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Original Research Article

Functional Capacity and Quality of Life in Overweight and Obese Children Aged 13-18 Years

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ABSTRACT

Objective: Obesity has been a rising alarm in children and adolescents from few decades, concerning the day to day life of children. We focused on investigating the relation of functional capacity and quality of life in overweight and obese children and comparing it with normal weight children.
Methods: A methodological study was done, using the individuals studying in school aged between 13-18 years from two schools of South Delhi, one Government and one Private. By using Khadikhar's classification of BMI for Indian adolescents we categorized the individuals into three groups- Normal weight (NW), Overweight (OW) and Obese (Ob). The normal weight was between ≥18 - <23kg/mt^2, overweight was between ≥23 - <28kg/mt^{2}and obesity was ≥28kg/mt^2. Functional capacity was assessed from 6MWD using 6MWT. Quality of life was measured under four dimensions - physical functioning, emotional functioning, and social functioning and school functioning. Blood pressure (B.P.) and Heart rate (H.R.) of overweight and obese group were compared with normal weight group. One way ANOVA was used for between the group analyses and then Tukey's post hoc test was done.
Results: A significant difference was found in 6MWD as well as in physical component of PedsQL between the three groups. A significant difference was found in pre and post reading of systolic blood pressure and in heart rate in all the three groups.
Conclusion: In the present study we found that increased BMI had a significant effect on 6MWD in OW. In case of quality of life, we found that NW, OW and Ob all three of them shared an equal level of quality of life. Blood pressure and heart rate had a significant effect on all the three groups.

Keywords: Overweight, quality of life, obesity, functional capacity.

INTRODUCTION

Over the last few decades, children have become taller worldwide as well as heavier in some countries. [1] The obesity is not only affecting developed countries but developing countries as well. The prevalence of childhood obesity has tripled in last few decades in developed countries. In 2013, 23·8% (22·9-24·7) of boys and 22·6% (21.7-23.6) of girls were found OW or Ob in developed countries. In developing countries prevalence has increased from 8·1% (7·7-8·6) to 12·9% (12·3-13·5) in 2013 for boys and from 8·4% (8·1-8·8) to 13·4% (13·0-13·9) in girls. In India prevalence for overweight and obesity in 2013 for boys was5·3 (4·3-6·4) and 2·3% (1·8-2·8), and in girls was 5·2% (4·2-6·4) and 2·5% (1·9-3·1). [2] In Delhi in age group of 5-18years it was 16.75% and 5.59% in boys and 19.01% and 5.03% respectively in girls in 2006. [1] Increasing evidence which shows that obesity is associated with serious health complication and an increased risk of

premature illness the perception of heavy child a healthy child has been changed. [3] Many of the outcomes associated with obesity that was previously thought of as diseases adults are now affecting children as well. Outcomes related to childhood obesity include hypertension, type 2 diabetes mellitus, dyslipidemia, left ventricular hypertrophy, nonalcoholic steatohepatitis, obstructive sleep apnea, and orthopedic problems, as well as social and psychological problems. [4] The body mass index (weight/height^2) is widely used in adult populations, and a cutoff point of 30 kg/m^2 is recognized internationally as a definition of adult obesity. [5] and ≥28 kg/m^2 for Indian adolescents.

HRQOL, by World Health Organization is defined as a subset of QOL related to individual's health which includes physical, mental and social well being. [6] Overweight children as young as 5 years of age reported to have a negative self-image, whereas, on the other hand obese adolescents had reduced self-esteem along with sadness, and loneliness. The PedsQL is a short survey instrument assessing physical, emotional, social, and school functioning, it is found to be a reliable tool to assess quality of life. [7] A decrease in physical activity and sedentary lifestyle are regarded as the most important factors contributing to the development of childhood obesity. [6] Demand for clinical assessment tools to evaluate physical capacity has been increasing and 6MWT was found to be a safe, simple and inexpensive test to use in clinical settings. As the prevalence of overweight and obesity in adolescents is increasing, it might affect the life of adolescents and risk factors associated with it might also increase. Therefore, the present study aimed to find out 1) the relation between functional capacity and health related quality of life in children aged 13-18 years and 2) pre and post vitals of functional capacity in all the three groups.

MATERIALS AND METHODS

Study design

A methodological study has been done including subjects from both genders. Subjects were selected by convenient sampling from different schools of South Delhi.

Sample

A total of 154 subjects were included between 13-18 years of age. Subjects were included after taking history and checking the medical records for any diagnosed developmental disorder, any orthopedic limitation or any diagnosed metabolic or neurological conditions.

The study was approved by the institutional research and ethics committee of Indian Spinal Injury Centre (ISIC). Aprior permission for the study was taken from school authority as well as from parents of the subjects.

Procedure

Minimum of 154 children aged between 13 to 18 years were included according to inclusion and exclusion criteria. Each subject was assessed after obtaining informed consent. All the subject has been assessed for, functional capacity and quality of life.

Instrumentation

BMI

In the subjects were assessed for BMI by calculating the height and weight. Height was measured by using a stadiometer with the subject standing straight without shoes. Weight was measured by using a weighing machine (Krups). After BMI calculation subjects were divided into three groups- normal weight, overweight and obese by using Khadilkar's classification. [8]

6MWT

6 MWT was performed on a 30 meter long corridor according to American Thoracic Society Guidelines (ATS 2002). [9] Baseline and post test blood pressure (BP) was recorded using automated blood pressure device (Omron) after 5 minutes of rest using automated blood pressure device (Omron). Choice MMed pulse oxymeter was used to monitor heart rate (HR) and

oxygen saturation (SpO_2). Dyspnea and fatigue were recorded on Modified Borg scale. Subjects were asked to walk to and fro in the assigned area for 6 minutes. Number of laps was counted and 6MWD was calculated.

HRQOL

The PedsQL is a survey instrument for the assessment of physical, emotional, social, and school functioning. [10] PedsQL is a modular instrument consists of a self report format. It is a 23 item scale, consisting four components- physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). The scoring is done by calculating Psychosocial Health Summary Score which is the sum of the items in the Emotional, Social, and School Functioning Scales, Physical Health Summary Score which is Physical Functioning Scale Score and Total Score i.e. sum of all the items in the scale. [10]

Data analysis

Data analysis was done using SPSS Statistics 16.0. For between the group analyses One Way ANOVA (Analysis of variance) was done and after that Post Hoc Tukey's test was used.

RESULT

In the study a total number of 154 individuals aged between 13-18years with mean age of being 15.5±1.87 were included. By Khadilkar's classification of BMI[5] for adolescents samples were divided into three groups (*Table 1*).

Group 1- Normal (≥18-<23 kg/mt^2)
Group 2- Overweight (≥23- <28 kg/mt^2)
Group 3- Obese (≥28 kg/mt^2)

Table 1: details of all the three groups

	Normal (≥18-<23 kg/mt2)	Overweight (≥23- <28 kg/mt2)	Obese (≥28 kg/mt2)
No. of males	37	31	8
No. of females	39	30	9
Age	14.1±1.54	16.3±1.7	16.6±1.22
BMI	20.88±1.23	24.8±1.2	31.6±3.05

Table 2: Comparison of all three groups

Variables	Normal	Overweight	Obese	Values		Post Hoc		
				F	p	N/OW	N/Ob	OW/Ob
6MWD	513.42±79.30	490.46±55.39	464.12±52.52	4.41	.014*	.125	.021*	.338
Physical	89.25±9.70	85.91±12.50	82.14±14.98	3.22	.043*	.214	.047*	.460
Psychosocial	82.84±11.36	78.89±10.76	79.10±10.52	2.40	.093	.097	.420	.997
Total	85.21±9.28	81.75±9.52	80.30±11.47	3.11	.047	.095	.142	.847
Pre Systolic	114.76±7.40	123.89±9.40	127.24±7.94	14.15	.000*	.000*	.000*	.309
Post Systolic	123.79±8.14	128.75±18.15	132.76±6.34	4.53	.012*	.070	.029*	.499
Pre Diastolic	77.61±3.79	77.93±8.62	78.82±8.04	.23	.791	.958	.775	.876
Post Diastolic	79.21±4.87	80.39±7.38	80.05±6.72	.63	.52	.508	.866	.979
Pre HR	87.65±12.55	86.44±16.97	92.05±13.99	.98	.377	.882	.500	.343
Post HR	100.95±16.38	109.87±22.04	117.71±19.57	7.03	.001*	.020*	.004*	.298
Post Dyspnea	.57±1.09	1.24±1.61	2.29±1.96	11.09	.000*	.020*	.000*	.023*
Post Fatigue	.31±.89	81±1.44	1.17±1.38	5.14	.007	.041*	.022*	.523
Pre SpO2	977.92±.70	97.77±1.14	97.88±.48	.490	.61	.589	986	.891
Post SpO2	98.03±.59	97.75±.96	97.88±.78	2.27	.106	.088	.734	.821

*Significantly different, 6MWD – 6 minute walk distance

A significant difference was found in 6MWD between the three groups and after post hoc analysis significant difference was found in NW with Ob. In physical component of PedsQL we found a significant difference in all the three groups and post hoc showed a significant difference in NW with Ob (Table 6). As there was smaller sample size in Ob population (N=17) we did not found a significant difference in BMI and 6MWD and between BMI and PedsQL. Baseline SBP was found to be significantly different in all three groups and after host hoc analysis significant difference was found in NW with OW and NW with Ob. SBP measured after 6MWT was found to be significantly different in all three groups and post hoc showed a significant difference in NW with Ob. HR measured after 6MWT was found to

be significantly different in the three groups. Post hoc showed a significant difference in NW with OW and NW with Ob. Dyspnea measured after 6MWT showed a significant difference in all three groups and post hoc showed a significant difference in NW with OW, NW with Ob and OW with Ob. Fatigue measured after 6MWT was found to be significantly different after post hoc analysis in NW with OW and NW with Ob.

DISCUSSION

In the present study we found that there was a significant difference between BMI and 6MWD in the three groups (p=0.014) and after post hoc analysis significant difference was found between normal and obese (p=0.021) (Table 2). In our study Ob individuals covered shorter distance than the normal weight. A similar study by Mariana [11] showed a similar result. Morinderet al, [12] found that 6MWT performances were 26% worse in obese subjects when compared with normal weight subjects.

Obesity is related to sedentary lifestyle, which effects the performance, and increase the fat mass relative to muscle mass per unit of weight. Obese group walked a shorter distance than normal weight because of extra load, weak musculature, and sedentary lifestyle and reduced glycolytic capacity. Mariana et al and Morinder et al explain that shorter distance in obese children could be lower values of relative VO_2max. [11,12]

The physical score of PedsQL was found to be significantly different between the three groups (p=0.043) and post hoc showed a significant difference between normal and obese group (p=0.047) (Table 2). Psychosocial and total score of PedsQL showed a non significant difference (p=2.40 and 3.11) and after post hoc analysis there was no significant difference in between all the three groups. In a similar study by Navidet al [13] on physical function subscale average differences of normal weight with obesity, normal weight with overweight, obesity with overweight was found significant and Swallen [14] et al study where they found a negative relation between BMI and physical quality of life.

By increase in BMI, the physical quality of life would decrease; however, relationship with psychosocial aspects of quality of life was not significant. In the under developed countries compared to developing countries obesity and overweight are not regarded as a bad state and even in many cases, individual's overweight is signified as a sign of healthiness. Therefore, in the present study, lack of difference in psychological aspects of the Health-Related QOL can be because of the mentioned reasons. [13]

Baseline and after test systolic blood pressure in 6MWT, there was a significant difference (p=0.000) found between the groups and after post hoc analysis significant difference (p=0.000) was found in overweight and normal with obese group, and no significant difference was found between overweight and obese group (Table 6). Rajalakshmi Ret al [15] found that BP response to physical exertion in adolescents is influenced by OW and Ob, where there was an increase systolic arterial pressure (SAP) at maximal overload in OW and Ob.

In the present study no difference was found in baseline and after 6MWT diastolic reading which is supported by the study, where in a treadmill exercise test no significant difference was present in diastolic arterial pressure between genders, and a high systolic arterial pressure was found. [4,1]

Certain mechanism was proposed to explain effect of overweight and obesity on blood pressure in children including-activation of sympathetic nervous system, insulin resistance and vascular dysfunction. [16]

High levels of sympathetic activity and low level of parasympathetic activity have been associated with obesity and hypertension. [17,18] Dose-response increase in sympathetic outflow was found in a high fat diet in animals which was not possible in human so, peroneal nerve sympathetic

activity was measured in obese which showed an increased burst frequency, indicating increased sympathetic activity. [17] The increased sympathetic activity is reduced substantially with weight loss, which coincides with a drop a blood pressure. The coordinated appearance of insulin resistance and high blood pressure in obese individuals and the observation that lean hypertensive individuals exhibit some degree of insulin resistance, led several authors to hypothesize that insulin resistance or hyperinsulinemia is a major determinant of increased systemic vascular resistance in obese individuals. Like adults, obese children also appear to be characterized by adverse changes in vascular health, which may also contribute to the propensity for high blood pressure. Ultrasound imaging of the carotid artery revealed that severely obese (BMI ~34 kg/m2) children display arterial stiffness and increased diastolic wall stress, compared with age and gender matched lean children. Carotid artery stiffness and carotid intima media thickness, are both significantly elevated in overweight children and negatively correlated with several measures of adiposity. [18]

In our study there was a significant difference (p=0.001) found in post 6MWT heart rate value in all the three groups. The post hoc analysis showed significant difference between normal and overweight (p=0.020) and normal and obese (0.004) (Table 6). The heart rate (HR) increases due to withdrawal of parasympathetic activity, while a further increment in HR is mediated by the sympathetic drive. [19] A study showed a statistically significant increase in HR in obese compared to non obese males. It was because of activation of sympathetic nervous system, which occurs early in the course of obesity. HR increases with increase in percentage of body fat. A 10% increase in body weight is associated with a decline in parasympathetic tone accompanied by increase in HR and conversely HR decreases with weight reduction. [20]

Present study showed a significant difference in after test dyspnea and fatigue values of 6MWT (Table 6). Baseline values were not taken into consideration as the baseline values were zero. A study by Mendelsonet al [21] was done which showed that obese participants attained lowered distance in 6MWT than healthy weight adolescents and exertional breathless was greater in obese participants.

We found that functional capacity is affected in obese children and adolescents. Along with that there was a significant difference in the baseline systolic blood pressure in overweight and obese population when compared to normal individuals, which can be used as a predictor of coronary artery disease or metabolic syndrome.

CONCLUSION

The present study concluded that 6MWD is positively affected by BMI especially in Ob individuals and physical functioning is also affected by BMI in Ob individuals. As there is a marked difference in baseline SBP in 6MWT in both overweight and obese individuals, one can suspect the physiological changes in them indicating a risk for coronary heart disease or metabolic syndrome.

ABBREVIATIONS: 6MWD, 6 minute walk distance; 6MWT 6 minute walk test; DBP, diastolic blood pressure; HRQOL, health related quality of life; PedsQL, Pediatric Quality of Life Inventory.

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