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PREVALENCE, PATTERNS AND HEALTH-RISK AWARENESS OF ENERGY DRINK AND DIETARY STIMULANT CONSUMPTION AMONG FEMALE MEDICAL STUDENTS IN SIALKOT, PAKISTAN

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Abstract

Background: Energy drinks are widely available and inexpensive in Pakistan, where they are consumed alongside a longstanding habit of daily tea drinking that is largely absent from the Western populations in which most energy drink research has been conducted. Pakistani studies have rarely described energy drink use together with background tea intake symptoms and care-seeking in the same population.

Objective: To describe the prevalence and patterns of energy drink and dietary stimulant consumption and to characterise health-risk awareness and care-seeking behaviour among female medical students in Sialkot, Pakistan.

Methods: This cross-sectional study enrolled 274 female medical students from three medical colleges in Sialkot, selected by stratified sampling proportional to institutional enrolment. A structured pilot-tested, interviewer-administered questionnaire recorded energy drink brand, frequency, serving size, timing, and reason for use; background tea and coffee intake; self-reported

cardiac autonomic and stimulant-related symptoms in the past 30 days and awareness of caffeine content and cardiac risk, symptom attribution, and care-seeking. Data are presented as frequencies and percentages.

Results: In total, 171 participants (62.4%) had used energy drinks in the past 3 months, and 36 (13.1%) consumed five or more cans weekly. Among the 171 consumers, Sting was the most used brand (42.7%), night-time use after 9 pm was the most common timing (50.9%), and studying was the most frequently cited reason for use (62.6%). Two to three cups of tea per day was the modal background intake (45.3%), and 19.0% of participants self-estimated a total daily caffeine intake of 300 mg or more. Most participants already knew that energy drinks contain high amounts of caffeine (91.2%), and 64.2% were aware that caffeine can affect heart rhythm. Of the 154 participants reporting at least one cardiac symptom in the past 30 days, 64 (41.6%) attributed their symptoms to energy drinks, while only 22 participants (8.0% of the sample) had ever sought medical care for them. Just over half of the full sample, which included non-consumers, said they would definitely reduce their energy drink intake if advised by a doctor (53.6%).

Conclusion: Energy drink use is common in this population and is layered onto habitual tea drinking; nearly a fifth of participants estimated a combined daily caffeine intake of 300 mg or more, approaching the 400 mg/day level that the European Food Safety Authority regards as not raising safety concerns in healthy adults. Awareness of stimulant-related cardiac risk was high, whereas care-seeking for symptoms was rare, a gap that general risk information may not close by itself.

INTRODUCTION

The global energy drink market was projected in 2024 to grow by USD 125.40 billion between 2022 and 2027, at a compound annual growth rate of 8%. [1] Heavy promotion, wide availability, and low prices have been identified as drivers of energy drink use among young people, and many Asian and African countries still have no policies to limit consumption. [2,3] In Pakistan, Sting, a PepsiCo product sold in an inexpensive 250 mL single-serve bottle, contains about 72 mg of caffeine per 250 mL according to published product data[4]. Across the wider energy drink market, caffeine content varies substantially between brands and countries, a pattern linked to inconsistent labelling and regulatory oversight and to concerns about caffeine intoxication and dependence.[5]

What distinguishes Pakistani consumers from the populations in which most energy drink surveys have been conducted is an older stimulant habit underneath the newer one. Black tea, often prepared as doodh patti, is the main caffeinated drink in Pakistan: in a survey of 1,500 adults in Karachi it was the most used caffeine source for 86% of women, and two cups a day was

Documenting how much of this consumption occurs, in what form, and for what reason is a necessary first step. Surveys of Pakistani medical students have reported prevalence, brands, reasons for use, and awareness, [12,13] but to our knowledge none has measured energy drink use together with background tea intake, symptoms, and care-seeking. Awareness itself does not appear to predict consumption reliably. In a 2025 online survey of 871 Polish university students, most of them women, medical students had significantly better knowledge of energy drink ingredients and adverse effects than their non-medical peers, yet their consumption frequency did not differ. [14] Whether the same disconnect holds among Pakistani medical students, whose energy drink use sits on top of an existing tea habit, has not been described.

This study aimed to describe the prevalence and patterns of energy drink and dietary stimulant consumption, and to characterise health-risk awareness and care-seeking behaviour, among female medical students in Sialkot, Pakistan.

METHODS

Study Design and Setting

This was a descriptive cross-sectional study conducted among female medical students at three medical colleges in Sialkot district, Punjab, Pakistan: Islam Medical & Dental College, Sialkot Medical College, and Khawaja Muhammad Safdar Medical College. Data were collected between April and August 2026. This study reports the prevalence, consumption-pattern, and awareness component of a larger parent survey of this cohort; companion analyses examining the association between energy drink frequency and cardiac autonomic symptoms, and the role of anxiety severity, are reported separately using the same dataset.

Study Population and Sampling

Eligible participants were female medical students aged 18-30 years enrolled at one of the three participating colleges, excluding those with a known history of cardiovascular disease, pregnancy or

lactation, current use of medication with a strong influence on heart rate or QT interval, or a self-reported chronic illness capable of independently producing palpitations.

Sample size was calculated using Cochran's formula for an anticipated energy drink use prevalence of 65% (based on regional pilot data on energy drink use among medical students) and a 5% margin of error at 95% confidence (baseline n= 350),[15] adjusted for the finite target population of 1,243 female students across the three colleges (finite population correction, n=274), and divided by 0.85 to allow for 15% anticipated non-response (enrolment target 323). Participants were selected by stratified sampling, with each institution treated as a separate stratum and the sample allocated in proportion to its share of the total eligible population (531, 369 and 343 female students at Islam Medical & Dental College, Sialkot Medical College and Khawaja Muhammad Safdar Medical College, with invitation targets of 138, 96 and 89, respectively). Students were selected within each college through simple random sampling from class lists. Data collection continued until the calculated target of 274 completed responses was reached (117 from Islam Medical & Dental College, 81 from Sialkot Medical College, and 76 from Khawaja Muhammad Safdar Medical College).

Data Collection and Measures

Trained female data collectors, with permission from the head of each institution, administered a structured, pilot-tested questionnaire (piloted on 20 participants) face to face in a private setting after written informed consent. The questionnaire was designed for this study and had eight sections: sociodemographic characteristics; menstrual and reproductive history; energy drink consumption; tea and coffee intake; cardiac autonomic and related symptoms; the Generalized Anxiety Disorder 7-item scale (GAD-7); [16] physical activity and sleep; and knowledge and awareness. This report uses the energy drink items (use in the past 3 months and, for users, weekly frequency, brand, typical serving size, time of day, main reason for use, and duration of habitual use), the tea and coffee items (frequency, predominant type, and self-estimated total daily caffeine), a checklist of seven cardiac autonomic and stimulant-related symptoms rated by frequency over the past month, and items on prior knowledge of the caffeine content of energy drinks, awareness that caffeine can affect heart rhythm, perceived symptom trigger, care-seeking, previously diagnosed cardiac conditions, and willingness to reduce energy drink consumption if advised by a doctor. Interviews lasted approximately 12-15 minutes.

Statistical Analysis & Ethical Considerations

Table 1. Energy Drink Consumption Patterns

Variable	Category	n	%
Energy drink use in past 3 months	Yes	171	62.4
	No	103	37.6
Weekly consumption frequency	Non-consumer	103	37.6
	1-2 cans/week	81	29.6

	3-4 cans/week	54	19.7
	≥ 5 cans/week	36	13.1
Brand most used*	Sting (PepsiCo)	73	26.6
	Red Bull	54	19.7
	Monster	17	6.2
	Power Horse	15	5.5
	Other	12	4.4
Typical serving size*	250 mL (standard can)	79	28.8
	500 mL (large can)	58	21.2
	Variable	19	6.9
	More than 500 mL	15	5.5
Time of consumption*	Night (after 9 PM)	87	31.8
	Evening (5-9 PM)	43	15.7
	Afternoon (12-5 PM)	28	10.2
	Morning (before 12 PM)	13	4.7
Main reported reason for use*	Studying/academic performance	107	39.1
	Physical energy boost	38	13.9
	Taste preference	13	4.7
	Social/peer influence	13	4.7
Duration of habitual use*	More than 1 year	56	20.4
	6-12 months	43	15.7
	3-6 months	42	15.3
	Under 3 months	30	10.9

**Percentage of total N=274 the 103 non-consumers are coded not applicable on these items. Percentages among the 171 consumers are given in the text.*

Background dietary stimulant intake was also substantial (Table 2). Two to three cups of tea per day was the modal category (45.3%), predominantly loose-leaf doodh patti (44.9%) rather than teabags (34.7%). Fifty-two participants (19.0%) self-estimated a total daily caffeine intake of 300 mg or more; this open-

ended category approaches, but does not by itself show intakes above, the 400 mg/day level that the European Food Safety Authority regards as not raising safety concerns in healthy adults. [7]

Table 2. Background Dietary Stimulant Intake (N=274)

Variable	Category	n	%
Tea (doodh patti / black tea) intake	1 cup/day	73	26.6
	2-3 cups/day	124	45.3
	> 4 cups/day	57	20.8

Awareness of stimulant-related risk was high, but care-seeking was rare (Table 4, Figure 1). Most participants (91.2%) already knew that energy drinks contain high amounts of caffeine, and 64.2% reported being aware that caffeine can affect heart rhythm, with a further 28.1% somewhat aware. Of the 154 participants who reported symptoms, 64 (41.6%) attributed them to energy drinks, 48 (31.2%) to tea or coffee, and 42 (27.3%) to neither. Only 22 participants (8.0% of the sample) had ever sought medical care for their symptoms. Analysis confirmed that all 22 were among the 154 symptomatic participants; if so, this is 14.3% of those with symptoms. Seven participants (2.6%) reported a diagnosed cardiac condition and 39 (14.2%) were unsure whether they had one Asked whether they would reduce their energy drink consumption if advised by a doctor, 53.6% of the full sample answered definitely yes and a further 34.7% probably yes.

Knew energy drinks contain caffeine	91.2%
Aware energy drinks can affect heart rhythm	64.2%
Attributed their own symptoms to energy drink use	23.4%
Had sought medical care for their symptoms	8.0%

Figure 1. The awareness-to-action gap: proportion of participants at each stage from general caffeine awareness through to care-seeking for their own symptoms (N = 274). [AUTHOR: every stage uses N = 274 consider redrawing the attribution and care-seeking stages with the 154 symptomatic participants as denominator.]

Table 4. Symptom Attribution, Care-Seeking, and Health-Risk Awareness (N=274)

Variable	Category	n	%
Perceived symptom trigger	Never experienced symptoms	120	43.8
	After energy drinks	64	23.4
	After tea/coffee	48	17.5

	Not related to any drink	42	15.3
Sought medical care for symptoms	No	252	92.0
	Yes	22	8.0
Diagnosed cardiac condition	No	228	83.2
	Not sure	39	14.2
	Yes	7	2.6
Knew energy drinks contain high caffeine	Yes	250	91.2
	No	24	8.8
Aware caffeine can affect heart rhythm	Yes, aware	176	64.2
	Somewhat aware	77	28.1
	Not aware	21	7.7
Would reduce intake if advised by a doctor	Definitely yes	147	53.6
	Probably yes	95	34.7
	Probably not	23	8.4
	Definitely not	9	3.3

DISCUSSION

Energy drink consumption in this sample was common. heavy in a minority (13.1% drank five or more cans a week), and

The use of energy drinks was prevalent, excessive in a small proportion (13.1% used five or more cans per week), and added to the consumption of large amounts of tea. There was high awareness of stimulant-related risks, as over 90% of the participants knew that energy drinks have a large quantity of caffeine in them, and about two-thirds were aware that caffeine affects heart rhythms. However, only 22 of the participants (8.0%) ever sought medical consultation, while 154 (56.2%) experienced at least one symptom related to the heart during the past month.

The use prevalence within the past 3 months was higher (62.4%) than the rate of 52% of the users of energy drinks among medical students in a private university in Karachi in 2013, in which Red Bull was the most consumed drink, while studying for examinations was the reason given by 14.6% of all the

respondents.[12] In the current sample, Sting was the most popular brand and studying was cited by 39.1% of all the participants. The figure is also higher than the 37.1% of energy drink consumers among female students in four medical colleges in Karachi in 2012.[13]

The dissociation between knowledge and behaviour is known from other studies. Medical students in a 2025 study in Warsaw showed significantly better knowledge of energy drink components and effects but used the drinks equally often compared to non-medical students.[14] This research included no non-medical students and cannot determine whether medical training increased knowledge. It takes the question further from consumption frequency to symptom attribution and help-seeking, the stage where knowledge needs to be translated into actions to have a clinical impact. Clinical nurses in the United States who use energy drinks showed poorer sleep quality and higher stress perception than those not using them,[17] suggesting the habit of using stimulants formed during training could continue in their clinical work.

Symptom attribution was more common than suggested by the numbers for the whole sample: 41.6% of participants with symptoms attributed them to energy drinks while an additional 31.2% attributed symptoms to tea or coffee. The real difference is between symptoms and care-seeking. In the corresponding analysis of the same data, anxiety severity measured by GAD-7 was independently associated with symptom burden even adjusted for energy drink and tea consumption (aOR 1.18 per point).[18] This provides another perspective on personal exemption – attribution of symptoms in this case might be partially due to perception of symptoms caused by anxiety rather than underestimation of stimulant risks.

The motivation of use most commonly cited by respondents (studying/academic performance, 62.6% of energy drinks consumers) provides some insight into the matter of continuity of the practice. When people view energy drinks as a functional necessity to cope with academic pressures, rather than an indulgence, mere knowledge of general risks might not be sufficient to encourage changing the practice, whereas addressing the compromise between short-term coping with academic pressures and symptom risks might be.

An absolute number of the dietary stimulant load is worth mentioning as well. Almost a fifth of the sample (19.0%) estimated their overall caffeine intake at 300 mg or more per day. It comes close to the habitual intake of 400 mg/day which is regarded as safe for healthy adults by European Food Safety Authority;[7] since the upper range of the category was open-ended, no conclusions can be made about prevalence of 400 mg and higher. As this estimate includes both energy drinks and tea, and the combination is virtually absent in Western survey literature, would not be fully covered by a research project involving only the measure of energy drink intake. For instance, a person described as having moderate energy drink intake but being a heavy tea drinker would possess an equivalent amount of caffeine as a heavy energy drink consumer but low tea intake.

There are a number of limitations in the current study. First, all measures were based on self-reporting. As the survey was conducted in face-to-face interviews, there is the possibility of under reporting the amount of intake or symptoms. The total daily intake was estimated without the aid of standardized reference tables, and hence it is prone to estimation errors both ways. It was also not possible to assess the awareness

with knowledge tests but with self-ratings. The symptom list cannot show any causal relationship between symptoms and energy drink intake as it does not provide evidence that the symptoms occurred after energy drink intake; moreover, the one-month reference period of symptoms does not tally with 3-month period of energy drink intake. Lastly, as the current sample comprised only of female medical students enrolled in three colleges of one district of Pakistan, these estimates cannot be generalized to male students, However, in view of the fact that all the participants belonged to the same category being young female medical students of three colleges from one particular district, the results cannot be extended to young male students, students of other disciplines or other parts of the country.

In spite of the shortcomings of the study, there is a practical application of the results. In places where awareness is high and care-seeking is low, more awareness might not necessarily be sufficient to bridge the gap. Strategies aimed at finding out why students consume these drinks mainly to cope with their academic requirements and providing them an

alternative that serves the same purpose would work better.

CONCLUSION

Consumption of energy drinks was prevalent in the sample of female medical students in Sialkot, excessive in almost one out of eight subjects, in combination with the significant tea drinking; around a fifth of subjects were aware of the combined consumption of caffeine in an amount of 300 mg/day or more. There was high general awareness regarding the risks of cardiac problems due to stimulant intake, but very low rate of seeking medical attention when experiencing adverse effects, in line with the well-known knowledge-behavior gap described in medical students elsewhere. Since studying was the main motivation for the use of stimulants, direct interventions addressing the reasons for studying might prove more efficient than mere awareness campaign, though this needs verification.

Ethical Approval: This study was approved by the Institutional Ethics Review Committee, Islam Medical & Dental College, Sialkot, in accordance with the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from all participants before enrollment.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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