Review article of caffeine energy drinks.

Alishba Naeem*, Khadija Tul Kubra

Department of Food Science and Human Nutrition, Kinnaird College for Women University, Lahore, Pakistan

Abstract

The research articles discuss various aspects of caffeine consumption patterns and levels, covering both energy drinks and coffee beverages. For instance, studies such as "Quantitative determination of caffeine in imported energy drinks of Lahore, Pakistan" and "The caffeine content of energy drinks in accordance with the information on the package label" analyze the quantitative measurement of caffeine levels in energy drinks, highlighting the importance of accurate labeling and quality control to reduce potential health risks related to excessive caffeine consumption. Additionally, "The relationship between energy drink consumption, caffeine content, and nutritional knowledge among college students" uncovers the connection between demographic characteristics, caffeine levels, and nutritional knowledge among college students, revealing a common consumption of energy drinks despite reported adverse effects. Meanwhile, "Influence of various factors on caffeine content in coffee brews" and "Antioxidants, phenols, caffeine content, and volatile compounds in coffee beverages obtained by different methods" concentrate on the factors that influence caffeine content in coffee brews, emphasizing the importance of brewing methods in determining caffeine levels and other bioactive compounds. While espresso brewing produces coffee with high caffeine levels, French press brewing enhances aromatic volatile compounds, highlighting the intricate interplay between preparation methods and sensory attributes in coffee beverages.

These studies highlight the diverse aspects of caffeine research, including analytical quantification, consumer behavior, and brewing science. Together, they enhance our understanding of caffeine's presence in beverages, its impact on consumer health, and the effects of preparation methods on sensory attributes. By conducting thorough analysis and critical examination, these studies provide valuable insights into maximizing caffeine consumption and promoting informed dietary choices among consumers.

Keywords: Caffeine energy drinks, Coffee beverages, Brewing science, Package label, Antioxidant activity.

Introduction

These introductions provide a detailed analysis of caffeine consumption, especially concerning energy drinks and coffee. They highlight the widespread use of caffeine worldwide, its effects on the body, and the delicate balance between its benefits and potential health risks. The authors offer valuable insights into the historical, cultural, and chemical aspects of caffeine. However, they also stress the potential dangers of excessive caffeine intake, particularly from energy drinks, which is a growing concern among young people. Regulatory efforts are underway to address these health risks.

The authors also recognize the complex interplay between caffeine and antioxidants and other bioactive compounds found in coffee. This interplay points towards potential health benefits and underscores the importance of understanding coffee processing methods. Though coffee has antioxidant properties and potential health benefits, the authors consistently call for moderation and awareness regarding caffeine intake. They advocate for informed consumer choices and regulatory measures to ensure safety [1].

In summary, these introductions explore the complex landscape of caffeine consumption. They provide a balanced view of its cultural significance, physiological effects, and health implications, emphasizing the need for a nuanced approach towards its consumption. By comparing energy drinks with coffee's antioxidant properties and processing methods, they offer a comprehensive understanding of caffeine's role in modern life. The authors urge for responsible consumption practices and regulatory measures to ensure public health.

These set of literature reviews provides comprehensive insights into various aspects of caffeine consumption, leaving no stone unturned. The reviews delve deep into topics such as the effects of energy drinks on academic performance, the global coffee industry, the health benefits and risks of caffeine, and the

***Correspondence to:** Alishba Naeem, Department of Food Science and Human Nutrition, Kinnaird College for Women University, Lahore, Pakistan, E-mail: naeemalishba08@gmail.com

***Received:** 20-May-2024, Manuscript No. AAJFSN-24-136454; **Editor assigned:** 22-May-2024, AAJFSN-24-136454 (PQ); **Reviewed:** 05-Jun-2024, QC No. AAJFSN-24-136454; **Revised:** 14-Aug-2025, Manuscript No. AAJFSN-24-136454 (R); **Published:** 21-Aug-2025, DOI: 10.35841/AAJFSN.8.3.296*

***Citation:** Naeem A, Kubra KT. Review article of caffeine energy drinks. J Food Nutr Health. 2025;8(3):298.*

dangers of excessive caffeine intake from energy drinks. These reviews are a must-read for anyone seeking to understand the impact of caffeine consumption on different populations and its implications for overall health and well-being.

The consumption of energy drinks among college students has been a subject of interest. Studies have focused on the potential impact of energy drinks on academic performance and the consumption habits of college-aged students. On the other hand, a broader view of the coffee industry, including production, consumption, and health benefits, has been discussed. The coffee industry review has highlighted the antioxidant properties and bioactive compounds in coffee. However, the energy drink consumption review may not address the potential health benefits of moderate caffeine consumption from coffee [2].

The biochemical composition of coffee, including its caffeine content and health effects, has been explored in detail. The factors influencing caffeine levels in brewed coffee have also been discussed. While the health risks associated with energy drinks and caffeine overdose have been reviewed, regulatory measures and potential interventions have also been addressed. However, the biochemical composition review may not directly address the specific health risks associated with energy drink consumption, and the health risks review may lack detailed information about coffee's biochemical properties and metabolism.

When comparing energy drink consumption in college students to the biochemical composition and metabolism of coffee, specific insights into college-aged students' consumption habits and academic performance have been discussed. The higher caffeine content in energy drinks compared to other beverages has also been highlighted. Detailed information on coffee's biochemical composition, caffeine content, and metabolic processes has been provided. The health effects of caffeine and factors influencing caffeine levels in coffee have been discussed. However, the energy drink consumption review may lack detailed information on coffee's biochemical properties, and the biochemical composition review may not directly address caffeine consumption habits among college students [3].

Literature Review

The five articles present different methodologies for investigating caffeine content in beverages, as well as its implications. "Quantitative determination of caffeine in imported energy drinks of Lahore, Pakistan" and "The caffeine content of energy drinks by the information on the package label" use precise analytical methods such as UV-visible spectrophotometry and High-Performance Liquid Chromatography (HPLC) to measure caffeine levels accurately. On the other hand, "The relationship between energy drink consumption, caffeine content, and nutritional knowledge among college students" focuses on surveying college students about their energy drink consumption habits, without any experimental controls to establish causality [4].

"The relationship between energy drink consumption, caffeine content, and nutritional knowledge among college students" and "antioxidants, phenols, caffeine content and volatile compounds in coffee beverages obtained by different methods" are two studies that investigate the relationship between caffeine intake and beverage consumption among college students. However, these studies have limitations in their methodology, specifically in terms of validation and error analysis. Therefore, it is important to incorporate both analytical and survey-based approaches to gain a more comprehensive understanding of caffeine content and its impact on consumer behavior.

A study on imported energy drinks uses UV-visible spectrophotometry to determine caffeine concentrations. Standard stock solutions are prepared, and samples are analyzed after careful sample preparation and calibration curve generation. However, the analysis doesn't provide enough detail about the validation of the analytical method and potential sources of error [5].

In the realm of caffeine research, some studies concentrate on how extraction methods affect the amount of caffeine in coffee, while others only examine energy drinks. It is important to merge these approaches and rectify methodological weaknesses such as validation procedures and experimental controls to gain a thorough understanding of caffeine's presence in beverages and its impact on health and behavior. To progress comprehensively in this field, it is crucial to prioritize methodological rigor and interdisciplinary collaboration.

Literature Review

The five articles provide insights into the caffeine content of beverages and its association with various factors. "quantitative determination of caffeine in imported energy drinks of Lahore, Pakistan" reveals significant variability in caffeine concentrations among different energy drink brands, with concentrations ranging from 30.95 mg/100 mL to 50.66 mg/100 mL. Similarly, "the caffeine content of energy drinks in accordance with the information on the package label" finds considerable disparities between actual caffeine content and the values reported on package labels, with some drinks containing higher caffeine levels than stated. However, both studies lack comprehensive analyses of factors influencing these variations, such as manufacturing processes or regional regulations [6].

"The relationship between energy drink consumption, caffeine content, and nutritional knowledge among college students" study found a positive correlation between energy drink consumption and caffeine content. Interestingly, it was also discovered that nutritional knowledge among college students did not significantly impact consumption patterns. This highlights the complex interplay between consumer behavior and beverage composition. "Influence of various factors on caffeine content in coffee brews" study explores the impact of extraction methods, roasting levels, and brewing parameters on caffeine content in coffee. The study reveals that factors like grind size, water temperature, and brewing time significantly

influence caffeine extraction, offering valuable insights for coffee enthusiasts and industry professionals alike [7].

The research paper titled "Antioxidants, phenols, caffeine content and volatile compounds in coffee beverages obtained by different methods" is a valuable source of information for coffee enthusiasts and researchers alike. The paper provides an in-depth analysis of the composition of coffee, highlighting the variations in antioxidant activity, phenolic content, and volatile compounds across different brewing methods. One of the key findings of the study is the positive correlation between caffeine content and antioxidant activity, which suggests that caffeine consumption in coffee may have potential health benefits. However, the lack of standardized methodologies across brewing techniques limits the comparability of results, making it challenging to draw definitive conclusions [8].

The study emphasizes the need for further research to understand the complex interactions between manufacturing processes, consumer behavior, and beverage composition. Integrating findings from diverse methodologies can enrich our understanding of caffeine's role in both energy drinks and coffee, informing industry practices and public health initiatives [9].

In summary, this research paper is a valuable contribution to the field of coffee science, shedding light on the complex composition of coffee and its potential health benefits. The findings underscore the need for more research to better understand the relationship between coffee production, consumer behavior, and the health effects of caffeine consumption [10].

Conclusion

The range of studies examining the caffeine content in beverages offers a nuanced understanding of its implications for consumer health and industry practices. Although there are variations in caffeine levels among energy drinks and coffee brews, accurate labeling and quality control measures are necessary. The complex interplay between consumer behavior, nutritional knowledge, and beverage composition highlights the importance of targeted educational interventions and regulatory oversight. Standardized methodologies are essential to ensure consistency and reproducibility in caffeine analysis, especially in the context of coffee preparation where factors like extraction techniques and brewing parameters significantly influence caffeine content. Moreover, the potential health benefits associated with caffeine consumption, such as antioxidant activity in coffee, warrant further exploration through interdisciplinary research efforts. Overall, these findings underscore the multifaceted nature of caffeine's role in beverages and emphasize the importance of transparency, education, and methodological rigor in promoting informed decision-making and safeguarding consumer well-being.

Recommendations

Here are some recommendations for further research to improve the study on caffeine consumption patterns and levels:

- Develop and implement standardized methods for analyzing caffeine content in beverages, such as energy drinks and coffee. This will ensure consistency, reproducibility, and comparability of results across different studies and laboratories.
- Implement strict quality control measures in the production and labeling of energy drinks and coffee products to ensure accurate representation of caffeine content and minimize discrepancies between actual levels and label claims.
- Investigate consumer behavior patterns related to caffeine consumption, including factors that influence beverage choice, awareness of caffeine content, perceived health risks, and motivations for consumption. This will help in designing targeted educational interventions and public health campaigns.
- Study the effect of different brewing methods (e.g. espresso, French press, drip coffee) on caffeine extraction, antioxidant activity, and sensory attributes of coffee beverages. This will help in understanding how preparation techniques affect caffeine levels and overall beverage quality.
- Conduct comprehensive health impact assessments to evaluate the physiological effects of varying caffeine levels in beverages, especially concerning vulnerable populations such as pregnant women, children, and individuals with certain medical conditions.

References

1. Chavez SG, Mendoza MM, Caetano AC. Antioxidants, phenols, caffeine content and volatile compounds in coffee beverages obtained by different methods. Food Sci Technol. 2022;42:e47022.
2. Hardy R, Kliemann N, Dahlberg P, et al. The relationship between energy drink consumption, caffeine content, and nutritional knowledge among college students. J Prim Prev. 2021;42:297-308.
3. Mackus M, van de Loo AJ, Benson S, et al. Consumption of caffeinated beverages and the awareness of their caffeine content among Dutch students. Appetite. 2016;103:353-7.
4. Kelly CK, Prichard JR. Demographics, health, and risk behaviors of young adults who drink energy drinks and coffee beverages. J Caffeine Res. 2016;6(2):73-81.
5. Khan MS, Nisar N, Naqvi SA. Caffeine consumption and academic performance among medical students of Dow University of Health Science (DUHS), Karachi, Pakistan. Ann Abbasi Shaheed Hosp Karachi Med Dent Coll. 2017;22(3):179-84.
6. Kudema S, Thomas C, Ngowi H. The caffeine content of energy drinks in accordance with the information on the package label. Adv Public Health. 2023;2023(1):9938190.
7. Olechno E, Puścion-Jakubik A, Zujko ME, et al. Influence of various factors on caffeine content in coffee brews. Foods. 2021;10(6):1208.
8. Passos CP, Costa RM, Ferreira SS, et al. Role of coffee caffeine and chlorogenic acids adsorption to

polysaccharides with impact on brew immunomodulation effects. Foods. 2021;10(2):378.

9. de Melo-Pereira GV, de Carvalho-Neto DP, Júnior AI, et al. Exploring the impacts of postharvest processing on the aroma formation of coffee beans–A review. Food Chem. 2019;272:441-52.
10. Verster JC, Benson S, Johnson SJ, et al. Alcohol Mixed with Energy Drink (AMED): A critical review and meta-analysis. Hum Psychopharmacol. 2018;33(2):e2650.

Citation: *Naeem A, Kubra KT. Review article of caffeine energy drinks. J Food Nutr Health. 2025;8(3):298.*