Alarming High Levels of Energy Drinks Consumption among School Children in Hail, Northern of Saudi Arabia

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Abstract: Saudi Arabia (KSA) is one among the countries for top energy drink markets. Amid growing controversies globally surrounding the increasing usage of energy drinks by children, it is felt important to understand how these trends are reflected in KSA. A cross-sectional survey was conducted to explore the trends of energy drink consumption among, and differences between, middle and secondary school children, and the associated socioeconomic and behavioral factors. Randomly selected 1006 male children from secondary and middle schools from Hail region in KSA were included in the study, using a self-administered validated questionnaire. Results revealed that about 60% of school children were current energy drink consumers. Secondary school children were significantly (*P<0.001*) higher than middle schoolers in terms of both frequency and quantity. Concomitantly, unhealthy dietary and lifestyle behaviors were reported in significantly higher proportions (*P<0.001*) among secondary school children. Home was the first place for exposure for majority of children while unreliable resources were the major sources of knowledge about energy drink composition and health effects. Poor knowledge concerning energy drink composition was reported. Taste and being energized were the major driving forces for energy drink consumption. Higher disposable income on hand and poor lifestyle behaviors were all significantly associated with energy drink consumption. It can be concluded that high proportion of energy drink consumption was reported among school children in Hail, with higher proportions in secondary than middle schools. This matter raises the significance of mounting awareness of community concerning the ingredients and potential hazards of energy drinks.

Keywords: Energy drinks, School children, Lifestyle Behaviors.

INTRODUCTION

Energy drinks are caffeinated beverages intended to enhance alertness and provide a burst of energy and represent the rapidly growing segment of beverage industry [1]. Caffeine is the chief bioactive ingredient in energy drinks, but they may also include small amounts of nutritional supplements such as vitamins or L-carnitine or taurine; herbal extracts; and additional stimulants such as Ginseng or *Ginkgo biloba*. Further, these drinks may or may not contain high doses of sugar or a sugar substitute [2].

Globally, recent studies report alarmingly raising trends in consumption of energy drinks among all age groups including children and adolescents [3-6]. Initially, energy drink industry was primarily targeting athletes and sports persons [1]. Today, however, with growing competition, the target populations for energy drinks were expanded in a drive to create niche markets with massive marketing strategies focusing on the stimulant and psychoactive properties of these beverages and cross promotional tactics directed towards adolescents and young adults between 16–35 years of age [7, 8]. Particularly, increasing popularity of energy drinks among children has generated considerable concern off late in researchers, physicians and parents, since children may be the most vulnerable group for experiencing adverse health consequences of caffeine consumption [4, 9, 10].

Caffeine, the most abundantly found legal stimulant in numerous products, is often consumed for a list of positive cognitive, physical and muscular impacts including increasing alertness, wakefulness, and feelings of energy; the ability to solve problems requiring reasoning and to make correct decisions; decreasing mental and muscular fatigue; enhancing physical, motor and cognitive performances and short-term memory [4, 11, 12]. However most of these researches have been done in adult populations. Safety of caffeine use in adolescents and children is largely unknown. Given the rising consumption trends of energy drinks in children and adolescents, it is therefore very important to understand the trends in energy drinks consumption and factors associated with these trends.

Energy drinks consumption and hence increased caffeine consumption among children and adolescents can be a worrying factor for many reasons. To begin with, there are very few studies conducted to understand neither pharmacological tolerance to caffeine nor its physiological and psychological effects

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at increased consumption levels in children [4, 5, 13]. Most importantly childhood and adolescence are still periods of growth and development and any factors affecting their nutrition and sleep can have negative influence on them. To support this belief, there are limited studies available to indicate caffeine intake in children even at moderate amounts can create disturbances of sleep and promote poor lifestyle choices [7, 14, 15]. Further childhood is the critical period for establishment of eating behaviors because any faulty taste preferences formed during this period may continue into their later lives [16, 17].

Studies on the consumption of energy drinks in Kingdom of Saudi Arabia (KSA) are scarce, despite the fact it is a common sight to observe frequent consumption of these drinks in various community settings. This observation was further strengthened by the *Global Energy Drinks Report (2012)* [18], which unraveled that Saudi Arabia was ranked among the top ten countries for the consumption of energy drinks. Amongst the limited studies available from the kingdom, a study conducted on 600 secondary school girls in Western province found a 55.5% prevalence of energy drink consumption habit [19] while a study done on 412 college students from Eastern province indicated that 54.60% of males and 26.15% of females were habitual energy drink consumers [20]. However, in the Middle provinces, a study done by Al Buhairan *et al*. [21] indicated that the majority (66%) of 1719 intermediate and secondary school male and female students were not usual consumers for energy drinks indicating regional, age and gender differences in consumption patterns.

A recent study on patterns of energy drink consumption among 1062 adolescents and young adults (867 males and 195 females) in Hail province, Northern part of the Kingdom exposed that 37% of the study population started drinking energy drinks from primary school itself while 44 % of them were currently consuming two or more cans per day [22]. Thus, it was hypothesized that the habit of energy drink consumption may begin very early in adolescents than expected in this population. Observations have suggested that it is easy for the young children in KSA to access and use energy drinks. However there are no available studies from the region to either indicate the prevalence of consumption of energy drinks in neither children nor reasons why they prefer energy drinks, and the influencing factors for their consumption. Therefore, the current study was planned to find out the prevalence of consumption trends of energy drinks amongst the middle and secondary school children in Hail city, and the socioeconomic and behavioral factors associated with it. Further, the study aimed at identifying the differences between the trends in energy drink consumption between middle and secondary schoolers, and to explore the degree to which energy drink consumption is linked to different lifestyle behaviors.

METHODS

Study Design and Objectives

This cross sectional survey was conducted during the 2013–2014 school year in the Province of Hail, which has a population of about 17,000 young children in middle (12- to 15-year olds) and secondary (16- to18- year olds) schools. The survey included a sample of 1006 male students randomly selected from twelve boy's schools (6 middle and 6 secondary) out of 60 boy's schools for the two levels. Approval for the study was obtained from the Ethical Committee of the University, and official permissions were obtained from the Education Authority in Hail Province prior to school visits. Informed verbal consent to the students' participation was requested first from the school director, then from each student enrolled. None of the students refused, but a small number of class teachers denied due to time-management reasons. Those who were absent for various reasons (illness, skipping lessons etc.) on the day of the survey were the only non-respondent students. Participation was voluntary and no incentives were provided to participants. A short and brief explanation on the energy drinks was introduced to each class, and examples on brand names of energy drinks available in the local market were provided in order not to be confused with common soda colas or sport drinks available.

Study assessment tool was a questionnaire adopted from questionnaire developed by Attila and Cakir [23], and slight modifications were done to make it compatible with school children in the Saudi society based on pilot study during validation process. The self- administered questionnaire consisted of 30 multiple-choice questions. Briefly, respondents were asked for socio-demographic information (monthly income and expenditure and housing), the characteristics of their social groups (nature of family and residency sharing), and nutritional and lifestyle factors (eating breakfast, practicing physical activity, sleep and smoking habits and safety behaviors). Questions related to consumption of energy drinks

included frequency, reasons for consumption or non-consumption, knowledge about contents of energy drinks and sources of knowledge, social influences and preferences.

Statistical Analysis

Statistical analyses is presented in frequencies and percentage distributions for prevalence of energy drink consumption, socio economic, lifestyle and energy drink related behaviors among all study participants. Differences between middle and secondary school energy drinkers are presented using chi-square analysis. A chi-square analysis was also initially conducted to elucidate the relationship between socio-economic and behavioral variables and the consumption of energy drinks. Logistic regression analysis was finally applied for associations of energy drink consumption with socioeconomic and lifestyle behaviors emerging from the chi-square analysis as being associated with energy drink consumption. The covariates applied in the models were: monthly expenditure (<1000 *vs*. >1000 SR), no. of sleep hrs (<6hrs *vs*. >6hrs), smoking (non-smokers *vs*. current or past smokers), safety behaviors (safe *vs*. unsafe behaviors) and physical activity (regular *vs*. irregular). Excluded variables included family (nuclear *vs*. extended); parental home *vs*. others (shelters or friends); monthly parental income (<5000 *vs*. >5000 SR); mother education (primary/uneducated *vs*. middle school & above); father education (primary/uneducated *vs*. middle school & above); sleep patterns (regular *vs*. irregular); eating breakfast (regular *vs*. irregular). The statistical analyses were performed using SPSS software ver. 17, and a value of $P<0.05$ was considered statistically significant.

RESULTS

Table **1** shows the basic socio-demographic characteristics of study participants. Secondary school students represented slightly more than half of the study participants (54.4%) while middle schoolers were

Table 1: Basic Socio-Demographic Characteristics of Study Participants

		Count	Percentage
Level	Middle	459	45.6
	Secondary	547	54.4
Nature of the household/family	Nuclear family	762	75.7
	Extended Family	244	24.3
Sharing the house with	Sharing with parents and siblings	989	98.3
	Friends or shelters	17	1.7
Average monthly income	Low:< 5000 SR	376	37.4
	Middle:5000 - 10000 SR	313	31.1
	High: >10000 SR	317	31.5
Monthly personal expenditures	< 1000 SR	813	80.8
	1000-2000 SR	130	12.9
	>2000 SR	63	6.3
Mother educational level	Uneducated	312	31.1
	Primary school	172	15.1
	Middle school	145	14.4
	Secondary school	170	16.9
	Higher education	207	20.5
Father educational level	Uneducated	173	17.2
	Primary school	177	17.6
	Middle school	133	13.2
	Secondary school	225	22.3
	Higher education	289	28.7

around 45.6 %. Nuclear family households were more common among study subjects (75.7 %) and almost all children were living with their parents except for only 1.7 % children who were living in other places than their parental homes. Only about 28.7 percent of fathers and 20.5 percent of mothers had higher education while one third of mothers were uneducated as compared to 17 percent of uneducated fathers.

The economic level of study participants was almost evenly distributed over the three classes (high-, middle-, and low-socioeconomic classes) as defined by their parental monthly income. In addition students were also asked to report their average monthly income that they usually spend for their personal needs and privates expenses rather than official fees and governmental expenses. The study results suggest that majority students spent less than 1000 SR as monthly personal expenditure while around 19 % of students informed that they spend 1000 and above SR monthly as personal expenditure. As the study population were school children, all the participants were dependent on others (parents or guardians) for their monthly expenses.

Personal lifestyle habits of the study participants that may be associated with energy drinks consumption are reported in Table **2**. As it was shown in the table, irregular sleeping habit was reported by about 36 % of the study participants. About half of the study participants had normal sleep duration of 6-8 hours, while about 20%of the respondents reported a sleeping pattern of less than 6 hours a day. The majority of the school students were non-smokers while around 18 % reported having current or past smoking habit. About two thirds of the study participants were either not regularly practicing physical exercises or not practicing at all. Irregular eating habit of breakfast was reported by around half of the study participants.

Although legally not allowed, driving cars by secondary school students is not very uncommon in Hail. Not using the safety belt while driving car was reported by about half of the secondary students enrolled in the study. Other risky behaviors such as driving car very fast was reported by 13 % of the study population. A small percentage of this group reported that they indulge in practices like carrying weapons and practice violence or got exposed to violence.

Table 2: Distribution of Energy Drink Consumption and Personal Daily Habits among the Study Participants

Habit	Response	Count	Percentage
Nature of sleeping	Normal/Regular	647	64.3
	Abnormal/irregular	359	35.7
Sleeping hours	<6 hr.	199	19.8
	6-8 hr.	479	47.6
	>8 hr.	328	32.6
Smoking status	Non-smoker	823	81.8
	Previous Smoker	49	4.9
	Smoker now	134	13.3
Safety behaviors (*n=547* for secondary school students only)	Not using safety belt while driving car	263	48.1
	Driving car very fast	71	13.0
	Carrying weapons and guns	20	3.6
	Practicing violence or exposed to violence	11	2.0
	None of the above	182	33.3
Practicing physical exercises	Regularly practiced	367	36.5
	Not Regularly practiced	457	45.4
	Not practiced	182	18.1
Eating breakfast meal	Regularly eaten	503	50.0
	Not regularly eaten	415	41.3
	Not eaten	88	8.7

*Driving a car is restricted for secondary school students, as it is not very uncommon among Saudi people.

Table 3: Energy Drink Consumption and its Related Behaviors and Knowledge among Study Participants

Behavior	Response	Count	Percentage
Do you drink energy drinks?	Yes	606	60.2
	No	400	39.8
If drinking energy drink, why?(Up to three reasons*) (number of responses=819)	Like its taste	488	59.6
	To be more active and energized	122	14.9
	To improve my physical and mental activities	37	4.5
	To mix it with other drinks	31	3.8
	To be awake for longer time	69	8.4
	To improve my academic and studying performance	19	2.3
	To mimic others (famous persons, friends and colleagues)	19	2.3
	For courtesy and compliment with others	31	3.8
Timing when first tried energy drinks (*n*=606)	Before primary school	71	11.7
	During primary school	171	28.2
	During middle school	178	29.4
	During secondary school	26	4.3
	Do not remember	160	26.4
Place where the first trail of using energy drinks was (*n*=606)	In my home	152	25.1
	In recreational places	73	12.0
	In the street	153	25.3
	In the coffee shop	42	6.8
	In the student dormitory	3	0.5
	In other places	30	5.0
	Do not remember	153	25.3
Companion when first tried energy drinks (*n*=606)	Friend or classmates	200	33.0
	Family member	53	8.7
	No body	200	33.0
	Do not remember	153	25.3
Places in which energy drinks are taken usually (multiple choices, up to three choices)*(number of responses=911)	House/home	322	35.3
	Coffee shop	126	13.9
	Recreational places	196	21.5
	Car	232	25.5
	College/school	35	3.8
Time periods during which energy drinks are mostly taken (*n*=589)	Examination periods	101	17.1
	Vacations	141	23.9
	Car driving/travelling by car	88	14.9
	When tasks and jobs are overcrowded	11	1.9
	No special time period	248	42.2
Intake of energy drinks in relation to regular meals (*n*=597)	Before meals	91	15.2
	After meals	154	25.8
	With meals	120	20.1
	Without meals	232	38.9
You prefer drinking energy drinks with: (*n*=587)	Fast foods	147	25.0
	Home dishes	64	10.9
	Chocolates	181	30.9
	Potato chips	41	7.0
	Solely without any food	154	26.2

(Table 3). Continued.

Behavior	Response	Count	Percentage
For energy drinkers, how many cans do you drink a day? (*n*=582)	> two cans/day	88	15.1
	Two cans/day	79	13.6
	One can/day	236	40.5
	< one can	179	30.8
For drinkers , the most commonly used energy drinks are (up to3 types can be chosen)* (number of responses=1215)	Red Bull	194	16.0
	Power Horse	109	9.0
	Bison	235	19.3
	Bugzy	203	16.7
	Code Red	333	27.4
	Pepsi Cola X Energy	75	6.2
	Other types	41	3.4
	Not determined	25	2.1
Physiological changes reported by drinkers after taking energy drinks* (number of responses=715)	Changes in cardiac activity and heart beating	135	18.9
	Reduced sleeping hours	169	23.6
	Becoming energized and activated	119	16.6
	Body provided with water and electrolytes, feeling of being hydrated	28	3.9
	No any beneficial effects	86	12.0
	Becoming addicted	76	10.6
	Becoming obese	29	4.1
	Depressed and frustrated	11	1.5
	Increased blood sugar	20	2.8
	Gastric irritation and ulceration	14	2.0
	Brain activity while limbs idle	22	3.2
I know that energy drinks contain (more than one answer allowed) ** (number of responses=1793)	Sugar	708	39.5
	Caffeine	376	21.0
	Water and minerals	95	5.3
	Carbon dioxide and other gasses	112	6.2
	Citric acid	161	9.0
	Taurine	34	1.9
	Protein	51	2.8
	Alcohol (diethyl ether)	82	4.6
	Nicotine	33	1.8
	Hormones and activating substances	141	7.9
Sources of knowledge about energy drinks (up to three major sources)* (number of responses=1399)	School colleagues and partners	273	19.5
	Friends	576	41.2
	Social networks	146	10.4
	Viewed mass media (TV)	118	8.4
	Written media (newspapers and magazines)	57	4.2
	General, non-scientific, websites	39	2.8
	Scientific journals, academic books and websites	27	1.9
	Food labels on energy drinks cans	163	11.6

*Due to multiple answer-questions, percentage is from the total number of responses not from total participants. Therefore, total number of responses may exceed the total number of drinker or non-drinker participants.
**Components listed are according to what is known not what is actually present.

Energy drink consumption and its related behaviors among study participants are shown in Table **3**. About two thirds of the school children enrolled in the present study answered "Yes" when asked whether they are

"ever energy drink consumers" or not. The three major forces driving them for using energy drinks were: taste, feeling to be activated and energized, and to keep themselves awake for longer periods of time.

For the energy drink consumers, home and streets were the most common places for first acquaintance with energy drinks followed by recreational places and coffee shops. Collectively, less than two thirds of the school children who were consuming energy drinks started drinking them while they were still in the primary and middle schools. Around one third of the study population tried on their own on their first experiment with energy drinks while another one third tried in the presence of their friends or classmates. Usual places for energy drinks consumption were reported as home followed by cars, recreational places and coffee shops. A small percentage of children (3.8 %) reported their usual place of drinking was school campus. When asking for the most common time periods during which energy drinks were drank, 42% reported that there was no definite time period, followed by vacations (23.9%), examinations (17.1 %) and car travel (14.9 %). Regarding the intake of energy drinks with meals, 39% reported that don't follow any specific rules for clubbing meal consumption with drinking energy drinks. Meanwhile, about 31% of respondents reported that they do prefer drinking energy drinks with chocolates while a quarter of energy drink consumers reported their preference to drink while eating fast foods (Table **3**).

Energy drinkers preferred various brands according to their taste preferences. The major physiological effects reported by energy drink consumers were as follows: reduced sleeping hours (23.6 %), changes in cardiac activity and heart beating (18.9 %), and becoming energized and activated (16.6 %). Around one tenth of the study population reported addiction as the major effect of drinking energy drinks.

We also tried to assess the knowledge level of the study population on the composition of energy drinks. The major sources of knowledge pertaining energy drink composition and health implications include friends (41.2 %), school colleagues (19.5 %), food labels on energy cans (11.6 %) and social networks (10.4 %) of responses. Two thirds of the responses regarding composition of energy drinks were about caffeine and sugar, while other components like taurine was identified by only a very small percentage of respondents. Surprisingly some responses even suggested the presence of ethanol, recreational hormones and chemicals, along with nicotine as components of energy drinks suggesting that these children probably would be consuming energy drinks looking for alternates for sensual products.

As the study tries to find out the difference in trends of energy drink consumption between middle and secondary school children, Table **4** presents these trends. Results indicate that secondary children have 1.3 odd's of higher chance for consumption of energy drinks as compared to middle school children. Nevertheless a 54 .2 % "yes" among middle schoolers for energy drink consumption is still a worrying factor given the long term consequences like addiction, sleeplessness and impact on growth.

Table **5** compares the differences between middle and secondary children for energy drink related behaviors among "ever energy drinkers". Secondary school children consuming 2 or more than 2 energy drink cans per day (34.6 %) were higher in proportions significantly as compared to middle school children (20.4 %). Noticeably a total of 59.5 % of middle school children and 62. 3 % secondary school children admitted that their habit of consuming energy drinks was either before or during or immediately after meals which may impact their meal intake or increased calories or both. There was no statistical difference between middle and secondary school children for their daily, weekly or monthly consumption; and for their preference of drinking energy drinks in combination with other foods like fast foods, home foods, chocolates, or potato chips. However the daily consumption of energy drinks has increased from 33.6

Table 4: Difference between Middle and School Children Regarding Energy Drink Consumption

	Do you drink energy drinks?				Chi-Square	Odds Ratio (95 % CI)
	Yes		No			
	Count	%	Count	%		
School Middle	249	54.2	210	45.8	12.646 **	1.317
Secondary	357	65.3	190	34.7		(1.131- 1.533)

**P<0.001 Chi-Square difference comparing secondary to middle school students.

Table 5: Differences between Secondary and Middle School Energy Drinks consumers Enrolled in the Study Regarding Energy Drink Consumption Behaviors

		School				Chi-square
		Middle		Secondary		
		Count	%	Count	%	
For energy drinkers, how many cans do you drink a day?	> two cans/day	25	10.4	63	18.5	22.272**
	Two cans/day	24	10.0	55	16.1	
	One can/day	95	39.4	141	41.3	
	< one can/day	97	40.2	82	24.0	
	Total	241	100	341	100	
Do you drink energy drinks	Monthly	62	25.1	67	19.7	4.657
	Weekly	102	41.3	131	38.5	
	Daily	83	33.6	142	41.8	
	Total	247	100	340	100	
Timing of energy drink intake with meals	Before meals	56	23.1	35	9.9	25.671**
	After meals	53	21.9	101	28.5	
	With meals	35	14.5	85	23.9	
	Without meals, out of meal time	98	40.5	134	37.7	
	Total	242	100	355	100	
Do you prefer drinking energy drinks with any of the foods	Fast foods	68	28.3	79	22.8	4.700
	Home dishes	23	9.6	41	11.8	
	Chocolates	65	27.1	116	33.4	
	Potato chips	17	7.1	24	6.9	
	Solely without any food	67	27.9	87	25.1	
	Total	240	100	347	100	

**P<0.001 Chi-Square difference comparing secondary to middle school students.

% among middle schoolers to 41.8 % among secondary school students.

Table **6** indicates that there were significant differences for lifestyle behaviors between middle and secondary children among “ever energy drinkers”. Skipping or not regularly eating breakfast, abnormal/irregular sleeping, smoking and lower practicing for physical activity were reported in significantly higher proportions (*P<0.001*) among secondary school children as compared to middle school children.

Table **7** presents logistic regression model for associations of energy drink consumption with socioeconomic and lifestyle behaviors. Only monthly expenditure (<1000 *vs*. >1000 SAR), no. of sleep hrs (<6hrs *vs*. >6hrs), smoking (non-smokers *vs*. current or past smokers), safety behaviors (safe vis. unsafe behaviors) and physical activity (regular *vs*. irregular) were included in the model since chi-square analysis has indicated non-significant associations for remaining variables like family (nuclear *vs*. extended); parental home *vs*. others (shelters or friends); monthly parental income (<5000 *vs*. >5000 SAR); mother education (primary/uneducated *vs*. middle school & above); father education (primary/uneducated *vs*. middle school & above); sleep patterns (regular *vs*. irregular); eating breakfast (regular *vs*. irregular). Although family income was not associated, higher disposable income on hand was significantly associated with energy drink consumption. Similarly poor lifestyle behaviors like smoking, sleeping less than 6 hrs, low physical activity and unsafe behaviors (not using safety belt while driving or driving fast or carrying weapons) were all significantly associated with energy drink consumption.

Table **8** presents the results of additional analysis done to find out the differences in lifestyle behaviors between daily *vs*. occasional energy drink consumers

Table 6: Differences between Secondary and Middle School Energy Drinks Consumers Enrolled in the Study Regarding the Dietary and Lifestyle Behaviors

		School				Chi-square
		Middle		Secondary		
		Count	%	Count	%	
Eating breakfast meal	Regularly eaten	134	53.8	137	38.4	14.370**
	Not regularly eaten	91	36.5	179	50.1	
	Not eaten	24	9.6	41	11.5	
	Total	249	100	357	100	
Practicing physical exercises	Regularly practiced	109	43.8	84	23.5	34.050**
	Not Regularly practiced	112	45.0	185	51.8	
	Not practiced	28	11.2	88	24.6	
	Total	249	100	357	100	
Nature of sleeping	Normal/Regular	168	67.5	183	51.3	15.813**
	Abnormal/irregular	81	32.5	174	48.7	
	Total	249	100	357	100	
No. of Sleeping hrs.	<6 hrs	54	21.7	81	22.7	1.389
	6-8 hrs	110	44.2	141	39.5	
	> 8hrs	85	34.1	135	37.8	
	Total	249	100	357	100	
Smoking status	Non-smoker	215	86.3	241	67.5	38.461**
	Previous Smoker	18	7.2	23	6.4	
	Smoker now	16	6.4	93	26.1	
	Total	249	100	357	100	

**P<0.001 Chi-Square difference comparing secondary to middle school students.

Table 7: Logistic Model Regression for Energy Drink Users vs. Non Users

Variables in Model	Beta	S.E.	P (WaldTest)	Odd's Ratio	95.0% Confidence Interval for Odd's Ratio	
					Lower	Upper
Monthly Expenditure (<1000 vs. >1000 SR)	-0.653	0.245	0.008	0.520	0.322	0.841
Sleep hrs (<6hrs vs. >6 hrs)	0.786	0.260	0.003	2.194	1.318	3.653
Smoking (Non smokers vs. Current Smokers.)	-0.900	0.244	<0.000	0.406	0.252	0.655
Safety behaviors(Safe vs. unsafe)	-0.723	0.195	<0.000	0.485	.331	0.712
Physical Activity (Regular vs. irregular)	-0.479	0208	0.021	0.620	0.412	0.932
Constant	1.802	0.757	0.017	6.059		

(weekly or monthly) and those who take 2 or more cans *vs*. less than 2 cans. Lifestyle behaviors included eating breakfast (regular *vs*. irregular & not eating), physical activity (regular *vs*. irregular & not practicing), sleep patterns (regular *vs*. irregular), safety behaviors (safe *vs*. unsafe behaviors) and smoking (non-smokers *vs*. current or past smokers). The results show that daily energy drink consumption in children was strongly associated with smoking (OR 2.243) and irregular sleep (OR 1.616); drinking 2 or more cans per day was strongly associated with smoking (OR 1.422), poor breakfast (OR 1.161), unsafe behaviors (OR 1.200) and irregular sleep (OR 1.254).

DISCUSSION

In the last decade, the consumption of energy drinks has grown exponentially, with aggressive

Table 8: Differences in Lifestyle Behaviors between Daily *vs*. Occasional Energy Drink Consumers (Weekly or Monthly) and those who Take Two or More Cans *vs*. Less than Two Cans

		Energy Drink Consumption (%)			
		Daily vs. Occasionally		2 or more Cans *vs*. < 2 Cans when Taken	
		Daily	Occasionally	2 or more Cans	< 2 Cans
Eating breakfast meal	Regularly eaten	46.6	40.0	35.9	48.9
	Irregular / not eaten	53.4	60.0	64.1	51.1
	Chi Square	2.543		8.109*	
	Odds Ratio (95 % CI)	1.309 (0.939-1.824)		1.161(1.049-1.286)	
Practicing physical exercises	Regularly practiced	33.0	30.0	33.5	31.3
	Irregular / not practiced	67.0	70.0	66.5	68.7
	Chi Square	0.589		0.267	
	Odds Ratio (95 % CI)	1.148 (0.806-1.636)		1.106 (0.755- 1.621)	
Nature of sleeping	Normal/Regular	61.8	50.0	44.3	63.1
	Abnormal/irregular	38.2	50.0	55.7	36.9
	Chi Square	8.145*		17.286**	
	Odds Ratio (95 % CI)	1.616 (1.161-2.250)		1.254 (1.120-1.403)	
Safety Behaviours	Safe Behaviours	31.1	24.3	20.3	31.6
	Practicing Unsafe behaviours	68.9	75.7	79.7	68.4
	Chi Square	1.990		4.937*	
	Odds Ratio (95 % CI)	1.400 (0.876-2.235)		1.200 (1.035-1.393)	
Smoking status	Non-smoker	81.7	66.5	61.7	76.1
	Current / Previous Smoker	18.3	33.5	38.3	23.9
	Chi Square	18.064**		28.864**	
	Odds Ratio (95 % CI)	2.243 (1.538 -3.271)		1.422 (1.210-1.672)	

**P<0.001.
*P<0.01.

advertising and marketing strategies primarily targeting adolescents and young adults [3-6]. This trend is expected to continue as new and niche products with clever and aggressive marketing campaign about improved and long lasting energy boost and stimulatory properties are entering in fierce competitive markets. Children and young people are easily swayed towards these attractive advertising and peer pressures. The ease of access with which these drinks are available to adolescents and to even children because of largely unregulated markets for energy drinks is also a growing concern [1, 3, 4].

The potential health risks of increased exposure to energy drinks in young children and adolescents are only recently gaining research scientists interest. Few limited studies published expose energy drinks as a possible significant threat to public health in case of young children [5-7]. The fact that the KSA is ranked amongst the top energy drink consuming countries in the world [18] emphasizes the importance of conducting such a research to explore the extent to which the practice of energy drink consumption is popular and common among young children.

The present study results indicate precariously high prevalence of energy drink consumption habit (60.2 %) among the participants. Many factors could be possible reasons for this alarming high levels of energy drink intake, including the relatively low price of energy drinks (1-2 SR/can= 0.27-0.54 USD/can) concomitant with the high economic levels of people in KSA, the lack of governmental and school educational programs explaining the negative health implication of these drinks, and the lack of parental educational role regarding energy drink hazards. The study results were also strongly suggestive of the role played by dispensable income in the hands of children as one major contributing factor for energy drink habit.

The major concern point is the exposure of energy drinks from very young ages. Around 40 % of energy drink consumers of study population have tried it before or during primary school and altogether around 70 % of energy drinkers have tried by middle school. These results bring to our notice that energy drinks consumption habit, albeit, is not just very high among the study population but has begun very early too in their lives. In particular, the proportion of students with energy drink consumption habit increased considerably as they age, growing significantly from 54.2 % among the middle schoolers to 65.3 % among the secondary schoolers. We also found that daily usage proportions also increased from 33.6 % among the middle schoolers to 41.8 % among the secondary schoolers. These findings are similar to the other studies which reported increasing prevalence of energy drink consumption among school children in general and a linear trend in usage of energy drinks with increasing age [9,13, 24-26].

Home is the place for both first acquaintance as well as usual consumption place for energy drinks for majority study population. Energy drinks are available in attractive cans which almost look similar to soda or cola cans making it difficult for small children to notice the differences between them. They are also easy for small hands to hold and taste like soda or soft drinks. The presence of energy drinks in easily accessible places at homes and cars therefore is the major route for unintentional exposure for children in KSA. Together with the picture of parents, siblings and friends consuming them everywhere in Saudi Arabia can confuse the young children to mistake energy drinks as safe drinks. The study population seems to be neither aware about the components of energy drinks properly nor have access to reliable sources of knowledge about energy drinks. Only one third of the study population was even aware of major components like caffeine and sugar presence in the energy drinks. They are dependent on their friends and school mates for the knowledge about energy drinks who themselves may have very poor knowledge about the consequences of energy drink consumption over a period of time.

Energy drinks, unlike sport drinks contain caffeine as a major stimulant, besides may also contain a variety of other active ingredients such as taurine, ginseng, guarana, and B vitamins. Sugar is also a major component of many of these drinks. They claim to increase energy, improve performance and even promote weight loss [11, 12] which can all appeal to children. In KSA, energy drinks are marketed with limited regulations which were updated recently [26]. However energy drinks are still easily accessible to children because of their ubiquitous presence in the environments surrounding them. In addition in the wake of today's rush and run life children and adolescents are attracted to energy drinks for staying more active and energized, enjoying the taste, stay awake for a longer time and/ or to improve the physical and mental activities [1, 27, 28]. In the current study also children have quoted similar reasons in variable degrees as reasons for preferring energy drinks. The most common reason cited was for taste (59.6 %) followed by to remain active and energized (14.9 %). Other findings from our study support the premise that a small percentage of students prefer to use energy drinks during examinations and to improve academic performance although there is no published literature supporting energy drinks positive role in boosting academic performance even among young adults [29, 30].

The study results give enough hints to worry about the consequences of possible caffeine consumption in young children by identifying changes in cardiac activity and heart beating, reduced sleeping hours and addiction as major physiological effects reported by energy drink consumers. In addition middle and secondary school stages are part of critical phases of growth and development. Any possible insults on nutrition profile and sleep patterns can irreversibly affect growth and development during these stages. A Previous study by Al Hazzaa and his colleagues [31] suggested energy drinks consumption among Saudi adolescents was positively correlated with screen setting (TV and PC use), eating fast foods, sugar-sweetened beverages, French fries and potato chips, cake and donuts, and sweets. In the present study also around half of the energy drinks consumers preferred to take them during or after meal timings or with fast foods and chocolates which may impact their meal intake or increased calories or both. In addition energy drinks intake during meal timings may replace water and other nutritious drinks. The possible net effects of these behaviors on children's growth and development need to be further explored. However a report by Rush *et al.* [32] need a mention in this context which speculated that the cumulative effects of high intakes of caffeine and table sugar from energy drinks may lead to obesity in young adults.

In general many poor lifestyle behaviors were admitted by the study population. Poor lifestyle behaviors like smoking, sleeping less than 6 hrs, low physical activity and unsafe behaviors (not using safety

belt while driving or driving fast or carrying weapons) were all significantly associated with the habitual use of energy drinks. In a cross sectional study done on college going students, Miller [33] has found similar results indicating frequency of energy drink consumption being positively associated with marijuana use, sexual risk-taking, fighting, seatbelt omission, and taking risks on a dare for the sample as a whole, and associated with smoking, drinking, and alcohol problems. He also hypothesized that "frequent consumption of energy drinks may serve as a useful screening indicator to identify students at risk for substance use and/or other health compromising behaviors". Another recent study echoed similar results in very young adolescents [24].

In our study also we found strong support to the above mentioned hypothesis even in children by doing some additional analyses between high frequency consumers and low frequency consumers (daily *vs*. monthly & weekly; 2 or more cans *vs*. are less than two cans use). These results indicate that high frequency consumers are strongly associated with smoking, irregular sleep, poor breakfast and unsafe behaviors. Although it is difficult to draw a causality relationship using cross sectional studies, a growing body of literature is in support of similar findings [4, 34, 35]. Probably using energy drinks for stimulant properties from very young age may encourage users to seek more stimulant products and behaviors as they age because both smoking and higher usage of cans per day are high among secondary schoolers. In addition secondary schoolers with poor lifestyle choices like not eating breakfast regularly, not practicing physical exercise, and irregular sleep habit were significantly high in proportions as compared to middle schoolers. This would prompt concerns that habitual energy drink consumption may have links with more serious health compromising behaviors in children.

To sum up, in the wake of these alarming results, there is need for further scientific research to identify potential public health effects of energy drinks. Given that children are exposed from early ages to different brands of energy drinks and potential sources of caffeine like chocolates, carbonated beverages, and others, it may be beneficial to focus on actual intake of caffeine through these various sources and their possible effects on health compromising behaviors and physiological effects. Government of KSA needs to further tighten the regulations related to energy drinks making their access difficult to children. Awareness programs highlighting negative health effects of energy drinks are also important at this juncture to motivate children and adolescents against the consumption of energy drinks.

The current study is the first study on the prevalence of energy drink consumption among children in the Northern part of Saudi Arabia. Nevertheless, this study has several limitations, the fore most being a cross-sectional study limiting the causal inference for the findings. Secondly, lack of female subjects and primary school children limited comparative analysis. Further lack of measurement of actual caffeine intake could be a limiting factor in understanding its direct effects on physiological effects and tolerance level in children. Future studies possibly exploring these factors are required.

CONCLUSION

It can be concluded that our hypothesis is right, and energy drinks are consumed in alarmingly high proportions by middle and secondary school children in KSA. Energy drink consumption is associated with many health compromising behaviors among the study population. High disposable income on hands of children is one major determinant affecting the consumption of energy drinks. Home is the primary source for unintentional first exposure for majority study population. Educational and awareness programs should be designed and implemented by government including various stakeholders like schools, parents, media etc. to raise the level of awareness about deleterious health implications of energy drinks in young children.

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