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Research Article

Prevalence of Flexibility Among Health Care Professional Students

E. Shanmugananth [1*], J. Muthukumaran[2], M. Ranjani [3], K. Rekha[4], S. Vaishnavi[5], Gopal Nambi .S[6], And Sabarish Hariharan[7]

[1] *Professor & HOD, Sri Balaji Vidyapeeth, MGMCRI, Department Of Physiotherapy, Pondicherry.*
[2] *Professor, SCPT, Saveetha university. Chennai.*
[3] Physiotherapist, *Department Of Physiotherapy, Pondicherry, India.*
[4] *Assistant professor, SCPT, Saveetha university. Chennai.*
[5] *lecturer & principal in charge, Mayor Radhakrishnan College of Pharmacy. Cuddalore, India.*
[6] *Associate professor, Department of Physiotherapy & Rehabilitation medicine, Prince satam Bin Abdul Aziz University. Saudi Arabia*
[7] BPT, Sri Balaji Vidyapeeth, MGMCRI, Department Of Physiotherapy, Pondicherry.

Abstract: Flexibility is a physiological characteristic that allows an individual to execute voluntary movements of maximum joint angular amplitude within morphological limits, free of pain and restrictions. The prevention of musculoskeletal injuries and improvement in muscle movement and performance depend on body flexibility. The purpose of this study was to analyse the prevalence of flexibility among health care professional students. A total of 700 students, in which 68 students were excluded and 632 students were included, Subjects were assessed for joint flexibility by using the measurements of joint range of motion developed by Norkin and White. The inclusion and exclusion criteria were female students aged between 17 and 25 years with recent fractures and sprains, a history of neurological problems, and recent surgeries. The major muscles tested for flexibility are trapezius, pectoralis major, hip flexors, rectus femoris, hamstrings, and calf muscles, as these muscles commonly cause the restriction identified with stretching pain for each muscle. Statistical analyses were conducted according to gender, age, body mass index value[normal-overweight-obese], and the results of the muscle flexibility test. In the overall sample, 9.17% of students had pectoral muscle tightness; 22% of students had upper trapezius muscle tightness; 38% of students had hamstring muscle tightness; 18.2% of students had calf muscle tightness; 3.32% of students had adductor muscle tightness; and 9.33 % of students had rectus femoris muscle tightness. This study confirms that the flexibility of the major muscles is poor because of their daily activities, BMI, and ageing process. Poor flexibility may lead to poor posture and some musculoskeletal problems. These studies help them learn how important it is to do regular physical activities every day.

Keywords: Trapezius, Pectoral Muscle, Hamstring and Calf Muscles, Rectus Femoris, Tightness.

***Corresponding Author**

E. Shanmugananth , Professor & HOD, Sri Balaji Vidyapeeth, MGMCRI, Department Of Physiotherapy, Pondicherry.Professor, SCPT, Saveetha university. Chennai.

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1. INTRODUCTION

Flexibility is defined as the capacity to bend, or to be flexed or extended without breaking[1]. Flexibility is a physiological characteristic that allows an individual to execute voluntary movements of maximum joint angular amplitude within morphological limits[2], free of pain and restrictions[3], which is closely associated with muscle extensibility, range of motion, and plasticity of ligaments and tendons.[4] The prevention of musculoskeletal injuries and improvement in muscle movement and performance depend on body flexibility.[5] When there is a limitation in movement, the body undergoes a number of counterbalances, in order to establish an adaptive response to a set of disharmonies[6], which may influence the adopted posture. A good flexibility level can greatly impact an individual's quality of life as the benefits of flexibility include: improved skills in daily activities and sports; reduced risk of musculotendinous injuries and incidence of muscle pain, reduced stress and improved posture[7]. In addition, psychosocial factors and fitness are crucial for stimulating physical activity[8], which is essential for health. There are basically two types of flexibility measures. The first is "single joint action," which consists of the body when only one joint action is involved. The most common device to measure joint action is a manual goniometer[10]. Moore et al.[11] group the goniometers into two classes: [1] instruments of universal application to all joint actions and [2] instruments designed to measure a single range of motion for a specific joint. A second type of flexibility measurement involves the measure of composite action, which consists of the extent of movement when more than one joint or more than one type of action within a single joint is used[10]. Several physical fitness tests contain a flexibility measure that is usually of this type. According to Harris et al.[10], "this practise is based on the assumption that flexibility characteristics within the body are of a general nature, i.e., they vary systematically for the various joint actions or combinations of them." Several of the composite measures involve flexion or extension of the entire length of the body, while others involve movement of only one or more segments. Some of the tests are static in nature, requiring the ability to hold a stretched position, while others are dynamic and require the ability to make rapid, repeated movements[10]. Cureton's battery of four tests is one of the earliest composite measures of flexibility[12]. It consists of trunk flexion, trunk extension, shoulder elevation, and ankle flexibility. The purpose of this study was to analyse the prevalence of flexibility among health care professional students.

2. METHODOLOGY

This cross-sectional study was conducted among the students of four constituent colleges of Saveetha Institute of Technical and Medical Sciences and Sri Balaji Vidyapeeth. This study involved 700 non-medical students, in which 68 students were excluded and 632 students were included. A convenient sampling method was followed for this study. Participants of this study were normal, healthy female students aged between 17 and 25, and participants were excluded if they had recent fractures and sprains, a history of any other neurological problem, or recent surgeries around the joints.

2.1 Ethical clearance statement

The ethical clearance was obtained for this study from the Institutional Ethical Committee[IEC]. IEC/SMC/2019/1015.The consent of the students were taken after informed consent. The consent of the institute was also taken after prior explanation of the study. Initially, the demographic data, i.e., name, age, height, weight, and BMI, was assessed. After that, these subjects were assessed for joint flexibility, in which we tested some major joints of the body, such as cervical, shoulder, lumbar, hip, knee, and ankle joints, by using the measurements of joint range of motion by Norkin and White[9]. The major muscles tested for flexibility are trapezius, pectoralis major, hip flexors, rectus femoris, hamstrings, and calf muscles, as these muscles commonly cause the restriction identified with stretching pain for each muscle.

2.1 The flexibility was assessed through various tests

2.2 Shoulder reach Flexibility Test / Back scratch test

Shoulder reach Flexibility Test/Back Scratching Test[13,14], measures how close the hands can be brought together behind the back. purpose of This test measures the general shoulder range of motion.

2.3 Procedure

This test is done in the standing position. Place one hand behind the head and back over the shoulder, and reach as far as possible down the middle of your back, your palm touching your body and the fingers directed downwards. Place the other arm behind your back, palm facing outward and fingers upward, and reach up as far as possible, attempting to touch or overlap the middle fingers of both hands. An assistant is required to direct the subject so that the fingers are aligned and to measure the distance between the tips of the middle fingers. If the fingertips touch, then the score is zero. If they do not touch, measure the distance between the finger tips[a negative score]; if they overlap, measure by how much[a positive score]. Practice two times, and then test two times. Stop the test if the subject experiences pain.

2.4 Scoring

Record the best score to the nearest centimetre or 1/2 inch. The higher the score the better the result. Table 1 showing the recommended ranges[in inches] for this test based on age groups.

2.5 Trapezius stretch test[23]

2.6 Purpose

Sit straight up in a chair with your shoulders relaxed. Bring your chin down toward your right collar bone as far as you can without rounding your upper back. Then turn your head slightly to the left. You should feel a pulling sensation on the left side of your neck. The flexibility of the trapezius muscle is identified by restriction of movement due to stretch pain.

2.7 Sit and Reach Flexibility Test[15]

The sit and reach test is a common measure of flexibility and specifically measures the flexibility of the lower back and hamstring muscles.

2.8 Purpose

This test measures lower body flexibility.

2.9 Procedure

This test involves sitting on the floor with your legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. The knees should be locked and pressed flat to the floor—the tester may assist by holding them down. With the palms facing downwards and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practise reaches, the subject reaches out and holds that position for one to two seconds while the distance is recorded. Make sure there are no jerky movements.

2.10 Scoring

Record which leg was used for measurement. table 2 showing the recommended ranges[in inches] for this test based on age groups.

2.11 Calf muscle flexibility test[16]

This is a simple indirect flexibility test of the calf muscle that requires minimal equipment.

2.12 Procedure

Stand as far away from the wall as you can while remaining flat-footed and able to bend your knee to touch the wall.Repeat for each leg.

2.13 Scoring

Measure the maximum distance from toe to the wall.

2.14 5 Groin flexibility test[17]

2.15 Purpose

This simple test measures the flexibility in the adductor muscles.

2.16 Procedure

Sit on the floor with your knees bent, and your feet flat on the floor with your legs together. Let your knees drop sideways as far as possible, keeping your feet together. The soles of your feet should be together and facing each other. Grab hold of your ankles with both hands, and pull them as close to your body as possible. Measure the distance from your heels to your groin.

2.17 Scoring

The smaller the score, the better your flexibility.

3. STATISTICAL ANALYSIS

Analyses were conducted according to gender, age, body mass index value[normal-overweight-obese] and the results of a muscle flexibility test. Descriptive statistical parameters such as mean and standard deviation were calculated.

2.18 Data extraction

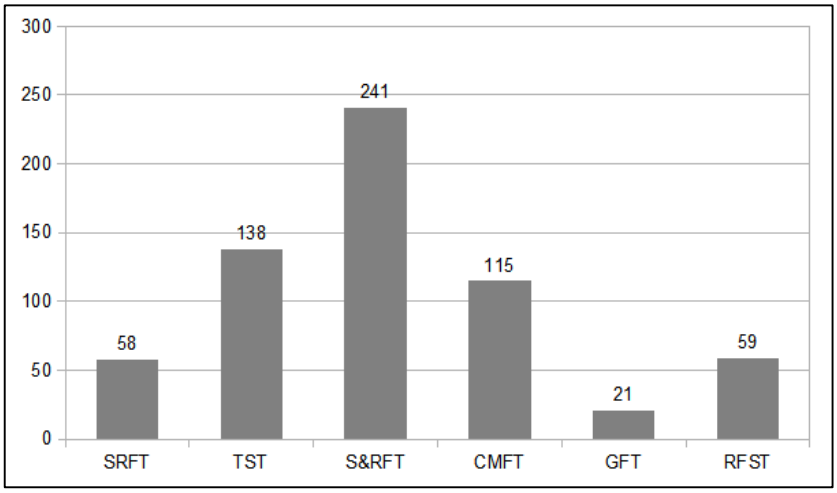
The first author was in charge of gathering data on the following characteristics of each article: Study specifics such as the author, location, and design; Data collection of measures related to psychological flexibility and professional quality of life; Participant characteristics, including the number of recruits, demographics, and type of healthcare profession; Analysis, including the method used and effect sizes; and Key findings. A second reviewer also independently extracted data for a subset of the studies[33%] to check for accuracy and assess the consistency of information extraction between the two reviewers.

2.19 Quality appraisal

The study used two specific tools to evaluate the quality of studies included in the analysis: the Critical Appraisal Skills Programme[CASP] quantitative checklist for cohort studies and the Appraisal tool for Cross-Sectional Studies[AXIS tool]. Both of these tools were used to appraise a subset of studies[33%] for the quality, and the inter-rater reliability of the quality appraisal was assessed by having a second reviewer independently evaluate a subset of the studies. Any differences in opinions were resolved through discussion.

4. RESULT

A total of 632 students were evaluated for flexibility; the occurrence of poor flexibility varied depending on their age and body mass index. The highest difference was found in the age group of 18 to 20 years. The percentage of poor flexibility is shown in charts 1 and 2. The mean age, height, weight, and BMI are shown in table 5. In the overall sample, 9.17% of students had pectoral muscle tightness; 22% of students had upper trapezius muscle tightness; 38% of students had hamstring muscle tightness; 18.2% of students had calf muscle tightness; 3.32% of students had adductor muscle tightness; and 9.33% of students had rectus femoris muscle tightness. And also, the percentage of BMI of students varies from underweight to obese; 72% of students are normal, 22.5% of students are overweight, 2.5% of students are obese, and 3.5% of students are underweight. A study of 632 students found that the occurrence of poor flexibility varied depending on age and BMI, with the highest difference found in 18-20 year-olds. The study also found 9.17% of students had pectoral muscle tightness, 22% upper trapezius muscle tightness, 38% hamstring muscle tightness, 18.2% calf muscle tightness, 3.32% adductor muscle tightness, and 9.33% rectus femoris muscle tightness. Percentage of BMI varies from underweight to obese, with 72% normal, 22.5% overweight, 2.5% obese and 3.5% underweight.



SRFT: Shoulder Reach Test, TST: Trapezius Stretch Test, S&RFT: Sit and Reach Flexibility Test, CMFT: Calf Muscle Flexibility Test, GFT: Groin Flexibility Test, RFST: Rectus Femoris Stretch Test

Chart 1: Shows the total number of students who are having various muscle tightness

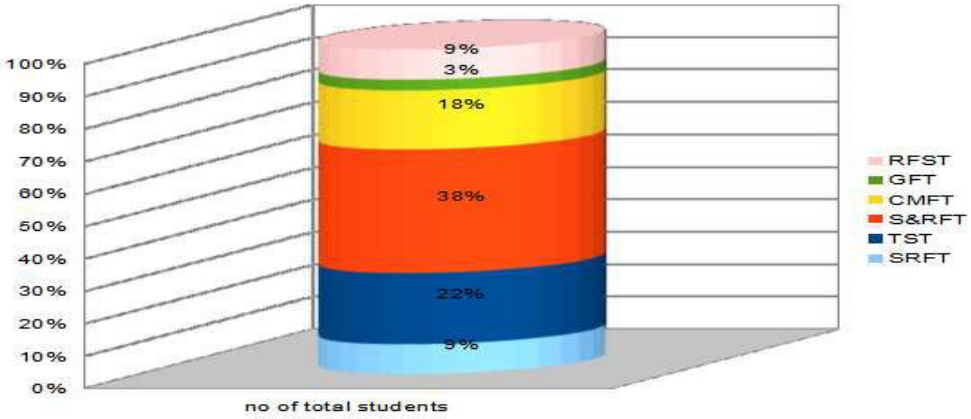


Chart 2: Shows the percentage of each test

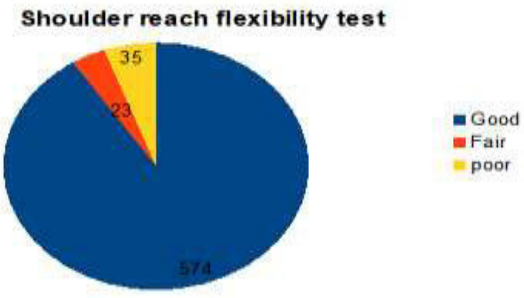


Chart 3: shows the total no., students who are having shoulder muscle tightness

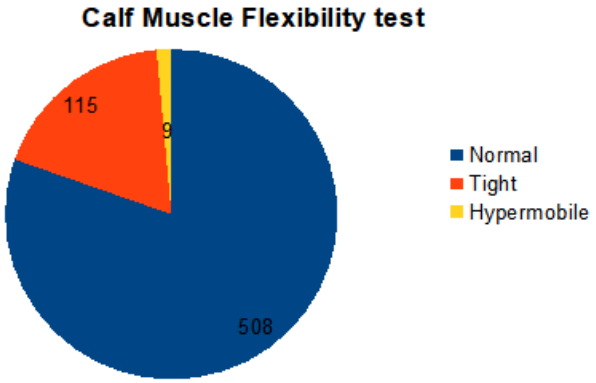


Chart 4: Shows the total no., of students who are having calf muscle tightness

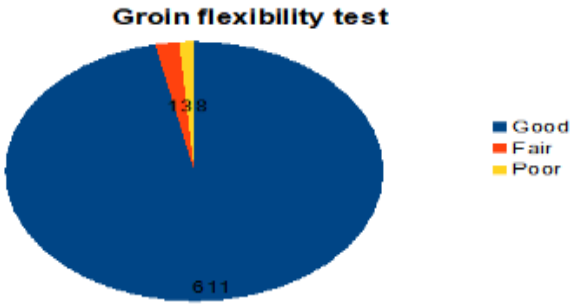


Chart 5: Shows the total no., of students having groin muscle Tightness

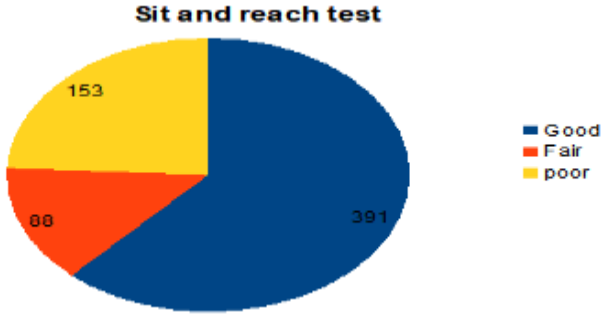


Chart 6: Shows the total no., students who are who are having hamstring muscle tightness

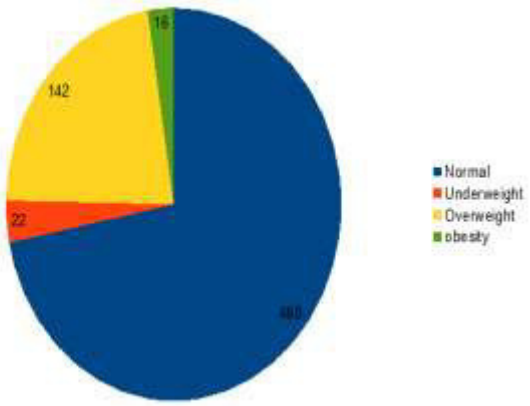


Chart 7: Shows the BMI values of total population in different age group

Table 1 : Interpretation of Shoulder reach Flexibility Test / Back scratch test	
Rate	**Description**
Good	Fingers are touching
Fair	Fingers are not touching but are less than two inches(5cm] apart
poor	Fingers are greater than two inches(5cm] apart.

Table 2 : Interpretation of Sit and Reach test and Trapezius stretch test	
Ratings	**Cm / inches**
Good	+11 to +20 / +4.5 to +7.5
Fair	- 7 to 0 / - 2.5 to 0
Poor	- 15 to – 8 / - 6.0 to – 3.0

Table 3: Interpretation of Calf muscle flexibility test	
Values	**Description**
< 6 cm	Tight
10 – 12 cm	Normal
> 12 cm	Hyper mobile

Table 4: Interpretation of Groin flexibility test	
Rating	**Score**
Good	15cm
Fair	20cm
poor	25cm

Table 5: Shows the mean and standard deviation value for total number of students in different age group

Age	Number of students	Height		Weight		BMI	
		Mean	SD	Mean	SD	Mean	SD
17	n = 53	±154.94	±3.38	±58.29	±8.95	±24.29	±2.95
18	n = 94	±156.25	±3.60	±58.03	7.89	±23.68	±2.44
19	n = 93	±155.70	±3.68	±57.44	8.11	±23.66	±2.96
20	n=147	±156.09	±3.67	±58.28	8.43	±23.82	±2.83
21	n=90	±155.72	±3.69	±57.26	8.15	±23.56	±2.93
22	n=70	±155.01	±3.76	±55.72	7.96	±23.54	±2.76
23	n=35	±159.75	±3.86	±61.37	5.93	±23.85	±1.73
24	n=30	±159.59	±3.79	±61.53	6.15	±23.93	±1.82
25	n=20	±160.24	±3.82	±60.05	5.02	±23.25	±1.34

5. DISCUSSION

The present study shows the flexibility of college students in which the prevalence of flexibility was measured by using the performance scales for each and every muscle group. There are many benefits to being flexible, including good health, good posture, reduced risk of injury, and improved performance. One of the health benefits of good flexibility is the prevention of back pain. Poor flexibility can also contribute to poor posture. Pectoral muscle tightness can lead to rounded shoulders and can cause the head to lean forward. Hamstring and calf muscle tightness can cause a curve in the lower back that can result in muscle soreness and pain. Excess body fat in and around joints and muscles can present a mechanical block to full range of motion. The excess tissue acts like a wedge, preventing full joint motion, which leads to poor flexibility. Leighton stated that flexibility refers to one element of body movement; that is, the range of movement of the different body segments at the various joints of the body. Inadequate range of motion in certain joints may restrict a person's ability to perform. Kraus also found that the lack of flexibility contributes to lower back pain. BMI: obesity can also affect the body's flexibility and movement; people who lead sedentary lifestyles usually have stiff joints and muscles become tight without regular movement, and inactivity can lead to chemical changes in surrounding connective tissue that restrict flexibility. And also, a sedentary lifestyle often leads to weight gain and obesity, which further inhibits joits, muscles, and connective tissues. In this way, body size affects flexibility. Age: Due to the ageing process, the tissue around joints tends to thicken. This can decrease the joints' range of motion. Trends indicate a decrease in flexibility with ageing, which is largely attributed to a loss in elasticity in the connective tissues surrounding the muscles. In general, these muscles throughout the body undergo a natural shortening process as a result of decreased frequencies of physical activity. It is suggested that a gradual deterioration of cell function within cartilage, ligaments,

tendons, and muscles is the mechanism for this loss of ROM as the ageing process continues.

5.1 Limitations

The limitations of this study that focused on the relationship between psychological flexibility and professional quality of life for healthcare practitioners are as follows. The study only included primary quantitative empirical studies that explicitly aimed to assess this relationship. The limitation of this study is that it may have missed out studies that measured this relationship as a part of another research question. This may mean that there could be more studies to be included in a more extensive review or meta-analysis.

6. CONCLUSION

The study that aimed to analyze the prevalence of flexibility among healthcare professional students. A total of 632 students were included in the study and were assessed for joint flexibility by using Norkin and White's measurements of joint range of motion. The major muscles tested for flexibility were trapezius, pectoralis major, hip flexors, rectus femoris, hamstrings, and calf muscles, as these muscles are commonly associated with stretching pain. The study found that 9.17% of students had pectoral muscle tightness, 22% upper trapezius muscle tightness, 38% hamstring muscle tightness, 18.2% calf muscle tightness, 3.32% adductor muscle tightness, and 9.33% rectus femoris muscle tightness. The results showed that the flexibility of the major muscles is poor due to their daily activities, BMI, and ageing process. Poor flexibility may lead to poor posture and musculoskeletal problems. The study highlights the importance of regular physical activities every day.

7. AUTHORS CONTRIBUTION STATEMENT

E. SHANMUGANANTH has done by the concept], J. MUTHUKUMARAN has done by the design, M. RANJANI , K. REKHA, S. VAISHNAVI has done by the Data collection , GOPAL NAMBI .S supervision , SABARISH HARIHARAN manuscript help

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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