



Original article

Impact of energy drink consumption on pattern and quality of sleep among students in Libyan International Medical University

Nouha E. El-Shintiri^{1*}, Adel Elsharksi², Iman E. Mohamed¹, Ali A. Elmabsout³, Sondos F. Elathram⁴, Mohamed A. Aldressi⁴ and Noor H. Aboshawesh⁴

¹Department of Pharmacology and Toxicology, Faculty of Pharmacy, ²Department of Statistics, Faculty of Sciences, ³Department of Nutrition, Faculty of Public Health, University of Benghazi, Benghazi and ⁴Faculty of Pharmacy, Libyan International Medical University, Benghazi, Libya

*Author to whom correspondence should be addressed

Received: 12-07-2022, Revised: 15-08-2022, Accepted: 22-08-2022, Published: 30-09-2022

Copyright © 2022 El-Shintiri et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

HOW TO CITE THIS

El-Shintiri et al. (2022) Impact of energy drink consumption on pattern and quality of sleep among students in Libyan International Medical University. *Mediterr J Pharm Pharm Sci.* 2 (3): 24 - 30. <https://doi.org/10.5281/zenodo.7115154>

Keywords: Energy drink, Libya, sleep pattern, sleep quality, University student

Abstract: Consumption of energy drinks was significantly associated with sleep problems, which are progressively used regardless of negative health effects particularly among adolescents and young adults. The goal of this study is to examine the relationship between energy drinks and sleep patterns on college students by more than one parameter. Target number of students was taken to be 1 000 participants and the study reached 434 participants were invited via self-administered questionnaire at Libyan International Medical University students during 2020 and 2021 in all levels which consisted of 20 questions and the main measurements are dependency, negative effect of energy drink and effect of energy drink on sleep. The results showed that the consumption prevalence rate of energy drinks amongst participants is 59.4%. The majority of participants enrolled in this study are male (52.5%) and 47.5% were female students. In conclusion: energy drinks consumption is a risk factor of poor sleep quality between Libyan International Medical University students. An awareness must be increased about energy drinks consumption to confirm the relation to sleep quality and general health.

Introduction

The first energy drinks (EDs) appeared in Europe and Asia and then in the USA. Consumption of EDs has consequently been increased in the world. For instance, the universal consumption of these type of drinks increased by 17% in 2006 compared to the previous year [1, 2]. Sleep is one of the factors associated with a person's health and according to the American Psychological Association, the recommended amount of sleep for an adult is 7 - 8 hours per day [3]. EDs differ from sport drinks,

most of them contain similar ingredients including water, sugar, caffeine, non-nutritive stimulants (guarana, ginseng, yerba mate, taurine, l-carnitine, d-glucunolactone and inositol) and certain vitamins and minerals (B vitamins) [4, 5]. Producers of EDs claim that these beverages contain natural ingredients that expand fatigue and improve mental alertness, in contrast with sports or isotonic drinks which are intended to help athletes rehydrate after exercise. However, there are implicit claims that

EDs promote a more active and healthy life-style [6].

Nowadays, EDs consumption are increasingly used despite growing evidence of their negative health effects particularly among adolescents and young adults [3, 7]. When people drinking three or more ED during a day has more chance to report sleeping less than four hours a night and more likely to report sleep disruption related to stress and illness on average than individual taking two drinks or less during a day [8]. Hershner and Chervin establish that poor sleep quality can be caused by sleep disorders, use of technology before sleeping, consumption of alcohol, EDs and use of stimulants [9]. This can adversely affect student's academics, as irregular sleep patterns have been shown to have negative impact on learning and memory. Moreover, consumption of EDs increases sleep latency and the effects of EDs can persist for up to eight hours that can lead to sleepless [9]. Long-term consumption of EDs are had risks negative health affect that include reduced sleep duration and sleep quality which manifested by increased wake time after sleep onset and decreased the proportion of deep sleep [10]. Accordingly, there is a need for suitable public health prevention and intervention for ED consumers which can make informed choices when indulging in these health behaviors [11].

There is a high risk for several problems when young child and adolescents take high ED consumption as high stress, low school performance and suicide attempts [12]. Even though EDs are targeted to young adult consumers who are into sports and other activities. EDs is one of the most common substances used by athletes due to its role in increasing ergogenic effect [13]. EDs also contain moderate concentration of carbohydrates and lack of electrolytes, they are also habitually consumed before exercise [14]. Indeed, carbohydrate sources in EDs, glucose and sucrose, in the beverages supply the substrates needed for physiological energy. Adolescents who consume EDs are likely to smoke, use alcohol and illicit drugs [15, 16]. About half of U.S young adults and one third of minor teens are consuming caffeinated EDs [17]. In UK, sales of EDs have raised from 235

to 600 million which the leading brands' shares Red Bull (25.0%), Own Label (12.0%) and Monster (10.0%) [18, 19]. Several studies have been carried out on the consumption of EDs among university students. ED consumption among university students in USA estimate over 50.0% consumed over one ED per month with 67.0% citing inadequate sleep [20]. Also, consumption of EDs is quite common among university students in Turkey and most of them were not aware of the effects or ingredients of EDs [21].

Nevertheless, ED consumption is a common drinking behavior among university students in an urban setting in Lebanon, particularly in males [22]. Although, there is no much published data on ED consumption among university students in Africa. Thus, one study evaluated the consumption of EDs among students in Ghana but it considered only those who were athletes. Further, the study did not explore the effects of EDs on sleep quality [23]. In Ethiopia, the consumption of EDs was associated with poor sleep quality. As much as 50.0% of the students had poor sleep quality. However, the poor sleep quality as factors such as cigarette smoking and that use were cited and not exclusively due to EDs consumption [24]. In Saudi college and university, consumption of EDs has been used at higher rate, specifically during examinations or presentations that has marketed aggressively from the last two decades [25]. Studies have established that poor sleep quality caused by psychosocial stressors, according to inadequate sleep leads to judgment impairment, agitation, irritability and even increased mortality and significantly prolong QTc interval and associated with rise of blood pressure [12, 26, 27]. Most of the drivers had poor knowledge of the potential health problems linked with the consumption of EDs [28]. Thus, the study was aimed to analyze the outcome of EDs consumption on sleep pattern and quality among university students in Libyan International Medical University in Benghazi.

Materials and methods

This is a descriptive cross sectional study and was carried out at Libyan International Medical University (LIMU) in Benghazi, Libya by undergraduate self-reported students. Data were collected to help analyzers of survey measures. The target period was for three months from December, 2020 to February, 2021. Public announcement was made online for all the students and the target number was 1 000 participants. The response rate of the study reached 434 participants (43.4%). The sample of convince is made non-randomly. Data were collected via self-administered questionnaire which consisted of 20 questions included, 15 questions are multiple choices (MCQs) and the rest was open written questions. Selected questions included gender, academic year, smoking state, sport level, chronic disease, level and kind of ED use, reason for use ED, knowledge about EDs, quality of sleep, quality of health, dependency and negative effect of ED. Open written questions included age, drug used to help in sleep, effect of ED on sleep and content of EDs. This research project being conducted by informed consent. Participants were free to refuse or withdraw from the study. The participation in this research study is voluntary and there is no harm physically and/or psychological. Confidently was confirm that no information about the participants was exposed to anyone who was not part of the research team. This observational study was approved by the research ethics committee of Libyan International Medical University (4-G-00001 Certificate Reference Number: PHR-2022-00002 issued by LIMU).

Statistical analysis: data were presented as frequency and percentage as a descriptive statistics by using SPSS software version (21).

Results

General demographic information of the study population: The majority of participant were between 20 and 23 years old, while minority of participant are between 28 and 40 years old because the average of students in LIMU at young aged. The study showed that number of male 228 while number of female are 206, **Table 1**.

In **Table 1**, most of students responded to survey are from Faculty of Pharmacy (27.4%) while minor one is business administration (08.3%). The distribution of participant according to the years of study showed that most of participants from first year (39.6%) while rest (just three) of the participants from internship year. The greater number of participants are non-smoker (83.9%) while the smaller number of participants are former smoker (05.5%). According to sport level of students, the majority of the participants are occasionally did sport (73.5%) while minority of the participants are did not do sport (10.1%). The higher of participants did not had any chronic disease (88.7%) while the lower of participants (two of them) had diabetes type (one and two). Most of participants did not take any medications help to sleep (94.9%) while rest of the participants are take medications help to sleep (05.1%).

Table 1: General demographic information of the Libyan Participants

Characteristics of participants		Frequency	Percentage
Age frequency	16-19	194	44.7%
	20-23	212	48.8%
	24-27	022	05.1%
	28-40	006	01.4%
Gender	Male	228	52.5%
	Female	206	47.5%
Faculty categories	AMS	056	12.9%
	IT	059	13.6%
	Pharmacy	119	27.4%
	Business Administration	036	08.3%
	Dentistry	064	14.7%
	Medicine	100	23.0%

Year of study	First year	172	39.6%
	Second year	068	15.7%
	Third year	102	23.5%
	Fourth year	059	13.6%
	Fifth year	020	04.6%
Smoking state	Internship year	013	03.0%
	Non-smoker	364	83.9%
	Smoker	046	10.6%
Sport level	Former smoker	024	05.5%
	Occasionally	319	73.5%
	Non	044	10.1%
Chronic disease	Every day	071	16.4%
	Heart disease	003	00.7%
	Diabetes T1	002	00.5%
	Diabetes T2	002	00.5%
	Hypertension	006	01.4%
	Other disease	036	08.3%
	Don't have	385	88.7%
Take medications help to sleep	Yes	022	05.1%
	No	412	94.9%

Table 2: Assessment evaluation of Libyan university students for energy drinks

Assessment		Frequency	Percentage
Are you consumed energy drinks	Yes	258	59.4%
	No	176	40.6%
How much ED are consumed	Daily	096	22.1%
	Monthly	093	21.4%
	At examination period	107	24.7%
Why you take energy drinks	Stay awake	137	31.6%
	Improve performance	135	31.1%
	Improve memory	036	08.3%
	Mood improvement Increase focus	041 085	09.4% 19.6%
Can you quit energy drinks	Yes	385	88.7%
	No	049	11.3%
Are you aware of the harms of ED	Yes	332	76.5%
	No	102	23.5%
Which type of ED are you consuming	Boom Boom	190	43.7%
	Monster	007	01.6%
	Red Bull	141	32.6%
	More than one type	096	22.1%
Do you think that consuming energy drinks causes difficulty sleeping	Probably	169	38.9%
	Yes	174	40.1%
	No	091	21.0%

Assessment evaluation of energy drinks parameters: The majority of the participants consume ED (59.4%), while the rest of the participants are not (40.6%) **Table 2**. The extent of consumption of EDS most of participants take ED at examination period (24.7%) while a little of participants approximately consume ED monthly and daily (21.4%). Furthermore, most of the participants taken EDs to stay awake (31.6%) while smaller of participants consume ED to improve their memory (08.3%). In addition, the majority of participants can quit EDs (88.7%). The higher of participants are aware of harms of EDs (76.5%). The majority of participants are consume Boom Boom (23.3%) while the rest of them consume Monster (01.6%).

Discussion

In this study, the main purpose of this study was to determine the outcome EDs consumption and their effects on sleep quality among undergraduate students at University Faculties. The prevalence rate of ED consumption was medium (59.4%) compared to consistent with the findings in similar study in Copperbelt University School of Medicine in Zambia [15] where the incidence of EDs was a slightly above 27.0%. This may be because most students in Libyan university think that the consumption of EDs to improve the performance and stay awake. A total number of participant students reached are 434.

According to **Table 1**, when compare the prevalence age of consumption in Libyan university students result that the majority of participants were between 20 and 23 years-old. These because the average of students at young aged. Number of male and female participants are approximately similar, the percentage of males is 52.5% while female is 47.5%. This due to Libyan university male and female students have both capability to share in the studies. Faculty of Pharmacy students most responded to survey and the distribution of participant according to the years of study showed that most of participants from first year [29]. This because the Faculty of Pharmacy students and first year students had more excited

and desired for sharing in this study. The majority of participants are occasionally did sport may be because EDs enhance the performance during exercise which is according to similar study demonstrated that pre-exercise ingestion of an ED did improve endurance performance on 12 professional cyclists from both genders. The higher of participants did not had any chronic disease while the lower of participants (two) had diabetes type (one and two). This is may be due to Libyan University students not heavily consume ED. In comparing with similar studies showed that some individuals are genetically susceptible to the effects of EDs, resulting in arrhythmias or it may be the actual acute ingestion of EDs putting the patient at risk of arrhythmias [30] and her strongest risk factor about kidney disease was her daily consumption of large amounts of EDs [31]. Most of participants did not take any medications help to sleep (94.9%). This is may be because the majority of students take ED at examination period to stay awake and improve their performance, therefore, they did not need medications to help them sleep.

According to **Table 2**, when asked about consume of EDs, a lot of participants consume ED (59.4%). And when asked about the extent of their consumption of energy drinks most of participants take ED at examination period (24.7%). This may be to make them more active mentally and physically and stay awake during examination period. Furthermore, participants were asked about the reason of taken EDs, the greater of participants consume ED to stay awake (31.6%). Hence, when asked the participants if can quit ED, the majority of them say can quit EDs (88.7%). While participants asked about awareness of harms of EDs the greater of them were aware of harms effects (76.5%). This indicates that the majority students have sufficient awareness and knowledge of the dangers side effect energy drinks consuming. When asked participants about which type of ED are consumed, most of them consume Boom Boom (23.3%) while the rest of them take Monster (01.6%). This is possible because the Boom Boom is the most popular in the University students. In comparing with the previous study carried out at Peruvian college students [29], which report that

the majority of the participants have a poor sleep quality (55.0%) while the present findings showed a poor sleep quality among Libyan University students.

Thus, 40.0% had difficulty of sleeping and 40.0% had difficulty of sleeping associated with ED consumption. However, this study did not assess other factors that can affect sleep quality and patterns such as alcohol intake, smoking and stimulants use.

Conclusion: consumption rate of EDs among Libyan University students is high. Poor sleep quality among is high and associated with ED consumption. High consumption of EDs to stay awake and improve memory is concluded. Poor sleep quality reported factors with high consumption of EDs and have shown positive and negative behavioral, cognitive and health effects depending on amount intake. The effects can be avoided by education program and promotion of the daily intake of EDs among the college students.

Acknowledgments: The authors would like to thank all the participants for their support of this study. Special thanks to IT employees for put our questionnaire on LIMU model.

Data availability statement: The raw data that support the findings of this article are available from the corresponding author upon reasonable request.

Author contributions: SFE, MAA & NHA collected data and contributed in analysis of data with drafting the manuscript. MA, NES & AE contributed to the conception, compilation of data and drafting the manuscript. AE performed the analysis and interpretation of data. All authors approved the final version of the manuscript and agreed to be accountable for its contents.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethical issues: Including plagiarism, informed consent, data fabrication or falsification and double publication or submission have completely been observed by authors.

Author declarations: The authors confirm that all relevant ethical guidelines have been followed and any necessary IRB and/or ethics committee approvals have been obtained.

References

1. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, Dinges DF, Gangwisch J, Grandner MA, Kushida C, Malhotra RK, Martin JL, Patel SR, Quan SF, Tasali E (2015) Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Sleep*. 38 (6): 843-844. doi: 10.5665/sleep.4716.
2. Muñoz VC, Rovira MU, Ibañez VV, Domínguez JMM, Blanco GR, Rovira MU, Toran P (2020) Consumo de bebidas refrescantes , deportivas y energéticas en adolescentes. *Estudio BEENIS. Anales de Pediatría*. 93 (4): 242-250. doi.org/10.1016/j.anpedi.2020.01.004.
3. De Sanctis V, Soliman N, Soliman AT, Elsedjy H, Di Maio S, EL Kholy M, Fiscina B (2017) Caffeinated energy drink consumption among adolescents and potential health consequences associated with their use: A significant public health hazard. *Acta Biomedica*. 88 (2): 222-231. doi: 10.23750/abm.v88i2.6664.
4. Centers for Disease Control and Prevention (2011) Quitting smoking among adults - United States , 2001 - 2010. *Morbidity and Mortality Weekly Report*. 60 (44): 1513-1519. doi: 10.1016/s0025-7125(16)30362-5.
5. Fernandes L, Mokwena K, Ntuli B (2020) Case report on energy drink consumption among Health Sciences University students in Gauteng Province, South Africa. *Public Health Reviews*. 41 (9): 1-11. doi: 10.1186/s40985-020-00129-2.
6. Goodhew CA, Perry TL, Rehrer NJ (2020) Factors influencing energy drink consumption in participants and viewers of extreme sports. *Journal of Nutrition and Metabolism*. Article ID: 9382521. doi: 10.1155/2020/9382521.
7. Ruiz LD, Scherr RE (2018) Risk of energy drink consumption to adolescent health. *American Journal of Lifestyle Medicine*. 13 (1): 22-25. doi: 10.1177/1559827618803069.
8. Visram S, Cheetham M, Riby DM, Crossley SJ, Lake AA (2016) Consumption of energy drinks by children and young people: A rapid review examining evidence of physical effects and consumer attitudes. *British Medical Journal Open*. 6 (10): 1-23. e010380. doi: 10.1136/bmjopen-2015-010380.
9. Hershner SD, Chervin RD (2014) Causes and consequences of sleepiness among college students. *Nature and Science of Sleep*. 6: 73-84. doi: 10.2147/NSS.S62907.

10. Kim SY, Sim S, Choi HG (2017) High stress, lack of sleep, low school performance, and suicide attempts are associated with high energy drink intake in adolescents. *PLoS one*. 12 (11): 1-12. e0187759. doi: 10.1371/journal.pone.0187759.
11. Jiménez SL, Díaz-Lara J, Pareja-Galeano H, Del Coso J (2021) Caffeinated drinks and physical performance in sport: A systematic review. *Nutrients*. 13 (9): 1-18. doi: 10.3390/nu13092944.
12. Mwape RK, Mulenga D (2019) Consumption of energy drinks and their effects on sleep quality among students at the copperbelt university school of medicine in Zambia. *Sleep Disorders*. 2019: 1-7. ID: 3434507. doi: 10.1155/2019/3434507.
13. Sampasa-kanyinga H, Masengo L, Hamilton HA, Chaput J (2020) Energy drink consumption and substance use among middle and high school students. *International Journal of Environmental Research and Public Health*. 17 (9): 3110. doi: 10.3390/ijerph17093110.
14. Miller KE, Derman KH, Lucke JF (2018) Caffeinated energy drink use by u.s. adolescents aged 13-17: A national profile. *Psychology of Addictive Behaviours*. 32 (6): 647-659. doi: 10.1037/adb0000389.
15. Hashem KM, He FJ, Macgregor GA (2017) Cross-sectional surveys of the amount of sugar, energy and caffeine in sugar-sweetened drinks marketed and consumed as energy drinks in the UK between 2015 and 2017: Monitoring reformulation progress. *British Medical Journal Open*. 7 (12): 1-8. doi: 10.1136/bmjopen-2017-018136.
16. Marriott BP, Hunt KJ, Malek AM, Newman JC (2019) Trends in intake of energy and total sugar from sugar-sweetened beverages in the United States among children and adults, NHANES 2003-2016. *Nutrients*. 11 (9): 2004. doi: 10.3390/nu11092004.
17. Malinauskas BM, Aeby VG, Overton RF, Carpenter-Aeby T, Barber-Heidal K (2007) A survey of energy drink consumption patterns among college students. *Nutrition Journal*. 6 (35): 1-7. doi: 10.1186/1475-2891-6-35.
18. Borlu A, Oral B, Gunay O (2019) Consumption of energy drinks among turkish university students and its health hazards. *Pakistan Journal of Medical Sciences*. 35 (2): 537-542. doi: 10.12669/pjms.35.2.638.
19. Ghozayel M, Ghaddar A, Farhat G, Nasreddine L, Kara J, Jomaa L (2020) Energy drinks consumption and perceptions among University Students in Beirut, Lebanon: A mixed methods approach. *PLoS one*. 15 (4): 1-21. e0232199. doi: doi.org/10.1371/journal.pone.0232199.
20. Buxton C, Hagan JE (2012) A survey of energy drinks consumption practices among student -athletes in Ghana: lessons for developing health education intervention programmes. *Journal of International Society of Sports Nutrition*. 9 (9): 1-8. doi: 10.1186/1550-2783-9-9.
21. Lemma S, Patel SV, Tarekegn YA, Tadesse MG, Berhane Y, Gelaye B, Williams MA (2012) The epidemiology of sleep quality, sleep patterns, consumption of caffeinated beverages, and Khat use among Ethiopian college students. *Sleep Disorders*. 2012: 1-11. ID 583510. doi: 10.1155/2012/583510.
22. Rahamathulla MP (2017) Prevalence, side effects and awareness about energy drinks among the female university students in Saudi Arabia. *Pakistan Journal of Medical Sciences*. 33 (2): 347-352. doi: 10.12669/pjms.332.12084.
23. Pressure B, Randomized PA, Shah SA, Szeto AH, Farewell R, Shek A, et al. (2019) Impact of high volume energy drink consumption on electrocardiographic and blood pressure parameters: A randomized trial. *Journal of the American Heart Association*. 8 (11): e011318. doi: 10.1161/jaha.118.011318.
24. Fletcher EA, Lacey CS, Aaron M, Kolasa M, Occiano A, Shah SA (2017) Randomized controlled trial of high-volume energy drink versus caffeine consumption on ecg and hemodynamic parameters. *Journal of the American Heart Association*: 6 (5): 1-8. e004448. doi: 10.1161/jaha.116.004448.
25. Saku EY, Nuro-Ameyaw P, Amenya PC, Kpodo FM, Esua-Amofo P, Kortei NK (2020) Energy drink: the consumption prevalence, and awareness of its potential health implications among commercial drivers in the Ho municipality of Ghana. *BMC Public Health*. 20 (1): 1-13. 1304. doi: 10.1186/s12889-020-09421-x.
26. Al-Fares MN, Alsunni AA, Majeed F, Badar A (2015) Effect of energy drink intake before exercise on indices of physical performance in untrained females. *Saudi Medical Journal*. 36 (5): 580-586. doi: 10.15537/smj.2015.5.11141.
27. Mangi MA, Rehman H, Rafique M, Illovsy M (2017) Energy drinks and the risk of cardiovascular disease: A review of current literature. *Cureus*. 9 (6): e1322. doi: 10.7759/cureus.1322.
28. Al Yacoub R, Luczkiewicz D, Kerr C (2020) Acute kidney injury and hepatitis associated with energy drink consumption: A case report. *Journal of Medical Case Reports*. 14 (1): 1-4. 23. doi: 10.1186/s13256-019-2340-0.
29. Sanchez SE, Martinez C, Oriol RA, Yanez D, Castañeda B, Sanchez E, Gelaye B, Williams MA (2013) Sleep quality, sleep patterns and consumption of energy drinks and other caffeinated beverages among Peruvian college students. *Health (Irvine Calif)*. 5 (8B): 26-35. doi: 10.4236/health.2013.58A2005.