Environmental Risk Factors contributing to Childhood and Adolescence Weight Standard Deviation, Height Standard Deviation and Body Mass Index Changes

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Abstract

There are many risk factors contributing to childhood and adolescence BMI changes including socioeconomic status, and genetic factors. Due to increased prevalence of overweight and obesity among children and adolescents, different factors that are associated with overweight and obesity among children must be controlled. The predefined aim of this research study was to determine the environmental risk factors associated with childhood and adolescent weight SD, height SD and BMI changes in Mecca, Saudi Arabia. A retrospective cross-sectional study was carried out from June to August 2017 by considering the selected number of primary health care facilities and ambulatory clinics in Makkah region. Boston Children Hospital Growth calculator version 2.01 was used to calculate height standard deviation, weight standard deviation, BMI and BMI standard deviation. After acquiring the verbal consent of the parents and child/adolescent, an electronic questionnaire was filled during a face to face interview with only a parent, parent and child, and the adolescent according to their age group. Data was entered, coded, and analysed with the use of the Statistical Package for Social Sciences software (SPSS) version 20. The outcomes of this study revealed that different environmental factors contributing to childhood and adolescence weight standard deviation, height standard deviation and body mass index changes are dietary habits, socioeconomic status, physical activity, electronic devices in the room, and duration of using electronic devices.

Keywords*: Environmental Risk Factors, Childhood Adolescence, Weight Standard Deviation, Height Standard Deviation, Body Mass Index*

1. Introduction

The normal growth rate is essential for the physical and mental health of individuals, and in this regard, mentoring childhood and adolescence Body Mass Index (BMI) is crucial. The reason behind this is that Body Mass Index (BMI) is linked to potentially devastating effects on their health as adults [1]. There are many risk factors contributing to childhood and adolescence BMI changes including socioeconomic status and genetic factors. Paternal obesity, as well as lower socioeconomic status, are other factors associated with childhood obesity [2]. With respect to physical activity, overweight children were found to be significantly less active as compared to their non-overweight peers. Inappropriate consumption of junk food and sweetened beverages and the impacts of drink and food advertisements watched on electronic entertainment and communication platforms has also been linked to BMI issues [3, 4]. Skipping breakfast has also been a contributing factor to childhood and adolescence BMI changes [5].

BMI abnormalities have also been associated with the time period that is spent on the communication devices and electronic entertainment, for instance, television sets, computers, cell phones, electronic tablets, and video game consoles [6]. Regardless of father's working hours, increased maternal working hours is also linked to abnormal BMI values in such age groups [7]. Underweight in younger children have also shown to have an increased risk of poor global health and are more prone to require special health care needs. Additionally, they are at potential risk to develop more postoperative complications with an increased hospital stay [8, 9]. On the other hand, obese children have more risk to develop other comorbidities as cardiovascular conditions, diabetes and sleep apnea during childhood and even adulthood. Increasing BMI leads to increase the risk to develop asthma and orthopaedic conditions as slipped capital femoral epiphysis and spinal complications [8, 10]. As a result of globalization in the Kingdom of Saudi Arabia (KSA), extensive advertisement and improvement of socioeconomic status, a sedentary lifestyle is becoming the favoured way of living for Saudi population. This has resulted in increased prevalence of obesity (from 6.3-11.3%) among children and adolescents in KSA [11] and up to 20.5% among adults [12]. In 2015, the worldwide prevalence of underweight was 17.6% [13]. Due to increased prevalence of overweight and obesity among children and adolescents, it is important to control

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different factors that are associated with overweight and obesity among children.

1.1. Aims

The predestined aim of this research study was to determine the environmental risk factors associated with childhood and adolescent weight SD, height SD and BMI changes in Mecca, Saudi Arabia.

2. Research Methodology

2.1. Participants

A retrospective cross-sectional study was carried out from June to August 2017 by considering the selected number of primary health care facilities and ambulatory clinics in Makkah region. Primary health care facilities are outpatient clinics that provide primary health care services to the local population (Invitations to the general population were provided to encourage the community to visit the primary health care facility for a regular check-up). 481 children and adolescent participants between the age of 2 and 18 years old were enrolled in the study. In the study population, female participants were 230, while male participants were 251. The children who were below 2 years of age and people above the age of 18 were excluded from the research participants.

2.2. Instrument

The weight of each participant was measured to the nearest 0.1 kg by a single measurement scale. Participant's height was measured to the nearest cm with the mechanical beam scale with the help of height rod (without shoes). Boston Children Hospital Growth calculator version 2.01 was used to calculate height standard deviation, weight standard deviation, BMI and BMI standard deviation [6].

2.3. Data collection

BMI is an easily applicable method to identify weight categories that can lead to several health issues. A calculation of BMI of children and adolescents was carried out for children. Body Mass Index is defined as "the weight in kilograms divided by the square of height in meters". According to the Centre for Disease Control and Prevention (CDC) growth charts, the children and adolescent were subdivided into 4 categories, underweight (<5th percentile), normal (5-85thpercentile), overweight (85-95th percentile), obese (95-99th percentile) or morbidly obese (>99th percentile).

After acquiring the verbal consent of the parents and child/adolescent, an electronic questionnaire was filled during a face to face interview with only a parent, parent and child, and the adolescent according to their age group respectively. The interviewer asked questions about demographics, parents' social and educational status, weight problems in the family, breakfast habits, and consumption of unhealthy food and beverages. In addition, he also asked questions about eating meals away from home, following the diet, physical activity frequency and duration, and time spent on TV, video games, DVDs and mobiles. Other questions asked were related to fruits and vegetable consumption, the frequency of milk and dairies intake, a number of meals daily, eating habits while upset or watching TV, the intention of improving the child, body weight monitoring at home, breastfeeding during infancy, and healthy food cooking by parents during the week. Some participants were excluded from the study due to some missing data like weight, height, out of range BMI SD. To compare the finding of this research to previous similar studies, PubMed and Google Scholar were used for evaluation.

2.4. Data Analysis

Data was entered, coded, and analysed with the use of the Statistical Package for Social Sciences software (SPSS) version 20. The frequency tables were generated by the same software to identify the relation between BMI SD differences and the effect of social and educational status of the parents, electronic devices use, the frequency and duration of physical activity, eating habits, cooking for family during the week, number of consumed meals daily, and familial weight issues. The analysis was carried out for a sample size of 481 children and adolescent between the ages of 2 to 18 years old. The results were considered significant if the p-value was less than 0.05. All collected data was used only for scientific purposes of this study.

3. Results

This report was based on (481) child, 251 (52.2%) of them were males, and 230 (47.8%) of them were female. Age of the participant was between 2-20 years old; 99 (20.6%) were 2-6 years old, 227 (47.2%) were 7-12 years old, 155 (32.2%) were 13-20 years old. Regarding distribution of BMI in our sample; 158 (41.1%) children were 3rd percentile (underweight), 106 (27.6%) children were 5th percentile (healthy weight), and 68 (17.7%) children were 85th percentile (overweight), and 52 (13.5%) children were 95th percentile (obese). Regarding the prevalence of family obesity; 181 participants (37.6%) did not have an obese family member, 192 (39.9%) had 1-2 obese family member, 68 (14.1%) had 3-4 obese family members, and 40 (8.3%) participants had 5 or more obese family members. The percentage of family members who suffered from obesity, 88% had an obese father, 81 % had obese mothers, 80 % had obese maternal aunt/uncle, 88% had obese paternal aunt/uncle, 45 % had other obese relatives, 31% had obese sisters, and 58% had an obese brother. The data for the onset of obesity in the family revealed that 92 (32.7%) had onset during childhood, 188 (66.42) had onset during adulthood, 3 (1.1%) had onset during both childhood and adulthood. The question regarding the socioeconomic status of the family was also asked and 188 (39.7%) participants had income above average and getting more than 10,000, 235 (49.6%) were average earners and were getting 5,000-10,000, 51 (10.8%) were below average and were getting less than 5,000.

3.1. Parents' Educational Level and Socioeconomic Status

Education status of father: The outcomes obtained for education status of children have shown that 15 (3.1%) were illiterate, 200 (41.9%) had low education (high school or below), 212 (44.4%) had average education (Bachelor), and 50 (10.5%) had high education (master/PhD). Regardless the fathers' occupation: 417 (88.5%) were employed, and 54 (11.5%) were unemployed. 308 (71.3%) of employed had a professional job, and 124 (28.7%) of employed had a manual job. Working hour for father: 27 (5.6 %) worked less than 6 hours, 239 (56.0%) worked 6-8 hours, 133 (31.2%) worked 8-10 hours, 31 (7.3%) worked for more than 10 hours. Education status of the mother: 26 (5.4%) were illiterate, 186 (38.8%) had low education (high school or below), 232 (48.4%) had average education (Bachelor), 35 (7.3%) had high education (master/PhD). Regardless the mother occupation: 173 (37%) were employed, 300 (63%) were unemployed, 158 (33.4%) of employed had a professional job, 22 (4.7%) of employed had a manual job, 293 (61.9%) employed were housewives. Working hour for mother: 14 (7.9%) worked less than 6 hours, 135 (75.8%) worked for 6-8 hours, 25 (14.0%) worked for 8-10 hours, and 4 (2.2%) worked for more than 10 hours. According to the cause of obesity, 108 perceived that the cause is genetics, 309 considered that the cause is overeating, other factors associated with obesity are mentioned in Table 1.

3.2. Eating Habits

243 (50.6%) children did not have a habit of eating their breakfast, 62 (12.9%) children had the habit of eating their breakfast, 175 (36.5%) children sometimes had their breakfast. 111 (23.3%) participants had 1-2 unhealthy snacks per week, 155 (32.5%) had 3-4 unhealthy snacks per week, 169 (35.4%) had 5 or more unhealthy snacks per week, and 42 (8.8%) occasionally have unhealthy snacks per week. In addition, 133 (27.8%) had 1-2 healthy snacks per week, 128 (26.8%) had 3-4 healthy snacks per week, 119 (24.9%) had 5 or more healthy snacks per week, and 98 (20.5%) occasionally had healthy snacks per week. Furthermore, 40 (8.3%) family did not have taken-outs or eat away from home, 221 (46.0%) the family had taken-outs or eat away from home 1-2 times a week, 85 (17.7%) family had taken-outs or eat away from home 3-4 times a week. 46 (9.6%) the family had taken-outs or eat away from home 5 times or more a week, 88 (18.3%) the family occasionally had taken-outs or eat away from home every week. 371 (78.6%) children drink milk, 103 (21.7%) children did not have habit of drinking milk, 23 (6.1%) children drink Fat-free (Skim) milk, 31 (8.2%) children drink low-fat (1%) milk, 12 (3.2%) children drink 2% milk, 262 (69.5%) children drink Whole milk, and 49 (13.0%) children drink flavoured milk. Additionally, 137 (28.8%) children skip meals, 175 (36.8%) children did not skip meals, and 164 (34.5%) children sometimes skipped meals. 263 (55.3%) children ate in front of the TV, 118 (24.8%) children did not eat in front of the TV, and 95 (20.0%) children sometimes eat in front of the TV.

3.3. Physical Activity to Lose Weight

105 (22.7%) children were doing physical activities to lose weight, 282 (60.9%) children were doing any physical activity to lose weight, and 76 (16.4%) children sometimes did some physical activities to lose weight.

3.4. Outdoor Activities

211 (46.3%) children were doing outdoor activities, 162 (35.5%) children were not doing any outdoor activity, 83 (18.2%) children sometimes did outdoor activities. 107 (33.6%) children exercised less than 30 minutes, 114 (35.8%) children exercised 30-60 minutes, and 97 (30.5%) children exercised for 1-2 hours. 78 (19.7%) never exercised, 40 (10.1%) exercised 1 time/month or less, 64 (16.2%) exercised 1 time/week, 77 (19.5%) exercised 2-3 times/week, 37 (9.4%) exercised 4-6 times/week and 99 (25.1%) exercised daily.

3.5. Electronic Devices

179 children had the TV in their room, 97 children had computers in their room, 150 children had video games in their room, 349 children had mobile/tablet in their room, and 68 children had any other entertainment electronic items in their room. 92 (19.7%) children used their electronic items for less than 2 hours a day, 142 (30.5%) children used their electronic items for 2-4 hours a day, 232 (49.8%) children used their electronic items for 4 hours or more per day. 59 (12.7%) children used TV more than other entertainment electronic devices, 18 (3.9%) children used computers more than other entertainment electronic devices, 53 (11.4%) children used video games more than other entertainment electronic devices, and 333 (71.9%) children used mobile/tablet more than other entertainment electronic devices.

163 (34.5%) children were scolded because of overeating, 244 (51.7%) children were not scolded because of overeating, and 65 (13.8%) children sometimes are scolded because of overeating. 4 (1.8%) children were neglected as a way of scolding, 124 (56.1%) children were verbally scolded, 8 (3.6%) children were physically scolded, and 85 (38.5%) children were deprived as a way of scolding. On the other hand, 191 (40.3%) children are rewarded with food, 283 (59.7%) children were not rewarded with food, and 42 (22.5%) children were rewarded with ice cream. In addition, 52 (27.8%) children were rewarded with chocolate, 28 (15.0%) children were rewarded with pastries, 55 (29.4%) children were rewarded with candies, and 10 (5.3%) children were rewarded with fast food. In 99 (26.7%) participants, obesity affected the school performance and achievements of children, in 272 (73.3%) participants obesity did not affect the child's school performance and achievements. Moreover, 287 (63.6%) new-born babies were breastfed, 164 (36.4%) newborn babies were fed with formula milk. 219 (46.3%) parents were following up with the child's weight, 254 (53.7%) parents were not following up with the child's weight.

437 (91%) mothers were cooking healthy food for the child, 43 (9%) mothers were not cooking healthy food for the child. 268 (60.2%) mothers cooked every day for their children, 34 (7.6%) mothers cooked 1-2 times

a week for their children, 79 (17.8%) mothers cooked 3-4 times a week for their children, 48 (10.8%) mothers cooked 4 or more times a week for their children, and 16 (3.6%) mothers cooked once a week for their children.

Table 1: Valid percentage of participants in various BMI categories and different variables.

Variable	Category	Frequency	Valid %
BMI SD	3rd percentile (underweight)	158	41.1%
	5th Percentile (Healthy weight)	106	27.6%
	85th Percentile (Overweight)	68	17.7%
	95th Percentile (Obese)	52	13.5%
Ethnicity	White/ Caucasians	75	16.0%
	Hispanic	17	3.6%
	Black	29	6.2%
	Asian/Pacific islander	55	11.7%
	Arab	294	62.6%
Socioeconomic	above average > 10,000	188	39.7%
	average 5000-10,000	235	49.6%
	below average < 5000	51	10.8%
Mother's Education	Illiterate	26	5.4%
	Low education (high school or below)	186	38.8%
	Average (Bachelor)	232	48.4%
	High education (master/PhD)	35	7.3%
Mother's working hours	< 6 hours	14	7.9%
	6-8 hours	135	75.8%
	8-10 hours	25	14.0%
	> 10 hours	4	2.2%
Causes	Genetics	108	12.4%
	Overeating	309	35.5%
	Psychological	72	8.3%
	Physical inactivity	190	21.8%
	Sleep	41	4.7%
	Junk food	142	16.3%
	Others	9	1%
Fruits and vegetables	None	37	8.0%
	1-2 times	133	28.9%
	3-4 times	116	25.2%
	5 or more	122	26.5%
	Occasionally	52	11.3%
Breakfast	Yes	243	50.6%
	No	62	12.9%
	Sometimes	175	36.5%
Milk	Yes	371	78.6%
	No	103	21.7%
Diet	Yes	57	12.4%
	No	401	87.6%
Mother's cooking healthy meals	Yes	437	91%
	No	43	9%
Outdoor activities	Yes	211	46.3%
	No	162	35.5%
	Sometimes	83	18.2%
Electronic devices in the room	None	68	8.1%
	TV	179	21.2%
	Computer	97	11.5%
	Videogames	151	17.9%
	Mobile/Tablets	348	41.3%
Duration of using electronic items per day	< 2 hours	92	19.7%
	2-4 hours	142	30.5%
	≥ 4 hours	232	49.8%

Table 2: The relation between BMI and different environmental factors.

Environmental factors	p-Value (ρ-Value)
Socioeconomic status	0.146 (0.075)
Mother working hours	0.885 (-0.012)
Mother educational level	0.684 (-0.021)
Healthy snacks per week	0.283 (0.055)
Unhealthy snacks per week	0.508 (-0.034)
Drinking soda	0.179 (0.069)
Eating outside	0.404 (0.043)
Eating fruits and vegetables daily	0.636 (0.025)
Duration of using electronic items	0.028 (0.114)
Mother cooking at home	0.708 (-0.02)

ρ: Correlation coefficient of Spearman test.

Table 3: The relation between BMI and different environmental factors.

Environmental factor	Mean (SD)	p-value
Gender		0.814
Male	0.21 (± 1.73)	
Female	0.2 (± 1.6)	
Eating in front of TV		0.0001
Yes	0.48 (± 1.69)	
No	-0.48 (± 1.67)	
Sometimes	-0.33 (± 1.41)	
Eating when upset		0.011
Yes	0.54 (± 1.77)	
No	0.05 (± 1.6)	
Duration of using electronic devices		0.025
< 2 hours/day	- 0.24 (± 1.38)	
2-4 hours	- 0.15 (±1.79)	
≥ 4 hours/day	0.39 (±1.64)	
Most used electronic devices		0.331
TV	0.3 (± 1.49)	
Computer	-0.56 (± 1.66)	
Videogames	0.26 (± 1.69)	
Mobile/Tablets	0.21 (± 1.67)	
Exercise frequency		0.0001
None	0.52 (± 1.72)	
1 time a month or less	0.64 (± 1.29)	
1 time a week	0.39 (± 1.53)	
2-3 times a week	0.34 (± 1.53)	
4-6 times a week	-0.03 (± 1.8)	
Duration of exercise		0.010
< 30 minutes	0.60 (± 1.51)	
30-60 minutes	0.31 (± 1.73)	
1-2 hours	-0.13 (± 1.63)	
Outdoor activity		0.065
Yes	0.01 (± 1.59)	
No	0.26 (± 1.76)	
Sometimes	0.54 (± 1.65)	

4. Discussion

Few studies have described the longitudinal association between snacking and body mass index (BMI) of a child especially in China, where overweight and obesity incidence has been increased at a rapid rate [14]. In the present study, 111 (23.3%) children had 1-2 unhealthy snacks per week, 155 (32.5%) had 3-4 unhealthy snacks per week, 169 (35.4%) had 5 or more unhealthy snacks per week, 42 (8.8%) occasionally had unhealthy snacks per week. The outcomes of this study had determined that there is no significant relationship between BMI SDS categories and frequencies of unhealthy snacks per week, with a p-value of 0.508 r= - 0.034.

A cohort data which was collected by the Avon Longitudinal Study of Parents and Children in the United Kingdom has demonstrated a significant relationship between some types of food and beverages with excess weight gain or loss in three-year periods for the children of age group 7–13 [15]. In the present study, there is no significant relationship between BMI SDS categories and frequencies of drinking soft drinks per week, with a p-value of 0.179 and r= 0.069. Furthermore, there is no significant relationship between BMI SDS categories and frequencies of eating fruits and vegetables, with a p-value of 0.636, r= 0.025.

Previous studies have found a strong relationship between the use of computers, television watching, and video game play in children and adolescent. A crossover trial of the comparison between watching television and computer use, the video game on spontaneous energy intake in normal-weight males aged 9-13 years was determined. Watching TV increases food intake as compared to using the computer and video game [16]. In the present study, there is a significant difference in BMI SDS means among who eat in front TV and who didn't with a p-value= 0.0001. Children who eat in front TV have higher BMI SDS mean than as compared to those who did not. In addition, a cross-sectional study in New Hampshire and Vermont carried out a study on 2343, 9-12 years old children with a television in their bedroom and determined that they are at higher risk for being overweight [17]. In this study, there is no significant difference in BMI SDS mean among mostly used item (electronic devices), as p-value= 0.331 but, we can notice that the higher BMI SDS mean was in kids who watch TV mostly and the lower BMI SDS mean in kids who were using the computer mostly. However, we found that there is a significant difference in BMI SDS means among duration of using electronic devices with a p-value of 0.025. Kids who were using electronic devices less than 2hr/day have lower BMI SDS mean than who were using it 4hrs or more/day.

Previous studies have found the relationship between the physical activity and increase in the BMI in children and adolescent. In a systematic review of the health benefits of fitness and physical activity in school-aged children and adolescent identified a total of 11,088 potential papers. The review of studies included in this study has indicated that increase in the physical activity would increase the health benefit. The outcomes that were obtained from the experimental studies have determined that the modest amounts of physical activity high-risk youngsters (e.g., obese) can produce health benefits [18]. A cross-sectional study in Australia with a total of 245, 3- to 5-y-olds (127 girls, 118 boys) demonstrated that boys, who were overweight were significantly less active as compared to their non-overweight peers. The outcomes also revealed that no significant differences were observed in girls [19].

In this study, 105 (22.7%) children were doing physical activities to lose weight, 282 (60.9%) children were not doing any physical activity to lose weight, and 76 (16.4%) and children sometimes did some physical activities to lose weight. Furthermore, the study also found that 107 (33.6%) children exercised less than 30 minutes, 114 (35.8%) children exercised 30-60 minutes, and 97 (30.5%) children exercise for 1-2 hours. 92 children exercised in school, 147 children exercised in public places, and 30 children exercised at the gym. The results also found that there is a significant difference in BMI SDS means among those, who were exercising to lose weight and who didn't p-value= 0.0001. Kids who were exercising to lose weight have higher BMI SDS mean than those who were not.

Previous studies carried out on the children and adolescents in India and Ghana found a consistent and strong association between BMI and SES; implying that the higher the SES, the higher BMI [20]. Whereas, other studies in the developed countries like Australia, Spain, Germany and USA [20-23] and studies in Nigeria, Serbia, and Mauritius, the three developing countries, have shown an inverse association between BMI and SES. This has revealed that the higher BMI was associated with low SES [24-26]. The present study corroborates that inverse relationship in 17.7%, suggesting that the majority of this relationship remains unascertained. Potential factors resulting in the variability in the relationships between SES and BMI are believed to be dependent upon each indicator of SES (education, income, and occupation) which has its own variation in studying the SES-BMI relationship [26].

In literature, Anderson et al. (2003) and Ziol-Guest et al. (2012) approached to children at age 3 and 11 and 13 or 14 years, respectively of a mother aged 25. Have reported that the addition of 10 hours' work per week causes about 1.9% and 1.5%, respectively, increase in BMI [7, 27]. On the other hand, a study conducted in Denmark found no statistical relationship between mothers working hours and the probability of children's being overweight [28]. The present study supports that mother's working hours and BMI have no association. Contradicting results could be due to the quality of childcare and father's contribution to child's life [28]. Pointing to the fact that non-maternal childcare could offer either healthier environment as the supervision of a day-care institute or unhealthy lifestyle with less responsibility for childcare and home production if in the care of a housekeeper or a domestic servant.

Additionally, the findings of Ziol-Guest et al. (2012) and Anderson et al. (2003) showed that among higher educated mothers their children BMI would increase in return [7, 29]. However, this study has found that the mother's education level has no attribution to their children BMI. Among children, the obese and overweight children and adolescents were only 9% and 7%, respectively, of highly educated mothers. This has suggested that the time may be the key factor underlying these associations, as the time spent on work of a higher SES and higher educated mother could be consumed on preparing home-cooked meals or other health-promoting activities. This is less likely to be found in those with low SES and low educated mother [7].

In literature, several studies showed a positive and significant relationship between children BMI and parent BMI. One of these studies has demonstrated that the risks of childhood obesity are increased to three-folds when one of the parents is overweight [30]. Another study has demonstrated that the parental obesity increases the risk factor of childhood obesity to two to three time in all ages. The previous study has confirmed that parental influence is considered as a major key risk factor, which is associated with the obesity and weight gain of childhood. It can affect the child's dietary habits, the accessibility and availability of foods, physical activity, and food-related processes and thus control the obesogenic environment. In the present study, we found more than 80% of obese children have an obese parent (88% father, 81% mother), so there is a positive correlation between obese children and obese parent. The effect of parental obesity on childhood obesity is most probably due to a combination of genetic and environmental influences such as eating habits and lack of activity. In addition, sharing familial characteristics like food preferences and parental behaviour have possibility effect on running of obesity in the family.

In the US, a cross-sectional study was carried out among children and adolescents to measure the BMI of milk consumers (plain or flavoured) with non-milk consumers. This study has revealed a significant difference in BMI among the adolescent's age group in comparison to our study, there was no significant relationship between BMI and milk drinking (P=0.144) [31]. In this study, the researchers tried to evaluate family purchases of fast food for meals and related it with BMI and outcomes revealed that no statistical significance between the two p-values= 0. 404. This is in contrast to a study done in Canada, and they found a higher BMI among families purchasing fast food as the meal more than 3 times a week and most of them were overweight in that study p=0.01 [32]

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6. References

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