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Food Handlers' Intentional Behaviors toward Food Waste in Hospitals

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ABSTRACT

Food waste (FW) has been associated with factors such as nutrient intake, menu effectiveness, food acceptability, financial costs, and environmental consequences. FW is present at various stages of the supply chain, but the greatest loss in terms of value added occurs when consumers waste food. This study aims to explore the intentional behavior of food handlers with respect to food waste in hospitals. Using the theory of planned behavior (TPB) as a theoretical framework, researchers develop a questionnaire that includes contextual factors to elucidate the intentional behavior of food waste. Data collected from 243 food handlers who work in private hospitals. The researchers utilize partial least squares structural equation models to test the hypotheses. The findings revealed that the model study was accepted since all hypotheses were confirmed.

1. Introduction

Food waste, as defined by the Food and Agricultural Organization (FAO), refers to edible food that is discarded, regardless of whether it has reached its expiration date or has become spoiled. In recent times, food waste has gained significant attention and is increasingly acknowledged as the underlying cause of various negative consequences, encompassing issues related to health, the economy, society, and the environment (FAO, 2019).

"Wasted food" encompasses various disposal methods such as sending it to landfills or incineration plants, using it as animal feed, composting, anaerobic digestion, or donating it to feed the impoverished. This term includes plate waste, leftover cooked food, unsold food from retail establishments, and trimmings from kitchen operations, as well as by-products generated by food and beverage production facilities. The Environmental Protection Agency (EPA) prefers the more inclusive term "wasted food" over "food waste" when referring to food that was not used for its intended purpose. This is because "wasted food" highlights the squandering of a valuable resource, while "food waste" implies that the food has lost all value and must be treated as waste (Dias-Ferreira, Santos & Oliveira, 2015).)

The food service provided by hospitals plays a crucial role in patient care and recovery (Sonnino & McWilliams, 2011). From food preparation to distribution, it is essential for the hospital's food service to consistently offer safe and nutritious meals that meet defined standards in terms of quality, adequacy, palatability and temperature (Antasouras, et al., 2023) these meals serve as a vital component of hospital treatment and contribute to patient recovery. The responsibility for providing appropriate diets to patients lies with the food and nutrition service of each hospital. The hospital's dietary approach should ensure the adequate supply of nutrients to hospitalized patients, supporting their nutritional status, and serving a co-

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therapeutic function in both chronic and acute diseases (Eriksson et al., 2020). Food waste (FW) has become a subject of concern within the hospital food service, as it is associated with various negative impacts, including health, economic, social, and environmental issues (Porter & Collins, 2021).

The Theory of Planned Behavior (TPB) has been extensively utilized as a theoretical framework to elucidate consumer behavior in the context of food waste. For example, in a study by Karim Ghani et al. (2013), the TPB was employed along with situational factors to explain food waste at home. They observed that the TPB, along with the additional construct, accounted for 13.7% of the variance in the intention to separate, indicating the influence of other factors not considered in the study. Similarly, Graham-Rowe et al. (2015) investigated household food waste reduction using an extended TPB model, finding that the intention to reduce fruit and vegetable waste was predicted by attitude, subjective norm, and perceived behavioral control. Their model accounted for 8% of the variance in food waste reduction behavior. In a similar vein, Russell et al. (2017) examined food waste behavior using the TPB, incorporating emotions and habits as additional explanatory variables. Their model explained 46% of the variance in food waste behavior, highlighting the impact of these factors on food waste reduction. However, there is no in-depth study on managing food waste in hospitals.

2. The study problem

Food waste management in hospitals is a significant concern, and studies on this topic have also been conducted in Egypt. Given the importance of efficient resource management and sustainability, understanding, and addressing food waste in healthcare facilities is crucial. Hospitals in Egypt, like many other countries, face challenges related to overproduction, patient dietary restrictions, plate waste, meal timing disturbances, and communication errors, among others. To tackle this problem, researchers in Egypt have explored various strategies, including improving meal planning, engaging patients in the process, providing staff training, implementing waste monitoring systems and establishing donation programs. These studies aim to identify the factors that influence food waste in hospitals, develop interventions, and promote sustainable practices.

Considering the discussion above of related literature, this study aims to investigate the factors influencing the management of food waste management in hospitals in Alexandria, Egypt, using the Theory of Planned Behaviour (TPB) as a theoretical framework (Figure 1). The study will try to answer the fowling questions:

1. How do attitudes of hospital staff towards food waste management affect their intentions and behaviors in reducing food waste in hospitals in Alexandria, Egypt?
2. What are the subjective norms and social influences that influence the intentions and behaviors of hospital staff in managing food waste in hospitals in Alexandria, Egypt?
3. To what extent does perceived behavioral control, including knowledge, resources, and infrastructure, influence the ability of hospital staff to effectively manage and reduce food waste in hospitals in Alexandria, Egypt?

By exploring these research questions, the study aims to provide valuable information on the factors influencing the management of food waste in hospitals in Alexandria, Egypt. The findings can contribute to the development of targeted interventions and strategies to effectively reduce food waste, promote sustainability, and improve resource management in healthcare facilities in the region.

3. Literature review

3.1The study model: the theory of planned behaviour

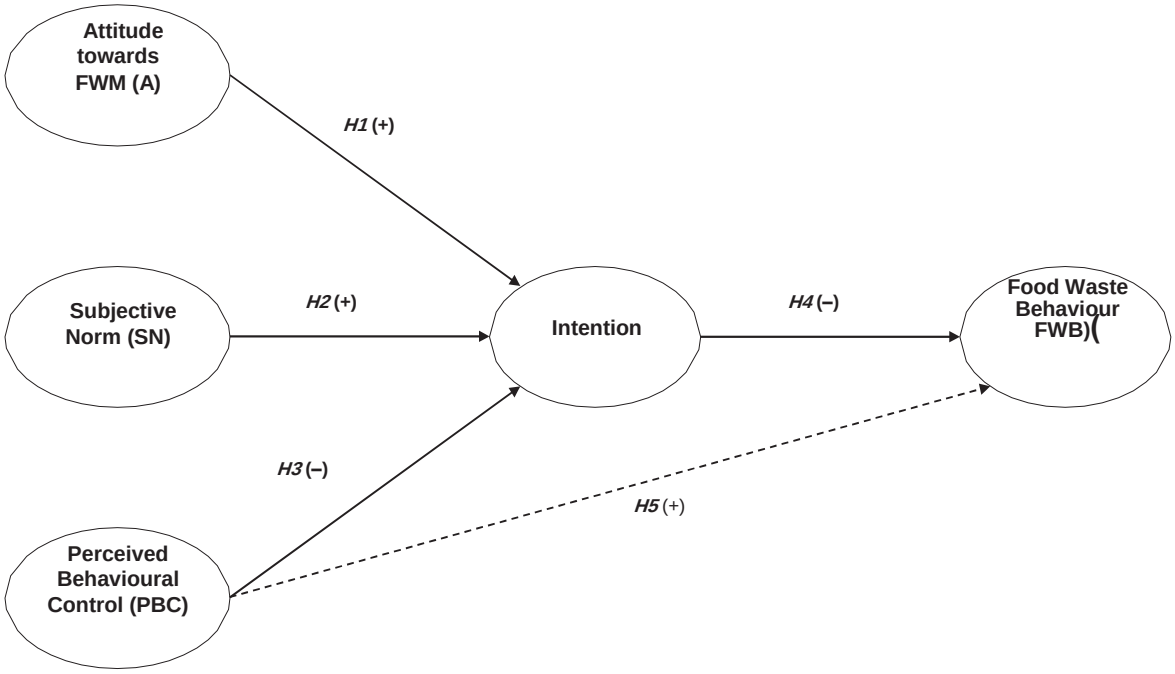
The Theory of Planned Behaviour (TPB), developed by Icek Ajzen in 1991, is an individual-based theoretical framework that focusses on behavioral intention. This theory is an extension of the Theory of Reasoned Action proposed by Fishbein and Ajzen in 1975, excluding the component of "Perceived Behavioral Control." It has gained recognition as a useful tool for predicting human behavior (Tommasetti et al., 2018). The TPB was developed in 1980 with the purpose of predicting an individual's behavior in a specific action and context. It encompasses a wide range of human behaviors associated with self-control. The model centers around the notion of behavioral intent, which is influenced by one's perception of the likelihood that the behavior will lead to the desired outcome, as well as one's subjective assessment of the

benefits and risks associated with that outcome. The TPB has been applied in various disciplines, including sustainability, waste minimization, recycling, and food-related behavior (Jaiswal et al., 2022; Jaiswal and Singh, 2018; Tommasetti et al., 2018). It has proven to be a valuable tool for predicting and understanding ecological performance. Additionally, studies have shown that attitudes, subjective norms, and perceived behavioral control (PBC) collectively influence intentions for food waste reduction (Wang et al., 2022). Similarly, personal attitudes and perceived behavioral control (PBC) have a direct impact on food loss behavior (Blešić et al., 2021).

Previous research has consistently supported the applicability of the TPB in predicting behavioral intentions (Graham-Rowe et al., 2015; Jaiswal et al., 2022). The findings suggest that intentions can effectively forecast behavior pertaining to the environment, as stipulated by the TPB model. The TPB provides a valuable framework for understanding the complexities of social human behavior and serves as a starting point for initiating change. In a multifaceted topic like sustainability, which involves dynamic social concerns and human behavior, the theory proves to be a viable option for comprehending decision-making processes (Ajzen, 1991). Each aspect of behavior, including attitude toward behavior, perceived behavioral control, subjective norm, and intention, as outlined by Ajzen, represents a distinct facet of conduct. According to the TPB, individuals' intentions to engage in a specific behavior are strengthened when they hold a favorable attitude toward that behavior (Jaiswal et al., 2021). Additionally, the TPB suggests that individuals are more likely to act confidently when they perceive societal approval and believe they possess the necessary capabilities to carry out the desired behavior. These frameworks primarily reflect an individual's personal beliefs. There can be a discrepancy between what individuals believe important people want them to do and the actual desires of those key individuals when directly asked.

3.3 The study hypotheses based on the theory of planned behaviours

Figure 1: The study proposed model



However, the TPB emphasizes that perception plays a more significant role than objective facts in determining behavior. Socio-demographic characteristics have been identified as important predictors of food-related behaviors, and these findings form the basis for developing policy measures that align with the determinants of household food waste behaviors, particularly in developing countries (Abouhatab et al.,

2022). Certain behaviors such as habits, attitudes, perceived behavioral control, and intention to reduce food waste are crucial in describing behaviors related to food waste reduction. Notably, habits and perceived behavioral control (PBC) can serve as potential avenues for designing effective policy interventions (Niha et al., 2022).

Our synthesis of previous work explaining the food waste behaviour suggests that the TPB sets a strong basis for explaining food waste behaviour. Therefore, we set the following hypotheses in line with the implementation of TPB in the papers we reviewed:

H1. Personal attitudes towards food waste impact the staff intentions to reduce food waste.

H2. Subjective norms on food waste with the staff intentions to reduce food waste.

H3. The perceived behavioral control impact the staff intentions to reduce food waste.

H4. Higher staff intentions to reduce food waste impact food waste behavior.

H5. The perceived behavioral control impact the food waste behavior.

Hypothesis 1 (H1) indicates a positive correlation between attitudes and intentions, suggesting that individuals who experience negative emotions when food is discarded are more likely to have a stronger intention to reduce food waste. Hypothesis 2 (H2) proposes a positive relationship between subjective norms and intentions, implying that if an individual's close friends and family express the belief that food waste should be minimized, their intention to reduce food waste will be higher. Hypothesis 3 (H3) suggests a negative correlation between perceived behavioral control and intentions, indicating that individuals who perceive preventing food waste as challenging are likely to have lower intentions to reduce food waste. Hypothesis 5 (H5) proposes a positive association between perceived behavioral control and food waste behavior, suggesting that the more difficult individuals perceive it to prevent food waste, the more likely they are to waste food

4. Research Methodology

4.1 The research design

The TPB (Ajzen, 1991) is a widely-used theoretical framework for systematically explaining behavior. In our study, we applied the TPB model, incorporating personal attitudes, subjective norms, perceived behavioral control, intention, and behavior, through literature review and empirical work in hospitals. To investigate food waste behavior, we developed a questionnaire based on the literature and conducted data collection from food handlers at hospitals in Egypt. A sample measurement item for each construct in the research model is presented in Figure 1. The constructs' number of measurement items in the questionnaire is indicated in parentheses. The complete survey tool is provided in Table 1. Respondents indicated their agreement with the measurement items using a five-point Likert scale ranging from "strongly disagree=1

to =1to"strongly agree=5"

4.2The questionnaire design

A developed self-administered questionnaire derived from previous related studies to explore the food handlers' perceived behaviours towards managing food waste in hospitals (e.g. Ajzen, 1991; Blešić et al., 2021; Wang, et al., 2023; Jamaludin, , Mohamed, & Noorashid, 2020). There were five sections in the questionnaire. There were four questions about socio-demographic characteristics in the first section. The second section contained seven subjective norm (SN) related questions about food waste. The third section included 6 questions on Subjective Norm (SN). Staff perceived behavioural control was addressed in the fourth section with seven items. Five questions were included in the sixth section about the intention to manage food waste, and the final section is related to food waste management behaviour with including six items. .

4.3 Sampling

According to Edgar & Manz (2017), convenience sampling is a prevalent type of no probabilistic sampling that is often misapplied. It involves collecting samples that are easily accessible in a specific location or through online platforms. Therefore, in this study a convenient sample of 300 of food handlers working in for public and private hospitals was targeted. The authors used a paper based self-administrative questionnaire for collecting the study data of direct food handlers working for public and private hospitals. Of 300 questionnaire distributed between November 2022- to March 2023, a range of 243 valid response (response rate 81%) were included in the analysis.

4.4 Data analysis

To evaluate the proposed conceptual model and its hypotheses (Figure 1), the study utilized partial least squares structural equation modeling (PLS-SEM). PLS-SEM is a valuable approach for theory development, as highlighted by Haar et al. (2016). The collected data was analyzed using WarpPLS 7.0 software. To ensure the reliability and validity of the measurement models, established guidelines provided by Fornell and Larcker (1981), Kock (2017), and Hair et al. (2016) were employed.

5. Results and discussions

5.1 Profile of respondents

Looking at Table 1, males are most respondents (82.7%) while females are the minority (17.3%). Most respondents (53%) aged between31-40. Similarly, most of them (58.4%) have university education qualifications. Finally, nearly three-quarter of the respondents are working in operational jobs.

Table 1: The profile of respondents

Demographics		**Respondents**	
		N	**(%)**
Gender	Male	201	(82.7)
	Female	42	(17.3)
Age (years)	25- 30	57	(23.4)
	31-35	62	(25.5)
	36-40	69	(28.3)
	40 <	55	(22.8)
Educational level	High school	93	(38.5)
	University	142	(58.4)
	Postgraduate	8	(3.1)
Job level	Managerial level	64	(26.33)
	Operational level	179	(73.67)
Total		**243**	**100**

Additionally, Table 2 indicates that respondents have a relatively high positive attitudes toward food waste management at their workplace know a good amount about food allergies (Grand Mean= 4.64) and as well as they have a relatively high subjective norms(Grand Means= 3.9), perceived behavioural control(Grand Means= 3.57) and intention (Grand Means= 4), however, they a relatively low self-reported practices related to food waste management (Grand Means= 3.33).

Table 2. Mean statistics for the constructs of the study

Constructs	Mean Statistics	SD
Attitude towards FWM (A)	4.64	598
Subjective Norm (SN)	3.9	609
Perceived Behavioural Control (PBC)	3.57	.542
Intention	4.0	.591
Food waste management Behaviour (FWMB)	3.33	.593

5.2Measurement model

The presence of convergent validity in the measurement model is indicated when the average variance extracted (AVEs) of a construct surpasses 0.5, as established by Fornell and Larcker (1981). Discriminant validity is achieved when the square roots of AVEs are greater than the inter-construct correlations, as shown in Table 3. The reliability of the measurement is demonstrated by a positive correlation exceeding 0.7 between Cronbach's alpha (CA) and composite reliability (CR), as outlined by Field (2009) and Hair et al. (2016) (Kock, 2020). Additionally, multicollinearity is absent when the variance inflation factors (VIFs) are below 5, as per Kock (2020). Discriminant validity is supported by an HTMT (heterotrait-monotrait) ratio of less than 0.90, as presented in Table 4 (Kock, 2020). Based on these findings, it can be inferred that the current measurement model exhibits both validity and reliability

Table 3. Measurement model of behaviour towards food waste management among hospitals' food handlers

Constructs	Indicators	Loading	CA	CR	AVE
Attitude towards FWM (A)	A1: I believe that reducing food waste in hospitals is important.	0.790	**0.860**	**0.896**	**0.628**
	A2: I feel guilty when I see food being wasted in hospitals.	0.908			
	A3: I think it is necessary to raise awareness about the impact of food waste in healthcare facilities.	0.893			
	A4: I believe that implementing effective food waste management practices can benefit both patients and the environment.	0.880			
	A5: I consider reducing food waste in hospitals as a responsibility that should be taken seriously.	0.916			
	A6: I perceive efforts to minimize food waste in healthcare settings as valuable and worthwhile	0.895			
	A7: Throwing away food does not bother me.	0.866			
Subjective Norm (SN)	SN1: My close friends and family members believe that reducing food waste in hospitals is important.	0.874	**0.891**	**0.925**	**0.755**
	SN2: People whose opinions I value think that hospitals should prioritize food waste reduction efforts.	0.868			

	SN3: I feel pressure from those around me to support initiatives aimed at minimizing food waste in healthcare facilities.	0.852			
	SN4: I believe that actively engaging in food waste reduction in hospitals aligns with the values and expectations of the broader community.	0.844			
	SN5: My managers think my efforts towards preparing food from leftovers are necessary	0.874			
	SN6: My co-workers think my efforts towards preparing food from leftovers are necessary.	0.874			
Perceived Behavioural Control (PBC)	PBC1: I find it difficult to store food at high temperatures.	0.864	**0.899**	**0.897**	**0.794**
	PBC2: I have the necessary knowledge and skills to effectively manage and reduce food waste in my role as a food handler.	0.854			
	PBC3: I feel confident in my ability to implement food waste reduction practices in my daily tasks as a food handler	0.864			
	PBC4: I believe that I have sufficient resources and support to carry out food waste management initiatives at the hospital.	0.877			
	PBC5: perceive that I have control over the amount of food wasted in my work area.	0.858			
	PBC6: I am aware of the proper procedures and guidelines for minimizing food waste in hospital food service.	0944			
	PBC7: I have access to training and educational materials that help me understand and implement food waste reduction strategies.	0.934			
Intention (I)	I1: I intend not to throw away food.	0.854	**0.809**	**0.887**	**0.724**
	I2: I am strongly committed to actively participating in food waste reduction efforts in my role as a food handler.	0.864			
	I3: I intend to prioritize and incorporate food waste management practices into my daily tasks as a food handler.	0.877			
	I4: I have a clear intention to follow the recommended guidelines and procedures for reducing food waste in my work area.	0.858			
Food waste management	FWMB1: I consistently follow proper portion control measures to minimize food waste during food preparation.	0.834	**0.899**	**0.897**	**0.794**

Behaviour (FWMB)	FWMB2: I actively monitor and track the amount of food wasted in my work area to identify areas for improvement.	0.882			
	FWMB3: I make efforts to creatively repurpose leftover ingredients or meals to reduce food waste.	0.882			
	FWMB4: I prioritize serving meals in a manner that ensures all food is consumed, minimizing plate waste.	0.882			
	FWMB5: I regularly participate in training sessions and educational programs related to food waste management.	0.882			
	FWMB6: I actively participate in food donation programs or initiatives to redistribute surplus food and minimize waste.	0.836			

Note: CA: Cronbach's alpha, CR: Composite reliability, AVE: Average variance extracted

Table4. Square root of AVEs and inter-constructs correlations

Constructs	Attitude towards FWM (A)	Subjective Norm (SN)	Perceived Behavioural Control (PBC)	Intention (I)	Food waste management Behaviour (FWMB
Attitude towards FWM (A)	**(0.862)**				
Subjective Norm (SN)	0.641	**(0.943)**			
Perceived Behavioural Control (PBC)	0.687	0.720	**(0.967)**		
Intention (I)	0.777	0.732	0.767	**(0.953)**	
Food waste management Behaviour (FWMB	0.545	0.725	0.677	0.676	**(0.974)**

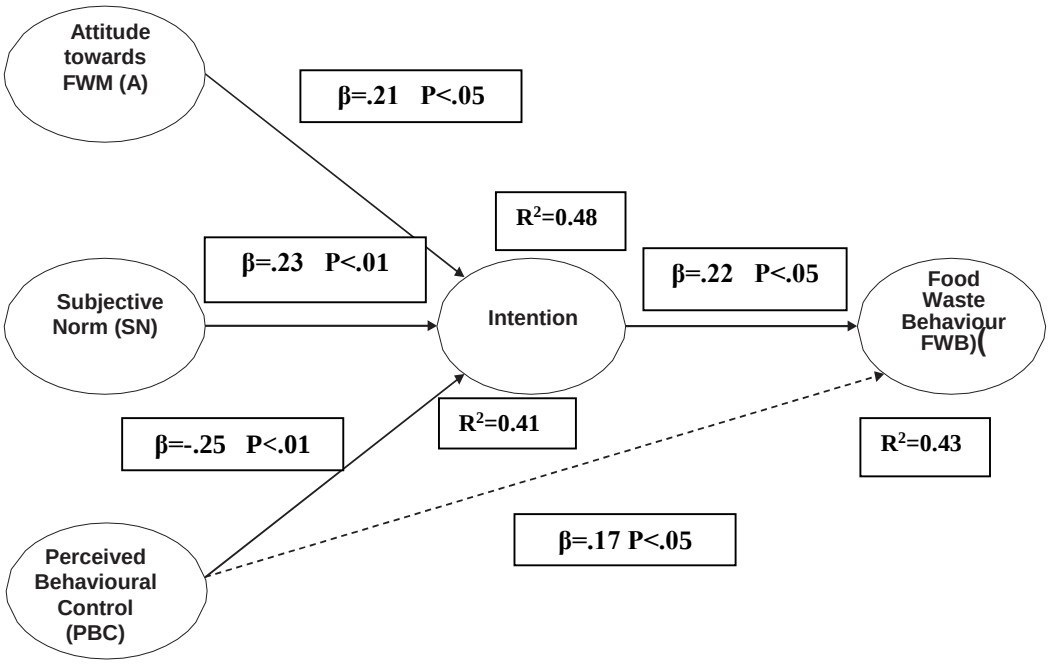
5.3 Structural model

Figure 2 shows the causal associations between research latent variables. It is revealed that attitude towards FWM positively and significantly affects Intention towards food waste management (β=0.21), and H1 is supported. The subjective norm of food handlers towards food waste management (β=0.23) is positively and significantly affects the intention, and H2 are supported. On the other hand, the perceived behavioural control ((β=0.25) is negatively and significantly affects the intention, and H3 is accepted. Furthermore the intention of food handlers towards managing food waste generated in hospitals is positively and significantly affects the self-reported behaviours towards food waste management (β=.22 P<.05), and H4 is supported. Finally, the perceived behavioural control is positively and significantly affects the self-reported behaviours towards food waste management (β=.17 P<.05), Consequently, H5 is confirmed.

Table 5. HTMT ratios

Constructs	Attitude towards FWM (A)	Subjective Norm (SN)	Perceived Behavioural Control (PBC)	Intention (I)	Food waste management Behaviour (FWMB
Attitude towards FWM (A)	0.744				
Subjective Norm (SN)	0.653	0.764			
Perceived Behavioural Control (PBC)	0.840	0.653	0.754		
Intention (I)	0.739	0.870	0.643	0.653	
Food waste management Behaviour (FWMB	0.850	0.769	0.840	0.830	0.643

Figure2. The structural model of behaviour toward food waste management among hospitals' food handlers.



These three constructs (A, SN, and PBC) explain 41% of the variance in the intention of food handlers towards food waste management in hospitals. In addition, the food handlers' food waste behaviour of the variance is explained by 43% of the model constructs. Accordingly, the actual behaviors of the respondents are lower than those they report in their self-reported behavior towards FWM in their workplace.

5. Conclusion

This study examined the employees' behavioral intention of food waste management in hospitals by applying the Theory of Planned Behavior (TPB). The findings demonstrated the applicability and usefulness of the TPB in understanding and predicting employees' intentions towards food waste management. Attitudes towards food waste, subjective norms, and perceived behavioral control were found to significantly influence behavioral intentions. These results highlight the importance of promoting positive attitudes towards food waste reduction, creating a supportive social environment that encourages waste reduction, and providing employees with the necessary resources and control to effectively manage food waste in hospital settings. Overall, this study provides valuable insights into the factors influencing employees' intentions and paves the way for the development of targeted interventions and strategies to enhance food waste management practices in hospitals.

Table 6. Hypothesis testing results

No.	Hypotheses	B value	Result
H1	Attitude towards FWM (A) ➡ Intention (I)	0.21*	Accepted
H2	Subjective Norm (SN)) ➡Intention (I)	0.23**	Accepted
H3	Perceived Behavioural Control (PBC) ➡Intention (I)	0.24**	Accepted
H4	Perceived Behavioural Control (PBC) ➡Food Waste Behaviour (FWB)	0.17 NS	Rejected
H5	Intention (I)) ➡ Food Waste Behaviour(FWB)	0.22*	Accepted

*Note: * Significant at 5%, ** Significant at 1%, ^{NS} Not Significant*

6. Implications and further research

6.1Implications

The findings of this study have important implications for the management of food waste in hospital settings. By applying the Theory of Planned Behavior (TPB), the study provides insights into the factors influencing employees' behavioral intentions towards food waste management. These implications can inform strategies and interventions aimed at promoting more sustainable food practices in hospitals.

1. *Educational and Training Programs:* The study highlights the need for educational and training programs that focus on enhancing employees' knowledge and awareness of the importance of food waste reduction. By providing employees with information about the environmental, economic, and social impacts of food waste, organizations can foster a sense of responsibility and motivation to actively participate in waste management efforts.
2. *Creating Supportive Social Norms*: The study underscores the significance of subjective norms in shaping employees' intentions. Hospitals should encourage a supportive social environment where colleagues and supervisors value and prioritize food waste reduction. This can be achieved through communication campaigns, team discussions, and recognition programs that emphasize the importance of waste management and create a culture of sustainability.
3. *Providing Resources and Support:* Perceived behavioral control emerged as a significant factor influencing behavioral intentions. Hospitals should ensure that employees have the necessary resources, tools, and support to effectively manage food waste. This may include implementing proper waste separation systems, providing clear guidelines and procedures, and offering feedback mechanisms to facilitate continuous improvement.
4. *Leadership and Policy Support:* Hospital leaders and policymakers play a crucial role in promoting food waste reduction initiatives. They should demonstrate commitment to sustainability and set clear goals for waste management. Providing the necessary infrastructure, allocating adequate budgets, and integrating waste reduction strategies into organizational policies can further support employees' intentions and actions towards food waste management
5. *Collaboration and Partnerships:* The study highlights the potential benefits of collaborating with external stakeholders such as food suppliers, waste management companies, and community

organizations. Engaging these stakeholders in joint initiatives and partnerships can facilitate the development of comprehensive and sustainable food waste management practices in hospitals.

By considering these implications, hospital administrators, policymakers, and sustainability teams can work towards creating a culture of waste reduction, improving resource efficiency, and contributing to a more sustainable healthcare system.

6.2 Limitations and future research

Despite the contributions of this study, several limitations should be acknowledged. Firstly, the study relied on self-reported data, which may be subject to response bias. Future research could incorporate objective measures or observational methods to strengthen the validity of the findings. Secondly, the study was conducted in a specific hospital setting, which may limit the generalizability of the results to other contexts. Replication studies in different hospital settings and cultural contexts would provide a more comprehensive understanding of employees' behavioral intentions towards food waste management. Lastly, the study focused on employees' intentions rather than actual behavior. Future research should consider examining the actual implementation of food waste reduction practices and evaluating their effectiveness.

Building on the current study, future research could explore additional factors that may influence employees' behavioral intentions of food waste management in hospitals. For example, organizational factors such as leadership support, communication channels, and incentive systems could be examined to understand their impact on employees' engagement in food waste reduction efforts. Additionally, investigating the role of individual characteristics, such as personal values, environmental consciousness, and knowledge levels, could provide further insights into the predictors of behavioral intentions. Furthermore, longitudinal studies could be conducted to assess the long-term effectiveness of interventions aimed at promoting food waste management in hospitals. Lastly, comparative studies across different healthcare systems and countries could shed light on the cultural and contextual factors that influence employees' intentions and behaviors towards food waste reduction in healthcare settings.

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