently susceptible to increase atelectasis (Corn et al., 2010). IS established by Bartlett et al to allow exhalation, particularly in case of dull, persistent and low volume breathing pattern (Narayanan et al., 2016). Studies said that spirometer is widely used for Sustained maximal inspirational exercises (Goldstein et al., 2012). The volume incentive model of IS said to be physiological because here the exercise volume is persistent until it extents the maximum inhalational volume by the physiotherapist (Do et al., 2014).The significant of charts depend upon the patient's age, gender and height which are generally provided with each spirometer (Armstrong et al., 2017).

Chest wall is an elastic structure and allow dislocation of the lung (De et al., 2013). In case of decreased lung function chest expansion measurement is a key factor to discover the following object (Olsen et al., 2011). Chest diameter assessed by using a measuring tape from the axillary to xiphoid levels in an upright sitting position (Jung et al., 2015).These measurement are performed with a measuring tape at 2 levels, first is the anterior axillary line (third to the fourth intercostal space) and another is tip of the xiphoid process(Olsen et al., 2011). The landmark were drawn from the frontal axillary line to the tip of the xiphoid process, individually (Moreno et al., 2012). For clinical practice, a simple and cheap strategy for measuring is to use a measuring tape (Olsen et al., 2011).

Clinically respiratory muscle action is assessed with maximal inspiratory and expiratory pressure and these pressure produced by respiratory muscle which are responsible for changes of lung volume in the respiratory system (De et al., 2013). Examination of chest diameter, a specific point is fixed during maximal inhalation and maximal exhalation (Olsen et al., 2011).

The procedure for measuring the chest diameter was to keep the zero point of the tape stable on the midline of the body, bring into line horizontally with the benchmark, when the other end of the tape is not allowed to be removed (De et al., 2013). The tape was placed comfortably but not strongly in order to keep the soft tissue shape unchanged (Moreno et al., 2012). Depend upon on the pressure- volume association

of the respiratory system, when the inhalation stars from the bottom of the lung, the maximal inspiratory pressure is attained and vice versa (De et al., 2013). For evaluation of the chest diameter, instructed the patients to perform maximal inhalation and then asked exhalation again (Jung et al., 2015). These measurement procedure performed twice in separate breathing time during at the end of maximal inspiration and maximal expiration (Moreno et al., 2012). The maximal inspiration and expiration hold for at least 2 second to allow information to be collected (De et al., 2013).

A peak flow meter is a small hand-held device that can be measured how quickly a people blast air out of the lungs by forceful expiration after maximal inspiration and this measurement procedure is called peak expiratory flow'(Adeniyi et al., 2011). Another research said that peak expiratory flow means the maximum amount of air that can be expired when propelling out at a balanced rate (Moore et al., 2012). Measurement of the peak expiratory flow needs to improve maximal exhalation of the persons who are physically inactive (Perez et al., 2009).Dr Martin first formed peak expiratory flow (PEF) to measure pulmonary function (Adeniyi et al., 2011). Evidence shows that significant enhancement of lung capacity and inspiration capacity by using PEF (Meamarbashi et al., 2013).

The procedure of PEF are: first of all instruct the persons and set the cursor to zero. Aware the persons so that they do not touch the cursor. Then peak flow meter horizontally place in front of the mouth and take a deep breath in and close the lips around the mouthpiece. Make sure there is no air leak out of the mouthpiece and breathe out as fast as possible. During breath out notice the number of cursor and then the cursor return to zero. Repeat this procedure 3 times and obtaining the highest point (Adeniyi et al., 2011). Normal range of the PEF depend upon on the person's age, sex and height and measured by L/min (Chan et al., 2009).

Author hypothesize that after inspiration the nasal air force enhanced and thus to improve oxygen supply to the brain which is effective for leading the physical performance (Meamarbashi et al., 2013). Peak flow meter contains a housing which comprise channel with a pointer meter is used to detect distance according to the persons lung function and also helps to evaluate the airflow through the airway and thus detect the grade of obstruction (Adeniyi et al., 2011).

Maximal oxygen consumption (VO2max) is well- demarcated as the capacity to passage and ingest oxygen during fatigue activity which is related to the cardiorespiratory appropriateness (Koutlianos et al., 2013). Physical well-being depends mainly on the patience of a person with cardiorespiratory strength (Doijad et al., 2013). Consequently cardiorespiratory fitness is assessed by VO2 max (Goldstein et al., 2012). According to Hoque et al (2018), maximum heart rate estimated by 220-present age formula. Literature said that it is the globally recognized method to assess the cardiopulmonary strength (Doijad et al., 2013).

Recently the aerobic performance has fulfill the demand to achieve the highest ability (Habibi et al., 2014). Than VO2max= 15 x (maxHR÷ RestHR) formula is utilized to detect the VO2max (Hoque et al., 2018). These measurement procedure is categorized into two approach including direct and indirect where indirect method is performed by heart rate (Habibi et al., 2014).This measurement is stated as used in (ml/kg/min) (Doijad et al., 2013). Heart rate of the participants was measured in 3 time (Hoque et al., 2018).

# CHAPTER-III METHODOLOGY

## 3.1. Study Design

The Quasi experimental quantitative design was used for the study design. An experimental design that was not meet all requirements necessary for controlling impacts of extraneous variables. Quasi-experimental research was similarities with the traditional experimental design or randomized controlled trial. Since quasi-experimental designs was used when randomization will impractical and or unethical, they are typically easier to set up than true experimental designs, which require random assignment of subjects. Here researcher was chosen the Single-Group as the subjects in the experimental group was act as their own control. The subjects were given a pretest, followed by intervention and a post test. But this also keeps many challenges for the investigator. This lack of randomization makes it harder to rule out confounds and introduces new threat to internal validity. Utilizing quasi-experimental designs minimizes threats to external validity. Since quasi- experiments are natural experiments, findings in one may be applied and setting, allowing for some generalizations to be made about population.

## 3.2 Study site

The researcher is a fourth year B.Sc. in Physiotherapy student of Bangladesh Health Professions Institute (BHPI) in session 2014-2015 and the research is a part of the course curriculum. For this reason the researcher has to be collecting data with in short time to maintain the contrasts.Data was collected from paraplegic SCI people attending at Center for the Rehabilitation of the Paralysed, Savar, Dhaka. CRP is the biggest hospital and renowned Rehabilitation Centre for Spinal Cord Injury (SCI) in South Asia.

## 3.3 Study Populationand sample population

A population is the total group or set of events or totality of the observation on which aresearch is carried out. It is the group of interest to the researcher, the group whom the researcher would like to generalize the result of the study.In this study the paraplegic SCI people playing wheelchair basketball at CRP was chosen as a sample population to carry out this study. About 43 samples were selected for this study.

Subjects, who met the inclusion criteria, were taken in this study from Spinal cord injury unit of CRP, Savar.

### 3.4 Sample size calculation

The number of items to be selected from the population was the sample size.Sample a group of subjects were selected from population, who were used in a piece of research (Hicks, 1999).For quantitative analysis Sample size has been calculated considering a formula from Miot (2011) as he was stating if a pretest has been obtained in a similar subject to observe the impact of an intervention and conducted posttest than the formula can be used.

$$n = \left( \frac{\left( \frac{z\alpha}{2} + z\beta \right) . Sd}{D} \right) 2$$

Where,

n = Sample Size

α = .05 (5% level of significant)

β = .02 (80% power of the study)

Sd = Standard deviation

D = Mean value of the difference between the pairs

Here, the value of $\frac{z\alpha}{2} + z\beta$ is 1.96+.84 is constant. Considering 5% error, with level of significance less than .05 and maximum difference between systolic and diastolic blood pressure estimated 50 mm/Hg; and minimum difference between systolic and diastolic blood pressure to be considered as 30 mm/Hg, the standard deviation was 14.14 in the baseline. In the posttest, the minimum level of difference between systolic and diastolic BP due to sports can be considered as clinical relevance of change was more or equal to 6 mm/Hg from baseline difference, the calculation explored minimum sample as 43.5 person in a single group.

### 3.5 Duration of Study

Duration of data collection for the study was 16 April to 10 July, 2019.

### 3.6 Sampling technique

Sampling refers to the process of selecting the subjects or individual by hospital based randomization.Searching an appropriate number and kind of people who are a part of this study is called –Sampling(Hicks, 1999). Participants were selected from SCI unit of CRP because they were easily accessible for the researcher.Sampling was an important concept in research. Basically it was a procedure to how to choose the people who will study or who would participate in research.

Patients admitted with SCI at CRP from 16 April 2019 to 10 July, 2019 were selected as the study population.Total 75 patients has been screened, among respondents who were eligible for playing wheelchair basketball only they are selected for my study.45 patients were fitted with inclusion criteria and employed in the intervention process, here 40 patient completed the intervention. Although, the players are not selected by the researcher's will, there is no scope for biasness. The patients are evaluated by professionals of the SCI unit to take decision to play on their physical status

### 3.7 Inclusion criteria

The inclusioncriteria has been set up incorporating studies on wheelchair basketball in similar cultural context by Imran, et al., (2018).

1. Persons with paraplegic spinal cord injury attending at CRP.
2. Age range 15-65 years.
3. Both male and female
4. People who willingly participate in the study.
5. Have trunk control.
6 Playing basketball less than 2 weeks.
7. Which patients must took physiotherapy and occupational therapy they were the Participants.
8. Indoor participants who are receive ongoing rehabilitation service.

### 3.8 Exclusion criteria

1. Undiagnosed injury or other condition.
2. SCI patient with psychological problem(such as cognitive or mental impairment).
3. Patient suffering from serious pathological disease. E.g. tumors, tuberculosis etc.
4. SCI patients with severe head injury.
5. Patients receiving outdoor service.
6. Patient who are not fit for wheel chair basketball sports.
7.Receivingbronchodilator, anti-hypertensive drug or other cardiorespiratory drug.
8. Participants who did not complete 2 weeks intervention.

#### 3.8.1 Data collection tools

The researcher organized the materials to successfully complete the interview session.Data would be collected by using a structural mixed type questionnaire paper, Bengali Consent form set by researcher to collect information. The questionnaire sought information on identification socio-demographic information(name, age, sex,occupation) and cardiorespiratory effect related questions.The organized materials that needed for the study was a written questionnaire and other some necessary materials that were Pen, Pencil, File, Eraser, Clip board, White paper,Note book,Laptop and Calculator were used in the conduction of this study.

#### 3.8.2Measurement too**l**s

Peak flow meter, blood pressure machine, Pulse oximetry, Incentive Spirometry, Measurement tap.

#### 3.8.3Intervention:

Selected participated were willingly participated in a two weeks sports program, one hour per day and weekly five days.

#### 3.8.4Procedure of data collection

Data collection procedure was conducted through assessing the patient, initial recording, intervention and final recording. After screening the patient at outdoor department, the patients were assessed by qualified physiotherapist in SCI unit of

CRP. 2 weeks of intervention was provided for every subject. 43 subjects were chosen for data collection according to the inclusion criteria.

Data will be gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form which has been formatted by the researcher. The same procedure was performed to take post-test at the end of 2 weeks of intervention. The researcher was collected the data from the group in front of the qualified physiotherapist in order to reduce the biasness.After quantitative investigation, the data collector took a face to face interview in a setting far from the treatment room by preset open ended questionnaire and recorded the interview.Each questionnaire took approximately 20-30 minutes to complete.

### 3.8.5 Data analysis procedure

Data was analyzed with the software which named Statistical Package for Social Science (SPSS) version 20.0 and Microsoft Excel 2016. Every questionnaire was rechecked for missing information or unclear information. At first put the name of variables in the variable view of SPSS and the types, values, decimal, label alignment and measurement level of data. The next step was to input data view of SPSS. After input all data researcher checked the inputted data to ensure that all data had been accurately transcribed from the questionnaire sheet to SPSS data view. Then the raw data was ready for analysis in SPSS. Descriptive statistic test, Paired t Test was performed for finding result. Data was presented by using the bar graph and table.

**Paired t test:**

Paired t-test was used to compare difference between means of paired variables. Selection of test of hypothesis is mean difference under t distribution.

**Assumption:**

Paired variables
Variables were quantitative
Parent population of sample observation follows normal distribution

**Formula:**Paired t test defined by- According to Hicks (2009),

$$t = \frac{\bar{d}}{SE(\bar{d})}$$
$$= \frac{\bar{d}}{\frac{SD}{\sqrt{n}}}$$

Where,

$\bar{d}$= Mean of difference (d) between paired values
SE ($\bar{d}$) = Standard Error of the mean difference
SD= Standard deviation of the differences d and
n= number of paired observations.

### 3.8.6 Level of Significance

In order to find out the significance of the study, the "p" value was calculated. The p values refer to the probability of the results for experimental study. A p value is called level of significance for an experiment and a p value of <.05 was accepted as significant result for health service research.

## 3.9 Ethical consideration

The researcher maintained some ethical considerations: The research proposal including methodology was submitted to Institutional Review Board (IRB) of Bangladesh Health Professions Institute (BHPI) for oral presentation and defense was done in front of IRB. Then IRB approved the proposal. Researcher had followed the Helsinki guideline of world medical association. This protocol presentation was firstly submitted to the Institutional Review Board (IRB) of BHPI and initial permission was taken. Permission was taken from the Head of the Department of Physiotherapy, BHPI**,**CRP before data collection.Permission was takenfrom the In-Charge of SCI Unit, CRP for data collection from the patients. Researcher maintained the confidentiality of the collected data from the individuals.Researcher ensured the confidentially of participants and shared the information only with research supervisor. All rights of the participants were reserved and researcher was accountable to the participant to answer any type of study related question.

The participants would be informed before to invite participation in the study.The ethical consideration was obtained through an informed consent letter to the

participant. Consent was obtained by providing each participant a clear description of the study purpose, the procedure involve in the study and also informing them that if they wish they could withdraw themselves any time from the study. The necessary information had been kept secure place to ensure confidentiality. All kinds of confidentiality highly maintained. They were also assured that it would not cause any harm. Researcher also ensured that the organization (CRP) was not hampered by the study. Then they signed the consent form.

### 3.10 Informed Consent

Written consent (appendix) was given to all participants prior to completion of the questionnaire .The researcher explained to the participants about his or her role in this study and aim and objective of this study. The researcher received a written consent form every participants including signature.So the participant assured that they could understand about the consent form and their participation was on voluntary basic. The participants were informed clearly that their information would not be kept confidential. The researcher assured the participants that the study would not be harmful to them. It wasexplained that there might not a direct benefit from the study for the participants but in the future cases like them might be get benefit from it. The participants had the rights to withdraw consent and discontinue participation at any time without prejudice to present or future care at the spinal cord injury (SCI) unit of CRP. Information from this study was anonymously coded to ensure confidentiality and was not personally identified in any publication containing the result of this study.

# CHAPTER-IV RESULTS

## 4.1 Sociodemographic information

### 4.1.1 Age

Among 40 participants, mean age of the respondents were 25.20 years with standard deviation ± 6.9 years, median 24.50 and mode 28. Among them 37% (n=15) were in the age group between the range of 16-20 years. Also 40% (n=16) of the respondents found in the age group between 21-30 years and 23% (n=9) of them were in the age group between 31-45 years.

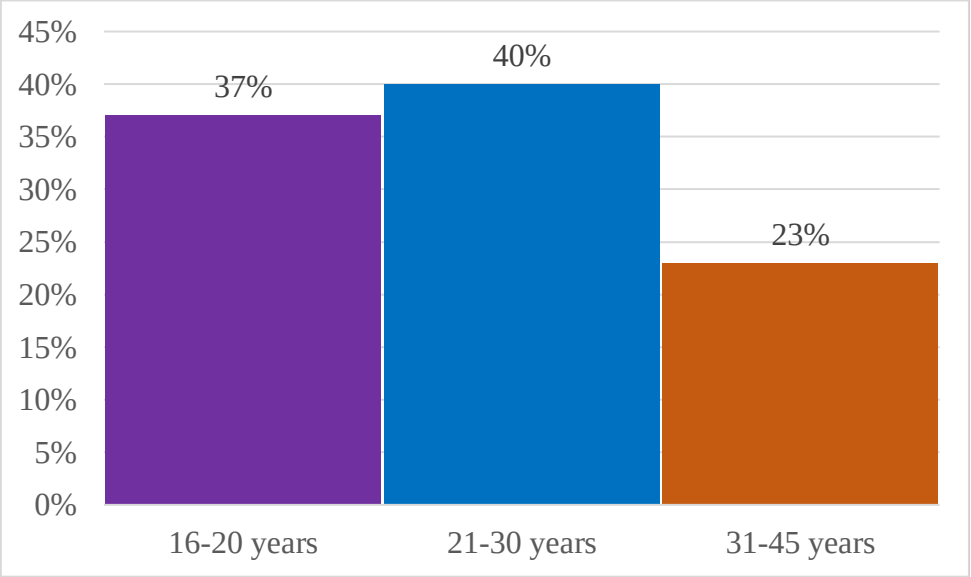



**Fig 01: Age of the participants**

### 4.1.2 Gender

Male was predominantly higher than female. Out of 40 participants 95% (n=38) were male and 5% (n=2) were female.

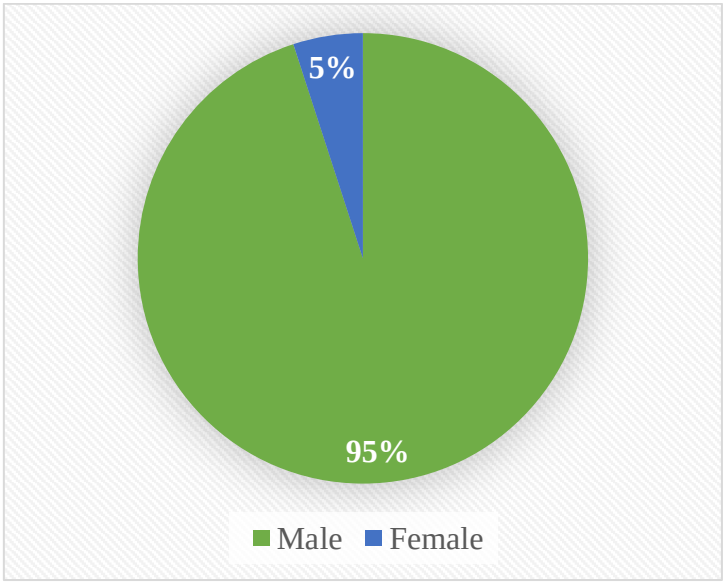



**Fig 02: Gender distribution of the respondents**

### 4.1.3 Marital status

Around 40 participants researcher found unmarried person 55% (n=22), married person 40% (n=16) and divorced person 5% (n=2). Most frequent status in unmarried that was higher than married and divorced person.

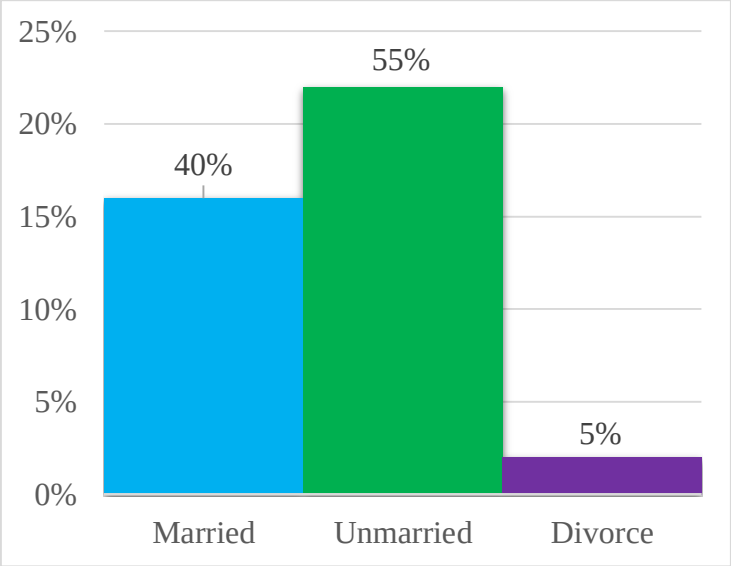



**Fig 03: Marital status of the participants**

### 4.1.4 Educational status

Out of 40 participants, most of them were secondary level 32.5% (n=13) that means have the outstanding knowledge to read and write. After that primary level was the second most common and number was 30% (n=12). Table 1 show the details of the educational status of the participants.

**Table 1: Educational status of the participants**

| **Educational status** | **Number(n)** | **Percent(%)** |
|---|---|---|
| No formal education | 3 | 7.5 |
| Primary education | 12 | 30 |
| Secondary education | 13 | 32.5 |
| Higher education | 8 | 20 |
| Bachelor or above | 4 | 10 |
| **Total** | **40** | **100** |

### 4.1.5 Occupation

The chart shows that the number of service holder are more than other profession. 10% (n=4) are car driver, 17.5% (n=7) are student, 7.5% (n=3) are day labor, 17.5% (n=7) are businessman, 7.5% (n=3) are farmer and 17.5% (n=7) are mason, 2.5% (n=1) are engage in household activities.

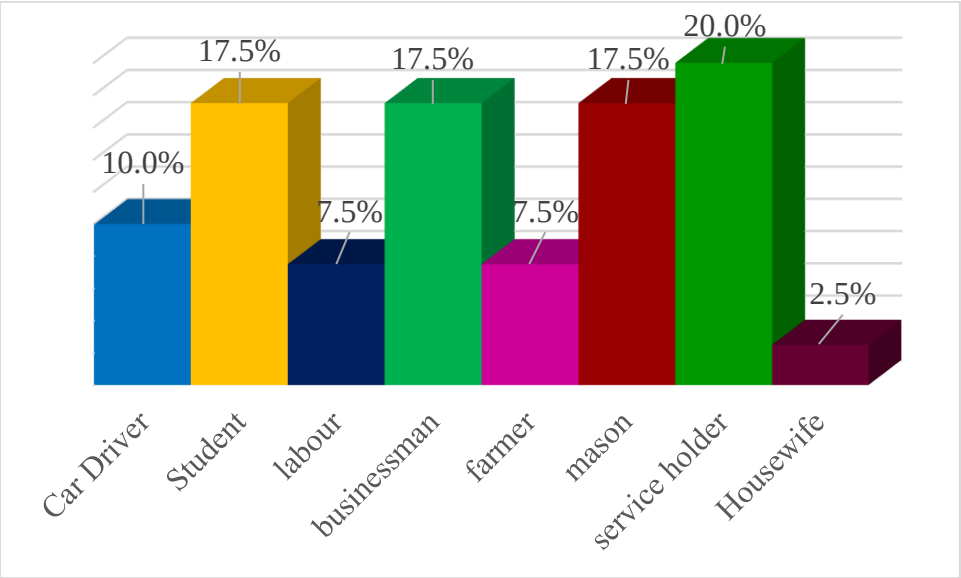



**Fig 04: Occupation of the participants**

### 4.1.6 Living area

Most of the respondents who are suffering from spinal cord injury were from rural areas. Only 10% (n=4) were from urban area and rest of them from semi urban area 23% (n=9).

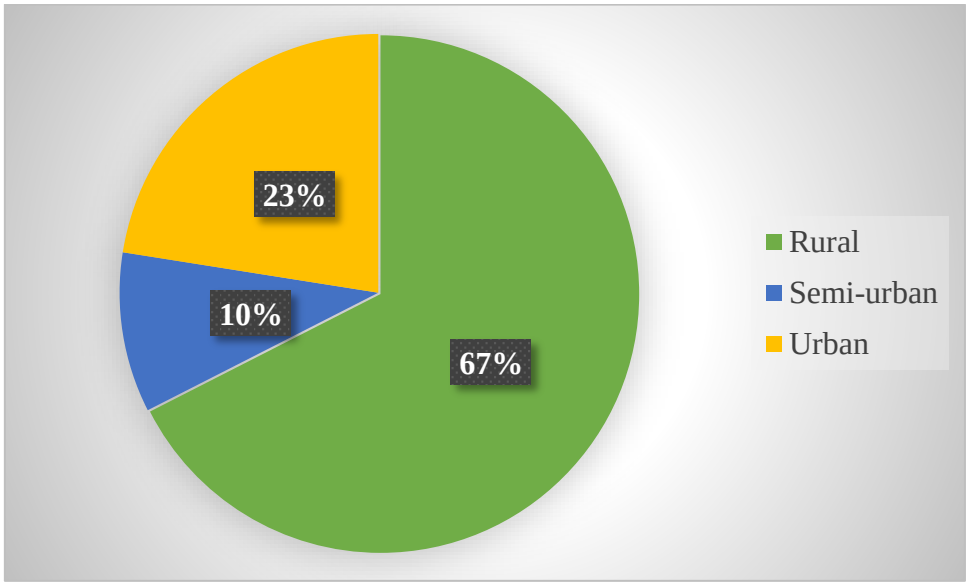



**Fig 05: Living area of the participants**

### 4.1.7 Duration of injury

Among 40 participants duration of injury were n=1-10 week 10% (n=4), 11-20 week 42% (n=17), 21-30 week 17% (n=7) and 31-40week 13% (n=5) and 41-50 week 18% (n=7).

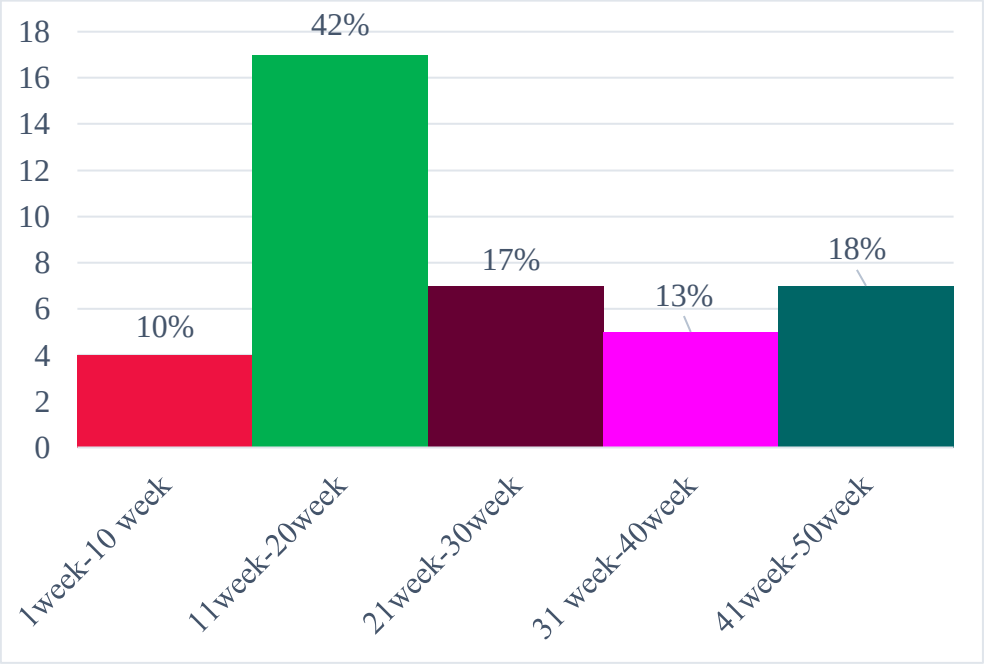



**Fig 06: Duration of injury**

### 4.1.8 Causes of injury

Out of 40 participants of traumatic spinal cord injury, most of them were suffering from fall from height 55% (n=22) and the second most common cause were road traffic accident 30% (n=12). Table 2 show the details information of the causes of injury of the respondents.

**Table 2: Causes of injury of the participants**

| **Causes of injury** | **Number (n)** | **Percent (%)** |
|---|---|---|
| Fall from height | 22 | 55 |
| Road traffic accident | 12 | 30 |
| Fall of heavy object on back | 3 | 7.5 |
| Fall of heavy object on neck | 2 | 5 |
| Others | 1 | 2.5 |
| **Total** | **40** | **100** |

### 4.1.9 Pressure Sore

In this study it was found that about 20% (n=8) participants suffering from pressure sore and 80% (n=32) had no pressure sore during admission.

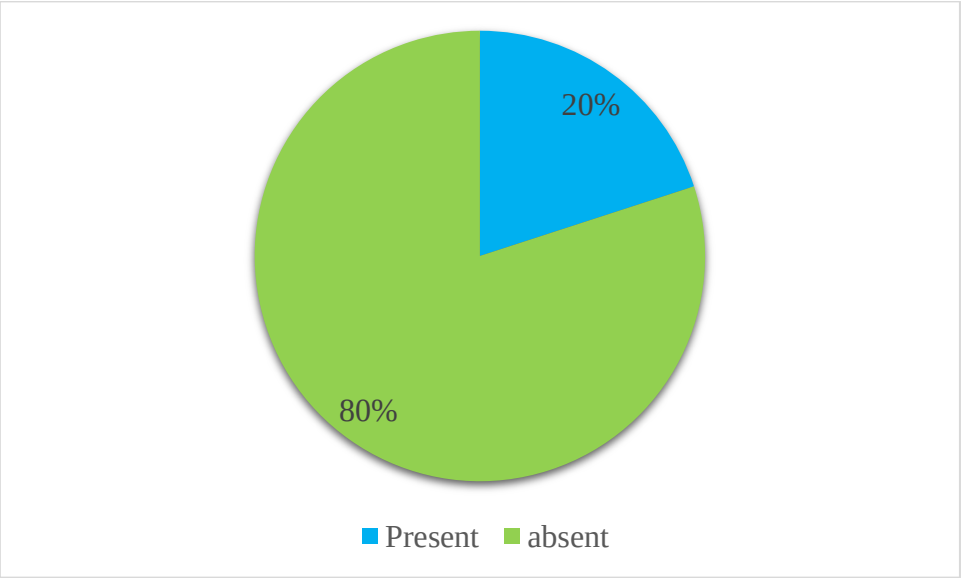



**Fig 07: Pressure sore of the participants**

### 4.1.10 Average monthly income

Most of the participants leads approximately in a standard life style. Twenty two participants family income was between 10000-19999 taka. The percentage was 55% (n=22).Seventeen participants family income was less than 10000 taka and the percentage was 42.5% (n=17). Rest of the participants was earned between 20000-29999 and the percentage was 2.5% (n=1).

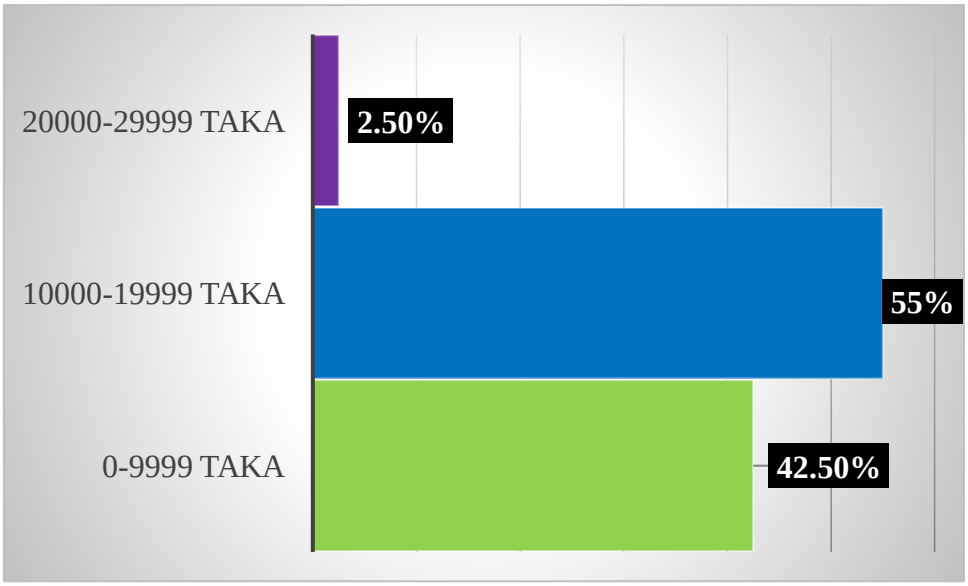



**Fig 08: Average monthly income of the participants**

### 4.1.11 Blood Pressure

Paired t test has been determined to measure the changes between pretest and posttest followed by sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | T | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| Systolic Blood Pressure | -5.57 | 11.39 | -9.22 | -1.93 | -3.09 | 39 | .004* |
| Diastolic Blood Pressure | 1.57 | 10.81 | -1.88 | 5.03 | .92 | 39 | .362 |

*** Level of significance (<.05)**

Table 3: changes in blood pressure

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| Systolic Blood Pressure | -5.57 | 11.39 | .49[a] |
| Diastolic Blood Pressure | 1.57 | 10.81 | .14[d] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 4: Effect size in blood pressure

Cardiovascular outcome of sports has been evaluated through comparison of mean difference between pre and post-test evaluation complying statistical significance, 95% CI and effect size. Table 3 shows outcome, 4 shows effect size. Significant difference has been noted in systolic and diastolic blood pressure; in systolic blood pressure mean -5.57± 11.39, 95% CI (-9.22, -1.93), P= .004, effect size .49; in diastolic blood pressure mean 1.57 ± 10.81, 95% CI (-1.88, 5.03), P= .362, effect size .14. That means the null hypothesis has been rejected and alternative hypothesis accepted. Sports interventions has a highly significant (<.05) impact in cardiovascular outcome for sports for spinal cord injury peoples wheelchair basketball playing with smaller effect size.

### 4.1.12 Oxygen Saturation

Paired t test has been determined to measure the changes between pretest and posttest followed by sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | t | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| Oxygen Saturation | -.725 | 1.12 | -1.08 | -.370 | -4.13 | 39 | .000* |

***Significant (<.05)**

Table 5: Paired t test for changes oxygen saturation

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| Oxygen Saturation | -.725 | 1.12 | .65[b] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 6: Effect size of oxygen saturation

Cardiorespiratory consequence evaluated by oxygen saturation rate where pre and posttest evaluation complying statistical significance, 95% CI and effect size before and after sports activity. Table 5 shows cardiorespiratory outcome in oxygen saturation due to sports activity, Table 6 shows effect size. In oxygen saturation mean was -.725±1.12, 95% CI including upper limit -1.08 and lower limit -.370), P= .000, effect size .65. That means the null hypothesis has been rejected and alternative hypothesis accepted. Sports interventions has a highly significant (<.001) impact in oxygen saturation in the person with spinal cord injury. The result has comply with a medium size effect (Cohen's *d* .65)

### 4.1.13 Pulse

Paired t test has been determined to measure the changes between pretest and posttest followed by sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | t | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| Pulse | 6.10 | 17.32 | .56 | 11.64 | 2.23 | 39 | .032* |

***Significant (<.05)**

Table 7: Paired t test for pulse

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| Pulse | 6.10 | 17.32 | .03[d] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 8: Effect size of pulse

Cardiovascular effect has been elicited by measurement of pulse before and after sports activity and statistically tested through paired t test. The Pulse measurement had a statistical significant result revealing changes between pre and posttest. Table 7 shows cardiovascular effect in pulse due to physical activity, Table 6 shows effect size. The mean was 6.10 with standard deviation 17.32, 95% CI where upper limit 11.64 and lower limit .56, significant value found .032, effect size .03. That means the null hypothesis has been rejected and alternative hypothesis accepted. Sports interventions has a highly significant (<.05) impact in pulse in the person with spinal cord injury.

### 4.1.14 Speed of expiration

Paired t test has been determined to measure the changes between pretest and posttest followed by sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | t | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| Speed of Expiration | -102.37 | 47.27 | -117.49 | -82.26 | -13.60 | 39 | .000* |

***Significant (<.05)**

Table 9: Speed of expiration

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| Speed of Expiration | -102.37 | 47.27 | 2.16[c] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 10: Effect size of speed of expiration

Cardiorespiratory outcome had been invented through peak flow meter by the measurement of speed of expiration previously and subsequently sporting activity. Table 9 shows improvement of speed of expiration, Table 9 shows effect size. In speed of expiration mean was -102.37, Standard deviation 42.27, 95% CI including – lower limit 117.49, upper limit -82.26), significant value .000, effect size 2.16. That means the null hypothesis has been rejected and alternative hypothesis accepted. Sports interventions has a highly significant (<.001) impact in speed of expiration in the person with spinal cord injury. The outcome fulfil with a larger size effect (Cohen's *d* 2.16).

### 4.1.15 Chest Diameter

Paired t test has been determined to measure the changes between pretest and posttest of chest diameter followed by wheelchair sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | t | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| Chest diameter(inspiration) | -.050 | .189 | -.111 | .011 | -1.67 | 39 | .103 |
| Chest diameter (expiration) | -.0375 | .175 | -.093 | .018 | -1.36 | 39 | .183 |

***Significant (<.05)**

Table 11: Changes of chest diameter

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| Chest diameter (inspiration) | -.050 | .189 | 0.26[a] |
| Chest diameter (expiration) | -.0375 | .175 | 0.21[a] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 12: Effect size of chest diameter

Cardiorespiratory effect of sports has been evaluated through comparison of mean difference between pre and posttest evaluation complying statistical significance, 95% CI and effect size. Inspiratory chest diameter mean was -.050 with standard deviation .189, 95% CI contain lower limit -.111 and upper limit .011, significant level .103, effect size 0.26. Expiratory chest diameter mean was -.0375 with standard deviation .175, 95% CI comprise lower limit -.093 and upper limit .018, significant level .183, effect size 0.21.Comparison between inspiratory and expiratory chest diameter shows that there is no significant difference between inspiratory and expiratory chest diameter and also their effect size is small.

### 4.1.16 Vital Capacity

Paired t test has been determined to measure the changes between pretest and posttest of chest diameter followed by wheelchair sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | t | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| Vital capacity | -365.25 | 287.60 | -448.23 | -264.27 | -7.834 | 39 | .000* |

***Significant (<.05)**

Table 13: Pair t test for vital capacity

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| Vital capacity | -365.25 | 287.60 | 1.27[c] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 14: Effect size of vital capacity

The respondents improved in vital capacity measured by incentive spirometry due to mean was -365.25 and standard deviation was 287.60, 95% CI encompasses lower limit -448.23 and upper limit -264.27), significant value .000, effect size 1.27. That means the null hypothesis has been rejected and alternative hypothesis accepted and it could be said that the result was highly significant (<.001). The effect size is large as 1.27 (Cohen's *d)*.

### 4.1.17 Vo2 Max

Paired t test has been determined to measure the changes between pretest and posttest of chest diameter followed by wheelchair sports interventions.

| Variable | Mean difference | SD of difference | 95% CI | | t | df | Sig |
|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | |
| VO2 Max | -.194 | .515 | .081 | -.359 | -2.38 | 39 | .022* |

***Significant (<.05)**

Table 15: Changes of Vo2 Max

| Variable | Mean difference | SD of difference | Cohen's *d* |
|---|---|---|---|
| VO2 Max | -.194 | .515 | 0.38[a] |

**[a] =Small effect, [b] =medium effect, [c] =large effect, [d] =no effect**

Table 16: Effect size of Vo2 Max

In Vo2 Max paired t test has a statistical significant result clarifying the changes between pre and posttest. Table 15 shows that the changes of Vo2 max before and after sporting activity, Table 16 shows the effect size. The mean was -.194±.515, 95% CI (.081, -.359), P= .022, effect size .038. That means the null hypothesis has been rejected and alternative hypothesis accepted. Sports interventions has also a significant (<.05) impact in case of Vo2 Max in the people with spinal cord injury. The result comply with a smaller size effect.

# CHAPTER-V: DISCUSSION

The purpose of the study to evaluate the sociodemographic information (i.e., Age, sex, marital status, education, occupation) and cardiorespiratory effect of wheelchair basketball players with spinal cord injury people. Quasi experimental design was selected for this study due to unavailability of the patients. A quasi experimental research design has been employed as a method to evaluate the cardiovascular effect of wheelchair basketball sports in patients with spinal cord lesion. The study might be a randomized control trial but for the time limitations and lake of participants does not include a comparison or control group. In randomized control trial several authors have indicated the relevance of spinal cord injury in decreased pulmonary function resulting from alterations in the mechanism of respiratory muscles.

In addition, evidence showed a decline in the pulmonary function of subjects with spinal cord injury (SCI), which they attributed to decline level of physical fitness. The literature features few studies on the effects of wheelchair sports training on respiratory muscle strength. Furthermore, the majority of these studies evaluated only subject with SCI (Pereira et al., 2016).

In this experimental study 40 traumatic paraplegic SCI person were randomly assigned into a single group in order to demonstrate the improvement. For the study every person with a traumatic history attended at Centre for the Rehabilitation of the paralyzed from 16.04.2019 to 15.07.2019 has been screened for eligibility criteria and 45 person met the criteria for participants. From 45 people 5 patients 3 female are discontinued due to cultural reason and unwillingness and 2 people did not complete session scheduled. 40 respondents has been analyzed for quantitative analysis and complete the pretest, sports intervention and posttest. The outcome was measured by using a structured questionnaire. The researcher found the significant improvement of blood pressure, pulse, oxygen saturation rate and vital capacity, speed of expiration, chest diameter and Vo2 Max (Maximal Oxygen Consumption)

Age, gender, marital status, educational status and occupation were taking to consideration as demographic variables. In this study participation were both male and female. Male was predominantly higher than female. Out of 40 participants 95% (n=38) were male.

From recent study of 2017 on SCI, it had been found that there were also male members predominantly and this was the similarity between two studies. On the other hand traumatic paraplegic patient's participants in this study and on a recent study of 2017, there were also the same report had found. The difference between the current study and the previously published study was that the current study was a quasi-experimental whereas the previously published study was a cross sectional study (Rahman et al., 2017).

Distribution of age pattern by 3 yearly age group among them the age range between 21-30 years, which showed maximum number of 16 patients (40%) and the mean age of the participants was 25.20 years with standard deviation ± 6.9 years which shows partial similarities on the study of Islam et al. ( 2011). Propensity of rural people suffering more from SCI are found in this study and the fact that 67% of the respondent were from village and it was also supported by Rahman et al (2017). Taznos et al. (2016) stated on their study was on designed with spinal cord injury patients of Greece and there they found that the majority of the population has an average educational status and it was almost 78.7% whereas the present study shows that the same report among 40 participants.

In case of occupational status of the participants, all the respondents are engaged in an employment before injury and the study shows that most of the participants are service holders that is around 20% while car driver, student, day labour and farmer were 10%, 17.5%, 7.5% and 7.5% and also respectively businessman (17.5%), housewife (2.5%). But after injury participations are rarely engaged in occupation whereas Tzanos et al., (2016) demonstrate that the same picture. In Nigeria it is found that 20% of students and businessmen mostly suffer from spinal cord injury (Nwankwo&Uche, 2013).

In present study among 40 participants most of them are earned 10000-19999 taka. Another study of Bangladesh similarly found among 56 participants 32.1% (n=18) were earned more than 6,000 taka per month (Razzak, 2013). This study found a remarkable participants 26.5% (n=27) who were farmer.

After completion of discussion on socio-demographic aspects focus should be given on SCI related information. It may include the causes of injury, duration of injury and pressure during injury. In Bangladesh, causes of SCL are most likely to be influenced

by their socioeconomic condition. The causes of injury mainly leading to trauma and in this study among the traumatic causes fall from a height, either from trees, construction works, electric poles or roofs, was found to be the most common cause (55%) of SCI in this study. This is similar to other studies. Razzak (2013) found that the main reason for the spinal cord injury was to fall from the height 43.1% (n=44) and in India it is 55%.In Bangladesh other studies also found the main reason for the spinal cord injury was fall from height among 56 participants were 50%. The present study, 80% people had no pressure sore during admission. The proportion of pressure sores found among Americans was reported as 46%, which is slightly higher than our study (Islam et al., 2011).

In this research, it had demonstrate the blood pressure in pre - test and posttest and in a previous research they also measure blood pressure by pretest and posttest (Herawati&Azizah, 2016). In this research the mean of systolic blood pressure pretest (111.15mmHg) and posttest (116.73 mmHg) and the mean difference of pre and posttest was -5.58. Paired t test of SPSS was for systolic blood pressure value obtained 0.004. Which meant that there was a significant difference between the systolic blood pressure on pre-test and posttest.

In diastolic blood pressure pretest mean was (78mmHg) and posttest mean was 76.43mmHg) and the mean difference of diastolic blood pressure was 1.575 and the significant value was .362.That means there was a slightly significant are found in diastolic blood pressure. Scharhag et al. (2013) stated that dynamic exercises like sports increase systolic blood pressure, which relates to the amount of the exercise when the diastolic pressure is only slightly changed (Scharhag et al., 2013).

In this study, chest expansibility measure through pre and posttest where inspiratory chest diameter mean difference was -.050, p value 0.103 and expiratory chest diameter mean difference was -.0375 and p value obtained .183. Comparison between inspiratory and expiratory chest diameter shows that there is no significant difference between inspiratory and expiratory chest diameter. Another experimental study also found that there is no significant difference between pre and posttest (Jung et al., 2015).

In quantitative analysis of Vo2 max in this study showed that the significant improvement in case of paraplegic person with SCI after sporting activity. Another

study also stated that the changes of Vo2 max after spinal cord injury depend on extending of lower limb paralysis (Hoque et al., 2018). The result showed significant improvement of vital capacity through sports intervention in a single group of peoples with spinal cord injury. The pre and post mean was 1008.75, 1365.00 and the mean difference was -365.25, significant value p=000. The increase in vital capacity also has been shown in previous studies which is conducted with two group experimental and control, where both group showed significant improvement in case of spinal cord injured patient (Roth et al., 2010).

**Study Limitation**

The study has been designed as Randomized Control Trail but it was not done because unavailability of the patients and due to data limitation.If the duration of the study is longer, the sample size will be larger so this is the limitation of my study.For the ensuring of the generalization of the research it is recommended to investigate large sample. As a first researcher, may be the lack of knowledge and experience. In this type of relevant study are not available in Bangladesh so the research related information is limited.

# CHAPTER-VI: CONCLUSION AND RECOMMENDATION

High proportion of SCI in Bangladesh was due to traumaticcauses, which were preventable. SCI, a disability-orientedinjury seems to occur mostly in young males of low socialstatus, in terms of education, occupation and income in their productive years, demolishing their physical andearning capability leading to grievous problem at individual,family and social level. The study was a quasi-experimental single group pre-test and post-test design to examine the cardiorespiratory effect after sports intervention, where the results of the study have demonstrated that the change was very significant. Most of the persons with SCI had died with respiratory complication.Sports had beneficial effects on the improvement in cardiorespiratory area of the paraplegic spinal cord injury peoples. Physiotherapy also play important role for their improvement.

From this research, researcher concluded the specific variables and comparison of their improvement. This will research helps the professionals to prediction patient's recovery time and progress.

The aim of the studyto assess the cardiorespiratory effect of wheelchair basketball players with spinal cord injury people.Though the study had some limitations but investigator identified some further step that might be taken for the better accomplishment of future research.We need to do more research on this subject. True experimental research would give a specific result about their cardiorespiratory effect. The duration of the study was short, so in future wider time would be taken for conducting the study.The ratio of the male and female participants were not equal, in case of furtherthe equality of the male and female respondents should be maintained for the accuracy of the result.

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সম্মতিপত্রবাংলা

(অংশগ্রহনকারীকেপড়েশোনাতেহবে)

আসসালা্মুআলাইকুম,

আমিকুলছুমআক্তার, আমিএইগবেষনাপ্রকল্পটিবাংলাদেশহেলথপ্রফেশন্সইন্সটিটিউট (বিএইচপিআই)
এপরিচালনাকরছি্যাআমার৪র্থবর্ষবিএসসিইনফিজিওথেরাপীকোর্সেরঅধিভুক্ত।

আমি"সিআরপিতেমেরুরজ্জুতেআঘাতপ্রাপ্তহুইলচেয়ারবাস্কেটবলখেলোয়াড়ব্যক্তিদের–শ্বাসপ্রশ্বাসসমন্ধনীয়প্রভাব"এরউপরগবেষনাকরছি্।আমিএক্ষেত্রেআপনাকেকিছুব্যক্তিগতএ বংসংশ্লিষ্টবিষয়ের উপরকিছুপ্রশ্নকরতেচাচ্ছি।এতেআনুমানিক২০-৩০মিনিটসময়লাগবে।আমিআপনাকেআশ্বস্থকরছি্যেএটাআমারঅধ্যয়নেরঅংশএবংযাঅন্য কোনোউদ্দেশ্যেব্যবহৃতহবেনা।এইগবেষনায়আপনারঅংশগ্রহনবর্তমানওভবিষ্যতচিকিৎসাতে কোনোপ্রকারপ্রভাবফেলবেনা।আপনিযেসবতথ্যপ্রদানকরবেনতারগোপনীয়তা বজ়ায় থাকবে এবং আপনার প্রতিবেদনের ঘটনা প্রবাহে এটা নিশ্চিত করা হবে যে এই তথ্যের উৎস অপ্রকাশিত থাকবে। এই গবেষনায় আপনার অংশগ্রহন স্বেচ্ছায় প্রনোদিত এবং আপনি যে কোনো সময় এই গবেষনা থেকে কোনো নেতিবাচক ফলাফল ছাড়াই নিজেকে প্রত্যাহার করতে পারবেন। এছাড়াও কোনো নির্দিষ্ট প্রশ্নে আপনি উত্তর দিতে না চাইলে সাক্ষাৎকারের যে কোনো সময় আপনারউত্তর না দেয়ার অধিকার ও আছে ।

এ গবেষনায় অংশগ্রহনকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা আমার সুপারভাইজ়ার মুহাম্মদ ওবায়দুল হক, বিভাগীয় প্রধান, ফিজ়িওথেরাপী, বিএইচপিআই, সিআরপি, সাভার, ঢাকা-তে যোগাযোগ করতে পারেন।

আমি কি আপনার অনুমতি নিয়ে সাক্ষাৎকার শুরু করতে পারি?

হ্যানা ☐ ☐

অংশগ্রহনকারীর স্বাক্ষরঃতারিখঃ

উপাত্ত সংগ্রহকারীর স্বাক্ষরঃতারিখঃ

স্বাক্ষীরস্বাক্ষরঃতারিখঃ

**CONSENT FORM (English)**

**(Please read out to the participants)**

Assalamualikum,

My name is KulsumAkter; I am conducting this study for a B.Sc. in Physiotherapy project study dissertation titled **"Cardiorespiratory Effect of Wheelchair Basketball Players with Spinal Cord Injury people at CRP"** under Bangladesh Health Professions Institute (BHPI**),** University of Dhaka. I would like to know about some personal and other related information regarding SCI. You have to answer some questions which are mention in the attached form. This will take approximately 20-30 minute.

I would like to inform you that this is a purely academic study and will not be used for any other purpose. The researcher is not directly related with this SCI area, so your participation in the research will have no impact on your present or future treatment in the SCI unit. All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous and also all information will be destroyed after completion of the study. Your participations in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me or Professor Md.ObaidulHaque, Head of the Department of Physiotherapy and Vice Principal, BHPI, CRP, Savar, Dhaka.

So, may I have your consent to proceed with the interview or work?

Yes ☐ No ☐

Signature of the Participant _____ Date_____

Signature of the Interviewer _____Date_____

Signature of the Physiotherapist_____Date_____

# English questionnaire:

**Title:Cardiorespiratory Effect of Wheelchair Basketball Players with Spinal Cord Injury people at CRP**

**1. Personal information**

| | |
|---|---|
| 1.1 | Identification number: |
| 1.2 | Name of respondents: |
| 1.3 | Age: ☐ Years |
| 1.4 | Phone number: |

**2. Socio-demographic information**

**(Please put the √ mark in the box).**

| **Question and filters** | **Response** | |
|---|---|---|
| 2.1 | Address: | |
| 2.2 | Sex | ☐ 1=Male<br>☐ 2=Female |
| 2.3 | Marital status | ☐ 1=Married<br>☐ 2=Unmarried<br>☐ 3=Widow/widower<br>☐ 4= Divorcee |
| 2.4 | Educational status | ☐ 1= No formal education<br>☐ 2=Primary education<br>☐ 3=Secondary education<br>☐ 4=Higher secondary<br>☐ 5=Bachelor or above |
| 2.5 | Occupation | |
| 2.6 | Living area | ☐ 1=Rural<br>☐ 2=Semi Urban<br>☐ 3=Urban |

| | | |
|---|---|---|
| 2.7 | Average monthly income of family | ☐ 1= 0 to 9999<br>☐ 2=10000 to 19999<br>☐ 3= 20000 to 29999<br>☐ 4= Above 30000 |

**3. Spinal cord injury related information**

| | | |
|---|---|---|
| 3.1 | Date of injury | |
| 3.2 | Causes of traumaticinjury | ☐ 1= Fall from height<br>☐ 2= Fall while carrying heavy load on head<br>☐ 3= Fall of heavy object on neck<br>☐ 4= Fall of heavy object on back<br>☐ 5= Road traffic accident (RTA)<br>☐ 6= Others |
| 3.3 | Pressure sore on admission at CRP | ☐ 1= Present<br>☐ 2= Absent |

**4. Wheelchair Basketball Sports and Cardiorespiratory effect related question**

**(Data were taken before and after 5 hours of Wheelchair Basketball)**

| | | 1st day before WB playing | After 15 days of WB playing |
|---|---|---|---|
| 4.1 | Blood Pressure | 1. Systolic =<br>2. Diastolic = | 1. Systolic =<br>2. Diastolic = |
| 4.2 | Oxygen Saturation | | |
| 4.3 | Pulse | | |
| 4.4 | Speed of Expiration | | |
| 4.5 | Chest Diameter | 1.Maximal Inspiration =<br><br>2.Maximal Expiration = | 1.Maximal Inspiration =<br><br>2.Maximal Expiration = |
| 4.6 | Vital Capacity | | |
| 4.7 | VO2 Max | | |

বাংলা প্রশ্নোত্তর

“সিআরপিতেমেরুরজ্জুতেআঘাতপ্রাপ্তহুইলচেয়ারবাস্কেটবলখেলোয়াড়ব্যক্তিদের–শ্বাসপ্রশ্বাসসমন্ধনীয়প্রভাব”।

**১। ব্যক্তির তথ্য**

| | |
|---|---|
| ১.১ | সনাক্তকরণনম্বরঃ |
| ১.২ | উত্তরদাতাদেরনামঃ |
| ১.৩ | বয়সঃ বছর |
| ১.৪ | ফোননম্বরঃ |

**২।ব্যক্তির আর্থ-সামাজিক অবস্থা**

(অনুগ্রহপূর্বকনিচেরপ্রশ্নগুলোরমধ্যেসঠিকউত্তরেরডানপাশেটিক ( √) চিহ্ন)

| | প্রশ্ন | উত্তর |
|---|---|---|
| ২.১ | ঠিকানা | |
| ২.২ | লিঙ্গ | ☐ ১=পুরুষ<br>☐ ২= মহিলা |
| ২.৩ | বৈবাহিক অবস্থা | ☐ ১=বিবাহিত<br>☐ ২=অবিবাহিত<br>☐ ৩= বিধবা/বিপত্নীক<br>☐ ৪= বিবাহ বিচ্ছিন্ন |
| ২.৪ | শিক্ষাগত অবস্থা | ☐ ১= কোন প্রাতিষ্ঠানিক শিক্ষা না<br>☐ ২= প্রাথমিক শিক্ষা<br>☐ ৩= মাধ্যমিক শিক্ষা<br>☐ ৪= উচ্চ মাধ্যমিক |

| | | |
|---|---|---|
| | | ☐ ৫= স্নাতক ডিগ্রী |
| ২.৫ | পেশা | |
| ২.৬ | বসবাসেরএলাকা | ☐ ১= গ্রামীণ<br>☐ ২= আধা শহুরে<br>☐ ৩= শহুরে |
| ২.৭ | পরিবারের গড় মাসিক আয় | ☐ ১=০ থেকে ৯৯৯৯<br>☐ ২=১০০০০ থেকে ১৯৯৯৯<br>☐ ৩= ২০০০০ থেকে ২৯৯৯৯<br>☐ ৪= উপরে ৩০০০০ |

## ৩. মেরুদণ্ড আঘাত সংক্রান্ত সম্পর্কিত তথ্য

| | | |
|---|---|---|
| ৩.১ | আঘাতের তারিখ | |
| ৩.২ | দুর্ঘটনাজনিতআঘাতের কারন | ☐ ১ = উচু স্থান থেকে পড়ে যাওয়া<br>☐ ২ = ভারী ভার মাথায় বহন করতে গিয়ে পড়ে যাওয়া<br>☐ ৩ = ঘাড়ে ভারী বস্তুর পতন<br>☐ ৪ = পিঠে ভারী বস্তুর পতন<br>☐ ৫ = সড়ক দুর্ঘটনা<br>☐ ৬ = অন্যান্য |
| ৩.৩ | সি আর পি তে ভর্তির সময় চাপ জনিত ঘা | ☐ ১ = হ্যাঁ<br>☐ ২ = না |

৪. হুইলচেয়ার বাস্কেটবল খেলা এবং কার্ডিও শ্বাসযন্ত্রের প্রভাব সম্পর্কিত প্রশ্ন

(৫ঘন্টা হুইলচেয়ার বাস্কেট বল খেলার আগে এবং পরে তথ্য গ্রহণ করা হয়)

| | | প্রথমদিন(হুইলচেয়ার বাস্কেটবল খেলার আগে) | ১৫দিন পর (হুইলচেয়ার বাস্কেটবল খেলার পরে) |
|---|---|---|---|
| ৪.১ | রক্তচাপ | ১.সিস্টোলিক =<br>২. ডায়াস্টোলিক = | ১.সিস্টোলিক =<br>২.ডায়াস্টোলিক = |
| ৪.২ | অক্সিজেন সম্পৃক্ততা | | |
| ৪.৩ | নাড়ির স্পন্দন | | |
| ৪.৪ | শ্বাসত্যাগের গতি | | |
| ৪.৫ | বুকের ব্যাস | ১ সর্বাধিকনিশ্বাসনেওয়ারসময়=<br>২সর্বাধিকশ্বাসত্যাগকরারসময়= | |
| ৪.৬ | ফুস্‌ফুসের বায়ুধারকত্ব | | |

**Permission letter**

**Date: 16 April, 2019**

To

Head of the Department,

Department of the Physiotherapy,

Center for the Rehabilitation of the paralyzed (CRP),

Chapain, Savar, Dhaka-1343.

**Through:** Head, Department of Physiotherapy, BHPI.

**Subject**: Seeking permission of data collection to conduct my study.

Dear Sir,

With due respect and humble submission to state that I am Kulsum Akter, student of 4th Professional B. Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The ethical committee and IRB has approved my dissertation entitled on **"Cardiorespiratory Effect of Wheelchair Basketball Players with Spinal Cord Injury People at CRP"** under the supervision of Professor Md. Obaidul Haque, Head of the Department of Physiotherapy and Vice Principal, BHPI, CRP. Conducting this research project is partial fulfillment of the requirement for the degree of Bachelor of Science in Physiotherapy (B. Sc. PT). I want to collect data for my study from the Spinal Cord Injury Unit of CRP, Savar. So I need permission for data collection. I would like to assure that anything of my study will not be harmful for the participants.

I therefore, pray and hope that you would be kind enough to grant my application and give me permission for data collection and oblige thereby.

Sincerely,

Kulsum Akter, 16.04.2019

Kulsum Akter

4th Professional B.Sc. in physiotherapy

Session: 2014-2015

Bangladesh Health Professions Institute (BHPI)

CRP, Chapain, Savar, Dhaka-1343.

Forwarded & Recommended

16.04.19

Prof. Md. Obaidul Haque
Head, Department of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343

Allow for data collection from SCI unit.

ZAFFOR HOSSAIN 20.04.19

Approved

18/04/19

Mohammad Anwar Hossain
Professor & Head
CRP

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

Ref.

Date: 11/07/2019

CRP-BHPI/IRB/07/19/1310

To
Kulsum Akter
B.Sc. in Physiotherapy
Session: 2014-2015 Student ID: **112140249**
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

**Subject: Approval of the dissertation"Cardiorespiratory Effect of Wheelchair Basketball Players with Spinal Cord Injury people at CRP." by ethics committee.**

Dear Kulsum Akter,
Congratulations.
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above mentioned dissertation, with yourself, as the Principal investigator. The Following documents have been reviewed and approved:

| Sr. No. | Name of the Documents |
|---|---|
| 1 | Dissertation Proposal |
| 2 | Questionnaire (English version) |
| 3 | Information sheet & consent form. |

The study involves use of a questionnaire and some measurement tools including blood pressure machine, pulse oximetry, incentive spirometry, peak flow meter and a measuring tape. It may take 20 to 30 minutes to fill in the questionnaire and participate in the test and there is 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 August 11, 2019 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

Date: 10.07., 2019

The Chairman
Institutional Review Board (IRB)
Bangladesh Health Professions Institute (BHPI)
CRP-Savar, Dhaka-1343, Bangladesh

Subject: **Application for review and ethical approval.**

Sir,

With due respect I would like to draw your kind attention that I am a student of B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI)- an academic institute of CRP under Faculty of Medicine of University of Dhaka (DU). I have to conduct a dissertation entitled, "Cardiorespiratory Effect of Wheelchair Basketball Players with Spinal Cord Injury people at CRP" under honorable supervisor, Professor Md.Obaidul Haque, Head of Department of Physiotherapy and Vice Principal, BHPI, CRP, Savar, Dhaka-1343. The purpose of the study is to evaluate the cardiorespiratory effect on wheel chair basketball playing.

The study involves use of a questionnaire and some measurement tools. The tools are blood pressure machine, pulse oximetry, incentive spirometry, peak flow meter and a measuring tape. It may take 20 to 30 minutes to fill in the questionnaire or participate in the test and there is no likelihood of any harm to the participants and have possibility of benefit of the participants to design appropriate rehabilitation program. Related information will be collected from the patients' guide books. Data collectors will receive informed consents from all participants. Any data collected will be kept confidential.

Therefore I look forward to having your kind approval for the thesis proposal and to start data collection. I can also assure you that I will maintain all the requirements for study.

Sincerely,

Kulsum Akter

Kulsum Akter
B.Sc. in Physiotherapy
Session: 2014-2015 Student ID: 112140249
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Recommendation from the thesis supervisor:

10.07.19

Professor Md. Obaidul Haque
Head of the Department of Physiotherapy and Vice Principal
BHPI, CRP, Savar, Dhaka.

**Attachment:** Thesis Proposal including measurement tools and process and procedure for maintaining confidentiality, Questionnaire (English and Bengali version), Information sheet & consent.