Title: Does the Childhood Obesity Require Special Attention? A Cross-Sectional Pilot Study

Authors: Sushanta Bhanja[1,*], Satabdi Mitra[2], Jiban Krishna De[3]

1. *Department of Pediatrics, Jagannath Gupta Institute of Medical Sciences, Kolkata, West Bengal, India.*
2. *Department of Community Medicine, Jagannath Gupta Institute of Medical Sciences, Kolkata, West Bengal, India.*
3. *Department of Radiology, Jagannath Gupta Institute of Medical Sciences, Kolkata, West Bengal, India.*

***Corresponding Author:** Sushanta Bhanja**,** Department of Pediatrics, Jagannath Gupta Institute of Medical Sciences, Kolkata, West Bengal, India. Email: drsushantabhanja@gmail.com

To appear in: **Journal of Pediatrics Review**

Received date: 2022/02/10

Revised date: 2022/05/09

Accepted date: 2023/01/21

Please cite this article as:

Bhanja S, Mitra S, Krishna De J. Does the Childhood Obesity Require Special Attention? A Cross-Sectional Pilot Study. Journal of Pediatrics Review. Forthcoming 2023.

Abstract:

Background: childhood overweight and obesity once was a disease of affluent countries now being a burning issue of developing countries too. As it is a lifestyle disease, it increases manifold chances of development of different non-communicable diseases in adult life.

Objective: The study was conducted to assess the effects of different determinants of childhood obesity. **Methods:** a cross-sectional study was conducted for six months among seventy-five pediatrics out-patient attendees aged 5-18 years of a teaching hospital of west Bengal. Socio-demographic characteristics including physical activity levels were taken with questionnaire, anthropometric measurements, laboratory investigations and carotid intima-medial thickness (CIMT) was measured with B-mode USG. Data were analyzed with SPSS, Epi Info and WHO Anthro plus software.

Result: statistically significant association of childhood overweight and obesity was found to have with exclusive breast feeding, high lipid profile & blood sugar, physical inactivity, high LFT & CIMT values. **Conclusion:** alarming increase of childhood overweight and obesity indicates towards need of more comprehensive preventive interventions to avoid pandemic of this impending non-communicable disease.

Key words: Childhood obesity, Carotid intima-medial thickness, Developing countries, Cross-sectional study, Physical inactivity

Introduction

World Health Organization (WHO) defines overweight and obesity as: 'abnormal or excessive fat accumulation in fatty tissues (adipose tissue mass) that may impair health'.[1] Overweight and obesity is measured by body mass index (BMI) which is calculated by body weight (kg.) divided by height squared (m^2).[2] Once upon a time, overweight and obesity were considered as a high-income country problem but currently it is 30% higher in low and middle-income countries compared to high-income ones.[3,8] These developing nations are residents of over 30 million overweight and obese children.[4] Obesity, itself a budding disease besides being a risk factor of a number of non-communicable diseases (NCD). Childhood obesity is associated with numerous health problems like as, asthma, early onset type 2 diabetes, and cardiovascular diseases.5 Obese children are more likely to suffer from mental health and behavioral problems and may have long-term health consequences, as childhood obesity is a strong predictor of adult obesity, premature death and disability in adulthood.6

According to the National Health and Nutrition Examination Survey 2015-16, worldwide prevalence of obesity among adolescents was 20.6%, among school-aged children 18.4% and 13.9% among preschool-age children.7

As a by-product of growth and development, different NCDs with their risk factors are engulfing the developing nations too and India is being grasped fast. Physical inactivity, preferences towards social media and virtual gaming, lifestyle change specially changes in dietary habits in form of increased consumption of canned/dried processed and junk foods, sweetened beverages, processed dairy products, savory snacks are main driving forces behind it. Besides these, there are uncontrolled eating, binge eating, continued consumption of high calorie foods despite the knowledge of its negative consequences and inability to cut down despite the desire to do so.[8] Most eating disorders begin in childhood and adolescence. Night eating syndrome is another disorder that can lead to significant weight gain among children. These all lifestyle factors develop at individual as well as family level and as the eating behavior among children is hugely contributed by peers, community has a contagious role behind adoption of unhealthy habits.[9] According to the World Health Organization exclusive breastfeeding can protect the children against childhood obesity. Studies conducted in other countries have shown an association between these two.[10-12]

Carotid intima-media thickness (CIMT) measurement can be used as a predictor of increased risk of future development of cardiovascular diseases, obesity, hypertension, chronic kidney disease compared to general population.[13, 14, 15]

A systematic review conducted by Ranjani et al. (2012) reported that prevalence of overweight among 5 to 19 years children, ranged between 6.1 and 25.2% while that of obesity between 3.6 to 11.7% which is enough alarming.[16] A systematic review and Meta analysis from Bangladesh showed similar findings.[17] There are sporadic studies conducted in different parts of the country addressing childhood obesity but uniformity was not found among them in aspects like, age group as study population, methods of assessment etc. Over and above all, neither any national level data are available on prevalence of

childhood obesity nor has any health programme started rolling on yet addressing it. On extensive literature search, no data have been found on current status of this burning issue at district level as well as predictive potential of CIMT in country level also.

With this backdrop, the researchers planned to conduct a pilot study to assess prevalence of different risk variables of childhood obesity and effects of its determinants in a semi-urban area growing fast and hence adopting good and evils of urbanization.

Materials and Methods

A descriptive observational study with cross-sectional design was conducted from February to July, 2020 among children aged 5-18 years attending out-patient department of Paediatrics of a remotely located medical college situated in south 24 parganas district of West Bengal. The children suffering from any kind of long standing physical and/or mental disabilities were not included in study. As the prevalence of childhood overweight in west Bengal was found to be 22.57%, taking the allowable error to 10%, the sample size was calculated as 68. Assuming non-response rate to be 10%, the calculated and rounded off sample size was 75. With a pre-designed, pre-tested questionnaire the data were collected on basic demographic characteristics like as, age in completed years, gender, caste, religion, educational qualification of both the parents in terms of last examination passed, occupation of both the parents, per capita monthly income and from there socio-economic status was calculated using B.G. Prasad's SES scale. Weight of the children at birth and vaccination status was taken, if available. Physical Activity Questionnaire for older Children (PAQ-C) and for Adolescents (PAQ-A)[18] were used to assess the physical activity level (PAL) of the participants in preceding one week of data collection. The participants were undergone with complete blood count, lipid profile, liver function tests. With the help of stadiometer, standing height was recorded and calibrated weighing machine was used for taking weight in kgs. All CIMT measurements were done with high resolution B-mode Ultrasonography. Three measurements were taken and average of these three was used for final analysis of CIMT. The questionnaire was undergone with content validity testing by subject matter experts from Department of Paediatrics, General Medicine, Radiodiagnosis and Community Medicine of the study setting among those who did not have any involvement in the study itself. For the language validation, two forward and two backward translations were done in parallel by two language experts, so that the meaning and contents of the items remained unaltered as well as sentences were grammatically correct. The questionnaire was pre-tested in the month of January, 2020 among 15 children from a health care setting situated in

same district thereby assumed to share similar characteristics. As per norm, these children and/or the findings were not included in the study proper.

As all the study participants were aged less than 18 years, assent was obtained from the guardian or responsible accompanying person. From the Institutional Ethics Committee, the ethical permission was taken before commencement of the study.

Data were entered in Microsoft Excel spread sheet. Analysis was done with the help of software SPSS 22.0 free version, Epi Info™ free version 7 and Micro Soft Excel. The anthropometric calculation (Body Mass Index-for-age-sex) was conducted using WHO Anthro plus software V.1.0.4. The dependent variable of the study was overweight/obesity which was based on the Body Mass Index (BMI) for the age-sex of the children. "Overweight" was defined as having a BMI-for-age between the 85th and 95th percentiles, and "Obesity" was defined as having the BMI-for-age at or above the 95thpercentile. Descriptive statistics were expressed by mean, SD and proportion. Relationship between socio-demographic factors to outcome was established by using inferential statistics like Chi- square tests and p value <0.05 was considered significant at 95% of confidence interval. Binary logistic regression was used to test for association of educational status of parents, socio-economic factors and different laboratory parameters. Internal consistency of Physical Activity Questionnaire for older Children (PAQ-C) and for Adolescents (PAQ-A) were showed by Cronbach's alpha. Association of Physical Activity Questionnaire for older Children (PAQ-C) and for Adolescents (PAQ-A) with influencing factors was done by non-parametric test like, Kruskal-Wallis ANOVA test.

Results

Childhood obesity is a multidimensional state evolving through non-linear interaction and combination of factors namely, parental education, socio-economic factors, exclusive breast feeding, different laboratory parameters, physical activity level and pattern, to proof experiential or empirical evidence. Among the total participants, majority was male, a bit more than 1/3rd was Hindu by faith and belief and nearly 1/5th were found to belonged general caste. Nearly 1/3rd of the mothers of the children were found never to attend school and this is 10% for fathers of the participants. Among the mothers, 24% were found to work outside the side and most of them are involved in unorganized sectors mainly as daily based labors. Majority of the fathers of the children under study were found to work, and involved in rickshaw pulling, daily labor, domestic servant, carpentry, mechanic/electrician and vendor etc. More

than fifty percents of the participants were from low socio-economic strata. More than 75% of the children were claimed to receive exclusive breast feeding [Table 1].

Regarding parental education as determinant, more childhood obesity was found among those borne to parents educated upto primary level and the difference to illiterate mothers was significant. Regarding occupation of the parents, majority of the homemaker mothers' children were overweight and obese. Out of 18 children who were not breastfed exclusively, 12 (66.7%) were overweight and obese but it was not found to be statistically significant [not displayed].

Physical activity level (PAL) among both the older children as well as adolescents was 21.87±9.11 (mean±SD). Only 17 (22.7%) had PAL above mean for the preceding seven days of data collection. Omnibus χ^2 at d.f. 3 shows significant p value with help of Epi info (version 7) in reference to non-obese. The table revealed that compared to the non-obese, those who were overweight and obese were 0.23 times (C.I. 0.11-0.46) more likely to had low physical activity levels. The difference was statistically significant in all ($p<0.05$) [Table 2].

In chi-square test, overweight and obesity was found to be more among male children, those belonged to low socio-economic status and low physical activity level and these were found to be statistically significant [Table 3].

Children who were found overweight and obese, on in-depth interviewing were found to have preferences for street foods, junk foods, sweet and sugar, intake of food in-between meals, beverages. Many of the parents of small children stated that they cannot keep sugar, milk powder, sweets etc. within reach of the children. One of the working mothers told "if I don't bring either of the street foods while coming back home, my adolescent boy creates huge mess evening beating his younger sister out of anger……"

Binary logistic regression revealed that, statistically significant association ($p<0.05$) of childhood overweight and obesity were observed by birth weight (AOR 1.45, 95% C.I. 1.34-11.64), exclusive breast feeding (AOR 3.12, 95% C.I. 2.75-12.42), high lipid profile (AOR 5.11, 95% C.I. 2.17-11.58), high liver function tests (AOR 3.40, 95% C.I. 1.49-12.86), high fasting blood sugar (AOR 5.02, 95% C.I. 1.34-16.56), low physical activity level (AOR 3.70, 95% C.I. 1.34-7.79) and high CIMT value (AOR 4.11, 95% C.I. 1.11-12.09); while male gender and high SES was not significant. The Hosmer and Lameshow test (x^2= 9.278, df=4, p=0.934) proved the regression model fit of the data well [Table 4].

In Kruskal-Wallis ANOVA test, PAL score for non-obese showed mean score 39.93, for overweight 36.38 and for obese children as 33.71 and these were significant for overweight (p=0.04) and obesity (p=0.002) [Fig.1].

Discussion

Childhood obesity is a recognized precursor for various non-communicable diseases and related complications increasing overall disease burden and out-of-pocket expenditure at its present level as well as during adulthood. Majority of the nutrition-related national health programmes are concentrated on undernutrition and people are still in belief of obesity as a sigh of good health especially for children.

The proportion of children found to be overweight and obese in the current study area, itself being a non-privileged one is quite worrisome. A study conducted in Rajasthan by Jain A et al. found nearly 40% of study children to have overweight and obesity,[9] a Telengana-based study revealed more than 2/3rd of the study participants to have weight far above the normal[19] and similar findings was obtained from a population-based study conducted in Pakistan.[20] These findings point towards burden childhood obesity in these developing nations too. Male preponderance of childhood overweight and obesity had similarities with a study conducted among primary school children in urban Nepal.[21] But study from Delhi by Kaur S,[22] in South Africa by Armstrong ME,[23] Song Y from China,[24] Ahmed J from Pakistan[25] showed female propensity of childhood obesity in their respective study areas. In contrast to the current study findings, parents with higher education, especially for mothers were not protective in studies from urban Nepal,[21] rural South India.[4] It can be presumed that among the study population higher education was responsible for awareness generation among parents. Mothers who were found as homemaker had more obese children in present study might be because of conventional belief of obesity as a marker of good health and proper child care. But these findings were not in accordance to different other studies.[21,22] The protective role of exclusive breast feeding against obesity as found in the current study has supportive evidences from NFHS-III. One of the most alarming finding in the current study being higher proportion of children from low SES to be overweight and obese was somewhat similar to the study from Rajasthan[9] but evidence from urban Nepal was different.[21] There are dubious findings regarding this matter from different parts of the world.[3,8]

Regarding the physical activity level and types, in accordance to the current study protective role was established by studies by Jain A,[9] Kumar et al.,[26] Goyal et al.,[27] Keerthan et al.[28] The pattern of physical activity level as found in present study for the previous one week was also supported by Goyal et al.[27] and also from a study conducted in North India in 2009. Study conducted in urban Nepal[21] however had no significant association in this regard in contrary to others including the current one supported also by mean rank on non-parametric statistical test. The CIMT measurement of the study was found to have supporting evidences from Baroncini LAV et al.,[13] Brady TM et al.[29] and Mehta A et al.[30] from Maharashtra, India. As in logistic regression findings of the current study considering effects of confounders, those showing significance in Univariate analysis except FBS and birth weight, being the researcher's choices, the findings were corroborative to that form Karki A,[21] Azagba et al.[31]

Conclusions

Childhood obesity is on rise and in momentum to be pandemic of 21st century. In the study area with semi-urban background the cross-section of population showed alarming evidence for it. Factors showing significant positive impact on it like as, exclusive breast feeding, lipid profile, blood sugar level, liver function tests, physical activity level, carotid intima media thickness all are modifiable risk factors and hence definite role of primordial and primary preventive measures can be taken for their control.

Limitations

the study was conducted on a pilot basis and hence population studied was less. Dietary history in details was not taken. A future prospective study preferably with mixed-methods approach with non-participant observation for especially dietary and lifestyle factors to explore in-depth and follow-up of CIMT for development of non-communicable diseases and providing interventions accordingly is recommended.

References:

1. WHO (2014), Obesity and overweight, Fact sheet No. 311, May 2014
2. Park K. Park's Textbook of Preventive and Social Medicine. 23rd edition. Jabalpur (M.P.), India: Banarasidas Bhanot; 397.
3. Arteaga SS et al. Childhood obesity research at the NIH: Efforts, gaps, and opportunities. TBM; 962-7.
4. Jagadesan S et al. Prevalence of Overweight and Obesity among School Children and Adolescents in Chennai. Indian Pediatrics. 2014. July: 544-9.
5. Chakraborty P, Dey S, Pal R et al. Obesity in Kolkata children: Magnitude in relationship to hypertension. J Natural Sci Bio Med. 2012;2: 101-6.
6. Shah B, Anand K, Joshi P et al. Report of the Surveillance of Risk Factors of Non-communicable Diseases (STEPS 1 and 2) From Five Centers in India – WHO India – ICMR initiative. New Delhi: http://www.whoindia.org/LinkFiles/NCD_Surveillance_NCD_RF_surveillance_report.pdf.2004.
7. National Health and Nutrition Examination Survey 2015-2016. Centres for Disease Control and Prevention.
8. Reddy S, Resnicow K, James S, et al. Underweight, overweight and obesity among South African adolescents: results of the 2002 National Youth Risk Behaviour Survey. Public health nutrition. 2008;12(2):203–7.
9. Jain A, Jain A, JP Pankaj et al. The study of obesity among children aged 5-18 years in Jaipur, Rajasthan. Muller Journal of Medical Sciences and Research. 2016. Jul - Dec (7) 123-30.
10. World Health Organization (2012) Population-based approaches to childhood obesity prevention. World Health Org.
11. Agho KE, Dibley MJ, Odiase JI, Ogbonmwan SM (2011) Determinants of exclusive breastfeeding in Nigeria. BMC Pregnancy Childbirth 11: 2.
12. Tan KL (2011) Factors associated with exclusive breastfeeding among infants under six months of age in peninsular Malaysia. Int Breastfeed J 6: 2.
13. Baroncini LAV, Sylvertre LDC, Filho RP. Assessment of Intima-Media Thickness in Healthy Children Aged 1 to 15 Years. Arq Bras Cardiol. 2016; 106(4):327-332.
14. Baroncini LAV, Sylvertre LDC, Baroncini CV et al. Assessment of Carotid Intima-Media Thickness as an Early Marker Of Vascular Damage In Hypertensive Children. Arq Bras Cardiol. 2017; 108(5):452-457.

15. Ravani A, Werba JP, Frigerio B et al. Assessment and Relevance of Carotid Intima-Media Thickness (C-IMT) in Primary and Secondary Cardiovascular Prevention. Current Pharmaceutical Design, 2015, Vol. 21, No. 9. 1164-71.
16. Rajani H, Mehreen TS, Pradeepa R et al. Epidemiology of childhood overweight & obesity in India: A systematic review. Indian Journal of Medical Research. 2016 Feb; 143(2): 160–74.
17. Biswas T, Islam A, Islam MS. Et al. Overweight and obesity among children and adolescents in Bangladesh: a systematic review and meta-analysis. Public Health.2017; January. 94-101.
18. Crocker PRE. The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual. https://www.researchgate.net/publication/228441462
19. Chandra N, Anne B, Venkatesh K et al. Prevalence of Childhood Obesity in an Affluent School in Telangana Using the Recent IAP Growth Chart: A Pilot Study. Indian Journal of Endocrinology and Metabolism. 2019 July-August; 23(4): 428-32.
20. Tanzil S, Tanzil J. Obesity, an emerging epidemic in Pakistan. A review of evidence. J. of Ayub Medical College Abbottobad-Pakistan. 2016. 28 (3)
21. Karki A, Sreashtha A, Subedi N. Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. BMC Public Health (2019) 19:1055.
22. Kaur S, Kapil U, Singh P. Pattern of chronic diseases amongst adolescent obese children in developing countries. Current Sciences. 2005; 88:1052-6
23. Armstrong ME, Lambert MI, Sharwood KA, Lambert EV. Obesity and overweight in South African primary school children: the Health of the Nation Study. S Afr Med J. 2006; 96:439–44.
24. Song Y, Wang H, Ma J, Wang Z. Secular Trends of Obesity Prevalence in Urban Chinese Children from 1985 to 2010: Gender Disparity. Plos one. 2013:1722.
25. Ahmed J, Laghari A, Naseer M,et al. Prevalence of and factors associated with obesity among Pakistani schoolchildren: a school-based, cross-sectional study. East Mediterr Health J. 2013; 19(3):242–7.
26. Kumar KM, Prashanth K, Baby KE *et al.* Prevalence of obesity among High School children in Dakshina Kannada and Udupi districts. Nitte University Journal of Health Sciences 2011; 1:16-20.
27. Goyal JP, Kumar N, Parmar I, Shah VB, Patel B. Determinants of overweight and obesity in affluent adolescent in Surat City, South Gujarat Region, India. Indian J Community Med. 2011; 36:296-300.

28. Keerthan Kumar M, Prashanth K, Baby KE, Rao KR, Kumarkrishna B, Hegde K, *et al*. Prevalence of obesity among high school children Dakshina Kannada and Udupi District. Nitte Univ J Heal Sci 2011; 4:16-20.
29. Brady TM, Schneider MF, Flynn JT, Cox C, Samuels J, Saland J, et al. Carotid intima-media thickness in children with CKD: results from the CKiD study. Clinical J American Society of Nephrology. 2012; 7(12):1930-7.
30. Mehta A, Mishra S, Ahmed K. Carotid intima media thickness in children with nephrotic syndrome: an observational case control study. SUDANESE JOURNAL OF PAEDIATRICS 2019; Vol 19, Issue No. 2. 110-6.
31. Azagba S, Sharaf MF. Fruit and Vegetable Consumption and Body Mass Index: A Quantile Regression Approach. J Prim Care Comm Health. 2012: 210–20 https://doi.org/10.1177/2150131911434206.

Table 1: Distribution of study participants according to background characteristics (n=75)

Parameter(s)	Category	No. (%)
Gender	Male	42 (56.0%)
Religion	Hindu	28 (37.3%)
Caste	General	16 (21.3%)
Maternal education	Literate and above	52 (69.3%)
Paternal education	Literate and above	69 (92.0%)
Maternal occupation	Homemaker	57 (76.0%)
Paternal occupation	Working	68 (90.7%)
SES	Low	47 (62.7%)
Birth weight	Low birth weight	14 (18.7%)
Vaccination status	Up-to-date	64 (85.3%)
EBF	Done	57 (76.0%)

Table 2: Association of physical activity level and obesity pattern among participants (n=75)

PAL	Outcome			Omnibus χ^2 at d.f. 2 p value	χ^2 at d.f. 1 p value	Odds ratio	95% C.I.	
	Non-obese no. (%)	Overweight no. (%)	Obese no. (%)				Lower	Upper
Below mean	23 (39.6)	26 (44.8)	9 (15.5)	10.250 <0.001	7.68 <0.001	0.23	0.11	0.46
Above mean	0 (0.0)	14 (82.3)	3 (17.6)		*	1.00	*	*

Table 3: Association of outcome variable to different determinants (n=52)

Outcome	Parameter(s) no. (%)		X^2 at df 1	p value
Overweight and obesity	Male 31 (59.6)	Female 21 (40.4)	6.67	0.02
	Low SES 36 (69.2)	High SES 16 (30.8)	3.76	0.05
	Low PAL 35 (67.3)	High PAL 17 (32.7)	10.25	0.008
	Low lipid level 38(73.1)	High lipid level 14 (26.9)	2.69	0.07

Table 4: Binary Logistic Regression showing association between determining factors and outcome

Variables	Category	B	Sig.	AOR	95% C.I. for AOR	
					Lower	Upper
Gender	Male	*	*	1.00	*	*
	Female	.26	0.09	2.97	2.01	15.9
SES	Low	*	*	1.00	*	*
	High	.22	0.16	1.98	0.09	2.01
Birth weight	Low	*	*	1.00	*	*
	Normal	.60	**0.05**	1.45	1.34	11.64
EBF	Yes	*	*	1.00	*	*
	No	.66	**0.01**	3.12	2.75	12.42
Lipid profile	Low	*	*	1.00	*	*
	High	-.19	**0.05**	5.11	2.17	11.58
LFT	Low	*	*	1.00	*	*
	High	.97	**<0.001**	3.40	1.49	12.86
FBS	Low	*	*	1.00	*	*
	High	-.59	**<0.001**	5.02	1.34	16.56
PAL	High	*	*	1.00	*	*
	Low	.43	**0.03**	3.70	1.34	7.79
CIMT	Low	*	*	1.00	*	*
	High	0.43	**0.02**	4.11	1.11	12.09

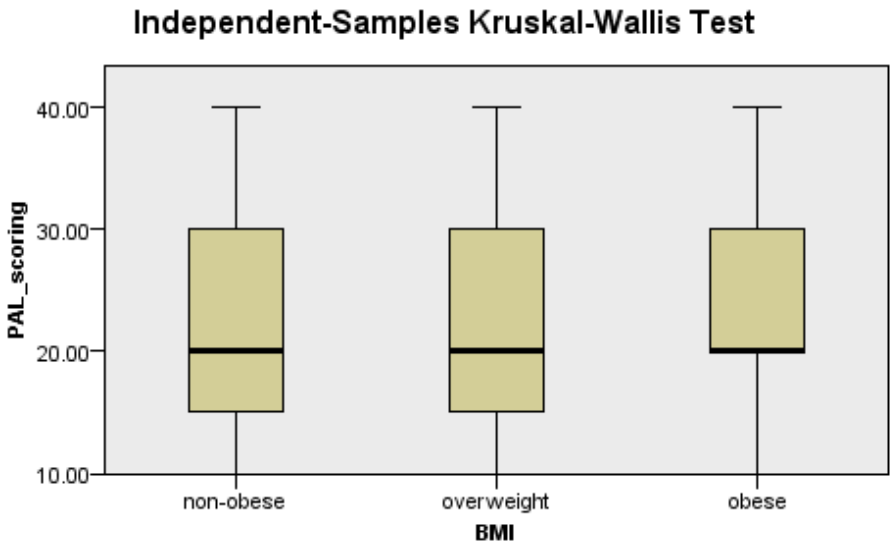

Figure1: Kruskal-Wallis test showing relationship between status of obesity and PAL scoring

Compliance with ethical guidelines:

This study was conducted with the study-approval of the corresponding hospital authorities. Informed consent was obtained from the legal guardians (father/ mother) of each patient (younger children) included in the study

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' contributions

All authors equally contributed to preparing this article.

Conflicts of interest

The authors declared no conflicts of interest.

Acknowledgements

The authors of this study are very grateful to all hospital authorities for their permission to conduct this study and all kinds of cooperation.