

## **Health-risk behaviors associated with sugar-sweetened beverage consumption among Saudi young adults.**

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### **Abstract**

**Sugar-Sweetened Beverages (SSBs) are a large source of added sugar in Saudi diets and are commonly consumed among 75% of Saudis, especially young adults aged 18-30 years. The present study aimed to identify the health-risk behaviors associated with SSBs (e.g., soft, and energy drinks) consumption among university students. This association was examined separately for male and female students. A cross-sectional study was conducted among 414 students (195 males and 219 females) at King Faisal University (KFU) in Al-Hasa, Saudi Arabia. Data were collected using a pre-tested, self-administered questionnaire. The prevalence of SSBs consumption was very high among students and varied between genders. Male students drank more SSBs than females, with soft drinks constituting the most common SSBs, followed by energy drinks. Greater soft drink consumption among male (OR 1.05, 95% CI 0.67 to 2.82) and female (OR 2.11, 95% CI 1.32 to 3.33) students was associated with more weekly fast food intake. Male students who consumed energy drinks were more likely to have fewer hours of sleep daily (OR 1.78, 95% CI 1.07 to 2.61), female students skipped breakfast more weekdays than males (OR 1.67, 95% CI 1.07-2.61). Future studies need to provide longitudinal evidence regarding SSB consumption and health behaviors to determine the direction of this relationship. We also need to know more about the clustering of health-risk behaviors related to SSB intake by gender for health comparison.**

**Keywords:** Sugar-sweetened beverages, University students, Health-risk behaviors.

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### **Introduction**

Sugar-Sweetened Beverages (SSBs), including but not limited to soft, and sports drinks, are a large source of added sugar in the Saudi diet [1]. Seventy five percent of Saudis consume SSBs, and they have the highest per capita consumption in the Gulf Cooperation Council for soft (more than 250 L) and energy drinks (120 L) [2]. High SSB consumption has negative health effects associated with excessive sugars, calories and caffeine. These individuals are at a 75% higher risk for gout, [3] a 26% greater risk of type 2 diabetes [4] and a 20% higher risk of heart disease [5]. Furthermore, these individuals typically have poor nutrition [6] and excess weight gain and obesity [7].

Approximately one-third of Saudi Arabia's population is between 15 and 29 years old, [8] comprising the largest youth population in the Middle East. Therefore, Saudi Arabia contains a large target audience for companies to advertise SSBs as refreshing drinks that give you greater speed, strength and power, especially in hot weather, using athletes or music icons [9].

National studies have [10-12] found that university students usually have low physical activity, skip breakfast, have low fruit and vegetable intake, partake in un-healthy weight-loss

methods, have poor sleep quantity and quality and consume diets high in fats and sugars. A recent study conducted in the eastern region of Saudi Arabia found that 81% of students consume a soft drink or sweet beverages once or twice daily [11]. Alsunni and Badar [10] found that 45.6% of Saudi college students in the same region consumed energy drinks daily. Another study conducted among university and non-university students in the Hail, or north region, reported that 46% of their subjects consumed energy drinks daily [12].

Studies among university students in Saudi Arabia [10-12] have only examined prevalence, rates, patterns and reasons for soft and energy drink consumption. No local studies have examined health-risk behaviors that are associated with SSB consumption among university students who are exposed to many health-risk behaviors, which may increase their risk for developing chronic diseases. Furthermore, university students are an interesting study cohort, representing a large proportion of Saudi Arabia, because they are relatively easy to access and are an open community susceptible to change. In addition, universities have the appropriate infrastructure to support health promotion initiatives. However, the current study aimed to identify the health-risk behaviors that are associated with SSB consumption among students. This association was examined separately for male and female students because

previous studies have documented that male students have a greater consumption of SSBs than do female students [10,11].

## Methodology

### *Study location and subjects*

A cross-sectional study was conducted utilizing a pre-tested self-administered questionnaire among undergraduate students at King Faisal University (KFU) in Al-Hasa, Saudi Arabia. The sample size was computed using prevalence formula ( $N = z^2pq/d^2$ )  $(1.96)^2 \times (0.46) \times (1-0.46)/(0.05)^2 = 382$  students, the sample size calculated based on the prevalence of energy drink consumption among young adults in Saudi Arabia (46%) [12].

The recruitment process included advertisements about the study protocol and objectives with a general invitation through posters, social media, such as WhatsApp, and announcements at the beginning of lectures or tutorials by researchers. Students were assured that responses were confidential, and the questionnaire was distributed at the end of lectures or tutorials by researchers. All students signed a consent form. Approximately 15 min was needed to complete the questionnaire. The inclusion criteria for the study were Saudi, disease-free undergraduate students at KFU. Female students that were pregnant were excluded from the study. The Ethical Committee at King Faisal University approved the study protocol.

### *Instrument*

The questionnaire was pretested among 25 students (64% female, 36% male) to determine the clarity of the meaning and readability (i.e., face and content validity). Difficulties encountered by students, such as an inability to understand statements, were noted, and changes were made accordingly.

**SSBs consumption:** two questions were separately asked about weekly intake of soft, and energy drinks: "In the past week, how many cans or bottles of (...) did you drink?" frequency categories included once/week, two-three times/week, four to five times/week and never or less than once/week [13]. Specific examples of name brands available in the local markets were used to increase clarity (e.g., Coca Cola, Pepsi, RedBull, Mountain Dew, etc.). The present study focused on the weekly consumption of soft, energy and sports drinks. Previous researchers have found that SSB intake one or more time(s)/week was associated with an increased risk of non-communicable diseases [4,5]. Therefore, the students were classified into two groups: one or more times/week and less than once/week (test-retest  $r=0.78$ ).

### *Health risk behaviors*

**Body mass index:** Body weight and height were self-reported, and the Body Mass Index (BMI) was computed and categorized based on WHO guidelines [14].

**Dietary risk behaviors:** fruit and vegetable intake was assessed daily as, "How many serving of vegetables and fruits do you consume daily?", and the frequency of consumption was listed as none, one serving, two servings, three to four servings and five servings or more [15] (test-retest  $r=0.81$ ). Coffee and tea intake was assessed daily as, "How many cups of coffee and tea do you drink daily?", and the frequency of intake included once/week, two to three times/week, four to five times/week and never or less than once/week [13] (test-retest  $r=0.79$ ). Skipping breakfast was assessed weekly as, "during the past week, how many times did you skip breakfast" The five response categories were never, once/week, two times/week, three to four times/week, and more than five times/week (test-retest  $r=0.61$ ). Eating fast food was assessed weekly as, "during the past week, how many times did you eat fast food", and the frequency of intake was the same as the skipping breakfast assessment (test-retest  $r=0.65$ ).

**Physical inactivity:** physical activity was assessed by the short form from the International Physical Activity Questionnaire (IPAQ-short form). Students were asked to recall their activities during the past week as a frequency (days/week) and duration (hours and minutes/day), and they were then classified into three groups according to the official IPAQ-short form scoring protocol as low, moderate or high [16].

**Weight control behaviors:** for weight control behaviors, students were asked, "To control your weight, which method do you use?", and the responses were six items classified into unhealthy weight control (skipping meals, diet pills and fewer meals and snacks) and healthy weight control (more exercise, low calorie food and visiting a weight control center) (test-retest  $r=0.52$ ).

**Media use:** students were asked separately the number of hours on weekdays and on weekends they use media, with the question "how many hours do you do the following activities: playing videogames, talking or texting on the phone, watching television, browsing the internet and social network sites (e.g., Twitter, Facebook) or using apps?" Total weekly hours were calculated as follows: (weekday duration  $\times 5/7$ )+(weekend duration  $\times 2/7$ ) (test-retest  $r=0.51$ ).

**Daily sleep hours:** For daily sleep hours, students were asked separately on weekdays and on weekends, "how many hours of sleep do you usually get within 24 h?" Total weekly hours were calculated as follows: (weekday duration  $\times 5/7$ )+(weekend duration  $\times 2/7$ ). Sleep duration was categorized into  $>7$  h/day and  $<7$  h/day [17] (test-retest  $r=0.70$ ).

**Smoking:** for smoking, the students were asked, "do you currently smoke cigarettes or shisha?", and the response options were either yes or no.

### *Statistical analysis*

Chi-square tests were used to identify the relationship between study variables, and the difference between the variables was examined by independent sample t-testes. Pearson's correlation assessed test-retest reliability of the items. Logistic regression analysis was used to identify health-related behaviors

associated with weekly soft, and energy drink consumption separately for male and female students. The data were analysed using the SPSS statistical package version 19, and a P value<0.05 was the cut-off point for statistical significance.

**Results**

A total of 414 university students were included in the study, the majority of whom were females (52.8%), with a mean age of 21.2 ± 2.2 y old and a monthly average household income of more than 5,000. Females had lower than normal mean BMI (22.1 ± 3.9) than males (24.3 ± 4.4), which was significantly different (P=0.03) (Table 1).

**Table 1.** Subjects characteristics (N=414).

Variables	Male (47.2%) 195	Female (52.8%) 219	P
Age (Mean, s.d)	22.8+6.1	21.1+2.2	0.21
Marital status			
Single	190 (97.4%)	165 (75.3%)	0.00*
Married	5 (2.6%)	54 (24.7%)	
Education years			
First year	40 (20.5%)	47 (21.5%)	0.41
Second year	39 (20%)	41 (18.7%)	
Third year	35 (17.9%)	36 (16.4%)	
Fourth year or more	81 (41.5%)	95 (43.4%)	
Household income (Saudi Real)			
<5000	66 (33.8%)	68 (31.1%)	0.27
>5000	129 (66.2%)	151 (68.9%)	
Body mass index (kg/m <sup>2</sup> ), (Mean, s.d)	24.3+4.4	22.1+3.9	0.03*
Underweight	12 (6.2%)	34 (15.5%)	0.00*
Normal	120 (61.5%)	139 (63.5%)	
Overweight	47 (24.1%)	36 (16.4%)	
Obese	16 (8.2%)	10 (4.6%)	

\*P<0.05

The majority of the students consumed soft drinks once or more/week (92.8% male, 66.2% female). Male and female students who consumed soft drinks less than once/week had

**Table 2.** Soft drink consumption related to health-risk behaviors.

Variables	Male (n 195)		Female (n 219)	
	One or more/week 181 (92.8%)	Less than one/week 14 (7.2%)	One or more/week 145(66.2%)	Less than one/week 74 P (33.8%)
Dietary behaviours				

significantly more daily intake of fruits and vegetables (P=0.02, 0.01; respectively) and less weekly fast food intake (P=0.00, 0.01; respectively). Furthermore, males in the once or more/week group skipped breakfast almost four days weekly (3.9 ± 0.4), significantly more than the once/week group (3.1 ± 0.4) (P=0.03, Table 2). Male students who drank one or more/week were significantly more active (MET=2863.64 ± 322.63, P=0.00), with 42% moderately and 30.9% highly active, and they spent more daily hours using the internet and social media (P=0.00) than students who drank less than one/week. More male and female students consumed soft drinks once or more/week and slept less than seven hours daily compared to students who drank less than once/week and slept more than seven hours daily, although no significant difference was observed between the groups. Eighty percent of females in both groups used unhealthy weight control methods. A low proportion of students smoked, with only 22 males and 16 females, and most of them consumed soft drinks once or more/week, which was significant different compared with the less than once/week group (P=0.00) (Table 2).

Male students (61.5%) consumed more energy drinks than did female students (20%). Female students in the less than one/week group had healthier behaviors, with a high mean of fruit and vegetable intake (2 ± 0.3), a low mean of skipped breakfast days (3.6 ± 0.4), more hours slept (7.7 ± 1.3) and fewer hours using the internet and social media (P=0.04). On the other hand, they had a low mean of physical activity (MET=1087.43+112.82), and 51.7% of them were in the low physical activity category. Furthermore, 42.2% were in the moderate activity and 20% in the high activity category, with a significant difference (P=0.02) (Table 3). Male students in the one or more/week group had a high mean of coffee and tea intake, days skipping breakfast and days of fast food intake (P=0.03). They were also more physically active (P=0.01), and the majority of them placed in the high activity category (40.8%). Most female students in the one or more/week group used unhealthy weight control methods, with a significant difference between female groups (P=0.03). Moreover, more male and female students in the less than one/week group had not smoked (Table 3).

Greater soft drink consumption among male (OR 1.05, 95% CI 0.67 to 2.82) and female (OR 2.11, 95% CI 1.32 to 3.33) students was associated with more weekly fast food intake. Male students who consumed energy drinks were more likely to have fewer hours of sleep daily (OR 1.78, 95% CI 1.07 to 2.61), female students skipped breakfast more weekdays than males (OR 1.67, 95% CI 1.07-2.61).

Fruit and vegetable (serving/day) (Mean, s.d)	1.9+0.3	2.6+0.3	0.02*	2.2+0.3	2.8+0.2	0.01*
Coffee & tea (serving/day) (Mean, s.d)	1.7+0.3	2.1+0.4	0.04*	1.9+0.2	2.2+0.2	0.23
Skipping breakfast (d/w) (Mean, s.d)	3.9+0.4	3.1+0.4	0.03*	3.7+0.4	3.5+0.04	0.54
Fast food (d/w) (Mean, s.d)	5.5+0.4	4.2+0.4	0.00*	5.8+0.3	3.3+0.3	0.01*
Physical activity (MET) (Mean, s.d)	2863.64+322.63	2625.32+202.82	0.00*	1163.64+112.63	1025.32+102.82	0.59
Physical activity levels						
low	49 (27.1%)	10 (71.4%)	0.00*	68 (64.9%)	39 (52.7%)	0.63
Moderate	76 (42%)	1 (7.1%)		49 (33.8%)	24 (32.4%)	
High	56 (30.9%)	3 (21.4%)		28 (19.3%)	11 (14.9%)	
BMI category						
Underweight-normal	122 (67.4%)	10 (71.4%)	0.75	115 (79.3%)	58 (78.4%)	0.52
Overweight-obese	59 (32.6%)	4 (28.6%)		30 (20.7%)	16 (21.6%)	
Weight control behaviours						
Unhealthy weight control	40 (22.1%)	4 (28.6%)	0.81	128 (88.3%)	59 (79.7%)	0.07
Healthy weight control	141 (77.9%)	10 (71.4%)		17 (11.7%)	15 (20.3%)	
Media use (h/daily)	6.9+1.3	5.3+0.9	0.02*	6.7+0.8	5.8+0.8	0.04*
Daily sleep hours (Mean, s.d)	6.3+1.4	7.85+1.2	0.33	6.1+1.1	7.72+1.2	0.61
>7 h/d	122 (67.4%)	10 (71.4%)	0.57	115 (79.3%)	58 (78.4%)	0.52
<7 h/d	59 (32.6%)	4 (28.6%)		30 (20.7%)	16 (21.6%)	
Smoking						
Yes	21 (11.6%)	1 (7.2%)	0.00*	14 (9.6%)	2 (2.7%)	0.00*
No	160 (88.4%)	13 (92.8%)		131 (90.4%)	72 (97.3%)	
*P<0.05						

**Table 3.** Energy drink consumption related to health-risk behaviors.

Variables	Male (n 195)			Female (n 219)		
	One or more/week 120 (61.5%)	Less than one/week 75 (38.5%)	P	One or more/week 45 (20.5%)	Less than one/week 174 (79.5%)	P
Eating behaviours						
Fruit and vegetable (serving/day) (Mean, s.d)	1.8+0.3	2.2+0.3	0.14	1.7+0.3	2+0.3	0.24
Coffee and tea (serving/day) (Mean, s.d)	1.9+0.2	1.7+0.2	0.74	2.4+0.3	2.1+0.2	0.63
Skipping breakfast (d/w) (Mean, s.d)	3.8+0.4	3.1+0.4	0.03*	4.3+0.4	3.6+0.4	0.01*
Fast food (d/w) (Mean, s.d)	4.9+0.4	4.1+0.4	0.02*	4.1+0.4	3.8+0.4	0.14
Physical activity (MET) (Mean, s.d)	3063.64+412.63	2613.32+402.82	0.01*	1209.64+212.63	1087.43+112.82	0.03*
Physical activity levels						

Low	32 (26.7%)	27 (36%)	0.00*	17 (37.8%)	90 (51.7%)	0.02*
Moderate	39 (32.5%)	38 (50.7%)		19 (42.2%)	54 (31%)	
High	49 (40.8%)	10 (13.3%)		9 (20%)	30 (17.3%)	
BMI category						
Underweight-normal	79 (65.8%)	53 (70.7%)	0.48	37 (82.2%)	136 (78.2%)	0.35
Overweight-obese	41 (34.2%)	22 (29.3%)		8 (17.8%)	38 (21.8%)	
Weight control behaviours						
Unhealthy weight control	19 (15.9%)	13 (17.4%)	0.94	39 (86.7%)	135 (77.5%)	0.03*
Healthy weight control	101 (84.1%)	62 (82.6%)		6 (13.3%)	39 (22.5%)	
Media use (h/daily)	6.1+0.8	5.1+0.8	0.03*	6.2+0.9	5.1+0.9	0.04*
Daily sleep hours (Mean, s.d)	6.2+1.5	7.8+1.2	0.04*	6.1+1.1	7.7+1.3	0.01*
>7 h/d	68 (56.7%)	53 (70.7%)	0.00*	27 (60%)	136 (78.2%)	0.02*
<7 h/d	52 (43.3%)	22 (29.3%)		18 (40%)	38 (21.8%)	
Smoking						
Yes	19 (15.8%)	3 (4%)	0.00*	12 (26.6%)	4 (2.3%)	0.00*
No	101 (84.2%)	72 (96%)		33 (73.4%)	170 (97.7%)	

\*P<0.05

## Discussion

Soft drinks are the popular SSBs consumed by students, with virtually all males and more than two-thirds of females drinking them once or more/week, which is an important public health concern. Local studies by Majeed [11] (81%) and Mahfouz et al. [18] (male 88.4%, female 83.9%) found similar results among university students. Corroborating other international studies, younger males had a higher rate of soft drink consumption [19], and this was also true among Australian university students (male 58.3% vs. 42.3% female) [20]. A higher rate was found among Brazilian adults (20.4%), with the majority of them more than 29 years old (73.9%) [21].

All students in both groups consumed less than five servings daily of fruits and vegetables, with almost three servings daily (2.6 servings) in the less than one/week group. This was observed in local studies among Saudi youth (aged 15-24 y), with 57.2% of males and 53% of females consuming 1-4 servings daily [22]. A study of students at the University of Dammam showed that 63% of males and 66% of females ate less than five servings daily [23]. However, 52% of university students from Thailand consumed less than five servings daily [24]. The present study found that Saudi students in the less than one/week groups replaced soft drinks by drinking more servings of coffee and tea.

Students who consumed soft drinks once or more/week ate fast food almost six days a week, with a significant difference compared to the less than one/week group among male and female students. Similar results have been observed in local [18,20,22] and international studies [25]. Going to fast food

restaurants is a popular option among young adults socializing in Saudi Arabia, especially for dinner because there are restrictions on some forms of entertainment, such as cinemas and live music. Almost four days (male  $3.9 \pm 0.4$ , female  $3.7 \pm 0.4$ ) of skipping breakfast was found in students in the one or more/week group. This result is similar to what has been observed in local and international studies [11,18,24].

Male students in the one or more/week group were more active than those in the less than one/week group, with 27.1% in the low activity category, showing significant differences. Furthermore, previous studies have found that young adults who spend more time being physically active drink more soft drinks [21]. Physical inactivity was more prevalent in females and corroborated previous studies [22,23], which may explain the high prevalence of unhealthy weight control methods used among females in our study, especially in the one or more/week group. While males used healthy weight control methods in the form of more exercise, intake of low calorie food and a higher frequency of using weight control centers, more females used unhealthy methods, which might indicate that females have a greater concern about weight control and body self-perception. No significant difference was found between groups for soft drink consumption (male and female students) or BMI category, which maybe resulted from weight control methods they used. Similar results have been observed in other studies [21].

Students in the one or more/week group using media heavily spent almost seven hours daily, in contrast to five hours daily in the less than one/week group, which may have affected their

daily food and lifestyle choices. Abdal et al. [26] reported similar results, where 24.3% of university students consumed soft drinks while using the internet and social media. Meyer et al. [27] found that young adults who slept less than seven hours daily were positively associated with more SSB consumption (more than one serving daily) and more weekly screen time, similar to what was found in the present study. Collectively, these results establish that sleeping less than seven hours daily affects adult health and food choices [28].

Currently, smoking among students is very low (9.1%), especially among female students (16% female, 22% male). The one or more/week group had more smokers than the less than one/week group, with significant differences. This result confirms other local studies of Saudi youth, [22] where only 8.6% smoked (16.6% of male versus 0.8% of female). Similar results were reported among Thai university students (3.3% of female versus 17.3% of male). [24] The low smoking rate in the present study reflects the conservative society of Saudi Arabia, especially for females, because it is culturally unacceptable and is an expression of independence [29].

According to the Global Energy Drinks Report, [30] Saudi Arabia ranks among the top ten countries for consumption. The present study found that an alarming 61.5% of male students consume energy drinks once or more/week, which is in contrast with female students (20.5%) and is consistent with the observation that males are more likely than females to consume energy drinks [10,12,20]. A similar result in a recent local study by Aljaloud [31] found that 60.1% of students from three Saudi universities consumed energy drinks once or more/week. Mahfouz et al. [18] reported 55.6% of male and 35.5% of female students attending Jazan University consumed energy drinks. Comparing our results with other international studies, Argentinean (64.9%) [32] and Ghana (62.2%) [33] university students reported similar percentages.

Energy drinks consumed once or more/week was related to skipping breakfast and eating fast food more than four days/week among males and females. In a study that included 1062 university and non-university students in Hail, the authors found a higher consumption of energy drinks associated with irregular breakfast intake, with 60% skipping breakfast [12]. Approximately 53% of college students at the University of Sharjah, UAE who consumed energy drinks on a regular basis skipped breakfast [34].

Male and female students in the present study who consumed energy drinks once or more/week were more physically active. Similar results were reported among 439 Turkish students at Hacettepe University, where 36.4% exercised regularly and consumed energy drinks to enhance their physical performance [35]. Energy drinks contain large amounts of caffeine (50 to 505 mg/serving), more than that found in a soft drink (35-50 mg/serving). Consequently, they affect sleep quantity (sleep duration) and quality (sleep: latency, efficiency and disturbances) [36]. More than 40% of male and female students in the one or more/week more group slept less than seven hours daily. Similar results were observed among university students from many previous studies [12,34,35]. Thirty-nine

female students used unhealthy weight control methods, such as diet pills. Until now, there have been unclear results on whether the interactions between ingredients in energy drinks, especially caffeine, and substances found in diet pills pose health risks. Studies have found that exposure to media technologies is associated with greater cigarette smoking and consumption of caffeinated products, [36] such as energy drinks, similar to what was observed in this study.

We found a significant association between weekly soft drink consumption (one or more/week) and weekly fast food intake. Previous studies [37,38] have found that adults who eat fast food three or more times/week consumed more SSBs, especially soft drinks, ate fewer fruits and vegetables, had poor nutritional diets and skipped breakfast. Furthermore, early studies have found subjects who consume soft drinks eat a higher glycemic index diet, such as pizza and burgers, confirming the assumption that subjects who consume high glycemic index foods stimulate the intake of other high glycemic index foods [39]. Consumption of energy drinks among male students is associated with lower daily sleep hours. Similar results were observed among 667 American college students [40]. Energy drink consumption was associated with less frequent breakfast intake among females, similar to previous studies [37,38].

This study has some limitations. First, it only examined representative students from one university, which might not be the representative population for other universities in other regions. Second, we used convenient volunteer students that could have caused selection bias. Third, all measures and health-risk behavioral data were self-reported and may have caused social desirability biases, especially among female students. Finally, this study was a cross-sectional design, and observed associations do not provide the direction of causality. Despite these limitations, the study has much strength. We used a standardized methodology for all the measures to decrease any biases. Additionally, during data collection, we used multiple procedures to improve the reliability of the data and ensure confidentiality and anonymity. The present study used a specific definition for SSBs, and we asked students to recall their SSBs consumption as weekly consumption, which has proven to be more reliable than the one-month recall time [41]. Furthermore, we updated existing knowledge about the nutritional status of young adults, a large segment of the Saudi Arabian population. Furthermore, the study investigated ten health-risk behaviors associated with SSBs consumption for age groups facing a critical developmental period to be more independent and to independently establish many of their dietary and lifestyle behaviors.

## Conclusion

The prevalence of SSBs consumption was high among students and varied between genders. Male students drank more SSBs than females, and soft drinks were the most common SSBs consumed, followed by energy drinks. In addition, students in the one or more/week group had more unhealthy behaviors than the less than one/week group. They ate more fast foods,

consumed fewer fruits and vegetables daily, frequently skipped breakfast, slept less than seven hours daily and smoked. Female students in both groups were physically inactive and used unhealthy weight control methods. The results indicate different health behaviors between males and females associated with SSBs consumption. Future studies should examine SSBs consumption and health behaviors longitudinally to determine the direction of this relationship. Further research should investigate the effect of the new regulations by the Saudi Parliament who decided to impose a unified tax of 100% on energy drinks, tobacco and 50% on soft drink in April 2017, hopefully that can reduce the SSBs consumption.

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### **Authorship**

All authors contributed to the study design and data management and assessment. HO contributed to the data analysis, data interpretation and manuscript writing and review. SK contributed to the data interpretation and revision of the manuscript. All authors read and approved the final manuscript.

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### **Conflict of Interest**

The authors declare no potential conflicts of interests.

### **References**

1. Popkin BM. Global nutrition dynamics: The world is shifting rapidly toward a diet linked with non-communicable diseases. *J Clin Nutr* 2006; 84: 289- 298.
2. Business Monitor International. Saudi Arabia: Food and Drink Report Q3 2012; 2012.
3. Choi HK, Curhan G. Soft drinks, fructose consumption, and the risk of gout in men: prospective cohort study. *BMJ* 2008; 336: 309-312.
4. Malik VS, Popkin BM, Bray GA, Despres JP, Willett WC, Hu FB. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes Care* 2010; 33: 2477-2483.
5. Fung TT, Malik V, Rexrode KM, Manson JE, Willett WC, Hu FB. Sweetened beverage consumption and risk of coronary heart disease in women. *Am J Clin Nutr* 2009; 89: 1037-1042.
6. Sharkey JR, Johnson CM, Dean WR. Less-healthy eating behaviors have a greater association with a high level of sugar-sweetened beverage consumption among rural adults than among urban adults. *Food Nutr Res* 2011; 55.
7. Malik VS, Hu FB. Sweeteners and risk of obesity and type 2 diabetes: the role of sugar-sweetened beverages. *Curr Diabetes Rep* 2012; 12: 195-203.
8. De Bel-Air F. Demography, migration and labour market in Saudi Arabia, Explanatory note no. 1/2014. *Gulf Labour Markets and Migration* 2014.
9. Al-Fares MN, Alsunni AA, Majeed F, Badar A. Effect of energy drink intake before exercise on indices of physical performance in untrained females. *Saudi Med J* 2015; 36: 580-586.
10. Alsunni AA, Badar A. Energy drinks consumption pattern, perceived benefits and associated adverse effects amongst students of University of Dammam, Saudi Arabia. *J Ayub Med Coll Abbottabad* 2011; 23: 3-9.
11. Majeed F. Association of BMI with diet and physical activity of female medical students at the University of Dammam, Kingdom of Saudi Arabia. *J Taibah Univ Med Sci* 2015; 10: 188-196.
12. Faris M. Patterns of caffeinated energy drinks consumption among adolescents and adults in Hail, Saudi Arabia. *Food Nutr Sci* 2014; 5: 158-168.
13. Hedrick VE, Savla J, Comber DL, Flack KD, Estabrooks PA, Nsiah-Kumi PA. Development of a brief questionnaire to assess habitual beverage intake (BEVQ-15): sugar-sweetened beverages and total beverage energy intake. *J Acad Nutr Diet* 2012; 112: 840-849.
14. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a world health organization consultation on obesity 1998.
15. Staser KW, Zollinger TW, Saywell RM, Kunapareddy S, Gibson PJ, Caine VA. Dietary behaviors associated with fruit and vegetable consumption, Marion County, Indiana. *Preventing Chronic Disease* 2011; 8: 66.
16. Craig CL, Marshall AL, Str MS, Bauman AE, Booth ML, Ainsworth BE, Oja, P. International physical activity questionnaire : 12-country reliability and validity. *Med Sci Sports Exerc* 2003; 35: 1381-1395.
17. Kabrita CS. Hajjar-Muca TA, Duffy JF. Predictors of poor sleep quality among Lebanese university students: Association between evening typology, lifestyle behaviors, and sleep habits. *Nat Sci Sleep* 2014; 6: 11-18.
18. Mahfouz M, Makeen AM, Akour AY, Madkhly TM, Hakami HM, Shaabi WM, Ageeli AF, Khawaj FA, Najmi KA, Hakami SY, Al-Ali MA. Nutritional habits and weight status among Jazan university students: eating patterns and healthy lifestyle assessment. *Epidemiol Biostat Publ Health* 2016; 13: 11658-1- e11658-7.
19. Garriguet D. Beverage consumption of Canadian adults. *Health Rep* 2008; 19: 23-29.
20. O'leary F, Hattersley L, King L. Sugary drink consumption behaviors among young adults at university. *Nutr Diet* 2012; 69: 119-123.
21. Rombaldi AJ, Neutzling MB, Silva MCD, Azevedo MR, Hallal PC. Factors associated with regular non-diet soft

- drink intake among adults in Pelotas, Southern Brazil. *Rev Saude Publica* 2011; 45: 382-390.
22. Moradi-Lakeh M, El Bcheraoui C, Tuffaha M, Daoud F, Al Saeedi M, Basulaiman M, Memish ZA, Al Mazroa MA, Al Rabeeah AA, Mokdad AH. The health of Saudi youths: current challenges and future opportunities. *BMC Fam Pract* 2016; 17: 26.
  23. Al-Qahtani MH. Dietary habits of Saudi medical students at university of Dammam. *Int J Health Sci (Qassim)* 2016; 10: 353-362.
  24. Pengpida S, Peltzer K. Prevalence of overweight and underweight and its associated factors among male and female university students in Thailand. *J Comp Human Biol* 2015; 66: 176-186.
  25. Larson N, Neumark-Sztainer D, Laska MN, Story M. Young adults and eating away from home: Associations with dietary intake patterns and weight status differ by choice of restaurant. *J Am Diet Assoc* 2011; 111: 1696-1703.
  26. Abdal Qader MA, Ghazi HF, Zaleha Md, Tiba Nezar Hasan TN, Mohammed MF. Nutritional habits among internet users in a private Malaysian medical school. *Pak J Nutr* 2015; 14: 409-411.
  27. Meyer K, Wall M, Larson N. Sleep duration and BMI in a sample of young adults. *Obesity* 2012; 20: 1279-1287.
  28. National Sleep Foundation of America: Sleep in America Poll. Washington, 2009.
  29. AlSwuailem AS, AlShehri MK, Al-Sadhan S. Smoking among dental students at King Saud University: consumption patterns and risk factors. *Saudi Dent J* 2014; 26: 88-95.
  30. Global Energy Drinks Report 2012, 2013.
  31. Aljaloud SO. Effectiveness of an educational program on the cognitive status and habits on the use of dietary supplements facts information to consumers in Saudi Arabia. *J Theor Appl* 2015; 86; 3.
  32. Ballistreri MC, Corradi-Webster CM. Consumption of energy drinks among physical education students. *Rev Lat Am Enfermagem* 2008; 16: 558-564.
  33. Buxton C, John EH. A survey of energy drinks consumption practices among student-athletes in Ghana: lessons for developing health education intervention programmes. *J Int Soc Sports Nutr* 2012; 9: 1-8.
  34. Faris MA, Jahrami H, AL-Hilali MM, Chehyber NJ, Ali SO, Shahd SD, Obaidi RS. Energy drink consumption is associated with reduced sleep quality among college students: a cross-sectional study. *Nutr Diet* 2016; 9: 1-7.
  35. Attila S, Cakir B. Energy-drink consumption in college students and associated factors. *Nutrition* 2011; 27: 316-322.
  36. Calamaro CJ, Mason TBA, Ratcliffe SJ. Adolescents living the 24/7 lifestyle: effects of caffeine and technology on sleep duration and daytime functioning. *Pediatrics* 2009; 123: 1005-1010.
  37. Larson N, Laska MN, Story M, Neumark-Sztainer D. Sports and energy drink consumption are linked to health-risk behaviours among young adults. *Public Health Nutr* 2015; 16: 1-10.
  38. Cornwell TB, McAlister AR. Contingent choice. Exploring the relationship between sweetened beverages and vegetable consumption. *Appetite* 2013; 62: 203-208.
  39. Schulze MB, Manson JE, Ludwig DS, Colditz GA, Stampfer MJ, Willett WC. Sugar-sweetened beverages, weight gain, and incidence of type 2 diabetes in young and middle-aged women. *JAMA* 2004; 292: 927-934.
  40. Patrick ME, Griffin J, Huntley ED, Maggs JL. Energy drinks and binge drinking predict college students sleep quantity, quality, and tiredness. *Behav Sleep Med* 2016; 1-14.
  41. Fletcher JM, Frisvold D, Tefft N. Taxing soft drinks and restricting access to vending machines to curb obesity. *Health Affairs* 2010; 29: 1059-1066.

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