Nutrition Knowledge, Meal Patterns and Nutritional Status of Energy Drink Users in a Ghanaian University

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ABSTRACT A cross-sectional survey was conducted to assess the nutrition knowledge, meal patterns and nutritional status of energy drink users in the Methodist University College, Ghana. One hundred and twenty (120) energy drink users were purposively selected and interviewed using a combination of methods, including a structured questionnaire, anthropometry and dietary assessment methods. Data collected were analyzed using the Statistical Package for Social Sciences (SPSS) software (Version 16). Most of respondents (76%) had poor to fair nutrition knowledge and majority (80%) ate 3 times a day. Female respondents met 97 percent of energy requirement while the males met only 66 percent. Energy drinks did not make much contribution to energy intake among the respondents. The mean BMI of males and females were 23.52 kg/m^2 and 24.2 kg/m^2 respectively. About two-thirds had normal BMIs and a third were either overweight, obese or underweight. No significant relationships were observed between frequency of consumption of energy drinks and nutrition knowledge, diet quality and nutritional status.

INTRODUCTION

The term "energy drink" referred to beverages that contained caffeine in combination with other ingredients such as sugar, taurine, guarana and B vitamins, and that claimed to provide its consumers with extra energy (European Commission on Food Safety 1999; Zucconi et al. 2013). Energy drinks have become ubiquitous on university campuses and recreational hot spots around the world and Ghana is no exception (Hawkes et al. 2009). Miller et al. (2008) observed that this wide usage has probably been as a result of the aggressive promotional advertisements in the mass media which generally target the youth. Research has shown that increased consumption of sugary beverages is associated with increased energy intake. Thus, the energy drinks are a prime source of extra energy that can contribute to weight gain if consumed in excess of a person's daily energy needs (Malik et al. 2006; Adepoju and Ojo 2014; Puvaneswari and Janathaam 2014). There are several brands of energy drinks on the Ghanaian market including Red Bull, Burn, Blue jeans, Lucozade, Smart and Bullet. Tertiary students have busy schedules and can be under great stress at times. One way they may combat the problem is by consuming energy drinks to cope (Ibrahim et al. 2014). As a result, some students may consume energy drinks more frequently than desirable and if energy drinks are used to replace meals, it may result in inadequate nutrient intakes leading to undesirable health consequences (Nawrot et al. 2003; King et al. 2007; Breda et al. 2014). If students regularly meet their daily energy requirements mainly from energy drinks then they may not be meeting the recommended daily intakes for the macro and micronutrients apart from the B vitamins. This is, because, most energy drinks contain 500% to 2000% of the daily intake requirement for the B vitamins (Ruka et al. 2005; Adepoju and Ojo 2014).

Studies among Korean and Chinese university students, which examined the relationship between nutrition knowledge and nutritional status have indicated that good nutrition knowledge and attitude have positive effects on eating habits and food selection (Aranda and Morlock 2006; Son et al. 2014). Taylor et al. (2004) observed that eating patterns play an important role in energy intake and weight management. Three meals throughout the day provide the body with essential energy and nutrients and help keep one focused and less irritable. Spreading meals through the day also helped with efficient digestion and absorption and maintains stable blood sugar levels. Frequent skipping of

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meals has been reported to be associated with poorer nutritional status and the risk of cardio-vascular disease, diabetes and some cancers (Smith-Rockwell et al. 2001). Intakes of energy and nutrients below or in excess of the body requirements for a prolonged period of time can adversely affect health leading to diet-related chronic diseases (Bener 2006).

Although, the presence of energy drinks on the Ghanaian market has increased significantly in recent times, there has been little research regarding nutrition parameters and energy drink consumption. It has, therefore, become necessary to investigate the influence of energy drink use on dietary habits, nutrient intakes and nutritional status of consumers. The findings of the study would help draw attention of nutritionists, policy makers and health care providers to the influence of energy drink use on dietary patterns and nutritional status of energy drink users, especially, among the youth, for the necessary nutrition interventions required.

Objectives of the Study

This study was conducted with the aim of assessing the nutrition knowledge, meal patterns and nutritional status of energy drink users among university students. The specific objectives were to: assess nutrition knowledge and dietary practices of energy drink users; examine their energy and nutrient intakes; assess the nutritional status of these energy drink users and to ascertain whether significant relation-ships exist between energy drink consumption and nutrition parameters studied.

MATERIAL AND METHODS

The study, which was a cross-sectional survey, was conducted at the Methodist University College (MUC) campus in Dansoman, Accra, Ghana. The target population comprised all energy drink users at MUC campus. For the purpose of this study, an energy drink user was classified as a MUC student who consumed at least 5 cans of energy drink a week and had done so for at least a month. Since, it was not possible to estimate the entire population of energy drinks users; it was not theoretically practical to do a random sampling. Purposive sampling was, therefore, used to select one hundred and twenty students who met the set criteria and were willing to participate in the study. A structured questionnaire, a 24-hour dietary recall, a food frequency questionnaire and anthropometry were the instruments used for data collection. A structured questionnaire with both open and close-ended questions was used to collect data on background information of the respondents and nutrition knowledge. Nutrition knowledge assessment involved the use of 9 nutrition-related questions to determine respondents' knowledge of nutrition. The nutrition knowledge questions, which are presented in Table 1, were adapted from a standard nutrition knowledge questionnaire by Paramenter and Wardle (1999). The highest attainable score was

Table 1: Scoring of nutrition knowledge based on responses to nine nutrition-related questions

Questions responses score

1) How do you understand the term "balanced diet"?	Do not know	0
	Meals containing energy and nutrients in right proportion	1
2) Why do we eat	To satisfy hunger	0
	Answer relating to growth and development	1
3) Name 2 foods which provide energy	Fruits, vegetable, Animal products	0
	Food items from starchy roots/plantain or Cereals/grains or fats and oil group	1
4) Name 2 foods which protect the body	Animal products	0
	Food items from fruits and vegetable group	1
5) Name 2 foods which repair worn out tissues/build the body	Cereals, grains, fruits, vegetables	0
	Food items from animal foods and legumes group	1
6) Name any 2 major health problems Or diseases related to nutrition	Do not know/No response	0
	Any 2 of: obesity, diabetes, cardiovascular disease, Cancer, anemia, hypertension, kwashiorkor	1
7) Fruits are good snacks	Agree	1
	Disagree/ Not sure	0
8) Only those who are overweight should exercise	Agree/Not sure	0
	Disagree	1
9) Breakfast is not important	Disagree	1
	Agree/Not sure	0

9 and the minimum was 0. Individuals with scores between 0-3 were classified as having poor knowledge, those with scores between 4 and 6 had fair knowledge and those with scores of 7-9 had good nutrition knowledge.

A Food Frequency questionnaire was used to determine food consumption patterns of various foods from the Ghana six food groups. Five response categories which included daily, weekly, monthly, occasionally and never were used. This provided descriptive information about the respondents' habitual food patterns which was used to determine diet quality based on the following criteria:

  a. Diets including at least one food item from 5-6 food groups daily were rated as good enough;
  b. Diets including at least one food item from 4 food groups daily were rated as fair; and
  c. Diets including one food item from 3 or less food groups daily were rated as poor.

A 24-hour dietary recall was used to collect information on all foods and beverages consumed by respondents during the previous 24 hours. This information was used to determine the energy and nutrient intakes. The estimated portions of foods, snacks and beverages in household measures were converted into grams using the Ghana food composition table and ESHA-Food Processor Nutrient Database software (Version 6). The WHO/ FAO (2004) Recommended Nutrient Intakes was used as reference data to evaluate the energy and nutrient adequacy of the respondents' diets.

Anthropometric measurements (heights and weights) were taken following standard procedures outlined by Gibson (2005). Respondents' BMIs were classified using the International Classification of Adult BMIs by the WHO (2000). All data were analyzed using the Statistical Package for Social Sciences (SPSS; Version 16) software. The Pearson correlation coefficient was used to test the relationships between frequency of energy drink consumption and nutrition knowledge, diet quality and nutritional status at 5% level of significance.

Ethical approval was obtained from the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional Review Board (IRB), University of Ghana, Legon. Informed consent was obtained from the respondents after details of the nature and procedures of the study were clearly communicated to them. Confidentiality was maintained throughout the study period. Respondents had the right to discontinue with the study at any time, should they opt to do so.

RESULTS AND DISCUSSION

Characteristics of the Sample

Of the 120 students who participated in the study, 61% were males and 39% females. Eighteen percent were at level 100, 33% at level 200, 35% at level 300 and 14% at level 400. The ages of the respondents ranged between 18 and 30 years with a mean age of 22 ±1.9 years. Most (67%) were aged between 22 – 25 years, 28% were between 18 – 21 years and the rest were between 26 – 30 years. Seventy seven percent (77%) drank 5 to 6 cans of energy drinks a week while 23% drank 7-8 cans a week and majority (91%) have been users for 1 – 3 years.

Nutrition Knowledge of Respondents

Nutrition knowledge assessment, shown in Table 2, revealed that only 24 percent had good nutrition knowledge, with the rest having poor to fair nutrition knowledge. These findings are different from that of Barzegari et al. (2011) who reported that 57% of Iranian college students studied had average nutrition knowledge with only 19% having poor knowledge. Similarly, a study of college athletes in the USA by Dunn et al. (2007) reported that 47% had poor nutrition knowledge. Al-Isa and Alfaddagah (2014) recorded overall nutrition knowledge of 56.9 percent among Kuwaiti college students. It is obvious that this study sample has poor nutrition knowledge which needs improvement. A weak positive correlation ($r^2 = 0.127$) but statistically insignificant relationship ($p > 0.05$) existed between nutrition knowledge and frequency of consump-

Table 2: Nutrition parameters of respondents

Characteristics	Frequency	Percentage
Nutrition Knowledge		
Poor	18	15.0
Fair	73	61.0
Good	30	24.0
Frequency of Eating		
Twice	24	20.0
Thrice	86	71.6
Four times	10	8.4
Diet Quality		
Poor	14	12.0
Fair	49	40.8
Good	57	47.2

tion of energy drinks. This probably suggested that nutrition knowledge did not affect the frequency of energy drink consumption, but as knowledge increases, one would expect that consumption will decrease since the respondents would be aware of the side effects of consuming too many energy drinks. In this study, respondents' consumption seems to have increased probably because majority of them had poor to fair nutrition knowledge. Therefore, the youth especially university students need help to improve their nutrition knowledge so that the eating choices they make throughout their lifetimes would be sound.

Meal Patterns of Respondents

Majority of the respondents (72%) ate three times a day with a few eating four times daily. This practice corresponds with the normal meal pattern of three meals in a day (breakfast, lunch and supper) as reported by Taylor et al. (2004). Opare-Obisaw and Moss (1980) reported that 79 percent of University of Ghana students ate three meals a day while Kallai's (2006) study observed 86 percent eating three meals daily at the same university. Similarly, Ruka et al. (2005) in a study of Chinese university students reported that majority of them (84%) ate three times a day. These studies seem to suggest that the students eating patterns are quite similar and have not changed much over the years. Eating regular meals and the composition of meals are important factors for healthy nutrition (Neslisah and Emine 2011)

Sixty- one percent (61%) of the respondents sometimes skipped meals during the day. Meals sometimes skipped included breakfast (59%), lunch (34%) and supper (10%). According to Adesola et al. (2014), 52 percent of university students in Nigeria skipped breakfast. Neslisah and Emine (2011) reported that among Turkish university students, breakfast and lunch were the most frequently skipped meals with 47.7 percent and 25.2 percent skipping breakfast and lunch respectively. Kallai's (2006) study of University of Ghana students found that 30% skipped breakfast sometimes which is much lower than the results in this study. The relatively high percentage of students skipping meals as observed in this study is expected. This is because the study sample was energy drink users whose habit could easily make them skip meals.

Kallai's work covered the general student population. It has been reported that of all eating occasions, breakfast is the most commonly skipped meal. Breakfast is, however, very important for its role in preventing short-term hunger thereby, improving cognition, short term memory and concentration (Kant et al. 2006). As university students, improved cognition and concentration are necessary for effective learning, therefore, breakfast is an important meal that should be eaten by all students. Supper appeared to be the most frequently consumed meal by most of the study sample, a finding which parallels what Barzegari et al. (2011) reported among college students in Iran.

Diet Quality of Respondents

About half of respondents had diet quality rated as good, although, only 24 percent had good nutrition knowledge. A positive (r^2=0.093) but statistically insignificant correlation existed between frequency of consumption of energy drinks and diet quality. This finding suggested that nutrition knowledge may have no influence on diet quality. For instance, Akbay (2006) reported that high income families consumed nutritious meals irrespective of exposure to any formal nutrition education. It is disappointing though to note that despite 80% of respondents eating at least three times daily, a much lower percentage had good quality diets. Even though, the number of meals eaten daily may not necessarily translate into an acceptable diet quality, the poor nutrition knowledge among the study group probably prevented them from making food choices that would enhance their diet quality.

Energy and Nutrient Intakes of Respondents

The energy and nutrient intakes of respondents are presented in Table 3. Mean energy intakes were lower among the males than the females. The mean energy intakes for males and females were 1983±517.6 and 2124±541.2, representing 66 percent and 97 percent of the RNI respectively. The two- third energy intake obtained by the males is surprising since males are generally known to eat larger meals compared to females. Although, the majority of this study sample ate three meals daily, the low energy intakes may probably be due to respondents consuming small portion sizes of meals during the

recall period or portion sizes recalled were underestimated. Although, 74 percent drank energy drinks daily, the energy from the drinks did not reflect much on their energy intakes. A 250ml can of energy drink provides 150kcal to 300kcal of energy depending on the brand. However, if the results point to a real energy deficit, it is important to address the issue since adequate energy intake spares protein for more important functions like hormone and enzyme production and building of tissues instead of for energy generation.

Protein intakes for males and females were 53g/day and 55g/day respectively, with both sexes exceeding the RNI. This was not surprising because the respondents consumed animal products such as milk, fish, egg and chicken which are high in protein on daily basis. Calcium intakes were also adequate for both sexes, with a mean calcium intake of 613.1mg for males and 614.3mg for females. This was probably due to the consumption of milk, fish and boiled beans on daily basis. With respect to iron, the females met 86 percent of their iron requirements while the males exceeded their RNI. Females required more iron than their male counterparts to replace menstrual iron losses which makes them vulnerable to anemia and other iron deficiency disorders. However, the iron requirements met by the females were well above the accepted minimum level of 66 percent of the RNI. Both sexes exceeded their RNI for zinc.

In terms of vitamin requirements, Vitamin A intakes were lower than the recommended in both sexes. The percent RNI met by both males and females were 78 percent and 89 percent respectively. These values are however acceptable since both groups met at least 66 percent of the RNI. Palm oil, which is abundant in Ghana, is a rich source of pro-vitamin A. Frequent consumption of palm oil is, therefore, highly recommended among this group. Intakes of thiamin and riboflavin were slightly lower than recommended for the males at 96 percent and 87 percent of RNI respectively, but the levels were above the accepted minimum percentage. The females, however, exceeded the RNI for both vitamins. Intakes of niacin and vitamin C were exceeded by both males and females.

Nutritional Status of Respondents

The nutrition parameters of respondents are shown in Table 3. The females had a mean BMI of 24.2 Kg/m^2. This value compares with a national average of 23.6 Kg/m^2 for Ghanaian women (GSS 2009). The males had a mean BMI of 23.52 Kg/m^2. The Ghana Statistical Service (2009) report had no data on national average BMI for male adults. A BMI value between 18.5 and 24.99 is classified as normal. Therefore, it can be concluded that the mean BMI of respondents was within the normal range. In general, 61 percent had normal BMIs and 32 percent were overweight Table 4. It is surprising that only 7 percent of males were underweight since the males met only two thirds of their daily energy requirements. BMIs are a reflection of past dietary history, therefore, this inconsistency could be due to the fact that the male respondents did not eat adequately during the single 24-hour dietary recall period. In this study, 38 percent of the females and 27 percent males respectively were overweight. Nationally, the proportion of Ghanaian women who are overweight stands at 30 percent, with 9 percent considered obese (GSS 2009). The re-

Table 3: Mean energy and nutrient intakes of respondents

Energy/ Nutrients	Male				Female			
	RNI*	Mean	±SD	% RNI	RNI*	Mean	± SD	% RNI
Energy (kcal)	3000	1983	517.6	66.1	2200	2124	541.2	96.5
Protein (g)	49	53.2	77.7	108.6	41	55.3	9.2	134.8
Calcium(mg)	600	613.1	75.9	102.2	600	614.3	52.8	102.3
Iron (mg)	10	14.5	3.1	145.0	18	15.6	3.9	86.6
Zinc (mg)	5.5	6.1	1.3	110.9	5.5	6.4	0.6	116.4
Vitamin A (µg RE)	600	465	31.2	77.5	600	535	111.3	89.2
Thiamin (mg)	1.25	1.2	0.3	96.0	1.0	1.6	0.2	160.0
Riboflavin (mg)	1.5	1.3	1.2	86.6	1.2	1.4	1.5	116.6
Niacin (mg)	17	29.2	8.2	171.2	13	27.6	6.6	212.3
Vitamin C (mg)	30	191.7	40.2	639.0	30	200.3	34.8	667.6

*Recommended Intakes by WHO/FAO 2004

Table 4: Classification of nutritional status of respondents

Nutritional status	Males (%)	Females (%)	Overall (%)
Underweight	6.8	4.3	5.8
Normal	64.4	55.3	60.8
Overweight	27.4	38.4	31.7
Obese	1.4	2.1	1.7

port did not have information on male overweight/obesity. The higher percentage of female overweight observed in this study probably indicated a rising incidence of the condition which definitely should be of public health concern. Tan et al. (2008) found 17 percent of USA college students to be overweight, Sop et al. (2010) reported 20 percent of Cameroonian university students studied being overweight and Duoduo (2012) in a study of college students in Western China reported that 15 percent were overweight. The levels of overweight observed in this study and the other studies referred to are not surprising given the fact that obesity has been described as an emerging problem among many adults in the developing world. This trend is undesirable due to the increasing prevalence of chronic diseases related to obesity.

Energy drinks when drank frequently, in addition to daily meals, become a prime source of extra energy that can contribute to undesirable weight gain (Malik et al. 2006; Adepoju and Ojo 2014). Most respondents had been energy drink users for 1-3 years but only a third were overweight or obese. This is likely due to the fact that respondents were not eating enough at mealtimes in addition to drinking energy drinks so that there was no excess energy to be stored. This is reflected in the 24-hour dietary recall where many students did not make the energy requirements despite energy drink use. There was a negative but statistically insignificant correlation ($r^2 = -0.055$) between frequency of consumption of energy drinks and nutritional status. Even though the correlation was not significant, it indicated that as frequency of consumption of energy drinks increased, nutritional status deteriorated and vice-versa. There is, therefore, the likelihood that the more respondents consumed energy drinks, the lower their nutritional status would be. From this study, where about three quarters consumed one can a day, frequency of consumption probably had a negative effect on their nutritional status. Hence, in situations where more than one can is drunk daily, nutritional status will be adversely affected which could possibly be the case for those who were overweight.

CONCLUSION

The findings have thrown more light on the potential dangers facing energy drink users, especially, students who erroneously believed that consumption of energy drinks improves academic performance while totally overlooking the harmful consequences of frequent ingestion of caffeine and sugar, the chief ingredients in energy drinks. Although, the relationships were observed between energy drink consumption and nutrition knowledge, diet quality and nutritional status, the findings suggested potential negative effects on diet quality, energy intakes and nutritional status of energy drink users.

RECOMMENDATIONS

It is recommended that the Ghana Ministry of Health, Food and Drug Authority, dietitians and all other health care providers should make efforts to provide clear public health information on the effects of energy drinks as well as other sugary soft drinks on diet and health. There is also a need to develop and implement nutrition education programs for students in tertiary institutions to improve upon their nutrition knowledge and dietary practices.

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