

## Effect of energy drinks on the mental health of adolescents and young people: Systematic review

## Efecto de las bebidas energéticas en la salud mental de adolescentes y jóvenes: Revisión sistemática

## Efeito das bebidas energéticas na saúde mental de adolescentes e jovens: Revisão sistemática

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## Abstract

**Introduction:** The nursing area should perform a comprehensive assessment of adolescents and young people to be able to have an early intervention in the risk habits of this part of the population. **Objective:** Know how the consumption of energy drinks affects the mental health of adolescents and young adults. **Methodology:** Systematic review using selected reports for systematic reviews and PRISMA meta-analysis, searching Web Of Science, Medline, Scopus and Pubmed databases with descriptors such as energy drinks, mental health, young adult and adolescent. The inclusion criteria included articles published between 2017 and 2022, in Spanish, English or Portuguese, in the population aged 13 to 25, excluding secondary research, editorials, letters to the editor and expert opinions, not available in full text. Identifying 372 articles, leaving a sample of 10 for analysis and methodological evaluation using CASPe guidelines. Data used were duly referenced, respecting and identifying their authors. **Results:** The majority were studies using cross-sectional design. Frequent consumption of energy drinks increased levels of anxiety, depression, aggression and suicidal risk, with male adolescents being more affected. **Conclusions:** Although there was evidence of a relationship between energy drink consumption and mental health risks, most of the research used cross-sectional designs, so it was not possible to determine causality or direction of effect. In order to study the effect of energy drink consumption in depth, longitudinal studies and interventions are required since consumption is frequent and mental health problems are on the rise.

**Key words:** Energy drinks, mental health, adolescent, young adult, nursing (DeCS).

## Resumen

**Introducción:** Enfermería debe realizar una valoración integral de adolescentes y jóvenes para poder intervenir en forma temprana sobre hábitos de riesgo. **Objetivo:** Conocer cómo afecta el consumo de bebidas energéticas en la salud mental de adolescentes y adultos jóvenes. **Metodología:** Revisión sistemática empleando informes preferidos para revisiones sistemáticas y metaanálisis PRISMA, realizando búsqueda en bases de datos Web Of Science, Medline, Scopus y Pubmed con descriptores bebidas energéticas, salud mental, adulto joven y adolescente, los criterios de inclusión fueron; artículos publicados entre 2017 y 2022, en idioma español, inglés o portugués, en población de 13 a 25 años, excluyendo investigaciones secundarias, editoriales, cartas al editor u opiniones de expertos, no disponibles en texto completo. Identificando 372 artículos, quedando una muestra de 10 para análisis y evaluación metodológica mediante pautas CASPe. Los datos utilizados fueron debidamente referenciados, respetando e identificando a sus autores. **Resultados:** La mayoría fueron estudios con diseño transversal, el ser consumidor frecuente de bebidas energéticas aumentó niveles de ansiedad, depresión, agresividad y riesgo suicida, siendo más afectados los adolescentes de género masculino. **Conclusiones:** Si bien se evidenció relación entre consumo de bebidas energéticas y riesgos para la salud mental, la mayoría de las investigaciones utilizaron diseños transversales, por lo cual no fue posible determinar causalidad o dirección del efecto. Se requieren estudios longitudinales e intervenciones para estudiar con profundidad el consumo de bebidas energizantes, debido a que el consumo es frecuente y los problemas de salud mental van en aumento.

**Palabras clave:** Bebidas Energéticas; Salud Mental; Adolescente; Adulto Joven; Enfermería (DeCS).



## Abstrato

**Introdução:** A área de enfermagem deve realizar uma avaliação abrangente dos adolescentes e jovens para poder intervir precocemente nos hábitos de risco dessa parcela da população. **Objetivo:** Conhecer como o consumo de bebidas energéticas afeta a saúde mental de adolescentes e adultos jovens. **Metodologia:** Revisão sistemática usando relatórios selecionados para revisões sistemáticas e meta-análise PRISMA, pesquisando nos bancos de dados Web Of Science, Medline, Scopus e Pubmed com descritores como bebidas energéticas, saúde mental, adultos jovens e adolescentes. Os critérios de inclusão foram artigos publicados entre 2017 e 2022, em espanhol, inglês ou português, na população de 13 a 25 anos, excluindo pesquisas secundárias, editoriais, cartas ao editor ou opiniões de especialistas, não disponíveis em texto completo. Identificando 372 artigos, restando uma amostra de 10 para análise e avaliação metodológica utilizando as diretrizes do CASPe. Os dados utilizados foram devidamente referenciados, respeitando e identificando seus autores. **Resultados:** A maioria era de estudos com desenho transversal. O consumo frequente de bebidas energéticas aumentou os níveis de ansiedade, depressão, agressão e risco de suicídio, sendo os adolescentes do sexo masculino os mais afetados. **Conclusões:** Embora houvesse evidências de uma relação entre o consumo de bebidas energéticas e os riscos à saúde mental, a maioria das pesquisas utilizou desenhos transversais, de modo que não foi possível determinar a causalidade ou a direção do efeito. Para estudar o efeito do consumo de bebidas energéticas em profundidade, são necessários estudos longitudinais e intervenções, já que o consumo é frequente e os problemas de saúde mental estão aumentando.

**Palavras-chave:** Bebidas energéticas; saúde mental; adolescente; adulto jovem; enfermagem (DeCS).

## Introduction

In the country of Thailand, the first energy drink began to be marketed in 1976, and due to its sales success, this type of drink is currently sold by several brands <sup>(1)</sup>. Its components are mainly based on caffeine and sugars, which generates a state of alertness and excessive energy; such state helps during study or recreational situations attracting mainly young people <sup>(2)</sup>. At a global level, some studies indicated that consumption of energy drinks in adolescents has increased from 10% to between 20% and 50% in the last ten years <sup>(3,4)</sup>. It is estimated that a high percentage of this sector of the population consumes these beverages to positively increase their effects on mental agility, to be able to stay awake longer and have more energy; however, not many know the adverse effects they cause such as insomnia, poor academic performance, and irritability, among others <sup>(5)</sup>.



The aforementioned adverse effects could affect the mental health of young population, since it is estimated that around 58 million children and adolescents experience anxiety and around 23 million experience depression <sup>(6)</sup>. In view of these figures, it is essential to know which factors are associated with the development of these problems, especially if they are attributable to the lifestyle of this sector of the population <sup>(7)</sup>.

Nursing plays a key role in meeting the mental health needs of adolescents and young adults, including nursing care such as health education, groups, cognitive-behavioral therapy, interpersonal relationships and activities involving the adolescent, family, peers and the school environment <sup>(8)</sup>. Since there is no school nurse in Chile, despite its recognized importance in health care and education <sup>(9)</sup>, the nursing professional only has access to the child and adolescent population at specific times, which makes continuity of care difficult, so in order to intervene early in the risks detected, an adequate assessment of the needs of the adolescent or young adult must be made, not only in the physical area, but also in the mental area.

Therefore, the question was defined according to Patient, Intervention, Comparison, Outcome or results <sup>(10)</sup> based on the acronym PICO, leaving the question: How does the consumption of energy drinks affect the mental health of adolescents and young adults? Hence, the objective set was to determine how the consumption of energy drinks affects the mental health of adolescents and young adults.

## **Methodology**

Systematic review using Preferred Reporting Items Method for Systematic Reviews and Meta-Analyses (PRISMA) defined as a research publication guideline, created to improve the integrity and quality of systematic reviews <sup>(11)</sup>. To carry it out, searches were carried out in electronic databases Web Of Science, Medline, Scopus and Pubmed applying filters of language, Spanish, English and Portuguese, and year of publication (last five years). The key words were retrieved from the Medical



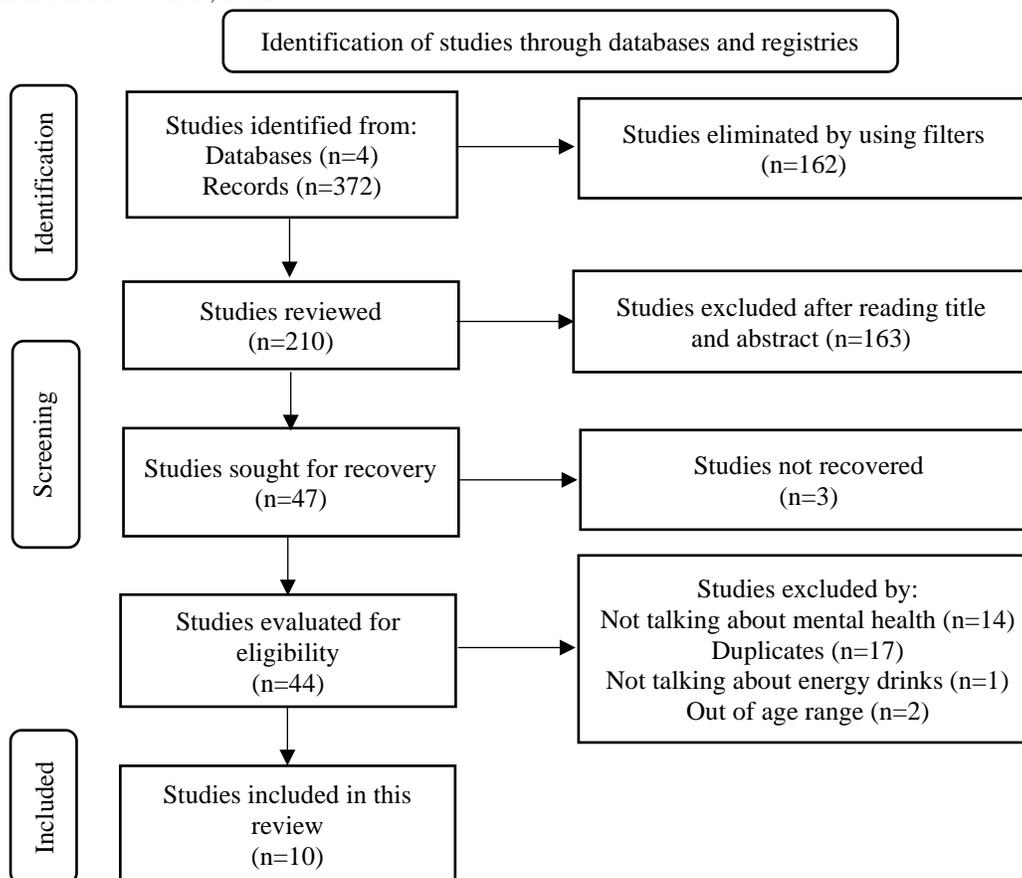
Subject Headings (MeSH) <sup>(12)</sup>, finally using: energy drinks, mental health, young adult, adolescent, using the following search equation: (Adolescent) OR (young adult) AND (mental health) AND (Energy drink). The inclusion criteria were defined as: articles published from 2017 to 2022, in Spanish, English or Portuguese and whose population was adolescents and/or young adults (age range 13 to 25 years), and as exclusion criteria: articles that were systematic reviews, editorials, letters to the editor or expert opinions, that studied mental health disorders associated with hereditary factors, studies that exclusively related caffeine and mental health, articles not available in full text for free or through databases of university students.

In the databases used, a total of 372 articles were identified, and after applying filters (year of publication 2017 to 2022 and languages Spanish, English and Portuguese), 210 studies remained. 163 articles were excluded due to reading the title and/or abstract, leaving 47 articles for complete review; however, 3 of them could not be recovered in full text. Consequently, of the 44 articles that were recovered, 17 of them were not included because they met some exclusion criteria and, likewise, 17 articles were eliminated because they were duplicates, leaving a total of 10 articles for the evaluation of methodological quality, which was carried out through the application of guidelines Critical Appraisal Skills Program Spanish (CASPe), a non-profit association that teaches critical reading of clinical evidence to people in the health area. This tool is accessible online and has eight templates made up of questions, in order to provide the reader with help to understand and analyze the research <sup>(13)</sup>.

The 10 studies met the minimum methodological quality, being classified as “satisfactory”, which is why they were included in the present review, this is evident in the following PRISMA flowchart <sup>(14)</sup>, (Figure 1).



Figure 1: PRISMA Flowchart, 2022



Source: Self-development.

Since this is a systematic review, there is no contact with people, so it is considered a risk-free research <sup>(15)</sup>. The information collected from each article included title, year, country, sample, and main findings. The references of the data used were duly included, i.e., their authors were respected and identified.

## Results

The studies analyzed were 30% each from Asia and Europe, and 20% each from North America and Oceania simultaneously, finding that 90 % <sup>(16,19-25)</sup> had a cross-sectional design and only 10 % was cohort <sup>(17)</sup>, (Table 1).



Table 1. Publications included, year and country, 2022, (n=10)

	Publications included (Number/title/reference)	Year	Country
1.	Energy drink consumption, psychological distress, and suicidality among middle and high school students <sup>(16)</sup>	2020	United States
2.	Consumption of energy drinks is associated with depression, anxiety, and stress in young adult males: Evidence from a longitudinal cohort study <sup>(17)</sup>	2020	Australia
3.	Mental and physical effects of energy drinks consumption in an Italian young people group: a pilot study <sup>(18)</sup>	2018	Italy
4.	Energy drink consumption among New Zealand adolescents: Associations with mental health, health risk behaviors and body size <sup>(19)</sup>	2017	New Zealand
5.	High stress, lack of sleep, low school performance, and suicide attempts are associated with high energy drink intake in adolescents <sup>(20)</sup>	2017	Korea
6.	Does Caffeine Intake Influence Mental Health of Medical Students? <sup>(21)</sup>	2021	Malaysia
7.	Energy drink use in U.S. service members after deployment: associations with mental health problems, aggression, and fatigue <sup>(22)</sup>	2018	United States
8.	Energy drink consumption, depression, and salutogenic sense of coherence among adolescents and young adults <sup>(23)</sup>	2020	Hungary
9.	Intake of caffeine and its association with physical and mental health status among university students in Bahrain <sup>(24)</sup>	2020	Bahrain
10.	Energy drinks consumption associated with emotional and behavioral problems via lack of sleep and skipped breakfast among adolescents <sup>(25)</sup>	2021	Slovakia

Source: Self-development.

The minimum population under study was 10 people <sup>(18)</sup> and the maximum 121,106 <sup>(20)</sup>, keeping an age range from 11 to 27 years <sup>(18, 25)</sup>. The results indicate that the consumption of energy drinks increased the levels of anxiety, stress and depression <sup>(17-19,24)</sup>, mainly, even the correlation between high consumption of energy drinks and suicide attempts is mentioned <sup>(16, 20)</sup>. Relationship between consumption of energy drinks and aggressive behavior, fatigue and poor academic performance was also observed <sup>(22, 23, 25)</sup>. However, in some studies authors established the need for further research in order to obtain a better correlation <sup>(18, 24)</sup>, (Table 2).

Table 2. Publications included, sample and main findings, 2022 (n=10)

Publications (Reference)	Sample	Main findings
16	5,538 students between 13 and 18 years	Energy drink consumption was associated with increased risk from moderate to severe (IRR 1.2, 95% CI=1.0-1.4) and severe levels of psychological distress (IRR: 1.5, 95% CI=1.1-1.9), suicidal thoughts (IRR: 1.9, 95% CI=1.6-2.4) and suicide attempts (IRR: 3.7, 95% CI: 2.3-5.9). Association between energy drinks consumption and mental health was much stronger in high school male students.



17	429 people between 20 and 22 years old	Participants who switched from energy drinks non-consumers to consumers had a mean increase in stress scores of 2.3 (95% CI=0.04, 4.6) over the 2-year follow-up. Men, but not women, who switched from being non-users to users had average increases in depression, anxiety, and stress scores of 6.1 (95% CI=3.4, 8.8), 3.8 (95% CI=1.8, 5.7) and 3.2 (95% CI=0.5, 5.9) respectively.
18	10 people between 18 and 27 years old	Anxiety and depression tests showed that before the energy drinks consumption, subjects were in the minimum range of anxiety (10th and 60th percentiles) and reported no level of depression. After the consumption of energy drinks, mild anxiety was recorded, the depression instrument showed a case with a pathological profile.
19	8500 high school students	35 % of participants consumed energy drinks and 12 % consumed energy drinks four or more times in the past week. Students in the high frequency group of energy drink consumption reported greater depressive symptoms (P<0.001), greater emotional difficulties (P<0.001), and lower levels of well-being (P<0.001) than students who did not consume energy drinks.
20	121,106 adolescents between 13 and 18 years old	High level of stress, abnormal sleep time and poor school performance were proportionally related to higher energy drinks intake (P<0.001). Frequent energy drink intake was significantly associated with suicide attempts in multiple logistic regression analyzes (adjusted OR for frequency of energy intake $\geq 3$ times a week =3.03, 95% CI=2.6-3.5, P < 0.001).
21	262 medical students	The prevalence of caffeine intake among medical students was 98.5 %, the mean concentration of caffeine intake among consumers was 67.9 (25th, 75th percentile: 24.8, 139.7) mg/day. Depressed respondents according to the DASS-21 score consumed more caffeine per day at a mean of 87.7 mg/day compared to those not depressed at 66.1 mg/day. However, the difference in caffeine consumption between those who were depressed and those who were not depressed was not significant (p=0.2). Respondents with anxiety consumed slightly more, 70.0 mg/day, than those without anxiety, who consumed 67.4 mg/day, the difference was not significant (p=0.9). Non-stressed respondents consumed caffeine per day at a rate of 68.2 mg/day than those stressed (11.1 mg/day), the difference was not significant (p=0.2).
22	627 infantry male soldiers	Last month, the energy drinks used was 75.7 % of soldiers, where 16.1 % consuming high levels (2+ energy drinks/day). Energy drinks use was associated with mental health problems (adjusted OR 2.0 to 2.7), aggressive behaviors (adjusted OR 2.3 to 3.5), and fatigue (p<0.001) relative to those who drank none or less than one per week.
23	631 high school and college students	A total of 31.1 % (95 % IC=64.7-77.3) of respondents consumed energy drinks, 24.0 % of those affected consumed energy drinks with alcohol, 71.4 % (95% CI=64.7-77.3) experienced adverse effects after energy drinks consumption and 10.2 % (95 % CI=6.7-15.2) experienced at least four symptoms simultaneously. The sense of coherence and tendency to depression had a significant influence on the respondents' probabilities of addiction. A tendency toward depression increased the chances of addiction, while a strong sense of coherence decreased the effects of depression.
24	727 university students from Bahrain	Participants who consumed 400 mg/day or more showed statistically significant differences in the following five symptoms: headaches (p=0.02, 95% CI=1.1-3.0), terror or panic episodes (p=0.001, 95% CI=1.2 -2.8), feeling trapped (p=0.001, 95% CI=1.3-3.2), worrying too much about things (p= 0.01, 95% CI=1.2-2.5), feelings of worthlessness (p= 0.03 , IC 95 %=1.1-1.1), anxiety score (p=0.001, 95% CI=1.2-2.6) and psychological distress (p=0.001, 95% CI=1.2-2.7).
25	8,405 adolescents from 11 to 15 years old	Energy drinks consumption was significantly associated with emotional problems (p<0.001) and behavioral problems (p<0.001), greater energy drinks consumption led to more emotional and behavioral problems.

Source: Self-development. Note: IRR: Adjusted incidence rate ratio. CI: Confidence interval OR: Odds ratio.



The quality assessment of articles using the CASPe checklist for cross-sectional studies showed a satisfactory impression in all articles (16-25), (Table 3).

Table 3: Assessment of data quality obtained from cross-sectional studies, 2022 (n=9)

Publications (Reference)	1	2	3	4	5	6	7	8	9	10	11	Final print
16	Y	Y	Y	Y	Y	Y	It was found that energy drinks consumption was associated with mental health problems among adolescents, who were shown to be at higher risk of severe levels of psychological distress.	Y	Y	Y	Consuming energy drinks increased the risk of psychological distress and suicidality (risk to commit suicide) among high school students; it is important to be aware of the negative effects of drinking energy drinks.	SAT
18	Y	Y	Y	Y	Y	N	Initially participants were considered to have a minimal level of anxiety, after consuming energy drinks it rose to a mild level.	Y	Y	Y	Energy drinks can be a public health problem due to their positive effects in the short term, however, at high doses or in the long term they can negatively affect adolescents.	SAT
19	Y	Y	Y	Y	Y	Y	The consumption of energy drinks was associated with risk behaviors, greater depressive symptoms, lower well-being, and emotional difficulties were reported.	Y	Y	Y	Health professionals should consider consumption of energy drinks as a marker that increases the risk of presenting harmful behaviors to mental health.	SAT
20	Y	Y	Y	Y	Y	Y	Subjective stress level, sleep time and school performance showed significant associations with consumption of energy drinks, the population showed an association between this practice and risk of suicide.	Y	Y	Y	Suicide attempts increased with frequent intake of energy drinks, which represents a public health problem.	SAT



21	Y	Y	Y	Y	Y	Y	The most depressed respondents did not show a major difference with energy drinks consumption. There was a slight increase in predisposition to suffer anxiety, stress, or depressive episodes in people who consumed energy drinks, without significant differences.	Y	Y	Y	Researchers conclude that the study did not obtain significant data compared to other studies on the subject and they comment that this is probably because of the small population interviewed.	SAT
22	Y	Y	Y	Y	Y	Y	Results show that 16.1% of soldiers who excessively consumed energy drinks presented more fatigue, aggressive behaviors, and mental health problems in relation to non-consumers.	Y	Y	Y	Researchers conclude that results are alarming, therefore there is a need to include the energy drink as a product that represents a risk to mental health.	SAT
23	Y	Y	Y	Y	Y	Y	There was a high energy drinks consumption rate among young people, this was associated with the occurrence of symptoms such as tremors, insomnia, and tachycardia.	Y	Y	Y	Population (especially parents) should receive proper education to prevent the use of energy drinks due to their negative adverse effects.	SAT
24	Y	Y	Y	Y	Y	Y	High caffeine consumption was associated with headache, anxiety, and psychological distress.	Y	Y	Y	Although causality between excessive consumption and symptoms of mental health problems could not be demonstrated, an association was made that will allow other researchers to study this topic in more depth.	SAT
25	Y	Y	Y	Y	Y	Y	Energy drinks consumption was indirectly associated with emotional and behavioral problems, due to less sleep and breakfast consumption.	Y	Y	Y	It was concluded that adolescents with greater energy drinks consumption present less sleep hours, emotional and behavioral problems.	SAT

Source: Self-development. Note. Y: Yes, N: No, IDN: I don't know. SAT: Satisfactory. NOSAT: Not satisfactory.

For the cohort study (17), the quality assessment according to the applied guideline was classified as satisfactory (Table 4).



Table 4: Evaluation of data quality obtained from cohort studies (n=1).

Publications (Reference)	1	2	3	4	5	6	7	8	9	10	11	Final print
17	Y	Y	Y	Y	Y	The first control showed that people who went from non- consumers to consumers of energy drinks increased their stress scores. In the second control, men increased their depression, anxiety and stress levels, but women did not.	95%	S	S	S	N	SAT

Source: Self-development. Note. Y: Yes, N: No, IDN: I don't know. SAT: Satisfactory. NOSAT: Not satisfactory.

## Discussion

Based on the objective of knowing how the consumption of energy drinks affects the mental health of adolescents and young adults, it was possible to identify that in general, the studies reviewed show that being a frequent consumer, or after consuming energy drinks, anxiety levels, depression (17-19, 21,24) and, to a lesser extent, aggression (20,22,23,25) and suicidal risk (16,20) increased compared to those who did not consume energy drinks. The results of the studies show a relationship between the consumption of energy drinks and psychological discomfort in different ways, evidencing how cessation or reduction of this consumption reduces stress and anxiety levels (18). This can be influenced by gender and age, with male adolescents being more affected (17).

Added to these mental health alterations, the effects on physical health stand out, which should be a concern for nursing professionals, since it is estimated that almost half of university students consume energy drinks (27). As mentioned at the beginning, the main component of energy drinks is caffeine and, according to scientific evidence, one of its actions is on the cardiovascular system, generating, for example, elevations in blood pressure and heart rate, which could be a risk factor for developing cardiovascular diseases in the future (28,29). In addition to this, some studies also mention that energy drink consumers have a greater tendency to use multiple substances, including alcohol, tobacco and soft and hard drugs, developing deterioration of perception, weakness, headache, increased violent behavior and risk (30, 31). In addition to the above, frequent consumers



of energy drinks are more likely to have poor eating habits, including the consumption of sugary drinks and junk food <sup>(31)</sup>.

The main reasons for its consumption must be considered when carrying out interventions to prevent excessive consumption. Participation in studies, projects or exams, staying awake or alert, and participation in physical/sports activities have been identified as the main reasons for use of energy drinks <sup>(27)</sup>. There is no solid scientific evidence that supports the use of energy drinks as therapeutic agents in the promoted conditions, such as those mentioned above; on the contrary, there are multiple case reports in which the consumption of energy drinks is associated with adverse effects, affecting a wide variety of human body organs and systems <sup>(32)</sup>.

Nurses should associate with other professionals, such as nutritionists and psychologists, to focus their interventions, not only to warn about the possible risks of excessive consumption, previously exposed, but also to educate about healthier alternatives to obtain the same results, such as effective time management, workshops on study habits <sup>(33,34)</sup>, mindfulness to improve memory and attention <sup>(35,36)</sup>, and healthy eating interventions <sup>(37)</sup>, among others.

As a limitation, it can be mentioned that some articles were not accessible because it was a paid service, in addition to the fact that the number of studies answering the research question was low. It is also worth highlighting the important difference in the sample sizes and the research design type, which, although they relate the consumption of energy drinks with mental health risks, the majority of research examined used cross-sectional designs, therefore, it was not possible to determine causality or direction of the effect <sup>(38)</sup>. For this reason, longitudinal and intervention studies are required to increase understanding of the nature of the relationships that were observed. Due to the aforementioned, it is important to study the issue raised in greater depth since the consumption of energy drinks is common, and mental health problems are increasing. It is



imperative that there are more studies on this matter so that it can be considered as an issue to be discussed when talking about health promotion and prevention <sup>(39, 40)</sup>.

## Conclusions

The consumption of energy drinks affects the mental health of adolescents and young adults, producing mental health disorders such as anxiety, stress and/or depression, even leading to suicidal ideation, as well as behavioral changes such as aggression, poor academic performance and sleeping disorders. Nursing professionals play a fundamental role in promoting mental health throughout the life cycle, being of greatest relevance in such a fragile stage as adolescence and young adulthood. It is through knowledge of risk factors that population can be educated to avoid the risky consumption of energy drinks.

This study does not seek to impose a complete veto on the sale and consumption of energy drinks, but rather to raise awareness among consumers and health professionals, highlighting that, as with all foods and activities, excess is not recommended, since in addition to the effects on physical health, there is a risk of alterations in mental health.

## Conflict of interests

The authors declare that there is no conflict of interest.

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