

Association of Awareness towards Diet and Nutritional Factors on Obesity among School Going Adolescent

By

Mr. Varun Singh Bhadoria

Research Scholar, Central University of Haryana, Mahendergarh, Haryana, INDIA

Email: varunsingh639@gmail.com

Dr. J.P.Bhukar

Associate Professor, Department of Physical Education and Sports, Central University of Haryana, Mahendergarh, Haryana, INDIA

Email: jpbhukar@cuh.ac.in

Dr. Davinder Singh

Assistant Professor, Department of Physical Education, Kanya Maha Vidyalaya, Jalandhar, Punjab, India

Abstract

The growing prevalence of obesity among school adolescents is a major public health concern. It can be seen mostly as a result of modifiable risk factors like lack of required physical activity and rapid change in dietary habits among them. The present cross sectional descriptive study was done among adolescents studying in schools (government and private) of Bhopal city. School adolescents were classified as obese and non-obese as per the WHO criteria used for obesity in South East Asia Region (SEAR). Pre-tested, self-administered questionnaire was used to collect data which comprised of socio demographic information and various dietary habits like frequent consumption of fast & fried food, bakery products and little dietary behavior. Obesity epidemic has been on rise and this has been attributed to unhealthy practices including physical inactivity and unhealthy diet. Adolescence has been a critical period for development of obesity due to changes in body composition and behavior. To assess knowledge, attitude and practices (KAP) regarding obesity-risk reduction factors and its association with obesity-risk among Junior high school students. The growing prevalence of obesity among school adolescents is a major public health concern. It can be seen mostly as a result of modifiable risk factors like lack of required physical activity and rapid change in dietary habits among them. The present cross sectional descriptive study was done among adolescents studying in schools (government and private) of Lucknow city. School adolescents were classified as obese and non-obese as per the WHO criteria used for obesity in South East Asia Region (SEAR). Pre-tested, self-administered questionnaire was used to collect data which comprised of socio demographic information and various dietary habits like frequent consumption of fast & fried food, bakery products and little dietary behavior.

Keywords: Nutrition, Obesity, Diet

Introduction

Obesity in India has reached epidemic proportions in the 21st century [1], with morbid obesity affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese. Unhealthy, processed food has become much more accessible following India's continued integration in global food markets. This, combined with rising middle class incomes, is increasing the average caloric intake per individual among

middle class and high income households[2]. Obesity is a major risk factor for cardiovascular disease, and NGOs such as the Indian Heart Association have been raising awareness about this issue.[3]

Adolescence is treated as a transition period from childhood to adulthood. During this transitional phase, adolescents develop behavioral patterns and make lifestyles that can also affect their present health and future. Obesity is a disease of an unhealthy or unnecessary accumulation of fat in adipose tissue to such a degree as to affect an individual's health. About 1.2 billion adults worldwide, one of every five people in the world is teenage and about 18% of the world's population are teenagers. Around 90% of the world's population lives in developing countries and only around 20% of adolescents belong to India.[4]

BMI is a standardized measure of a person's weight (kg) measured by his/her height (m)[5]. World Health Organization (WHO) guidelines for youth, if BMI values greater than + 1 SD are categories of overweight and more than + 2 SD are categories of obesity for specific age and gender[6] which have also been used in this report.

India will become a global hub for diabetes by 2050, so India's Ministry of Health and Family Welfare raising the BMI cut-off to tackle obesity. In India, about 18.3% of age group female adolescents aged 2–17 years is either in the category of overweight or obese. According to the 2015–16 National Family Health Survey (NFHS-4)[7], the prevalence of obesity among women was 20.6%, and for men it was 18.9% of the 15–49 year age group, which is slightly higher than the NFHS-3 study (2005–06).

Adolescent overweight and obese people at younger stages of their lives may develop various non-communicable diseases, such as diabetes and cardiovascular diseases. Morbidity from cardiovascular disease, diabetes, cancers, and arthritis because of obesity was 50–100% higher among obese individuals suffering from childhood or teenage obesity[8]

Owing to lifestyle changes, such as balanced organic foods to processed foods, more cell phone and television use, a more sedentary lifestyle, and a decrease in physical activity may be risk factors for teenage obesity[8].

Factors involved in adolescent obesity cannot be ignored, such as the contribution of genes and metabolic diseases. However, changes in social culture represent another important factor[2]. Social and economic development have resulted in a large number of fast food sources becoming easily available to teenagers, resulting in excessive energy intake. In addition, increased social activities among younger people have led to declining consumption and the associated benefits of a healthy family diet. Among sociocultural lifestyle changes, unhealthy eating patterns are a main reasons for the increase in obesity worldwide.[9] It has been proven that less frequent consumption of fruits and vegetables and excessive intake of drinks high in sugar content as well as fast foods directly affect body mass index (BMI). However, the role of multiple dietary preferences related to the incidence of obesity among college students, an important group of young people, has not previously been studied[10].

We administered a questionnaire to college students in Lucknow. We queried their dietary habits and preferences via the survey, and then explored the relationship between students' responses and their BMI. We aimed to identify eating habits related to weight and to then use this information to improve unhealthy eating habits and some obesity risk factors common among college students. This study provides new insights that may be helpful in exploring the relationship between dietary habits and obesity in our target age group. Our

results may provide a scientific basis for interventions related to eating habits that can help to reduce and prevent obesity among college students.

Methods

Participants

Our cross-sectional study was conducted at Lucknow, the capital of Uttar Pradesh in India. From June 2022 to July 2022, we recruited students at Lucknow University. The inclusion criteria for participants were University students between the ages of 18 and 25 years. Exclusion criteria included chronic diseases such as diabetes and endocrine diseases (e.g., Cushing syndrome or vacuolar sella) and long-term use of oral medication affecting body weight (e.g., estrogen or glucocorticoids). All participants gave their informed consent for inclusion before participating in the study, and they provided physical examination reports from within the previous 1 year. Participants were provided with a fact sheet and instructed to follow the survey guidelines. A total of 141 questionnaires were collected, with a participation rate of 70.5% (141/200). After consulting the physical examination reports of participants, questionnaires completed by non-Chinese college students and individuals with chronic diseases were excluded. The remaining questionnaires were considered valid and were included in the study.

Anthropometric measurement

BMI is useful for estimating body fat and is calculated by dividing an individual's weight (kg) by their height in meters squared (m²). Height and weight were measured during physical examinations. Height was measured using a portable rangefinder to the nearest 1 cm and weight was measured with a calibrated scale to the nearest 0.1 kg. According to World Health Organization definitions, individuals are classified as underweight with BMI <18.5 kg/m², normal weight with BMI between 18.5 and 24.9 kg/m², and overweight with BMI ≥25 kg/m².

Self-administered questionnaire

We collected participant information using a self-administered questionnaire. Survey questions included general information: class, name, student number, region of residence, and sex; eating habits: speed at which meals are eaten (slow, normal, slightly fast, fast), number of times participants eat per day (twice, three times, four times, more than four times), dining at regular times (yes, no), eating breakfast (yes, no), excessive food consumption resulting in abdominal distension or discomfort (yes, no), eating snacks at night (never, once or twice a week, three to six times a week, every day), consuming high-fat foods (never, once or twice a week, three to six times a week, every day), consuming fruits and vegetables (never, a small amount, a normal amount), eating dessert (never, once or twice a week, three to six times a week, every day), drinking sugar-sweetened beverages (never, one or two servings a week, three to six servings a week, every day), exercising regularly (never, less than 1 hour per week, 1–2 hours per week, daily), and consuming alcohol (never, less than one drink per week, one or two drinks per week, more than three drinks per week).

Statistical analysis

All data were entered into a spreadsheet by the researcher and examined for validity. All statistical analyses were performed using IBM SPSS version 22.0. Measurement data are expressed as mean ± standard deviation. Pearson's chi-squared test was used to investigate the

relationship between participants' general characteristics, dietary habits, and BMI. The alpha value was set to 0.05 for all tests.

Result and Discussion

Sixty-one percent of respondents had urban background with the remaining coming from rural areas. Of the 39% from rural areas, 10.6% were male and 28.4% were female. For the urban background, 12% were male and 48.9% were female. In terms of age, the results showed the following: 18-22 year old (57.7%), 23-27 (27.0%), 28-32

(7.1%), 33-37 (3.5%) and 38-42 (2.1%) only a miniscule proportion (2.1%) accounted for those beyond the age of forty-two.

Regarding parents' education 32.6% indicated their mothers had a high school/GED level of education, 26.2% attended college but did not finish, 20.6% hold a college degree, and 19.1% received a graduate degree. When dealing with fathers' educational level, 38.3% indicated that they received a high school diploma or GED, 18.4% had some college education, 22.0% finished college and 12.1% attained a graduate degree.

Table 1: *Classification Aware that Poor Diets Put Health at Risk Cross Tabulation*

| Classification | Aware that poor diets put health at risk | | |
|----------------|--|----|-------|
| | Yes | No | Total |
| Freshman | 13 | 0 | 13 |
| Sophomore | 19 | 4 | 23 |
| Junior | 28 | 4 | 32 |
| Senior | 31 | 4 | 35 |
| Graduate | 33 | 5 | 38 |
| Total | 124 | 17 | 141 |

When the individuals were questioned as to whether or not they were aware of poor diets can jeopardize health, 124 responded yes (87.9%) and 17 no (12.1%). The graduate class had the most yes responses with 33 (86.8%) and the freshman class had the fewest no responses, with 0 indicating that individuals are aware of poor diet but obesity doesn't concern them. Therefore they had no reason to inquire about the issue

Table 2: *Plans to Change Eating Habits Which Would Encourage Plans to Change Eating Habits Crosstabulation*

| Selected Variables | Which would encourage change in eating habits | | | | Total |
|--|---|--|--------------------------------|-------|-------|
| | Nutrition Education | Availability of low cost exercise facilities | Reduced portion sizes of foods | Other | |
| Yes (Count) | 47 | 28 | 18 | 9 | 102 |
| Percent within Plan to change your eating habits | 46.1 | 27.5 | 17.6 | 8.8 | 100.0 |
| Percent within Which would encourage change in eating habits | 71.2 | 82.4 | 75.0 | 60.0 | 73.4 |
| Percent of Total | 33.8 | 20.1 | 12.9 | 6.5 | 73.4 |
| No (Count) | 19 | 6 | 6 | 6 | 37 |

| | | | | | |
|--|-------|-------|-------|-------|-------|
| Percent within Plan to change your eating habits | 51.4 | 16.2 | 16.2 | 16.2 | 100.0 |
| Percent within Which would encourage change in eating habits | 28.8 | 17.6 | 25.0 | 40.0 | 26.6 |
| Percent of Total | 13.7 | 4.3 | 4.3 | 4.3 | 26.6 |
| Total Count | 66 | 34 | 24 | 15 | 139 |
| Percent within Plan to change your eating habits | 47.5 | 24.5 | 17.3 | 10.8 | 100.0 |
| Percent within Which would encourage change in eating habits | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Percent of Total | 47.5 | 24.5 | 17.3 | 10.8 | 100.0 |

A question in the survey inquired about changing eating habits, and what would help encourage change. Of those responding, 47.5 percent indicated that nutrition education can help change eating habits while, 24.5 percent agreed that availability of low cost exercise facilities and 17.3 percent indicated reduced portion sizes of food can help change eating habits. The category other is selected by 10.8 percent of the respondents. The importance of more events that inform about healthy eating, free exercise facilities, reading labels, eating more fruits and vegetables, and eating less fast foods are underscored by the respondents.

Table 3: Classification: Plan to Change Your Eating Habits Cross Tabulation

| Classification | Plan to change your eating habits | | |
|--|-----------------------------------|-------|-------|
| | Yes | No | Total |
| Freshman (Count) | 8 | 5 | 13 |
| Percent within Classification | 61.5 | 38.5 | 100.0 |
| Percent within Plan to change your eating habits | 7.7 | 13.5 | 9.2 |
| Percent of Total | 5.7 | 3.5 | 9.2 |
| Sophomore (Count) | 21 | 2 | 23 |
| Percent within Classification | 91.3 | 8.7 | 100.0 |
| Percent within Plan to change your eating habits | 20.2 | 5.4 | 16.3 |
| Percent of Total | 14.9 | 1.4 | 16.3 |
| Junior (Count) | 23 | 9 | 32 |
| Percent within Classification | 71.9 | 28.1 | 100.0 |
| Percent within Plan to change your eating habits | 22.1 | 24.3 | 22.7 |
| Percent of Total | 16.3 | 6.4 | 22.7 |
| Senior Count | 27 | 8 | 35 |
| Percent within Classification | 77.1 | 22.9 | 100.0 |
| Percent within Plan to change your eating habits | 26.0 | 21.6 | 24.8 |
| Percent of Total | 19.1 | 5.7 | 24.8 |
| Graduate (Count) | 25 | 13 | 38 |
| Percent within Classification | 65.8 | 34.2 | 100.0 |
| Percent within Plan to change your eating habits | 24.0 | 35.1 | 27.0 |
| Percent of Total | 17.7 | 9.2 | 27.0 |
| Total Count | 104 | 37 | 141 |
| Percent within Classification | 73.8 | 26.2 | 100.0 |
| Percent within Plan to change your eating habits | 100.0 | 100.0 | 100.0 |
| Percent of Total | 73.8 | 26.2 | 100.0 |

When the students were asked if they had planned to change their eating habits, 73.8 said yes and 26.2 responded no. The individuals who agreed can be said to have some knowledge of healthy diet, or unhappy with their current body build. Those who responded no either don't care about their body build, they could be physically fit, or are content with their current diet status.

Table 4: Distribution Frequencies of Awareness of Obesity Problems among Designed Groups

| Total | Awareness Levels of Obesity Problems | | | | Total |
|--|--------------------------------------|------|-------------|------|-------|
| | A lot | Some | Very Little | None | |
| Number of respondents | 74 | 51 | 11 | 5 | 141 |
| Percent | 52.5 | 36.2 | 7.8 | 3.5 | 100.0 |
| Awareness of the Effects of Poor Diets | | | | | |
| Yes (# of resp.) | 71 | 42 | 7 | 4 | 124 |
| Percent | 57.3 | 33.9 | 5.6 | 3.2 | 100.0 |
| No (# of resp.) | 3 | 9 | 4 | 1 | 17 |
| Percent | 17.6 | 52.9 | 23.5 | 5.9 | 100.0 |
| Knowledge of Dietary Guidelines | | | | | |
| Yes (# of resp.) | 52 | 23 | 0 | 3 | 78 |
| Percent | 66.7 | 29.5 | .0 | 3.8 | 100.0 |
| No (# of resp.) | 22 | 28 | 11 | 2 | 63 |
| Percent | 34.9 | 44.4 | 17.5 | 3.2 | 100.0 |
| Reading Food Labels | | | | | |
| Often (# of resp.) | 33 | 15 | 4 | 0 | 52 |
| Percent | 63.5 | 28.8 | 7.7 | .0 | 100.0 |
| Seldom (# of resp.) | 31 | 17 | 2 | 3 | 53 |
| Percent | 58.5 | 32.1 | 3.8 | 5.7 | 100.0 |
| Never (# of resp.) | 10 | 19 | 5 | 2 | 36 |
| Percent | 27.8 | 52.8 | 13.9 | 5.6 | 100.0 |
| Distribution of Frequencies Awareness Levels of Obesity Problems | | | | | |
| | A Lot | Some | Very Little | None | Total |
| Vegetable Consumption Habits | | | | | |
| Yes (# of resp.) | 56 | 26 | 3 | 2 | 87 |
| Percent | 64.4 | 29.9 | 3.4 | 2.3 | 100.0 |
| No (# of resp.) | 18 | 25 | 8 | 3 | 54 |
| Percent | 33.3 | 46.3 | 14.8 | 5.6 | 100.0 |
| Exercise Habits | | | | | |
| Daily (# of resp.) | 15 | 8 | 1 | 1 | 25 |
| Percent | 60.0 | 32.0 | 4.0 | 4.0 | 100.0 |
| Often (# of resp.) | 23 | 16 | 2 | 0 | 41 |
| Percent | 56.1 | 39.0 | 4.9 | .0 | 100.0 |
| Sometimes (# of resp.) | 26 | 17 | 3 | 1 | 47 |
| Percent | 55.3 | 36.2 | 6.4 | 2.1 | 100.0 |
| Seldom (# of resp.) | 8 | 8 | 4 | 1 | 21 |
| Percent | 38.1 | 38.1 | 19.0 | 4.8 | 100.0 |
| Never (# of resp.) | 2 | 2 | 1 | 2 | 7 |
| Percent | 28.6 | 28.6 | 14.3 | 28.6 | 100.0 |
| Plan to Change Eating Habits | | | | | |
| Yes (# of resp.) | 58 | 39 | 5 | 2 | 104 |
| Percent | 55.8 | 37.5 | 4.8 | 1.9 | 100.0 |
| No (# of resp.) | 16 | 12 | 6 | 3 | 37 |
| Percent | 43.2 | 32.4 | 16.2 | 8.1 | 100.0 |

associated with their knowledge about healthy or poor diets, with their observed behavior or life style, and with their intentions to change their current habit.

First, the study examined the linkage between the awareness of obesity problems with knowledge and awareness of the adverse effects of poor diets and knowledge of the dietary guidelines. The results show that most respondents associated obesity problems with the adverse effects of poor diets. The results also indicate respondents who knew about dietary guidelines were more likely to know a lot about obesity problems; and those who had no knowledge of dietary guidelines mostly likely knew little about obesity problem. The evidence suggests that respondents had a higher degree of awareness of obesity problems and the adverse effects of poor diets, than their awareness of dietary guidelines. Consider dietary guidelines provide information on healthy diet, whereas obesity problems relate to the adverse effects of poor diet. It implies that respondents were more aware of obesity problems, poor diets and ensuing adverse effects, than of healthy diets and related effects.

Second, this study assesses whether and how the awareness of obesity problems is associated with observed behavior or actions, namely reading food labels, consuming vegetables, and exercise. The hypothesis that individuals who are more aware of obesity problems would be more likely to read food labels, consume vegetables on a daily basis, and exercise regularly was tested. The results show that individuals who were aware of obesity problems revealed their awareness in their life-style choices and behavior. Namely, for respondents who had some or a lot awareness of obesity problems, 84 engaged in exercises daily, often, or sometimes, 65.5 percent consumed two servings of vegetables daily, and 37.9 percent often made it a point to read food labels.

Finally, the study evaluated the association between the awareness of obesity problem with stated intention to change behavior in the future. The findings indicate that individuals who had some and high awareness of obesity problems intended to make changes in their dietary habits, regardless whether or not they were practicing healthy diets at the time. In contrast, 50 of those who had very little or no awareness of obesity problem indicated that they had no plans to change their eating habits. This suggests that the awareness levels of obesity problem are likely to influence individuals' intention to change their current dietary behavior.

Table: 7 BMI Among Students

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|------|------------------|----------------|----------------------|---------------------------|
| Valid | .00 | 37 | 26.2 | 26.2 | 26.2 |
| | 1.00 | 104 | 73.8 | 73.8 | 100.0 |
| Total | | 141 | 100.0 | 100.0 | |

Table 7 shows that of the 141 respondents 26.2 percent (37) of them are classified as obese, and the other 73.8 percent (107) did not respond to the weight question, are overweight, underweight or normal weight. Of the 26.2 percent it can be assumed that they have little or no awareness about the obesity issue, simply because they are obese.

Recommendations

This study can provide some insights on the subject of awareness about obesity and strategies to tackle it based on responses received from the study group/college students. An expanded study covering a mix of universities and states can yield comparative results. Given that factors contributing to obesity are many, a concerted effort involving different Government

and non-government agencies, communities, university researchers, outreach professionals and schools, is critical to make progress in tackling the obesity problem.

Bibliography

- Ickes, M. J., & Slagle, K. M. "Targeting obesity in rural and Appalachian children and families: a systematic review of prevention and treatment interventions." *Universal J Public Health*, Vol 1 No (3), pp.51-64,2013
- S. Gulati and A. Misra, "Abdominal obesity and type 2 diabetes in Asian Indians: Dietary strategies including edible oils, cooking practices and sugar intake," *Eur J Clin Nutr*, vol. 71, no. 7, pp. 850–857, Jul. 2017, doi: 10.1038/ejcn.2017.92.
- Dinç, N., Güzel, P., Özbey, S., Besikçi, T., Seyhan, S., Kalkan, N., & Gezer, G. (2019). Obesity Prevalence and Physical Fitness in School-Aged Children. *Universal Journal of Educational Research*, Vol 7 No (3), pp.659-663,2019.
- Demirci, N., Demirci, P. T., & Demirci, E. . "The Effects of Eating Habits, Physical Activity, Nutrition Knowledge and Self-Efficacy Levels on Obesity". *Universal Journal of Educational Research*, Vol 6 No (7),pp. 1424-1430,2018.
- Johnson, M. K., McInerney, M. C., Yen, W. J., & Hutchins, M. D. (2016). Television and electronic device use and overweight/obesity status: children and adolescents with and without autism spectrum disorders. *Universal Journal of Public Health*, Vol 4 No (5),pp. 259-67,2016.
- Manaf, N. U. A., Ahmad, A., & Yusoff, N. A. M. A. (2018). Systematic Review on Long Term Effects of Weight Loss Diet on Body Weight and Lipid Profile: findings from Randomized Controlled Trials. *Universal Journal of Public Health*, vol 6, pp.40-48.
- Safouane, E. G., Khalid, Y., Misk, M., Tarik, A., Fatine, E. A., Soad, K. L., & Abdellatif, B. "Obesity, Physical Activity and Sedentary Time during Covid-19 Confinement: Moroccan Adult Study". *Universal Journal of Public Health*, Vol 10 no (1),pp.79-85, (2022).
- Güngör, N. K. (2014). Overweight and obesity in children and adolescents. *Journal of clinical research in pediatric endocrinology*, vol. 6, no. 3, p. 129, Sep. 2014, doi: 10.4274/JCRPE.1471.
- Bentham, J., Di Cesare, M., Bilano, V., & Boddy, L. M. "Worldwide trends in children's and adolescents' body mass index, underweight and obesity, in comparison with adults, from 1975 to 2016: a pooled analysis of 2,416 population-based measurement studies with 128.9 million participants". *Lancet*. vol. 390, no. 10113, pp. 2627–2642, Dec. 2017, doi: 10.1016/S0140-6736(17)32129-3.
- J. Kim and H. Lim, "Nutritional Management in Childhood Obesity," *J Obes Metab Syndr*, Vol. 28, no. 4, p. 225, 2019, DOI: 10.7570/JOMES.2019.28.4.225.
- Popkin BM, Adair LS, Ng SW. "Global nutrition transition and the pandemic of obesity in developing countries". *Nutr Rev*. Vol 70 No (1), pp. 3-21,2012. DOI: 10.1111/j.1753-4887.2011.00456.x.
- Demirci, N., Demirci, P. T., & Demirci, E. . "The Effects of Eating Habits, Physical Activity, Nutrition Knowledge and Self-Efficacy Levels on Obesity". *Universal Journal of Educational Research*, Vol 6 No (7),pp. 1424-1430,2018.
- Manaf, N. U. A., Ahmad, A., & Yusoff, N. A. M. A. (2018). Systematic Review on Long Term Effects of Weight Loss Diet on Body Weight and Lipid Profile: findings from Randomized Controlled Trials. *Universal Journal of Public Health*, vol 6, pp.40-48.
- Glinkowska B, Glinkowski WM. "Association of sports and physical activity with obesity among teenagers in Poland" *Int J Occup Med Environ Health*. Vol 20 No 31(6),pp.771-782, 2018. DOI: 10.13075/ijomeh.1896.01170.

- Menon S, Philipneri A, Ratnasingham S, Manson H. “The integrated role of multiple healthy weight behaviours on overweight and obesity among adolescents: a cross-sectional study”. *BMC Public Health*. Vol 19 No (1), pp.1157, 2019. DOI: 10.1186/s12889-019-7007-7.
- Brown T, Moore TH, Hooper L, Gao Y, Zayegh A, Ijaz S, Elwenspoek M, Foxen SC, Magee L, O'Malley C, Waters E, Summerbell CD. “Interventions for preventing obesity in children” *Cochrane Database Syst Rev*. Vol 23 No 7, pp.(7), 2019. DOI: 10.1002/14651858.CD001871.pub4. PMID: 31332776; PMCID: PMC6646867
- Dinç, N., Güzel, P., Özbey, S., Besikçi, T., Seyhan, S., Kalkan, N., & Gezer, G. (2019). Obesity Prevalence and Physical Fitness in School-Aged Children. *Universal Journal of Educational Research*, Vol 7 No (3), pp.659-663,2019.
- Popkin BM, Adair LS, Ng SW. “Global nutrition transition and the pandemic of obesity in developing countries”. *Nutr Rev*. Vol 70 No (1), pp. 3-21,2012. DOI:10.1111/j.1753-4887.2011.00456.x.
- Menon S, Philipneri A, Ratnasingham S, Manson H. “The integrated role of multiple healthy weight behaviours on overweight and obesity among adolescents: a cross-sectional study”. *BMC Public Health*. Vol 19 No (1), pp.1157, 2019. DOI: 10.1186/s12889-019-7007-7.
- Kansra AR, Lakkunarajah S, Jay MS. “Childhood and Adolescent Obesity: A Review”, *Front Pediatr*. Vol 12 No8,pp.581461, 2021 DOI: 10.3389/fped.2020.581461.
- Anderson LN, Carsley S, Lebovic G, Borkhoff CM, Maguire JL, Parkin PC, et “Misclassification of child body mass index from cut-points defined by rounded percentiles instead of Z-scores”. vol 10,pp.639, 2017. DOI:10.1186/s13104-017-2983-0
- Ickovics JR, O'Connor Duffany K, Shebl FM, Peters SM, Read MS, Gilstad- Hayden KR.” Implementing school-based policies to prevent obesity: cluster randomized trial”. *Am J Prev Med* Vol56,pp1–11. 2018 DOI10.1016/j.amepre.2018.08.026
- Geserick M, Vogel M, Gausche R, Lipek T, Spielau U, Keller E, et “ Acceleration of BMI in early childhood and risk of sustained obesity”. *N Engl J Med*. Vol 379,pp.1303–12,2018.DOI: 1056/NEJMoa1803527
- Lee JM, Wasserman R, Kaciroti N, Gebremariam A, Steffes J, Dowshen S, “. Timing of puberty in overweight vs. obese boys”. *Pediatrics*. Vol 137,pp.201 DOI:10.1542/peds.2015-0164.
- Ip P, Ho FK, Louie LH, Chung TW, Cheung YF, Lee SL, Hui SS, Ho WK, Ho DS, Wong WH, Jiang F . “Childhood Obesity and Physical Activity-Friendly School Environments.” *J Pediatr*. Vol Dec, pp.191:110-116,2017. DOI: 10.1016/j.jpeds.2017.08.017.