Saudi Pharmaceutical Journal 28 (2020) 1635–1647

Contents lists available at ScienceDirect

Saudi Pharmaceutical Journal

journal homepage: www.sciencedirect.com

Original article

Assessment of beverage consumption by young adults in Saudi Arabia

Md. Ashraful Islam [a,*], Aseel Fuad Al-karasneh [a], Ahmed Bin Hussain [b], Ali Muhanna [b], Taher Albu-hulayqah [b], Atta Abbas Naqvi [a], Muhammad Shahid Iqbal [c], Maryam Farooqui [d], Mahmoud E. Elrggal [e,g], Mansour Adam Mahmoud [f], Abdul Haseeb [g]

[a] Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
[b] College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
[c] Department of Clinical Pharmacy, College of Pharmacy, Prince Sattam Bin Abdul Aziz University, Alkharj, Saudi Arabia
[d] Department of Pharmacy Practice, Unaizah College of Pharmacy, Qassim University, Qassim, Saudi Arabia
[e] Pharmaceutical Research Center, Deanship of Scientific Research, Umm Al Qura University, Makkah, Saudi Arabia
[f] Department of Clinical and Hospital Pharmacy, College of Pharmacy, Taibah University, Al-Madinah Al-Munawarah, Saudi Arabia
[g] Department of Clinical Pharmacy, College of Pharmacy, Umm Al Qura University, Makkah, Saudi Arabia

ARTICLE INFO

Article history:
Received 26 May 2020
Accepted 18 October 2020
Available online 22 October 2020

Keywords:
Beverage consumption
SSBs
Caffeine
Carbonated drinks
Energy drinks
Undergraduate student
Saudi Arabia

ABSTRACT

Objective: The primary objective was to assess beverage consumption pattern and calorie intake among undergraduate students on weekly and daily basis. Secondary objectives were to determine the relationship between demographic variables and beverage intake, assess mean differences in calorie intake between students' groups and, report the predictors of beverage consumption.

Methods: A cross-sectional study was conducted for 3 months (January–March 2019) among currently enrolled undergraduate students studying in 8 colleges of a public sector university in Dammam, Saudi Arabia. The study used the Arabic version of Beverage Frequency Questionnaire (BFQ) and collected data through purposive stratified sampling. Total intake in ml and calories in kcals were calculated. Data was analyzed through SPSS version 23 and the study was approved from ethics committee of the university (IRB-2019-05-021).

Results: A total of 507 students responded to the survey. The average volume of sugar sweetened beverages (SSBs), caffeine containing beverage (CCBs) and carbonated beverages (CarBs) consumed was 4.2 L, 4 L and 1.5 L per week and 650.6 ml, 575.2 ml and 224.6 ml per day, respectively. Average daily calorie intake from SSBs, CCBs and CarBs was 187.6 kcals, 87.6 kcals and 52.5 kcals, respectively. Body mass index (BMI) was significantly related to CCB ($\rho = 0.130$) and CarBs ($\rho = 0.100$) intake (mL) ($p < 0.05$). Mean difference in calorie intake was mostly significant ($p < 0.05$) when accounted for students' demographics, gender, BMI, residence, illness and, examination time, in case of SSBs, CCBs, CarBs and, all beverages. Averge % contribution towards total daily energy expenditure (TDEE) for SSBs, CCBs and CarBs were 10.2%, 6.3% and 2.8%, respectively. Year of study, BMI, residence and illness were predictors of SSBs consumption while BMI, residence and examination time were predictors of CCBs consumption. Gender and BMI were predictors of CarBs intake.

Conclusion: There was a high consumption of beverages in students that was related to their demographic characteristics. There is a need to create awareness among the students regarding the detrimental effects of chronic consumption of these beverages.

1. Introduction

Sugar sweetened beverages (SSBs) are consumed in every part of the world (WHO, 2020). The World Health Organization (WHO) emphasizes on reduction in consumption of free sugars as taking sugars in high amount can increase likelihood of dental problems, obesity, and diabetes (WHO, 2020; Vartanian et al., 2007). Evidence highlights that increase SSBs consumption have

* Corresponding author.
E-mail address: salimashraf.ru@gmail.com (M.A. Islam).

Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

https://doi.org/10.1016/j.jsps.2020.10.010
1319-0164/

somewhat decrease in the last few years however, it is still quite high among adolescents (Bleich and Vercammen, 2018). In a meta-analysis, it was reported that soft drinks were associated with weight gain, reduction in intake of other nutrients and increased risk of diseases such as diabetes (Vartanian,et al., 2007).

In a study by West and colleagues, it was reported that 95% of students consumed SSBs in the past month and 65% reported daily SSB intake (West et al., 2006). Due to their high sugars, SSB are also a significant source of non-nutritional calories and an estimated 20% of total calories consumed by adolescents are sourced from sweeteners in such beverages (West et al., 2006; Guthrie and Morton, 2000). Evidence indicates that a high SSB intake is linked to an increased risk of adverse health outcomes and cardiometabolic risk factors (Dhingra et al., 2007; Duffey et al., 2010).

Apart from the SSBs, caffeine containing beverages (CCBs) are another popular category of consumed beverages (Bhatti et al., 2013). It was mentioned in a study that 85% of US population consumes at least 1 CCB daily (Mitchell et al., 2014). Another study mentioned that coffee is second most popular beverage among Canadian adult population. (Garriguet, 2008; Yu et al., Dummer, 2017). Available evidence highlights that compared to non-coffee consumers, those who consume coffee have less likelihood of developing diabetes, coronary heart disease and stroke (Bhatti et al., 2013). However, several studies conducted to evaluate the association between caffeine intake and above mentioned health outcomes have reported conflicting results (Yu et al., 2017). A study by Liu and colleagues showed a positive association between coffee consumption and all cause mortality in individuals <55 years (Liu et al., 2013). Contrastingly, study by Freedman showed an inverse association with all cause and cause-specific mortality (Freedman et al., 2012). Besides, meta-analysis studies have also reported differing results as meta-analyses by Malerba et al., and Crippa et al., showed that coffee consumption was inversely related with cardiovascular disease and all-cause mortality (Malerba et al., 2013; Crippa et al., 2014). While meta-analysis by Ding and colleagues showed that moderate coffee consumption was inversely associated with risk of CVD (Ding et al., 2014).

The intake of beverages are quite common in Saudi Arabia as evidenced from recent researches on estimation of SSBs and energy drinks consumption among young adult Saudis (Benajiba and Mahboub, 2019). According to the data from Statista, the forecast for revenue from the sale of food and beverages was estimated to be USD 234.4 million in August 2020 and with over 7.5 million users. Over 15% of the revenue from the sales of beverages came from the individuals between 18 and 24 years (Statista, 2020). It is important to mention that this age group is mostly comprised of students who are in universities and most habit forming behaviors are formulated at this time in life. Several studies have been conducted in Saudi universities that report a high consumption of beverages among undergraduate students. In a study among female students, it was reported that beverages were mostly consumed for recreational purposes and for improving academic performance (Rahamathulla, 2017). Alabbad and colleagues identified male gender, marital status, and college (medical/non-medical) as determinants of energy drinks consumption in a large sample of university students in Saudi Arabia (Alabbad et al., 2019).

However, none of the studies mentioned above used a validated questionnaire to document a holistic account of beverage consumption with their frequency and quantity. This study used a previously validated questionnaire known as the Beverage Frequency Questionnaire (BFQ) to document the frequency, quantity of SSBs and caffeinated beverages consumed by university students and calculated their energy intake (Hedrick et al., 2010; Vanderlee et al., 2018). The questionnaire takes into account several categories of beverages that include caloric and non-caloric, sugar-sweetened beverage (SSBs), caffiene containing beverage (CCBs), etc., with a picture of possible sizes of container to facilitate the respondents during filling of questionnaire (Hedrick et al., 2010; Vanderlee et al., 2018).

2. Methods

2.1. Objective

The primary objective was to assess consumption pattern of several beverages and calorie intake among undergraduate students. Assessment of beverages included individual beverages as well as beverage categories such as SSB, caffeinated and carbonated beverages. Secondary objectives were to determine the relationship between demographic variables and beverage intake, assess mean differences in calorie intake between students' groups and, report the predictors of beverage consumption.

2.2. Design

A cross-sectional study was conducted among undergraduate students studying in colleges affiliated with Imam Abdulrahman Bin Faisal University in Dammam, Saudi Arabia.

2.3. Duration and venue

The duration of the study was three months, i.e., January 2019–March 2019. It was conducted in colleges of pharmacy, medicine, dentistry, applied medical sciences, business, architecture and planning and design.

2.4. Participants and eligibility criteria

The participants of the study were undergraduate students who were enrolled in health and non-health colleges. Those who consented to participate were given a written informed consent form and were included in the study after they signed the form. Drop-out students and those who had graduated were not included in the study.

2.5. Sampling technique and sample size

Purposive stratified sampling was used for the study. There were 17 colleges located at the main campus out of which 8 provided permission to carry out the study at their premises. The students were briefed about the study and its objectives. Those who consented to participate were provided with the questionnaire. Based on official figure obtained from the university, the total number of registered students at IAU were 30,062 (IAU, 2020). This was identified as known population. The sample size was calculated using the formula (Krejcie and Morgan, 1970).

$$n = \frac{N}{1 + Nd^2}$$

where n = required sample size, N = Population size and d = margin of error (ideal value is 0.05) for 95% confidence level. Based on the formula the required sample was 394.74. The sample size after accounting for potential non-response rate was calculated using the formula (Sakpal, 2010).

$$n_n = \frac{n}{1 - d}$$

where, n_n = sample size after accounting for the non-response rate, n = calculated sample size and d = non-response rate. Thus, n = 394.75 and d = 20%. The final sample required for the study was 493.42. We managed to document responses from 520 samples in the study.

2.6. Proportional allocation

Proportional allocation sample from all colleges of IAU was calculated. Proportional allocation is calculated by the formula (Pandey and Verma, 2008).

$$n_x = n_n \frac{n}{N}$$

where n_x = proportional allocation number of college (x), n_n = sample size after accounting for the non-response rate, n = total student population of college (x) and N = total student population of all colleges.

2.7. Research instrument translation and piloting

A previously developed and validated survey questionnaire known as Beverage Frequency Questionnaire (BFQ) was used in the study (Hedrick et al., 2010; Hedrick et al., 2012; Hedrick et al., 2013; Vanderlee et al., 2018). Permission was taken from the developers of the scale. The BFQ examines the weekly frequency and quantity of beverages consumed. It incorporates 17 types of beverages. Based on the frequency and quantity of specific beverages, their caloric value may be estimated. The BFQ was translated in Arabic language before handing it to the students. The translation process was according to the guidelines for translation and cross culture adaptation. (Beaton et al., 2000). The BFQ was not available in Arabic language and therefore its translation was required before the study. A nutrition pharmacist who was a subject matter expert and a native Arabic speaker translated the questionnaire into Arabic language. This version was termed as version 1.0. At the same time, an Arabic linguist who was a non-subject matter expert, and native Arabic speaker whose second language was English, translated the English version into Arabic. This was termed as version 2.0. These versions were reconciled. Following this step, the Arabic version was back translated into English by two different academicians, a subject matter expert, and a non-subject expert. The back translated versions obtained from subject and non-subject experts were termed as versions 3.0 and 4.0, respectively. The versions 3.0 and 4.0 along with versions 1.0 and 2.0, were subjected to review by an expert committee and were reconciled to produce a final Arabic version of BFQ. The translated version of BFQ was pre-tested in 13 students and was validated at this point.

2.8. Operational definitions

2.8.1. Sugar sweetened beverages (SSBs)

All beverages that had sugar contents were included in SSBs. Based on the approach of Jones and colleagues, we considered carbonated soft drinks, fruit drinks, sports drinks, energy drinks, flavored water, coffee, tea, hot chocolate, flavored milk or substitutes, meal replacement beverages, protein drinks, smoothies, and drinkable yogurt, as sugar sweetened beverages (Jones et al., 2019).

2.8.2. Caffeinated beverages

All beverages that contained caffeine were included in caffeinated beverage category. We reviewed the findings of Verster and Koenig and further categorized carbonated soft drinks, energy drinks, tea and coffee as caffeinated beverages (Verster and Koenig, 2018).

2.8.3. Carbonated beverages

The beverages with carbon dioxide or those which contained carbonates were considered as carbonated beverages (Kregiel, 2015). Soft drinks, energy drinks, diet soft drinks were identified in this beverage group.

2.9. Calculation of total volume and caloric value

The total volume and caloric value of beverages were calculated using the frequency and quantity of beverages consumed in a week. The total volume of beverage consumed in a week was calculated by the following formula:

$$V_n^{Tw} = F_w \ x \ Q$$

where, V_n^{Tw} is the total volume of a beverage (n) consumed in a week, F_w is the weekly frequency and Q is the quantity. The average volume of a beverage (n) consumed in a day was calculated by the formula:

$$V_n^{Td} = \frac{V_n^{Tw}}{7}$$

where, V_n^{Td} is the average volume of a beverage (n) consumed in a day, 7 denotes number of days in a week and V_n^{Tw} is the total volume of a beverage (n) consumed in a week. The weekly caloric value of a beverage (n) was calculated by the following formula:

$$C_n^w = Kcal_n \ x \ V_n^{Tw}$$

where, C_n^w is the weekly caloric value of a beverage (n), $Kcal_n$ is the average calories per milliliters (ml) of beverage (n) and V_n^{Tw} is the total volume of a beverage (n) consumed in a week. The daily caloric value of a beverage (n) was calculated by the following formula:

$$C_n^d = Kcal_n \ x \ V_n^{Td}$$

where, C_n^d is the daily caloric value of a beverage (n), $Kcal_n$ is the average calories per milliliters (ml) of beverage (n) and V_n^{Td} is the total volume of a beverage (n) consumed in a day. The total weekly volume of a beverage category consumed was calculated by the formula:

$$\Sigma V_x^{Tw} = V_{n1}^{Tw} + V_{n2}^{Tw} + V_{n3}^{Tw} + \cdots V_{nx}^{Tw}$$

where, ΣV_x^{Tw} is the total weekly volume of a beverage category and $V_{n1}^{Tw} + V_{n2}^{Tw} + V_{n3}^{Tw} + \cdots V_{nx}^{Tw}$ are the sum of all total weekly volumes (ml) of individual beverages (n1, n2, n3, … nx) included in a beverage category (x). The total daily volume of a beverage category (x) consumed was calculated by the formula:

$$\Sigma V_x^{Td} = V_{n1}^{Td} + V_{n2}^{Td} + V_{n3}^{Td} + \cdots V_{nx}^{Td}$$

where, ΣV_x^{Td} is the total daily volume of a beverage category and $V_{n1}^{Td} + V_{n2}^{Td} + V_{n3}^{Td} + \cdots V_{nx}^{Td}$ are the sum of all total daily volumes (ml) of individual beverages (n1, n2, n3, … nx) included in a beverage category (x). The total weekly caloric value of a beverage category (x) was calculated by the following formula:

$$\Sigma C_x^w = C_{n1}^w + C_{n2}^w + C_{n3}^w + \cdots C_{nx}^w$$

where, ΣC_x^w is the total weekly caloric value of a beverage category (x) and $C_{n1}^w + C_{n2}^w + C_{n3}^w + \cdots C_{nx}^w$are the sum of all total weekly caloric values (kcals) of individual beverages (n1, n2, n3, … nx) included in a beverage category (x). The total daily caloric value of a beverage category (x) was calculated by the following formula:

$$\Sigma C_x^d = C_{n1}^d + C_{n2}^d + C_{n3}^d + \cdots C_{nx}^d$$

where, ΣC_x^d is the total daily caloric value of a beverage category (x) and $C_{n1}^d + C_{n2}^d + C_{n3}^d + \cdots C_{nx}^d$are the sum of all total daily caloric values (kcals) of individual beverages (n1, n2, n3, … nx) included in a beverage category (x).

2.9.1. Calculation of average calories

The average calories for each beverage category were provided in a scoring sheet along with the BFQ. The calculation of Total Daily Energy Expenditure (TDEE) was conducted using the online calculator (ScyMed).

2.10. Overlapping beverages in categories

The questionnaire had several beverages that were categorized based on operational definitions and local expert consensus. Soft drinks, fruit drinks, sports drinks, energy drinks, flavored water, coffee, tea, hot chocolate, flavored milk or substitutes, meal replacement beverages, protein drinks, smoothies, drinkable yogurt were considered sugar sweetened beverages (SSBs). While soft drinks, energy drinks, sweetened/unsweetened tea and coffee, were categorized as caffeine containing beverages (CCBs). At the same time, soft drinks, energy drinks, diet soft drinks were identified in carbonated beverage group. This resulted in overlapping of soft drinks, energy drinks, sweetened tea, sweetened coffee in SSBs and CCBs while soft drinks, energy drink were present in both SSBs and carbonated groups. To avoid over estimation of calories and quality, total calories and volume were calculated before categorization of beverages. However, there may be an inflation in calories and volume due to the overlapping of beverages when categorized. To compensate for the over estimation, beverage categories were analyzed one at a time and solely with respect to demographics.

2.11. Data cleaning

Data cleaning was conducted before analysis as it was essential to avoid possible unidentified error or misleading results (Osborne, 2013). In particular, in conducting linear regression analysis using ratio/scale data, extreme value may give rise to ambiguous results. Informal technique was used to checked and eliminate data outliers and incomplete information from the dataset (Dunn and Clark, 1974; Islam et al., 2016). Moreover, the value of the statistics 'Mahalanobis Distance' was used to check and rid the data of multivariate outliers before conducting multiple linear regression. Due to using self-administrative data collection procedure used in the study, for some unintentional missing cases, a small number was treated by, 'last observation carried forward method', for grouped cases and, imputation method, for scale data (Lang, 2007). The rest of data were cleaned.

2.12. Data analysis

The data were analyzed using SPSS version 23 and were expressed as sample counts (N) and percentages (%). Descriptive statistics such as mean (X), median (M), standard deviation (SD), interquartile range (IQR), coefficient of variation (CV) and minimum & maximum values as range, were used to report continuous data. Frequency (N) with their corresponding percentages (%) were reported for grouped data. Pearson correlation (ρ) was applied to report the correlation between beverage consumption with student age and BMI. Student's *t*-test was utilized to compare the calorie intake from different beverages based on their demographics. Simple and multiple linear regression analyses were used to report the predictors of different beverage consumption. Checking multicollinearity among predictors is an important assumption for applications of multiple linear regression model. Variance inflation factor (VIF) was used to check for the problem of multicollinearity among the predictor variables and the value of VIF < 5 highlighted no evidence of multicollinearity (Chatterjee and Hadi, 2006). Model assumptions for linearity and homoscedasticity were checked using scatter plot. A two-tailed p value of <0.05 was considered significant at the 95% confidence interval (CI) level.

2.13. Consent and ethics approval

The students were asked to provide their written consent before documenting their response. Those who consented to participate were included in the study. The study was approved by the Institutional Review Board of Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia (IRB-2019-05-021).

3. Results

A total of 507 responses were collected. The mean age of students was 20–21 years (20.72 ± 1.68) and the range was between 18 and 27 years. Most responses were from male students (N = 318, 62.7%). The responses were gathered from students from all study years and a third of them were from pharmacy students (N = 180, 35.5%). The mean body mass index (BMI) was 23 kg/m^2 (23.41 ± 5.21) and ranged between 14.5–40.1 kg/m^2. The average total daily energy expenditure was 2360.5 kcals. Most students (N = 270, 52.3%) had normal BMI and lived with family (N = 371, 73.2%). A small proportion of students (N = 71, 14%) had illnesses. Out of these 71 students, 28 (39.4%) had glucose 6 – phosphate dehydrogenase deficiency, 19 (26.8%) had sickle cell anemia, 9 (12.7%) had asthma, 7 (9.9%) suffered from hypertension, 3 (4.2%) sickle cell trait, 4 (5.6%) had diabetes and 1 (1.4%) had depression (Table 1).

Most students (315, 62.1%) consumed water 3 times a day while fruit juice and sweet juice were consumed 1 time a week by almost a third (N = 148, 29.2%) and a fifth (N = 105, 20.7%) of students respectively. Very few students (N = 22, 4.3%) drank vegetable juice 1 time a week. Whole milk was most consumed 2–3 times weekly

Table 1
Demographic information of students (n = 507).

Student information	N (%)
Gender	
Male	318 (62.7)
Female	189 (37.3)
Study year	
Preparatory year	93 (18.3)
2nd year	118 (23.3)
3rd year	116 (22.9)
4th year	68 (13.4)
5th year	112 (22.1)
College	
Science college (Health track)	91 (17.9)
Science college (Non health track)	34 (6.7)
Pharmacy	180 (35.5)
Medicine	46 (9.1)
Physiotherapy	51 (10.1)
Nursing	32 (6.3)
Respiratory care	24 (4.7)
Dentistry	49 (9.7)
BMI Categories	
Malnutrition	72 (14.2)
Normal weight	270 (53.3)
Overweight	95 (18.7)
Obese	70 (13.8)
Residence	
Living with family	371 (73.2)
Living alone	136 (26.8)
Time of Survey	
Exam time	122 (24.1)
Normal academic time	349 (68.8)
Vacation time	36 (7.1)
Illness	
No	436 (86)
Yes	71 (14)

(N = 119, 23.5%) while reduced fat milk was mostly consumed 1 time per week (N = 60, 11.8%). The low-fat milk was most consumed 1 time per week (N = 30, 5.9%). Most students (N = 87, 17.2%) consumed soft drinks 2–3 times in a week. Diet soft drinks were mostly consumed once a week (N = 29, 5.7%). Most students drank sweetened tea 2–3 times per week and tea/coffee/creamer 1 time per week (N = 86, 17%). Black coffee was consumed 2–3 times weekly by most students (N = 63, 12.4%). Meal replacement drinks were consumed 1 time per week by a small proportion of students (N = 21, 4.1%) while energy and sports drinks were consumed once weekly by a small number of students (N = 32, 6.3%) (Table 2).

Most students consumed water, fruit juice and sweet juice in 250 ml cup (N = 193, 38.1%), (N = 155, 30.6%) and (N = 168, 33.1%) respectively. Vegetable juice was consumed in 150 ml or less by most students (N = 151, 29.8%). Whole milk was consumed by most students in 250 ml cup (N = 195, 38.6%) while reduced fat milk and low-fat milk were consumed in quantity of 150 ml or less by the majority (N = 131, 25.8%) and (N = 149, 29.4%) respectively. Soft drinks were mostly consumed in a can of 335 ml (N = 197, 38.9%) while diet soft drinks were consumed in quantity < 150 ml (N = 137, 27%). Sweetened tea, tea/coffee with creamer and black tea/coffee were consumed in quantity of 150 ml or less by most students (N = 228, 45%), (N = 170, 33.5%) and (N = 170, 33.5%) respectively. Meal replacement drinks were used by a small number of students in 250 ml cup (N = 22, 4.3%) while energy and sports drinks were consumed in 150 ml or less (N = 32, 6.3%) (Table 3).

The mean and median quantity of beverages consumed per day and per week with their ranges are tabulated in Table 4. The mean and median energy in kilo calories (kcals) liberated from the beverages are also mentioned in Table 4.

3.1. Relationship between demographic variables and beverage intake in kcal

The variable of age had a non-significant, negative, and weak relationship ($\rho = -0.009$, $p > 0.05$) with SSBs intake (kcal). However, it was non-significant, positive, and weak ($\rho = 0.036$, $p > 0.05$) for relationship between age and caffeinated beverage intake in kcal. Similarly, there was a non-significant, negative, and weak relationship ($\rho = -0.001$, $p > 0.05$) between age and carbonated beverage intake (kcal).

The BMI had a non-significant, positive, and weak relationship ($\rho = 0.44$, $p > 0.05$) with SSBs intake (kcal). However, it was significant, positive, and weak-to-moderate ($\rho = 0.130$, $p < 0.01$) for relationship between BMI and caffeinated beverage intake (kcal). The relationship between BMI and carbonated beverage intake (kcal) was marginally non-significant, positive, and weak ($\rho = 0.100$, $p = 0.05$). The correlation among variables of age, BMI and beverages are mentioned in Figs. 1, 2 and 3 and the squares in the diagonal show data distribution.

3.2. Mean comparison in daily calorie intake from beverages

The mean difference between male and female gender was significant ($p < 0.05$) as calorie intake from all beverages for males was 39.44 kcal more than females. Besides, it was significant ($p < 0.01$) for SSBs as well as calorie intake from SSBs for male students was 49.17 kcals more than females. Similarly, the mean difference was significant ($p < 0.01$) for caffeinated beverages as calorie intake from caffeinated beverages for males was 42.7 kcal more than females. Moreover, it was significant ($p < 0.01$) for carbonated beverages as calorie intake from such beverages for male students was 53.77 kcals more than females. The mean difference between the BMI categories of obese and non-obese was significant ($p < 0.05$) for calorie intake for all beverages. Obese students had calorie intake of 30.2 kcals more than non-obese students. It was marginally non-significant ($p = 0.05$) for SSBs as obese students obtained 37.79 kcals more than non-obese students. Furthermore, the mean difference was significant ($p < 0.01$) for caffeinated beverages as obese students obtained 69.53 kcals more from such beverages as compared to their non-obese counterparts. Similarly, the mean difference was significant ($p < 0.01$) for carbonated beverages as obese students obtained 73.24 kcals more from such beverages as compared to non-obese students.

The mean differences in calorie intake was significant with respect to residence of students. It was significant for all categories of beverages. Students living alone in university accommodation had 39.99 kcals more from all sorts of beverages as compared to students living with their families. Similarly, students living alone obtained 48.06 kcals, 49.92 kcals and 53.80 kcals more from SSBs, caffeinated and carbonated beverages respectively, as compared to students who lived with their families. The mean difference in calories intake with respect to illness was significant ($p < 0.05$) only for SSBs and caffeinated beverages. Students who had no illness had a higher calorie intake of 32.92 kcals and 39.19 kcals from SSBs and caffeinated beverages respectively, as compared to students who suffered from any illness. The mean difference in calories intake related to time of survery, i.e., examination/normal academic session, was significant ($p < 0.05$) only for CCBs and CarBs. Students who had exams had a higher calorie intake of 54.06 kcals and 61.19 kcals from CCBs and CarBs respectively, as compared to students who had normal academic session (Table 5).

Table 2
Beverage consumption frequency (n = 507).

Beverage	Never or < 1 T/W	1 T/W	2–3 T/W	4–6 T/W	1 T/D	2 + T/D	3 + T/D
Water	1 (0.2)	12 (2.4)	17 (3.4)	27 (5.3)	25 (4.9)	110 (21.7)	315 (62.1)
Fruit juice	209 (41.2)	148 (29.2)	91 (17.9)	27 (5.3)	23 (4.5)	6 (1.2)	3 (0.6)
Sweet juice	242 (47.7)	105 (20.7)	89 (17.6)	36 (7.1)	25 (4.9)	7 (1.4)	3 (0.6)
Vegetable juice	463 (91.3)	22 (4.3)	11 (2.2)	7 (1.4)	3 (0.6)	1 (0.2)	0 (0.0)
Whole milk	184 (36.3)	85 (16.8)	119 (23.5)	37 (7.3)	57 (11.2)	11 (2.2)	14 (2.8)
Reduced fat milk	354 (69.8)	60 (11.8)	49 (9.7)	23 (4.5)	15 (3)	3 (0.6)	3 (0.6)
Low-fat milk	442 (87.2)	30 (5.9)	15 (3)	9 (1.8)	6 (1.2)	1 (0.2)	4 (0.8)
Soft drink	234 (46.2)	83 (16.4)	87 (17.2)	52 (10.3)	29 (5.7)	12 (2.4)	10 (2)
Diet soft drink	429 (84.6)	29 (5.7)	26 (5.1)	11 (2.2)	7 (1.4)	4 (0.8)	1 (0.2)
Sweetened tea	186 (36.7)	78 (15.4)	85 (16.8)	51 (10.1)	55 (10.8)	26 (5.1)	26 (5.1)
Tea coffee creamer	231 (45.6)	86 (17)	82 (16.2)	37 (7.3)	35 (6.9)	26 (5.1)	10 (2)
Black tea coffee	287 (56.6)	59 (11.6)	63 (12.4)	25 (4.9)	36 (7.1)	19 (3.7)	18 (3.6)
Meal replacement	457 (90.1)	21 (4.1)	9 (1.8)	7 (1.4)	5 (1)	5 (1)	3 (0.6)
Energy and sports drink	446 (88)	32 (6.3)	18 (3.6)	6 (1.2)	2 (0.4)	1 (0.2)	2 (0.4)

T = Time; W = Week; D = Day.

Table 3
Beverage consumption quantity (n = 507).

Beverage	None	150 ml or less	1 cup (250 ml)	Can (355 ml)	Bottle (591 ml)	Fountain cup (710 ml)
Water	0 (0.0)	49 (9.7)	193 (38.1)	91 (17.9)	111 (21.9)	63 (12.4)
Fruit juice	82 (16.2)	96 (18.9)	155 (30.6)	119 (23.5)	29 (5.7)	26 (5.1)
Sweet juice	112 (22.1)	128 (25.2)	168 (33.1)	82 (16.2)	11 (2.2)	6 (1.2)
Vegetable juice	248 (48.9)	151 (29.8)	78 (15.4)	20 (3.9)	8 (1.6)	2 (0.4)
Whole milk	93 (18.3)	136 (26.8)	195 (38.6)	66 (13)	11 (2.2)	6 (1.2)
Reduced fat milk	206 (40.6)	131 (25.8)	127 (25)	32 (6.3)	6 (1.2)	5 (1)
Low-fat milk	238 (46.9)	149 (29.4)	79 (15.6)	29 (5.7)	8 (1.6)	4 (0.8)
Soft drink	125 (24.7)	97 (19.1)	71 (14)	197 (38.9)	12 (2.4)	5 (1)
Diet soft drink	236 (46.5)	137 (2)	50 (9.9)	76 (15)	7 (1.4)	1 (0.2)
Sweetened tea	97 (19.1)	228 (45)	136 (26.8)	41 (8.1)	5 (1)	0 (0)
Tea coffee creamer	118 (23.3)	170 (33.5)	148 (29.2)	60 (11.8)	7 (1.4)	4 (0.8)
Black tea coffee	196 (38.7)	170 (33.5)	96 (18.9)	31 (6.1)	10 (2)	4 (0.8)
Meal replacement	443 (87.4)	13 (2.6)	22 (4.3)	16 (3.2)	8 (1.6)	5 (1)
Energy and sports drink	426 (84)	28 (5.5)	28 (5.5)	22 (4.3)	3 (0.6)	0 (0)

Table 4
Beverage consumption frequency and energy (n = 507).

Beverage consumption	Frequency						kcals/day		
	Weekly			Daily					
	Mean & Median	Range	CV	Mean & Median	Range	CV	Mean & Median	Range	CV
Water (l)	17.58 19.76	0.6–22.1	0.33	2.36 2.45	0.2–3.2	0.33	–	–	
Fruit juice (ml) (n = 425)	680.04 335.00	150.0–3250.0	1.01	104.64 47.90	21.4–750.0	1.19	62.51 28.59	12.8– 448.1	1.19
Sweet juice (ml) (n = 395)	639.26 335.00	150.0–2950.0	0.99	98.01 47.90	21.4–750.0	1.19	47.52 23.16	10.4– 363.0	1.19
Vegetable juice (ml) (n = 259)	299.79 150.00	150.0–2130.0	1.22	43.53 21.40	21.4–450.0	1.30	40.63 19.71	19.7– 414.0	1.37
Whole milk (ml) (n = 414)	969.21 750.00	150.0–5250.0	1.17	138.45 107.10	21.4–750.0	1.17	106.75 82.61	16.5– 578.3	1.17
Reduced fat milk (ml) (n = 301)	512.70 250.00	150.0–3150.0	1.11	73.23 35.70	21.3–450.0	1.11	46.29 22.57	12.8– 284.4	1.11
Low-fat milk (ml) (n = 269)	384.48 150.00	150.0–3150.0	1.42	54.91 21.40	21.4–450.0	1.42	21.26 8.29	8.3–174.2	1.42
Soft drink (ml) (n = 382)	876.23 335.00	150.0–2345.0	0.87	127.58 47.90	21.4–450.0	0.89	57.29 21.49	9.6–202.1	0.89
Diet soft drink (ml) (n = 271)	425.76 250.00	150.0–2485.0	1.21	61.17 35.70	21.4–450.0	1.22	0.61 0.36	0.2–4.5	1.22
Sweetened tea (ml) (n = 410)	934.56 450.00	150.0–3150.0	0.96	133.50 64.30	21.4–450.0	0.96	48.84 21.73	7.2–253.5	1.12
Tea coffee creamer (ml) (n = 389)	867.66 450.00	150.0–3500.0	1.11	123.78 47.90	21.4–500.0	1.11	34.29 13.26	5.9–138.5	1.11
Black tea coffee (ml) (n = 311)	951.00 450.00	150.0–3546.0	1.09	134.82 64.30	21.4–506.6	1.10	1.48 0.71	0.24–5.6	1.10
Meal replacement (ml) (n = 64)	1173.02 710.00	150.0–4137.0	1.01	167.57 101.40	21.4–591.0	1.01	169.92 102.85	21.7– 599.3	1.01
Energy and sport drink (ml) (n = 81)	666.14 250.00	150.0–3546.0	1.23	95.16 35.70	21.4–506.6	1.23	45.01 16.89	10.1– 239.6	1.22
***Sugar sweetened beverages (ml) (n = 487)**	4226.40 3512.50	335.0– 15760.0	0.71	650.58 534.25	47.9– 2156.5	0.69	187.61 171.21	21.0– 487.0	0.62
***Caffeinated beverage (ml) (n = 427)**	4041.87 3060.00	250.0– 15610.0	0.83	575.23 437.10	35.7– 1927.8	0.82	87.57 82.06	1.7–227.1	0.68
***Carbonated beverages (ml) (n = 401)**	1534.19 1005.00	150.0–7935.0	1.05	224.55 143.60	21.4– 1326.4	1.11	52.54 21.96	0.48– 199.7	0.91
†**All beverages**	–	–	–	–	–	–	440.71 357.88	2.8– 1863.9	0.72

*Some beverages are present in more than one category, †all beverages are present in this category.

3.3. Percentile contribution of calories from beverages towards total daily energy expenditure (TDEE)

The average % calorie contribution of SSBs towards TDEE was 10.23 ± 8.86 (median = 8.05, IQR = 8.85). The lowest % calorie contribution was 0 while highest was 56.6% towards TDEE. Besides, caffeinated beverages had an average % contribution of 6.34 ± 7.45 (median 4.1, IQR = 6.4) with a range between 0%–51.4% calorie contribution towards TDEE. Similarly, average % calorie contribution of carbonated beverages towards TDEE was 2.82 ± 5.03 (median = 0.9, IQR = 2.8). The lowest % calorie contribution was 0 while highest was 45.4% towards TDEE. The percentiles are tabulated in Table 6.

3.4. Predictors of beverage intake (ml)

The VIF values showed no multicollinearity presence among predictors. Results from multiple linear regression model predicted

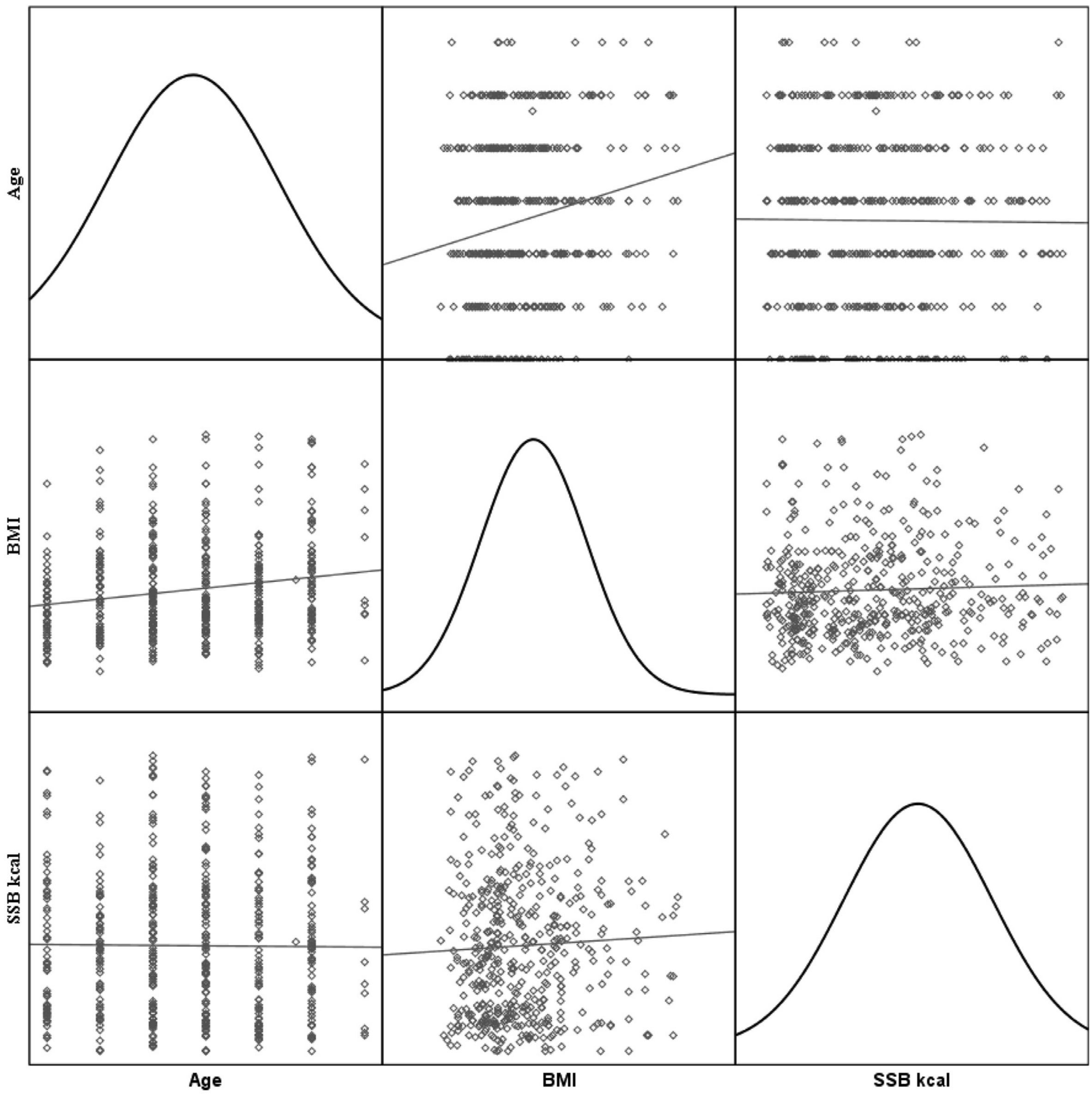

Fig. 1. Correlation among age, BMI and calories from SSBs intak.

that for a year-wise increment in study year, the intake of SSBs would increase by 130 ml holding all other IV fixed ($p < 0.01$). Similarly, for every unit increase in BMI, i.e., obesity, the intake of SSBs would increase by 70 ml holding all other IV constant ($p < 0.05$). Besides, the model predicted that for every ml of SSBs consumed, there will be 279 ml more of SSBs consumed by students living with family as compared to students living alone, provided other IVs remain constant ($p < 0.05$). Moreover, for every ml of SSBs consumed by students with or without illness, there would be 89 ml more of SSBs consumed by students with an illness consumed as compared to those without any illness considering other IVs fixed ($p < 0.05$) (Table 7).

The model for caffeinated beverages predicted that for every unit increase in BMI, i.e., obesity, the intake of caffeinated beverages would increase by 163 ml holding all other IVs constant ($p < 0.05$). Besides, for every ml of caffeinated beverages consumed by students who lived alone or with their families, intake would increase by 122 ml for students who lived alone when all other IVs are fixed ($p < 0.05$). Moreover, the model predicted that for every ml of caffeinated beverages consumed by students during examination or academic period, intake would increase by 116 ml for students in examination period when other IVs are adjusted for ($p < 0.05$). The VIF values showed no multicollinearity presence among predictors (Table 8).

The model for carbonated beverage predicted that for every ml of carbonated beverage consumed by students, the intake would increase by 147 ml for male students considering other IV constant ($p < 0.05$). Similarly, for every unit increase in BMI, i.e., obesity, the intake of carbonated beverages would increase by 312 ml holding all other IV constant ($p < 0.05$). Moreover, the model predicted that for every ml of carbonated beverages consumed by students during examination or academic period, intake would increase by 254 ml for students in examination period when other IVs are adjusted for ($p = 0.05$). The VIF values showed no multicollinearity presence among predictors (Table 9).

4. Discussion

Saudi Arabia is the largest consumer market for beverages in the Middle Eastern Region (Benajiba and Mahboub, 2019). This

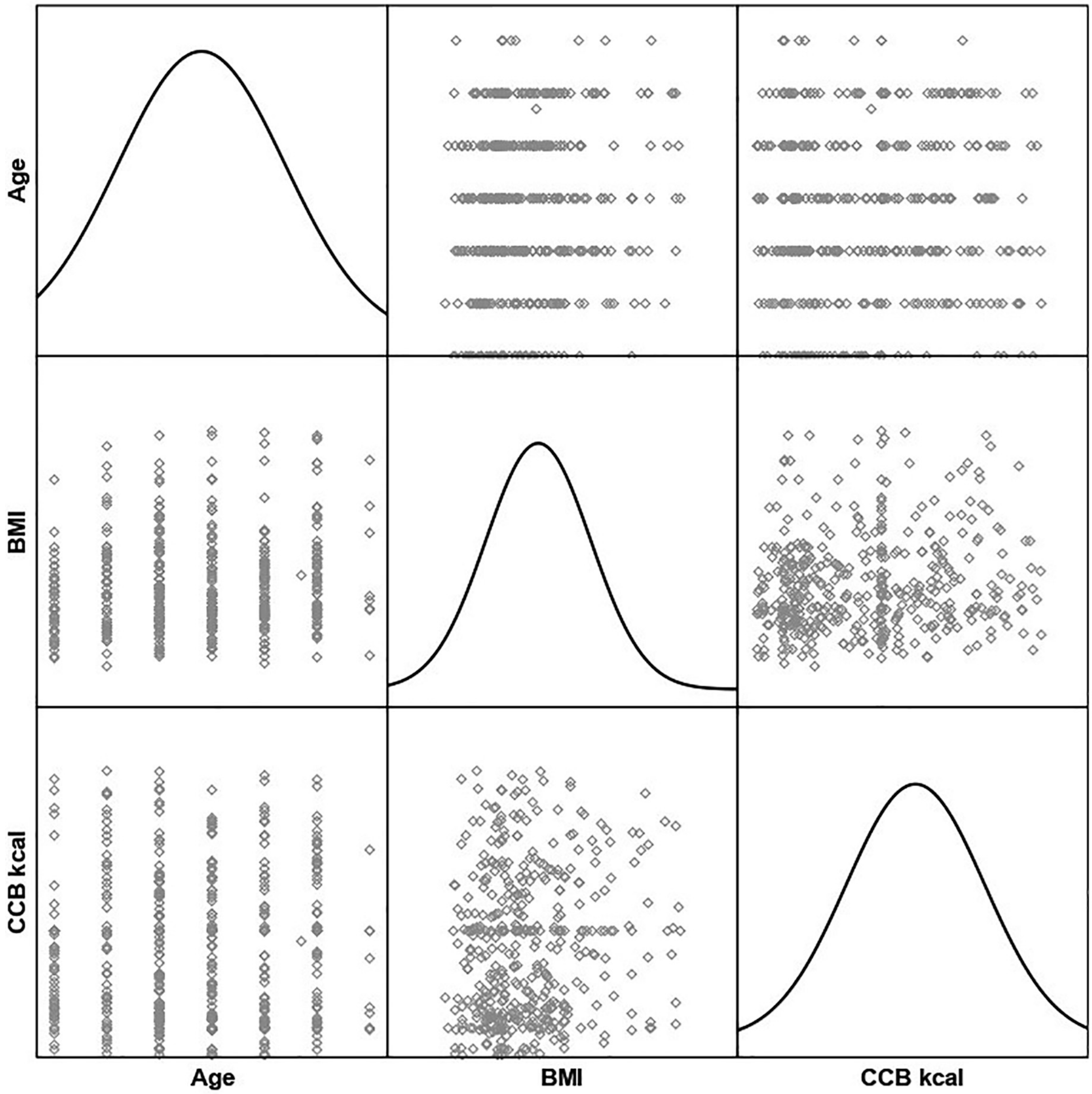

Fig. 2. Correlations among Age, BMI and calories from caffeinated beverages.

study was novel in the aspect that it documented beverage consumption of students using a validated instrument. The study documented responses from male and female students from all study years studying in seven colleges of the university. A third of students (32.5%) were overweight and obese. This figure was similar to that reported in a study from another public sector university in neighboring city of Alahsa (Al Otaibi and Kamel, 2017). Unlike previous studies, we documented students' responses during academic and examination time to observe any variation in consumption pattern.

Consumption of free sugars may negatively impact weight control (Ruff et al., 2014). The average volume of SSBs consumed by students were > 4 L per week that amounted to an average 650 ml per day. This was lower than the figure reported in Malaysian adolescents (Gan et al., 2019). Considering its association with BMI, such beverages could increase likelihood of suffering from metabolic and endocrine disorders (Ruff et al., 2014; Malik et al., 2010). The WHO stresses on the reduction of free sugars to 10% of total calorie intake (Bellisle et al., 2018). Considering the % calorie contribution towards TDEE, we observed that 75% of students had a % kcal contribution of 12.7% or less from SSBs towards their daily energy intake which was slightly higher than the levels recommended by WHO (WHO, 2015). We also found that the mean calorie intake from SSBs for male students was more than female students. This finding was in line with finding of previous studies as males consumed more SSBs in the US (Ogden et al., 2011; Rosinger et al., 2017). Moreover, BMI had a positive relationship with SSBs intake in our results. This meant that BMI increased with a higher SSBs intake. This was highlighted while comparing mean differences in calorie intakes of obese and non-obese students. Regression analyses revealed that a quantity of 70 ml of SSBs increased for every unit increase in BMI. This is detrimental for health of an obese student as sugar drinks have high glycemic index (GI) and studies have highlighted their ability to impair insulin sensitivity and stimulate weight gain (Guerreiro et al., 2010; Kahlhöfer et al., 2016). As a result, this practice would increase likelihood of diabetes and promote further obesity. It was highlighted in a review that SSBs alter sensitivity of insulin which increase the chances of having diabetes or metabolic disease. Besides SSBs have been observed to contribute to weight gain,

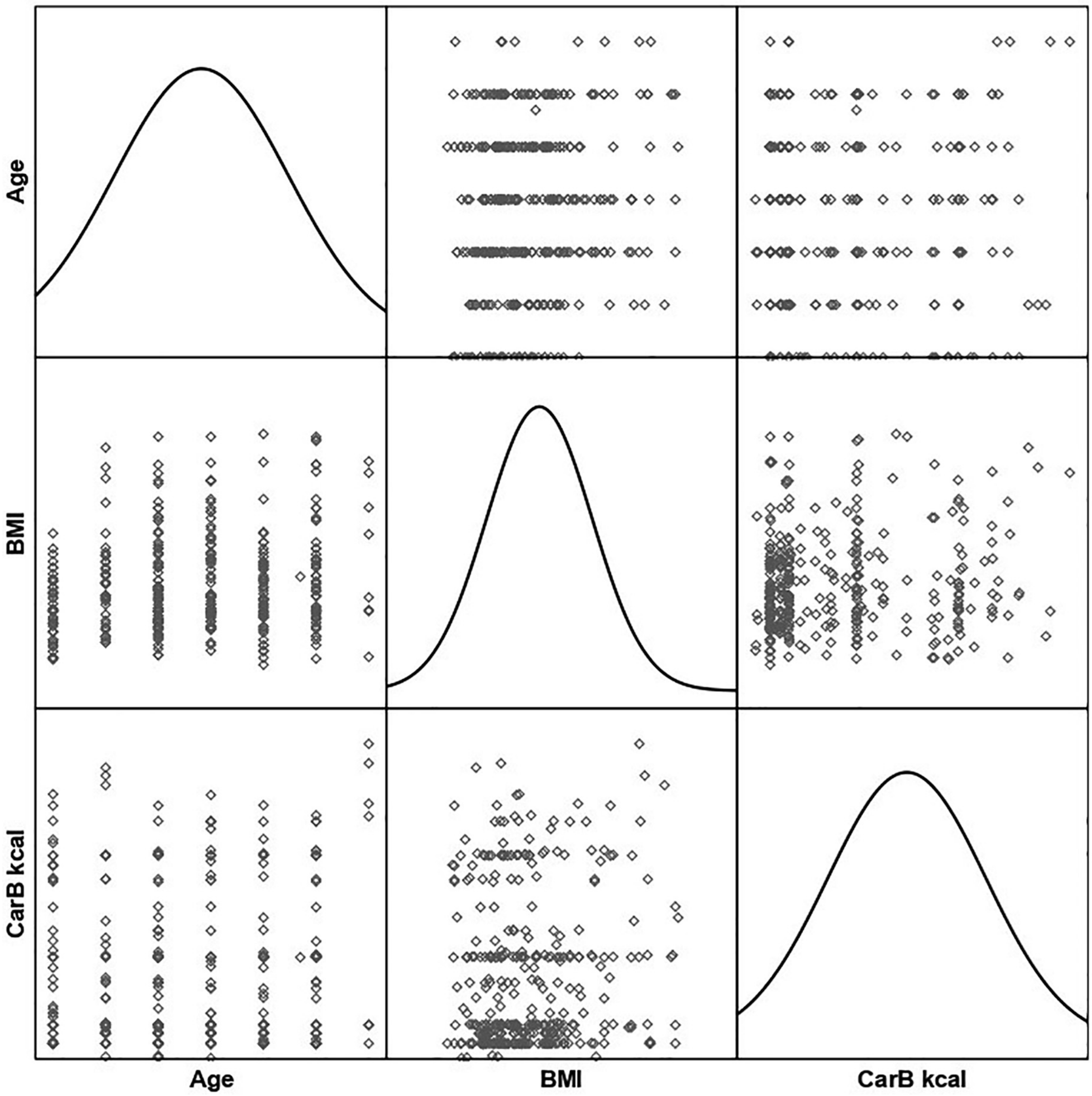

Fig. 3. Correlations among Age, BMI and calories from carbonated beverages.

Table 5
Mean comparison in daily calorie intake from beverages.

Comparison	**Beverages (per day)**			
	AB (kcal)	**SSBs (kcal)**	**CCBs (kcal)**	**CarBs (kcal)**
	Mean Differences with 95% CI			
Gender	0.043	0.001	0.007	<0.001
Male vs Female	39.44	49.17	42.70	53.77
	(1.17, 77.72)	(21.39, 76.95)	(11.64, 73.76)	(35.32, 75.51)
BMI Categories	0.027	0.050	0.002	0.006
Obese vs Others	30.20	37.79	68.53	73.24
	(13.48, 83.88)	(−1.37, 76.97)	(25.18, 111.87)	(21.53, 124.96)
Residence	0.046	0.026	0.032	0.046
Living alone vs with family	39.99	48.06	49.92	53.80
	(3.48, 86.25)	(4.67, 71.73)	(7.27, 94.04)	(12.10, 81.90)
Timing of survey	0.017	0.357	0.004	0.008
Exam time vs Others	56.58	27.71	54.06	61.19
	(16.67, 91.82)	(−3.43, 96.86)	(9.58, 72.11)	(12.63, 114.22)
Illness	0.252	0.035	0.026	0.084
No vs Yes	31.53	32.92	39.19	19.94
	(−22.46, 85,52)	(6.52, 72.35)	(4.69, 73.68)	(−2.68, 42.57)

ABs = All Beverages, SSBs = Sugar sweetened Beverages, CCBs = Caffeinated Beverages, CarBs = Carbonated Beverages.

Table 6
Percentage calorie contribution of beverages to total daily energy expenditure.

Weighted Average	Percentiles						
	5	**10**	**25**	**50**	**75**	**90**	**95**
% kcal contribution of SSBs towards TDEE	1.605	2.300	4.100	8.050	12.675	21.000	25.795
% kcal contribution of CafBs towards TDEE	0.100	0.800	1.600	4.100	8.000	14.550	20.280
% kcal contribution of CarBs towards TDEE	0.000	0.000	0.400	0.900	3.200	6.490	11.585

TDEE = total daily energy expenditure, SSB = sugar sweetened beverage, CafB = caffeinated beverage, CarB = carbonated beverage.

Table 7
Model for SSBs consumption (n = 494).

Variables	Simple Regression		Multiple Regression		
	Coefficient (β)	p-value	Coefficient (β)	p-value	VIF
Age (year)	−0.033	0.469	–	–	–
Gender (Male vs Female)	0.119	0.008	0.079	0.111	1.23
Study year (Preparatory year vs Others)	0.136	0.002	0.130	0.006	1.10
College (Medical vs Others)	−0.006	0.897	–	–	–
BMI Categories (Obese vs Others)	0.082	0.007	0.070	0.013	1.08
Residence (Living with family vs Alone)	0.374	0.040	0.279	0.047	1.14
Timing of Survey (Exam time vs Others)	0.140	0.757	–	–	–
Illness (No vs Yes)	0.098	0.030	0.089	0.046	1.01

ANOVA (F = 3.453, p = 0.002); R^2 = 0.41 and adjusted R^2 = 0.29.

Table 8
Model for caffeinated beverage consumption (n = 445).

Variables	Simple Regression		Multiple Regression		
	Coefficient (β)	p-value	Coefficient (β)	p-value	VIF
Age (year)	0.003	0.942	–	–	–
Gender (Male vs Female)	0.044	0.354	–	–	–
Study year (Preparatory year vs Others)	0.068	0.153	–	–	–
College (Medical Dr. vs Others)	−0.064	0.181	–	–	–
BMI	0.174	0.037	0.163	0.044	1.01
Residence (Living Alone vs Family)	0.132	0.021	0.122	0.029	1.01
Timing of Survey (Exam time vs Others)	0.137	0.004	0.116	0.025	1.03
Illness (Yes vs No)	−0.063	0.185	–	–	–

ANOVA (F = 7.429, p = 0.019); R^2 = 0.37 and adjusted R^2 = 0.26.

hypertension, cardiovascular risk, dental carries, etc. (Malik et al., 2010; Bernabe et al., 2014). The Global Burden of Disease 2010 Report revealed that individuals from Middle East and North Africa (MENA) region consumed about 0.4 servings daily and reported about 12,236 deaths related to chronic SSBs intake (Singh et al., 2015).

Our study found that caffeinated beverages were also consumed in large quantities. An average 4 L of such beverages were consumed that amounted to about 250 ml per day. The average daily calorie intake from caffeinated beverages was 87.57 kcals. In terms of % kcal contribution towards TDEE, three quarters of students had 8% calorie contribution from caffeinated beverages towards their TDEE. A systematic review by Wikoff and colleagues mention that a daily intake of 400 mg caffeine in healthy adults was not associated with any adverse effects (Wikoff et al., 2017). However, considering the average consumption in our sample, it was higher than the recommended amount. Of all caffeinated beverages, coffee and tea are widely consumed in the world. Studies have reported that coffee may be beneficial in reducing likelihood of cardiovascular diseases and diabetes. It may prevent kidney diseases as well as neurodegenerative diseases (O'Keefe et al., 2013; Lew et al., 2018; Herden and Weissert, 2018). Previous studies in this population also highlighted consumption of coffee, tea, and energy drinks, as a source of caffeine by most students (Al Rasheed et al., 2017; Al-Shagawi et al., 2017). Both studies reported that students mentioned exams as major stressor and determinant for high caffeine consumption. In our study we found that study period was significantly related to beverage intake as an increase of 116 ml

Table 9
Model for carbonated beverage consumption (n = 401).

Variables	Simple Regression		Multiple Regression		
	Coefficient (β)	p-value	Coefficient (β)	p-value	VIF
Age (year)	−0.034	0.502	–	–	–
Gender (Male vs Female)	0.127	0.011	0.147	0.006	1.14
Study year (Preparatory year vs Others)	0.093	0.063	0.068	0.179	1.06
College (Medical vs Others)	0.056	0.267	–	–	–
BMI Categories (Overweight & Obese vs Others)	0.501	0.032	0.312	0.038	1.11
Residence (Living Alone vs Family)	0.057	0.255	–	–	–
Timing of Survey (Exam time vs Others)	0.509	0.033	0.254	0.050	1.11
Illness (Yes vs No)	−0.016	0.749	–	–	–

ANOVA (F = 3.171, p = 0.014); R^2 = 0.31 and adjusted R^2 = 0.21.

of caffeinated beverages was reported among students during exams compared to normal academic session.

The average volume of carbonated beverage consumption was 1.5 L per week. This amounted to an average 225 ml and 52.54 kcals per day. We observed that male students consumed an average 53 ml more than female students. This was similar to the findings of previous two studies at this venue (Al Rasheed et al., 2017; Al-Shagawi et al., 2017). A high intake of carbonated beverages is associated with an increased risk of dental carries especially in children and may be considered as a risk factor for periodontal diseases (Sohn et al., 2006; Song et al., 2016). There was a significant relationship between BMI and carbonated drink consumption in our sample. Moreover, study period was identified as a predictor of carbonated beverages consumption as an increase of 254 ml of carbonated beverages was attributed to exams. In this context, consumption of 300 ml of carbonated drinks is associated with gastric distress (Cuomo et al., 2009).

The impact of academic activities on beverages consumption was evident in our study while comparing calorie intake during exams with usual academic sessions. Calorie intake increased by 27.1 kcals, 54.06 kcals and 61.19 kcals from SSBs, caffeinated and carbonated beverages. Studies highlight that students may consume caffeinated and carbonated energy drinks to improve their academic performance specially in the time of exams (Al Rasheed et al., 2017; Al-Shagawi et al., 2017).

We observed that the average consumption of water was between 2 and 3 L. Studies mention the impracticability of establishing a recommended range for water since its requirement varies among individuals based on body metabolism, exercise, climate, health, disease state, occupation, etc. Therefore, an adequate intake (AI) was formulated that provided a range for satisfactory intake of water considering normal climate, diet, exercise, and urine output (Grandjean, 2004). The AI of water ranges from 2.2 to 3.0 L per day (Meinders and Meinders, 2010).

More than half of students consumed fruit juices and mostly drank it in a 250 ml cup. The average calorie intake from juice was 47.52 kcals. Though, fruit juice may be regarded as a good source of sugar and calories for an individual and studies prove a positive impact of fruit juice on CVD risk reduction, consumption of whole fruit is preferred over juices (Scheffers et al., 2019). This could be understood with reference to the glycemic index (GI) which measures the ability of carbohydrates to raise the level of blood glucose in blood (Guerreiro et al., 2010). A study in Portugal compared the GIs of several fruit juice beverages and found that several juices had low, moderate, and high index values (Guerreiro et al., 2010).

The study had a limitation of over lapping since some beverages were present in more than one group. This could result in over estimation of beverage consumption and resultant calorie intake. This issue was resolved by analysing each beverage category separately from the other. The average volume and calories are also presented in tables for each beverage so that the readers could interpret the results more accurately and with caution. Nonetheless, this work would serve as a primary data for further research in the field of clinical obesity and nutrition. The notable strength of this work lies in estimation of calories and energy intake based on each category of beverages. This may further open new areas for investigation of consumption of a particular beverage among students including its academic and social determinants. The study estimated mean difference in quantity and calories based on body mass index of students. This would provide the opportunity to further investigate repercussions of increased beverage consumption on obesity and overall health of students.

5. Conclusion

There was a high consumption of beverages in students that was related to their demographic characteristics. Besides, BMI, examination period and residence were identified as predictors of beverage consumption. The average calorie intake from SSBs beverages was higher than recommended amounts. The volume of caffeinated and carbonated beverages consumed by the students were more than the safe limits. There is a need to create awareness among the students regarding the detrimental effects of chronic consumption of these beverages.

6. Supporting information

This research paper is based on student research project undertaken as thesis for partial fulfillment of Doctor of Pharmacy (Pharm.D) degree by Ahmed Bin Hussain, Ali Muhanna, Taher Albu-hulayqah, at College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, Dammam 31441, Saudi Arabia. A research abstract detailing based on this work was presented as a poster in SIPHA 2020 that took place from January 21 to 23, 2020 at Riyadh, Saudi Arabia (SIPHA 2020.).

Declaration of Competing Interest

The authors declare that they have no competing interests. No funding was obtained for this study.

References

Alabbad, M.H. et al., 2019. Determinants of energy drinks consumption among the students of a Saudi University. J. Family Community Med. 26, 36–44.

Al Otaibi, H.H., Kamel, S.M., 2017. Sugar sweetened beverages consumption behavior and knowledge among University Students in Saudi Arabia. J. Econ. Bus. Manage. 5, 173–176.

Al Rasheed, F., Naqvi, A.A., Ahmad, R., Ahmad, N., 2017. Academic stress and prevalence of stress-related self-medication among undergraduate female students of health and non-health cluster colleges of a public sector University in Dammam, Saudi Arabia. J. Pharm. Bioallied. Sci. 9, 251–258. https://doi.org/10.4103/jpbs.JPBS_189_17.

Al-Shagawi, M.A., Ahmad, R., Naqvi, A.A., Ahmad, N., 2017. Determinants of academic stress and stress-related selfmedication practice among undergraduate male pharmacy and medical students of a tertiary educational institution in Saudi Arabia. Trop. J. Pharm. Res. 16, 2997–3003.

Beaton, D.E., Bombardier, C., Guillemin, F., Ferraz, M.R., 2000. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine. 25, 3186–3191.

Bellisle, F., Hébel, P., Fourniret, A., Sauvage, E., 2018. Consumption of 100% Pure fruit juice and dietary quality in French adults: analysis of a nationally representative survey in the Context of the WHO recommended limitation of free sugars. Nutrients. 10, 459. https://doi.org/10.3390/nu10040459.

Benajiba, N., Mahboub, S.M., 2019. Consumption of sugar-sweetened soft drinks among saudi adults: assessing patterns and identifying influencing factors using principal component analysis. Pak. J. Nutr. 18, 401–407. https://doi.org/10.3923/pjn.2019.401.407.

Bernabe, E., Vehkalahti, M.M., Sheiham, A., Aromaa, A., Suominen, A.L., 2014. Sugar-sweetened beverages and dental caries in adults: a 4-year prospective study. J. Dent. 42, 952–958.

Bhatti, S.K., O'Keefe, J.H., Lavie, C.J., 2013. Coffee and tea: perks for health and longevity?. Curr. Opin. Clin. Nutr. Metab. Care. 16, 688–697. https://doi.org/10.1097/MCO.0b013e328365b9a0.

Bleich, S.N., Vercammen, K.A., 2018. The negative impact of sugar-sweetened beverages on children's health: an update of the literature. BMC. Obes. 5, 6. https://doi.org/10.1186/s40608-017-0178-9.

Chatterjee, S., Hadi, A.S., 2006. Regression Analysis by Example. John Wiley & Sons, New York, USA.

Crippa, A., Discacciati, A., Larsson, S.C., Wolk, A., Orsini, N., 2014. Coffee consumption and mortality from all causes, cardiovascular disease, and cancer: a dose-response meta-analysis. Am. J. Epidemiol. 180, 763–775. https://doi.org/10.1093/aje/kwu194.

Cuomo, R., Sarnelli, G., Savarese, M.F., Buyckx, M., 2009. Carbonated beverages and gastrointestinal system: between myth and reality. Nutr. Metab. Cardiovasc. Dis. 19, 683–689.

Dhingra, R. et al., 2007. Soft drink consumption and risk of developing cardiometabolic risk factors and the metabolic syndrome in middle-aged adults in the community [published correction appears in Circulation. 2007 Dec 4;116(23):e557. Circulation 116, 480–488. https://doi.org/10.1161/CIRCULATIONAHA.107.689935.

Ding, M., Bhupathiraju, S.N., Satija, A., van Dam, R.M., Hu, F.B., 2014. Long-term coffee consumption and risk of cardiovascular disease: a systematic review and a dose-response meta-analysis of prospective cohort studies. Circulation 129, 643–659. https://doi.org/10.1161/CIRCULATIONAHA.113.005925.

Duffey, K.J., Gordon-Larsen, P., Steffen, L.M., Jacobs Jr., D.R., Popkin, B.M., 2010. Drinking caloric beverages increases the risk of adverse cardiometabolic outcomes in the Coronary Artery Risk Development in Young Adults (CARDIA) Study. Am. J. Clin. Nutr. 92, 954–959.

Dunn, O.J., Clark, V.A., 1974. Applied Statistics: Analysis of Variance and Regression. John Wiley & Sons. Toronto, Canada.

Food and Beverage. Saudi Arabia. Statista. Available from: https://www.statista.com/outlook/253/110/food-beverages/saudi-arabia.

Freedman, N.D., Park, Y., Abnet, C.C., Hollenbeck, A.R., Sinha, R., 2012. Association of coffee drinking with total and cause-specific mortality. N. Engl. J. Med. 366, 1891–1904. https://doi.org/10.1056/NEJMoa1112010.

Gan, W.Y., Mohamed, S.F., Law, L.S., 2019. Unhealthy lifestyle associated with higher intake of sugar-sweetened beverages among Malaysian school-aged adolescents. Int. J. Environ. Res. Public Health 16, 2785. https://doi.org/10.3390/ijerph16152785.

Garriguet, D., 2008. Beverage consumption of Canadian adults. Health Rep. 19, 23–29.

Grandjean, A., 2004. Water Requirements, Impinging Factors, and Recommended Intakes. World Health Organization. 2004. Available from: https://www.who.int/water_sanitation_health/dwq/nutwaterrequir.pdf.

Guerreiro, S., Alçada, M., Azevedo, I., 2010. Sugary drinks and glycemia. Acta Med. Port. 23, 567–578.

Guthrie, J.F., Morton, J.F., 2000. Food sources of added sweeteners in the diets of Americans. J. Am. Diet. Assoc. 100, 43–50. https://doi.org/10.1016/S0002-8223(00)00018-3.

Hedrick, V.E., Comber, D.L., Estabrooks, P.A., Savla, J., Davy, B.M., 2010. The beverage intake questionnaire: determining initial validity and reliability. J. Am. Diet. Assoc. 110, 1227–1232.

Hedrick, V.E. et al., 2012. Development of a brief questionnaire to assess habitual beverage intake (BEVQ-15): Sugar-sweetened beverages and total beverage energy intake. J. Acad. Nutr. Diet. 112, 840–849.

Hedrick, V.E. et al., 2013. A rapid beverage intake questionnaire can detect changes in beverage intake. Eating Behav. 14, 90–94.

Herden, L., Weissert, R., 2018. The impact of coffee and caffeine on multiple sclerosis compared to other neurodegenerative diseases. Front. Nutr. 5, 133. https://doi.org/10.3389/fnut.2018.00133.

IAU, 2020. Active Students Demographics. https://www.iau.edu.sa/en/about-us/uod-observatory/students-dashboard/active-students-dashbord-0.

Islam, A., Islam, N., Bharati, P., Aik, S., Hossain, G., 2016. Socio-economic and demographic factors influencing nutritional status among early childbearing young mothers in Bangladesh. BMC Womens Health. 16, 58. https://doi.org/10.1186/s12905-016-0338-y.

Jones, A.C., Kirkpatrick, S.I., Hammond, D., 2019. Beverage consumption and energy intake among Canadians: analyses of 2004 and 2015 national dietary intake data. Nutr. J. 18, 60. https://doi.org/10.1186/s12937-019-0488-5.

Kahlhöfer, J., Karschin, J., Silberhorn-Bühler, H., Breusing, N., Bosy-Westphal, A., 2016. Effect of low-glycemic-sugar-sweetened beverages on glucose metabolism and macronutrient oxidation in healthy men. Int. J. Obes. (Lond). 40 (6), 990–997.

Kregiel, D., 2015. Health safety of soft drinks: contents, containers, and microorganisms. Biomed Res. Int. 2015, 128697. https://doi.org/10.1155/2015/128697.

Krejcie, R.V., Morgan, D.W., 1970. Determining sample size for research activities. Educational and psychological measurement. 1970;30(3):607–610. https://doi.org/10.1177/001316447003000308.

Lang, T., 2007. Documenting research in scientific articles: Guidelines for authors: 3. Reporting multivariate analyses. Chest. 131, 628–632.

Lew, Q.J., Jafar, T.H., Jin, A., Yuan, J.M., Koh, W.P., 2018. Consumption of coffee but not of other caffeine-containing beverages reduces the risk of end-stage renal disease in the Singapore Chinese health study. J. Nutr. 148, 1315–1322. https://doi.org/10.1093/jn/nxy075.

Liu, J. et al., 2013. Association of coffee consumption with all-cause and cardiovascular disease mortality. Mayo Clin. Proc. 88, 1066–1074. https://doi.org/10.1016/j.mayocp.2013.06.020.

Malerba, S. et al., 2013. A meta-analysis of prospective studies of coffee consumption and mortality for all causes, cancers and cardiovascular diseases. Eur. J. Epidemiol. 28, 527–539. https://doi.org/10.1007/s10654-013-9834-7.

Malik, V.S. et al., 2010a. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. Diabetes Care 33, 2477–2483. https://doi.org/10.2337/dc10-1079.

Malik, V., Popkin, B., Bray, G., Desprs, J.-P., Hu, F., 2010b. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. Circulation 121, 1356–1364.

Meinders, A.J., Meinders, A.E., 2010. How much water do we really need to drink?. Ned. Tijdschr. Geneeskd. 154, A1757.

Mitchell, D.C., Knight, C.A., Hockenberry, J., Teplansky, R., Hartman, T.J., 2014. Beverage caffeine intakes in the U.S. Food Chem. Toxicol. 63, 136–142. https://doi.org/10.1016/j.fct.2013.10.042.

Ogden, C.L., Kit, B.K., Carroll, M.D., Park, S., 2011. Consumption of sugar drinks in the United States, 2005–2008. NCHS Data Brief. 71, 1–8.

O'Keefe, J.H. et al., 2013. Effects of habitual coffee consumption on cardiometabolic disease, cardiovascular health, and all-cause mortality. J. Am. Coll. Cardiol. 62, 1043–1051. https://doi.org/10.1016/j.jacc.2013.06.035.

Osborne, J.W., 2013. Best practices in data cleaning: A complete guide to everything you need to do before and after collecting your data. Sage. USA. ISBN-13: 978-1412988018.

Pandey, R., Verma, M.R., 2008. Samples allocation in different strata for impact evaluation of developmental programme. Rev Bras Biom. 26, 103–112.

Rahamathulla, M.P., 2017. Prevalence, side effects and awareness about energy drinks among the female university students in Saudi Arabia. Pak. J. Med. Sci. 33, 347–352. https://doi.org/10.12669/pjms.332.12084.

Rosinger, A., Herrick, K., Gahche, J., Park, S., 2017. Sugar-sweetened beverage consumption among U.S. youth, 2011–2014. NCHS Data Brief. 271, 1–8.

Ruff, R.R., Akhund, A., Adjoian, T., Kansagra, S.M., 2014. Calorie intake, sugar-sweetened beverage consumption, and obesity among New York City adults: findings from a 2013 population study using dietary recalls. J. Community Health 39, 1117–1123.

Sakpal, T.V., 2010. Sample size estimation in clinical trial. Perspect. Clin. Res. 1, 67–69.

Scheffers, F.R. et al., 2019. Pure fruit juice and fruit consumption and the risk of CVD: the European Prospective Investigation into Cancer and Nutrition-Netherlands (EPIC-NL) study. Br. J. Nutr. 121, 351–359.

Singh, G.M., et al., Global Burden of Diseases Nutrition and Chronic Diseases Expert Group (NutriCoDE), 2015. Estimated Global, Regional, and National Disease Burdens Related to Sugar-Sweetened Beverage Consumption i. Circulation. 132, 639–66. doi: 10.1161/CIRCULATIONAHA.114.010636.

Sohn, W., Burt, B.A., Sowers, M.R., 2006. Carbonated soft drinks and dental caries in the primary dentition. J. Dent. Res. 85, 262–266. https://doi.org/10.1177/154405910608500311.

Song, I.S., Han, K., Ko, Y., Park, Y.G., Ryu, J.J., Park, J.B., 2016. Associations between the consumption of carbonated beverages and periodontal disease: The 2008–2010 Korea national health and nutrition examination survey. Medicine 95 (28), e4253. https://doi.org/10.1097/MD.0000000000004253.

Vanderlee, L. et al., 2018. Evaluation of the online Beverage Frequency Questionnaire (BFQ). Nutr. J. 17, 73. https://doi.org/10.1186/s12937-018-0380-8.

Vartanian, L.R., Schwartz, M.B., Brownell, K.D., 2007. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. Am. J. Public Health 97, 667–675. https://doi.org/10.2105/AJPH.2005.083782.

Verster, J.C., Koenig, J., 2018. Caffeine intake and its sources: A review of national representative studies. Crit. Rev. Food Sci. Nutr. 58, 1250–1259.

West, D.S. et al., 2006. Self-reported sugar-sweetened beverage intake among college students. Obesity. (Silver Spring, Md.). 14, 1825–1831. https://doi.org/10.1038/oby.2006.210.

Wikoff, D. et al., 2017. Systematic review of the potential adverse effects of caffeine consumption in healthy adults, pregnant women, adolescents, and children. Food Chem. Toxicol. 109, 585–648.

World Health Organisation, 2015. WHO Guideline: Sugars Intake for Adults and Children. World Health Organisation; Geneva, Switzerland. https://www.who.int/publications/i/item/9789241549028.

World Health Organization (WHO), 2020. Reducing consumption of sugar-sweetened beverages to reduce the risk of unhealthy weight gain in adults. https://www.who.int/elena/titles/ssbs_adult_weight/en/. (accessed 19 September 2020).

Yu, Z.M., Parker, L., Dummer, T.J.B., 2017. Associations of coffee, diet drinks, and non-nutritive sweetener use with depression among populations in Eastern Canada. Sci. Rep. 7, 6255. https://doi.org/10.1038/s41598-017-06529-w.

SIPHA 2020. The Annual Meeting of SPS., (Accessed January 2020).

Health 101. ScyMed. Health Calculators. TDEE., 2020.