Public Health Nutrition: 17(10), 2156–2165 doi:10.1017/S1368980013003339

Energy drinks and other dietary supplement use among adolescents attending secondary schools in Trinidad and Tobago

Terence J Babwah[1,*], Rohan G Maharaj[2] and Paula Nunes[2]
[1]Princes Town District Health Facility, Circular Street, Princes Town, Trinidad and Tobago: [2]Department of Public Health and Primary Care, University of the West Indies, St Augustine, Trinidad and Tobago

Submitted 12 February 2013: Final revision received 13 November 2013: Accepted 14 November 2013: First published online 7 January 2014

Abstract

Objective: The objective of the present study was to determine the knowledge and practices among Trinidad and Tobago school-attending adolescents towards energy drinks (ED), alcohol combined with energy drinks (AwED), weight-altering supplements (WAS) and vitamin/mineral supplements (VMS) and their experience of adverse effects associated with such use.
Design: A cross-sectional, proportionate, stratified sampling strategy was adopted using a self-administered, *de novo* questionnaire.
Setting: Secondary schools throughout Trinidad and Tobago.
Subjects: Students aged 15–19 years.
Results: Five hundred and sixty-one students participated, an 84 % response rate; 43·0 % were male, 40·5 % East Indian and 34·1 % mixed race. VMS, ED, WAS and anabolic steroids were used by 52·4 %, 44·0 %, 8·9 % and 1·4 % of students, respectively, with 51·6 % of ED users using AwED. Predictors of use of AwED were males and students who played sport for their school (OR = 1·9; 95 % CI 1·2, 3·2 and OR = 2·6; 95 % CI 1·4, 4·7, respectively). Predictors of ED use were males and attendees of government secondary schools (OR = 1·7; 95 % CI 1·1, 2·4 and OR = 1·7; 95 % CI 1·2, 2·4, respectively). Side-effects, mainly palpitations, headaches and sleep disturbances, were reported in 20·7 % of dietary supplement users.
Conclusions: Many adolescent students in Trinidad and Tobago use dietary supplements, including ED and AwED, and about one-fifth of users experience side-effects. Identification of students at risk for ED, AwED and WAS use and education of students about the dangers of using dietary supplements need to be instituted to prevent potential adverse events.

Keywords
Risky behaviour
Caffeine
Athletes

Adolescence is a time of experimentation. Experimentation can assist adolescents in recognizing their personal limits but could also negatively affect their current and future health[1,2]. Health-compromising behaviours include substance use, such as cigarettes and alcohol, as well as the use of large amounts of caffeine. These behaviours are considered to be risk-taking behaviours when the action 'involves the implementation of options that could lead to negative consequences'[3], such as driving after consuming large amounts of alcohol.

Dietary supplements include vitamin/mineral preparations (VMS), weight-altering supplements (WAS; substances that persons use to either increase or decrease their weight), caffeinated energy drinks (ED) and herbal products. Caffeine is used by adolescents to keep alert while studying, partying, playing computer games or using cellular phones[4]. ED are a major source of caffeine. Over the last decade, the market has been flooded with the ever-popular Red Bull® and Monster® brands. ED have increased in popularity in the USA, with over 30 % of adolescents using them. In addition to acquiring more energy and maintaining alertness, the use of ED has been promoted to improve concentration, increase performance and increase weight loss[5].

ED contain large amounts of caffeine and gurana. The inappropriate use of these drinks can lead to side-effects of the cardiovascular and central nervous systems, which include arrhythmias, sleep disturbances and habituations in adults[5,6]. The side-effects of ED are magnified when they are consumed with alcohol[7] and such combinations are commonly used by young adults[8,9]. Persons who use alcohol combined with energy drinks (AwED) were found to consume more alcohol[7] and were involved in more risk-taking activity than those who consumed

*Corresponding author: Email terbab@hotmail.com

combinations of alcohol with mixer drinks other than ED[10]. Furthermore, adolescents often have an altered perceived body image of themselves with a desire to seek an ideal body[11]. In trying to achieve the perfect body, adolescents may adopt unhealthy practices such as vomiting after eating and using laxatives[11], WAS or anabolic steroids[12]. Stimulants such as ephedra, which are banned in many countries but still common in weight-loss pills purchased over the Internet, have been associated with strokes and cardiac arrhythmias[13] and anabolic steroids used for weight and muscle gain have been linked to cardiac disease, sudden cardiac death[14], skin disorders, aggression and psychosis[15].

ED, with or without alcohol combined, herbal supplements and anabolic steroids used for weight management are presently not well regulated[16] and have been associated with some serious side-effects[16,17]. As such, the unregulated use of dietary supplements represents an additional compounding risky behaviour in the adolescent population.

There are gaps in the literature concerning the use of ED and AwED in adolescents. Published studies have focused on the use of AwED by young adults in university settings using convenience sampling[8–10,18]. Previous studies on the use of ED in adolescents have been done in highly developed countries such as the USA and Germany but these studies have been limited by language[19] and current access of data on a website that is no longer functional[5]. Actual side-effects of ED previously were documented in young adults in one study[9]. Children and adolescents were found to be more sensitive to the effects of caffeine than adults[20]. However, at this time it is unclear if the effects of caffeine in adults can be extrapolated to children and adolescents[5]. No other study known to the authors examined the actual side-effects experienced by adolescents who use dietary supplements.

The primary aim of the present study was therefore to determine the use of dietary supplements, namely ED and AwED, WAS and VMS, within a student adolescent population aged 15–19 years from Trinidad and Tobago. Additionally, secondary aims of the study were to determine the reasons for use of ED and the side-effects experienced by users. The results of the study could help identify adolescents attending school who are at risk for the unregulated use of these supplements and help provide evidence for informing a national policy on ED and WAS for the Ministry of Education. The minimum age for purchasing alcohol in Trinidad and Tobago is 18 years old. However, the law is not clear on the consumption of alcohol in persons less than 18 years old[21].

Methods

In Trinidad and Tobago, students sit a secondary assessment examination prior to being placed into secondary schools at 11–12 years old. Secondary schools in Trinidad and Tobago are either government-assisted/private secondary schools (GASS) or government secondary schools (GSS). The highest performers in secondary assessment examinations are sent to the GASS and the lower performers are sent to the GSS. School attendance is compulsory until 15 years old. Secondary-school attendance can be for as long as 8 years.

Instruments

As there were no validated questionnaires located by the researchers looking at the variables being explored in the present study, a *de novo* questionnaire with nineteen items was designed to collect data from secondary-school students. This included dietary supplements use, the adolescents' actual and perceived body weight, and their weight-management behaviours aimed at weight loss or weight gain. Fourteen questions were directly related to the current paper and are described herein.

Questions 1–7 examined dietary supplements use and possible factors associated with the use of dietary supplements. Factors such as age, gender, ethnicity, type of secondary school attended, exercise and sports participation, perception of body weight (normal weight, underweight or overweight) and the individual's perception of health status were explored.

Question 8 was an investigation of the classes of dietary supplements that were being used by the students. Questions 9 and 10 were an investigation of the specific use of ED and AwED among the students. Question 11 was used to examine the side-effects experienced by the students using dietary supplements. Question 12 was an inspection of who used anabolic steroids and Question 13 was an examination of the adolescents' use of a product that would lead to an ideal body now but at the expense of a shortened lifespan or illness later in life. Question 14 looked at students' knowledge of dietary supplements by evaluating what benefits and adverse effects they knew were associated with the use of these products. Box 1 shows questions 8–14 of the questionnaire.

Six secondary-school students aged 15–19 years attending a clinic (three boys and three girls) were asked to pre-test the questionnaire for ease of understanding the wording and layout. The questionnaire was then re-administered to the six students a week later and the test–retest ratio varied from 0·83 to 1·00 for each of the questions. The content validity was assessed by a primary-care physician, a nutritionist and a sociology teacher, who reviewed the questions to determine their suitability for use in a primary-care setting and suitability of content for students 15–19 years old. Minor adjustments were made to the original questionnaire based on the recommendations of the reviewers.

Procedure

The study was conducted according to the guidelines set forth in the Declaration of Helsinki and all procedures

Box 1

Questions 8–14 from the questionnaire

Dietary supplements are products which include:

a. Vitamins and minerals (like Sanatogen®, Pharmaton®, Vitaron®, Vitamin B, C, Mega Men®)

b. Energy drinks (like Red Bull®, Full Throttle®, Shark®, Monster®)

c. Weight-gain supplements (like amino acids, protein powders, creatine, steroids)

d. Weight-loss supplements (like slimming capsules or Dinnetel®)

Q8A. Do you use dietary supplements (see list a–d above)? □ Yes □ No

Q8B. If **yes**, please state which one(s) from the list above. (You can choose more than one answer)

□ a □ b □ c □ d

Who recommended the use of supplements? Please state_____

If you use energy drinks in Question 8, please proceed to Question 9.

If you do not use energy drinks in Question 8, please go to Question 11.

Q9. If you use energy drinks, please tick the correct answer from each column in the table below.

How long have you started using them?	How often do you use them?	Why do you use energy drinks?
□ In the last month □ In the last year □ In the last 2–4 years □ Other _____	□ Every day □ 2–5 times/week □ Once/week □ 2–3 times/month □ <Once/month	□ To improve my sport performance □ To help me study harder or longer □ To give me a 'boost' of energy for my daily activities □ It tastes good □ Other _____

Q10A. Have you ever consumed energy drinks with alcohol? □ Yes □ No

If yes, go to Question 10B; if no go to Question 11.

Q10B. If **yes,** how often do you do so?

□ Once or more weekly □ 2–3 times/month

□ Once monthly □ Less than once monthly

Q11A. Have you ever experienced any side-effects or ill effects associated with using dietary supplements? □ Yes □ No

If yes go to Question 11B; if no go to Question 12.

Q11B. If **yes**, which side-effect did you experience?

□ Poor sleep □ Muscle cramps

□ Headache □ For girls: menstrual/period problems

□ Irritability □ Aggression

□ Racing heart rate/palpitations □ Other _____

https://doi.org/10.1017/S1368980013003339 Published online by Cambridge University Press

Q12. Have you ever used anabolic steroids or 'steroids' in an attempt to achieve your ideal weight? □ Yes □ No

Q13. If there was a product being sold that would cause you to achieve your perfect body now (including body size and shape, muscle structure), but would cause you to have a shorter life or cause serious illness later in life, would you use it? □ Yes □ No

Q14A. Do you know any benefits of using dietary supplements?
□ Yes □ No

Q14B. Do you know of any harms or side-effects associated with dietary supplement use?
□ Yes □ No

involving human subjects were approved by the local ethics committee. Institutional approval was obtained. Written informed consent was obtained from all participants. The study was cross-sectional in design. A proportionate, stratified sampling strategy was adopted based on the eight educational districts in Trinidad and Tobago[22]. Schools were selected at random from each educational district.

After permission was obtained from the Ministry of Education, letters were sent to the principals of the schools selected at random explaining the proposed project and procedures for conducting the study. For those agreeing to allow their students' participation, informed parental consent was obtained for each student less than 18 years old. All students who returned signed consent forms from their parents and those over 18 years old who agreed to partake in the survey then signed consent forms. Although the selection of schools was done at random, so it did not affect the functioning of classes; students who took part in the survey were those who had a free period at the time that the survey was being administered or those whose teachers volunteered to allow their students to participate during a class session. Students completed the questionnaires while in their classroom. No collaboration was allowed between students during the completion of the questionnaires. The questionnaires were administered by the researcher or the researcher's assistant, who answered any questions that may have arisen from the students concerning the questionnaire.

To obtain a 95% confidence interval with a 4% error, assuming 36% of adolescents attending secondary schools in Trinidad and Tobago used dietary supplements (TJ Babwah, P Nunes, Z Hassanali *et al.*, unpublished results), a sample size of 553 students was required[23]. Data were collected during September to December 2011. Data were analysed using the statistical software package SPSS version 15. The level of significance was set at 5%. Descriptive statistics were used to analyse the independent variables in the study. The χ^2 test was done to determine the associations between each of the two dependent variables, namely (i) the use of each of the different classes of dietary supplements and (ii) the side-effects that the students experienced with the use of each class of dietary supplement, and each of the independent variables in the study. Binary logistic regression analysis was used to determine significant predictors and odds ratios from the list of independent variables for each of the dependent variables.

Results

The response rate was 84% (561 of 669). Table 1 shows the frequencies of the independent variables: age, type of secondary school attended, sex, weight perception and exercise habits.

The proportions of students who used VMS, ED and WAS were 52·4%, 44·0% and 8·9%, respectively. The knowledge of dietary supplements was low in this population, with 267 of 561 (47·6%) students knowing of benefits and 195 of 561 (34·8%) knowing of potential problems with dietary supplements. Students who attended GASS knew of more benefits of dietary supplements (54·6% *v.* 43·3%, $P = 0{\cdot}01$) and knew of more potential problems of using dietary supplements (44·5% *v.* 27·7%, $P < 0{\cdot}005$) than those attending GSS. Of the students who used dietary supplements, parents were most likely to recommend VMS (49·4%) and coaches were most likely to recommend the use of WAS (34·3%).

About 44% of students attending secondary schools in Trinidad and Tobago used ED, with 180 of 222 (81·1%) starting to use them during the last one to four years. Of the persons using ED, 131 of 220 (59·5%) used these drinks once or more frequently per week.

The reasons for use of ED are shown in Fig. 1.

Of the students who used ED, 128 of 248 (51·6%) used ED with alcohol. Most of these students who used AwED,

https://doi.org/10.1017/S1368980013003339 Published online by Cambridge University Press

Table 1 The frequency and percentage of each independent variable among adolescents (*n* 561) aged 15–19 years from secondary schools throughout Trinidad and Tobago, September to December 2011

Independent variable	*n*	%
Age (years)		
Mean	17·1	
SD	0·6	
Type of secondary school (*n* 561)		
Government	343	61·1
Government-assisted/private	218	38·9
Age (years) (*n* 558)		
15–16	130	23·3
17	240	43·0
18–19	188	33·7
Sex (*n* 561)		
Male	241	43·0
Female	319	57·0
Ethnicity (*n* 558)		
East Indian	226	40·5
African	127	22·8
Mixed	190	34·1
Other	15	2·7
Do you exercise? (*n* 560)		
Yes	398	71·1
No	162	28·9
How often do you exercise/week? (*n* 560)		
1–2 times	185	46·4
3–4 times	168	42·1
≥5 times	46	11·5
Do you play sport for your school? (*n* 559)		
Yes	148	26·5
No	411	73·5
Do you consider yourself to be healthy? (*n* 560)		
Yes	406	72·5
No	154	27·5
How would you describe your present weight? (*n* 559)		
Ideal weight	358	64·0
Underweight	110	19·7
Overweight	91	16·3

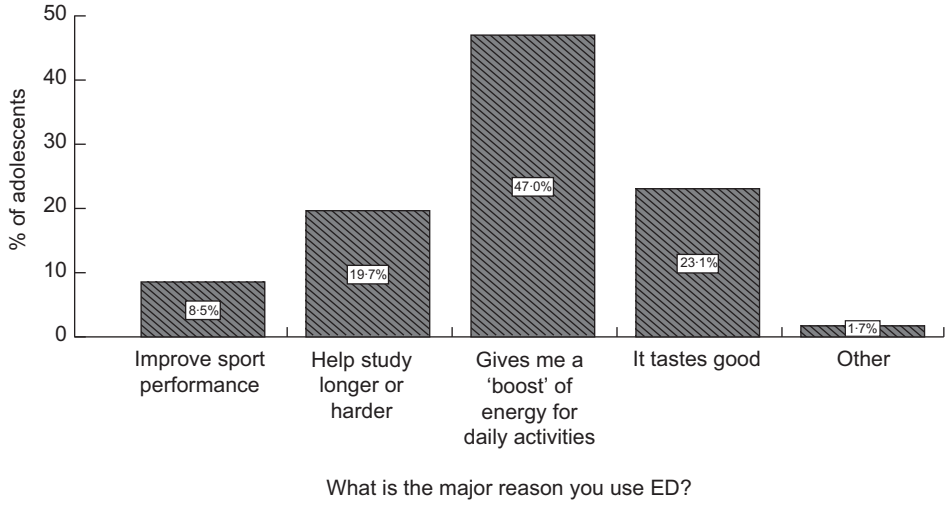

Fig. 1 Reasons for the use of energy drinks (ED) among adolescents (*n* 220) aged 15–19 years from secondary schools throughout Trinidad and Tobago, September to December 2011

seventy-six of 128 (59·4 %), used AwED less than once monthly but twelve of 128 (9·4 %) used this combination once or more weekly. Table 2 shows associations and predictors for the use of dietary supplements.

Side-effects of dietary supplements

In a review of the data collected, 20·7 % of students using dietary supplements reported one or more side-effects. There were 124 reported side-effects of dietary supplements

https://doi.org/10.1017/S1368980013003339 Published online by Cambridge University Press

Table 2 Associations and predictors of independent variables for the dependent variable 'use of the various classes of dietary supplements' among adolescents (n 561) aged 15–19 years from secondary schools throughout Trinidad and Tobago, September to December 2011

	ED	AwED	WGS	VMS
Associations (using χ^2 test)	1. Students of GSS ($P = 0{\cdot}003$) 2. Males ($P = 0{\cdot}001$)	1. Afro-Trinidadian 2. Males 3. Represents school at sport ($P < 0{\cdot}0005$)	1. Perception of being underweight ($P = 0{\cdot}001$) 2. Age 17 years old ($P = 0{\cdot}05$)	1. Attending GASS ($P = 0{\cdot}02$) 2. Age 17 years old ($P = 0{\cdot}006$) 3. Females ($P = 0{\cdot}01$) 4. Exercise 3–4 times/week ($P = 0{\cdot}01$)
Predictors of use (using binary logistic regression)	1. Students of GSS, OR = 1·7 (95 % CI 1·2, 2·4) 2. Males, OR = 1·7 (95 % CI 1·1, 2·4)	1. Represents school at sport, OR = 2·6 (95 % CI 1·6, 4·7) 2. Males, OR = 1·9 (95 % CI 1·4, 4·7)	1. Age 17 years old, OR = 2·8 (95 % CI 1·1, 6·9)	Nil

ED, energy drinks; AwED, alcohol with energy drinks; WGS, weight-gain supplement; VME, vitamin/mineral supplement; GSS, government secondary school; GASS, government-assisted secondary school.

from eighty-six students. Whereas 57·0 % (forty-nine of eighty-six) of students had experienced one side-effect, 22·9 % of students experienced three or more side-effects. Side-effects reported by the students are shown in Fig. 2.

Exploring the relationship between the use of dietary supplements and the occurrence of side-effects, there were significant associations with: the use of ED ($P < 0{\cdot}0005$), the use of WAS ($P = 0{\cdot}009$), among those attending GSS *v.* GASS ($P = 0{\cdot}013$) and among students who were 17 years old ($P = 0{\cdot}04$). The positive predictors for the occurrence of side-effects were: the use of ED (OR = 2·9; 95 % CI 1·6, 4·9); the use of WAS (OR = 2·4; 95 % CI 1·2, 4·7); and the attendence of GSS (OR = 1·7; 95 % CI 1·01, 3·0). Age 17 years old was a negative predictor for the occurrence of reported-side effects compared with the other age groups 15–16 years and 18–19 years (OR = 0·6; 95 % CI 0·3, 0·9).

In response to the question 'Have you ever used anabolic steroids or "steroids" in an attempt to acheive your ideal weight?', 1·4 % (eight of 559) replied 'Yes'. There was no significant gender difference in the answering of this question ($P = 1{\cdot}0$).

In response to the question 'If there was a product being sold that would cause you to acheive your perfect body now, but would cause you to have a shorter life or cause serious illness later in life, would you use it?', 2·9 % (sixteen of 559) responded 'Yes'. There was no significant gender difference in the responses to this question ($P = 0{\cdot}41$).

Discussion

The present study adds to the literature concerning the use of AwED in the 15–19 years age group regionally and internationally. While previous studies have been examinations of the use of AwED in young adults[7–10], the present study is the first one known that is an examination of AwED use in the adolescent school population aged 15–19 years. The study also reports on the occurrence of side-effects associated with the use of different classes of dietary supplements among adolescents and adds to the scant literature on the reasons why adolescents use ED and other dietary supplements.

Adolescents' use of energy drinks

ED use is alarming in this population, with slightly fewer than half of adolescents using them. Greater than 80 % of 15–19-year-olds who used ED began drinking them in the last one to four years, suggesting that some of these students have been consuming these drinks since they were 11–12 years old. This is a cause for concern: ED have not been recommended for persons younger than 17 years old because of associations with side-effects and even death[17]. In 1996, Viell *et al.* reported that 3 % of German teenagers used one to seven cans of ED per week as compared with the current study, which revealed that

https://doi.org/10.1017/S1368980013003339 Published online by Cambridge University Press

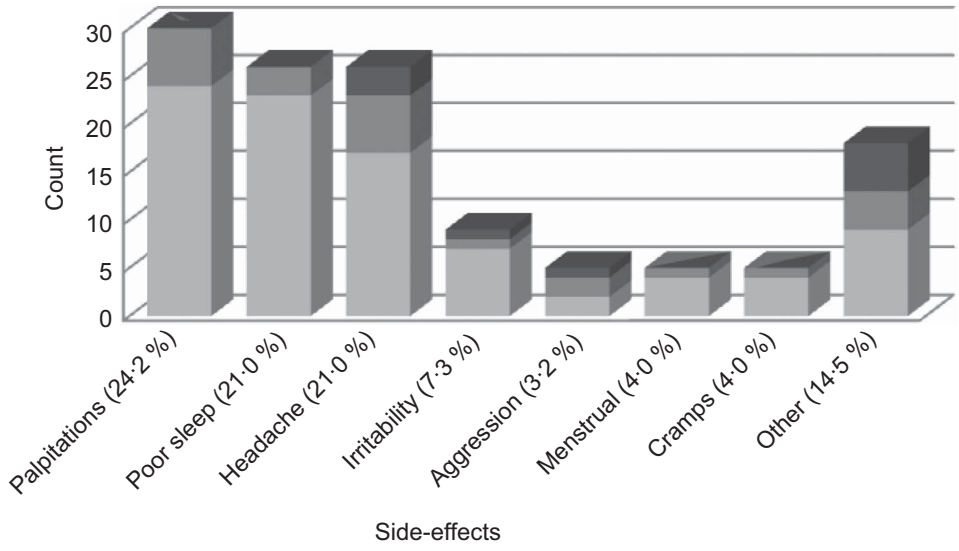

Fig. 2 Side-effects of using dietary supplements (■, vitamin/mineral supplements; ■, weight-altering supplements; ■, energy drinks) reported by adolescents (*n* 86, 125 adverse events) aged 15–19 years from secondary schools throughout Trinidad and Tobago, September to December 2011

almost three-fifths of students who used ED admitted using ED once or more weekly[19]. The Simmons study in the USA showed that 31 % of 12–18-year-olds use ED[5] but the frequency of use is not available, as the original website with the findings is no longer functional.

Getting an energy 'boost' was the most common reason for ED use and this rationale is congruent with the marketing strategies used by companies that sell ED. Between 15 and 19 years of age students are in the process of preparing for major examinations and have to study for long periods. Caffeine has been found to increase alertness and concentration. This would support students' use of ED, which could allow longer study times and less sleepiness[24].

Forty per cent of Trinidad and Tobago adolescents as compared with 51–68 % of university students reported using more than one ED per month[9,25]. Reasons for use of ED among university students included: they had 'insufficient sleep', needed to 'increase their energy', to drink with alcohol while partying and for 'studying or completing a major project'[8,9]. These reasons were broadly similar to those given by the 15–19-year-old students in the present study.

Students attending GSS were more likely to use ED than those attending GASS. This reflects a lack of official policy from the Ministry of Education about sales of ED in schools (A Deoraj, personal communication). In a 2012 address, the Minister of Health reported that his Ministry had adapted the policy on ED from Jamaica, a neighbouring Caribbean country[26]. The decision to sell ED is left to individual school principals. Students attending GASS had a greater knowledge of the benefits and risks associated with the use of dietary supplements than students attending GSS and this may have acted as a deterrent for the use of ED in this population.

Adolescents' use of alcohol with energy drinks

In the present study two-thirds of students who use AwED were less than 18 years old. In Trinidad and Tobago, it is not a routine practice of merchants and bartenders to request proof of age before selling alcohol. The majority of students using AwED used this combination once or less per month. This infrequent use may lead one to speculate that the majority of adolescents' use of AwED could be in social settings where peer pressure to consume alcoholic drinks may be a contributing factor.

Young adults have used ED to alter the taste of alcoholic beverages and to allow more alcohol consumption while partying[8,9], leading to more alcohol consumption with less sensation of drunkenness[25,27]. Co-administration of alcohol with ED resulted in increased alcohol consumption by the users of AwED[7] and users of AwED were more likely to exhibit high-risk behaviours, which included being more likely to take advantage of someone sexually or be taken advantage of sexually, riding with a driver who was under the influence of alcohol and being injured or requiring medical treatment[10,27].

The present study adds to the literature on risk-taking behaviours among adolescent male athletes. Bovard found that male athletes in high schools were more likely to be involved in high-risk behaviours[28] and in the present study, persons who represented their school at sport and males were more likely to use AwED. In part this use may be because of advertisers of ED targeting sports events and the sporting imagery in advertisements.

Adolescents' use of weight-altering supplements

The overall use of weight-gain supplements (WGS) and weight-loss supplements (WLS) among the Trinidad and Tobago student population was low. WGS and WLS were

https://doi.org/10.1017/S1368980013003339 Published online by Cambridge University Press

used by 6·8 % and 2·1 % of students, which contrasts with rates of 17·3 % and 35·1 %, respectively, by American adolescents[12]. Overall, the use of anabolic steroids in Trinidad and Tobago students was 1·4 %, which is similar to findings in the USA where 1·6 % of adolescents used these products[12]. There was no gender difference in Trinidad and Tobago as there was in the USA, where more males used these products. The use of anabolic steroids has been associated with improved sporting performance and a more muscular appearance[29] but has been associated with short-term and long-term health risks including premature death[14,29]. Adolescents need to be educated about these risks. Coaches have been found to be a valuable source of information for physically active adolescents[12] and must attempt to ensure their knowledge is current. Coaches were most likely to recommend the use of WAS for students and they must be aware of safe methods to alter weight of their athletes. Otherwise, this could lead athletes under their care to use potentially dangerous WAS.

Adolescents' use of vitamin/mineral supplements

The prevalence of VMS use was fairly high with more than half of the Trinidad and Tobago students using them. This is similar to vitamin/mineral use in US adolescents where almost three-fifths of them used such products[12]. In Korea, 35·8 % of 17-year-old students used VMS[30]. Parents were more likely to recommend the use of VMS for their children. This was most likely in keeping with the concept of 'nutritional insurance' referred to by O'Dea, where parents believe that vitamin and mineral supplementation compensated for any nutritional deficiencies in the diets of their children[31].

Adverse effects experienced by students using dietary supplements

Almost a fifth of students reported experiencing side-effects associated with using dietary supplements. Almost a quarter of students who reported experiencing side-effects from dietary supplements reported three or more side-effects. The present study is the first one known that is an examination of the side-effects of dietary supplements experienced in a population of 15–19-year-olds. It extends the work done by Malinauskas *et al.* who examined side-effects of ED in university students (average age 21·5 years). In that study, side-effects of ED were related to the dose of ED consumed[9] but in the current study the number of ED consumed at a single setting was not determined.

Most of the side-effects experienced by students in the present study were palpitations, poor sleep and headache. These are common side-effects of caffeine[9,32] and stimulants used in WAS. These symptoms also have been reported in caffeine withdrawal[9]. The current study was not an examination of the timing of the side-effects related to consumption of ED, nor was it an examination of the dose of dietary supplements related to the development of side-effects. It also was not an examination of the side-effects in the daily functioning of the student. It is thought provoking that ED were commonly used by students to stay awake to study but paradoxically it also affected the sleep of some students. Although occurring in few students, side-effects such as irritability and aggression need to be evaluated, as they may be contributing factors to interpersonal violence in schools. The study also supports the finding of a low incidence of side-effects being experienced by users of VMS. However, using vitamins in high doses has been associated with severe side-effects and VMS users should be advised to use the recommended daily doses for each vitamin or mineral supplement used[33].

Adolescents' use of products leading to an ideal body with risk of premature morbidity and mortality

Three per cent of Trinidad and Tobago students would take a product that will lead to an ideal body at the expense of illness later in life or a shortened lifespan. This shows that some adolescents in Trinidad and Tobago were willing to take huge risks to obtain their ideal body. In the USA, the positive response to this question increased with increasing age, especially among males. Three per cent of grade 8 students and 8 % of grade 12 students sampled in the USA would also take a product to obtain an ideal body at the expense of illness or premature death. In grade 8, males and females were equally likely to want to take this risk but at grade 12, almost three times as many males as females were prepared to take this risk[12].

Study limitations

The major limitation of the present study is that whereas the schools were randomly selected, when actual data were collected this was done with students in classes that were free at that time or those whose teachers agreed to allow their students to participate. Trying to obtain a random selection of students from the school register was not possible at any school because it would have disrupted the classes in progress. However, the authors believe that a wide cross-section of the national student body was sampled.

After form 5 approximately 40–50 % of students aged 16–18 years leave secondary school to go to higher education or work. The current study did not include the adolescents who left secondary schools and so the findings may not apply to that population. Therefore, the study findings are applicable only to the secondary-school students aged 15–19 years in Trinidad and Tobago and not the entire 15–19 years age group.

Evaluation of the socio-economic status of the students was not undertaken because of the lack of a proper indicator of socio-economic status in the Caribbean. Markers used in other studies, such as parental income and parents' highest education level, are not appropriate

in the Caribbean, as most students do not know their parents' annual income and there are many university graduates who are presently unemployed due to the current economic climate.

Implications for public and adolescent health

Males, especially those who play sport for their schools, are involved in a high degree of risk taking. In the present study, they were more likely to use ED and AwED. These students are generally healthy and every opportunity of contact should be taken by medical and non-medical personnel to counsel them about the dangers in using ED with and without alcohol and other dietary supplements.

In Trinidad and Tobago there is no official policy concerning the sale of ED at secondary schools. Some schools ban them but others, especially GSS, still allow the sale of such drinks. The Ministry of Education should make an offical policy banning the sale of ED in all secondary schools.

Because ED and WAS were associated with side-effects and the knowledge of dietary supplements among the students was low, it is recommended that schools embark on a dietary supplements sensitization programme showing benefits and adverse events associated with such use. This would allow students to make an educated decision regarding the use of such products.

Conclusions

The use of dietary supplements among 15–19-year-olds attending secondary schools in Trinidad and Tobago was high, with almost 75% admitting use. Whereas most students used the relatively benign VMS, almost half of students used ED on a regular basis. Almost a quarter of students used ED with alcohol, although most students used this combination infrequently. The use of ED and AwED in this adolescent age group mirrors the use by young adults attending universities in the USA. Most Trinidad and Tobago students admitted using ED for the 'boost' of energy associated with such use. Males and those who play sport for their schools were common users of AwED. Approximately one-fifth of students who used dietary supplements experienced side-effects and these effects were more commonly reported by users of ED and WAS than users of VMS. The knowledge of benefits and adverse effects associated with dietary supplements use was low, with approximately one-half and one-third of students knowing about them, respectively.

Acknowledgements

Sources of funding: This research did not receive funding from any private, public or not-for-profit organizations. This work represents part of a research project for the first author's Doctor of Medicine degree in Family Medicine from the University of the West Indies, 2012. *Conflicts of interest:* None to declare. *Ethics:* Ethical approval was obtained from the Medical Ethics Committee of the University of the West Indies, St Augustine Campus. Institutional permission to do this study was obtained from the Ministry of Education, Trinidad and Tobago. *Authors' contributions:* T.J.B. conceptualized and designed the study, collected and analysed data and wrote the manuscript. R.G.M. assisted in study design and data analysis and reviewed the manuscript for publication. P.N. reviewed the manuscript prior to submission for publication.

References

1. Eaton DK, Kann L, Kinchen S *et al.*; Centers for Disease Control and Prevention (2010) Youth risk behavior surveillance – United States, 2009. *MMWR Surveill Summ* **59**, 1–142.
2. Maharaj RG, Nunes P & Renwick S (2009) Health risk behaviours among adolescents in the English-speaking Caribbean: a review. *Child Adolesc Psychiatry Ment Health* **3**, 10.
3. Byrnes JP, Miller DC & Schafer WD (1999) Gender differences in risk-taking. *Psychol Bull* **125**, 367–383.
4. Calamaro CJ, Mason TB & Ratcliffe SJ (2009) Adolescents living the 24/7 lifestyle: effects of caffeine and technology on sleep duration and daytime functioning. *Pediatrics* **123**, e1005–e1010.
5. Seifert SM, Schaechter JL, Hershorin ER *et al.* (2011) Health effects of energy drinks on children, adolescents, and young adults. *Pediatrics* **127**, 511–521.
6. Weldy DL (2010) Risks of alcoholic energy drinks for youth. *J Am Board Fam Med* **23**, 555–558.
7. Price SR, Hilchey CA, Darredeau C *et al.* (2010) Energy drink co-administration is associated with increased reported alcohol ingestion. *Drug Alcohol Rev* **29**, 331–333.
8. Ballistreri MC & Corradi-Webster CM (2008) Consumption of energy drinks among physical education students. *Rev Latino-am Enfermagen* **16**, 558–564.
9. Malinauskas BM, Aeby VG, Overton RF *et al.* (2007) A survey of energy drink consumption patterns among college students. *Nutr J* **6**, 35.
10. Miller KE (2008) Wired: energy drinks, jock identity, masculine norms, and risk taking. *J Am Coll Health* **56**, 481–489.
11. Ramberan K, Austin M & Nichols S (2006) Ethnicity, body image perception and weight-related behaviour among adolescent females attending secondary school in Trinidad. *West Indian Med J* **55**, 388–393.
12. Hoffman JR, Faigenbaum AD, Ratamess NA *et al.* (2008) Nutritional supplementation and anabolic steroid use in adolescents. *Med Sci Sports Exerc* **40**, 15–24.
13. Bent S, Tiedt TN, Odden MC *et al.* (2003) The relative safety of ephedra compared with other herbal products. *Ann Intern Med* **138**, 468–471.
14. Dhar R, Stout CW, Link MS *et al.* (2005) Cardiovascular toxicities of performance-enhancing substances in sports. *Mayo Clin Proc* **80**, 1307–1315.
15. De Rose EH & Da Nobrega ACL (2001) Drug testing and doping. In *FIMS Team Physician Manual* [L Michell, A Smith, N Bachl *et al.*, editors]. Hong Kong: Lippincott Williams & Williams Asia Ltd.
16. Molinero O & Márquez S (2009) Use of nutritional supplements in sports: risks, knowledge, and behavioural-related factors. *Nutr Hosp* **24**, 128–134.
17. Finnegan D (2003) The health effects of stimulant drinks. *Nutr Bull* **28**, 147–155.

18. Marczinski CA (2011) Alcohol mixed with energy drinks: consumption patterns and motivations for use in US college students. *Int J Environ Res Public Health* **8**, 3232–3245.
19. Viell B, Gräbner L, Früchel G *et al*. (1996) New caffeinated beverages. A pilot survey of familiarity and consumption by adolescents in North-Rhine Westphalia and Berlin and considerations of consumer protection. *Z Ernahrungswiss* **35**, 378–386 (in German).
20. Luebbe AM & Bell DJ (2009) Mountain Dew or mountain don't?: a pilot investigation of caffeine use parameters and relations to depression and anxiety symptoms in 5th- and 10th-grade students. *J Sch Health* **79**, 380–387.
21. Ministry of Legal Affairs of Trinidad and Tobago (2013) Laws of Trinidad and Tobago, Liquor Licences Act, Chapter 84:10, section 60. http://rgd.legalaffairs.gov.tt/laws2/alphabetical_list/lawspdfs/84.10.pdf (accessed May 2013).
22. Ministry of Education of Trinidad and Tobago (2009) *Secondary School Education Districts. Fact Sheet.* Port of Spain: Ministry of Education of Trinidad and Tobago.
23. Naing L, Winn T & Rusli BN (2006) Practical issues in calculating the sample size for prevalence studies. *Arch Orofacial Sci* **1**, 9–14.
24. Haskell CF, Kennedy DO, Wesnes KA *et al.* (2005) Cognitive and mood improvements of caffeine in habitual consumers and habitual non-consumers of caffeine. *Psychopharmacology* **179**, 813–825.
25. O'Brien MC, McCoy TP, Rhodes SD *et al*. (2008) Caffeinated cocktails: energy drink consumption, high-risk drinking, and alcohol-related consequences among college students. *Acad Emerg Med* **15**, 453–460.
26. Khan F (2012) Statement by the Minister of Health at the launch of the U Health and Wellness Exposition, March 19, 2012. http://www.news.gov.tt/index.php?news=10617 (accessed June 2013).
27. Miller KE (2008) Energy drinks, race, and problem behaviors among college students. *J Adolesc Health* **43**, 490–496.
28. Bovard RS (2008) Risk behaviors in high school and college sport. *Curr Sport Med Rep* **7**, 359–366.
29. Schanzer W (2003) Analysis of Non-hormonal Nutritional Supplements for Anabolic-Androgenic steroids – an international study. http://multimedia.olympic.org/pdf/en_report_324.pdf (accessed January 2011).
30. Kim SH & Keen CL (1999) Patterns of vitamin/mineral supplement usage by adolescents attending athletic high schools in Korea. *Int J Sport Nutr* **9**, 391–405.
31. O'Dea JA (2003) Consumption of nutritional supplements among adolescents: usage and perceived benefits. *Health Educ Res* **18**, 98–107.
32. Persad LA (2011) Energy drinks and the neurophysiological impact of caffeine. *Front Neurosci* **5**, 116.
33. Pandita KK, Razdan S, Kudyar RP *et al*. (2012) Excess good can be dangerous. A case series of iatrogenic symptomatic hypercalcemia due to hypervitaminosis D. *Clin Cases Miner Bone Metab* **9**, 118–120.