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Association between Body Mass Index and Hamstring/Back Flexibility in Adolescent Subjects

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Abstract: ***Increasing levels of overweight and obesity in the dynamic adolescent phase of life has brought along with it an eclectic array of health related issues. Flexibility of hamstrings & low back constitute one such important issues and is a vital component of health related Physical Fitness. Since flexibility in adolescence would have far reaching repercussions not only in adolescent subjects presently but also in their future life, hence this research studies the association between Body mass Index & Flexibility in adolescent subjects. Analysis of data from 300 study subjects recruited as per inclusion criteria, found weak association between BMI & Flexibility in adolescent subjects. However there seems an overall decline in the flexibility of the study subjects.***

Keywords: Overweight, Obesity, Adolescents, Flexibility, Sit and Reach Test

1. Introduction

Adolescence is an important period of life, since dramatic physiological and psychological changes take place at this age. Long lasting lifestyle and behaviors are developed during these years, which may influence adult behavior & health status. On the other hand adequate fitness in childhood is likely to carry beneficial biological and behavioral effects into adulthood. This is justified by heuristics which support the claim that physically active children are more likely to become physically active adults and physical fitness in children may protect against future musculoskeletal and cardiovascular disease.[2]

Obesity & overweight in adolescents is now becoming a serious problem, thus it needs to be treated at the right time. It is associated with an increased risk of morbidity and mortality as well as reduced life expectancy.[7] Reports from various parts of India suggest significant heterogeneity in the distribution and growth of childhood obesity prevalence rates. A study was conducted in south India among 24842 school children belonging to the age group of 5–16 years showed that the proportion of overweight children increased from 4.94% of the total students in 2003 to 6.57% in 2005, demonstrating the time trend of this rapidly growing epidemic.[9]

Joint flexibility or range of motion is an important component of muscular fitness. The importance of flexibility as a component of health related fitness is related to prevention of orthopedic impairments later in life, especially lower back pain. Flexibility of the lower back, legs and shoulders acts as an effective deterrent to risk of musculoskeletal injury (Haskeil et al.,1985)[1].

The rate of skeletal growth during adolescence, outperforms soft tissue growth thus predisposing the subject to tightness. Also, growth during childhood and adolescence occurs distal to proximal. For example, the hands and feet experience accelerated growth first, followed by the calf and the forearm, the hips and the chest, and lastly the shoulders.

Thus, during childhood there are periods where youths appear to have large hands and feet in relation to the rest of their body. From childhood to adolescence, the lower extremities (legs) grow faster than upper body (trunk). However, during the adolescent growth spurt the legs experience a growth spurt earlier than the trunk. Thus, for a period during early adolescence, subjects have relatively long legs. This accelerated skeletal growth predisposes them to soft tissue tightness. Hamstring [4] is the most common muscle which is prone to become tight during the rapid growth& development occurring during adolescence. Various studies have related tight hamstring muscles with the reduction in the lumbar lordosis which can result in low back pain.[5]

Nevertheless, a major proportion of this soft tissue tightness associated with normal adolescent growth & development is countered by Physical Activity. With growing decline in levels of Physical activity during adolescence, most subjects spend a large part of their day seated at their desk, seated in front of laptops, televisions or plopped on the couch, consequently, putting the Hamstrings consistently in a shortened state. This recurring seated position and lack of repetitive daily exercise can often cause the Hamstring muscles to adapt to a shortened or "tight" state wherein it causes a backward rotational pull on pelvis and hips, which in turn triggers low back pain. This change in the pelvis' neutral position can irritate the nerves that originate from the lumbar-sacral part of the pelvis. The Sciatic nerve in particular can become irritated from the shift in the pelvis position, causing the hamstrings to further shorten[6].

Hence the increase in adiposity in adolescent age group perpetrated by a decline in physical activity & an accelerated growth & development phase might have a detrimental effect of the flexibility of hamstring & Back muscles.

Therefore the objective of this research is to study the association between Body Mass Index and hamstring/back flexibility in adolescent subjects.

2. Materials and Methods

A Cross sectional study design was used to conduct an assessment based study on 300 adolescent subjects from various schools & colleges in Mumbai and Navi Mumbai. The subjects were selected through convenient sampling within the age group of 10-19years.

Any musculo-skeletal injury or any type of back or knee pain in the past 3 months, resulted in exclusion of the subject. After description of the procedures, and purpose of the study, written informed consent was obtained from each subject's parent or guardian and written assent was obtained from the subject. This study was conducted in accordance with the ethical standards of institutional review boards and with the Helsinki Declaration.

Body Mass Index (BMI) was calculated using the Quetelet Index by taking the child's weight (in kg) and dividing by the height (in meters) squared. Subjects were classified into Underweight, Normal, Overweight or Obese categories based on the BMI cut-off points given by the Indian Association of Pediatrics.

The subject was then made to perform the sit and reach test in the following manner.

Sit and Reach Test

Prior to performing the test standardized static stretching exercises for 5 minutes on lower back and hamstrings was done.

The subjects were then asked to remove the shoes and sit on the floor with the legs stretched out in front , knees straight and feet flat against the front end of the test box. In a slow, steady movement, they were asked to lean forward at hips keeping the knees straight and slide the hand up the ruler as far as they can go. A rest pause was given and the test was repeated 3 times.

The average of the results was recorded as the final score.

3. Data Analysis and Results

A total of 300 subjects were enrolled in the study through convenient sampling as per the inclusion criteria. The data was processed using two aspects, which were as follows:-

- Descriptive statistics - for demographic data (age & BMI)
- Analytical Statistics – Spearman's correlation Coefficient was used to study the association between BMI & Flexibility. Level of significance was fixed at 0.05

Table 1: Descriptive Statistics

Descriptive Statistics

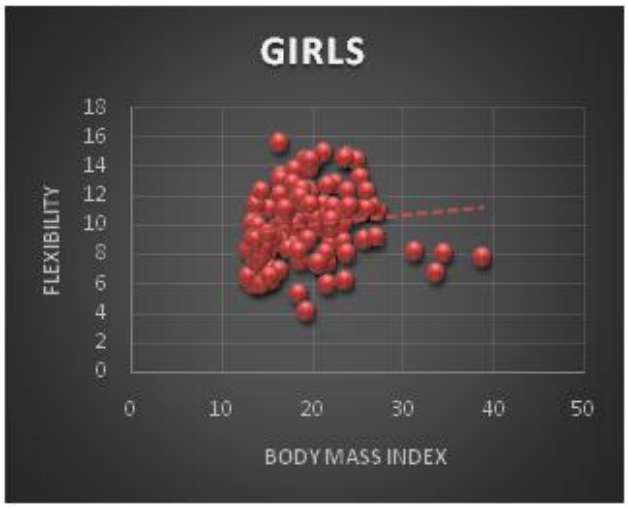
	N	Minimum	Maximum	Mean	Std. Deviation
Age	299	9.00	19.00	13.7539	2.53467
BMI	300	.00	38.78	19.4122	5.10249
Flexibility Av	290	3.67	16.58	10.1159	2.50649
Valid N (listwise)	290				

Table 2: Analytical Statistics

Correlations[a]

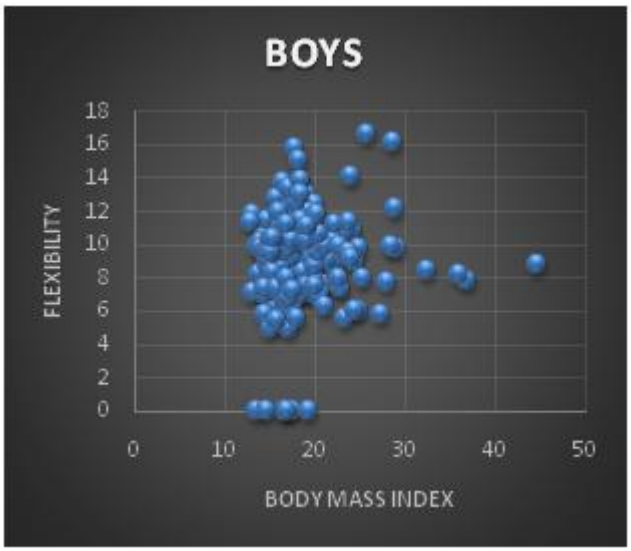
			BMI	Flexibility Av
Spearman's rho	BMI	Correlation Coefficient	1.000	.087
		Sig. (2-tailed)	.	.139
		N	300	290
	Flexibility Av	Correlation Coefficient	.087	1.000
		Sig. (2-tailed)	.139	.
		N	290	290

a. Inference. Speraman's correlation Coefficient showed no significant association between BMI & Flexibility



Graph 1: Association between BMI & Flexibility in Female Subjects

Inference : Spearman r = 0.2549
95% confidence interval: 0.07844 to 0.4158
The two-tailed P value is 0.0040, considered very significant.



Graph 2: Association between BMI & Flexibility in Male Subjects

Inference: Spearman r = 0.2549
95% confidence interval: 0.07844 to 0.4158
The two-tailed P value is 0.0040, considered very significant.

4. Discussion

Flexibility is the ability of a specific muscle or muscle group to move freely through a full range of motion is important aspect of normal human function and also is a key component for injury prevention and rehabilitation.

The analysis of data showed no association between BMI & Flexibility in Adolescent subjects. Our findings are corroborated by Michael J Alter in his literature on Science of Flexibility where he reaffirms that body mass may have little to do with flexibility in individuals which is clearly demonstrated by the ability to straddle split seen in Sumo Wrestlers.

However there is an overall decline in flexibility seen in the study subjects. This could be attributed to poor posture in todays' youth. Proper posture puts the least strain on the supporting muscle and ligaments surrounding the area. A prolonged sedentary postures in their regular schedule,lack of adequate physical activity positions the hamstrings in a shortened position. This would further cause the pelvis to tilt backwards, called a posterior pelvic tilt. In this position, the lumbar lordosis decreases, putting excessive strain on the lower back muscle.

5. Conclusion

From this study we concluded that there exists a weak association between hamstring and back flexibility and BMI in adolescent subjects. Confounding factors like decreased physical activity may have a detrimental effect on Hamstring flexibility irrespective of the BMI status of the individual. Our findings strongly suggests that growth as seen during adolescent phase plays only a small role in determining the flexibility of individuals.

6. Conflict of Interest

There exists no conflict of interest in this research to the best of our knowledge

7. Acknowledgements

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