International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	ENERGY DRINKS IN YOUTH: CARDIOVASCULAR, NEUROPSYCHIATRIC, AND POLICY PERSPECTIVES — A NARRATIVE REVIEW
DOI	https://doi.org/10.31435/ijitss.4(48).2025.4179
RECEIVED	07 November 2025
ACCEPTED	21 December 2025
PUBLISHED	24 December 2025
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ENERGY DRINKS IN YOUTH: CARDIOVASCULAR, NEUROPSYCHIATRIC, AND POLICY PERSPECTIVES — A NARRATIVE REVIEW

Maja Jabłońska *(Corresponding Author, Email: jabmaja@wp.pl)*
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0008-8498-0603

Agata Bukowska
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0009-8792-4284

Ewa Jagodzińska
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0008-4089-2708

Zuzanna Jabłońska
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0003-3592-879X

Jakub Kaczmarczyk
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0006-5994-1982

Joanna Zygadło
Infant Jesus Clinical Hospital UCC MUW, Warsaw, Poland
ORCID ID: 0000-0001-5377-5254

Julia Kamińska
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0009-2162-0712

Zofia Moskal
Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0009-8829-5635

ABSTRACT

Introduction and Objective: Energy drink (ED) consumption has markedly increased among adolescents and young adults, raising clinical and public-health concerns. Evidence links EDs to acute cardiovascular, neuropsychiatric, and metabolic disturbances, yet findings remain fragmented. This narrative review aimed to synthesize recent data on physiological effects, behavioral correlates, and regulatory responses to ED use in youth.

Materials and Methods: A narrative search of PubMed (1990–October 2025) identified randomized and crossover trials, observational studies, and PubMed-indexed reviews addressing ED exposure among individuals aged 10–35 years. Six domains were analyzed: cardiovascular, neuropsychiatric, metabolic/gastrointestinal/dental, sport performance, policy and labeling, and medication interactions.

Results: Evidence consistently indicates transient increases in systolic and diastolic blood pressure, heart-rate variability changes, and QTc prolongation following ED intake. Cross-sectional and longitudinal studies associate frequent ED consumption with reduced sleep duration, anxiety, depressive symptoms, and higher stress scores. Metabolic data show elevated insulin and glucose levels and rare cases of niacin-related hepatotoxicity. Co-use of EDs with alcohol amplifies risk-taking behaviors and cardiovascular strain. Despite labeling restrictions, marketing continues to target youth, with variable national policy enforcement.

Conclusions: ED use among adolescents and young adults exerts measurable short-term cardiovascular and neuropsychiatric effects and contributes to risky behavior patterns. Preventive efforts should combine clinical counseling on caffeine and alcohol co-use with regulatory strategies addressing marketing and accessibility.

KEYWORDS

Energy Drinks, Caffeine, Adolescents, Cardiovascular System, Sleep Disorders, Anxiety, Public Health Policy

CITATION

Maja Jabłońska, Agata Bukowska, Ewa Jagodzińska, Zuzanna Jabłońska, Jakub Kaczmarczyk, Joanna Zygadło, Julia Kamińska, Zofia Moskal. (2025) Energy Drinks in Youth: Cardiovascular, Neuropsychiatric, and Policy Perspectives - A Narrative Review. *International Journal of Innovative Technologies in Social Science*. 4(48). doi: 10.31435/ijitss.4(48).2025.4179

Introduction

Energy drinks (EDs) are increasingly relevant to frontline care because converging evidence links their use with acute cardiovascular and neuropsychiatric effects in young populations [1]. Large student cohorts further associate ED intake with shorter sleep duration and poorer sleep quality, underscoring day-to-day functional consequences for learning and mood [2]. Mechanistically, EDs deliver pharmacologically active doses of caffeine, often with taurine and other additives; narrative and clinical reviews outline plausible pathways for blood pressure, heart rate, and autonomic changes that are germane to adolescent and young-adult risk profiles [3].

Randomized trials quantify short-term physiological impacts: high-volume ED consumption elevates blood pressure and alters electrocardiographic parameters under controlled conditions [4], while additional trials demonstrate concurrent metabolic and cardiovascular shifts after typical commercial products [5]. These responses sit within a broader toxicological context in which caffeine—the primary active compound—exhibits dose-dependent effects and inter-individual variability shaped by age, medications, and habitual use [6]. Adolescence adds specific neurodevelopmental considerations; experimental and integrative reviews flag interactions between caffeine, taurine, and the developing brain, with implications for sleep and affect regulation [7].

At the population and policy level, governments and public-health agencies are experimenting with measures to curb youth exposure (e.g., age-based sales limits, point-of-sale restrictions, school policies), reflecting a widening concern beyond individual counseling [8]. Systematic syntheses in European children and adolescents consistently show that ED use clusters with other risky behaviors and lifestyle patterns, suggesting that prevention is most effective when embedded in broader school and community strategies rather than addressed in isolation [9,10]. Product mapping studies highlight substantial variability in ingredient profiles and doses across brands and "shots," reinforcing the value of label literacy and practical dose guidance during brief clinical encounters [11].

Certain use patterns amplify risk. Case-aggregated evidence indicates that co-ingestion of EDs with alcohol can mask intoxication and is linked to cardiovascular complaints and injuries—an intersection increasingly addressed in youth counseling [12]. Pediatric randomized data using 24-hour ambulatory monitoring show ED-related changes in blood pressure profiles, aligning with concerns about repeated exposures during school days and sports participation [12]. Adult crossover studies corroborate acute cardiovascular and cerebrovascular responses after a single commercial ED, supporting cautious advice on timing (e.g., avoiding late-day and pre-event use) [13]. Meta-analytic evidence on electrical cardiac effects adds signal for QT/QTc alterations in susceptible individuals, helping clinicians identify red-flag histories (e.g., congenital long-QT, prior syncope) during screening [14].

Taken together, composition, dose–response physiology, use patterns, and the evolving policy environment position EDs as a clinical–social issue. This review synthesizes evidence to support concise screening, sleep-focused harm reduction, and clear counseling on high-risk combinations (notably EDs with alcohol), while situating individual advice within school and community interventions [1–14].

Methodology

Scope and review questions

This narrative review synthesizes recent evidence on energy drinks (EDs) in adolescents and young adults (≈10–35 years) across six domains: cardiovascular effects; neuropsychiatric and sleep outcomes; metabolic, gastrointestinal and dental effects; risky use patterns (alcohol/stimulant co-use, pre-workout "stacking"); policy and labeling; and brief, clinic-ready counseling.

Evidence was sourced exclusively from PubMed (last search: 11 October 2025). Reference lists of included PubMed-indexed reviews were screened to identify additional PubMed records.

Search strategy

A pragmatic, domain-focused strategy combined free-text terms and MeSH where available. Master query (adapted per domain):

("energy drink"[Title/Abstract] OR "energy drinks"[Title/Abstract] OR "caffeinated beverage*"[Title/Abstract])

AND (adolescent[MeSH Terms] OR adolescent*[Title/Abstract] OR "young adult*"[Title/Abstract] OR student*[Title/Abstract])

AND (blood pressure OR heart rate OR HRV OR QT OR QTc OR arrhythmia OR sleep OR insomnia OR anxiety OR injury OR policy OR labeling OR taurine OR guarana)

Filters: Humans; English; 1990/01/01–2025/10/11

Eligibility (narrative, question-driven)

Inclusion: PubMed-indexed human studies (randomized/crossover trials, cohort, case-control, cross-sectional) and PubMed-indexed systematic or narrative reviews addressing ED exposure or ED-typical ingredient combinations at ED-like doses; outcomes relevant to the six domains. Foundational pre-2018 human studies were considered selectively to clarify mechanisms or safety thresholds.

Exclusion: animal/in-vitro studies; editorials without data; single case reports unless synthesized within a PubMed-indexed review; non-English articles; papers not addressing EDs or ED-like exposures.

Study selection and data handling

Screening was iterative and question-driven. Titles/abstracts matching domain needs were retrieved in full text. For each included record, we captured design, population, ED formulation/dose (caffeine mg; taurine presence), timing/context (e.g., pre-exercise), comparators, outcome measures (e.g., automated BP, 12-lead ECG QTc method, actigraphy), effect direction and magnitude where available, and adverse events. When multiple papers overlapped, we prioritized higher-quality designs and the most recent or comprehensive syntheses.

Results

Cardiovascular Effects

The main pharmacodynamic effects of caffeine are that it plays a key role in the development of adverse cardiovascular events [15]. At the cellular level, caffeine causes blockage of adenosine A1 and A2A receptors and, consequently, an increase in the release of dopamine, norepinephrine and glutamate. Adenosine acts through specific receptors and has a negative inotropic and chronotropic effect. Blockade of cardiac adenosine receptors inhibits the action of adenosine, which causes an increase in heart rate and blood pressure, and possibly heart rhythm disturbances [16]. A randomized controlled trial showed that ED intake increased MAP 1 hour after administration. Compared to baseline, ED intake led an increase in both SBP and DBP from 20 minutes after drinking, with the peak of SBP (5.2 ± 1.0 mmHg, approximately 70 min) being reached earlier compared to the peak of DBP (6.1 ± 1.1 mmHg, approximately 90 min). ED intake led to a drop in HR below baseline within the first 40 minutes. After that, HR after consuming ED steadily rose above the baseline, peaking at around 90 min (3.7 ± 0.7 beats/min), followed by a downtrend [17]. The effect caused by ED on arterial stiffness can be mainly attributed to the high content of caffeine and guarana in erectile dysfunction. Caffeine is believed to increase peripheral vascular resistance through sympathetic stimulation and consequently affect arterial stiffness [18]. As studies have shown, the consumption of energy drinks may be associated with myocardial infarction, spontaneous coronary artery dissection, and coronary vasospasm, and even with cardiac arrest. Through increased platelet aggregation, systolic blood pressure (SBP) rises, and the QTc interval is prolonged. QTc prolongation increases the risk of torsades de pointes, which can lead to fatal ventricular arrhythmia, and is also a biologically plausible cause of sudden cardiac arrest associated with energy drink consumption. Findings from a randomized study suggest that QTc changes are generally sustained throughout the 4-hour monitoring period, rather than being only a transient effect following the consumption of a specified dose of an energy drink. A significant prolongation of the QT interval indicates delayed ventricular repolarization, which may lead to life-threatening ventricular tachycardia (e.g., Torsade de Pointes) that can progress to ventricular fibrillation and, consequently, result in sudden cardiac death. One randomized trial also considered the possible arrhythmogenic risk (QT prolongation) of acute ED intake by analyzing the QT-RR relationship. A significant decrease in the period of 60-120 minutes after taking ED was observed [21,22].Therefore, the significantly reduced QT-RR relationship shown in this study may be explained by the much lower HR observed[23]. Therefore, individuals with long QT syndrome and those with hypertension should be more cautious and either avoid or limit the consumption of energy drinks; The authors of the study suggested that the effect of a sugary energy drink on increased cardiac activity may result from the combination of caffeine and sugar, mediated by insulin, which has been attributed a positive inotropic effect [21]. Overall, in the randomized study, palpitations and tachycardia were the most frequently reported categories of cardiac symptoms among energy drink consumers [24].

Table 1. Summary of Cardiovascular Effects of Energy Drinks in Adolescents and Young Adults

Study (Year)	Population (n, age)	Design	Energy Drink Composition	Main Cardiovascular Outcomes	Duration	Key Findings
Shah et al., 2019 [4]	34 adults (mean age 22)	RCT	320 mg caffeine + taurine	↑ SBP + DBP	4 h	↑ QTc
Oberhoffer et al., 2023 [12]	17 adolescents (12–18 y)	RCT	80 mg caffeine	↑ Mean 24-h SBP by 5 mmHg	24 h	BP effect persisted overnight
Costa et al., 2023 [13]	30 adults (18–22 y)	NRCT	80 mg caffeine + 100 mg taurine	↓ velocities of the carotid arteries and the middle cerebral artery ↓ CO ↓ HR	60 min	endothelial dysfunction
Li et al., 2022 [19]	24 adolescents (mean age 14)	RCT	3 mg/kg caffeine	↓peak circumferential strain of the CCA	4 h	↑arterial stiffness

Legend: SBP – systolic blood pressure; DBP – diastolic blood pressure; HR – heart rate; MAP – mean arterial pressure; QTc – corrected QT interval; CO – cardiac output, CCA – common carotid artery; NRCT– nonrandomized clinical trial; RCT–randomized clinical trial.

Neuropsychiatric & Sleep Outcomes

There is a vast body of research indicating that the consumption of EDs is a determinant for negative sleep outcomes. Authors agree that ED consumption, regardless of frequency, shortens sleep duration [25,26]. A cross-sectional study of 15- and 16-year-old adolescents revealed that high consumption of EDs, defined as ≥ 4 times a week, shortened sleep by approximately 57 minutes compared to the reference group (those who never consumed EDs). Moreover, high consumers had a shuteye period which was over 25 min longer compared to the reference group. It was also established that most ED consumers fail to obtain the recommended 8 hours of sleep per night [25]. This finding is consistent with another cross-sectional study involving participants from 12 schools in Belgrade, which found that regular ED consumption is negatively correlated with meeting recommended 8 hours of sleep among adolescents of both sexes [27]. Kaldenbach et al. observed a direct association between the frequency of ED consumption and sleep patterns such as sleep onset latency and wake after sleep onset. Moreover, they found that men had a slightly higher risk of short sleep duration associated with daily ED consumption than women [26]. These results are inconsistent with a study on the Australian population, where no significant associations were observed in males for any sleep outcomes. However, female ED consumers experienced significantly higher symptoms of daytime sleepiness and were five times more likely to experience insomnia compared with rare users [27]. A study involving Korean youth found that, among ED consumers, sleep satisfaction was lower. Adolescents who slept less than 5 hours had the highest levels of ED consumption, averaging at least one a day [29]. Due to sleep loss, among other mechanisms, EDs have a negative effect on mental health [30-34]. This association between high-caffeine beverage consumption and anxiety was shown to be statistically significant among South Korean adolescents who reported six or fewer hours of sleep per night [30]. A cross-sectional study involving adolescents aged 12-18 years recruited from schools in the West Bank, established that depressive symptoms assessed by PHQ-9 scale, also exhibited a significant relationship with ED consumption [31]. This finding is consistent with the results of a cross-sectional study involving Israeli-Arab adolescents, that found that ED consumers reported a lower well-being index and a higher anxiety index than non-consumers [32]. A prospective population-based study in Western Australia found that males who changed from being non-ED users to ED users showed an average increase of 6.09 points in depression, anxiety, and stress scores on the DASS-21 scale. Participants of both sexes who changed from being non-ED consumers to ED consumers had an average increase in stress scores of 2.30 points on the DASS-21 scale across the two-year follow-up [33]. This is consistent with a study involving American nursing students that reported higher levels of perceived stress in ED consumers compared to those consuming only caffeine and those who did not consume caffeine [34].

The simultaneous consumption of EDs with alcohol (AmED) has been linked to a range of negative behavioral, cognitive, and physiological outcomes [35-39]. One study found that frequent use of EDs among Norwegian adolescents aged 13–15 was associated with increased alcohol consumption and greater increase in alcohol use over time when participants were followed up to age 17–19 [35]. A study on rat models showed that binge-like consumption of AmEDs during adolescence causes lasting damage to hippocampal plasticity, which is critical for memory and learning [36]. Supporting this, Petribu et al. found that in rodent research, AmED consumption altered ethanol's effects, increasing motivation to drink, reducing alcohol aversion, and leading to biochemical changes such as oxidative stress, inflammation, and possible neuronal damage, especially in chronic users [37]. On a behavioral level, adolescents who consume AmED are more likely to be at-risk of or problem gamblers than those who drink alcohol alone, indicating that AmED may exacerbate impulsive or risk-taking behaviours [38]. Similarly, AmED consumers have shown a higher willingness to drive after drinking compared to those who drink alcohol alone, due to a misleading sense of alertness caused by ED consumption [39]. Interestingly, one study found that certain components of EDs, such as caffeine, taurine, and B-vitamins, might temporarily offset some of alcohol's acute physiological harms such as damage to cerebral capillaries [40]. However, this finding does not mitigate the other risks associated with AmED use.

Metabolic, GI & Dental

The consumption of energy drinks containing caffeine and other substances may also have effects on the gastrointestinal system, teeth and metabolism. As studies have shown, ED can lead to an increase of insulin secretion compared to sports drinks [5]. It was observed especially in a group of people who consume Eds regularly [41]. A randomized controlled trial of 38 people aged 18-25 revealed that consumption of an ED caused a marked increase in insulin serum concentration and a significant elevation of HOMA-IR [5]. This result aligns with another study involving healthy Israeli-Arab adolescents aged 14-18 from Northern Israel which shows that people who consume Eds at least once a week have significantly higher insulin concentration after drinking one than people who drank a soft drink. Moreover, higher glucose levels were observed among ED consumers than soft drink consumers[41]. Energy drinks are believed to increase risk of dental erosion when they are consumed regularly as they have low pH and high sugar content. They can also cause enamel demineralization and bacterial growth[42]. Sugar-free energy drinks which contain aspartame or acesulfame K can increase the risk of white spot lesions on teeth[43]. Energy drinks are rich in many ingredients such as caffeine, guarana, taurine but also B vitamins[44].One of them is niacin (vitamin B3) which overload can lead to hepatotoxicity as many authors think [44-47]. Usually it appears after consuming pharmacological dose of niacin which is 1g/day but the case of 22-year old woman who had been consuming 10 cans of energy drinks a day for two weeks which results in 300mg/day of niacin presented with acute hepatitis without any other possible causes of this condition shows that the toxic dose can be even smaller. However, regular consumption of alcohol combined with drinking EDs can lower the daily toxic dose of niacin to even 120 mg/day as the case of a 36-year-old man presented with acute liver failure shows[46]. Overall, metabolic changes, dental symptoms and hepatotoxicity are common side effects of drinking energy drinks.

Sport & Performance in Youth

The consumption of energy drinks (EDs) among adolescents and young adults has increased notably in recent years, particularly in relation to physical activity and sports settings. In many cases, EDs are used as pre-workout aids, but their effects on hydration, thermoregulation, and overall safety pose important concerns supported by empirical evidence.

Caffeine, as a principal active component in EDs, may exert mild ergogenic effects such as increased alertness and delayed onset of fatigue when consumed 30–60 minutes before exercise. However, the timing of ingestion is crucial because too early or excessive intake may lead to overstimulation, tachycardia, or reduced exercise tolerance—responses whose magnitude vary by individual sensitivity and metabolic factors[48]. With regard to hydration and thermoregulation, evidence indicates that moderate doses of caffeine do not invariably impair fluid balance or thermal control during exercise in temperate conditions. For instance, a classic controlled trial in a neutral environment (25 °C, 50% relative humidity) found no significant differences in rectal temperature or plasma volume changes between caffeine and placebo conditions. (5 mg/kg + 2.5 mg/kg doses)[49]. Similarly, in hot, humid environments, a caffeinated sports drink (caffeine + carbohydrate-electrolyte mix) during a 120-min cycling protocol did not compromise hydration markers (urine output, plasma-volume losses, sweat rate) relative to non-caffeinated controls, although slight increases in serum osmolality were observed[50]. However, under heat stress, caffeine can increase metabolic heat production, whole-body sweat rate, and core body temperature, while reducing skin blood flow—effects that may increase thermal strain without clear improvement in exercise endurance. In a double-blind crossover study with 5 mg/kg caffeine in 35 °C ambient heat, caffeine ingestion raised core temperature, sweat rate, and heat production compared to placebo, though it did not extend time-to-exhaustion[51]. Additionally, during exercise in the heat, caffeine increased urinary flow (≈28%) and excretion of sodium, potassium, and chloride (~14%) but these alterations were not sufficient to cause significant dehydration or electrolyte disturbance over 120 minutes of exercise[52]. In the context of energy drinks (which combine caffeine with sugar, taurine, guarana, etc.), there is more limited and variable evidence regarding synergistic effects on hydration or thermoregulatory stress. Nevertheless, the compounded stimulation raises concerns, especially in adolescents who may be more vulnerable to overstimulation or cardiovascular responses.

In adolescent nutrition and sports practice, several evidence-based alternatives to commercial energy drinks are considered safe and effective. Plain water remains the primary and recommended source of hydration for routine or low-intensity physical activity, as it adequately meets physiological needs without caffeine or added sugars. Public health authorities emphasize water as the default beverage and discourage habitual energy drink consumption due to potential stimulant and metabolic risks[53]. For prolonged or high-intensity exercise, isotonic or hypotonic sports drinks containing moderate amounts of carbohydrates and electrolytes may support hydration and thermoregulation without excessive stimulation[54]. When exercise exceeds 60–90 minutes, low-sugar carbohydrate–electrolyte solutions (6–8% CHO) help maintain endurance and fluid balance, although their use should remain limited to exercise contexts to prevent unnecessary sugar intake[55]. Low-fat chocolate milk has also been shown to be an effective post-exercise recovery option for adolescents, providing carbohydrates, high-quality protein, and electrolytes that promote muscle recovery and glycogen replenishment, though it should not be used as a daily energy drink[56]. Diluted 100% fruit juice or protein-enriched smoothies can serve as controlled sources of carbohydrates and micronutrients if portion sizes are limited to reduce sugar load[57]. For those seeking mild stimulation, low-caffeine or decaffeinated tea or coffee offer predictable caffeine doses and lower risks compared with energy drinks containing proprietary stimulant blends[58]. In selected cases, youth-formulated low-sugar electrolyte beverages can be used for rehydration during extended exertion, provided they are free from caffeine and stimulants. Leading health organizations such as the American Academy of Pediatrics and the CDC emphasize that, while sports drinks may occasionally be appropriate, energy drinks are not recommended for children or adolescents[59]. In summary, safe hydration strategies for youth prioritize water as the main beverage, moderate use of carbohydrate–electrolyte solutions during prolonged activity, balanced recovery options such as chocolate milk, and careful control of sugar and caffeine intake to support performance and health without the risks associated with conventional energy drinks.

Policy, Labeling & School Strategies

The manufacturers of sports and energy drinks have elected to target children in their marketing campaigns and promote a misleading association between their products, healthy lifestyles and sporting prowess [60]. Various regulations have been put in place to deter children from consuming energy drinks. Some of which include additional labelling that states "*product intended for adults only*" or "*not recommended for children*"[61]. However, such warnings, appear to have little influence on purchasing decisions, as scientific evidence consistently indicates frequent consumption of these drinks by children and adolescents, both in Europe and globally [61]. In addition to poor means of restricting the consumption of caffeinated beverages by children, some companies chose to specifically target children in their marketing campaigns. Since numerous countries have put in place age restrictions for ED consumption, companies started putting caffeine in "non-traditonal" sources. For example, caffeine has been added to products that people already consume such as water, gum, mints, and candy [62]. Combining that with slogans targeted towards underaged consumers may result in overconsumption and possible addiction. Some of these slogans are included on the the Jolt Gum website which claims that having 144 pieces of Jolt Gum (equivalent to 72 cups of coffee) will "make you the most popular kid on the block" and that you "may even be able to get an A in art history" because of the "greenish speckles" [62]. Aside from catchy phrases, brands such as Red Bull® and Monster Energy® engage in high-profile sports sponsorships, particularly those that appeal disproportionately to young people, such as the X Games, biking, skiing and skateboarding events. Consistent with this marketing, several studies suggest that energy drinks are being consumed by youth to improve their sports performance [63]. This type of marketing pushed Health Canada to constrict advertising of energy drinks to children, especially in a way that would reference physical performance (for example, physical exertion, endurance, aerobid, anaerobic, power, strength, motor performance, recovery or sports) [63].

Gaps & Future Research

Long term effects

Many studies mention the acute effects of ED. However, the long-term effect of prolonged ED consumption in children and young adults remains under-investigated. One of the possibilities is that there is an absence of long-term effects. For instance, the standard deviation of normal RR intervals was significantly elevated in the first hour post-ED consumption. However, after 240 min there were no changes observed. It suggests that perhaps the effects of EDs could be transient [64]. Similarly, when investigating the effect of EDs on arterial stiffness, the values returned to baseline after 2h, which further supports the idea that the effects may be temporary. These studies question the longevity of EDs' side effects [65]. Therefore, further research needs to be conducted on potential long term consequences of ED consumption.

Regulations worldwide

Poor academic outcomes, impaired concentration and declining mental efficiency often correlate with the consumption of EDs [66,67]. Therefore, both the World Health Organization (WHO) and the American Academy of Pediatrics (AAP) recommend the implementation of strict policies to reduce it among children and adolescents (under 18 years old) [68,69]. To address this issue, many policies have been introduced globally. 55 countries have tax policies, 33 have school access bans, 23 have sales bans, 15 have labeling policies, 14 have advertising and marketing bans and 2 have formulation policies. In some cases, multiple strategies are applied simultaneously [70].

However, the effectiveness of these regulations needs further assessment. Research shows that some bans may lead to unintended consequences, such as the emergence of black markets within schools. Additionally, the lack of clarity regarding the prohibited beverages allows manufacturers to circumvent the regulations [71,72].

Interactions with medication

EDs contain more than just caffeine and sugar. They are a concoction of different substances, many of which can interact with medication.

Caffeine is metabolized by the enzyme CYP1A2, therefore, it can interact with drugs which are substrates, inducers, or inhibitors of this enzyme [73,74]. It can elevate clozapine levels by inhibiting CYP1A2 [73,75] and stimulate lithium excretion [76]. Caffeine increases postprandial hyperglycemia and decreases insulin sensitivity [76,77]. It may also diminish the therapeutic efficacy of methotrexate, possibly through antagonism of adenosine receptors, which mediate anti-inflammatory effects [76]. Moreover, there appears to exist an influence on blood coagulation as it may increase the bioavailability and plasma concentration of aspirin [73]. Additionally, the simultaneous administration of caffeine and theophylline may elevate the serum levels of the latter because of the competitive inhibition of CYP1A2 [76].

Ginseng may interact with some medication. It can increase the risk of hypoglycemia, decrease platelet aggregation and warfarin concentration [73,76,78].

Ginkgo biloba, when taken concurrently with antiplatelet medication, increases the risk of bleeding. There appears to be a theoretical augmented risk of seizure when combined with agents that can lower the seizure threshold such as selective serotonin reuptake inhibitors (SSRI antidepressants and anorectics), monoamine oxidase inhibitors, neuroleptic agents, CNS stimulants, opioids, tricyclic antidepressants [73,78,79].

5-hydroxytryptophan can interact with medication with serotonergic activity such as antidepressants and increase the risk of serotoninergic syndrome [76].

Conclusions

Energy drink consumption among adolescents and young adults is a multidimensional health concern spanning cardiovascular, neuropsychiatric, metabolic, and behavioral domains. Experimental and clinical studies consistently demonstrate acute increases in blood pressure and QTc intervals, along with transient alterations in heart rate variability, suggesting heightened arrhythmogenic potential in susceptible individuals. Beyond cardiovascular risk, frequent energy drink use correlates with shortened sleep duration, daytime fatigue, and higher levels of anxiety, depression, and stress—effects that may impair academic performance and emotional well-being.

Metabolic data point to increased insulin and glucose levels and occasional cases of niacin-induced hepatotoxicity, underscoring the toxicological risks of excessive or chronic intake. The simultaneous use of energy drinks with alcohol further amplifies adverse outcomes by masking intoxication, promoting impulsive behaviors, and increasing injury risk. Despite warning labels and partial sales bans, youth-oriented marketing and sports sponsorships continue to normalize energy drink consumption.

Collectively, these findings support a precautionary approach: clinicians should routinely inquire about energy drink intake during adolescent consultations, provide brief education on caffeine and alcohol co-use, and reinforce evidence-based hydration and sleep practices. At the policy level, integrated strategies—combining labeling reform, marketing restrictions, and school-based education—are warranted to mitigate the growing public health burden associated with energy drink consumption in young populations.

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