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Case Report

Nutrition transition – Pattern IV: Leads Bangladeshi youth to the increasing prevalence of overweight and obesity

Mohammad Hamid Al Muktadir [a], Md Ashraful Islam [b], Mohammad Nurul Amin [c,*], Supriya Ghosh [b], Shafayet Ahmed Siddiqui [c], Dipti Debnath [c], Md Monirul Islam [d], Tufael Ahmed [d], Farhana Sultana [c,**]

[a] Department of Public Health, American International University-Bangladesh, Dhaka, 1229, Bangladesh
[b] Department of Food Technology and Nutrition Science, Noakhali Science and Technology University, Noakhali, 3814, Bangladesh
[c] Department of Pharmacy, Atish Dipankar University of Science and Technology, Dhaka, 1230, Bangladesh
[d] Department of Pharmacy, State University of Bangladesh, Dhaka, 1205, Bangladesh

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ABSTRACT

Fast food and soft drinks consumption leading to excess calorie intake coupled with lack of acceptable physical activity has augmented the prevalence of overweight and obesity among the world population for the past few eras. A cross-sectional study was carried out among 475 youth selected by systematic random sampling attending in 27 established public and private universities and colleges of Bangladesh. The study was aimed to evaluate habitual facts associated with the prevalence of overweight and obesity among Bangladeshi youth. The rates of fast food consumption (once/week) are 50.6%, 43.7%, and 53.3% in overweight, pre-obese and obese-1 respondents accordingly and the rates of soft drinks consumption (4–6 times/week) are 40.5%, 59.2%, and 73.3% respectively for the same subjects. Moreover, approximately 40.8% of the youth went to fast food restaurants at least once per week and 27.2% went regularly (2 times/week). Youth having fast foods 2 times/week, consuming soft drinks 3–4 times/week were more likely to be obese. Besides, obesity epidemic was observed among those who have not the habit of doing physical exercise. This study provides evidence of increasing trend and threat to overweight and obesity for the Bangladeshi youth.

1. Introduction

Over the development of human survival, diet and nutritional status have undergone a sequence of phases, defined as broad configurations of food and beverage ingestion and physical activity and inactivity and the consequent changes in body composition and analogous nutrition-related disease. The perception of the nutrition transition emphases on large fluctuations in both dietary and activity arrays. The idea of the nutrition transition places human diet, activity, and body configuration in a wide-ranging historical viewpoint, with highlighting on understanding the pace, magnitude, determinants, correlates, and results of dietary change across centuries and millennia [1–3]. In the pattern IV of nutrition transition, it stated about a diet high in total fat, cholesterol, sugar, and other developed carbohydrates and little in polyunsaturated fatty acids and fiber is often escorted by an increasingly inactive life. The result is an increased pervasiveness of obesity that leads to the non-communicable diseases [2,3].

The world pushes toward the higher fat and higher refined sugar Western eating regimen! Significant dietary change incorporates a substantial increment in the utilization of fat and included sugar in the eating routine, frequently a checked increment in creature nourishment items appeared differently in relation to a fall in complete oat admission and fiber [3]. The pervasiveness of obesity is very high in high income countries and many of them have acknowledged obesity as a rampant [4]. Worldwide vitality lopsided characteristics and related weight levels are quickly expanding. The world is quickly moving from a dietary period in which the higher-wage nations are commanded by examples of degenerative ailments to one in which the world is progressively being overwhelmed by degenerative diseases [5]. Mankind has

* Corresponding author.
** Corresponding author.
E-mail addresses: amin.pharma07@gmail.com (M.N. Amin), faru.pharma@gmail.com (F. Sultana).

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confronted real moves in dietary and physical activity, examples and body synthesis since Paleolithic man rose on Earth. Human eating regimen and healthful status have experienced a succession of significant movements among trademark states—characterized as wide examples of sustenance utilize and comparing nourishment related sickness. The idea of the nourishment progress centers around substantial moves in eating regimen and action designs, particularly their structure and general piece. These progressions are reflected in nutritious results, for example, changes in normal stature and body [5]. This move toward expanded heftiness and degenerative infections is just the most recent example of this progress.

Obesity represents around 300,000 passing every year in the United States, and commonness rates have been expanding over the previous decade [6]. In 2010, 43 million youngsters (35 million in creating nations) were assessed to be overweight and corpulent; 92 million were in danger of overweight [7]. The considerable wellbeing dangers of heftiness among young people incorporate asthma, hypertension, type 2 diabetes, cardiovascular malady, misery and overabundance mortality in adulthood [8]. Relationship between fast food utilization joined with expanding segment sizes and diminished physical action and measures of heftiness in youngsters and teenagers has been embroiled as a potential contributing element in the stoutness emergency [9,10]. Expanding rates of weight and overweight have been connected to the rising vitality thickness of the eating routine [11].

In Bangladesh, a study found the frequency of obesity and overweight among Bangladeshi school children of 6–15 year olds about 3.5% and 9.7% respectively [12]. As stated by World Health Organization (WHO).

- Since 1980, worldwide obesity has more than doubled.
- In 2014, more than 1.9 billion adults who are 18 years old or more, were overweight. Of these 600 million were obese.
- 39% of adults aged 18 years and over were overweight in 2014, and 13% were obese.

The term overweight and obesity are defined as atypical or excessive fat accumulation that may bigotry health. Body mass index (BMI) is a simple directory of weight-for-height that is universally used to classify overweight and obesity in adults. It is delineated as a person's weight in kilograms (kg) divided by the square of his height in meters (m) (kg/m^2). BMI delivers the most useful mass-level extent of overweight and obesity as it is the identical for both sexes and for all ages of adults. Still it should be well thought-out a rough guide because it may not resemble the same degree of fatness in different individuals. BMI classification established by the World Health Organization (WHO) in 1997 and published in 2000 where BMI value < 18.5 defined as Underweight; 18.5–24.9 as Normal weight; 25–29.9 as Overweight and >30 as Obese [13–16]. In recent years, there was a growing argument on whether there are possible needs for emerging different BMI cut-off points for different ethnic groups due to the increasing confirmation that the associations between BMI, percentage of body fat, and body fat distribution differ across populations and therefore, the health risks increase below the cut-off point of 25 kg/m^2 that defines overweight in the current WHO classification. There had been two previous endeavors to interpret the BMI cut-offs in Asian and Pacific populations, which contributed to the growing deliberation. Therefore, to shed the light on this deliberation, WHO summoned the Expert Consultation on BMI in Asian populations [13,15]. The WHO Expert Consultation clinched that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is significant at BMI's lower than the existing WHO cut-off point for overweight (= 25 kg/m^2). However, the cut-off point for observed risk varies from 22 kg/m^2 to 25 kg/m^2 in different Asian populations and for high risk, it varies from 26 kg/m^2 to 31 kg/m^2. The Consultation, therefore, advocated that the current WHO BMI cut-off points should be reserved as the international classification [13,15,17].

2. Methodology

2.1. Study design

This study was a cross sectional study. The majority of the demographic data was collected by face-to-face interview. Body mass index (BMI) (kg/m2) was calculated based on clinically assessed weight (kg) and height (m) at baseline. The current analysis considered only the baseline measurements. Asian criteria of BMI definitions were used to categorize students as normal weight (BMI: 18.5–22.9), overweight (BMI: 23–24.9) and obese (BMI: 30 and above). Weight and height was measured by pre-defined procedure using weight machine and measuring tape.

2.2. Study area

This study was conducted in among of 27 established public and private universities and colleges of Bangladesh.

2.3. Study population

Bangladeshi youth of aged from 18-35 was the target group of this study.

2.4. Sample size

Considering an expected result prevalence of 50% and using confidence level of 95% the sample size of the cross sectional study was calculated as 384. Formula used to calculate the sample size,

$$n = \frac{Z^2 \, x \, p(1-p)}{d^2}$$

where.

n = required sample size
Z = Standard normal variate (at 5% type 1 error ($p < 0.05$) it is 1.96)
p = Prevalence rate is 50%
d = Absolute error is 0.05

2.5. Study period

This cross-sectional study was carried out from April 27 to October 13, 2018 among the students attending in 27 established public and private universities and colleges of Bangladesh. A total number of 475 students within age 18 to 25 were selected by use of systematic random sampling.

2.6. Study instruments

A well structured and modified questionnaire was used to collect data regarding age, sex, meal pattern, fast-food preference, fast food consumption per week, soft drinks consumption per week etc. In the cross sectional study, weight and height status were observed as baseline. Weight and height was measured by predefined procedure using weight machine and measuring tape. Students who were there in campus during the survey period were

included in the study and those who were not regular in that sense were excluded from the study.

2.7. Anthropometric assessment

Weight and height were dignified to evaluate the BMI (body mass index). Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. A BMI greater than or equal to 23 is overweight and a BMI greater than or equal to30 is obesity. Ranges from 18.5 to 22.9 of BMI ensure the normal level. The problem with using BMI as a body weight categorization tool, is that it does not take into account bony structure, muscle mass or percentages of lean mass compared to adipose tissue. At best, Body Mass Index is a simple measure of health. Though, academic literature that analyzes weight status naturally uses BMI as a primary pointer for study group classification.

2.8. Statistical analysis

SPSS 20.0 version was used for statistical analyzes. Descriptive statistics including mean, standard deviation, frequency, and crosstabs were obtained. All analysis was done with the test of significance (p value, Chi-square).

3. Result

This paper indicates the prevalence of overweight and obesity risk determined by body mass index (BMI) among Bangladeshi university students. A total number of 475 respondents attending in 27 established public and private universities and colleges of Bangladesh were interviewed and examined. The mean age of the selected university students was 21.45 ± 2.22 (Mean ± SD).

The overall prevalence of sleeping of the respondents was 20.2% (<6 h/day), 66.5% (6–8 h/day) and 13.3% (>8 h/day). Approximately 54.3% of the respondents take participate in games and sports for 0–2 h/week while 7.2% for 2–4 h/week, and 5.7% for more than 4 h/week. The study seems that 32.8% youth don't take participate in games and sports regularly. This study also found that 72.60% youth (40.8% youth 1 time/week, 27.2% youth 2 times/week, 4.6% youth >4 times/month) consume fast foods regularly in against of 27.4% youth who don't consume fast foods. Moreover, the dominance of soft drinks consumption significantly shows that 39.6% youth take soft drinks 1–2 times/week while 14.5% and 24.8% of youth take 3–4 times/week and 4–6 times/week correspondingly. Only 21.1% youth don't have the habit of taking soft drinks [Table 1].

Table 2 shows that 149 (62.1%) youth enjoy normal body weight with BMI of 18.5–22.9 kg/m^2 who take participate in games and sports of minimum 0–2 h/week in against of 53 (22.1%) youth who don't take participate in games and sports. The rate of participating in games and sports in overweight, pre-obese and obese-1 respondents is 50.6%, 29.6%, and 26.7% accordingly. On the other hand, the results in case of don't participating in games and sports are 39.2%, 62%, and 60% respectively for the same categories of respondents. Moreover, the overall prevalence of overweight, pre-obese, and obese-1 in the youth who do regular physical exercise at least 1–2 h/week are 26.6%, 19.7% and 33.3% respectively. On the other hand, the values are 63.3%, 66.2% and 53.3% respectively for those who have not the habit of doing physical exercise. Furthermore, a significant correlation between BMI and frequency of fast food and soft drinks consumption was observed too. The rate of fast food consumption (1 time/week) is 50.6%, 43.7%, 53.3% in overweight, pre-obese and obese-1 respondents accordingly and the rate of soft drinks consumption (4–6 times/week) is 40.5%, 59.2%, and 73.3% respectively for the same subjects [Table 2].

Table 1
Characteristics and food habit patterns of the respondents.

Characteristics/habits	Respondents (%)
Gender	
Male	283 (59.6%)
Female	192 (40.4%
Sleeping habit	
<6 h/day	96 (20.2%)
6–8 h/day	316 (66.5%)
>8 h/day	63 (13.3%)
Frequency of participating in games and sports	
0–2 h/week	258 (54.3%)
2–4 h/week	34 (7.2%)
>4 h/week	27 (5.7%)
Don't play	156 (32.8%)
Frequency of doing physical exercise	
1–2 h/week	133 (28.0%)
2–4 h/week	40 (8.4%)
4–6 h/week	25 (5.3%)
Don't do	277 (58.3%)
Frequency of Fast food consumption	
1 time/week	194 (40.8%)
2 times/week	129 (27.2%)
>4 times/month	22 (4.6%)
Don't consume	130 (27.4%)
Frequency of soft drinks consumption	
1–2 times/week	188 (39.6%)
3–4 times/week	69 (14.5%)
4–6 times/week	118 (24.8%)
Don't consume	100 (21.1%)

4. Discussion

The main findings of this study was determined by the change of food intake habit, regular exercise, taking participation in games and sports, proper length of sleeping time, consumption of fast food and soft drinks associated with the increasing prevalence of overweight and obesity among Bangladeshi youth. The results of this study are very alarming with an epidemic of overweight and obesity in those youth consuming fast foods and soft drinks regularly, and do not participating in games and sports. Around twenty-two percent (22%) youth, taking sleep less than 6 h per day were identified as overweight where around twenty-seven percent (27%) were recorded as obese with different stages of obesity, taking sleep more than 8 h per day. Tiredness and lacking interest of doing physical works can not burn unnecessary fat, resulting in overweight [18,19]. About twenty-one percent (21%) youth were found as overweight, taking fast foods for at least one time per week which increased to 27% for those youth, taking more than 4 times in a month. Nearby twenty-one percent (21%) youth were encountered as obese with different stages of obesity, taking fast food regularly per week which turns into thirty-four percent (34%), taking two times per week. Shatabdi Goon et al. showed thirty-nine percent (39%) Bangladeshi youth, taking fast foods were recognized as overweight where thirty-two percent (32%) were noted as obese with different phases of obesity and overall prevalence of fast food consumption was about 53.8% [18]. The present study shows the prevalence of fast food consumption among youth with 72.60% [Table 1]. One more cross sectional study amongst northeast Ohio residents exposed the prevalence of fast food consumption with 42% [20], where these current findings shows an increased prevalence in Bangladesh. In a different study, it was stated that, almost 63% respondents took fast food at least once in a week [21]. Nowadays, the prevalence of both fast food consumption and overweight/obesity has been increased. A very recent study has mentioned that fast food consumption is positively associated with abdominal obesity based Waist-Hip Ratio (WHR) [22]. Same direct relationship between fast food consumption and overweight/

Table 2
Variables associated with BMI category.

Variables		BMI category						*P*- value
		Underweight	Normal weight	Overweight	Pre-obese	Obese-1	Obese- 2	
Gender								
Male		30 (44.1%)	140 (58.3%	54 (68.4%)	49 (69.0%)	9 (60%)	1 (50%)	0.033
Female		38 (55.9%)	100 (41.7%)	25 (31.6%)	22 (31.0%)	6 (40%)	1 (50%)	
Sleeping habit								
<6 h/day		10 (14.7%)	49 (20.4%)	21 (26.6%)	12 (16.9%)	2 (13.3)	2 (100%)	0.090
6–8 h/day		48 (70.6%)	164 (68.3%)	49 (62.0%)	46 (64.8%)	9 (60%)	0 (0%)	
>8 h/day		10 (14.7%)	27 (11.2%)	9 (11.4%)	13 (18.3%)	4 (26.7%)	0 (0%)	
Frequency of participating in games and sports								
0–2 h/week		43 (63.2%)	149 (62.1%)	40 (50.6%)	21 (29.6%)	4 (26.7%)	1 (50%)	0.000
2–4 h/week		5 (7.4%)	17 (7.2%)	6 (7.6%)	5 (7%)	1 (6.7%)	0 (0%)	
>4 h/week		2 (2.9%)	21 (8.8%)	2 (2.5%)	1 (1.4%)	1 (6.7%)	0 (0%)	
Don't play		18 (26.5%)	53 (22.1%)	31 (39.2%)	44 (62.0%)	9 (60%)	1 (50%)	
Frequency of doing physical exercise								
1–2 h/week		17 (25%)	74 (30.8%)	21 (26.6%)	14 (19.7%)	5 (33.3%)	2 (100%)	0.189
2–4 h/week		7 (10.3%)	24 (10.0%)	2 (2.5%)	6 (8.5%)	1 (6.7%)	0 (0%)	
4–6 h/week		0 (0%)	14 (5.8%)	6 (7.6%)	4 (5.6%)	1 (6.7%)	0 (0%)	
Don't do		44 (64.7%)	128 (55.3%)	50 (63.3%)	47 (66.2%)	8 (53.3%)	0 (0%)	
Frequency of Fast food consumption								
1 time/week		25 (36.8%)	89 (37.1%)	40 (50.6%)	31 (43.7%)	8 (53.3%)	1 (50%)	0.000
2 times/week		13 (19.1%)	52 (21.7%)	20 (25.3%)	37 (52.1%)	6 (40%)	1 (50%)	
>4 times/month		6 (8.8%)	6 (2.5%)	6 (7.6%)	3 (4.2%)	1 (6.7%)	0 (50%)	
Don't consume		68 (14.3%)	240 (50.5%)	79 (16.6%)	71 (14.9%)	15 (3.2%)	2 (0.4%)	
Frequency of soft drinks consumption								
1-2 times/week	24 (35.3%)	125 (52.1%)	21 (26.6%)	14 (19.7%)	3 (20%)	1 (50%)	0.000	
3-4 times/week	8 (11.8%)	23 (9.6%)	22 (27.8%)	15 (21.1%)	1 (6.7%)	0 (0%)		
4-6 times/week	8 (11.8%)	24 (10%)	32 (40.5%)	42 (59.2%)	11 (73.3%)	1 (50%)		
Don't consume	28 (41.2%)	68 (28.3%)	4 (5.1%)	0 (0%)	0 (0%)	0 (0%)		

obesity were also observed in different studies. Actually consumption of fast food is positively related to obesity and overweight due to extremely high energy density of these food items [22–25]. Fast foods are low in fiber, poor in micronutrients, high in glycemic load and large portion size with sugar (so high energy density). Increase in energy density of diet by fat or sugar, promote unhealthy weight gain through passive overconsumption of energy. There are many studies which demonstrated a significant association between BMI and fast food consumption [22,26,27]. In the present study, 40.5%, 59.2%, 73.3%, and 50% respondents taking soft drinks 4–6 times per week were categorized as overweight, pre-obese, obese 1 and obese 2 respectively. One study explained that soft drink consumption is remarkably related to overweight and obesity throughout the world including developing countries [28]. Industry analysts suggest that soft drink consumption is expected to rise by 15.7% over the next 5 years in low- and middle-income countries and 9.5% worldwide. This is very alarming issue for us [28]. According to our study, physical activity and exercise have an impact on overweight and obesity. The prevalence of obesity increased consistently in case of those subjects who have not the habit of doing physical exercise. Several previous studies demonstrated such effects. *Petri Wiklund* mentioned that Increasing physical activity and exercise most certainly can create energy deficit through increased energy expenditure [29]. For this reason physical activity and exercise hold potential as part of the solution for the ongoing obesity epidemic.

It was observed through this study that most of the youth are well known about negative effects associated with fast food and soft drinks consumption; lack of participating in games and sports; lack of doing physical activity and exercise regularly; and effects of sleeping less or more than usual length. However, they were conveyed to have fast food at regular basis without considering their health complications, consuming soft drinks in a higher rate and sleeping at unusual length. The young generations are getting habituated in such a way that indicates a serious public health concern and urgent actions should be taken to clutch this public health problem.

This study has a number of confines. The data were self-reported and the study is cross-sectional which does not conclude causal relationships.

5. Conclusion

This paper accounts fast food frequency and other habits associated with overweight and obesity prevalence among the youth of Bangladesh. It is acknowledged that prevention is the most viable option for decreasing the obesity epidemic since current action practices are largely aimed at conveying the problem under control rather than affecting a cure. A combined initiative from family, educational institutes, public health experts and government is much needed to wrestle this public health problem. Both diet and exercise are important components in the programs intended for weight loss.

Conflicts of interest

None of the authors declare a conflict of interest.

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References

[1] Popkin BM. Nutrition transition and the global diabetes epidemic. Curr

Diabetes Rep 2015;15(9):64.
[2] Omran AR. The epidemiologic transition. A theory of the epidemiology of population change. Milbank Mem Fund Q 1971;49(4):509–38.
[3] Popkin BM. The nutrition transition and obesity in the developing world. J Nutr 2001;131:871S–3S.
[4] James PT, Leach R, Kalamara E, Shayeghi M. The worldwide obesity epidemic. Obes Res 2001;9:228S–33S.
[5] Popkin BM. Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases–. Am J Clin Nutr 2006;84: 289–98.
[6] Maddock J. The relationship between obesity and the prevalence of fast food restaurants: state-level analysis. Am J Health Promot 2004;19:137–43.
[7] De Onis M, Blössner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. Am J Clin Nutr 2010;92:1257–64.
[8] Francis DK, Van den Broeck J, Younger N, McFarlane S, Rudder K, Gordon-Strachan G, et al. Fast-food and sweetened beverage consumption: association with overweight and high waist circumference in adolescents. Publ Health Nutr 2009;12:1106–14.
[9] Schröder H, Fïto M, Covas MI. Association of fast food consumption with energy intake, diet quality, body mass index and the risk of obesity in a representative Mediterranean population. Br J Nutr 2007;98:1274–80.
[10] Fraser LK, Clarke GP, Cade JE, Edwards KL. Fast food and obesity: a spatial analysis in a large United Kingdom population of children aged 13–15. Am J Prev Med 2012;42:e77–85.
[11] Mendoza JA, Drewnowski A, Cheadle A, Christakis DA. Dietary energy density is associated with selected predictors of obesity in US Children. J Nutr 2006;136:1318–22.
[12] Bulbul T, Hoque M. Prevalence of childhood obesity and overweight in Bangladesh: findings from a countrywide epidemiological study. BMC Pediatr 2014;14:86.
[13] Nuttall FQ. Body mass index: obesity, BMI, and health: a critical review. Nutr Today 2015;50:117.
[14] Adnan MT, Amin MN, Uddin MG, Hussain MS, Sarwar MS, Hossain MK, et al. Increased concentration of serum MDA, decreased antioxidants and altered trace elements and macro-minerals are linked to obesity among Bangladeshi population. Diabetes, Metab Syndrome Clin Res Rev 2019;13:933–8.
[15] World Health Organization. Obesity and overweight. 2018.
[16] Amin MN, Hussain MS, Sarwar MS, Moghal MMR, Das A, Hossain MZ, et al. How the association between obesity and inflammation may lead to insulin resistance and cancer. Diabetes, Metab Syndrome Clin Res Rev 2019;13(2): 1213–24.
[17] Lim JU, Lee JH, Kim JS, Hwang Y Il, Kim T-H, Lim SY, et al. Comparison of World Health Organization and Asia-Pacific body mass index classifications in COPD patients. Int J Chronic Obstr Pulm Dis 2017;12:2465.
[18] Goon S, Bipasha MS, Islam S. Fast food consumption and obesity risk among university students of Bangladesh. Eur J Prev Med 2014;2:99–104.
[19] Islam MA, Amin MN, Siddiqui SA, Hossain MP, Sultana F, Kabir MR. Trans fatty acids and lipid profile: a serious risk factor to cardiovascular disease, cancer and diabetes. Diabetes, Metab Syndrome Clin Res Rev 2019;13(2):1643–7.
[20] Butt S, Leon JB, David CL, Chang H, Sidhu S, Sehgal AR. The prevalence and nutritional implications of fast food consumption among patients receiving hemodialysis. J Ren Nutr 2007;17:264–8.
[21] Moore LV, Diez Roux AV, Nettleton JA, Jacobs DR, Franco M. Fast-food consumption, diet quality, and neighborhood exposure to fast food: the multi-ethnic study of atherosclerosis. Am J Epidemiol 2009;170:29–36.
[22] Mohammadbeigi A, Asgarian A, Moshir E, Heidari H, Afrashteh S, Khazaei S, et al. Fast food consumption and overweight/obesity prevalence in students and its association with general and abdominal obesity. J Prev Med Hyg 2018;59:E236.
[23] Dumanovsky T, Huang CY, Nonas CA, Matte TD, Bassett MT, Silver LD. Changes in energy content of lunchtime purchases from fast food restaurants after introduction of calorie labelling: cross sectional customer surveys. BMJ 2011;343:d4464.
[24] Azadbakht L, Esmaeilzadeh A. Fast foods and risk of chronic diseases. 2008.
[25] Dunn RA, Sharkey JR, Horel S. The effect of fast-food availability on fast-food consumption and obesity among rural residents: an analysis by race/ethnicity. Econ Hum Biol 2012;10:1–13.
[26] Rosenheck R. Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. Obes Rev 2008;9:535–47.
[27] Shah T, Purohit G, Nair SP, Patel B, Rawal Y, Shah RM. Assessment of obesity, overweight and its association with the fast food consumption in medical students. J Clin Diagn Res 2014;8:CC05.
[28] Basu S, McKee M, Galea G, Stuckler D. Relationship of soft drink consumption to global overweight, obesity, and diabetes: a cross-national analysis of 75 countries. Am J Public Health 2013;103:2071–7.
[29] Wiklund Petri. The role of physical activity and exercise in obesity and weight management: time for critical appraisal. J Sport Health Sci 2016;5:151–4.