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CONSUMPTION OF ENERGY DRINKS AND THEIR SHORT-TERM HEALTH EFFECTS ON CHILDREN IN IRAQ: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Energy drinks are non-alcoholic beverages that contain more sugar and caffeine, along with many energy-enhancing ingredients. This type of drinks is very popular among Iraqi adolescents although it may cause negative effect on health. **Purpose:** To determine the prevalence of energy drink consumption and its effects on some health aspects among children between the ages of 6 and 15 years. **Methods:** A cross-sectional study was carried out on a random sample of 548 primary and middle school children aged 6–15 years from four main schools in the village of Zuhairat/Diyala Governorate for the period from December 10, 2020, to January 22, 2021. We statistically analyzed the data using SPSS, version 21.0. A binary logistic regression analysis was used for short-term health effects in relation to energy drink consumption; a p-value of 0.05 was used as the lowest limit for statistical significance. **Results:** The study shows that the prevalence of energy drink consumption among children aged 6–15 years was estimated at 20.4%. Significantly, 76.8% of children had energy drinks once a week. Younger children significantly had 62.4% lower odds of daily consuming energy drinks than older children (OR = 0.376, CI: 0.237-0.598, p = 0.000). The majority of children who consumed energy drinks daily significantly had a poorer appetite than those who did not (72.3% vs. 55.3%, p = 0.001), (OR = 0.473; CI: 0.300-0.745). **Conclusion:** Most children who reported consuming energy drinks daily had a significantly poorer appetite and fewer sleep hours than those who did not.

Keywords: energy drinks, dietary pattern, short effects, sleep hours, poor appetite, headache

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INTRODUCTION

Energy drinks are non-alcoholic drinks that contain many substances, the most important of which are sugar and caffeine mixed with several energy-boosting components, such as taurine, some minerals, B complex vitamins, some herbs, and amino acids, which in turn increase calories (Mihaiescu *et al*., 2024). Globally, health authorities recommend that young people during their youth and adolescence avoid drinking beverages that contain high levels of caffeine (>150 mg/L), sugar, and other stimulating ingredients (Visram *et al*., 2016). The American Academy of Pediatrics (AAP) has declared that both children and teens should not include any type of energy drink in their usual daily diets because it contains intoxicating ingredients that are more likely to affect them over time (Morris, 2023). This reveals a knowledge gap regarding the essential ingredients in energy drinks, highlighting their negative health effects on adolescents and children. That is, those who consume them are vulnerable to their effects. The consumption of high-caffeine energy drinks by children and adolescents has been associated with a negative effect on heart health, especially increased cardiac output and hypertension (Wassef *et al*., 2017). Also, other studies have linked prolonged consumption of these drinks with impaired sleep and increased rates of headaches and hyperneurosis (Tomanic *et al*., 2022). In 2018, the United Kingdom banned the sale of energy drinks to teens and children due to high rates of various health complaints (Vogel *et al*., 2022). Nowak *et al*. (2015) found that consuming between 200 and 350 mg of these drinks is three times higher in the amount of caffeine than other beverages, and this may lead to further higher arterial blood pressure levels. From 2006 to 2015, sales of energy drinks in the United Kingdom increased by 185%, resulting in a total consumption of almost 672 million liters (Visram *et al*., 2017). The popularity of these beverages is rising due to the growing availability of markets that provide them for purchase. According to a self-report survey, between 30% and 50% of young adults and adolescents consume energy drinks (Frayon *et al., 2019).* Iraqi societies heavily consume energy drinks, particularly among adolescents, and, to curb this trend, they should restrict or outlaw the marketing of these drinks (Mekkey & Tizkam, 2022).

Based on these results, the priority and urgency of our research lies in urging the visual and audio media to instruct the owners of local shops, markets, and school shops to prevent the sale of energy drinks to children. Several previous studies identified the prevalence, reasons, contributing factors, and possible negative health effects of energy drink consumption in adults and late adolescents. However, there has been limited focus on study of children and young adolescents. This prompted the researcher to conduct a study specifically targeting children aged 6–15 years, as this age group is familiar with the phenomenon of energy drink consumption.

In terms of novelty, this study is unique in that it includes both young children of school age and children at the beginning of adolescence, thereby determining the extent to which daily consumption of energy drinks leads to decreased appetite. Children's consumption of these drinks, if not addressed by parents and health authorities, may lead to increased complaints about health and behavioral problems, which may negatively affect puberty and increase the burden on health authorities in dispensing medications and diagnostic procedures. This study aimed to determine the prevalence of daily energy drink consumption and its effect on some health aspects among children between the ages of 6 and 15 years.

METHOD

Study Design, Population and Sample

A cross-sectional survey of four schools in the village of Zuhairat, Muqdadya district, Diyala governorate, Iraq, included 548 students between the ages of 6 and 15. These students were selected using a multi-stage probability sampling method, where each of these stages is proportional to the sample size, as shown in Figure 1.

Data Analysis

The first phase was conducted through a simple random selection of four public schools: two primary schools (one for boys and one for girls), and two middle schools (one for boys and one for girls). The second stage was conducted through a simple random selection

of classes in each grade (levels I to VI) for primary schools and (I and III) for middle schools. For the third stage, data was collected from the students via a simple random sample using a questionnaire that included several questions. All these measures were implemented after the approval of the school administration concerned for the period from December 10, 2020, to January 22, 2021. The research topic was questioned and inquired about to determine the relevant literature through PubMed, Google Scholar, and ResearchGate to obtain a comprehensive questionnaire, which was presented to five experts with competence to indicate its validity for study, taking into account the observations advised by them. This questionnaire contained three sections, including:

Sociodemographic Information

This section consists of two questions, one for the age and the other for the sex of the child. The question of age is open-ended, provided that it falls within the specified age group of 6 to 15 years, while the answer to the question of gender is closed as either male or female.

Daily Energy Drink Consumption and Frequency

Energy drinks are defined as liquid with a stimulating effect, typically containing caffeine, taurine, vitamins, and other nutrients, sold in various markets and shops, and packaged in different colors and volumes. This study assesses the extent to which energy drinks are used and their frequency daily, or whether they are used or not, as determined through two questions. The first concerns the consumption of energy drinks daily in the past one week, and the answer is closed, i.e., either yes or no. The second question concerns the frequency of consumption of energy drinks per day, with a single answer (once, twice, or more than twice).

Self-Reported Health Effects

This section consists of questions related to health effects occurring in the past week, including headaches, urine burning sensations, low appetite, and sleep insufficiency. The answer to these questions is either yes or no. The questionnaire was pre-tested through a pilot project conducted on 11 students (excluded from the study), and the reliability of the questionnaire was tested by Cronbach's alpha, which was estimated at .871. The study included children ranging in age from 6 to 15 who were attending primary or middle school and excluded any child under 6 years or over 15 years and those with a previous history of chronic diseases like diabetes, cystic fibrosis, asthma, congenital heart disease, and depression after looking at their school records. After completing the data collection, it was statistically analyzed using SPSS for Windows, version 21.0 (Armonk, New York: IBM Corp.). To analyze these data, we used odd ratios to determine potential age or sex differences in the likelihood of daily energy drink consumption. We also applied binary logistic regression analysis to determine the relationship between the consumption of energy drinks and the health effects, including headaches, burning urine, poor appetite, and lack of sleep, which are categorized as 0 for exposed and 1 for non-exposed as dependent variables. No exposure to these health effects was adopted as a reference category, and for each non-reference pathway for these health effects, the Wald test was used. To quantify the change in the odds, we used the following formula:

Change in Odds %: (OR-1) * 100

We used a p-value of 0.05 as the lowest limit for the level of statistical significance to determine the association between daily consumption of energy drinks and certain health problems.

Ethical Clearance

The author considered ethical issues (plagiarism, informed consent, misconduct, fabrication or falsification of data, double publishing, etc.). This study was conducted after obtaining oral approval from all school directors in accordance with the Helsinki guidelines. The researcher was unable to obtain a numbered letter from the concerned authorities due to the imposition of strict measures during the period of the coronavirus pandemic in Diyala Governorate. The questionnaire did not include any identifying information, such as the participant's name, home address, phone number, or social security number.

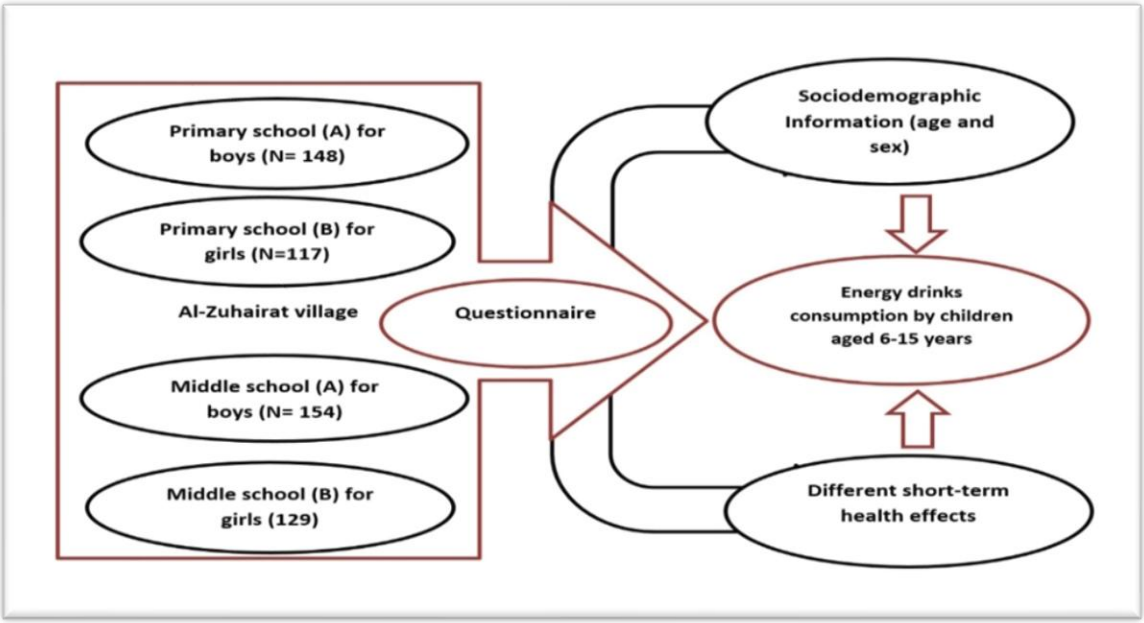

Figure 1. The number of students chosen from each school and technique of data collection through a questionnaire.

RESULT

The study sample, which comprises 548 children, shows that children aged 11–15 years old make up the highest percentage (53.8%), while younger children (6–10 years old) make up the lowest percentage.

Table 1. Sociodemographic characteristics, energy drink usage, and daily frequency

Groups	Variables	Freq.	%
Ages/years	6-10 years	253	46.2
	11-15 years	295	53.8
	Total	548	100.0
Sex	Males	302	55.1
	Females	246	44.9
	Total	548	100.0
Consumption of energy drinks daily in the past 7 days	Not consumed	436	79.6
	Consumed	112	20.4
	Total	548	100.0
Frequency of energy drinks per day in the past 7 days (non-consumers are excluded)	Once	86	76.8
	Twice	17	15.2
	Three and more	9	8.0
	Total	112	100

Approximately 20.4% of children between the ages of 6 and 15 took energy drinks. Out of all the children who consumed energy drinks, 76.8% drank them once a day in the preceding week, as shown in Table 1. In the current study, the proportion of energy drink consumption increased significantly among children aged 11-15 years compared with children aged 6-10 years (65.2% vs. 34.8%, p = 0.000); this indicates that younger children had 62.4% lower odds of daily consuming energy drinks than older children (OR = 0.376; CI: 0.237 - 0.598). The proportion of energy drink consumption may be almost identical between males and females (50.9% vs. 49.1%, p = 0.339), respectively. Males had 23.8% higher odds of daily energy drink consumption than females (OR = 1.238; CI: 0.817- 1.876) (Table 2).

Table 2. Distribution of daily energy drink consumption based on age and gender with proportions and odd ratios

Groups	Variables	Energy drinks consumption				Chi-square	P-value	Odd Ratios	95% CI
		Consumed		Not consumed					
		Freq.	%	Freq.	%				
Ages /years	6-10 years	39	34.8	214	49.1	7.292	0.000	0.376	0.237-0.598
	11-15 years	73	65.2	222	50.9				
	Total	112	100	436	100				
	Reference	11-15 years							
Sex	Males	57	50.9	245	56.2	1.012	0.315	1.238	.817- 1.876
	Females	55	49.1	191	43.8				
	Total	112	100	436	100				
	Reference	Males							

Table 3 comprises statements pertaining to the health, dietary, and sleep patterns that were documented two weeks prior to the child or mother being surveyed about their daily intake of energy drinks. The data shown in this table indicate that there was a statistically significant difference in the occurrence of headaches between children who consumed energy drinks and those who did not consume them (58.0% vs. 39.7%), This indicates that the odds of experiencing headaches in those who did not consume energy drinks were 52% lower than in those who consumed them (p = <.001) (OR = 0.476; CI: 0.312- 0.725).

The study found that there was a similar rate of urine burning sensation in children who took energy drinks daily and those who did not (36.6% vs. 35.8%); this means that a child who did not drink energy drinks daily for a week experiences a 3.5% lower odds in urine burning sensation compared to a child who did (p=0.871) (OR = 0.965; CI: 0.627 - 1.485). Furthermore, the study did not identify a significant statistical difference between the two groups. (p= 0.871). In terms of the child's poor appetite, a majority of children who consumed energy drinks daily showed a significant decrease in appetite, in contrast to children who did not consume those (72.3% vs. 55.3%); this means that a child who didn't drink energy drinks daily for a week experiences 52.7% lower odds of poor appetite compared to a child who did. (OR = 0.473; CI: 0.300-0.745) (Table 3)

The study shows that the majority of children who regularly took energy drinks indicated a significant decrease in their sleep duration (less than 8 hours per night) compared to children who did not consume them (59.8% vs. 33.3%); this means that children who did not drink energy drinks daily for a week experienced 66.5% lower odds in lack of sleep hours compared to a child who did (OR =.335; CI: 0.218-0.513).

Table 3. Binary logistic regression analysis for short- term health effects in relation to energy drink consumption

Health effects reported in the past days	Variables	Energy drinks consumption				Wald test	p-value	Odd ratio (OR)	95% CI
		Consumed		Not consumed					
		Freq.	%	Freq.	%				
Headaches	Exposed	65	58.0	173	39.7	11.941	0.001	0.476	0.312- 0.725
	Non-exposed	47	42.0	263	60.3				
	Total	112	100	436	100				
	Reference = exposed to headache								
Urine burning sensation	Exposed	41	36.6	156	35.8	0.026	0.871	0.965	0.627 - 1.485
	Non-exposed	71	63.4	280	64.2				
	Total	112	100	436	100				
	Reference = exposed to urine burning								

Continuation of Table 3. Binary logistic regression analysis for short- term health effects in relation to energy drink consumption

Health effects reported in the past days	Variables	Energy drinks consumption				Wald test	p-value	Odd ratio (OR)	95% CI
		Consumed		Not consumed					
		Freq.	%	Freq.	%				
Poor appetite	Exposed	81	72.3	241	55.3	10.402	0.001	0.473	0.300-0.745
	Non-exposed	31	27.7	195	44.7				
	Total	112	100	436	100				
	Reference = exposed to poor appetite								
Sleep duration at night is less than 8 hours	Exposed	67	59.8	145	33.3	25.235	0.000	0.335	0.218-0.513
	Non-exposed	45	40.2	291	66.7				
	Total	112	100	436	100				
	Reference = exposed to lack of sleep hours								

DISCUSSION

Several investigations have established a link between the use of energy drinks and common health problems such as stomachaches, headaches, and sleep difficulties (Subaiea *et al*., 2019; Tóth *et al*., 2020; Mekkey & Tizkam, 2022). Many researchers involve sociodemographic factors, including age and sex, in relation to different health issues or events, and this study revealed that half of the children (53.8%) were between the ages of 11 and 15 years, with older children representing the largest number in the schools involved in the study. The majority of the participating children (55%) were male, which aligns with findings from prior studies (Yalçın *et al*., 2021; Ajibo *et al*., 2024). In the present study, the prevalence of energy drink consumption by children aged 6–15 is 20.4%. Studies have reported that between 12% and 35% of children and young adults consume EDs at least once per week (Puupponen *et al*., 2021; Trapp *et al*., 2020; Girán *et al*., 2023; Ajibo *et al*., 2024).

The most common reasons why children consume energy drinks may be the company of older friends, curiosity, energy enhancement, and advertising media (Subaiea *et al*., 2019). In this study, 76.8% of children significantly reported drinking energy drinks once in the last week, which is comparable to a study in Lubumbashi, the Democratic Republic of Congo, where 63% of participants reported consuming them at least once (Kuhangana *et al*., 2021). Children in this study consumed fewer energy drinks compared to Saudi Arabia (Subaiea *et al*., 2019) and Turkey (Yalçın *et al*., 2021). In this study, the proportion of energy drink consumption increased significantly among children aged 11–15 (65.2%), and this may help future studies shed light on addressing unhealthy behavior among schoolchildren in Iraq. In comparison, several studies in different settings have revealed high rates of energy drink consumption, especially among young people (Veselska *et al*., 2021; Yalçın *et al*., 2021; Aonso Diego *et al*., 2023). As for the statistical association of consumption of these drinks with the child's age, this study revealed that older children are significantly more consuming; this statistically significant association was reported by another study (Brunborg *et al*., 2022).

This study found that the proportion of energy drink consumption between boys and girls is identically similar, with no significant difference. This agrees with previous studies (Kuhangana *et al*., 2021; Pavlovic *et al*., 2023). This means that sex does not determine a child's or adolescent's habit of drinking energy drinks. This study showed that headaches are associated with energy drinks consumption daily, and the reason is that caffeine (in the form of methylxanthine) constricts the blood vessels surrounding the brain. This finding is consistent with other studies (Khouja *et al*., 2022; Li *et al*., 2023).

Poor appetite is a common symptom in children (Derks *et al*., 2024); numerous reviews have shown that drinking CEDs with

friends, family, during exams, or at parties suppresses appetite (Khouja *et al*., 2022). The results revealed that 72.3% of children suffered significantly from poor appetite due to energy drink consumption. Nadeem *et al*. (2020) showed that there was consistent evidence of associations between energy drink consumption and poor appetite.

Any lack of sleep hours and regularity may affect its quality and schedule, negatively affecting children's physical health, cognitive ability, social and emotional processes, and behavioral performance, all of which can affect the child's normal growth and development (Liu *et al*., 2022). However, most of the children in this study who consumed energy drinks daily reported significantly fewer sleep hours. Other studies (Kaldenbach *et al*., 2022; Tomanic *et al*., 2022) have found that adolescents who drank energy drinks significantly reported fewer sleep hours. As mentioned, energy drinks contain caffeine in the form of methylxanthine, which is known for its central nervous system stimulant effect, and this may increase alertness and reduce sleep hours, thus disturbing sleep in the child (Mwape & Mulenga, 2019).

This study did not report a statistically significant difference ($p = \geq 0.05$) between energy drink consumption by children and the burning sensation of urine. The short period of time for consuming energy drinks, which was only one - week when the child was questioned, may be the most likely reason why consumption does not affect the nature of urine, and the effect may require a longer period of consumption.

This study employed a multi-stage random sampling design and included quite a large number of samples. However, cross sectional design of this study limits causal effect inference.

CONCLUSION

The prevalence of energy drink consumption among children aged 6–15 years is estimated at 20.4%. Most of them consume these drinks once a day; older children are more frequent consumers. Daily consumption over a whole week is significantly associated with headaches, decreased appetite, and fewer hours of sleep compared to children who did not consume them.

SUGGESTION

The author recommends parents to follow up on the child's daily purchase of drinks and replace energy drinks with healthy alternatives. It also recommends the health authorities conduct awareness campaigns toward this topic. As for future studies, it is recommended to investigate the extent to which the consumption of energy drinks affects school performance and physical activity of the school-age child.

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CONFLICT OF INTEREST

The author declares there is no conflict of interest.

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AUTHOR CONTRIBUTION

The author performed data collection and did formal analysis, research handling, resource management, visualization, original draft composition, review, and editing, while a qualified statistician carried out statistical analysis and methodological assessment.

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