International Journal of Community Medicine and Public Health
Viswambharan JK et al. Int J Community Med Public Health. 2020 Aug;7(8):3142-3148
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20203391

Original Research Article

Prevalence and determinants of obesity among adolescent school children of North Kerala

Jaya Koothupalakkal Viswambharan[1]*, Thomas Bina[2], Lucy Raphael[3]

[1]Department of Community Medicine, Government Medical College, Thrissur, Kerala, India
[2]Department of Community Medicine, Government Medical College, Kozhikode, Kerala, India
[3]Department of Community Medicine, Jubilee Mission Medical College, Kerala, India

Received: 24 May 2020
Accepted: 03 July 2020

***Correspondence:**
Dr. Jaya Koothupalakkal Viswambaram,
E-mail: jayakviswam@gmail.com

ABSTRACT

Background: Obesity has emerged as one of the major health problems in recent years. This increasing prevalence has implications in health issues in later parts of life. Life style factors and diet practices are the attributed factors to the development of obesity.
Methods: This cross sectional study was conducted among 1011 adolescent school children in Kozhikode corporation area, Kerala, South India after getting necessary permissions. A semi structured questionnaire which contained questions related to socio demographic characters, diet, physical activity and other known risk factors of obesity in adolescents was administered.
Results: 76.8% of the study subjects were of normal weight, while 15.5% were underweight (thinness- 9% and severe thinness- 6.5%). 1.9% were obese and 5.8% were overweight. The combined prevalence of overweight and obesity was 7.7%. Nuclear family, better family education, better SES, skipping breakfast and consumption of more sweets were associated with obesity.
Conclusions: Preventive and promotive measures to reduce the burden of obesity needs to be initiated from early childhood and must be insisted to the family members also. School based lifestyles and behavioural change measures, encouraging school teachers to actively participate in these measures, active involvement of school children in regular sports activities, periodic anthropometric assessment and intervention when needed along with sensitization of parents towards the consequences of obesity are some of the measures to prevent the rising epidemic.

Keywords: Adolescent school children, Obesity, Overweight, Risk factors

INTRODUCTION

Malnutrition is a silent emergency worldwide and it continues to be one of India's major human development challenge.[1] Malnutrition which refers to an impairment of health either from a deficiency or excess or imbalance of nutrients is a significant public health issue among adolescents all over the world and is a common cause of morbidity and mortality of adolescents throughout the world.[2,3]

Obesity has emerged as one of the global health problems with 200 million school-aged children world-wide categorized as being overweight/obese, of which 40-50 million are obese.[4] Globally, in recent decades, the prevalence of obesity in school children has reported a steep rise. High prevalence of childhood and adolescent obesity/ overweight are being reported in both developed and developing countries.[5] Adolescence is a period of increased autonomy which is often associated with changing life styles (food habits, physical activity,

sedentary behavior) combined with physiological changes promoting increased fat deposition.[6,7] There is a rapid rise in the prevalence of overweight/obesity among urban population and high socio economic families.5 The increasing prevalence of obesity and overweight and its health consequences prompted WHO to designate obesity as a global epidemic.[8,9]

Obesity during childhood and adolescent period leads to health consequences currently and also increases the risk of obesity and its related complications in the later part of life. Obesity may be associated with increasing prevalence and early occurrence of diabetes mellitus, hypertension, coronary artery disease, orthopaedic problems, mental disorders, and impaired quality of life. A rapid epidemiological and nutritional transition along with demographic transition in India has led to double threat of over- and under-nutrition. Different studies conducted during the past decade in India reported the prevalence of obesity in range from 2.9% to 14.3%, overweight in range from 1.5%–24.0%, and thinness/underweight in range of 12.2%–37.5%.5 Increased consumption of high energy dense foods, inadequate intake of fruits and vegetables, sedentary life style (TV watching, computer use) and lack of physical activity form the major modifiable risk factors for obesity and overweight among adolescents.[10-12]

Data from India related to obesity rates in children and adolescents comparing both national and international cut-offs are scarce.[5] Hence this study was planned to assess the prevalence of malnutrition in North Kerala and to study the determinants of obesity/overweight.

METHODS

This cross sectional study was conducted among 1011 adolescent school children in Kozhikode corporation area, Kerala, South India. Institutional ethical committee clearance was obtained before the start of the study. Prior permission was obtained for conducting the study in the school from the concerned authorities. The study was conducted between February 2010 and November 2010. Study subjects included adolescents of both sexes studying in year one and year two standards of higher secondary schools in Kozhikode corporation. A semi-structured questionnaire was designed using knowledge obtained on various determinants and factors associated with obesity from the studies which were reviewed.

The questionnaire contained items on identification data of student, height, weight, BMI and mid arm circumference. Height, Weight and Waist circumference were measured to the nearest 0.1 cm, 0.1 kg and 0.1 cm respectively using the standard method prescribed in WHO-STEPS field manual.13 Height was measured using a stadiometer (Portable Height Measuring Board). Weight was measured using an electronic scale with a precision of 0.1 kg. Waist circumference was measured using a non-stretchable measuring tape.

This measure was taken at the level of the midpoint between the inferior margin of the last rib and the crest of the ilium in the mid-axillary plane at the end of normal expiration with the arms relaxed at the sides, over light clothing. Body mass index 14 was calculated using the formula:

BMI= weight (kg) / height^2 (meters).

Socio-demographic data such as age, sex, religion, class of study, place of birth, immunization status, family type, education and occupation of parents, family income, dietary pattern - habits of food intake, frequency of consumption, dietary table(food items relevant for weight gain and obesity), physical activity-type, duration and frequency of physical activities, sleeping hours, duration of television and computer usage.

The data collected was entered in MS-Excel sheet and was analyzed and statistically evaluated using SPSS software. Quantitative data was expressed by mean and standard deviation. Qualitative data was expressed as proportion. Odds ratio and 95% confidence interval were used to quantify the risk factors. Univariate analysis was used to calculate adjusted odds ratios $p<0.05$ was considered significant.

RESULTS

Out of the 1011 subjects, 52% (526) were from government schools, 38.5% (389) were from aided schools and 9.5% (96) from unaided schools. 53.1% were girls and 46.9% were boys. The age of study subjects ranged between 15 and 18 years. The distribution of boys and girls in each age group was more or less similar (x^2= 2.46: p-0.48). Mean age of boys and girls (16.11±0.77 vs 16.03±0.7 respectively) were similar. 84.8% of fathers and 90.9% of mothers had more than 7 years of schooling (Figure 1).

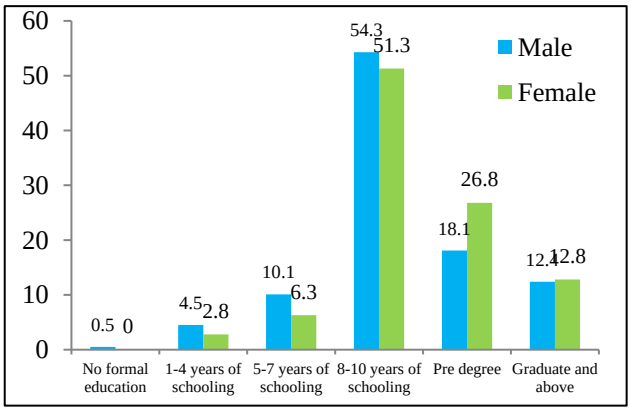

Figure 1: Educational status of the parents.

70% of the fathers were engaged in skilled and semi-skilled occupation but majority of the mothers (85.9%) were home makers and only 14% of the mothers were working (Figure 2).

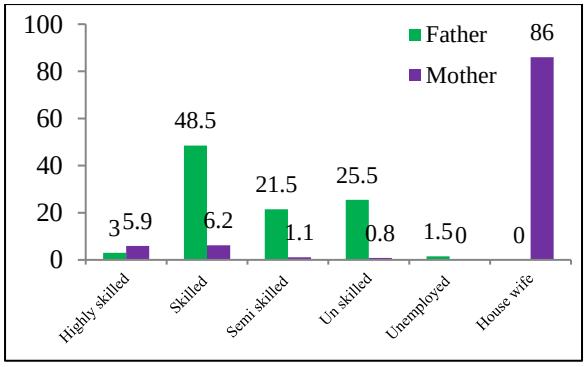

Figure 2: Occupational status of parents.

Majority of study participants (54.4%) belonged to middle socio-economic status followed by low socio-economic status (44.7%). Only 0.9% were in high socio-economic status (Figure 3).

76.8% of the study subjects were of normal weight, while 15.5% were underweight (thinness 9% and severe thinness 6.5%). 1.9% were obese and 5.8% were overweight. The combined prevalence of overweight and obesity was 7.7%. Prevalence of obesity and overweight was 8.2% among boys and 7.3% among girls. Also the proportion of underweight was higher among boys 21.3% as compared to girls 10.4%. The results are statistically significant (Table 1).

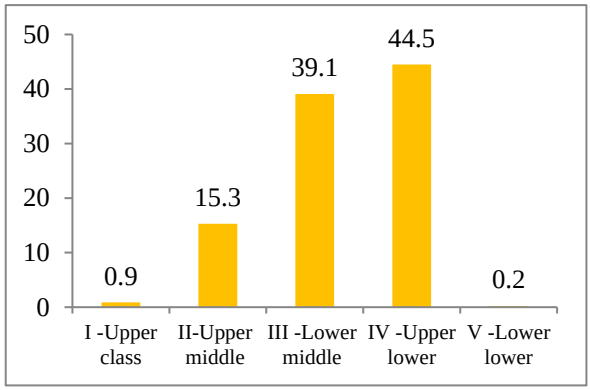

Figure 3: Socio economic status of study population.

The prevalence of overweight and obesity was similar among students of aided schools (8%), government schools (7.8%) and unaided schools (6.2%), (p>0.05). No statistically significant difference was noted in mean BMIs also among different categories of schools (ANOVA test, F= 1.40, p=0.24).

Table 1: Gender wise distribution BMI status.

Body weight status	Boys (n=474)		Girls (n=537)		Chi square value	P value
	N (%)	95% CI	N (%)	95% CI		
Obesity	10 (2.1)	0.81- 3.39	9 (1.7)	0.61- 2.79		
Over weight	29 (6.1)	3.94 - 8.25	30 (5.6)	3.65 -7.54		
Normal	334 (70.5)	66 -74.9	442 (82.3)	78.5-86.02	52.888	<0.001
Thinness	42 (8.9)	6.11 -11.6	49 (9.1)	6.29-11.9		
Severe thinness	59 (12.4)	9.18-15.6	7 (1.3)	0.19 -2.4		

Table 2: Distribution of obesity and type of school.

BMI status	Govt (n=526)	Aided (n=389)	Unaided (n=96)	Chi square value	P value
	N (%)	N (%)	N (%)		
Normal	401 (76.2)	302 (77.6)	73 (76)		
Overweight	28 (5.3)	26 (6.7)	5 (5.2)		
Obese	13 (2.5)	5 (1.3)	1 (1)	8.2094	0.4132
Thinness	50 (9.5)	35 (9)	6 (6.2)		
Severe thinness	34 (6.5)	21 (5.4)	11 (11.5)		

A weakly positive statistically significant correlation was seen between monthly income and BMI (r=0.11, p=0.001) (Figure 4).

There is 1.5 times increased risk of overweight and obesity if the family size is 4 or less than that. The better the father's education the higher the chance of overweight/obesity. Those who skip breakfast have 1.73 times higher chance of becoming obese/overweight. Use of coconut oil had 60% protective effect. Frequent and excessive sweet consumption has more chance (3 times) of obesity. Consumption of fish has a protective effect (by 48%) on obesity and overweight. All the above results are also statistically significant (Table 3).

There is a statistically non- significant association between maternal education, sibling less than 2 in the family and SES with overweight and obesity. There is no association between obesity with type of school, age, sex, SES, dietary pattern and sports activity (Table 3).

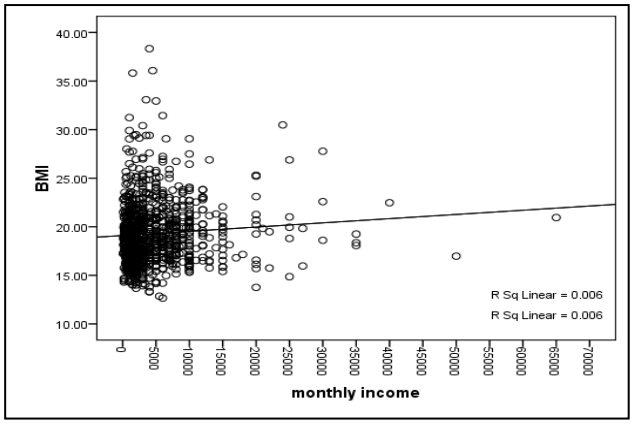

Figure 4: Correlation between BMI and income.

Table 3: Univariate analysis for determinants of Obesity in study population.

Characteristic	Odds ratio	95% confidence interval	P-value
Aided and unaided school	0.98	0.62-1.55	0.92
Age >16 years	1.02	0.59-1.79	0.94
Male gender	1.15	0.72-1.82	0.57
<4 members in family	1.50	0.94-2.39	0.09
Better paternal education	2.24	0.96-5.25	0.006
Better maternal education	1.90	0.68-5.32	0.21
Better SES	1.32	0.82-2.12	0.25
Working mother	1.14	0.6-2.17	0.69
Nonveg diet	1.03	0.31-3.43	0.96
Outside food	1.11	0.65-1.90	0.7
Skipping breakfast	1.73	0.99	0.005
Coconut oil	0.40	0.23-0.68	0.001
More sweet consumption	3	1.56-5.76	0.001
Fish consumed >2 times a week	0.52	0.27-0.99	0.045
No regular sports	0.91	0.55-1.49	0.70
Tv viewing >6 hours	1.28	0.50-3.26	0.61

DISCUSSION

Many studies done in India had shown that the prevalence of overweight and obesity are increasing among adolescents and children day by day.[4,5,15-18] Indians, as an ethnic group are particularly at a higher risk for insulin resistance (syndrome X) and central obesity, both forerunners of diabetes, CHD and other "life style" disorders. It is now evident that these disorders begin early (during childhood days) and manifest over the course of life owing to interactions and accumulation of various risk factors, throughout the life course.[19]

The adverse effects of excessive body fat are related to even a fairly minimal increase in body weight and not necessarily marked increase of bodyweight.[16] Adolescent obesity and overweight leads to a wide range of health issues regardless of adult weight. The treatment of adult obesity was not convincing: only less than 5% of the adult who reduced their body weight to ideal weight were able to maintain that even after five years. 62% of those who reduced weight regained their weight to the previous stage.[20] Hence, primordial prevention will be an effective approach to reduce the burden. It has become increasingly important to identify the risk factors predisposing to overweight/obesity so that it can be prevented in the childhood days. Examining the factors involved in weight gain and obesity in developing countries where socio-economic changes are taking place very important for predicting future impact and also for control measures, because the problem of obesity is emerging at the same time where under nutrition also remains as a major public health problem.[16]

This cross sectional study was done among 1011 school children in Kerala to find out the prevalence of malnutrition in Kerala and to determine the strength of known risk factors for obesity. 53.1% of our study population were females. As per 2011 census, the sex ratio of Kerala was 1084. The increased proportion of girl children may be due to this favorable sex ratio for females in Kerala.[21] The literacy rate of parents is high. This is similar to the high literacy rates in Kerala (census 2011-21, males-96.02% and females-91.98%).

The prevalence of obesity is more or less equal in all the type of schools (Government, aided and unaided schools). Unlike in this study, there was a high prevalence of obese and overweight children among private school children in studies done by Ramesh et al in Trivandrum, Jagadesan et al in Chennai and Vishnuprasad et al in Pondicherry.[4,17,22]

7.7% of our study population were overweight/obese. Similar result were obtained in a study done by Laxmaiah et al.[23] Higher prevalence were obtained in studies done by Shashidhar et al in Mangalore (15.4%), Goyal et al (15.41%), Jagadesan et al (16%) in Chennai and Chandra et al 18 (60%) in Telangana.[4]

Prevalence of obesity and overweight was 8.2% among boys and 7.3% among girls. The prevalence of obesity was high among boys compared to girls in a study done by Goyal et al from Ahmedabad (17.2% of boys vs. 10.7% of girls), Aggarwal et al from Ludhiana (15% of boy vs. 10.2% of girls), Premnath et al from Mysore (12.5% of boys vs. 11.2% of girls) and Chudasama et al from Gujarat (16.2% of girls vs. 5.8% of boys).[5,15,25,26] The prevalence was higher in girls in a study done by Jagadesan et al in Chennai.[4] There was no sex difference in the study done by Chandra et al in Telangana.[18]

Risk of obesity/overweight was higher in Nuclear families. Similar results were reported in studies done by

Padez et al and Guedes et al but Bharati et al reported a higher risk of obesity/overweight in joint families than nuclear families.[16,27,28] Social scientists have observed that as the number of children in the family increase, the time devoted to each child in the family gets diluted along with the available resources (e.g. sharing of available food). Siblings may act as a stimulus among themselves to improve child to child interaction with more creative play and other activities that increases the time spent on physical activity. These factors are additive in protecting against obesity and overweight due to better physical activity, and lack of parental pampering.[19]

The risk of obesity/overweight was higher among adolescents whose Parents had schooling for more than 7 yrs. Similar results were obtained by studies done by, Ramesh et al from Trivandrum and Bharati et al from Nagpur.[16,22]

The risk of obesity/overweight increases with improvement in Socio Economic status. Laxmaiah et al from Hyderabad reported more prevalence of overweight among high socio economic status (15% Vs 3.3%).[23] Goyal et al in his study found that overall prevalence of obesity was 70% among high socio economic status where as in middle socio economic status it was 30%.[15] Kapil et al from Delhi also reported that prevalence of overweight and obesity was low in low income group (3.1% and 0.2%) compared to middle income group (7.5% and 0.8%).[29] Similar reports were obtained in many other studies.[15,19]

Skipping breakfast is known to increase obesity/ overweight. Iranian study done by Mohsen et al30 found that the risk of overweight and obesity was higher among those who skipped breakfast (OR=1.4, CI: 1.09-1.93, p=0.002). A study done by Thompson et al from Boston, USA found that frequent breakfast skipping was associated with greater odds of overweight (OR=1.15, CI=1.06-1.26, p<0.01) and obesity (OR=1.18, CI=1.05-1.33, p<0.01).[31]

No association was noted between duration of exercises and obesity/overweight (OR=1.05, p=0.83). This is contradictory to many other studies.[15,16,19,24]

Risk of obesity/overweight was 1.28 times higher among those who watched television which was not statistically significant. Obesity was associated with TV viewing in many studies and more the duration of TV watching the higher the prevalence of obesity.[19,22-24]

Sedentary behavior and physical activity in children may be predictive of body mass in late adolescence. Sleeping habit in afternoon, increased motorized vehicle transport, decreased sports and exercise have also been implicated in childhood obesity because they reduce resting metabolism results in reduction of physical activity. A change in the volume of daily physical activity may account for imbalance between energy intake and energy expenditure.[19,23] But in our study no association was found between these factors and obesity.

As the socio economic status increases the prevalence of obesity increases. Similar results were obtained in many other studies.[15,19,23,29] Coconut oil consumption has a protective effect against obesity (OR=0.4). There are no studies supporting this result. A study done by Valente et al in Brazil have found that no such association exists.[32] But dietary consumption of coconut oil reduces the appetite.

Consumption of fish prevents obesity (OR=0.52). There is no such association observed by studies done by other authors.[33,34] Higher fish intake was associated with lower odds of developing metabolic syndrome due to lower Triglyceride and higher HDL-C content in the fish.[33]

CONCLUSION

Obesity is emerging as an important public health problem. 50 to 80 per cent obese children become obese adults. Primordial prevention is better. Preventive and promotive measures to reduce the burden needs to be initiated from early childhood and must be insisted to the family members also. School based lifestyles and behavioral change measures, encouraging school teachers to actively participate in these measures, active involvement of school children in regular sports activities, periodic anthropometric assessment and intervention when needed along with sensitization of parents towards the consequences of obesity are some of the measures to prevent the rising epidemic.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? Lancet. 2003;361(9376):2226-34.
2. Mahajan H, Srivastav S. Age-sex trends of under nutrition among the adolescent school children in an urban resettlement colony of district Gautam-budhnagar, Uttar Pradesh: a comparative study with WHO 2007 reference standards. Int J Med Sci Public Health. 2013;2(3):751-4.
3. The State of the World's Children 2005- Childhood under threat.2004 Available at: https:/ /www. unicef.org/publications. Accessed on 10 January 2020.
4. Jagadesan S, Harish R, Miranda P, Unnikrishnan R, Anjana RM, Mohan V. Prevalence of overweight and obesity among school children and adolescents in Chennai. Indian Paediatrics. 2014;51:544-9.
5. Chudasama RK, Eshwar T, Thakrar D, Eshwar ST. Prevalence and comparison of obesity, overweight,

and thinness by different growth standards among affluent schoolchildren (8-18 years) in Rajkot. J Mahatma Gandhi Inst Med Sci. 2017;22:99-104.
6. Bjorntorp P. International Text book of Obesity. 1st edition. UK: John Wiley and Sons Ltd. 2001.
7. World Health Organization. Nutrition in adolescence: Issues and challenges for the health sector. Adolescent health and development. WHO discussion papers on adolescence. Available at: https:// apps. World Health Organization. int/iris/handle. Accessed on 10 January 2020.
8. World Health Organization. Special issues in the management of obesity in childhood and adolescence. Obesity preventing and managing the global epidemic. Available at: https:/ /www.who. int/nutrition/publications/obesity/WHO_TRS_894/en/. Accessed on 10 May 2020.
9. World Health Organization. Controlling the global obesity epidemic, Nutrition. 2009. Available at: https://www.who.int/nutrition/topics/obesity/en. Accessed on 10 May 2020
10. World Health Organization. Obesity: preventing and managing the global epidemic. 2000. Available at https://www.who.int/nutrition/publications/obesity. Accessed on 10 May 2020.
11. World Health Organization. Childhood overweigh and obesity. Global strategy on diet, physical activity and health. Geneva; World Health Organization. 2020. Available at https:// www.who. int/dietphysicalactivity/childhood. Accessed on 10 May 2020.
12. World Health Organization. What are the causes for children and adolescents to become obese. Global strategy on diet, physical activity and health. Geneva; World Health Organization. 2020. Available at: https:// www.who.int/ dietphysicalactivity/ childhood. Accessed on 10 May 2020.
13. World Health Organization. STEPS Geneva: World Health Organization; 2017. Available at: https://www.who.int/ncds/surveillance/steps/STEPS_Manual.pdf. Accessed on 10 May 2020.
14. Park K. Parks textbook of social and Preventive medicine. 25th edition. Jabalpur: M/s Banarsidas Bhanot; 2019; 429.
15. Goyal RK, Shah VN, Saboo BD, Phatak SR, Shah NN, Gohel MC, et al. Prevalence of overweight and obesity in Indian adolescent school going children: Its relationship with socioeconomic status and associated lifestyle factors. J Assoc Physicians India. 2010;58:151-8.
16. Bharati DR, Deshmukh PR, Garg BS. Correlates of overweight and obesity among school going children of Wardha city, Central India. Indian J Med Res. 2008;127(6):539-43.
17. Prasad RV, Bazroy J, Singh Z. Prevalence of overweight and obesity among adolescent students in Pondicherry, South India. Int J Nutr Pharmacol Neurol Dis. 2016;6:72-5.
18. Chandra N, Anne B, Venkatesh K, Teja GD, Katkam SK. Prevalence of childhood obesity in an affluent school in Telangana using the recent IAP growth chart: a pilot study. Indian J Endocr Metab. 2019;23:428-32.
19. Rohilla R, Rajput M, Rohilla J, Malik M, Garg D, Verma M. Prevalence and correlates of overweight/obesity among adolescents in an Urban City of North India. J Fam Med Primary Care. 2014;3:404-8.
20. Warden SN, Warden CH. Pediatric obesity: an overview of etiology and treatment. In: Styne DM, editor. Pediatric endocrinology. Paediatric Clinic of North America. Philadelphia: WB Saunders Company; 2001: 361-369.
21. Government of India. Census of India 2011-Provisional population Totals, Kerala. Office of the Registrar General and Census Commissioner, India. 2011. Available at: https://censusindia.gov.in/2011-prov-results. Accessed on 10 May 2020.
22. Ramesh K. Prevalence of overweight and obesity among high school students of Thiruvananthapuram City Corporation, Kerala, India. AMJ. 2010;3(10):650-61.
23. Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M. Factors affecting prevalence of overweight among 12- to 17-year-old urban adolescents in Hyderabad, India. Obesity. 2007;15:1384-90.
24. Kotian MS, GK S, Kotian SS. Prevalence and determinants of overweight and obesity among adolescent school children of South Karnataka, India. Indian J Community Med. 2010;35(1):176-8.
25. Aggarwal T, Bhatia RC, Singh D, Sobti PC. Prevalence of obesity and overweight in affluent adolescents from Ludhiana, Punjab. Indian Pediatr. 2008;45(6):500-2.
26. Premanath M, Basavanagowdappa H, Shekar MA, Vikram SB, Narayanappa D. Mysore childhood obesity study. Indian Pediatr. 2010;47:171-3.
27. Padez C, Mourão I, Moreira P, Rosado V. Prevalence and risk factors for overweight and obesity in Portuguese children. Acta Paediatr. 2005;94:1550-7.
28. Guedes DP, Rocha GD, Silva AJ, Carvalhal IM, Coelho EM. Effects of social and environmental determinants on overweight and obesity among Brazilian schoolchildren from a developing region. Rev Panam Salud Publica. 2011;30:295-302.
29. Kaur S, Kapil U. Prevalence of overweight and obesity in school children in Delhi. Indian Paedia. 2008;45:330-31.
30. Maddah M, Nikooyeh B. Obesity among Iranian adolescent girls: Location of residence and parental obesity. J Health Popul Nutr. 2010;28(1):61-6.
31. Thompson JJ, Thomas JJ, Bhainvualiku A, Khan AN, Becker AE. Breakfast skipping as a risk correlate of overweight and obesity in school going ethnic Fijian adolescent girls. Asia Pac J Clin Nutr. 2010;19(3):372-82.

32. Valente FX, Candido FG, Lopes LL, Dias DM, Carvalho SDL, Pereira PF et al. Effects of coconut oil consumption on energy metabolism, cardiometabolic risk markers, and appetitive responses in women with excess body fat. Eur J Nutr. 2018;57(4):1627-37.
33. Karlsson T, Riise RH, Dierkes J, Drevon CA, Tell GS, Nygård O. Associations between fish intake and the metabolic syndrome and its components among middle-aged men and women: the Hordaland health study. Food Nutr Res. 2017;61(1):1347-79.
34. Jakobsen MU, Dethlefsen C, Due KM. Fish consumption and subsequent change in body weight in European women and men. Br J Nutr. 2013;109(2):353-62.

Cite this article as: Viswambharan JK, Bina T, Raphael L. Prevalence and determinants of obesity among adolescent school children of North Kerala. Int J Community Med Public Health 2020;7:3142-8.