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Original Research Article

Assessment of upper limb and core muscle strength in physiotherapy student aged 20-25 years

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ABSTRACT

Background: Aim of the study is to assess the upper limb and core muscle strength in physiotherapy student aged 20-25 years.
Methods: A observational study was carried out among 150 undergraduate physiotherapy students both males and females under the age group 20-25 years including final years and interns. A study was conducted by using modified push up test (females), standard push up test (males), hand grip strength using Jamar hand dynamometer and 1 min plank test to assess upper limb and core muscle strength respectively.
Results: The results showed that most of the female physiotherapy students have a weak upper limb and core muscle strength compared to males.
Conclusions: To conclude most of the female physiotherapy students have a weak upper limb and core muscle strength compared to male physiotherapy students. This is one of the factors that leads to musculoskeletal pain and work-related musculoskeletal disorders in physical therapy profession.

Keywords: Core strength, Hand grip, Musculoskeletal pain, Physiotherapy students, Upper limb strength

INTRODUCTION

Physiotherapy, it is one of health care profession concerned with human function and movement and maximizing physical potential. We use various physical approaches to promote, maintain and restore physical, psychological and social well-being taking into account variations in health status. The professional demands of physiotherapy profession require the therapist to engage in activities which demand good amount of strength, endurance and flexibility out of which a reasonable high level of physical strength is required to carry out the routine job activities of a physiotherapist.[1]

However, in the curriculum and academic experience no attention is given to the health of the students. ‘’Physiotherapists talk about enhancement of health, fitness and functioning for the entire population, but what about physiotherapists themselves being healthy? Is academic qualification the only criteria for performance by the therapist? Shouldn’t we practice what we preach? Therefore, as students of physiotherapy, it is all the more relevant that we understand the demands of the profession and the requirement to meet the demands.

The nature of work in physical therapy practice is physically demanding as it involves repetitive task, various manual technique and awkward positioning of joints during certain prolonged constrained postures. Physiotherapy students work in college OPD and hospitals with all varieties of patients. Job involves transferring patients from beds to wheelchair, gait and balance training, performing passive and resistive training, giving manual mobilization techniques to

patients of all builds and disorders.[2] All factors will lead to undue excessive stress on joints and work demands decreases work performance of an individual having weak upper limb strength and increases absenteeism.

Core strength is an important precondition for many sports, to provide a correct posture and to carry out ADL's- core of the body is considered to be torso. Functional movements are highly dependent on this part of body and lack of core muscle strength development can result in predisposition to injury. In addition, core determines to a large part of a person's posture.[4]

Adaptation of faulty postures due to prolonged hours of work in varied setups causes muscular imbalances which increases the risk of MSK injury leading to weakening of core muscles which highly contributes to increase risk of MSK disorders.

As educators of physical therapy profession, it is important to expose students to demands of the profession they have to face in their future employment. Hence to avoid these factors this study has been undertaken.

Objectives

Objectives were to evaluate the upper limb strength by modified push up test for female and standard push up test for male, to evaluate the hand grip strength using jamar hand dynamometer and to evaluate the core muscle strength using 1 min plank test in physiotherapy students.

METHODS

Study design

Type of study was of observational study.

The study carried out from April 2021 to June 2022.

The study conducted at Thane.

Sample design

Physiotherapy student aged 20-25 years (Final year and interns) were included in the study.

Sample size was of 150 population.

Sampling type was of convenient sampling.

Inclusion criteria

Students willing to participate in the study, subjects between 20-25 years of age (final year\interns), students with no history of any recent injury, students with no musculoskeletal pain, both genders, working hours: min 3 hours max 8 hours and physiotherapy students working in both OPD and IPD setups were included in study.

Exclusion criteria

Students not willing to participate in study, subjects <20 and >25 year of age, students with history of any recent injury, students with any musculoskeletal pain, students who regularly exercise were excluded from study.

Procedure

The study was undertaken after approval from institutional ethical committee. A written consent was taken from all the subjects in the language best understood by them. Subjects were explained procedure and the purpose of the study prior to the study. Selection of the subjects was done as per the inclusion and exclusion criteria of the research study. Demographic data was recorded where working hours/day and number of working days/weeks were recorded. Assessment of the upper limb strength was done using modified push up test for females and standard push up test for males. Total number of repetitions was noted. Assessment of hand grip strength was done by using Jamar hand dynamometer. Both the hands were assessed and best of three readings was noted. Assessment of core strength was done by using 1 min plank test. Seconds of hold was noted.

Outcome measures

To assess upper limb strength: modified push up test (female)

Perform a short warm up before starting. Begin in a modified pushup position, on the hands and knees, with hands shoulder-width apart and elbows fully extended. Drop the hips and move the hands forward until you create a straight line from the knees to the hips to the shoulders. While keeping a straight position from the knees to the shoulders, lower your upper body so your elbows bend to 90 degrees. Push back up to the start position. That is one rep. Continue with this form and complete as many repetitions as possible without breaking the form. Record the total number of full modified pushups completed.

To assess upper limb strength: standard push test (male)

Perform a short warm up before performing any fitness testing. Begin in a push-up position on your hands and toes with your hands shoulder-width apart and elbows fully extended. While keeping a straight line from the toes to hips, and hips to shoulders, lower your upper body so your elbows bend to 90 degrees. Push back up to the start position. That is one rep. Complete as many repetitions as possible without breaking form. Record the total number of full push-ups completed.

Hand grip strength: Jamar handgrip dynamometer[10]

Adjust the grip bar so the second joint of the fingers fits snugly under the handle and takes the weight of the

instrument. Set the dynamometer to zero. The subject holds the handgrip dynamometer in line with the forearm at the level of the thigh, away from the body. The subject squeezes the hand grip dynamometer as hard as possible without holding the breath. Neither the hand nor the dynamometer should touch the body or any other object. Repeat the test thrice with each hand. The score is the highest of the three readings for each hand.

To assess core muscle strength: 1 min plank test[8]

Perform a short warm up exercise. Start with the upper body supported off the ground by the elbows and forearms, and the legs straight with the weight taken by the toes. The hip is lifted off the floor creating a straight line from head to toe. As soon as the subject is in correct position, the stopwatch is started. The head should be facing towards the ground and not looking forward. Look for elevation of hip or any shifting of position to either side. Stop timing at one minute or when client can no longer hold position.

Statistical analysis

The values were documented in Microsoft office excel sheet version 2007. The descriptive analysis was done for demographic characteristics and for outcome measures.

RESULTS

The results showed that most of the female physiotherapy students have a weak upper limb and core muscle strength compared to males. This is one of the factors that leads to musculoskeletal pain and work-related musculoskeletal disorders in physical therapy profession.

Table 1: Demographic characteristics.

Gender	Mean	SD
Male	22.3	1.04
Female	22.25	0.88

This table presents mean and standard deviation of age.

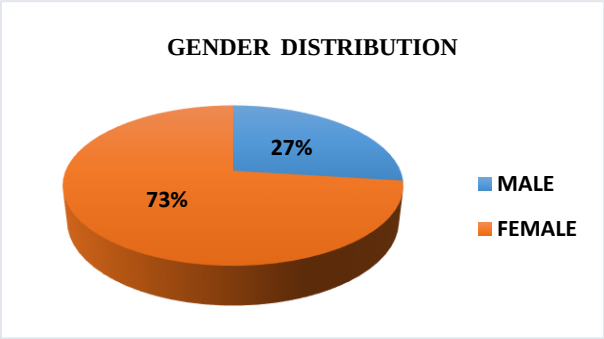

Figure 1: Gender distribution.

Majority of 73% physiotherapy students were females and rest 27% were males.

Table 2: Test values.

Tests	Mean	SD
Push ups		
Standard push up	28.9	9.1
Modified push up	16.02	9.46
Grip strength (kg)		
Male: dominant	34.8	6.30
Non-dominant	30.5	5.97
Female: dominant	16.69	5.07
Non-dominant	14.34	5.51
Plank test (secs)		
Male	59.1	3.67
Female	47.9	13.3

This table presents the mean and standard deviation of tests performed in physiotherapy students.

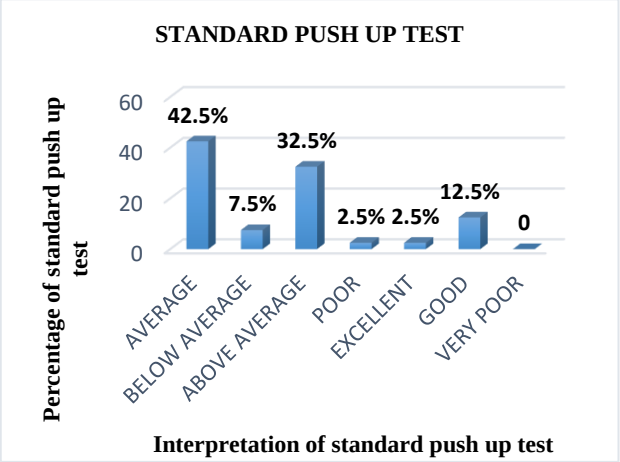

Figure 2: Standard push up test for males.

Maximum number of students under average category (42.5%) and very less (2.5%) under poor category.

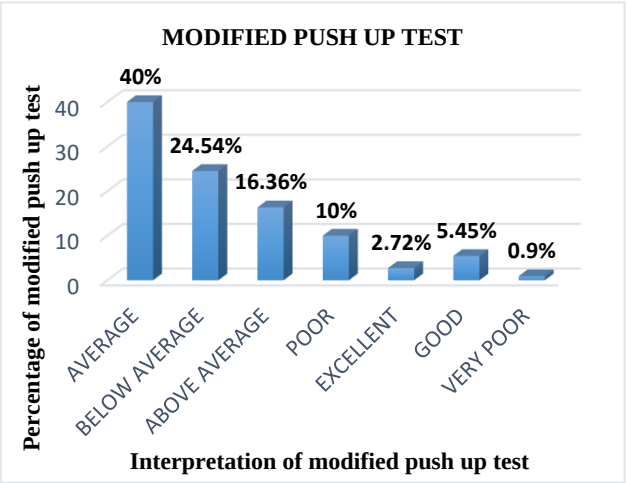

Figure 3: Modified push up test for females.

Maximum no. of students were under average category (40%) and very less (0.9) under very poor category.

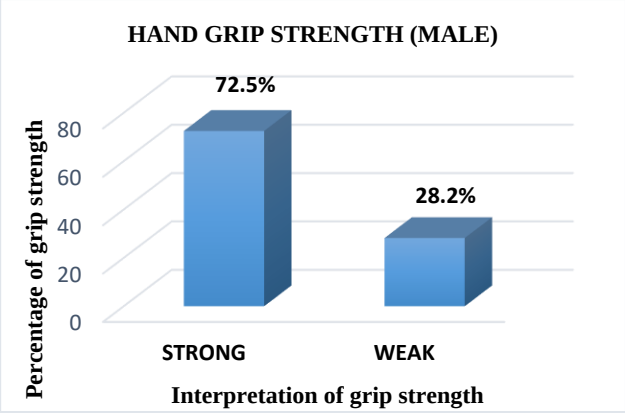

Figure 4: Hand grip strength test for males.

The 72.5% males have a stronger grip strength whereas 28.2% have a weaker grip strength.

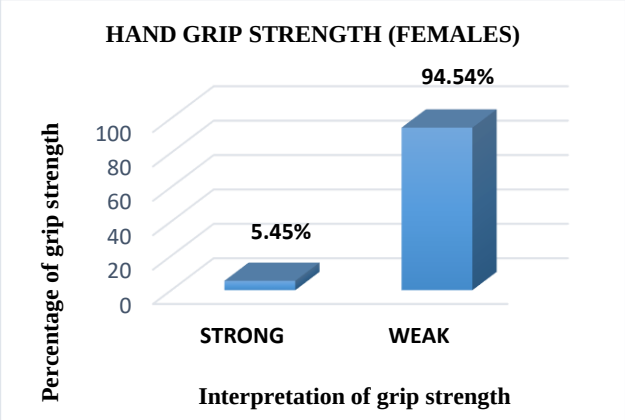

Figure 5: Hand grip strength test for females.

The 5.45% females have a stronger grip strength whereas 94.5% have a weaker grip strength.

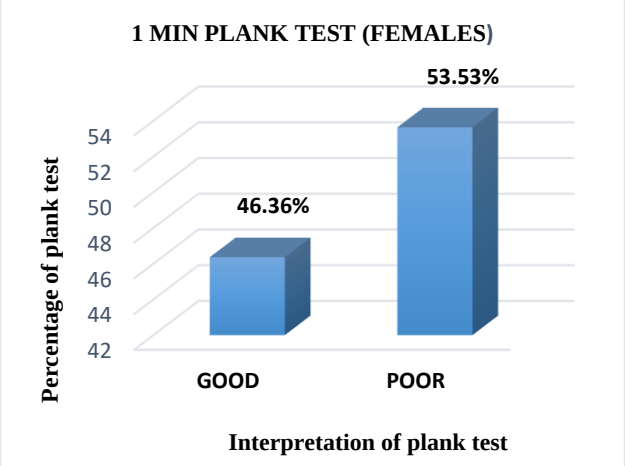

Figure 6: 1 min plank test for females.

The 46.36% females have a good core strength whereas 53.63% have a weak core strength.

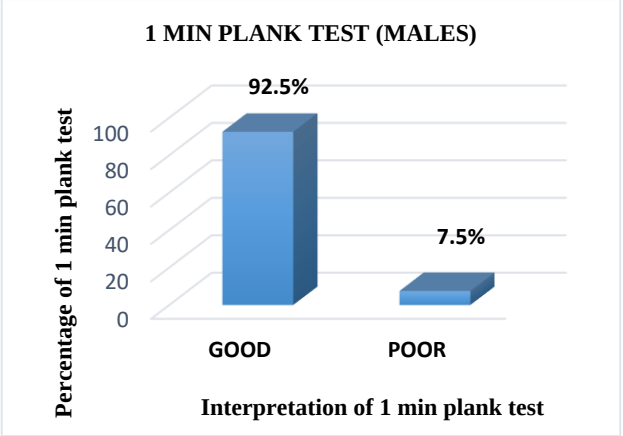

Figure 7: 1 min plank test for males.

The 92.5% males have a good core strength whereas 7.5% have a weak core strength.

DISCUSSION

The purpose of the study was to assess the upper limb and core muscle strength in physiotherapy students aged 20-25 years. This study was done on a sample of 150 students in undergraduate physiotherapy colleges who fulfilled the inclusion and exclusion criteria. Among 150 students who participated in the survey, 110 were females and 40 were males.

The first objective of our study was to evaluate the upper limb strength by using modified push up test for females and standard push up test for males. From the analysis of the results, it was revealed that, by modified push test, out of 110 females 40% were under average category, 5.45% were under good category and 0.90% were under very poor category. For males using standard push up test, the result reveal that out of 40 male students, 2.5% were under poor category, 12.5% were under good category, 42.5 % were under average category. These results clearly indicates that both male and females have an average upper limb strength. Almost all the students understand the benefits of physical exercise but more than 50% of the students do not exercise. The main reason can be lack of time for regular exercise. The professional demands of physiotherapy activity bear the therapist to engage in activities which demands good amount of upper limb strength. The nature of work in our practice is physically demanding as it involves repetitious task, various manual techniques and awkward positioning of joints during certain prolonged constrained postures.[1] Adaptation of defective postures due to prolonged hours of work, muscular imbalances lack of regular exercise and sedentary lifestyle causes weakening of shoulder (anterior and medial deltoids), chest (pectorals) back of the upper arm (triceps) muscles which largely contributes to increase risk of MSK disorders leading to weak upper limb strength causing improper and incorrect manipulation techniques on patients.

The second objective of our study was to evaluate hand grip strength using Jamar hand dynamometer. From the analysis of the result, it clearly indicates that females have a weaker grip strength than males. The evaluation of hand grip strength is of great importance in the assessment of upper limb strength, to measure the baseline deficiency in hand muscle power. It is a known fact that males have more muscle mass and therefore larger amount of contractile tissue leading to more grip strength as compared to females. Males have a greater height and length of forearm as compared to females who have shorter height and lesser length of forearm. Therefore, greater the height of the person, longer the arms which lead to greater lever arm for force generation and mechanical advantage. Therefore, it results in generation of an effective amount of force and higher grip strength. Hence, all the above-mentioned causes justify that male have higher grip strength as compared to females. The present study demonstrated higher grip strength in dominant hand as compared to the non-dominant hand. Handedness is an important factor that should be taken into consideration while measuring hand grip strength. A general rule frequently used states that the dominant hand is approximately 10% stronger than the non-dominant hand. In our day-to-day life, we perform nearly all the activities using dominant hand. Although, we also use non-dominant hand in our activities but the amount of contribution from dominant hand is much greater than non-dominant hand in domains of power, skill and dexterity. This leads to the differences in muscle mass and also hypertrophy of the muscle in dominant arm as compared to non-dominant. Therefore, it justifies that higher grip strength is seen in dominant hand as compared to non-dominant hand.[10]

The third objective of our study was to evaluate core muscle strength using 1 min plank test. From the analysis of the result, it clearly indicates that females have a slightly poor core strength compared to males. Core strength is an important precondition for many, to provide a correct posture and to carry out ADL's- core of the body is considered to be torso. Functional movements are highly dependent on this part of body and lack of core muscular development can result in predisposition to injury. In addition, core determines to a large part of a person's posture.

A study done by Jain et al stated that (70.1%) of physiotherapy students had musculoskeletal pain after joining the profession and the most common sites of pain were low back, shoulders, hands upper back and neck. Their findings reported physiotherapy to be a high-risk profession for developing work-related musculoskeletal disorders, especially the LBP.[6] According to previous studies conducted; the most common region of injury is the low back which is consistent with the finding of this study. Physiotherapy students attain potentially deleterious postures during training-related activities, prolonged sitting during lectures and twisting and bending activities thus increasing the risk of LBP. The core muscle strength is one of the contributing factors for low back pain. Core stability is important for maintaining an upright posture. Without core stability the lower back is not supported and can result in low back pain and poor posture.

A similar study was supported by Dsouza et al stating physical therapy practitioners are at a high risk of developing work-related musculoskeletal disorders (WRMSDs) because they are often involved in physically demanding and intense, repetitive tasks in their practices with age and gender of the therapists as a factor.[5]

Physiotherapy is a profession which requires physical activity and adequate level of physical fitness. The fitness levels required by us are high due to professional demands and also because we are projected as fitness experts in the society. The students perceive their fitness to be of the normal level, whereas, the measured fitness shows different results. Also, the presence of musculoskeletal pains in physiotherapy students is alarming.[1] These findings indicate towards the need of developing a fitness culture among the students. An attitude towards physical fitness is required to be developed among students. The ultimate goal of physiotherapy education is to prepare students for the job of a physiotherapist. Thus, achieving a good amount of fitness level should be the goal of curriculum. Thus, it becomes the responsibility of the educators of physiotherapy to develop the awareness and attitude of physiotherapy students towards physical fitness and exercise. It is important to expose students to the demands of the profession they have to face in their future employment. Newly qualified Physiotherapy students to give treatment do not seem to be using their principles of training or the instructions they give to patients for precautions, into their own practice. Such professionals are at the beginning of their career. As the WRMDs are known to accumulate and increase with age, the problem could grow with time making it difficult for them in future. Strategies are needed to be developed, that should help them to cope with such problems early. Hence, there is a need to create awareness among physiotherapy students regarding the association between poor strength, sustained postures and MSK disorders. Regular exercise and some physical activity to maintain muscle strength and endurance along with core strengthening is very important to maintain one's health minimizing the risk of WRMDs.[6]

Limitation

Similar study can be carried out on a broad scale with larger sample size to get a clearer picture. Comparison study of fitness level can be done with different medical professions. A study on strategies needed to be developed, that should help physiotherapist to cope with such problems early can be done.

CONCLUSION

Based on the study conducted among 150 physiotherapy students (110 females and 40 males), the following are the conclusion-For upper limb strength both male and females have an average upper limb strength. For grip strength using Jamar dynamometer, females have a weaker grip strength than males. For core muscle strength using 1 min plank test, females have a slightly poor core strength compared to males. To conclude most of the female physiotherapy students have a weak upper limb and core muscle strength compared to male physiotherapy students. This is one of the factors that leads to musculoskeletal pain and work-related musculoskeletal disorders in physical therapy profession.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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