Association between Childhood Computer Use and Risk of Obesity and Low Vision

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Abstract- **The objective of this cross-sectional study was to determine the relationship between excessive Internet/ Video games/ Television viewing and childhood obesity and low vision in the State of Qatar. A total of 3000 school students aged from 6 to 18 years were approached and 2467 (82.2%) students participated in this study. Of the 2,467 studied school children, 591 (24.0%) were either overweight (18.8%) or obese (5.1%). Majority of the overweight (80.2%) and obese (80.3%) children spent≥ 3 hours on the Internet (p < 0.001). A larger proportion of overweight (77.2%) and obese (70.1) children, when compared to normal weight (58.5%) children, slept 6 hours/night (p < 0.001). A significantly larger proportion of overweight and obese children, compared to normal weight children, prefer watching commercials, fantasy violence, violent movies and educational programs on TV (p < 0.001). Symptoms of excessive internet use and TV viewing (≥ 3 hours/day) manifested as headaches (36.5%), blurred vision (35.6%), double vision (9.8%), eye tiredness (15.7%), dizziness (24.4%) and hearing problems (25.0%). A significant number of those who spent≥ 3 hours on the Internet had low vision in both right (14.9%) and left (14.0%) eyes (p < 0.001). The current study findings confirmed a positive association between obesity and low vision because of excessive use of Internet, Video games and TV viewing.**

Keywords- Excessive Internet Use; TV Viewing; Obesity; Low Vision; Children

I. INTRODUCTION

The use of multimedia (the Internet and Television) in children's educational activities and settings has become a widespread global phenomenon. In fact, the lack of such facilities in both children's schools and homes is perceived as an educational disadvantage [1]. Nonetheless, concern has been raised, in the public and academic arenas, regarding both the content viewed and time spent on such technologies by children and its effect on their mental and physical health. This is particularly the case, in light of the recognition of the childhood obesity epidemic as a major global public health problem [2].

Numerous studies have documented the impact of the content of TV and the Internet on children's lifestyle choices; these range from the effect of popular TV characters' poor eating habits [3] to high calorie food advertising directed at children on both the TV and Internet [4-7]. These aspects of TV and Internet are seen as having an especially damaging impact since children do not yet have the cognitive capacity to discern real from fiction [8-40].

Similarly, a large body of literature has documented the effect of the time spent watching TV or using the internet on children, in terms of, adopting sedantary lifestyle habits associated with obesity [9, 11-14]. The majority of these studies have been conducted in developed countries, and there is a lack of empirical evidence which indicates whether similar findings would be found elsewhere.

While many studies have investigated the relationship between content and time spent on TV and internet and obesity, very few studies have been conducted on low vision. One of the few institutions, which have highlighted this problem, is the American Optometric Association [15]; it pointed out that children's vision is particularly at risk as the result of spending excessive time on screens as they often do not report that they are experiencing problems; this in turn could exacerbate existing eye defects. The only empirical study [16] to have investigated the associations between time spent on screens, obesity and low vision, found a meaningful interrelated association between these three variables. Our study differs from this previous study in that it has a larger community-based sample size.

The State of Qatar has experienced a rapid transition from developing to developed country during the last decade. The impact of such economic changes is likely to contribute to major changes in lifestyle factors especially on youth. The aim of the current study is to determine the effect of excessive Internet surfing, Video games using, and Television viewing on children and adolescents and its relationship with obesity and low vision.

II. METHODS

This is a cross-sectional study which included schoolchildren aged between 6 – 18 years, studying in the primary, preparatory and secondary levels in both government and private schools, in the State of Qatar. A multi-stage stratified random sampling technique was used and the schoolchildren were selected randomly. Stratification allowed both urban and semi-urban areas to be proportionally represented. The list of names of schools in

urban and semi-urban areas was obtained from the Supreme Council for Education and Higher Education.

A total of 151,050 students are studying in primary, preparatory and secondary schools. Schools were segregated according to sexes. There are 299 schools, of which 152 are for boys and 147 for girls located in twenty-one different districts. Forty schools were selected with twenty each of boys' and girls' located in twelve districts. During the first stage, one school from five regions (representing the North, South, East, West and Center) within each of these districts was selected randomly, thus overcoming the so-called "cluster effect". This could have occurred if the twenty schools were put in one pool and the names randomly selected; this strategy might have resulted in schools in only one area of the town being represented. Similarly, the classrooms and schoolchildren were selected in the second and third stages using the same simple random sampling procedure, finally resulting in the selection of 3,000 students who were a true random sample of the study population which is 1.5% of the total students in Qatar.

Ethical clearance for the study was obtained from both the Supreme Council of Education and Higher Education and Hamad Medical Corporation.

Data collection took place from September 2009 to March 2010. The questionnaires with a letter of explanation were distributed to the parents of the children studying in primary levels. Preparatory and secondary school students completed the questionnaires and returned them to the nurse in-charge of the school. The total 3,000 students were approached and 2,467 students participated in the study giving a response rate of 82.2%. Content validity, face validity, and reliability of the questionnaire were tested using 125 children. These tests demonstrated a high level of validity and high degree of repeatability (kappa = 0.84).

The data was collected through validated questionnaires, which were self-administered. The questionnaire had five parts. The first part included the socio-demographic details of the students; the second part included the lifestyle habits, extra physical activities and hobbies; the third part asked about dieting habits; the fourth part asked about internet and video game use and television viewing; finally, the fifth part asked about medical family history and contained a vision assessment which was conducted by a physician or school nurse. The questionnaire was available in two main languages common among the school children (English and Arabic). The original English version of the questionnaire was translated into Arabic by a professional translator and translated back to English to check for inconsistency.

Age and sex-specific categories of overweight and obese body mass index (BMI) cut-off points, of the studied children, were defined as over the 85th and 95th percentiles respectively, in accordance with the Qatari growth pattern curves devised by Bener and Kamal [17].

The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) was used for definition of visual impairment categories. Eye examination was determined by using a Slit Lamp, [Topcon] and visual acuity with tumbling E letters at a distance of twenty feet (six metres). The participants' visual acuity without correction was measured separately for each eye. Then visual acuity was tested with best spectacle correction. Visual acuity was recorded as the smallest line in which the patient could read the four letters correctly. Children with low vision or blindness (best corrected vision in good eye worse than 20/60 lower to 20/400 or worse than 20/400) were excluded from the study.

Student test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by non-parametric Mann-Whitney test. The Chi-square and Fisher's exact tests (two-tailed) were performed to test differences in proportions of categorical variables between two or more groups. One Way Analysis of variance (ANOVA) was employed for comparison of several group means and to determine the presence of significant differences between group means. The Spearman rank correlation coefficient was used to evaluate the association strength between two variables. The level $p < 0.05$ was considered as the cut-off value for significance.

III. RESULTS

This is a cross-sectional population study that included 2467 school children and adolescents in the State of Qatar. Table I shows socio-demographic characteristics of the studied school children according to BMI. Of the 2,467 studied school children, 591 (24.0%) were either overweight (18.8%) or obese (5.1%). The $\geq$ 15 years-age group had the greatest proportion of both overweight (36.8%) and obese (9.4%) children ($p < 0.001$). The highest percentage of overweight (26.3%) and obese (7.9%) children were with fathers who had a primary school education; moreover those students whose fathers were either not working or in manual labor were more likely to be overweight or obese than those whose fathers were employed in business, sedentary or professional occupations ($p < 0.001$).

TABLE I SOCIO-DEMOGRAPHICS AND SOCIAL CHARACTERISTICS OF THE STUDIED CHILDREN ACCORDING TO BMI (N=2467)

| Variable | Total N=2467 n(%) | Body Mass Index | | | p-value [a] |
		Normal (<85th Percentile) n=1876	Overweight (85th-95th Percentile) n=464	Obese (>95th Percentile) n=127	
Gender					
Male	1162	861(74.1)	236(20.3)	65(5.6)	<0.001

Female	1305	1015(77.8)	228(17.5)	62(4.8)	
Nationality					
Qatari	1779	1351(75.9)	343(19.3)	85(4.8)	0.292
Non-Qatari	688	525(76.3)	121(17.6)	42(6.1)	
Age Group					
Primary (6-10)	973	922(94.8)	37(3.8)	14(1.4)	
Intermediate(11-14)	612	480(78.4)	102(1.7)	30(4.9)	<0.001
Secondary(15-18)	882	474(53.7)	325(36.8)	83(9.4)	
Rank of Student in School Exam					
Very Good	758	565(74.5)	146(19.3)	47(6.2)	
Good	997	752(75.4)	194(19.5)	51(5.1)	0.063
Average	592	475(80.2)	93(15.7)	24(4.1)	
Poor	120	84(70)	31(25.8)	5(4.2)	
Father's Education					
Illiterate	136	104(76.5)	27(19.9)	5(3.7)	
Primary	331	218(65.9)	87(26.3)	26(7.9)	
Intermediate	491	347(70.7)	117(23.8)	27(5.5)	<0.001
Secondary	711	552(77.6)	127(17.9)	32(4.5)	
University	798	655(82.1)	106(13.3)	37(4.6)	
Father's Occupation					
Not Working	205	138(67.3)	45(21.9)	22(10.7)	
Manual	284	185(65.1)	71(25.0)	28(9.9)	
Government Officer	550	414(75.3)	107(19.5)	29(5.3)	<0.001
Business	624	505(80.9)	100(16.0)	19(3.0)	
Sedentary/Professional	804	634(78.9)	141(17.5)	29(3.6)	
Mother's Education					
Illiterate	420	318(75.7)	79(18.8)	23(5.5)	
Primary	444	339(76.3)	85(19.1)	20(4.5)	
Intermediate	603	455(75.5)	110(18.2)	38(6.3)	0.474
Secondary	591	437(73.9)	124(21.0)	30(5.1)	
University	409	327(80.0)	66(16.1)	16(3.9)	
Mother's Occupation					
House Wife	899	687(76.4)	171(19.0)	41(4.6)	
Clerk	531	403(75.9)	91(17.1)	37(7.0)	
Business	503	368(73.2)	105(20.9)	30(6.0)	0.113
Sedentary/Professional	534	418(78.3)	97(18.2)	19(3.6)	
Family income (QR)*					
<10,000	816	605(74.1)	150(18.4)	61(7.5)	
10,000 – 14,999	936	720(76.9)	190(20.3)	26(2.8)	0.094
>15,000	715	551(77.1)	124(17.3)	40(5.6)	
No. of Bedrooms					
<4 Rooms	323	280(86.7)	35(10.8)	8(2.5)	
≥4 Rooms	2144	1596(74.4)	429(20.0)	119(5.6)	<0.001

*1Qatari Riyal (QR) is equivalent to US$3.65.

[a] Chi-square analysis was performed.

Table II shows the lifestyle habits of the studied children according to BMI. The majority of overweight (80.2%) and obese (80.3%) children spent≥ 3 hours on the internet/day (p < 0.001). Moreover, a significantly larger proportion of overweight (85.1%) and obese (85.8%) children, when compared to normal weight children (73.3%), spent≥3 hours/day reclining (p < 0.001). A significantly larger proportion of overweight and obese children, compared to normal weight children watched commercials, fantasy violence, violent movies and educational programs on TV (p < 0.001).

TABLE II LIFESTYLE HABITS OF STUDIED CHILDREN ACCORDING TO BMI (N=2467)

Variable		Total n=2467 n	Body Mass Index			p-value [e]
			Normal (<85th Percentile) n=1876 n (%)	Overweight (85th – 95th Percentile) n=464 n (%)	Obese (>95th Percentile) n=127 n (%)	
No. of Hours Using Internet/Day						
< 3 Hours		649	532(28.4)	92(19.8)	25(19.7)	<0.001
≥ 3 Hours		1818	1344(71.6)	372(80.2)	102(80.3)	
No. of Hours Sitting or Reclining/Day [A]						
< 3 Hours		587	500(26.7)	69(14.9)	18(14.2)	<0.001
≥ 3 Hours		1880	1376(73.3)	395(85.1)	109(85.8)	
No. of Sleeping Hours/Day [B]						
≤ 6 Hours		1544	1097(58.5)	358(77.2)	89(70.1)	<0.001
> 6 Hours		923	779(41.5)	106(22.8)	38(29.9)	
Frequency of Watching TV/Computer Game/Video						
Daily (7 Days/Week)		930	748(39.9)	134(28.9)	48(37.8)	<0.001
Week Days (5 Days/Week)		1227	904(48.2)	265(57.1)	58(45.7)	
Weekends (2 Days/Week)		310	224(11.9)	65(14.0)	21(16.5)	
Habit of Eating Snacks while Watching TV						
Seldom		534	403(21.5)	100(21.6)	31(24.4)	0.739
Frequently		1933	1473(78.5)	364(78.4)	96(75.6)	
Type of Program Watch Usually*						
Popular TV Serial		1418	1060(56.5)	283(70.0)	75(59.1)	0.202
Commercials		856	587(31.3)	212(45.7)	57(44.9)	<0.001
Violent Movies		978	691(36.8)	222(47.8)	65(51.2)	<0.001
Cartoons		1522	1165(62.1)	278(59.9)	79(62.2)	0.681
Fantasy Violence		833	567(30.2)	208(44.8)	58(45.7)	<0.001
Educational Program		1036	729(38.9)	242(52.2)	65(51.2)	<0.001
Physical Activity						
Long Duration Activities [C]	Yes	1442	1093(58.3)	273(58.8)	76(59.8)	0.924
	No	1025	783(41.7)	191(41.2)	51(40.2)	
Short Duration Activities [D]	Yes	1382	1025(54.6)	277(59.7)	80(63.0)	0.039
	No	1085	851(45.4)	187(40.3)	47(37.0)	
No. of Students Who Eat Fast Food		1794	1375(76.8)	321(17.9)	94(5.3)	0.192
Frequency of Eating Fast Food						
Daily		486	373(19.9)	76(16.4)	37(29.1)	0.084
Weekly		890	672(35.8)	174(37.5)	44(34.7)	
Monthly		656	500(26.7)	127(27.3)	29(22.8)	
Occasionally		435	331(17.6)	87(18.8)	17(13.4)	

* Multi option, therefore totals do not add to 100%.

[a] This does not include number of school hours sitting or reclining.

[b] Number of sleeping hours where adjusted for age.

[c] Long duration activities entail engaging in physical activity for >30mins per day.

[d] Short duration activities entail engaging in physical activity for ≤30mins per day.

[e] Chi-square analysis was performed.

Table III presents the co-morbid factors and visual problems of the studied children according to time spent on the internet. A significantly high frequency of students who spent ≥ 3 hours on the internet, reported headaches (36.5%), blurred vision (35.6%), double vision (9.8%), eye tiredness (15.7%), dizziness (24.4%) and hearing problems (25.0%).

The majority of those who spent ≥ 3 hours on the internet had a TV viewing distance of less than 2m (p < 0.001). A significantly high number of students who spend ≥ 3 hours on the internet have low vision in both right (14.9%) and left (14.0%) eyes (p < 0.001).

TABLE III CO-MORBID FACTORS AND VISUAL PROBLEMS OF THE STUDIED CHILDREN ACCORDING TO TIME SPENT ON INTERNET (NN=2467)

Variable	No. of Hours Spent with Internet		p-value [a]
	< 3 Hours n=649 n(%)	≥ 3 Hours n=1818 n(%)	
Co-morbid Factors*			
Headaches	177(27.3)	663(36.5)	<0.001
Blurred Vision	143(22.0)	648(35.6)	<0.001
Double Vision	22(3.4)	178(9.8)	<0.001
Eyes Hurt	67(10.3)	159(8.7)	0.232
Eye Tired	57(8.8)	285(15.7)	<0.001
Dizziness	108(16.6)	444(24.4)	<0.001
Hearing Problem	104(16.0)	454(25.0)	<0.001
TV Viewing Distance			
≤1 m	216(33.3)	692(38.1)	<0.001
1 - 2 m	250(38.5)	912(50.2)	
>2 m	183(28.2)	214(11.8)	
Vision Aid			
Unaided	574(88.4)	1419(78.1)	<0.001
Aided	75(11.6)	399(21.9)	
Right eye			
Normal Vision	596(91.8)	1548(85.1)	<0.001
Low Vision	53(8.2)	270(14.9)	
Left eye			
Normal Vision	598(92.1)	1564(86.0)	<0.001
Low Vision	51(7.9)	254(14.0)	

*Multivariable, therefore totals do not add to 100%.

[a] Chi-square analysis was performed.

Table IV presents a stepwise logistic regression analysis for the predictors of obesity. Predictors included less physical activity, less sleeping hours, family income, frequency of watching TV/Computer/Video Game, age and number of bedrooms. The ANOVA analysis showed significant differences between mean age groups (p < 0.0001); mean number of sleeping hours (p < 0.0001); mean household income (p < 0.0001); and mean number of hours spent on the internet respectively.

TABLE IV STEPWISE LOGISTIC REGRESSION ANALYSIS FOR THE PREDICTORS OF OBESITY AMONG STUDIED CHILDREN *

Independent Variables	Odds Ratio (OR)	95% Confidence Interval (CI)	Significance (p Value)
Less Physical Activity	2.29	1.45-3.68	0.001
Less Sleeping Hours	1.74	1.26-2.55	<0.001
Family Income	1.59	1.27-1.96	= 0.029
No. of Bedrooms	1.34	1.21-1.46	<0.001
Frequency / Excessive Computer Use	1.27	1.06-1.51	= 0.008

* Adjusted for age and gender

IV. DISCUSSION

The World Health Organization [2] maintains that the emerging trend of childhood obesity is rapidly affecting many middle and low income countries especially in urban settings. It is reported that of the forty-two million overweight children in the world, approximately thirty-five million reside in developing countries [2]. The overall high prevalence of children (24.0%) who were either overweight (18.8%) or obese (5.1%) in the present study clearly indicates that children in Qatar show no exception to this trend. Numerous studies have linked this sharp rise in childhood obesity rates with the introduction of mass-communication technologies (such as excessive Internet use and Video Games and TV view) which have provided children with sedentary forms of entertainment as opposed to the previously more physically challenging active forms of play [5, 18, 19, 20, 21].

In a Scandinavian study, Andersen et al [11] reported that the odds ratio of becoming obese for schoolchildren watching TV/computer screens for a period of > 4 hours per day was 2.5 times higher relative to those watching for < 1

hour per day. This reinforces the findings of Musaiger et al [22] who found that watching TV for > 4 hours per day increased the relative risk of obesity by 1.3 among male university students in the UAE. The findings of the present study concur with these previous studies.

Further, it is evident that prolonged excessive Internet use and TV viewing takes away valuable time from certain necessary activities that children should engage in, the least of sleep. Taras and Potts-Datema [23] highlight that children need a minimum of nine hours of restful sleep each night, which many children were not receiving due to the multiple distractions especially excessive Internet use and TV view; nine hours is especially needed if they are to perform well at school. Excessive Internet use and TV viewing not only result in lack of sleep but also affect concentration levels. Vanderwater et al. [24] reported that time spent watching TV was negatively related to time spent doing homework for 7-12 year olds. Indeed our study revealed that the overwhelming majority of children received less than nine hours of sleep; more specifically most of the overweight and obese children received less than seven hours of sleep. This is particularly significant since numerous studies have reported that link of lack of sleep with becoming obese among both children and adults [25-28].

In addition to the correlations found between prolonged TV viewing and obesity by previous studies, associations between TV content and obesity among school aged children, have also been documented [5-7, 21, 29]. Rossner [3] asserts that the "TV diet" of many of the popular characters on TV serials is extremely unhealthy; add to this the fact that many of these characters remain very thin despite poor eating habits such as eating unhealthy food and eating for social/psychological needs rather than out of hunger. Moreover, Davey [30] highlights the fact that many prepackaged convenience foods are eaten in front of the TV as opposed to healthier home-made foods. Likewise, the preponderance of snacks that are consumed while watching TV has a big impact on obesity. This study attempted to measure whether eating snacks while watching TV was related to obesity and found that it was a widely prevalent practice among school-aged children; nonetheless, no significant differences between obese and non-obese children were obtained.

What is perhaps of more concern among researchers is the increasing influence of commercials for food directed at children on TV. Indeed, Wiecha et al [31] reported that each hour increase in TV viewing was associated with an additional 167 kcal/day and with increases in consumption of foods advertised on TV. These findings concur with a multitude of studies that consistently report that the longer the exposure to TV, the more commercials viewed, which leads to increased consumption of foods high in sugar, fat and salt [5, 6, 21, 29]. Carter [8] emphasizes the particular vulnerability of children to advertising due to their lack of capacity to perceive the commercial intent of advertisements until they get older.

These findings are especially relevant to the present study as it found that commercials were among the most commonly watched TV programs by overweight and obese children. Commercials are particularly influential in Qatar and the Arabian Gulf region as the overwhelming majority of households have satellite TV channels; a common feature of satellite TV is that it usually has 24 hour cartoon/children's programs channels which have child specific advertisements interspersed between programs. This explains the high proportion of children in Qatar, compared to other world regions, who watch commercials in addition to children's programs.

All of the major predictors of obesity found in our study were similar to those found in other international studies [32, 33]. However, unlike other studies, mother's education, was not found to be a predictor of obesity in our study. This difference could be attributed to the fact that a large proportion of mothers in Qatar have paid help (often referred to as maids or cooks) who prepare the food for the family. Another possible explanation for this difference could be attributed to what previous epidemiological studies in the region have noted,namely that the usual socio-economic factors found in other regions do not apply to the oil rich Arabian Gulf region [34].

Our findings indicate that children are experiencing serious co-morbid factors and are still spending prolonged hours on the internet. To date, only one other study has attempted to document the relationship between low vision and time spent on TV/computer screens by children [16]. The limited number of studies on this topic makes it very difficult to compare findings. Nonetheless, this is the second study to be conducted that has confirmed associations between prolonged hours on screens and low vision. It is anticipated that future research will build on this research.

The nature of our research precludes that we are only able to provide evidence suggesting an association between low vision and time spent on multimedia. As such, we cannot comment on the mechanism through which this happens; it is hoped that future research will address this gap. In addition, our research was not able to account for the genetic predisposition of subjects to obesity, nor was it able to exclude other causes of low vision. Nonetheless, the large community-based sample size of our study protects against the minimal influence that these factors may have had.

Quite a few action research studies have been undertaken to attempt to reduce the obesity and type 2 diabetes epidemics among school aged children [5, 6, 20]. Kameswararao and Bachu's [20] study among Indian schoolchildren found that by increasing physical activity and decreasing time spent watching TV, sedentary lifestyle and the consumption of high sugar, carbohydrate and fatty foods, could be reduced significantly.

V. CONCLUSION

The current study findings confirmed a positive association between obesity and low vision as a result of excessive use of Internet, Video games and time spent watching TV. A particularly worrying trend is the fact that most of the overweight and obese children were in the 15 – 18 years age group which highlights the potential for these bad lifestyle habits to continue on into adulthood. Many children are reporting serious symptoms (headaches, blurred vision, etc.) and are still persisting in spending prolonged hours on the internet without seeking appropriate medical help. These worrying trends call for immediate action to curb obesity and low vision.

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