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Original article

Correlation of Biomechanical Measures and BMI in School Going Children

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Abstract

Background: This study was done to find the relation between BMI and biomechanical measures of the body so as to understand its significance. Our objectives was to correlate BMI and biomechanical measures in school going children.

Material And Method: 30 participants from Little Flower Schooland Dr.VithalraoEknathraoVikhepatilVidyalaya were selected randomly. Their BMI was assessed and thereafter they were also assessed for biomechanical measures, i.e TBA, FPI and SRT. The analysis suggested that the correlation of BMI and right FPI was not significant with r value -0.03337 and p value 0.8610, the correlation between BMI and right TBA was not significant with r value 0.1327 and p value 0.4847 and the correlation between BMI and Sit and reach Test was not significant with r value of 0.1021 and p value 0.5913.

Result: The correlation between BMI and Biomechanical measure was not significant.

Conclusion: BMI cannot always have an effect on biomechanical measures, as various other factors could also be considered.

Keywords: BMI, Biomehanical measures, FPI, TBA, Sit and reach test

INTRODUCTION

Physical fitness is not only one of the most important keys to a healthy body ,it is a basis of dynamic and creative intellectual activity .Physical fitness in children can be achieved by activities like swimming , running which are fun to do and it has double benefit. Children enjoy it as well as become fit without getting bored. As children develop from infants to teens to adult they go through a series of developmental stages that are important to all aspect of their personhood including physical, intellectual, emotional and social. In today's life it is very important for child to be fit to win this race against time .Child fitness is key of nations progress today. In country like India child fitness is very important because the children are either malnourished or obese.

Childhood fitness is an emerging area of public health concern the world over. The prevalence of childhood obesity and morbidities associated with it are increasing. Some of the reasons attributed to this increase in obesity and decrease in fitness levels are improved economic status and better lifesty0le choices, increased academic demands, which decrease the time effectively spent in physical activity, and concerns of safety, which parents voice as reasons for disallowing physical activity. On the flip side, there are children with poor nutritional levels leading to poor fitness levels.

While these children are not prone to lifestyle diseases, they are also a cause for concern.

Some of the reasons attributed to poor nutritional status are cultural beliefs concerning foods, poverty, and lack of awareness [1].

Childhood and adolescence are crucial periods of life since dramatic physiological and psychological changes take place at these ages. Lifestyle and healthy/unhealthy behaviors are established during these years, which may influence adult behavior and health status .Latest developments with regard to physical fitness and health outcomes such as adiposity, CVD risk factors, skeletal health, cancer and mental health, in young people[2] .

Childhood obesity is a serious health problem, and an obesity epidemic is spreading in alarming rates among children. Obesity-associated problems and diseases decrease the quality of life and life span[3] .Adult obesityhas been associated with a higher prevalence of musculoskeletal disorders, primarily affecting the lower limbs. Some musculoskeletal disorders that are unique to childhood, such as slipped capital femoral epiphysisand tibia vara (Blount's disease), have retrospectively been associated with excessweight[6].

The BMI is used to assess weight status in children and adolescents as well as adults.It is in calculated as weight body mass index is a measure of weight adjusted for height. kilograms divided by the square of height in meters [4]. Musculoskeletal malalingments resulting in alteration of biomechanics of lower extremities likely contribute to joint pain experienced by children. Biomechanical measures commonly used to assess alignment of lower extremity include the BMI , the tibiofemoral angle(TFA)for genu valgum ,and the Foot Posture Index(FPI)for foot pronation ,supination. The sit-and-rich test (SRT) provides a measure of general flexibility in children [5].

METHODOLOGY

The 30 participants were recruited from Little Flower School, Loni, and Dr. Vithalrao Eknathrao Vikhe- patil Vidyalaya , Bableshwar. Children meeting the inclusion criteria of age 11 to 17 years were taken for study who follows the simple commands with no musculoskeletal, neurological, cardiorespiratory and psychological problems. An informed consent was taken from parents.

Clinical Test:

1) **BMI:** height (cm) and weight (kg) measured by standardized method,and BMI values are recorded.
2) **TIBIOFEMORAL ANGLE :** Participants stood barefoot with the hip-distance apart (approximately 6 inches) .The axis of goniometer placed at the center of patella ,the proximal arm was parallel with the anterior superior iliac spine of pelvis and distal arm was parallel with the lower leg in line. The goniometric angle was recorded for each participants left leg. Three measures were taken and recorded and then process was repeated on the right leg.
3) **Foot Posture Index** : Participants stood barefoot with their feet hip-distance apart(approximately 6 inches).The foot was assessed using an index of 6 components which includes (1) talar head palpation, (2) symmetry of curves above and below the lateral malleolus, (3)inversion/eversion of the calcaneus, (4) prominence in the region of the talonavicular joint, (5) medial arch height, and (6)forefoot abduction/adduction. For each participant's left foot, a rater

performed this assessment 3 times and then repeated the process on the right foot.

4) **Sit-and-Reach Test :** Before testing, a yard stick was secured to the floor and a 12-inch strip of tape was placed perpendicular to the yardstick at the 15-inch mark. Participants were positioned in long sitting on the floor with their legs extended on either side of the yard-stick and their feet 12 inches apart with their heels touching either end of the tape strip. Participants then placed their right hand over left and slowly stretched forward with maximal effort and distance recorded.TheSRTwas performed by each participant just 3 times, with all 3raters recording their own observed measures.

The data analysis was done with karlpearson correlation coefficient

Table no.1.mean value

BIOMECHANICAL MEASURES	MEAN+-SD
BMI	19.24+-3.756
FPI (rt.foot)	2.73+-3.503
(lft.foot)	2.83+-3.435
TBA(rt.leg)	5.73+-1.760
(lft.leg)	5.93+-1.760
SIT &REACH	4.33+-2.123

Table no.2 Correlation between BMI & right FPI

Correlation between	Karl Pearson's Correlation coefficient (r)	P VALUE and significance
BMI V/s FPI (rt.foot)	-0.03337	0.8610

Table no.3 correlation between BMI &lft FPI

Correlation between	Karl Pearson's Correlation coefficient (r)	P VALUE and significance
BMI V/s FPI (lft.foot)	0.2136	0.2570

Table no.4 correlation between BMI & rt. TBA

Correlation between	Karl Pearson's Correlation coefficient (r)	P VALUE and significance
BMI &TBA (rt.leg)	0.1327	0.4847

Table no.5 correlation between BMI &lft TBA

Correlation between	Karl Pearson's Correlation coefficient (r)	P VALUE and significance
BMI V/s TBA (lft.leg)	0.3051	0.1011

Table no.6 correlation between BMI & SIT & REACH test

Correlation between	Karl Pearson's Correlation coefficient (r)	P VALUE and significance
BMI V/s SIT & REACH	0.1021	0.5913

DISCUSSION

The present study "Correlation of biomechanical measures and BMI in school going children"was conducted in Little Flower School;Loni and Dr.VithalraoEknathraoVikhepatilVidyalaya , Bableshwar. Children with age group 11-17 years old were included, BMI and their biomechanical measures which includes sit and reach test to assess general flexibility, ,tibiofemoral angle to assess genu valgum , FPI to assess foot pronation and supination was measured. After assessing biomechanical measures they were correlated with BMI .The result of these study was found not significant for all biomechanical measures in correlation with their BMI.

BMI and TBAwas not significant because there is reversal of physiological varus which occurs in by the age of two years. Peak valgus angulation is seen at five to six years of age. Thereafter the valgus angulation gradually decreases till maturity.The study done by Blessing Omota on correlation between clinical tibiofemoral angle and body mass index in normal Nigerian children they found significant negative correlation between the tibiofemoral angle and BMI, Reason being that BMI as a measure of total body mass is superior to weight measures alone because it takes into consideration adjustments for height, age and gender. It has, however, been criticised as a tool for measuring underweight, overweight or obesity in children, who are not generally considered to have a medium frame. This is largely due to differences in bone density and the consequent ratio of bone to total weight, as well as to age and sex differences in amount of total body fat. Also there is a paucity of literature demonstrating the relationship between body mass and the magnitude of the knee angles in normal children. In a prospective study of the orthopaedic complications of overweight

children and adolescents, using whole-body dual-energy X-ray absorptiometry (DEXA) scans found greater malalignment of the metaphyseal–diaphyseal and anatomic TFA measurements in overweight compared with normal weight children.[7]

The current study observed the relation between BMI and FPI was not significant . Higher body mass index was not associated with a more pronated foot type and there was no important relationship between age and foot posture.Angela Margaret Evans and Leila Karimi conducted a study on the relationship between paediatric foot posture and body mass index, concentrating on the question: do heavier children really have flatter feet? The study concluded that there is no relationship between increased BMI and 'flatter' feet in children. It can be argued that the BMI is not an ideal measure for pediatric adiposity or body morphology. Also an important point arises that, all of the studies that have investigated the relationship between body mass and children's foot posture, shows that the association between factors cannot be regarded as causal. Whilst the majority of studies investigating the relationship between foot posture and body mass have concluded that flatter feet are found in heavier children, this association must be cautioned, as indeed the findings of the current study indicate no association between children's foot posture and body mass.[8]

The also suggests that BMI and Sit and reach correlation was also not significant. The World Health Organization (WHO) expresses overweight and obesity on BMI at >25 and 30+ kg/hm2 respectively in child and younger adult inhabitants (WHO, 1995). However, there is cumulative indication that these cut-off tenets are not operative for all populaces 9 as concerned between BMI and body fat percentage fluctuates between population clusters as according to their biotic environment.[9]There are reported studies suggesting that childhood obesity and decreasing levels of fitness are on an alarming rise. Also one reason for the study to result as not significant could be that the sampling method was random, and included only one obese participant. One of the reason for decrease in Sit and reach test with increased BMI could be that, obesity is usually related to decrease in physical activity. A decrease in physical activity leads to decrease in flexibility, and hence the decrease value for sit and reach test.Also, there are many other factors that can result to change the biomechanical measures which are not necessarily related to increased or decreased BMI such as improper footwear, ligament laxity and also environment.

CONCLUSION

From the above study it was concluded that there was no significant correlation between biomechanical measures and BMI in school going children.

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