Factors Associated with the Consumption of Carbonated Soft Drinks among Saudi Adolescents Aged 13-15 Years in Riyadh city

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ABSTRACT: The study aimed to identify factors associated with carbonated soft drink consumption among Saudi adolescents aged 13-15 years in Riyadh city and to evaluate the effect of age and gender on these factors. A total of 1200 questionnaires were distributed to intermediate schools students aged 13-15 years in Riyadh city, at 18 schools representing the five educational zones. The questionnaire consisted of specific questions related to the frequency of carbonated soft drink consumption, parental and peer soft drink consumption, availability at home, taste preference, fast food consumption, and television viewing. The response rate was 86.2%. Multivariate logistic regression analyses were conducted to predict the odds that carbonated soft drink consumption varied by the different factors. Preference of taste of carbonated soft drink was the strongest predictor in the analysis, with those who reported the strongest taste preference 2.3 times more likely to drink carbonated soft drinks 7 times or more per week. Adolescents who consume fast food more than once per week and those who watch television ≥3.5 hours/day were 1.75 and 1.7 times (respectively) more likely to drink carbonated soft drinks 7 times or more per week. It could be concluded that several factors may be associated with carbonated soft drink consumption in Saudi adolescents, most notably taste preference, fast food consumption, television viewing, peers and parental intake and the availability of carbonated soft drink at home.

INTRODUCTION

Contemporary changes have occurred in the types and quantities of beverages consumed, the manner in which they are consumed and their role in the diet. Most notable, milk intakes in the United States have decreased and carbonated soft drink intakes have increased among children and adolescents during the past several decades (Cavadini et al., 2000). In Saudi Arabia, an estimated 1.7 billion liters of carbonated soft drinks are consumed yearly, with an estimated total population of 20 million; this means 85 liters per capita consumption (Magin, 2000).The carbonated soft drink market is increasing steadily, with an average annual increase rate of 5%. Carbonated soft drinks probably make up about one fifth of all beverage consumed by Saudis. Sixty percent of the soft drinks consumed are cola beverages. Most of carbonated soft drinks are consumed at home, and in restaurants (Magin, 2000).

Bello and Al-Hammad (2006) studied the pattern of fluid consumption in a sample of 344 Saudi adolescents aged 12-13 years and they found that 26% of their daily fluid consumption came from carbonated soft drinks. Consumption of carbonated soft drinks is of health concern, especially in children and adolescents, because of its adverse nutritional and health effects (Harnack et al., 1999; Ludwig et al., 2001; Wyshak, 2000).

Adolescence is an age period in which there are many physical, psychological, and social changes at which the individual undergoes (Pinkham, 2005; AAPD, 1999-2000). The adolescent is able to choose friends, clothes, habits, foods, drinks, and more without

supervision (Pinkham, 2005). In this age group, there is often a pattern of irregular meals, frequent snaking, and consumption of higher amount of soft drinks (Griffen and Goepferd, 1991). Taste is the most important factor in decision making process by adolescents. The immediate pleasurable taste of sugar outweighed and deferred the recognition of dangers associated with its consumption (Freeman and Sheiham, 1997). Adolescents are highly targeted by marketing and advertisement. Many products including carbonated soft drinks are specifically and aggressively directed to the adolescents' market (Jacobson, 1998). In this age group, supervised tooth brushing may decrease in frequency, which may enhance the exposure for dental caries and periodontal disease (Pinkham, 2005).

Dental caries is a multi-factorial process in which the diet, the host, and microbial flora interact over a period of time in such a way to encourage demineralization of the tooth enamel with the resultant caries formation (Pinkham, 2005). Dental caries is still considered to be one of the most common diseases in the world today (Rockville, 2000). The prevalence of dental caries increased significantly in Saudi Arabia. Al-Shammery et al. (1991) reported that the prevalence of dental caries in Saudi adolescents aged 12-14 years was 57.2%. Fourteen years later, Al-Sadhan (2006) found that 93.7% of the investigated Saudi adolescents were having caries. In addition, dental erosion, which is defined as the loss of hard tissue by a chemical process without involving bacteria, increased in Saudi adolescents compared to other populations (Al-Majed et al., 2002).

Significant association has been shown between carbonated soft drink consumption and dental caries and erosion, due to their high sugar content and high level of acidity (Al-Majed et al., 2002; Ismail et al., 1984; Marshall et al., 2003). Carbonated soft drink consumption may affect the intake of other more nutritive beverages. Soft drinks displaced milk in the diet which negatively impact dental health (Ainutis, 2004). Milk has a caries preventive effect. Besides calcium, milk contains casein which has an effect on carcinogenesis through prevention of demineralization and inhibition of bacterial attachment and/or biofilm formation (Reynolds and Johnson, 1981).

To reduce the consumption of carbonated soft drinks, and subsequently to decrease its effects on dental and general health, factors that influence children and adolescents' carbonated soft drink consumption should be studied. Grimm et al. (2004) studied the factors that are associated with soft drink consumption in American school-aged children. They found that the taste preference of carbonated soft drinks was the strongest predictor in soft drink consumption, followed by parents' pattern of soft drink consumption. Bearing in mind that factors influencing carbonated soft drink consumption may vary from culture to culture, there is a need to investigate these factors and their effects on carbonated soft drink consumption in Saudi adolescents. A better understanding of these factors is needed for planning and implementation of dental and nutritional intervention.

The purpose of this study was to examine factors that may influence carbonated soft drink consumption in Saudi adolescents and to evaluate the effect of age and gender on these factors. Salient factors which are examined include parental and peer influence, availability at home, taste preference, fast food consumption, and television viewing.

MATERIALS AND METHODS

Data for this study were collected as part of a survey conducted in Riyadh city, Saudi Arabia, to investigate the commonly consumed drinks among Saudi adolescents aged 13-15 years. A total of 1200 questionnaires were distributed in 18 schools, from the five different educational zones in Riyadh city, 9 for boys and 9 for girls.

Measures

The questionnaire consisted of 11 questions. Adolescents were asked to report how often they drink carbonated soft drinks. Response options were "rarely or never", "one to two times per week", "seven times per week", ”more than seven times per week". Questions to assess parental and peer influence on carbonated soft drink consumption included a question that asked the participants whether one of their parents consumed soft drinks on a regular basis (three times or more per week) and if "most", "some", or "none" of their friends drink soft drinks on a regular basis. The questionnaire also included a question to assess the availability of carbonated soft drinks at home. Questions to assess taste preference for carbonated soft drinks, milk, and water were also included. The response options were "strongly like", "like", "dislike", and "strongly dislike". The number of hours of television watched was assessed as a proxy measure of exposure to carbonated soft drink advertising. Fast food consumption per week was also assessed as "rarely or never", "one time per week", "2-3 times per week", " more than 3 times per week". Places at which carbonated soft drinks were bought have also been asked. The questionnaire also included demographic data such as age and gender.

Data Analysis

The data were collected, entered the computer and analyzed using the Statistical Package for the Social Sciences (SPSS version 13) program. Frequency distribution tables for each question in the questionnaire were calculated and x^2 tests were conducted to determine whether carbonated soft drink consumption, factors related to the consumption and the places of purchasing varied by age and gender.

To estimate a mean amount of exposure to television, the response was converted into specific time variables: 0 hours=0, 1 to 2 hours=1.5, 3 to 4 hours=3.5, and more than 4 hours=4.5. These variables were then weighted to obtain a summary measure of daily television viewing (hours/day), and then they are converted into binomial variables (≥3.5 hours/day and <3.5 hours/day) for the analyses.

A binomial variable was created for carbonated soft drink consumption (drinking carbonated soft drinks “seven times or more per week", or "less than seven times per week") at which approximately half of the respondents were more than the cut-point and half were less than the cut-point.

Logistic regression analyses were conducted to predict the odds that carbonated soft drink consumption (outcome variable) varied by the different factors (predictor variables) after adjustment for age and gender. To determine which factors were independently associated with carbonated soft drink consumption, those factors that were statistically significant in the age and gender adjusted logistic regression analyses were included in a

final multivariate model. Included in the final model were age, gender, parental carbonated soft drink consumption (yes versus no); friends' carbonated soft drink consumption (most versus some/none); availability at home (yes versus no); taste preferences for carbonated soft drinks (strongly like versus like/dislike/strongly dislike); consumption of fast food (≤1/wk versus >1/wk); and television viewing (<3.5 hours/day versus ≥3.5 hours/day). A *P* value less than 0.05 was considered significant for all the conducted statistical tests.

RESULTS

A total of 1034 out of 1200 questionnaires (86.2%) were suitable for analysis, with an almost equal distribution of boys and girls (49.1% and 50.9%, respectively). Saudi adolescents from the five different educational zones in Riyadh city were represented in the sample.

Approximately 56% of the respondents reported drinking carbonated soft drinks seven times or more per week (Table 1). Soft drink consumption was higher among boys compared to girls (*P*=0.01), and the intake increased with the increasing age of the adolescent (*P*=0.006). About 30% of the respondents reported that one or both of their parents drink carbonated soft drinks on a regular basis (three times or more per week). It was strangely noted that 70% of the adolescents' parents are not drinking carbonated soft drinks as mentioned by the respondents. The proportion of adolescents who reported that one of their parents drinks soft drinks regularly increased significantly with adolescent' age (*P*=0.006). For example, 25.1% of those aged 13 years reported that one of their parents drinks soft drinks regularly compared with 35.7% of those aged 15-year-old. Sixty one percent of the male respondents reported that most of their friends drink soft drinks on a regular basis compared to 48.7% of female respondents (*P*=0.000).The availability of soft drinks at home differs by gender as 55.5% of the girls reported that soft drinks were available at home compared to 44.4% for boys (*P*=0.000). The majority (88.6%) of the surveyed adolescents like or strongly like the taste of carbonated soft drinks, while 76.6% reported they like or strongly like the taste of milk. In comparison with girls, more boys reported that they strongly like the taste of soft drinks, milk and water. There was no difference in fast food consumption between boys and girls but the intake of fast food significantly increased with age (*P*=0.037). Table 2 shows that about 46% of the respondents reported that the grocery near home was the main place for purchasing carbonated soft drinks. Significantly more boys are purchasing carbonated soft drinks from different places than girls except for school canteens (*P*=0.000).

Table 1. Frequency of carbonated soft drink consumption, parent and peer intake, home availability, taste preference, fast food consumption, and television viewing by age and gender.

			Age							Gender				
	Total		13 Y		14 Y		15 Y			Male		Female		
Variables	%	n	%	n	%	n	%	n	*P* value[a]	%	n	%	n	*P* value[a]
Soda intake														
> 7 times/ week	30.2	312	25.7	91	27.9	96	37.2	125		35	178	25.5	134	
7 times/ week	26.4	273	25.4	90	27	93	26.8	90		24.4	124	28.3	273	
1-2 times/ week	32.5	336	36.2	128	32.3	111	28.9	97		30.1	153	34.8	336	
Rarely or never	10.9	113	12.7	45	12.8	44	7.1	24	0.006	10.4	53	10.4	113	0.01
Parent intake														
Yes	29.3	303	25.1	89	27.3	94	35.7	120		31.3	159	27.4	144	
No	70.7	731	74.9	262	72.7	250	64.3	216	0.006	68.7	349	72.6	382	0.166
Friends intake														
Most	54.8	567	54.8	194	52.3	180	57.4	193		61.2	311	48.7	256	
Some	33.9	351	31.9	113	38.7	133	31.3	105		26.8	136	40.9	352	
None	11.2	116	13.3	47	9.00	31	11.3	38	0.134	12	61	10.5	116	0.000
Available at home														
Yes	50	517	45.5	161	51.2	176	53.6	180		44.3	225	55.5	292	
No	50	517	54.5	193	48.8	168	46.4	156	0.091	55.7	283	45.5	234	0.000
Taste of soda														
Strongly like	44.9	464	40.7	144	45.9	158	48.2	162		42.1	214	47.5	250	
Like	43.7	452	43.2	153	43.3	149	44.6	150		48	244	39.5	208	
Dislike	2.5	26	4.2	15	2.0	7.0	1.2	4.0		2.8	14	2.3	12	
Strongly dislike	8.9	92	11.9	42	8.7	30	6.0	20	0.014	7.1	36	10.6	56	0.020
Taste of milk														
Strongly like	23.2	240	28.2	100	21.2	73	19.9	67		29.7	151	16.9	89	
Like	49.4	511	48.6	172	49.1	169	50.6	170		49.8	253	49	258	
Dislike	11.5	119	10.7	38	10.5	36	13.4	45		10.6	54	12.4	65	
Strongly dislike	15.9	164	12.4	44	19.2	66	16.1	54	0.047	9.8	50	21.7	114	0.000
Taste of water														
Strongly like	59.2	612	61.6	218	60.2	207	55.7	187		67.3	342	51.3	270	
Like	35.9	371	35	124	34.9	120	37.8	127		28.9	147	42.6	224	
Dislike	1.5	16	1.4	5.0	1.5	5.0	1.8	6.0		1.6	8.0	1.5	8.0	
Strongly dislike	3.4	35	2.0	7.0	3.5	12	4.8	16	0.450	2.2	11	4.6	24	0.000
Fast food														
> 3 times/wk	18.7	193	16.1	57	20.1	69	19.9	67		19.3	98	18.1	95	
2-3 times/wk	29	300	27.7	98	26.2	90	33.3	112		32.3	164	25.9	136	
1 time/wk	25.2	261	23.7	84	27	93	25	84		23.4	119	27	142	
<1 time/wk or never	27.1	280	32.5	115	26.7	92	21.7	73	0.037	25	127	29.1	153	0.079
TV														
< 3.5 h/d	54.7	566	59.6	211	52	179	52.4	176		56.1	285	53.5	281	
≥ 3.5 h/d	45.3	468	40.4	143	48	165	47.6	160	0.076	43.9	223	46.6	245	0.387

[a] X^2 test.

In logistic regression analyses (controlled for age and gender), parents' soft drink intake, friends' soft drink intake, availability of soft drink at home, taste preference of soft drink, consumption of fast food and television viewing were all significantly associated

with carbonated soft drink consumption (Table 3). When all these factors included in the regression model simultaneously, all the factors remained statistically significant. A strong preference for the taste of carbonated soft drinks was the strong predictor. Those who reported that they "strongly like" the taste of carbonated soft drinks were 2.3 times more likely to drink carbonated soft drinks 7 times or more per week compared to those who reported that they "like", "dislike" or "strongly dislike" their taste. The second predictor in order is the consumption of fast food. Those who reported eating fast food more than once per week were 1.75 times more likely to drink carbonated soft drinks 7 times or more per week. The influence of Television viewing and friends' intake were also significantly associated with adolescents' carbonated soft drink consumption (odds= 1.7, 1.3) respectively. Those whom parents regularly drink carbonated soft drinks and those who reported availability of soft drinks at home were almost half as likely to drink this beverage 7 times or more per week.

Table 2. The main Place of Purchasing Carbonated Soft Drinks by Saudi Adolescents According to Age and Gender.

	Total% (no)	**Age**			**P value**	**Gender**		**P value**
		13 y	**14 y**	**15 y**		**Male**	**Female**	
Grocery near home	46.5 (480)	31.7(153)	34.1 (163)	34.2 (164)	0.007	55.8 (268)	44.2 (212)	0.000
Restaurant	25.0 (259)	30.6 (79)	32.0 (83)	37.4 (97)	0.014	59.6 (154)	40.4 (105)	0.000
Grocery near school	14.0 (144)	31.9 (46)	30.7 (44)	37.4 (54)	0.184	66.4 (96)	33.6 (48)	0.000
Vending machine	13.5 (140)	31.0 (43)	31.0 (43)	38.0 (54)	0.130	67.2 (94)	32.8 (46)	0.000
School canteen	1.00 (11)	7.70 (1)	38.5 (4)	53.8 (6)	0.097	61.5 (7)	38.5 (4)	0.268

Table 3. Logistic regression analyses: odds of consuming carbonated soft drinks seven times or more per week among Saudi adolescents (no=1034).

		OR[a]	**95% CI**	**OR[b]**	**95% CI**
Strongly like the taste of soda	No yes	1.00 3.30	(2.53, 4.29)	1.00 2.27	(1.71, 3,02)
Fast food consumption (times/week)	≤1 >1	1.00 2.47	(1.92, 3.20)	1.00 1.75	(1.32, 2.31)
Television viewing (hours/day)	<3.5 ≥3.5	1.00 1.77	(1.37, 2.28)	1.00 1.70	(1.21, 2.13)
Most of friends drink soda	No yes	1.00 1.66	(1.29, 2.19)	1.00 1.27	(1.16, 1.58)
Parents drink soda regularly	No yes	1.00 0.45	(0.33, 0.60)	1.00 0.69	(0.56, 0.95)
Soda available at home	No yes	1.00 0.33	(0.25, 0.59)	1.00 0.48	(0.36, 0.64)

OR[a] = Odds Ratio, adjusted for age and gender
CI = Confidence Interval
OR[b] = Odds Ratio adjusted for age, gender, preference for soda, fast food consumption, television viewing, friends soda intake, parental soda intake, soda availability at home.

DISCUSSION

More than 56% of the respondents consumed carbonated soft drinks 7 times or more per week. This high level of consumption might be related to many factors that have been investigated in this survey. In the present study, it has been noticed that with the increasing age of the adolescent, there is more consumption of carbonated soft drinks. Similar observations were reported by other studies which found a higher intake of soft drinks among children in older age group compared with children in younger age group (Pérez et al., 2007; Lytle et al., 2000). This is likely to be the case because the older child can go to many places by himself and has more freedom to choose and he is not confined to the rules and regulations made by his parents. In relation to gender, Saudi boys showed higher consumption of different drinks more than Saudi girls. This finding is in agreement with other studies which reported that in general, males consumed more beverages than females did (Bello and Al-Hammad, 2006; Forshee and Storey, 2003).

The number of adolescents who reported that one of their parents drinks carbonated soft drinks increased significantly with the increasing age of the adolescent. This reflects that as the child grows older, he or she tends to focus on their parents' habits and imitate them as they are transferring into the adulthood period. Boys significantly reported that most of their friends drink soft drinks more than reported by girls. This may be related to that friendship relation between boys is stronger than girls in this age group particularly in our culture where boys can meet with each other after school time to play. Such a result should alert the parents towards the effect of friends especially in boys.

In this study, taste preference for carbonated soft drinks was significantly associated with increased soft drink consumption in Saudi adolescents. This is consistent with Grimm et al. (2004) who reported that taste preference of soft drinks was the strongest predictor factor in soft drink consumption in American children 8-13-year-old. Other studies with children, adolescents, and adults have shown similarly that taste is one of the most important influences on food choices (Freeman and Sheiham, 1997; French et al., 1999; Glanz et al., 1998). A longitudinal study on children's taste preferences found that the strongest predictor of the number of foods that the child liked at age 8 was the number of foods liked at age 4 (Skinner et al., 2002). This reinforces that taste preference begins early in life, and thus it may be the most effective to intervene at an early age.

Fast food consumption of Saudi adolescents was also strongly associated with their carbonated soft drink consumption. Unfortunately, fast food restaurants in Riyadh city advertise for supersize carbonated soft drinks for only extra one or two Saudi Riyals and some of them allow for free drink refilling. French et al. (2001) found that the frequency use of fast food restaurants between adolescents was positively associated with the daily servings of soft drinks, and was inversely associated with daily servings of fruit, vegetables and milk.

Television viewing, which may be a proxy measure of exposure to carbonated soft drink advertising, was significantly found to be associated with carbonated soft drink consumption. In the final model, the result showed that the odds of drinking carbonated

soft drinks was 1.7 as likely for those who watched television 3.5 hours or more per day than those who watched less time of television. In a research supported by King Abdul-Aziz city for science and technology, Al-Thomali (2009) reported that 42% of Saudi adolescents watch television 2-6 hours per day and they prefer to watch movie and sport channels. Carbonated soft drink companies are the main sponsors for majority of sport activities, as they mainly advertise their products through sport channels as well as movie channels.

Both parents' and friends' pattern of carbonated soft drinks were associated with increased carbonated soft drink consumption of Saudi adolescents. The influence of peer carbonated soft drink intake was stronger than the influence of parental intake, which reflects the importance of friends in the adolescence period. This result contradicts the result of Grimm et al. (2004) who found that the influence of parental intake was more than the influence of peer intake. This might be related to the difference of age groups in both studies.

The availability of the carbonated soft drinks at home was the weakest factor that affect carbonated soft drinks intake of Saudi adolescents. This might be due to that 70% of the investigated adolescents' parents are not drinking carbonated soft drinks, which affect soft drink availability at home. In addition, 46.5% of Saudi adolescents purchase carbonated soft drinks from the grocery beside the house, which indicates the less importance of carbonated soft drink availability at home.

CONCLUSIONS AND RECOMMENDATIONS

1. Taste preference of carbonated soft drink is the strongest predictor in the increase of consumption of carbonated soft drinks by Saudi adolescents, which mostly related to its high sugar content; such a result should alert dental, medical and nutritional professionals about their deleterious effects.
2. There is a need for policies to limit the vigorous spread of fast food restaurants and to regulate their promotions (upsize measurement) and to enhance the replacement of soft drinks with canned or fresh fruit juice to decrease the consumption of carbonated soft drinks.
3. Because television viewing and hence the exposure to intensive marketing advertisement is considered one of the important factors in the increment of consumption of carbonated soft drinks, it should be used a lot by the government to reverse its effect on drinking habit and to explain their unfavorable side effects for the general population and especially the adolescents in an attempt to decrease its consumption.
4. Although the government is banning the selling of carbonated soft drinks in schools (which is considered to be a good step towards decreasing their consumption),but it is not enough because the adolescents are moving towards

buying them more from groceries and fast food restaurants which are present in every corner, so further measures have to be undertaken.

5. In the context of dental caries prevention and management, consideration should be given to encourage people to replace carbonated soft drinks with milk, fruit juices or even water.
6. The society should be informed about the side effects of carbonated soft drinks through lectures and educational booklets and it is even better if these lectures are introduced to children in the early school grades and considered a part of the school curriculum.

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العوامل المؤثرة في استهلاك المشروبات الغازية لدى المراهقين السعوديين من عمر 13-15 سنة في مدينة الرياض

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الملخص: هدفت الدراسة إلى استكشاف العوامل المؤثرة في استهلاك المشروبات الغازية لدى المراهقين السعوديين من عمر 13-15 سنة في مدينة الرياض وتقييم العلاقة بين هذه العوامل مع العمر والجنس. تم توزيع 1200 استبيان على طلاب وطالبات المرحلة المتوسطة في 18 مدرسة تمثل جميع المناطق التعليمية الخمس في مدينة الرياض. احتوى الاستبيان على أسئلة محددة متعلقة بعدد مرات استهلاك المشروبات الغازية واستهلاك الوالدين والأصدقاء لهذه المشروبات وتوفرها في المنزل والطعم المفضل واستهلاك الوجبات السريعة ومشاهدة التلفزيون. كان معدل الاستجابة لهذا الاستبيان 86.2٪. أُستخدم التحليل الانحداري اللوجستي متعدد المتغيرات لمعرفة ما إذا كان هناك علاقة بين زيادة استهلاك المشروبات الغازية وبين هذه العوامل. أظهرت النتائج أن تفضيل طعم المشروبات الغازية كان أقوى العوامل المؤثرة في زيادة استهلاك المشروبات الغازية ، حيث اتضح أن المراهقين السعوديين الذين يفضلون طعم المشروبات الغازية بشدة معرضون لاستهلاكها سبع مرات أو أكثر في الأسبوع بمقدار 2.3 مرة أكثر من الذين هم أقل تفضيلاً لها في الطعم. كما أن المراهقين الذين يستهلكون الوجبات السريعة أكثر من مرة في الأسبوع أو يشاهدون التلفزيون أكثر من ثلاث ساعات ونصف في اليوم معرضون لزيادة استهلاك المشروبات الغازية بمقدار 1.75 و 1.7 مرة على التوالي أكثر من الذين يستهلكون الوجبات السريعة بكميات أقل أو يشاهدون التلفزيون لمدة أقل. يمكن الاستنتاج بأن هناك عدة عوامل تؤثر في استهلاك المراهقين السعوديين للمشروبات الغازية ، من أهمها تفضيل الطعم واستهلاك الوجبات السريعة ومشاهدة التلفزيون واستهلاك الأصدقاء والوالدين لهذه المشروبات و توفرها بالمنزل.