

# From Root to Stem: Optimizing Produce Utilization and Reducing Waste through Sustainable Cooking Practices

\*<sup>1</sup>Hare Krishna Chaudhary, <sup>2</sup>Dr Ajay Khatter and <sup>3</sup>Tanushri Sharma

<sup>1</sup>Assistant Lecturer, Institute of Hotel Management, Catering & Nutrition, Ranchi

<sup>2</sup>Senior Lecturer, Faculty of Higher Education, William Angliss Institute, Melbourne, Australia

<sup>3</sup>Assistant Lecturer, Institute of Hotel Management, Catering & Nutrition, Pusa, New Delhi

\*hk2191chy@gmail.com

## Abstract

**Background:** In modern society, food waste is a pressing issue contributing to environmental degradation and resource depletion. “From Root to Stem” proposes a solution by advocating for sustainable cooking practices that maximize the use of every part of produce. **Objectives:** The objectives of this study were twofold. Firstly, to assess the existing levels of awareness and implementation of root-to-stem cooking practices among hospitality students. Secondly, to identify the obstacles hindering widespread adoption of root-to-stem cooking and to pinpoint the factors that facilitate its uptake. Additionally, the study aimed to propose effective strategies for promoting the incorporation of root-to-stem cooking practices in both domestic and commercial environments. **Methodology:** To accomplish these goals, a quantitative research approach, specifically employing a descriptive research design, was utilized. Data collection involved the use of an online questionnaire distributed via Google Forms among a select group of hospitality students with expertise in the kitchen. Convenience sampling was employed to gather data, resulting in a sample size of 328 participants. Data analysis was conducted using SPSS version 23, based on a mixed questionnaire format. **Results:** The data reveals that 92.1% of respondents are familiar with root-to-stem cooking. However, only 4.3% always incorporate these techniques, with 58.6% doing so sometimes. 87.4% have received formal education or training on root-to-stem cooking, and 78.1% believe it can contribute to reducing food waste. Additionally, 56.3% are moderately likely to explore root-to-stem cooking further in the future. **Conclusion:** Root-to-stem cooking offers a sustainable solution to minimize food waste by utilizing entire plants. Despite obstacles like limited consumer awareness and logistical challenges, collaborative efforts among stakeholders can drive its adoption. Through education, digital platforms, and policy interventions, root-to-stem cooking can revolutionize culinary practices and promote a more sustainable food system.

**Keywords:** sustainable cooking practices, root to stem concept, food waste, food sustainability

## Introduction

In recent years, the discourse surrounding sustainable food practices has gained significant momentum as concerns over food waste and environmental sustainability continue to escalate (Vågsholm et al., 2020). Food waste presents a critical global problem, and effectively managing it within institutional catering facilities is of utmost importance (Chaudhary & Sharma, 2023). Among the innovative solutions emerging in response to these challenges is the concept of root-to-stem

cooking. Root-to-stem cooking advocates for the utilization of the entire edible portion of fruits and vegetables, including stems, leaves, and peels, to minimize waste and maximize resource efficiency. By embracing this holistic approach to cooking, individuals can not only reduce their environmental footprint but also unlock new culinary possibilities and flavors (Root To Stem: Eating Fruits & Vegetables With Peels, Stems, Leaves Is Now A Food Trend! - NDTV Food, n.d.).

Root-to-stem cooking is akin to nose-to-tail cooking but with a plant-based focus. Just as nose-to-tail cooking encourages the use of every part of an animal to minimize waste, root-to-stem cooking advocates for utilizing all edible parts of fruits and vegetables to reduce food waste. Traditionally discarded parts like lemon rinds, broccoli stalks, and beet tops are incorporated into recipes instead of being thrown away. By maximizing the use of fruits and vegetables in cooking, not only do you consume more nutritious foods, but you also contribute to efforts aimed at reducing food waste, making your cooking and eating habits more environmentally-friendly and sustainable (Root-to-Stem Cooking: How to Maximize Your Produce and Minimize Waste - Clean Eating, n.d.).

While the principles of root-to-stem cooking hold great promise for promoting sustainability in the kitchen, their widespread adoption remains relatively underexplored, particularly within the context of culinary education and professional practice (Kumar & Chaudhary, 2023). The corporate sector and hotel industry is increasingly recognized as a pivotal player, alongside international organizations and governments, in driving efforts towards sustainable development (Anand & Chaudhary, 2023). According to the USDA, food waste constitutes approximately 30 to 40 percent of the food supply in the United States, a staggering figure that cannot be overlooked. Embracing root-to-stem cooking, essentially making full use of every part of a fruit or vegetable, offers a practical solution to minimize food waste while enhancing nutrition and flavour (How to Use Up All Your Fresh Produce, Root to Stem, n.d.).

Hotel management institute faculty, as key stakeholders in promoting responsible tourism practices within star-rated hotels, play a crucial role in advancing sustainable cooking practices (Chaudhary et al., 2024). These educators influence the next generation of hospitality professionals by integrating sustainable practices into their curriculum. They provide students with essential knowledge and skills to optimize produce utilization and minimize waste, fostering a culture of environmental responsibility. By incorporating sustainable cooking techniques and waste reduction strategies into their teaching, faculty members prepare students to implement these practices effectively in their future careers. This training ensures that graduates enter the workforce with a strong commitment to sustainability and are equipped to address the challenges of food waste and resource management in

the hospitality industry. Through their educational programs, hotel management institutes contribute significantly to the development of a workforce that prioritizes responsible tourism practices, enhancing the sustainability efforts of star-rated hotels and promoting an eco-friendlier approach to hospitality.

Global food security has become a major issue, with ongoing difficulties in ensuring widespread access to food (Bose & Chaudhary, 2023). The imperative for sustainable food practices has become increasingly apparent in light of mounting concerns about food waste and its environmental consequences. One such innovative approach gaining traction is root-to-stem cooking, which advocates for the utilization of all parts of produce to minimize waste. This holistic approach to cooking not only reduces the environmental footprint associated with food production but also presents an opportunity to explore new flavours and culinary techniques. Despite its potential benefits, the widespread adoption of root-to-stem cooking remains relatively unexplored, particularly within the hospitality sector. Consequently, there exists a notable research gap regarding the awareness, adoption, and barriers to the implementation of these practices among hospitality students, who represent the future workforce in the culinary industry.

Existing literature on sustainable cooking practices often focuses on consumer behaviours and preferences, overlooking the crucial role of culinary education in shaping future industry practices (Abdou et al., 2023; Scherer et al., 2023). While there has been growing interest in sustainability within the culinary field, studies specifically examining the awareness and adoption of root-to-stem cooking practices among hospitality students are scarce. Understanding the knowledge, attitudes, and behaviours of these future culinary professionals is essential for developing targeted educational programs and industry initiatives that promote sustainability. Additionally, while barriers to sustainability in the hospitality sector have been identified, such as cost considerations and consumer demand, there is limited research exploring how these factors specifically impact the adoption of root-to-stem cooking techniques. This research seeks to contribute to the advancement of sustainable practices within the culinary industry. Insights gained from the study can inform educational programs, industry practices, and policy initiatives aimed at promoting the widespread adoption of

root-to-stem cooking principles. Ultimately, the findings aim to support the transition towards a more sustainable food system by empowering future culinary professionals to embrace innovative approaches to cooking that minimize waste and maximize resource efficiency.

#### **Objectives of this study were:**

1. To investigate current levels of awareness and adoption of root-to-stem cooking practices among hospitality students.
2. To identify barriers and facilitators to the widespread adoption of root-to-stem cooking and propose strategies for promoting its uptake in both domestic and commercial settings.

### **Methodology**

**Research design:** The current research employed a quantitative research methodology.

**Locale:** The samples for this study were hospitality students within the Delhi National Capital Region (NCR).

**Sampling:** Convenience sampling was employed in the current study for data collection through online google form, resulting in a sample size of 328 participants. The demographic characteristics of the respondents, including factors directly and indirectly linked to kitchen expertise such as gender and educational background, are depicted in Table 1.

**Tools and Techniques:** The tools and techniques employed for this study include careful designed questionnaire to ensure clarity and relevance, predominantly consisting of close-ended questions with predefined response options to streamline data collection and analysis. Likert scale was utilized to measure the frequency of root-to-stem cooking practices, confidence levels, and beliefs about their potential contribution to reducing food waste, while binary yes/no questions determine respondents' familiarity with root-to-stem cooking and their formal education or training on the subject. Data were collected through survey technique using online google form.

The inclusion criteria for this study required participants to be 18 years or older to ensure they had the autonomy to make food-related decisions. Participants were selected

from regions where root-to-stem cooking practices are either well-known or emerging trends, ensuring familiarity with the topic. While not mandatory, individuals with at least some basic awareness of root-to-stem cooking were encouraged to participate to provide a broader understanding of its perceived value. Additionally, respondents needed to be willing to engage in the study and provide informed consent. Exclusion criteria included participants under 18 years of age, non-English speakers (due to the survey being in English), and individuals unable to provide informed consent, such as those with cognitive impairments or language barriers. These criteria were established to ensure that the sample population was appropriate for investigating the research questions related to root-to-stem cooking and food waste reduction while maintaining ethical standards.

**Data Analysis and Statistical Analysis:** Analysis was conducted using SPSS version 23 as the primary analytical software. The collected data underwent rigorous statistical examination, with particular emphasis on utilizing descriptive statistics, specifically focusing on frequency distributions.

### **Results and Discussion**

This section delved into the detailed analysis of two pivotal tables, Table 1 and Table 2, which offer profound insights into the awareness, adoption, and perceptions of root-to-stem cooking practices among hospitality students. Table 1 provided a comprehensive cross tabulation of respondents' educational background and gender distribution, revealing distinct variations in educational attainment across different gender categories among hospitality students. Understanding these demographic nuances is essential for elucidating the underlying factors influencing awareness and adoption rates of root-to-stem cooking practices within the sampled population. Building upon the demographic insights from Table 1, Table 2 delves deeper into respondents' awareness, adoption, and perceptions of root-to-stem cooking practices. The table offers a comprehensive overview of respondents' familiarity with root-to-stem cooking, the frequency of incorporating these techniques, receipt of formal education or training, confidence levels, beliefs about its impact on reducing food waste, and future exploration intentions. These insights contribute to a deeper understanding of the factors influencing the uptake of sustainable cooking practices and inform strategies for promoting their widespread adoption in both domestic and commercial settings.

**Table 1: Educational Background \* Gender Cross Tabulation**

		Gender		Total
		Female	Male	
Educational Background	High School	25(24.5 %)	77(75.5 %)	102
	Bachelor's Degree	70(43.2 %)	92(56.8%)	162
	Master's Degree	22(38.5 %)	35(61.5 %)	57
	Doctorate	4(57.1 %)	3(42.9 %)	7
Total		121	207	328

The cross tabulation presented in Table 1 offered valuable insights into the demographic composition of hospitality students participating in the study, particularly concerning their educational background and gender distribution. Notably, the data reveal distinct variations in the educational attainment of respondents across different gender categories. While males represent a larger proportion of respondents across all educational levels, there are discernible differences in the distribution of educational backgrounds between genders. For instance, a substantial majority of respondents with a Bachelor's degree are male, comprising 56.8% of this category, whereas females constitute only 43.2%. Similarly, within the Master's degree category, there is a higher proportion of males (61.5%) compared to females (38.5%). These findings underscore the importance of considering both gender and educational background as significant demographic factors influencing the composition of hospitality students engaged in the study.

In the context of the research objectives, the observed variations in educational background among respondents hold implications for understanding the awareness and adoption of root-to-stem cooking practices. The data suggest potential disparities in adoption rates based on educational attainment, with individuals holding higher qualifications exhibiting higher levels of adoption. This trend may indicate that individuals with higher educational qualifications, such as a Bachelor's or Master's degree, are more likely to be aware of and adopt root-to-stem cooking practices, possibly due to exposure to culinary education or sustainability concepts during their academic pursuits. For instance, research indicates that higher educational qualifications are often associated with greater awareness and adoption of sustainable practices (McKenzie-Mohr, 2000).

Furthermore, the data provide insights into the potential barriers and facilitators influencing the widespread adoption of root-to-stem cooking. While respondents with higher educational qualifications, such as Bachelor's and Master's degrees, exhibit higher adoption rates, the smaller proportion of respondents with Doctorate degrees show a lower adoption rate. This observation may suggest the presence of barriers such as time constraints or competing priorities at advanced academic levels, which could hinder the adoption of root-to-stem cooking practices. Overall, these findings highlight the complex interplay between demographic factors, educational background, and adoption rates of sustainable cooking practices among hospitality students. Addressing these variations is crucial for designing targeted interventions and educational initiatives aimed at promoting the uptake of sustainable cooking practices in both domestic and commercial settings. Future research could delve deeper into the underlying factors influencing adoption rates across different educational backgrounds to inform more nuanced strategies for fostering sustainability in the culinary industry.

**Table 2: Frequency Table**

Category	Frequency	Percent
1. Are you familiar with the concept of root-to-stem cooking?		
No	26	7.9
Yes	302	92.1
2. How often do you incorporate root-to-stem cooking techniques in your culinary practices?		
Always	13	4.3
Never	14	4.6
Often	82	27.2
Rarely	16	5.3
Sometimes	177	58.6
3. Have you received formal education or training on root-to-stem cooking?		
No	38	12.6
Yes	264	87.4
4. Rate your confidence level in executing root-to-stem cooking techniques.		
Extremely confident	10	3.3
Moderately confident	225	74.5
Not confident at all	17	5.6
Slightly confident	35	11.6
Very confident	14	4.6

Category		Frequency	Percent
5. Do you believe that root-to-stem cooking can contribute to reducing food waste?			
	Agree	236	78.1
	Disagree	9	3.0
	Neutral	19	6.3
	Strongly agree	17	5.6
	Strongly disagree	20	6.6
6. How likely are you to explore root-to-stem cooking further in the future?			
	Extremely likely	16	5.3
	Moderately likely	170	56.3
	Not likely at all	14	4.6
	Slightly likely	16	5.3
	Very likely	85	28.1

Table 2 provides a detailed breakdown of respondents' familiarity with root-to-stem cooking, the frequency of incorporating root-to-stem cooking techniques, receipt of formal education or training on the subject, confidence levels in executing these techniques, beliefs about its contribution to reducing food waste, and likelihood of exploring root-to-stem cooking further in the future. These insights are pivotal in understanding the awareness, adoption, and perceptions of root-to-stem cooking practices among hospitality students, which are central to the research objectives.

The data reveal that an overwhelming majority of respondents (92.1%) are familiar with the concept of root-to-stem cooking. This high level of awareness indicates that the term is recognized within the sampled population, suggesting that discussions surrounding sustainable cooking practices have gained significant traction among hospitality students. However, the frequency of incorporating root-to-stem cooking techniques varies, with the majority of respondents (58.6%) reporting doing so only sometimes. This discrepancy between awareness and adoption highlights potential barriers or challenges in translating knowledge into consistent culinary practices.

In terms of barriers and facilitators, the data indicate that a substantial proportion of respondents (87.4%) have received formal education or training on root-to-stem cooking. This formal education serves as a potential facilitator in promoting the uptake of sustainable cooking

practices, suggesting that educational institutions play a crucial role in shaping students' awareness and skills in this area. Furthermore, a significant percentage of respondents (74.5%) express moderate confidence in executing root-to-stem cooking techniques, indicating a level of proficiency that may encourage adoption. However, it is important to note that some respondents report lower confidence levels, indicating potential areas for improvement or support in skill development.

Beliefs about the contribution of root-to-stem cooking to reducing food waste are predominantly positive, with the majority of respondents (78.1%) agreeing or strongly agreeing with its potential impact. This positive perception aligns with the broader goal of sustainability and indicates a recognition among hospitality students of the role that culinary practices can play in mitigating environmental challenges. Looking towards the future, a substantial proportion of respondents (56.3%) express moderate likelihood of exploring root-to-stem cooking further, while a notable percentage (28.1%) report being very likely to do so. This indicates a willingness among students to engage with sustainable cooking practices and suggests opportunities for promoting further adoption and exploration in both domestic and commercial settings.

In conclusion, the detailed insights provided by Table 2 shed light on the nuanced landscape of awareness, adoption, perceptions, and intentions regarding root-to-stem cooking practices among hospitality students. Understanding the barriers and facilitators identified in the data can inform targeted interventions and educational initiatives aimed at fostering sustainability in the culinary industry. Further research could delve deeper into the factors influencing adoption rates and perceptions of root-to-stem cooking to develop more tailored strategies for promoting its uptake and ultimately contributing to a more sustainable food system.

Promoting the uptake of root-to-stem cooking practices in both domestic and commercial settings necessitates a comprehensive strategy that addresses various stakeholders and challenges. Firstly, educational initiatives targeting consumers, chefs, culinary students, and food service professionals are essential for raising awareness about the benefits of root-to-stem cooking. These campaigns should emphasize the environmental and economic advantages, such as reducing food waste, saving money, and maximizing nutritional value. Additionally, developing training programs

and workshops for chefs, kitchen staff, and culinary students is crucial to enhancing their skills in root-to-stem cooking techniques. Hands-on training, demonstrations, and access to resources can empower them to effectively incorporate these practices into their culinary repertoire.

Furthermore, encouraging restaurants, catering services, and food establishments to introduce root-to-stem dishes on their menus is pivotal. Collaboration with chefs and culinary experts can facilitate the development of creative and appealing recipes that showcase the versatility and deliciousness of using entire fruits and vegetables in cooking. Partnering with food suppliers, farmers, and producers to source imperfect or surplus produce suitable for root-to-stem cooking is another vital step. Establishing networks to redistribute surplus produce from farms and grocery stores to food service establishments for use in sustainable cooking practices can help reduce food waste (Coskun et al., 2023; El Bilali et al., 2021; Vizzoto et al., 2021).

Engaging consumers through cooking classes, online tutorials, and social media campaigns is essential to inspire them to adopt root-to-stem cooking at home. Providing tips, recipes, and resources can assist individuals in incorporating these practices into their daily cooking routines and reducing food waste in their households. Additionally, introducing certifications or accreditation programs for restaurants and food service providers that demonstrate their commitment to sustainable cooking practices, including root-to-stem cooking, can incentivize adoption. Recognition and rewards for establishments that actively promote and implement these practices through awards or certifications can further encourage participation. Moreover, advocating for supportive policies and regulations at the governmental level, such as tax incentives, subsidies, or mandates, can create an enabling environment for promoting sustainable cooking practices. Lastly, investing in research and development initiatives to explore innovative technologies and techniques for maximizing the utilization of food waste in culinary applications is essential for advancing knowledge and best practices in sustainable cooking. Through these concerted efforts, stakeholders can work together to foster the uptake of root-to-stem cooking practices and contribute to a more sustainable and efficient food system.

Root-to-stem cooking, a culinary approach aimed at minimizing food waste by utilizing the entire plant, faces

several obstacles hindering its widespread adoption. Firstly, consumer awareness and education about root-to-stem cooking techniques remain limited. Many individuals are unaware of the potential uses of plant parts typically discarded, such as stems, leaves, and peels. Without proper knowledge, consumers may hesitate to explore these ingredients, viewing them as inedible or unappetizing. Additionally, cultural norms and culinary traditions play a significant role, with some cuisines already incorporating root-to-stem principles, while others may be resistant to change or unfamiliar with the concept altogether.

Secondly, logistical challenges within the food supply chain contribute to the slow uptake of root-to-stem cooking. Retailers and suppliers often prioritize aesthetic perfection, leading to the discarding of imperfect or “ugly” produce, which could otherwise be utilized in root-to-stem recipes. Furthermore, inadequate infrastructure for distributing and marketing these ingredients may limit accessibility for consumers interested in adopting such practices. Overcoming these barriers requires collaboration among stakeholders across the supply chain to promote the value of utilizing entire plants and to develop strategies for sourcing and distributing surplus produce effectively.

On the other hand, several factors facilitate the uptake of root-to-stem cooking. Growing concerns about sustainability and food waste reduction have sparked interest in alternative culinary approaches that align with environmental values (Plakantonaki et al., 2023). As more individuals seek ways to minimize their ecological footprint, root-to-stem cooking presents a tangible solution that resonates with environmentally conscious consumers. Moreover, the rise of social media and digital platforms has democratized culinary knowledge, making it easier for enthusiasts to share recipes, tips, and tutorials on root-to-stem cooking, thus empowering others to experiment with these techniques in their own kitchens.

Furthermore, collaborations between chefs, food activists, and policymakers play a crucial role in promoting root-to-stem cooking on a broader scale. Through culinary innovation and advocacy efforts, chefs can showcase the creative potential of using overlooked ingredients, inspiring consumers and industry stakeholders alike to embrace sustainable practices. Meanwhile, policymakers can support initiatives aimed at reducing food waste and promoting

sustainable food systems through legislative measures, incentives, and educational programs. By addressing both the demand and supply sides of the equation, concerted efforts can drive widespread adoption of root-to-stem cooking, fostering a more sustainable and mindful approach to food consumption.

These outcomes resonate with the existing literature, emphasizing the pivotal roles of “Smart Cuisine” exemplifies the effective utilization of technology to advocate for healthy living and sustainable practices. It serves as a beneficial resource for individuals aiming to make educated dietary decisions, minimize food wastage, and economize while relishing flavourful dishes (Kansaksiri et al., 2023; Miyazawa et al., 2022).

### Conclusion

The discourse surrounding root-to-stem cooking represents a significant step forward in addressing the pressing global challenges of food waste and environmental sustainability. Despite facing obstacles such as limited consumer awareness and logistical challenges within the food supply chain, root-to-stem cooking offers a promising solution to minimize waste and maximize resource efficiency in culinary practices. The collaborative efforts of stakeholders across the supply chain, including consumers, retailers, chefs, and policymakers, are essential for overcoming these barriers and promoting widespread adoption. By harnessing growing concerns about sustainability, leveraging digital platforms for knowledge dissemination, and fostering partnerships between industry leaders and policymakers, the culinary community can drive meaningful change towards a more sustainable and mindful approach to food consumption.

Moreover, the convergence of sustainability concerns, culinary innovation, and consumer demand presents a unique opportunity to revolutionize culinary practices and reshape the food landscape. Through collaborative initiatives, educational programs, and policy interventions, stakeholders can empower individuals to embrace root-to-stem cooking principles and contribute to a more sustainable food system. By recognizing the value of every part of the plant and exploring innovative ways to incorporate overlooked ingredients into culinary creations, Different stakeholders can not only reduce food waste but also unlock new flavors and culinary possibilities. Ultimately, the widespread adoption of root-to-stem cooking holds the potential to create a more

resilient, efficient, and environmentally conscious food system that benefits both present and future generations.

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