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Effectiveness of Educational Interventions on Caffeine Habits Among Adolescents

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Declarations
Ethical Considerations:
Institutional Ethics Committee of the Krishna Institute of Medical sciences (KIMS) approved the study (KVV/IEC/08/2023, dated 19.07.2023) and was in accordance with Helsinki declaration. The written informed consent was taken from all participants prior to data collection.
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Abstract
The caffeine consumption is very common among adolescents, often driven by academic stress and lifestyle habits. Excessive intake can lead to sleep disturbances, cardiovascular effects, dependency and poor dietary practices. Despite its widespread use, knowledge regarding safe limits and associated health risks remains limited among young populations. A single-group study was conducted in April 2024 among undergraduate students (aged 18–19). A total of 60 participants were included in the study. A validated, structured questionnaire assessed baseline knowledge of caffeine and its health effects. Participants received an informative educational booklet followed by a post-test to evaluate changes in awareness. Before the intervention, 30% of participants demonstrated good knowledge, while 13% had poor knowledge. Post-intervention, all students (100%) achieved good knowledge levels. The pre-test score (10.58±2.54) was, significantly increased post-intervention (17.33±1.96) ($t = 18.740$, $p < 0.0001$). No significant associations were found between knowledge score and demographic variables. The study revealed a lack of baseline knowledge regarding caffeine's adverse effects among adolescents. A structured educational booklet significantly improved awareness, underscoring the need for early educational interventions to promote healthy caffeine habits and informed lifestyle choices.

Keywords: Caffeine consumption, educational intervention, lifestyle habits, Indian students

Introduction

Caffeine use has been associated with multiple health concerns, including acute toxicity, cardiovascular stress, sleep disruption, reduced calcium absorption, and possible impacts on bone health and reproductive development. While many of these behaviors begin in childhood and extend into adolescence or adulthood, there remains comparatively less robust evidence on caffeine's specific effects in children and teens [1,2].

The children and adolescents frequently consume caffeine to increase alertness, often to offset late bedtimes and early school start times, but this may lead to dependence. Withdrawal symptoms can include headaches, fatigue, irritability, and difficulties with concentration [3]. Caffeine-induced sleep disturbances are well documented: even modest amounts may shorten sleep duration by 15 minutes nightly, promoting a cycle of fatigue and increased caffeine intake [4]. Dietary patterns involving highly processed, caffeinated, sugary foods and beverages, sometimes labeled "JUNCS," contribute significantly to excess sugar intake, weight gain, and broader health risks in youth. Experts strongly recommend limiting such items to infrequent use, promoting fresh whole foods instead, and implementing policies such as restricting the sale of energy drinks near schools, enforcing clear labeling, and banning targeted advertising [5]. Surveillance data from poison control centers reveal sharp rises in caffeine-related exposures among children under six, particularly involving powdered supplements, underscoring the importance of safe storage and regulation [6]. Regulatory authorities like the European Food Safety Authority (EFSA) deem daily intake up to 3 mg per kg of body weight as generally safe for children and adolescents, and recommend no more than 200 mg/day for pregnant women, while acknowledging that high doses may impair sleep and increase heart rate or anxiety [1,7]. The present study aims to assess young adolescents' understanding of their caffeine consumption patterns and their awareness of its potential health risks.

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Material and Methods

The study was approved by the Institutional Ethics Committee. The written informed consent was taken from all participants prior to data collection. An experimental study was conducted on young adolescents in April 2024 to assess their caffeine intake habits and related health effects. A self-structured, expert-validated questionnaire was used for data collection. Participants were informed about the study objectives, and written consent was obtained. A pretest was administered to evaluate baseline knowledge, followed by an immediate educational intervention using an informative booklet, which was explained to the participants. Knowledge levels were classified as poor (0-7), average (8-12), and good (13-20). The study duration was one month, with no participant dropout. A booklet was developed specifically for adolescents to improve their awareness and understanding of caffeine consumption. It included a clear explanation of what caffeine is, its various ingredients, and the common dietary sources in which caffeine is found. It also described the physiological effects of caffeine on different organ systems, highlighting both the short-term and long-term health risks associated with excessive intake. In addition, the booklet provided practical preventive strategies to help students adopt healthier lifestyle habits. These included guidance on reducing caffeine consumption, choosing healthier beverage alternatives and maintaining adequate sleep. The educational material also emphasized how developing healthy habits can support improved concentration and academic performance, thereby providing the importance of mindful caffeine use.

Results and Discussion

A total of 60 participants were included in the study. The demographic details are presented in Table 1. Participants were equally distributed across the age groups of 18 and 19 years. Most students (47%) belonged to families with a monthly income between rupees 49,962 and 74,755. A majority (65%) came from joint families. The internet was the most commonly reported source of information (70%), and 58% of the students consumed fast food weekly.

Table 2 displays the comparison of pre- and post-test knowledge levels. Before the intervention, only 30% of the students had good knowledge, while 57% had average knowledge and 13% had poor knowledge. After the intervention, all participants (100%) achieved a good knowledge level, indicating a marked improvement in awareness.

The pre-test mean (SD) knowledge score was 10.58 (2.54). Following the intervention, the post-test mean (SD) score increased to 17.33 (1.96). The mean difference was 6.75, and the calculated t-value was 18.740. This was significant (p-value <0.0001) demonstrating that the educational intervention was highly effective in improving the knowledge of participants.

The association between pre-test knowledge levels and socio-demographic variables was analyzed using chi-square tests (Table 3). No statistically significant associations were found between knowledge levels and age, income, type of family, source of information, or dietary habits.

This study explored patterns of caffeine consumption and knowledge among undergraduate students, revealing prevalent use of caffeinated beverages and lifestyle influences such as online information sources and fast food habits. The findings underscore broad and pervasive patterns consistent with other published literature in Indian settings.

The study by Pulla et al. [8], conducted among medical undergraduates in Secunderabad, Telangana, reported an average self-reported daily caffeine intake of 151.3 mg, with higher consumption seen among male students (174 mg/day). This indicates moderate but widespread use within this demographic. Likewise, a larger survey across university students found an average intake of 264 mg/day, with nearly one-third consuming more than 400 mg/day. Most respondents used caffeine to enhance alertness during academic activities and after meals, with common sources including coffee, tea, and soft drinks [9]. These studies align with present study participants' behavior, particularly the reliance on fast food and the internet for health information.

Several studies have highlighted that knowledge gaps about safe caffeine limits and potential health risks are pervasive even among educated youth [10]. For instance, despite high awareness of caffeine dependence (88.7%) and intention to reduce consumption (62.5%), many students in South India remained uncertain about dosage thresholds and long-term effects. This highlights the baseline knowledge deficits detected in our cohort and emphasizes the need for structured educational interventions [10].

Educational programs using interactive and visual methods have shown promise in bridging these gaps. Given the absence of significant associations between demographics and baseline knowledge, this information gap appears universal across socioeconomic and family structures. Interventions designed to raise awareness about caffeine safety, healthy intake limits (e.g., not exceeding 300–400 mg/day per Indian Council of Medical Research (ICMR) guidance), and healthier coping strategies should therefore be applied widely rather than targeted by subgroup [11].

The available literature strongly supports that caffeine consumption is common among Indian undergraduate students, often driven by the need for alertness and shaped by fast-paced lifestyles. Furthermore, knowledge deficiencies regarding safe use persist across groups [8,11]. Well-designed, interactive educational interventions have the potential to meaningfully close these gaps and encourage healthier consumption practices.

Conclusion

The present study highlights a clear lack of awareness among adolescents regarding the potential health risks associated with excessive caffeine consumption. The implementation of an informational booklet as an educational intervention significantly

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enhanced their understanding and awareness of caffeine-related issues. This improvement underscores the importance of early health education in shaping responsible consumption habits. Proactive initiatives such as awareness programs and the distribution of evidence-based informational materials can serve as effective tools to mitigate unhealthy caffeine intake among youth and foster healthier long-term lifestyle choices.

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Table 1: Distribution of Participants by Socio-Demographic Variables (n = 60)

Variables	Categories	Frequency (%)
Age	18 years	30 (50%)
	19 years	30 (50%)
Monthly Family Income (INR)	≥199,863	1 (1%)
	99,931–199,863	6 (10%)
	74,755–99,930	16 (27%)
	49,962–74,755	28 (47%)
	29,973–49,961	6 (10%)
	10,002–29,972	3 (5%)
	≤10,001	0 (0%)
Type of Family	Nuclear	21 (35%)
	Joint	39 (65%)
Source of Information	Newspaper	18 (30%)
	Internet	42 (70%)
Dietary Habits	Fast food (weekly)	35 (58%)
	Fast food (daily)	25 (42%)

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Table 2: Comparison of Pre- and Post-Test Knowledge Levels (n = 60)

Knowledge Category	**Pre-Test** *n (%)*	**Post-Test** *n (%)*
Good (13–20)	18 (30%)	60 (100%)
Average (8–12)	34 (57%)	0
Poor (0–7)	8 (13%)	0

Table 3: Association of Pre-Test Knowledge Levels with Socio-Demographic Variables

Variable	**Chi-square**	**p-value**
Age	2.448	0.294
Monthly Income	5.141	0.881
Type of Family	0.591	0.744
Source of Information	2.717	0.257
Dietary Habits	0.978	0.613