Influence of Flexibility in Posture among Obese Adolescent Collegiates

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Abstract:

Background: A posture is a position of the body which is maintained by the balanced muscular forces on the skeletal system. The posture is affected by the imbalance between the muscle force and also by the reduction or increase in the muscle length.

Objective: To find the influence of flexibility in posture among obese adolescent collegiate.

Methodology: Non experimental, observational, convenient sampling, sample size was 100 subjects. Subjects of 17 to 18 years, more than 27 ratio of Asian BMI were included in the study. The exclusion criteria were any congenital or acquired musculoskeletal problems and the person who were going for regular fitness training.

Procedure: According to the inclusion and exclusion criteria subjects were selected. The flexibility and posture assessment were taken and documented.

Results: Paired t test was used to analyze the relation between the posture and flexibility which shows that the subjects who were having frontal head deviations having reduced shoulder flexibility and the subjects who having frontal hip deviations having reduced hamstring flexibility($p<0.05$).

Conclusion: The study concluded that the forward rounded shoulder is correlated with the reduced shoulder flexibility. Increase accumulation of fatty tissue on the anterior trunk creates the eccentric load on the hamstring muscles then it gets shortened and this causes compensatory pelvic and knee abnormal position. So the postural changes were more significant in the obese populations.

***Keywords*: Obesity, Posture, Flexibility.**

I. INTRODUCTION

A posture is described as a position of the body or the arrangements of body segments relative to one another[1]. The posture can be either static or dynamic. In static posture, the body and its segments are aligned and maintained in certain positions which include standing, sitting, lying, kneeling and etc. The dynamic posture refers to postures in which the body or its segments are having the ability to arrange and rearrange body segments to form a large variety of postures, but the sustained maintenance of erect bipedal stance is optimal to humans include moving like walking, running, jumping, throwing, and lifting. The study of any particular posture includes kinetic and kinematic analysis of all body segments[2]. Ideal postures are those assumed to perform an activity in the most efficient manner utilizing the minimal amount of energy. All activities starts with a posture and terminates with a posture. Correct posture is the position in which minimal stress is applied to each joint[3].Classically ideal posture (view from the lateral side) is defined as a straight line (line of gravity) that passes through the ear lobe, the bodies of the cervical vertebrae, the tip of the acromion, midway through the thoracic spines, through the bodies of the lumbar vertebrae, slightly posterior to the hip joint, slightly anterior to the axis of the lateral malleolus[4]. If the upright posture is correct, minimal muscle activity is needed to maintain the position[5]. Any position that increases the stress to the joints may be called faulty posture. If a person has strong, flexible muscles, faulty postures may not affect the joints because he or she has the ability to change position readily so that the stress do not become excessive[6].If the joint are restricted (hypo mobile) or too mobile (hyper mobile), or the muscles are weak, shortened or lengthened, the posture cannot be easily altered to the correct alignment, and the result can be some form of postural deviations. The pathology may be the result of the cumulative effect of repeated small stresses (micro trauma) over a long period of time or of constant abnormal stresses (macro trauma) over a short period of time[7]There are especially two different main causes the person to get poor posture, some are postural (positional) and some are structural. The most common postural problem is poor postural habit. This type of posture is often seen in the person who stands or sits for long period and begins to slouch. Maintenance of correct posture requires muscles that are strong, flexible, and easily adaptable to environmental change. These muscles must continually work against gravity to maintain an upright posture[8].Another cause of poor postural habits, especially in children, who does not want to appear taller than their peers. If a child has an early, rapid growth spurt there may be a tendency to slouch so as not to "stand out" and appear different. Such a spurt may also result in the unique growth of the various structures, and this may lead to altered posture. For example, the muscle growth may not keep up with the growth of bone. This process is sometimes evident in adolescents with tight hamstrings[9].Another cause of poor posture is muscle imbalance or muscle contracture. For example, a tightness of iliopsoas muscle increases the lordosis in the lumbar spine. Pain may also cause poor posture. Pressure on a nerve root in the lumbar spine can lead to pain in the back and result in the scoliosis as the body unconsciously adopts a posture that decreases the

pain[10].Respiratory conditions (e.g., emphysema), general weakness, excess weight, loss of proprioception, or muscle spasm may also lead to poor posture. The majority of postural nonstructural faults are relatively easy to correct after the problem has been identified. The treatment involves strengthening weak muscles, stretching tight structures, and teaching the pattern that it is his or her responsibility to maintain a correct upright posture in standing, sitting, and other activities of day today activities in living life [11].Flexibility is defined as the ability of the body part to allow its segments to go for an maximum desired level of range of motions, whose restriction lies in its own structure[12], which is closely associated to muscle extensibility, range of motion, and plasticity of ligaments and tendons[13]. When there is limitation of the latter, the body undergoes a number of counter balances, in order to establish an adaptive response to a set of abnormalities[14], which may influence the adopted posture.

II. AIM OF THE STUDY

To find the influence of flexibility in posture among obese adolescent collegiates

Objectives:

1. To find the level of flexibility among obese adolescent collegiate.
2. To find the level of body of posture among obese adolescent collegiate.
3. To find the correlation between the muscle flexibility on the body posture.

III. NEED FOR THE STUDY

Lot of study has supported the incidence of bad posture among adolescent people. Nowadays due to the change in lifestyle, physical activity is highly compromised. Carrying heavy bags and sitting for prolonged time in class rooms for so many years at school could have affected the muscle length. So this study has to be done to prevent the posture associated with muscular problems and poor posture in adulthood life of collegiate and also the number of studies are less to correlate the reduced flexibility and the associated postural problems.

IV. METHODOLOGY

STUDY DESIGN : Non-Experimental design

STUDY TYPE : Observational

SAMPLING METHOD : Convenient sampling

SAMPLE SIZE : 100 subjects

STUDY SETTING : SRM College of physiotherapy

SRM University, Kattankulathur – 603203

INCLUSION CRITERIA: College students aged 17 -18 years.

Both genders were included in the study.

According to the Asian criteria the student who has more than 27 ratio of BMI only included in the study.

EXCLUSION CRITERIA:

Previous history of surgery.

Congenital postural mal-alignment.

The student who are going to regular fitness center.

The student who doesnot have interest to participate in the study.

MATERIALS USED

Inch tape

Weight machine

Double sided tape

Cloth clips.

PROCEDURE

According to the inclusion and exclusion criteria the subjects was selected.

The subjects will included only if they agreed with study participation and signed the informed consent.

Calculation of BMI (Body Mass Index):

- Measure the height in Meters(m)
- Measure the body weight in kilograms(kg)
- **Formula(BMI)** =Weight(kg)/Height^2 (m^2)

BMI VALUES BY ASIAN CRITERIA

Asian Criteria	Nutritional status
< 18.5	Underweight
18.5-22.9	Normal
23-26.9	Overweight
≥27	Obese

THE FLEXIBILITY TEST:

It was measured for the shoulder, trunk, lower limb especially for the hamstring muscles.

FLEXIBILITY OF HAMSTRING AND THE LOW BACK MUSCLE

Sit and reach test:

The subject has to sit on the floor with the legs are stretched out against the sit and reach table. Shoes should be removed before to the test.

The knees should be fully extended and pressed straight to the floor. The examiner may assist the subject by holding the knees down.

The subject now asked to keep palms facing downwards, and the hands on top of each other or side by side and he has to reach forward along the measuring line as far as possible.

Make sure that the hands of the subject remains at the same level, not one reaching further forward than the other.

After some trail reaches, the subject reaches out and holds that position for at one-two seconds while the distance is recorded.

Ensure there are no trick movements.

SHOULDER FLEXIBILITY:

Back Scratch Test:

The Back Scratch test measures how close the hands can be brought together behind the back.

This test is done in standing position with one hand behind the head and back over the shoulder by abduction and external rotation, reach as far as possible down the middle of subject back, their palm touching their body and the fingers directed downwards.

The other arm is placed behind their back, palm facing outward and fingers upward by adduction and internal rotation, the patient is asked to reach up as far as possible attempting to touch or overlap the middle fingers of both hands.

The therapist have to give assistance 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, measures as a negative score, if they overlap, measures as a positive score.

Make them practice two times, and then test two times. Stop the test if the subject experiences pain.

TRUNK FLEXIBILITY:

Trunk Rotation Test:

The objective of this test is to measure trunk flexibility. The test procedure was explained below.

Mark a vertical line on the wall. The subject is made to stand with their back facing the wall directly in front of the line, with their feet shoulder width apart.

Subject should be made to stand about arms length away from the wall, though they may need to adjust the distance from the wall once they start the test.

Subjects are asked to extend their arms out directly in front of the therapist, so they are parallel to the floor.

Then subjects are instructed to rotate their trunk to their right and the touch the wall behind them with their fingertips, keeping their arms extended and parallel to the floor.

They were allowed to rotate their shoulders, hips and knees as long as and their feet shouldn't move.

The position where the fingertips touched the wall is marked, and the distance from the line was measured.

A point before the line is a negative score and a point after the line is a positive score. Repeat for the opposite side .

Trunk Lift Test

The aim of the test is to measure the trunk extensor flexibility.

The subject lies on the mat in prone position, with toes pointed back behind the body and hands placed on sides.

Place a marker on the floor in line with the student's eyes (a coin marker), which they must maintain focus on throughout the movement (to help keep head in alignment).

When ready, the subject extends the upper trunk off the floor, in a very slow and controlled manner, to a maximum height of 12 inches.

The head should be maintained in a straight alignment with the spine.

The position must be held long enough for a measurement to be made of the distance from the floor to the subject's chin. Once the measurement has been made, the student returns to the starting position. Two trials are allowed, with the best score recorded.

POSTURAL ANALYSIS:

Postural assessment was performed using a android mobile phone with the android application that is "POSTURE SCREEN MOBILE APPLICATION". This application has high reliability and validity[15]. The subject undressed adequately to the requirements of the anatomical landmarks and positioned on the particular place with the legs are slight apart from the midline adequately. The double sided tape is applied on the anatomical landmarks to detect using the application. If the clothes is unable to undress, it tightened by using the clips.

Then using the application the photos are taken to analysis the posture. Then the posture was analysed by using the anatomical landmarks into the application. The head posture, shoulder posture, hip posture and knee posture was taken.

The Anatomical markers used for postural analysis were external aquastic meatus, tip of the acromion process,

anterior superior iliac spine, greater trochanter of femur, lateral femoral epicondyle, midpoint of the patella and lateral malleolus of the fibula bilaterally.

The Anatomical markers were detected by palpating the bony land marks the double sided coloured sticker was exactly pasted on the land marks. For easy detection tight clothes are advisable or else the clothes is stretched and tightened by the hook placed on the clothes to exactly locate the sticker over the bony landmarks[16].

For postural assessment and photographic record, the individual was asked to remain in the standing position with arms extended along the body and feet positioned comfortably on a foot maker drawn on the floor, for use as a template for the photos.

The subject was placed at a distance of 3m from the camera on a demarcation on the ground to ensure proper positioning of the subject. Then, postural images were recorded in the frontal and sagittal planes for photgrammetry

A photographic record was made in each position by a single evaluator.

The angles analyzed in the frontal plane were: symmetry of the ear lobes, tip of the acromion process, anterior superior iliac spine, mid point of patellae, and malleoli of fibula.

All were determined by the intersection of the drawn lines, by joining the markers on the right and left side of each anatomical point, and by the straight line horizontally, perpendicular to the plumb line and parallel to the ground.

Body symmetry was also analysed, which was measured by free angle formed by the midpoint between the malleoli, with a line parallel the plumb line[17].

OUTCOME MEASURES:

Back scratch test

Trunk lift test

Trunk rotation test

Sit and reach test

V. DATA ANALYSIS

The data obtained from the students were tabulated and entered in MS-Excel spread sheet. The data was analysed using descriptive statistics and ANOVA with IBM SPSS statistics version 20.

TABLE 1

GENDER DISTRIBUTION OF ABOUT 100 SUBJECTS.

GENDER	MALE	FEMALE
NO.OF MEMBERS	44	66

This table shows the 44% of males and 66% of females

GRAPH 1

GENDER DISTRIBUTION OF ABOUT 100 SUBJECTS

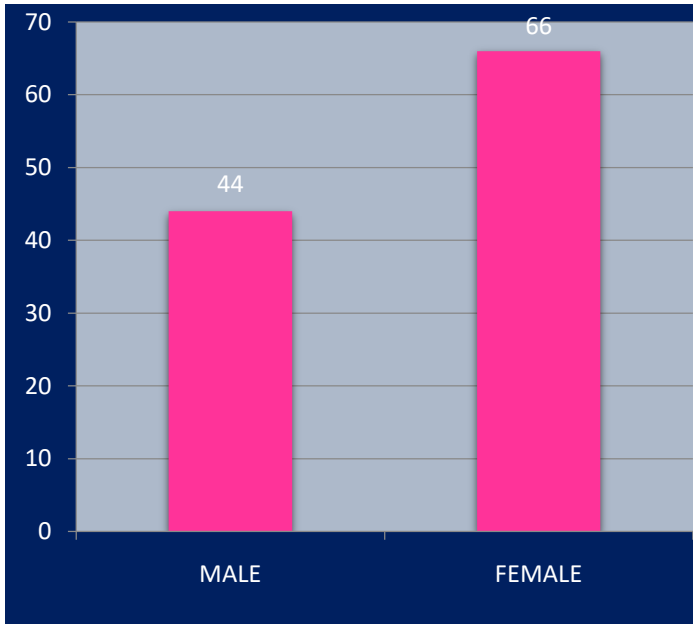


TABLE 2

NUMBER OF SUBJECTS WITH REDUCED FLEXIBILITY IN ACCORDANCE WITH THE DIFFERENT FLEXIBILITY TESTS AMONG OBESE ADOLESCENT COLLEGIATE

TESTS	NORMAL	REDUCED
SHOULDER STRETCH TEST	68	32
SIT AND REACH TEST	67	33
TRUNK ROTATION TEST	94	6
TRUNK LIFT TEST	79	21

This table shows about 32% of subjects presented with reduced shoulder muscle flexibility,about 33%of subjects have reduced hamstring flexibility as measured by sit and reach test,about 6% of subjects present with shortened trunk rotators whereas 21% reports reduced muscle extensibility among 100 obese adolescent collegiate.

GRAPH 2

NUMBER OF SUBJECTS WITH REDUCED FLEXIBILITY IN ACCORDANCE WITH THE DIFFERENT FLEXIBILITY TESTS AMONG OBESE ADOLESCENT COLLEGIATE

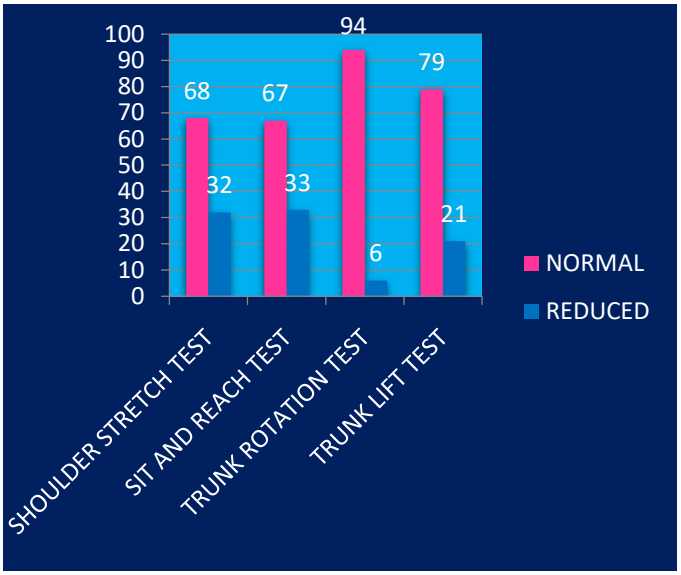


TABLE 3

PERCENTAGE OF NORMAL AND ABNORMAL POSTURE OF HEAD AMONG OBESE ADOLESCENT COLLEGIATES

AREA	VIEW	NORMAL	ABNORMAL
HEAD	ANTERIOR	79	21
	LATERAL	73	27
SHOULDER	ANTERIOR	54	46
	LATERAL	87	13
HIP	ANTERIOR	82	18
	LATERAL	79	21
	POSTERIOR	84	16
KNEE	ANTERIOR	97	3
	LATERAL	82	18

The above table shows that about 21% of subjects have a abnormal posture of head in anterior view and about 27% have a abnormal head posture in lateral view among 100 obese adolescent collegiate.

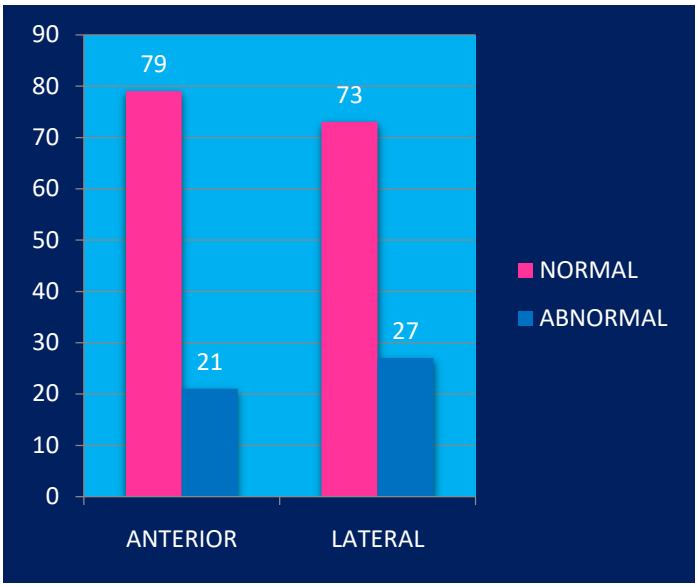
The above table shows that about 46% of subjects have a abnormal posture of shoulder in anterior view and about 13% have a abnormal shoulder posture in lateral view among 100 obese adolescent collegiate.

The above table shows that about 18% of subjects have a abnormal posture of hip in anterior view and about 21% have a abnormal hip posture in lateral view and about 16% have a abnormal hip posture in posterior view among 100 obese adolescent collegiate.

The above table shows that about 3% of subjects have a abnormal correct posture of knee in anterior view and about 18% have a abnormal knee posture in lateral view among 100 obese adolescent collegiate.

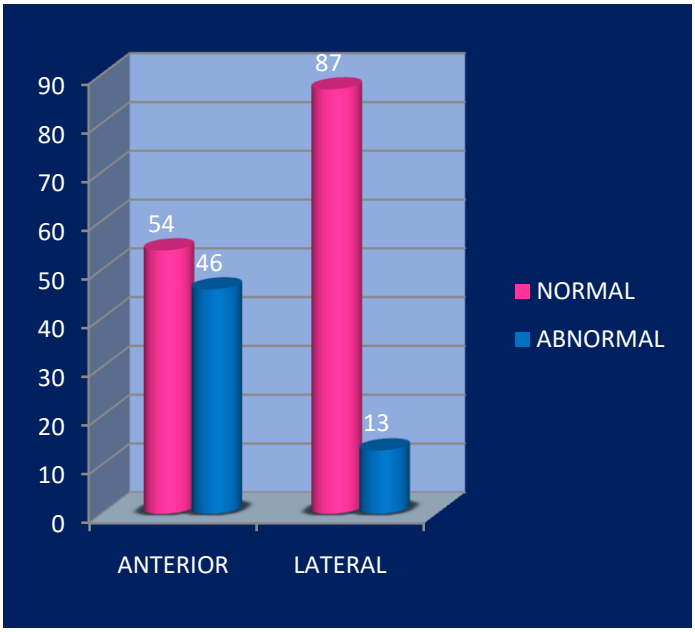
GRAPH 3

PERCENTAGE OF NORMAL AND ABNORMAL POSTURE OF HEAD AMONG OBESE ADOLESCENT COLLEGIATES



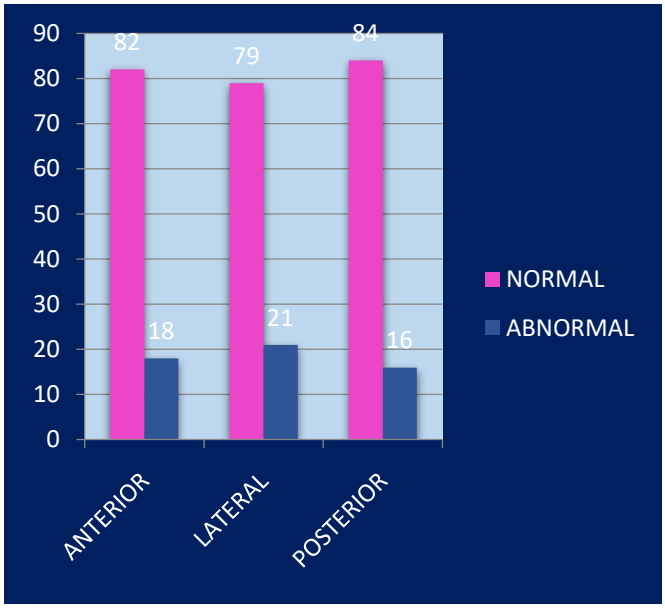
GRAPH 4

PERCENTAGE OF NORMAL AND ABNORMAL SHOULDER POSTURE AMONG OBESE ADOLESCENT COLLEGIATE



GRAPH 5

THE GRAPH SHOWS THE NUMBER OF NORMAL AND ABNORMAL POSTURE IN HIP JOINT



GRAPH 6

THE GRAPH SHOWS THE NUMBER OF NORMAL AND ABNORMAL KNEE POSTURE SUBJECTS

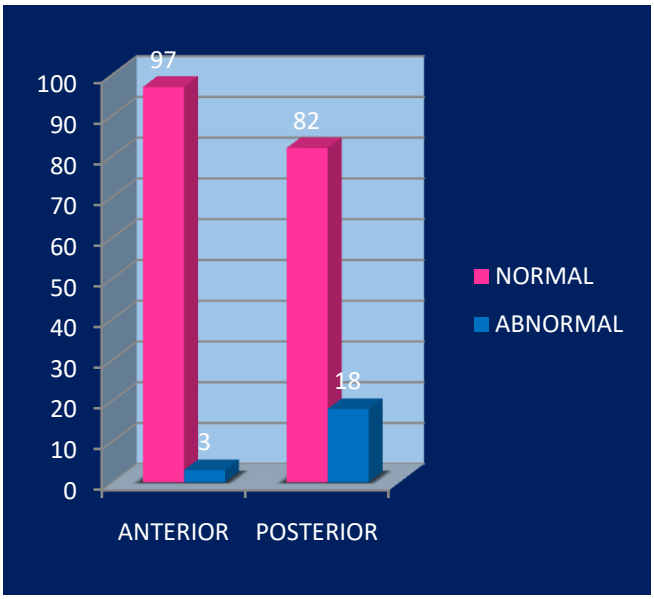


TABLE 7

FLEXIBILITY VERSUS POSTURE

Values	Mean		X2 value	Df	Significance
Anterior head versus Back Scratch test	Normal	shifted	1.693a	1	.193
	80	20			
Anterior head Versus Sit and reach test	80	20	0.61a	1	.804
Anterior head Versus Trunk rotation test	80	20	1.575a	1	.209
Anterior head Versus Trunk lift test	80	20	0.492a	2	0.782
Lateral head Versus Back Scratch test	74	26	0.731a	1	0.393
Lateral head Versus Sit and reach test	74	26	0.319a	1	0.572
Lateral head Versus Trunk rotation Test	74	26	1.763a	1	0.184
Lateral head Versus Trunk lift test	74	26	3.498a	2	0.174
Anterior shoulder Versus Back Scratch test	54	46	0.488a	1	0.485
Anterior shoulder Versus Sit and reach test	54	46	0.171a	1	0.679
Anterior shoulder Versus Trunk rotation test	54	46	0.384a	1	0.536
Anterior shoulder Versus Trunk lift Test	54	46	0.873a	2	0.646
Lateral shoulder Versus Back Scratch test	27	73	3.144a	1	0.000*
Lateral shoulder Versus Sit and reach test	87	13	0.625a	1	0.429
Lateral shoulder Versus Trunk rotation Test	87	13	0.082a	1	0.775
Lateral shoulder Versus Trunk lift test	87	13	0.436a	2	0.804
Anterior hip Versus Back Scratch test	82	18	0.172a	1	0.679
Anterior hip Versus Sit and reach Test	82	18	1.380a	1	0.240
Anterior hip Versus Trunk rotation test	82	18	0.006a	1	0.939
Anterior hip Versus Trunk lift test	82	18	3.400a	2	0.183
Lateral hip Versus Back Scratch test	79	21	3.898a	1	0.048

Lateral hip Versus Sit and reach test	31	69	0.203a	1	0.000*
Lateral hip Versus Trunk rotation Test	79	21	0.066a	1	0.797
Lateral hip Versus Trunk lift Test	79	21	2.720a	2	0.257
Posterior hip Versus Back Scratch test	84	16	0.329a	1	0.566
Posterior hip Versus Sit and reach Test	84	16	1.675a	1	0.196
Posterior hip versus Trunk rotation Test	84	16	1.464a	1	0.226
Posterior hip Versus Trunk lift Test	84	16	5.294a	2	0.071
Anterior knee Versus Back Scratch test	97	3	0.024	1	0.876
Anterior knee Versus Sit and reach test	97	3	6.371a	1	0.012
Anterior knee Versus Trunk rotation test	97	3	0.195a	1	0.659
Anterior knee Versus Trunk lift Test	82	18	3.956a	2	0.138
Lateral knee Versus Back Scratch test	82	18	2.214a	1	0.137
Lateral knee Versus Sit and reach Test	82	18	0.004a	1	0.947
Lateral knee Versus Trunk rotation test	82	18	0.006a	1	0.939
Lateral knee Versus Trunk lift Test	82	18	4.486a	2	0.106

The above table shows that about 27% of subjects have a abnormal posture of shoulder in lateral view and about 31% have a abnormal hip posture in lateral view among 100 obese adolescent collegiate.

VI. RESULTS

Table 1 shows the gende frequency of about 44% of males and the 66% of females.

Table 2 shows about 32% of subjects presented with reduced shoulder muscle flexibility,about 33%of subjects have reduced hamstring flexibility as measured by sit and reach test,about 6% of subjects present with shortened trunk rotators whereas 21% reports reduced muscle extensibility among 100 obese adolescent collegiate.

According to the table 3:

It shows that about 21% of subjects have a abnormal correct posture of head in anterior view and about 27% have a abnormal head posture in lateral view among 100 obese adolescent collegiate.

It shows that about 46% of subjects have a abnormal correct posture of shoulder in anterior view and about 13% have a abnormal shoulder posture in lateral view among 100 obese adolescent collegiate.

It shows that about 18% of subjects have a abnormal correct posture of hip in anterior view and about 21% have a abnormal hip posture in lateral view and about 16% have a abnormal hip posture in posterior view among 100 obese adolescent collegiate.

It shows that about 3% of subjects have a abnormal correct posture of knee in anterior view and about 18% have a abnormal knee posture in lateral view among 100 obese adolescent collegiate.

Table 4 shows the significant correlation between the lateral shoulder postures in relation with the back scratch test and correlation between the lateral hip posture in relation with the sit and reach test there by ($p<0.05$).

Graph 1 shows the number of male and females included in this study.

Graph 2 shows that among 100 subjects 32 subject have reduced shoulder flexibility. Among 100 subjects 33 subjects have reduced hamstring flexibility. Among 100 subjects 6 subjects have reduce trunk rotation flexibility. Among 100 subjects 21 subjects have reduced trunk extension flexibility.

Graph 3 shows among 100 subjects 21 subjects having frontal head deviations and among 100 subjects 27 subjects having sagittal head deviations.

Graph 4 shows among 100 subjects 46 subjects having frontal shoulder deviations and among 100 subjects 13 subjects having horizontal shoulder deviations.

Graph 5 shows among 100 subjects among 100 subjects 18 subjects shows frontal plane deviations, 21 subjects shows sagittal plane deviations on the pelvic alignment.

Graph 6 shows among 100 subjects 3 subjects shows knee frontal plane deviations and 18 subjects shows sagittal deviations.

VII. DISCUSSION

The study was aimed to find out the correlation of decreased flexibility and its association with the postural deviations.

The study shows the result of 73 subjects showed abnormal shoulder postures in which the 32 subjects having reduced shoulder flexibility.

Hertzberg found the occurrence of neck and shoulder pain due to shoulder muscle tightness was 33%.

Clark M.A. and Beach .M.L.M., PT, it has been assumed that rounded shoulder posture causes a decrease in flexibility of the pectoralis major and pectoralis minor as well as latissimus dorsi muscles. Due to adaptation of forward stooped posture in more of the functional activity like bike riding, sitting posture in classrooms will leads to shortness of the protractors. This shortness can leads to weakness of the retractors and this will indirectly causes the upper back pain and restriction in the shoulder range of motion.

The results shows the 69 subjects showed abnormal knee posture and 21 subjects shows abnormal pelvic postures among that the 33 subjects having the reduced hamstring and low back muscles flexibility. Hamstring shortness will leads to knee flexion and also leads to posterior tilt of the pelvis and which causes the kyphosis of the spine.

Lemos AT and Santos FR stated the reduced flexibility is related to shortening of hamstring muscle[18].

Carregaro RL and Sliva LC stated hamstring muscle group consist of three muscles that is semi-membranosus, semi-tendinosus and long head of biceps femoris. The muscle group is attached to the ischial tuberosity of the pelvis. The pelvis is considered the base of the spine and its anteroposterior orientation affects the sagittal alignment of spinal curvatures[19].

Wouters F says The prevalence of reduced muscle length is that it is clearly observed that the students mostly spend lot of time in the sitting posture[20].

Sacco IC concluded that the time spent in the class room are mostly sitting on the table which leads to posterior shortening of the posterior muscle group in position[21].

Polachini LO says shortening position can leads generate posterior tilt and misalignment of pelvis. The independence of actions performed by the hamstrings at the hip and knee joints suggests that the shortening of the muscles caused these postural changes[22]. The one more reason for the poor posture was carrying of an heavyweight backpack also may influence the neck as well as the pelvic postures that will increase in the anterior pelvic tilt **[Ries LG]** [23].

The studies showed that the shortening of the hamstring muscle will increase the posterior pelvic tilt and to compensate that there may be and lumbar kyphosis and along with that the slight flexion of knee also been occurred. The compensate posture also leads to till more shortening of the hamstring muscles.

VIII. CONCLUSION

The study concluded that the forward rounded shoulder is correlated with the reduced shoulder flexibility. And due to the increase accumulation of fatty tissue on the anterior trunk creates the eccentric load on the hamstring muscles then it gets tightens and which causes compensative pelvic and knee abnormal posture. So the postural changes due to the reduced flexibility is more significant in the obese populations.

IX. LIMITATIONS

The sample size is very small.

The sampling method for our study is convenient so we couldn't take the equal number of genders.

X. RECOMMENDATIONS

For further studies we recommend to take an equal number of men and women to find a relation with gender.

We also recommend the future study to find the flexibility and the associate postural changes among different body groups of the individuals.

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