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**EFFECT OF SPORTS ACTIVITY AND DIETARY HABITS WITH WEIGHT GAIN
AMONG CHILDREN IN RIYADH, SAUDI ARABIA**

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ABSTRACT

Lack of physical activity and life style habits are closely related with obesity but the degree of association is not clear. In this study we attempt to examine the relationship between physical activity [in terms of gaming habits] and dietary habits and their impact on weight among children. Study was cross-sectional and included questions on type of games children play, measurement of BMI and dietary habits. The questionnaire was distributed randomly in schools and on internet. The subjects [n=186] were divided into 4 groups depending on age, gender and private or public school. Their gaming habits were correlated to BMI and eating habits. Around 7% girls of 9-12 years old from private and 8.9% from public schools who played 10-20 minutes of simulation games were in overweight category. 26.5% boys and 44.7% girls from 6-8 years old who always consumed snacks while they played with electronic games were in normal BMI but on the other hand girls from 9-12 years old, 8.9% from private and 13.3% from public schools were in high BMI. Electronic and active games are both used extensively in Riyadh, Saudi Arabia among private and public elementary school children and high energy dense snacks are consumed daily among both boys and girls. The results of this study suggested no significant correlation between active games and BMI among children between 6-12 years old but suggest that dietary habits and lifestyle has a greater effect on the subjects BMI.

Keywords: Body Mass Index, Sports, Electronic Games

INTRODUCTION

Physical inactivity and sedentary living habits represent an independent risk factor for lifestyle-related diseases such as obesity, while physical activity reduces an individual's risk of both cardiovascular disease and all-causes of mortality [1-5]. Unfortunately, overweight and obesity is associated with increased risk of coronary heart disease, hyperlipidemia, hypertension, type 2 diabetes, and certain musculoskeletal disorders like knee osteoarthritis [6]. In spite of the increased risk for chronic disease, there are everyday symptoms that make living an obese life more difficult like depression, snoring, difficulty sleeping, pain in back and joints, rashes or infections in fat folds, sleep apnea, high blood pressure, and elevated lipids in the blood [7]. Recently, a number of consensus statements and governmental reports have further emphasized the importance of regular physical activity to the health and well being of people at all ages [1,8-12].

Childhood obesity is nowadays considered an epidemic of developed and industrialized countries [13]. The number of fat cells increase more rapidly during the growing years of late childhood and early puberty, during growth the fat cells increase in number and when energy intake exceeds energy expenditure size of the fat cells increase

.When these cells enlarge they stimulate cell proliferation so again their numbers will increase and thus obesity develops [14].

Prevalence of obesity in school children in a country such as Saudi Arabia increased along with the standard of living over decades, and body fatness correlated significantly with several coronary artery disease risk factors [1]. The same phenomenon has appeared in India, China, Brazil, New Guinea, and other countries [World Health Organization [12]. One study also indicated that over 70% of Saudi preschool children, about 60% of elementary school children and 71% of youth were not active enough to meet the minimal weekly requirement of moderate-to-vigorous health-enhancing physical activity. Obese, 8-12 years-old Saudi boys were significantly less active than non-obese boys [15].

Previous studies have indicated that electronic media used by children and adolescence have other unfavorable health outcomes including obesity and increased intake of food with low nutritional value and high calorie density [16, 17], distorted body image [16, 18], use of cigarette [16, 19], decreased school performance [16, 20], decreased sleep time [16, 21], and low physical aptitude [16, 22]. These sedentary activities contribute to weight gain in several ways. In response, a

recent trend has been to develop new video games that incorporate physical activity into gaming, rather than relying on traditional sedentary gaming activity. The active video games (AVGs) defined as Video games which required physical activity beyond that of conventional hand-controlled, in which players physically interact with images on screen [23-25], by using arm, leg, or whole-body movements], in a variety of activities such as sports (eg, football, boxing, and martial arts) and other activities, eg, dancing and washing windows [26] may help increase physical activity and improve body composition.

One study indicated that active video games, in which players physically interact with images on screen, may help increase physical activity which improves BMI and reduce body weight in overweight and obese children [27]. Playing these games helps body to exercise and to be active which is an important part of effective weight loss. It helps to control the weight by using excess calories that otherwise would be stored as fat which maintains the overall health.

The prevalence of childhood obesity is increasing rapidly worldwide [28-30]. Studies in Saudi Arabia are observed to be limited, non-competent for children; therefore this study was conducted due to the high spread of

sedentary life habits among Saudi children and the lack of awareness among mothers about healthy life style patterns that attains healthy lives for their children, and to correlate gaming patterns with obesity in the kingdom.

The overall aim of this study is to assess the association between sedentary life style with low physical activity and it's relation to obesity and bad dietary habits in children aged between 6-12 years old in regards to using simulation games on children's BMI compared with children using sedentary electronic games leading to low physical activity which is recognized as major factors in obesity. The obesity prevalence among children is at the highest levels and obesity is considered as a global epidemic which has a high risk for chronic diseases e.g. non dependent diabetes mellitus and hypertension.

METHODS AND SUBJECTS

Study Sample

A cross sectional study was carried out on subject (n=186) between the ages of 6 to 12 years old, From 6 to 8 years old boys and girls from a private school, From 9 to 12 years old girls from both private and public schools were randomly selected with varying weights and heights. For children between 6 to 8 years-old, parents or teachers in schools were asked for assistance with data collection. Before the

study was conducted, a meeting with the head of each school was arranged to present the study and consent was taken. Nature of participation and assurance of participation privacy and anonymity were included in the questionnaire. On the day of the survey, instruction about filling in the questionnaire was given to the students under the supervision of their teachers and was filled in front of at least one of the research assistants. The data collected from the internet were for girls aged from 9 to 12 years old from public schools. The questionnaire included questions on Anthropometric measurements, dietary habits and physical activity level in different sections.

Anthropometric Measurements

Anthropometric variables included body weight and height measurements which were performed in the morning by the researcher. Body weight was measured to the nearest 100g using calibrated portable scales. Measurements were done with minimal clothing and without shoes. Height was measured to the nearest centimeter using a calibrated measuring rod while the subject was in a full standing position without shoes. Body mass index (BMI) was calculated as the ratio of weight in kilograms by the height squared in meters. The International Obesity Task Force for age- and sex-specific BMI cut-

off reference standards was used to identify overweight and obese adolescents between the ages of 6 and 12 years [31]. Also, Waist circumference was measured to the nearest centimeter by place a non-stretchable tape above the upper hip bones on a level of horizontal plane on all sides of the body as an indicator of fat distribution [14], Since the National Institute for Health and Clinical Excellence recommend that this measurement be used to give additional information on the risk of developing other long-term health problems [32].

Eating Habits Questionnaire

This section included questions designed to determine the frequency of certain dietary habits of adolescents, the questions include how many times per typical week the participants consumed breakfast, sugar-sweetened drinks including soft beverages, vegetables [cooked and uncooked], fruit, milk and dairy products, donuts and cakes, candy and chocolate, energy drinks and fast foods. The fast foods in this regard included both Western fast foods and Arabic fast-food choices, such as shawarma [grilled meat or chicken in pita bread with some salad]. These questions covered healthy and unhealthy dietary habits. The answered were based on 7 day food recall.

Physical Activity Assessment

This section of the questionnaire included questions on sedentary behaviors which were followed by questions on physical activity and were aimed to determine important information from adolescents related to the daily time spent on sedentary activities, such as time spent viewing TV, browsing the internet, outdoor activities [home and school] and types of video games played [active or inactive]. Participants were asked to provide the average number of daily hours without differentiating between weekdays and weekends. The questionnaire was designed to collect information on frequency, duration and intensity of the variety physical activities during a typical week.

Statistical Analysis

The result was expressed in percentages which were calculated using Microsoft Excel Software.

RESULTS

Subjects were grouped into 4 groups according to the age and gender (**Table 1**). The first group was 6-8 years old boys (n=49), the second group was 6-8 years old girls (n=47) and the third group consisted of 9-12 years old private school girls (n=45) and the last group was from 9-12 years old public school girls (n=45). The Body Mass Index (BMI) was divided into 5 categories which

were underweight, at risk of being underweight, acceptable weight range, at risk of being overweight and overweight. In addition, Table 1 shows the percentage of subjects who have some health conditions, out of which 8.2% were from the boys (6-8 years old) group, 2.1% from the girls (6-8 years old) group, 8.9% from the girls (9-12 years old) private school group and 6.7% from the girls (9-12 years old) public school group.

Table 1 also showed school schedules of the subjects if they had sport classes. All subjects had sport classes in their schools except for the girls from public school, who did not have any sport classes in their school schedules.

It was observed that a majority in all groups played both electronic and active games. It was highest (88%) among the boys of age group 6-8 years, while only 8% played electronic games and 4% played only active games. Among girls from the same age group, 62% played both type of games, while 25% played only electronic and 11% played only active games. When comparing girls from private and public school of age 9-12 years, it was observed that a higher percent (64%) from private schools played both types of games than girls from public school (42.2%). When comparing all groups, it was observed that in all private schools, both electronic and active games were played in a higher percent

but in public school, the percent of girls who played electronic games was higher (**Figure 1**).

Figure 2 shows the frequency of snacking while playing electronic games / watching T.V/Internet. Among boys from six to eight years old, approximately 61% reported to have eaten snacks while playing electronic games/watching T.V/Internet, 30.6% reported that they sometimes ate snacks while playing electronic games/watching T.V/Internet, while 8.1% didn't eat snacks while playing electronic games/watching T.V/Internet. From girls of the same age group, 70.2% reported to eat snacks regularly, while 23% sometimes ate snacks. On the other hand, when private and public school girls of age 9-12 years were compared for snacking habits while playing electronic games/watching T.V/Internet, not much difference was seen in the responses.

Figure 3 shows the correlation between subjects BMI and types of games played. A common trend observed in all the groups that all most subjects who had normal BMI played both simulation and electronic games. Among the boys, 13 boys were overweight even though they played both type of games. From girls studying in private school, age group 9-12 years, eight girls who played both games were of normal weight, the others were slightly overweight. Among girls from the

public school, eight girls out of forty-five played both electronic and active games and had normal BMI, four girls had low weight (underweight) and another four had high BMI (overweight). The majority of subjects from both private and public school had normal BMI when playing both electronic and active games.

Figure 4 shows the correlation between subjects BMI and average time of playing simulation games. From boys of age 6-8 years old, ten out of forty-nine played simulation games for more than 30 minutes had normal BMI, while an equal number of boys (five of each) considered overweight played between 10 and 20 minutes and more than 30 minutes. Among the girls from the same age group, 13 out of 47 subjects played for more than 30 minutes and had normal BMI, while just three girls considered as overweight played more than 30 minutes, and 4 girls under the overweight category played less than 10 minutes. The majority of both group's boys and girls had normal BMI and played more than 30 minutes while there were some boys and girls who played more than 30 minutes but were overweight. Girls from 9-12 years old from private school, a majority of them played 20-30 minutes daily and had a normal BMI. Most of them how played 10-20 minutes but were at risk of being overweight.

Whereas 11 out of 45 girls from public school did not have simulation games yet had normal BMI, other girls had a high BMI. Four girls who played simulation games for 10-20 minutes were overweight, while some girls who played simulation games for more than 30 minutes were underweight. The majority of girls from public and private schools reported playing simulation games 10-20 minutes were in the high BMI (overweight) category, but they agreed that playing for more than 30 minutes helped them lose weight.

Figure 5 shows the correlation between subjects BMI and snack eating when playing electronic games. Boys from age group 6-8 years old, it was seen that 13 boys out forty-nine reported that they ate snacks while using electronic games while just a nine of them were considered as overweight, seven of the boys reported that they sometimes eat snacks while playing with electronic games and had normal BMI's. Among girls from six to eight years old, twenty-one out of seventy-four who had normal BMI reported that they always ate snacks while they played with electronic games and only six girls considered as overweight also reported the same thing. Most boys and girls had normal BMI and always consumed snacks while they played with electronic games. Girls who ate snacks

regularly had BMI ranging from underweight to overweight which was same in all categories. The majority of girls from both groups from public and private schools agreed that they had normal BMI because they did not snack regularly while playing and those who had high BMI regularly snacked while playing electronic games.

DISCUSSION

This study assessed the association between BMI and the type of games [active or electronic] played by the students, taking into consideration, their dietary habits in a sample of Saudi children aged from 6 to 12 years old of both genders. Studies similar to this have been done in developed countries like United States and Australia but not in any Middle Eastern country [15, 27, 28, 33-35].

The majority of the subjects did not have any disease, however a few admitted to having diabetes type 1, asthma and some food allergies which didn't have a direct effect on the aspect of the study.

It has been observed that increased sedentary behaviors are linked to increased risk for overweight and obesity in the child population [29, 30, 36-38]. A similar result is observed in our study. Girls from 9 to 12 years old from the private school, the majority of them are classified at risk of being overweight among all the groups, and this is

due to the sedentary lifestyle they are living. As one study in Saudi Arabia ensured that the high prevalence of physical inactivity was found in females [13]. However, we found that the highest level of overweight subjects was from public schools compared with other groups, and this may be due to absence of sport classes in their daily schedules.

Regarding dietary habits, we observed that skipping breakfast is only found in a few subjects from public school which did not appear among the other groups. One study found that skipping breakfast is associated with other lifestyle choices such as low levels of physical activity, low levels of cognitive ability and high level of soft drinks consumption [31] which is again similar to the results observed in the current study. On the other hand, there is variation in consumption of the three main meals between complete and incomplete meals. (Complete meal: consists of at least two food groups: meat group and its alternates, starch, milk and its substitutes, fruits, vegetables. Incomplete meal: Consists of less than two food groups).

An average of more than 10% in all groups of students playing simulation for over 30 minute come under the normal weight category, this is due to the recommended amount of exercise the students are getting while playing daily. The majority from the

first three groups stated that they consume both healthy and unhealthy snack while playing electronic games, watching TV/internet, unlike most among the fourth group subjects in the public schools who report that they consume unhealthy snacks, like calorie dense snacks, chocolate and chips and that maybe because unhealthy snacks are cheaper than the healthy snacks, and because of the easy access of these types of unhealthy snacks in the public canteens and shops.

Subjects studying in private schools have sport classes in their school schedules; otherwise public schools don't have sport classes. Mainly sport classes in private schools involved activities like football, basketball, and swimming, rope jumping and running. These activities keep the students healthier and help control abnormal weight gain.

Students from public schools mainly eat breakfast prepared in school canteens compared with other groups which could be one of the reasons for them to be in the high risk of being overweight category since canteen foods are known to be rich in unhealthy carbohydrate and fat [32]. Another interesting observation is students from public school mostly owned and played electronic games which reflect why they have a highest level of overweight. This again could be

because of lower income status among most students in public school.

No difference is seen among boys and girls of 6-8 years old regarding the types of games played as most of the overweight subjects play both types of games. In the same group we find that girls from the private school who are classified as overweight play both types of games, but overweight subjects in public school group play electronic games only. In one study they found a positive association between T.V viewing, electronic games and computer use and increased adiposity among subjects [31, 33]. Maybe the private school subjects who have both type of games have other factors to be overweight as: dietary habits, lifestyle, genetics and to some extent, the duration spent on playing active games. They may not also be eating healthy, or may be snacking at regular intervals throughout the day.

CONCLUSION

The observation was not what was expected. There was no strong relation found between BMI and the type of games played. That maybe because dietary habits and the sedentary lifestyle common in the Saudi population seemed to have a bigger effect on BMI than did the games. Further studies are required on a larger student population from private and public schools and the genetic

predisposition of the families should also be taken into account.

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Table 1: Physical Characteristics for the Subjects

Characteristics	Category	Boys[6-8] N [%]	Girls[6-8] N [%]	Girls[9-12] Private N [%]	Girls[9-12] Public N [%]
BMI	Underweight	2 [4.1%]	2 [4.3%]	6 [13.3%]	7 [15.6%]
	At risk of being underweight	6 [12.2%]	3 [6.4%]	4 [8.9%]	1 [2.2%]
	Acceptable weight range	21 [42.9%]	29 [61.7%]	17 [37.8%]	17 [37.8%]
	At risk of being overweight	6 [12.2%]	5 [10.6%]	10 [22.2%]	7 [15.6%]
	overweight	14 [28.6%]	8 [17%]	8 [17.8%]	13 [28.9%]
Age	6-8 years	49 [100%]	47 [100%]	0 [0%]	0 [0%]
	9-12 years	0 [0%]	0 [0%]	45 [100%]	45 [100%]
Disease	Yes	4 [8.2%]	1 [2.1%]	4 [8.9%]	3 [6.7%]
	No	45 [91.8%]	46 [97.9%]	41 [91.1%]	42 [93.3%]
Does your school schedule contain sport classes	Yes	49 [100]	47 [100]	45 [100]	0 [0]
	No	0 [0]	0 [0]	0 [0]	45 [100]

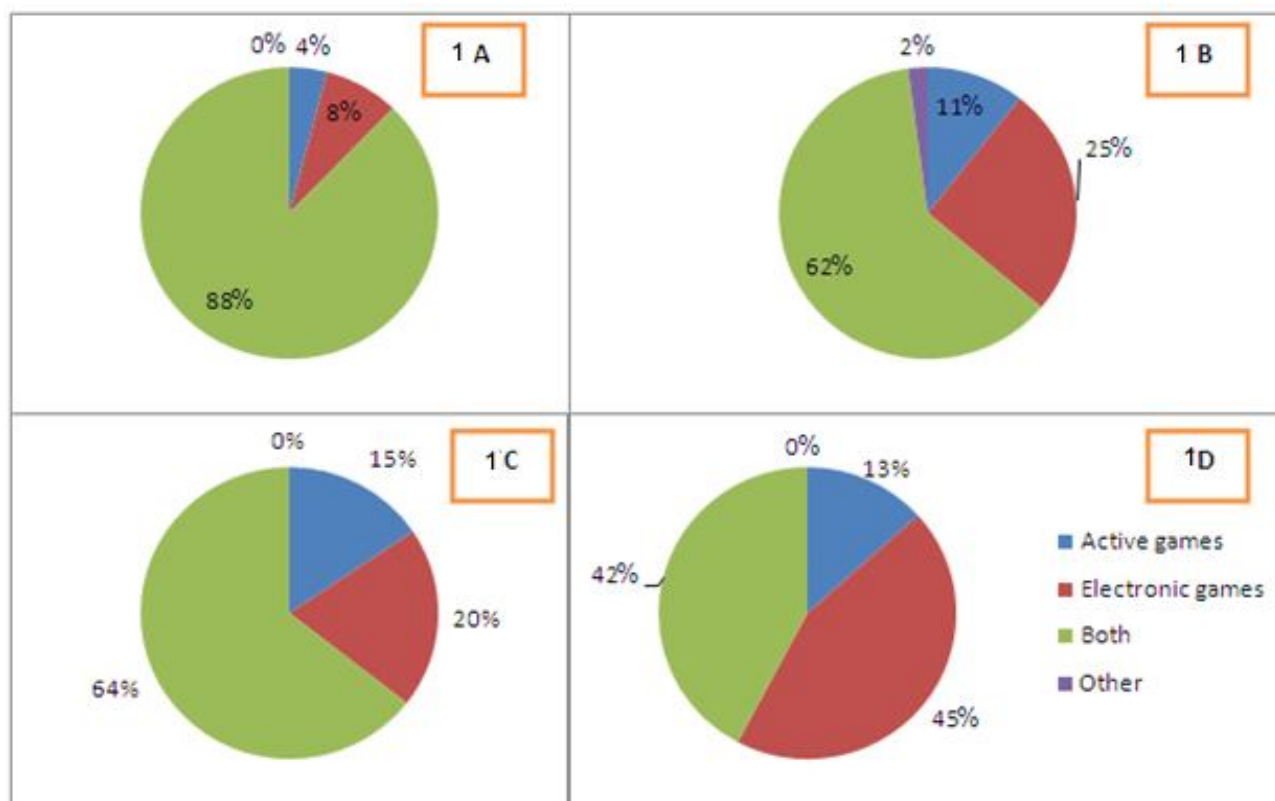


Figure 1: Pie Charts Show the Kind of Games Played by the Subjects, 1A: Boys From 6-8 Years Old, 1B: Girls From 6-8 Years Old, 1C: Girls From 9-12 Years Old (Private School), 1D: girls From 9-12 Years Old (Public School)

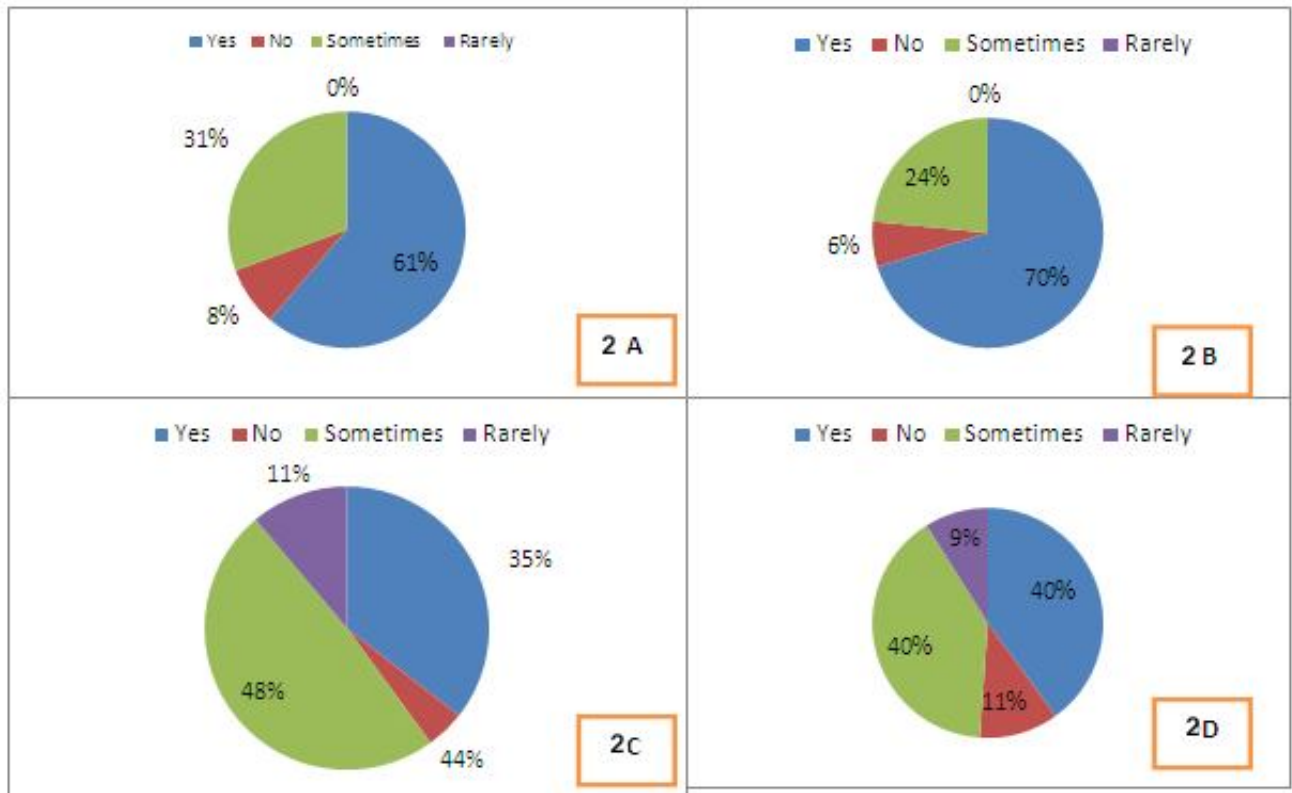
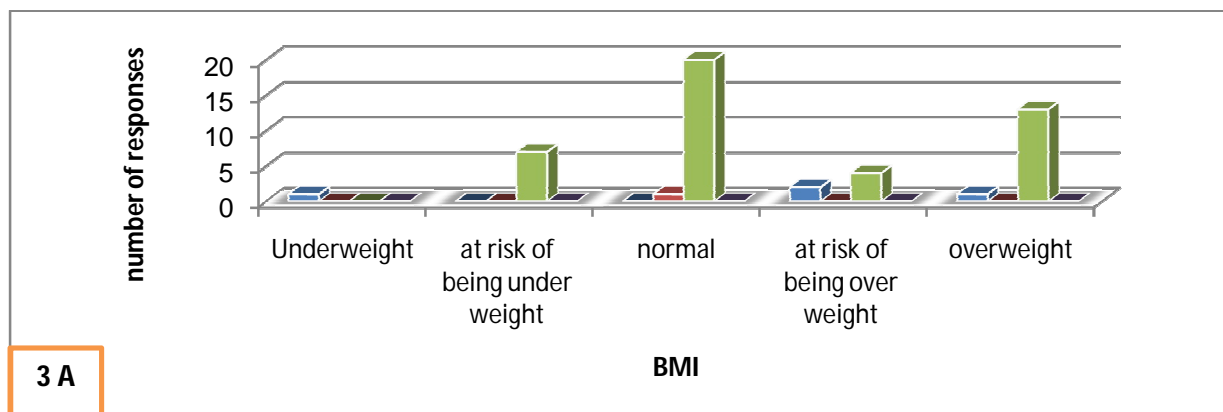


Figure 2: Pie Charts Show the Frequency of Snacking While Playing Electronic Games / watching T.V/Internet, 2a: Boys From 6-8 Years Old, 2b: Girls From 6-8 Years Old, 2c: Girls From 9-12 Years Old (Private School), 2D: Girls From 9-12 Years Old (Public School)



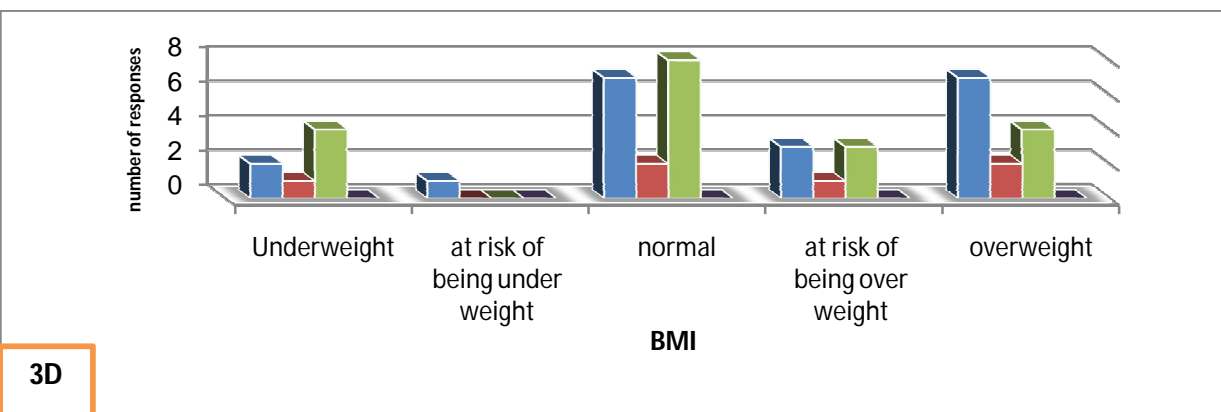
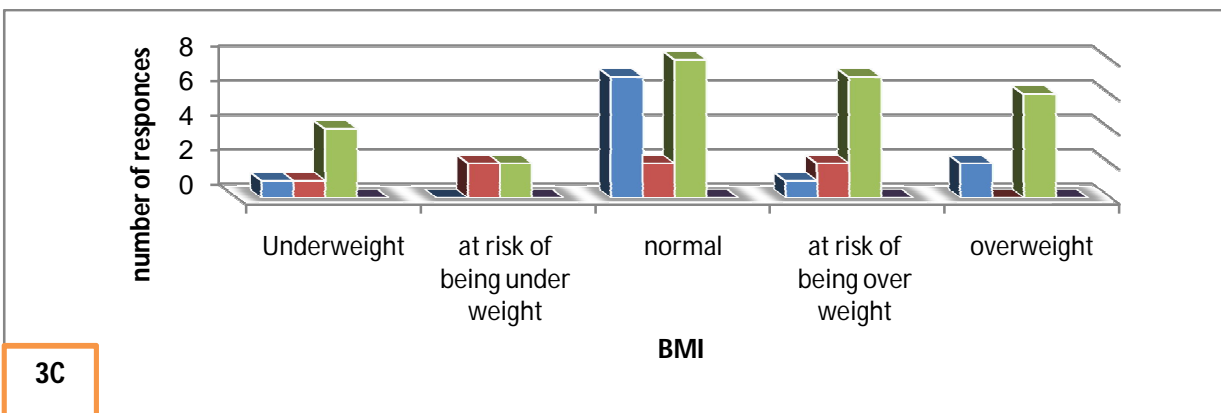
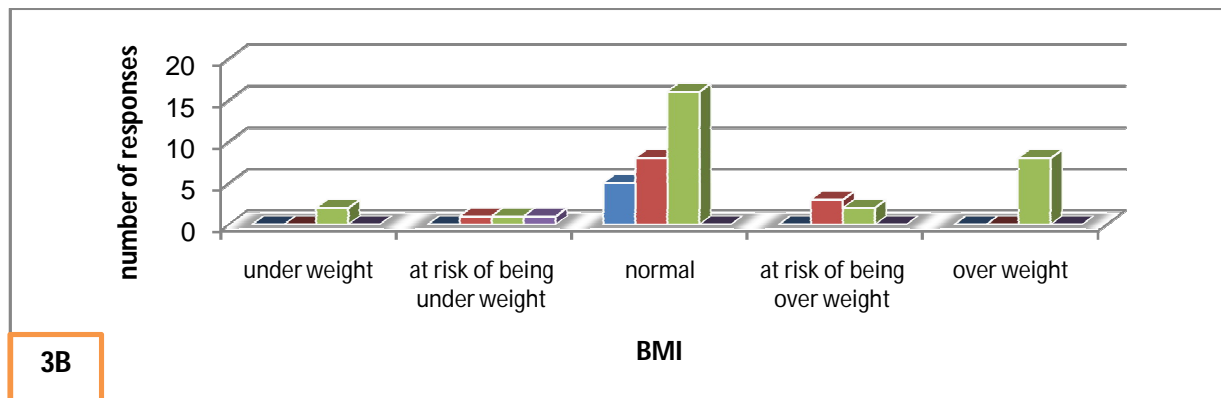
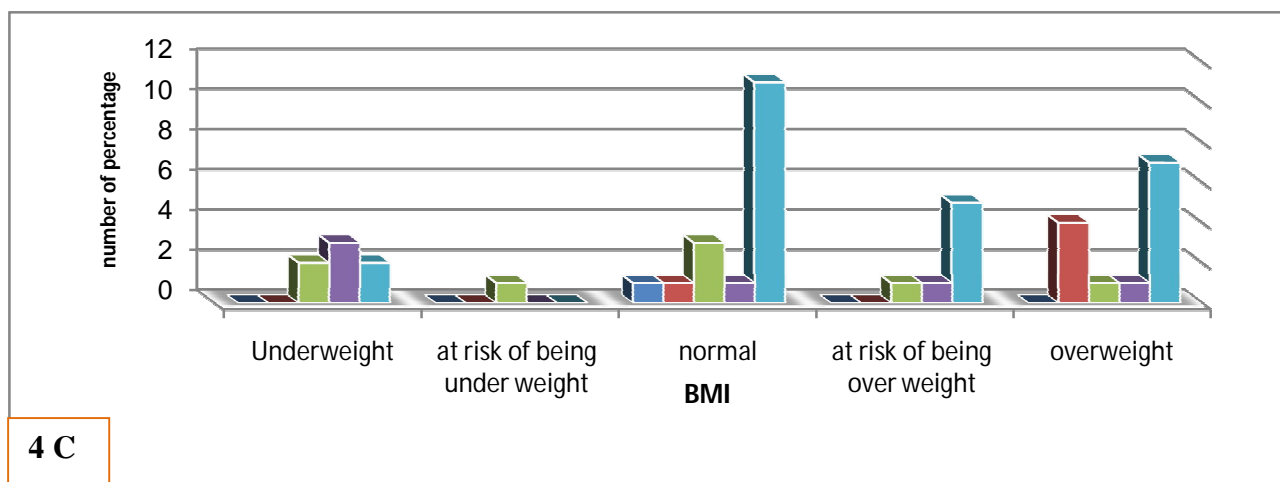
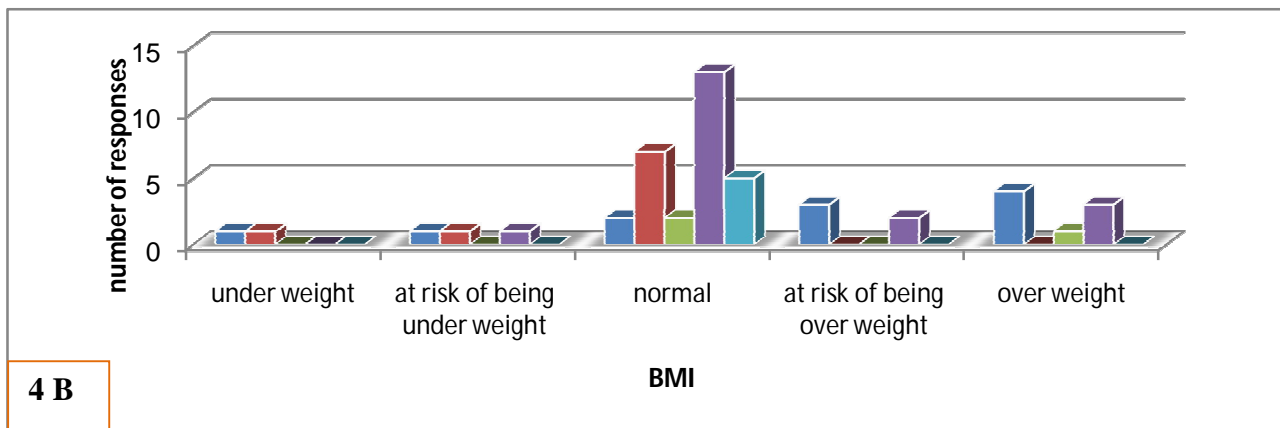
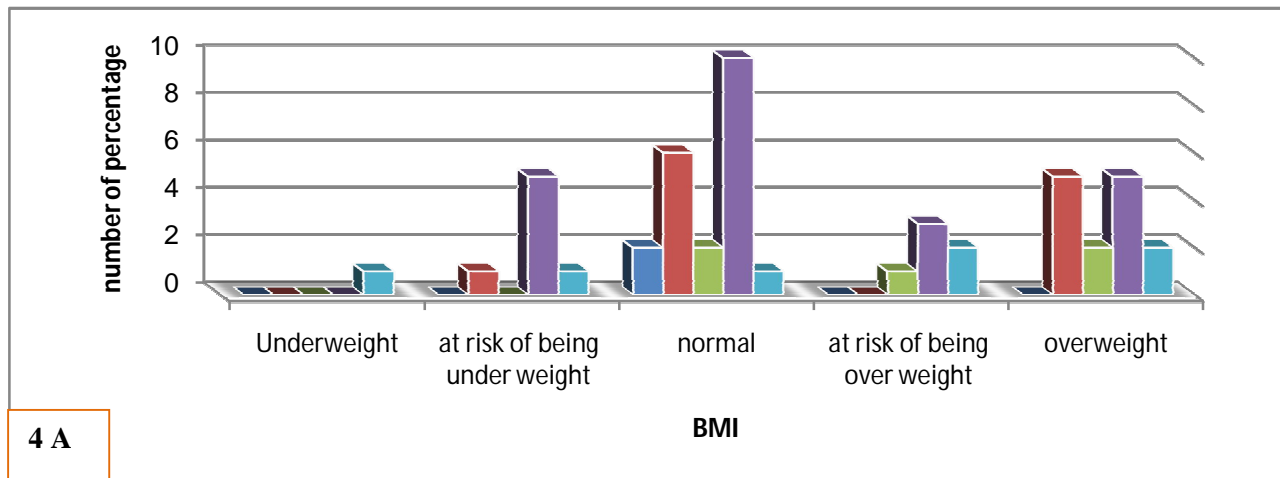


Figure 3: Bar Charts Show the Relation Between BMI's Subjects and Types of Games Played, 3A: Boys From 6-8 Years Old, 3b: Girls From 6-8 Years Old, 3c: Girls From 9-12 Years Old (Private School), 3d: Girls From 9-12 Years Old (Public School)



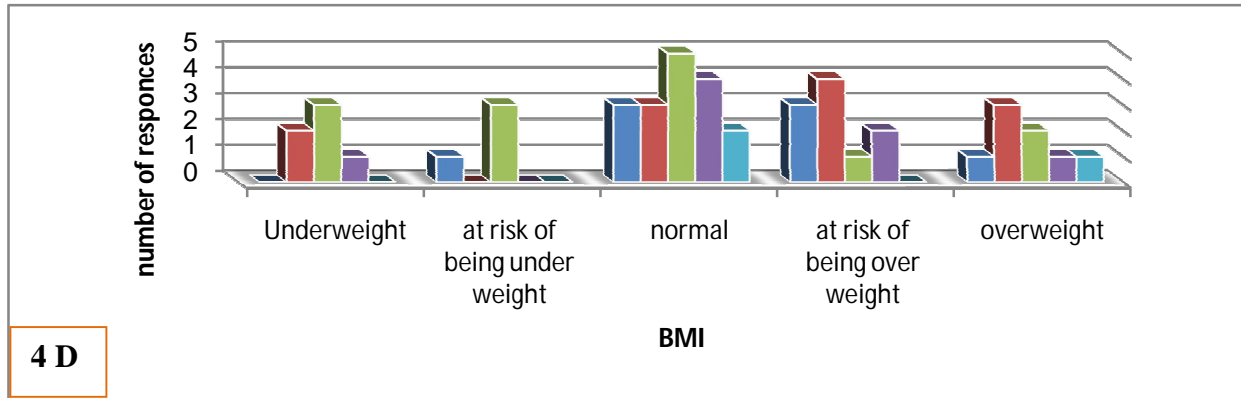
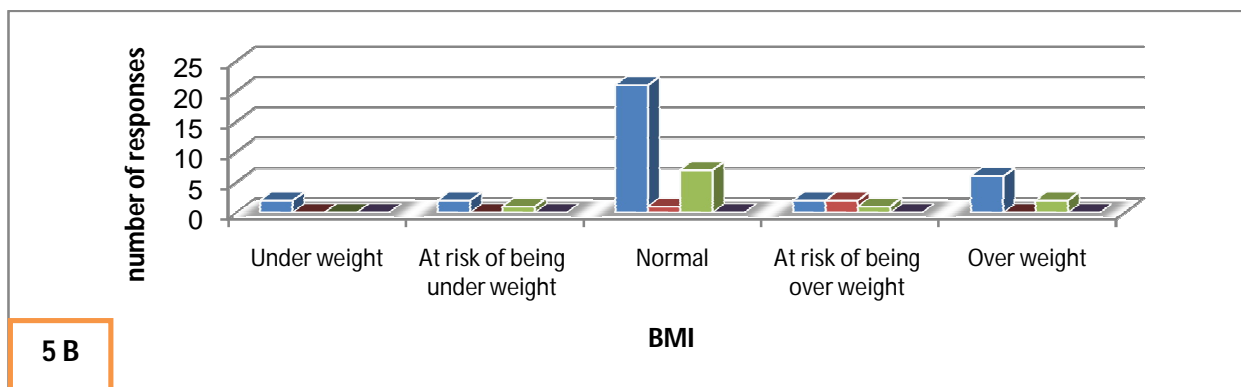
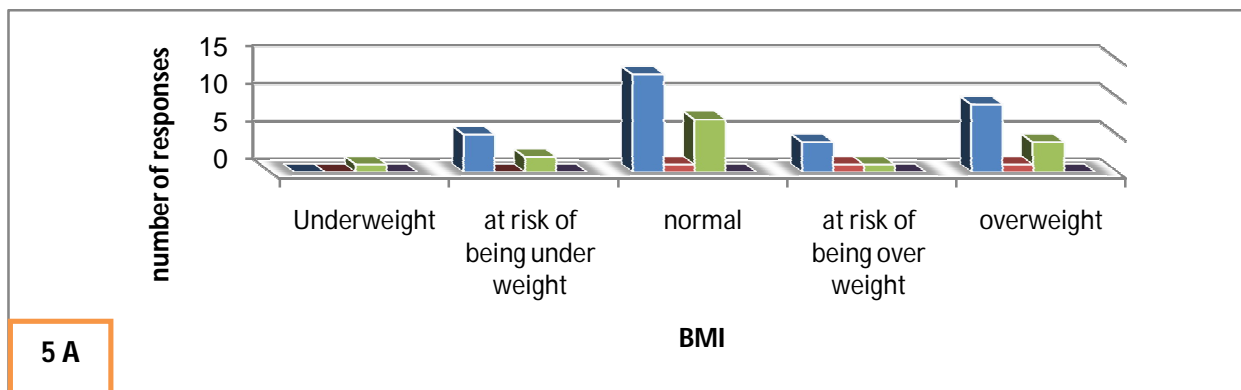


Figure 4: Bar charts show the relation between BMI's subjects and average time of playing the simulations games, 4A: boys from 6-8 years old, 4B:girls from 6-8 years old, 4C:girls from 9-12 years old (private school), 4D:girls from 9-12 years old (public school)



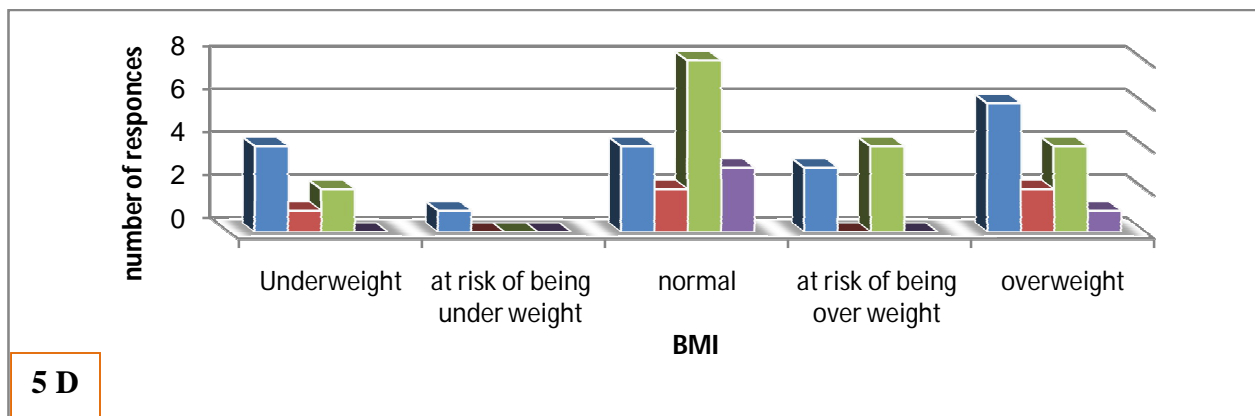
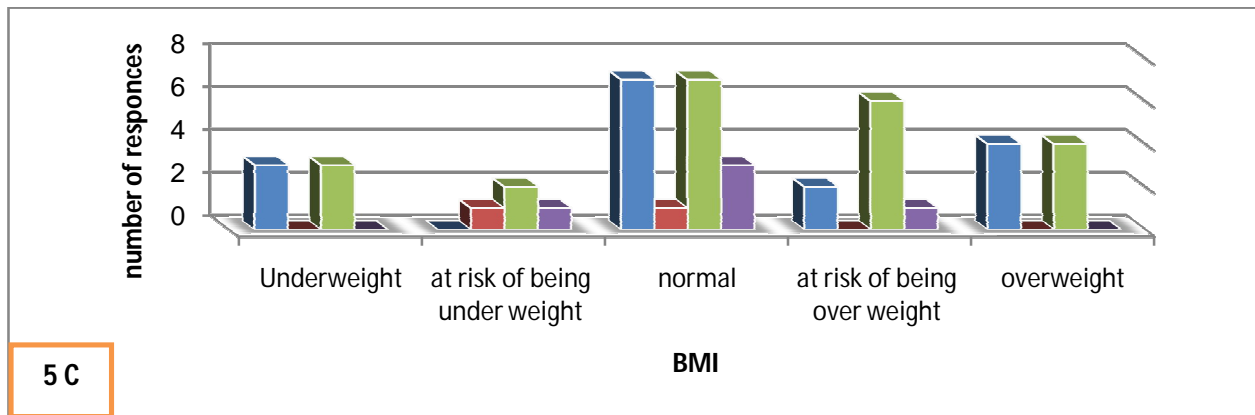


Figure 5: Bar Charts Show the Relation Between BMI's Subjects and Eat Snack When Playing Electronic Games, 5A: Boys From 6-8 Years Old, 5B: Girls From 6-8 Years Old, 5C: Girls From 9-12 Years Old (Private School), 5D: Girls From 9-12 Years Old (Public School)