ABSTRACT

One of the most serious public health challenges of the 21st century is obesity. Obesity or overweight is the condition in which the body stores excess amount of body fat/adipose tissue. Over the past few years, the prevalence of overweight and obesity has increased considerably across the globe. Recent scientific literature indicates that obese children (BMI $\geq$95th percentile) have increased tendency to become overweight adults and hence possess a greater positive predictive value than overweight children (BMI $\geq$85th percentile but $<$ 95th percentile). Adolescence is a period of heightened concern regarding obesity. The incidence of obesity increases during this period and tends to persist into adulthood. Furthermore, the overweight and obese children are more likely to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age. Obese children and adolescents suffer from both short-term and long-term health consequences. Furthermore, scientific evidence indicates that obese children suffer from low self-esteem and achieve poor academic scores and score less on physical fitness tests as compared to their normal weight counterparts.

The purpose of the present study was to analyse the effect of obesity on self-esteem, academic and physical performance variables in school going adolescents of Punjab. A total of 1069 school going adolescents (426 girls and 643 boys) aged 9-16 years participated in the study. These students were from grades 5th to 10th. From each grade and across various sections of the same grade/class, 170-175 participants were randomly selected (57-58 students per class per school). The students studied in three schools of Punjab namely, D.A.V. Public School, Amritsar (Majha region), Apeejay Senior Secondary School, Jalandhar (Doaba region) and General Gurnam Singh Public School, Sangrur (Malwa region). The subjects were divided into four groups depending upon their body mass index (BMI) percentiles into underweight (BMI $<$5th percentile), normal weight (BMI 5th to $<$85th percentile), overweight (BMI 85th to $<$95th percentile) and obese (BMI $\geq$95th percentile) categories (as per CDC guidelines). The age of the subjects was recorded from the date of birth registered in their school. The experimental protocol and potential risks of the study were explained to each subject both verbally and in writing before their informed consent was obtained. Furthermore, informed consent of
their parents was also obtained before the subject participated in the study. The study was approved by the local ethical committee.

Self-esteem (assessed by Self-esteem Inventory Questionnaire), Cardio-respiratory endurance (assessed by PACER test), muscular strength (assessed by curl-up and push-up tests), flexibility (assessed by classic sit and reach test), skinfold measurements (assessed to Harpendern skinfold calliper, to calculate percent body fat), waist circumference and academic performance were measured.

From the present study, it could be inferred that the prevalence of overweight and obesity amongst the school going adolescents of Punjab, aged between 9-16 years was 39% and 42% respectively (girls and boys considered together). It might be assumed that out of every 10 children, 4 were obese with almost equal number of children were overweight. In girls, the prevalence of overweight and obesity was 37% and 40% respectively and in boys, the prevalence of overweight and obesity was 38% and 41% respectively. Though the prevalence rates were similar for girls and boys, but the boys had greater fatness as compared to the girls.

**Aerobic capacity**

In boys, significant differences in the VO\(_2\)max were observed between all the weight categories, except between the underweight and normal weight boys. In girls, no significant inter-group differences in the aerobic capacity were observed in any of the weight categories. Significant inter-group differences (p<0.05-0.001) were observed between the various weight categories on PACER test in the boys and combined boys and girls group. Pearson product-moment correlation coefficients were computed to assess the relationship between BMI percentile and aerobic capacity. In the combined girls and boys group, there was a significant inverse correlation between aerobic capacity and BMI percentile (r =-0.231, p<0.001), percent body fat (r = -0.496, p<0.001) and waist circumference (r = -0.329, p<0.001), in the girls and boys combined group, for all the weight categories.

**Curl-up**

In boys, significant differences in the curl-up scores were observed between all the weight categories, except between the underweight and normal weight boys. In girls, significant differences in the curl-up scores were observed between all the weight
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categories, except between the underweight and normal weight girls. Significant inter-group differences (p<0.05-0.001) were observed between the various weight categories for curl-up test in the girls group, boys group and combined boys and girls group. Significantly negative correlations were observed between the BMI percentile and the curl-up scores (r = -0.275, p<0.001) in the girls and boys combined group, for all the weight categories.

**Push-up**

In boys, significant differences in the push-up scores were observed between all the weight categories. In girls, significant differences in the push-up scores were observed between all the weight categories, except between the underweight and normal weight girls. Significant inter-group differences (p<0.05-0.001) were observed between the various weight categories for push-up test in the girls group, boys group and combined boys and girls group. There was significantly negative correlation between the BMI percentile and the push-up scores (r = -0.347, p<0.001) in the girls and boys combined group, for all the weight categories.

**Flexibility**

When between-group differences were investigated, no significant effect of body weight was observed on flexibility in boys as well as in girls, implying that body weight had no significant effect on an individual’s flexibility. There was no significant correlation (p>0.05) between the BMI percentile and the flexibility in the girls and boys combined group, for all the weight categories.

**Waist circumference**

When between-group differences were investigated, significant (p<0.001) effect of body weight was observed on the waist circumference in boys as well as in girls. There was significant positive correlation between the BMI percentile and waist circumference (r = -0.712, p<0.001) in the girls and boys combined group, for all the weight categories.

**Academic performance**

In boys, significant difference in the academic performance scores was observed only between underweight and overweight category. In girls, significant difference in the academic scores was observed only between the overweight and normal weight girls. When between-group differences were investigated, statistically no significant effect of
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Body weight was observed on the academic scores in boys and in girls, implying that body weight had no significant effect on an individual’s academic performance. No correlation was observed between the BMI percentile and the academic performance in the girls and boys combined group, for all the weight categories.

Self-esteem

In boys, no significant differences in the self-esteem score were observed between any of the weight categories. In girls, significant differences were observed only between the underweight and obese girls, normal weight and obese girls and overweight and obese girls. There was no correlation between the BMI percentile and the self-esteem in the girls and boys combined group.