PREVALENCE OF FLEXIBILITY AMONG COLLEGE STUDENTS

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ABSTRACT

Background of the study: 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 college students.

Methods: A total of 700 students in which 68 students were excluded and 632 students are included. Subjects were assessed for joint flexibility by using the measurements of joint range of motion by Norkin and White. The inclusion and exclusion data were female students aged between 17 to 25 years & recent fracture and sprains, history of neurological problem, recent surgeries. The major muscles tested for flexibility are trapezius, pectorals 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 muscle flexibility stretch test.

Result: In the overall sample 9.17% of students having pectoral muscle tightness; 22% of students having upper trapezius muscle tightness; 38% of students having hamstring muscle tightness; 18.2% of students having calf muscle tightness; 3.32% of students having adductor muscle tightness and 9.33 % of students having rectus femoris muscle tightness.

Conclusion: This study confirms that the flexibility of the major muscle are poor because of their daily activities, BMI and age process. Poor flexibility may leads do poor posture and some musculoskeletal problems. This study helps to educate them to do the regular physical activities in their daily life.

Keywords: Trapezius, pectoral muscle, hamstring and calf muscle, rectus femoris, tightness.

1.1 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 to 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 the 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.

25% of flexibility is lost between the age of 25 and 50, 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)], 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] groups 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 measures 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 batteries contain a flexibility measure which is usually of this type. According to Harris et al [10], "this practice 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 assess the flexibility and muscle extensibility among college students.

2.1 Methods and Measures

This cross sectional study was conducted among the students of four constituent colleges of Saveetha University, this study involved 700 non-medical students in which 68 students were excluded and 632 students are included. Convenience sampling method was followed for this study. Participants of this study are normal healthy female students aged between 17 to 25 years, and participants were excluded if they had recent fracture and sprains, history of any other neurological problem, recent surgeries around the joints. The Ethical clearance was obtained for this study from Institutional Ethical Committee (IEC). Initially the demographic data that is Name, Age, Height, and Weight & BMI was assessed. After that this subjects were assessed for joint flexibility in which we are 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.a) Shoulder reaches Flexibility Test / Back scratch test [13, 14]: measures how close the hands can be brought together behind the back.

Purpose: This test measures general shoulder range of motion.

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.

Scoring: Record the best score to the nearest centimetre or 1/2 inch. The higher the score, the better the results. Below is a table showing the recommended ranges (in inches) for this test based on age groups.

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.

2.b) Trapezius stretch test [23]:

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 in the left side of the neck. The flexibility of trapezius muscle is identified by restriction of movement due to stretch pain.

2.c) 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.

Purpose: This test measures lower body flexibility.

Procedure: This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both 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 practice reaches, the subject reaches out and holds that position for at one-two seconds while the distance is recorded. Make sure there are no jerky movements.

Scoring: Record which leg was used for measurement. Below is a table showing the recommended ranges (in inches) for this test based on age groups

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

2.d) Calf muscle flexibility test [16]: This is a simple indirect flexibility test of the calf muscle, which requires minimal equipment.

Procedure: Stand the maximum distance you can stand flat footed away from the wall, and also be able to bend your knee to touch the wall. Repeat for each leg.

Scoring: Measure the maximum distance from toe to the wall.

Values	**Description**
< 6 cm	Tight
10 – 12 cm	Normal
> 12 cm	Hyper mobile

2.e) Groin flexibility test [17]:

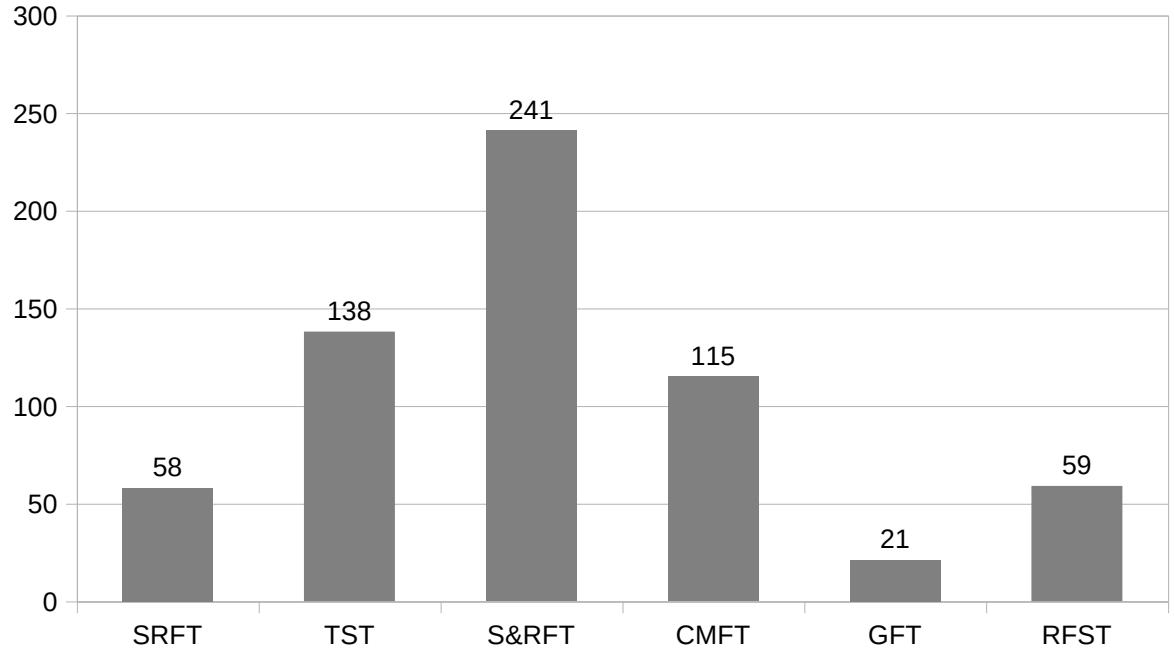
Purpose: This simple test measures the flexibility in the adductor muscles.

Procedure: Sit on the floor with your knees bent, and your feet flat on the floor and 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 on to your ankles with both hands, and pull them as close to your body as possible. Measure the distance from your heels to your groin.

Scoring: The smaller the score, the better flexibility.

Rating	**Score**
Good	15cm
Fair	20cm
poor	25cm

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



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 2: Shows the percentage of each test

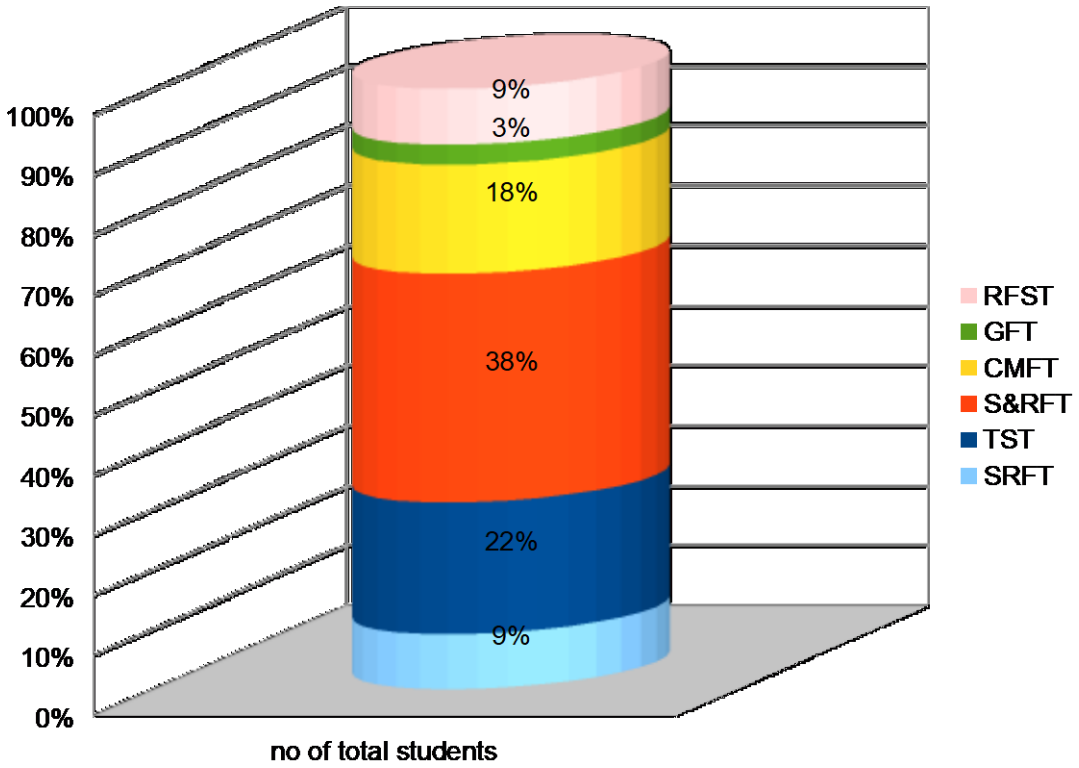


Chart 3: shows the total no., students who are having shoulder muscle tightness

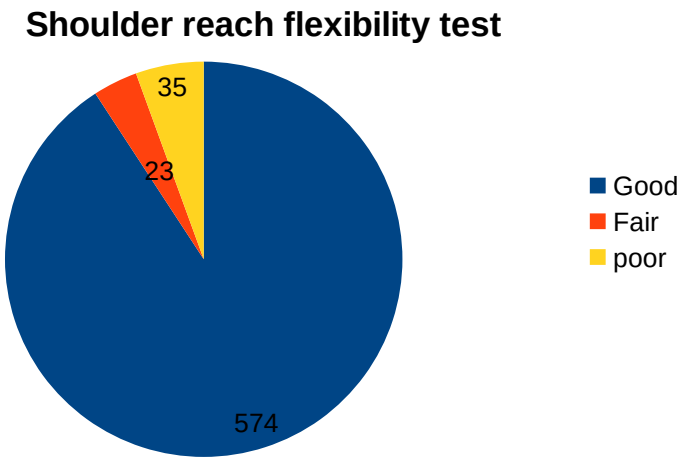


Chart 4: Shows the total no., of students who are having calf muscle tightness

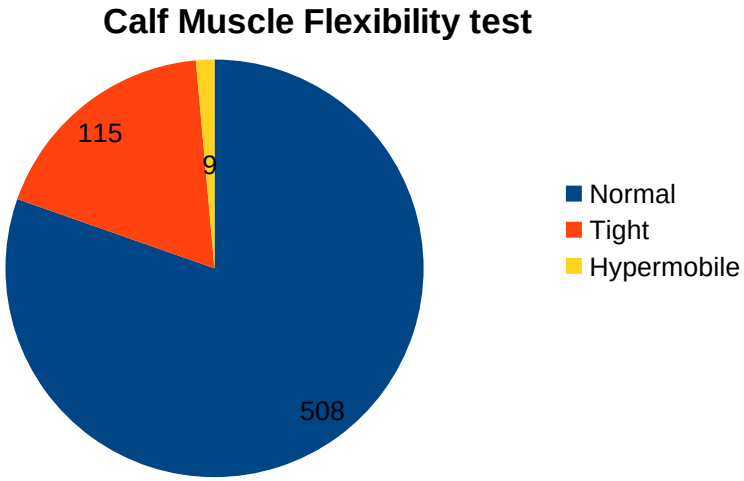


Chart 5: Shows the total no., of students having groin muscle tightness

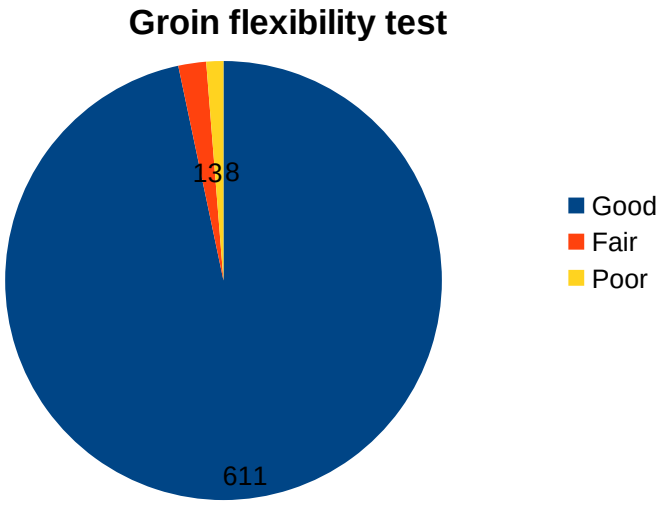


Chart 6: Shows the total no., students who are who are having hamstring muscle tightness

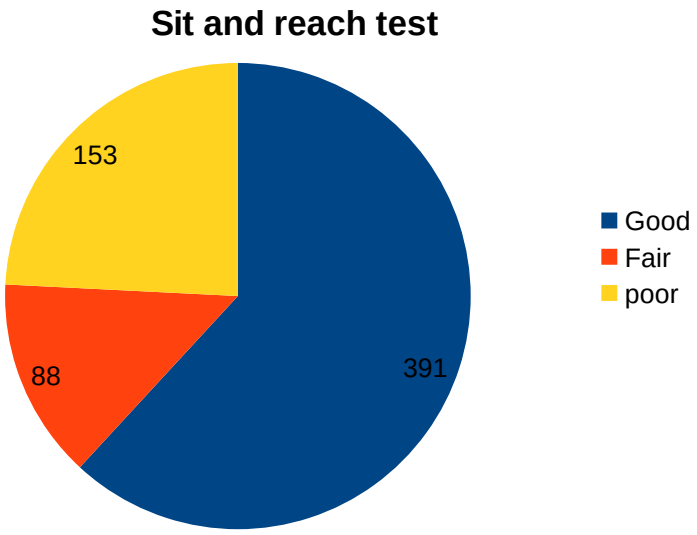
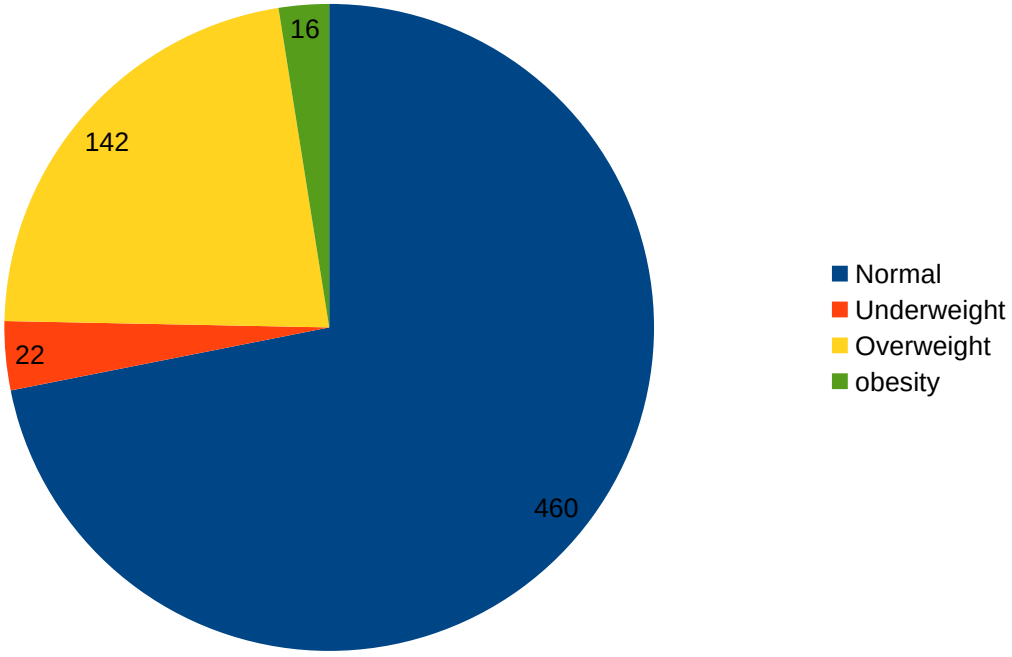


Table 1: Shows the mean and standard deviation value for total number of students in different age group

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

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



3.1 STATISTICAL ANALYSIS: Analyses were conducted according to gender, age, body mass index value (normal-overweight-obese), and the results of muscle flexibility stretch test. Descriptive statistical parameters: mean and standard deviation were calculated.

4.1 RESULT

A total of 632 students were evaluated for flexibility; the occurrence of poor flexibility was 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 the chart 1 & 2. The mean age, height, weight and BMI was shown in the table 1. In the overall sample 9.17% of students having pectoral muscle tightness; 22% of students having upper trapezius muscle tightness; 38% of students having hamstring muscle tightness; 18.2% of students having calf muscle tightness; 3.32% of students having adductor muscle tightness and 9.33 % of students having rectus femoris muscle tightness. And also the percentage of BMI of students vary from underweight to obese; 72% of students are normal, 22.5% of students are overweight, 2.5% of students are obesity and 3.5 % of students are underweight.

5.1 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. Leight on 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 ability to perform. Kraus also found that the lack of flexibility contributes to lower back pain.

BMI: obesity can also affect the body flexibility and movement; people who lead sedentary life style usually they should have stiff joint and muscle becomes 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, muscle and connective tissues, in this way body size affects flexibility.

Age: Due to the aging process, the tissue around joints tends to thicken. This can decrease the joints range of motion. Trends indicate a decrease in flexibility with ageing (Chapman, 1971), which is largely attributed to a loss in elasticity in the connective tissues surrounding the muscles. In general, these muscles throughout the body endure a natural shortening process as a result of decreased frequencies of physical activity (Kravitz and Heyward). Buckwalter (1997) suggested that a gradual deterioration of cell function within cartilage, ligaments, tendons, and muscles is the mechanism for this loss of ROM as the aging process continues.

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