How to Cite:
Shrivatsava, K., Sushma, B. J., & Lalwani, R. (2022). Assessment of liver function tests and bioelectrical impedence body fat analysis in obese adolescents. *International Journal of Health Sciences*, *6*(S3), 1777–1782. https://doi.org/10.53730/ijhs.v6nS3.5779

Assessment of liver function tests and bioelectrical impedence body fat analysis in obese adolescents

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***Abstract*---**The worldwide prevalence of obesity among children and adolescents has increased dramatically in the past four decades. The consequences of pediatric obesity are evident as it is associated with both impaired metabolic health psychosocial boundaries, and premature mortality. The objectives of the study include a) To estimate the prevalence of overweight and obesity among adolescents, b) To estimate liver function tests among adolescents and c) To compare liver function tests (total bilirubin, AST, ALT, ALP, GGT, total protein and albumin) in obese and normal adolescents. At baseline, pre-designed questionnaire was used to note down the demographic characteristics age, gender, residential address, telephone number and time spent in physical activity in hours. Anthropometric measurements included body weight, height, mid upper arm circumference. In the present study, we included 100 Adolescents aged between 13-17 years, the prevalence of overweight and obesity were estimated. We found that the prevalence of overweight and obesity (based on BMI) among adolescents were 16% and 8% respectively. We also evaluated liver function tests in these subjects, we found significantly elevated ALT, ALP and GGT in obese adolescents as compared non-obese adolescents. Conclusion: Changes in liver function are probably common in overweight kids. It's important for parents to know that even if liver enzyme levels are modestly elevated in their overweight kids, it is most likely related to the children being overweight. If the children will lose weight and repeat the liver function tests, they will usually normalize.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
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Manuscript submitted: 18 Nov 2021, Manuscript revised: 09 Feb 2022, Accepted for publication: 27 March 2022

***Keywords*---**obesity, over-weight, technology, physical inactivity, unhealthy diet, adolescents.

Introduction

The worldwide prevalence of obesity among children and adolescents has increased dramatically in the past four decades. The consequences of pediatric obesity are evident as it is associated with both impaired metabolic health psychosocial boundaries, and premature mortality. The biochemical tests that reflect liver cell damage or synthetic and excretion function are the main indicators of liver status and functions. These tests include liver enzymes: Alanine amino transaminase (ALT), aspartate amino transaminase (AST), alkaline phosphatase (ALK) and gamma glutamyl transpeptidase (GTT). The other important tests are serum bilirubin, albumin and international normalized ratio (INR).[1-4] In clinical practice, these tests or parameters are used to guide the management of liver diseases. Uncommonly, abnormalities of liver enzymes are found in asymptomatic healthy individuals. In obese subjects, the liver function tests (LFT) derangements have been noticed to be more frequent than in non-obese ones due to the high prevalence of non-alcoholic fatty liver disease (NALFD) and its consequences. Numerous studies have shown higher prevalence of liver function derangements and high prevalence of liver damage as well in morbidly obese patients.[4-8]

The four serum enzymes that are generally used in assessing liver functions are alanine and aspartate aminotransferase (ALT, AST), alkaline phosphatase (ALP) and γ-glutamyltransferase (GGT). Serum ALT is considered an important biomarker for hepatic dysfunction and is found mainly in this organ, while serum GGT is present in most cell surfaces and shows a high activity in the kidney and liver. Previously, some studies have been carried out to evaluate the relationship of ALT and GGT with obesity. A positive correlation was found for abdominal obesity with ALT and GGT in previous studies. Most of the earlier studies examined the associations considering a less number of liver enzymes and reported inconsistent results. Up to now, a few number of studies evaluated the relationship of the maximum number of hepatic enzymes level with both abdominal and general obesity in the general adult population. Hence we have taken up this study to prevalence of obesity and estimate liver function tests in obese adolescents in our population.[8-12]

Objectives of the study

The objectives of the study include a) To estimate the prevalence of overweight and obesity among adolescents, b) To estimate liver function tests among adolescents and c) To compare liver function tests (total bilirubin, AST, ALT, ALP, GGT, total protein and albumin) in obese and normal adolescents.

Materials and Methods

A written informed consent was obtained from each participant and their parents. The study protocol was approved Institutional Ethical Committee. In this cross-sectional study, we included 100 high school students of 13-17 years' age studying in Private School in Bhilai, Chhattisgarh. At baseline, pre-designed questionnaire was used to note down the demographic characteristics age, gender, residential address, telephone number and time spent in physical activity in hours. Anthropometric measurements included body weight, height, mid upper arm circumference. Measurements were recorded by the Investigator using standardized procedures [Jelliff, 1966]. Body weight was measured to the nearest to 100g with minimal clothing and without shoes, using portable personal weighing balance. Height was measured to the nearest cm with subject in the full standing position without shoes using stature meter. Mid-upper arm circumference was taken at biceps using non-stretchable measuring tape. BMI-for-age and sex appropriate z-score classification was used as indicator to classify underweight, normal weight, overweight and obesity.[1-4]

Body fat analysis was carried out using bioelectrical impedance technique which is based on the principle that electric current flows at different rates through the body depending upon its composition. The body is composed mostly of water with ions, through which an electric current can flow. On the other hand, the body also contains non-conducting materials (body fat) that provide resistance to the flow of electric current. Adipose tissue is significantly less conductive than muscle or bone. The principal of BIA is that electric current passes through the body at a differential rate depending on body composition. Hence, there is a direct relationship between the concentrations of ions and the electrical conductivity and an indirect relationship exists between the ion concentration and the resistance of the solution. The procedure is as follows: a. Participant stands on the machine barefoot b. low-grade current enters body c. impedance to current offered by tissue is measured d. impedance offered depends on the moisture content of the tissue e. difference in impedance is translated into percentage of tissue in body.[5-12] 2mL random blood sample was taken from all the participants in red stoppered tube and was subjected to centrifugation to separate the serum. Serum was used for the estimation of liver function test parameters by spectrophotometric method using automated biochemistry analyser EM200.

Statistical analysis

The collected data were analysed using IBM SPSS Statistics 19 version. The prevalence of underweight, overweight and obesity was calculated under each gender and age. Frequency distribution and Percentages were computed. Mean and Standard deviation was also calculated for television viewing time, sleeping time and time spent on physical activities. Group comparisons were performed using t-Test, ANOVA test and Chi-square test as appropriate.

Results

In our study, we included a total of 100 adolescents aged between 13-17 years. Body mass index (BMI) was calculated. We divided the students into 3 groups depending on their BMI.

Table 1: Shows Distribution Body Mass Index (kg/m^2) among the Adolescents

BMI	No of Students	Percentage
Group 1 <18.5 kg/m^2	38	38 %
Group 2 18.5 - 24.9 kg/m^2	40	40 %
Group 3 >25 kg/m^2	24	24 %

Table 2: Distribution of Students with Body Mass Index (kg/m^2) >25 kg/m^2

BMI	No of Students	Percentage
25-30 kg/m^2 (over weight)	16	16 %
>30 kg/m^2	08	8 %

Table 3: Shows Comparison of Duration of Exercise and Body Fat among the Adolescents based on BMI

BMI	Duration of Exercise (in hours)	Body Fat Analysis
Group 1 <18.5 kg/m^2	2.00	14.37
Group 2 18.5 - 24.9 kg/m^2	1.82	22.63
Group 3 >25 kg/m^2	1.41	27.79

Table 4: Shows Comparison of liver function tests among Adolescents based on BMI

Liver function test parameters	Group 2 18.5-24.9 kg/m^2	Group 3 >25 kg/m^2	P value
Total bilirubin (mg/dL)	1.2 ± 0.9	1.3 ± 0.9	NS
AST (U/L)	23.1 ± 9.9	24.2 ± 10.2	NS
ALT (U/L)	28.9 ± 17.4	34.6 ± 18.42	S
ALP (U/L)	74.2 ± 28.6	85 ± 32.4	S
GGT (U/L)	26.2 ± 17.67	34.9 ± 18.2	S
Total protein (g/dL)	7.2 ± 0.8	7.3 ± 0.9	NS
Albumin (g/L)	4.3 ± 0.3	4.4 ± 0.2	NS

Discussion

In the present study, we included 100 Adolescents aged between 13-17 years, the prevalence of overweight and obesity were estimated. We found that the prevalence of overweight and obesity (based on BMI) among adolescents were 16% and 8% respectively. Our study results are consistent with previous studies conducted by various authors of Delhi[13], Ludiana[14-16] and Udiapur[14-17]. The studies on determinants of Adolescent obesity clearly stated that more hours of TV viewing, lack of sleeping time, physical inactivity, high socioeconomic status and dietary transitions were major lifestyle factors causing overweight and obesity among adolescents. BMI is positively correlated with body fat, as evidenced in our study that, those who had increased BMI had increased body fat as compared to those with BMI less than 18.5 kg/m^2.

A significant correlation has been reported between increased ALT and WC in Korean adults. Among Australian adults, BMI and WC were found to be strongly associated with GGT and ALT. In that study, the increased risk of ALT was about seven times higher among individuals in the obese group, whereas, it was only two times higher among individuals with heavy or moderate alcohol consumption. Moreover, no interactive effects were found between BMI or WC and alcohol consumption on serum ALT and GGT concentrations. Alcohol consumption may also cause hepatic injury and abnormalities in hepatic enzymes concentrations. It is important to mention that consumption of alcoholic drinks is not very usual among the Bangladeshi population except in rare cases due to religious restrictions. Thus, there is less chance to have an effect of alcohol consumption on liver enzyme concentration in Bangladeshi adults. In the Australian population, liver injury is commonly associated with obesity than excessive alcohol use. A study conducted by Stranges et al. supports the role of central adiposity independent from BMI in predicting elevated levels of liver enzymes especially ALT and GGT. In another study, ALT, AST and GGT levels were found to be higher in obese individuals but these liver enzymes did not show any significant correlation with obesity. These inconsistent findings may reflect the differences of population groups between the studies.[14-17]

Conclusion

Obesity is associated with elevated biochemical markers of liver damage. These findings emphasize the need for prevention and treatment of overweight and obesity in children and adolescents. As a result of this increased prevalence of obesity, a multitude of chronic illnesses and risk factors for adult disease are now starting in childhood rather than in adulthood," further obesity is associated not only with liver problems, but with gall bladder disease, type 2 diabetes, high blood pressure, and orthopaedic problems.
"Changes in liver function are probably common in overweight kids. It's important for parents to know that even if liver enzyme levels are modestly elevated in their overweight kids, it is most likely related to the children being overweight. If the children will lose weight and repeat the liver function tests, they will usually normalize." "Our changing lifestyle, high-fat and fast foods, and developing computer-based technology with increased reliance on the Internet will most likely keep this childhood epidemic around for a long time,".

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