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A Cross-Sectional Study on the Causes, Impacts, And Management of Food Waste in Selected Small Business Establishments within the Emfuleni Local Municipality, Gauteng Province.

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Abstract – Food waste is a global issue, where approximately 10.3 million tons, are wasted annually. This waste occurs at various stages in the food system, from production to consumer service, and adversely affects the economy and the environment. While there have been studies on food waste in households, research on food waste from small businesses is lacking, despite the significant role these businesses play in the South African economy. This study aims to explore the causes, impacts, and management of perishable and non-perishable food waste in selected small business premises in Emfuleni Local Municipality, Gauteng, South Africa. A quantitative research approach was utilized, employing a cross-sectional study design with an estimated sample size of 165 participants (managers and supervisors). Data was collected through self-administered questionnaires and analyzed using IBM SPSS version 29.0, employing frequencies, descriptive statistics, and correlation analysis. The results indicated that 27.9% of participants generate perishable food waste, 6.6% generate non-perishable food waste, and 65.4% generate both types of food waste. Additionally, 27.0% of participants generate more than 20kg of waste per week, 8.8% generate between 16-20 kg, 10.9% generate between 11-15 kg, 16.8% generate between 5-10kg, and the remaining 36.5% generate less than 5kg of food waste per week. The study also revealed that the primary causes of food waste, to a large extent, were expiry (13.9%), power outages (13.1%), damage (11.1%), overstocking (10.9%), rotting (9.5%), fridge failure (5.8%), and poor stock rotation (2.9%). There were significant relationships between non-perishable and perishable food waste ($p < 0.001$), amount of food waste generated and its classification ($p = 0.049$), food expiry and the type of food waste ($p = 0.012$), food expiry and the volume of food waste ($p = 0.001$). It is recommended that environmental health practitioners provide education on the management and safe disposal of food waste on small business premises. Additionally, small business premises should recognize the importance of having insurance to compensate for losses resulting from food waste. Food waste has detrimental effects on the country's economy, leading to loss of profit, job scarcity, and reduced income.

Keywords**:** food waste; small business; food systems; food supply chain; expired food; perishable food waste, non-perishable food waste

1. Introduction

Food waste (FW) is defined as the edible portions of plants and animals that were originally intended for human consumption but ultimately did not fulfill this purpose [1]. It can occur during production, harvesting, and through handling and storage processes [2]. Globally, food waste accounts for a monetary loss of 1 trillion dollars and an estimated annual loss of 1.3 billion tons of food [3]. Food waste poses a significant challenge that threatens both our food systems and our economic and natural resources [4]. In high-income countries, food waste is more prevalent during the consumption stage, whereas in low-income countries, food losses are more common during agricultural production, post-harvest activities, and distribution stages. Thus, precise quantification across the food chain is essential to analyze domains that require rectification [3]. It is estimated that global food production must increase by 70% by 2050 to meet the needs of a growing population and sustain food supply [5]. There exists a substantial opportunity to prevent and manage food waste throughout the food supply chain, particularly during the consumption stages, through behavioral change, education, and awareness.

A major contributor to food waste in business food premises is the discarding of unsold products that have surpassed their expiration dates [6]. Grocery stores, restaurants, and consumers are responsible for the majority of food waste in South Africa; among the principal causes are overstocked shelves, misjudgment of product shelf life, and damaged products. Additionally, restaurants contribute to food waste due to improper inventory control, poor menu selections, or excessive

portion sizes [7]. Small businesses often purchase products in large quantities and a variety of food types to secure discounts, resulting in the procurement of more goods than necessary, which subsequently contributes to food waste [8]. As a result, many products are likely to reach their expiration dates before being sold, leading to waste. The specific causes of food waste in small businesses can vary significantly based on the particular conditions and circumstances [9]. According to Dlomo (2021), occurrences of food waste are influenced by both internal store operations and external factors. Identified causes include issues related to date labeling, food safety standards, shelf life, handling, promotions, and the lack of diversion pathways [10]. Additional reasons for waste include product recalls due to food safety concerns and compromised quality, resulting in food being discarded by small businesses, which may stem from cold-chain failures caused by equipment malfunctions, power outages, and the movement of stock out of cold-chain areas, leading to food condemnation [2].

The social impact of food waste leads to millions of people in South Africa going to sleep without food [6]. Although access to food is enshrined as a constitutional right, millions in both urban and rural areas remain vulnerable to daily hunger and malnutrition [11]. The malnutrition rate exceeds 20%, which is significantly higher than the global average of 10%. Therefore, advancements in combating hunger are critical for addressing the malnutrition rate and the social impacts of food waste in Africa [6]. Furthermore, food waste imposes an additional burden on the environment by generating greenhouse gas emissions during the production, processing, and transportation of food and from methane emissions generated at landfill sites [2]. Public ignorance regarding the concept of food waste exacerbates the complexity of the issue [12]. Moreover, despite the increasing global significance of this issue, academic research remains insufficient [13]. Consequently, this study aims to investigate the causes, impacts, and management of both perishable and non-perishable food waste among selected small business premises in Emfuleni Local Municipality (ELM), Gauteng, South Africa. To accomplish this aim, five objectives were established: to assess the occurrence of perishable and non-perishable food waste within selected small business premises in ELM; to identify the causes of perishable and non-perishable food waste within these premises; to describe the impact of food waste among these selected small businesses; to outline current food waste management practices in these establishments; and to evaluate the relationship between the occurrence, causes, and management practices of food waste within the selected small business premises in ELM.

2. Material and Methods

Study design and site

A descriptive cross-sectional study design was employed for this research. The study was conducted within the Emfuleni Local Municipality, located in Gauteng Province, which encompasses a total area of 987.45 km². The municipality includes the towns of Vanderbijlpark, Vereeniging, Sebokeng, Evaton West, Evaton Central, and Evaton North. Emfuleni is characterized as a highly urbanized municipality, with its predominant agricultural activity focusing on vegetable cultivation. Furthermore, Emfuleni Local Municipality is situated within the Sedibeng District Municipality [14].

Study population and Sampling

The study population comprised managers and supervisors from selected small businesses engaged in the sale of both perishable and non-perishable food items within the Emfuleni Local Municipality. These businesses included grocery stores, delis, bakeries, butcheries, fruit and vegetable shops, fishmongers, restaurants, takeaways, and tuck shops. Eligible participants were individuals who managed or supervised small business premises dealing with perishable and/or non-perishable food items in the Emfuleni Local Municipality. Both male and female managers and supervisors with a minimum of six months of experience in handling these food items were included, regardless of nationality.

The sample size was determined using the Centers for Disease Control and Prevention (CDC) EPINFO program, specifically designed for cross-sectional studies utilizing a population survey methodology. A 95% confidence interval for a two-sided test with 80% power for one cluster was applied in the sample size calculation, based on an estimated population size of 200. This approach yielded a calculated sample size of 132, with an additional 25% error contingency incorporated. Thus, the estimated sample size for EPINFO version 7.2 was 165. A convenience sampling technique was employed, whereby participants were selected based on their accessibility and proximity to the researcher.

Data Collection

A structured self-administered questionnaire consisting of fifteen (15) closed-ended questions served as the primary data collection method. Developed by the researcher following the study's objectives, the questionnaire comprised five sections. Section A included a screening question to determine participant eligibility. Section B collected demographic data, including variables such as gender, educational background, type of small business, and experience in managing food waste. Section C assessed the occurrence of perishable and non-perishable food waste, capturing data on types, frequency, and quantity generated. Section D explored the causes and impacts of food waste within small business contexts. Finally, Section E focused on food waste management, including inquiries about disposal methods and waste reduction strategies. The questionnaires were administered to managers and supervisors from selected establishments that generate both perishable and non-perishable food waste. A pilot study was conducted before the main research, and the resulting data were excluded from the final analysis.

Data management and analysis

The researcher collected completed hard copies of questionnaires and securely stored them on a lockable shelf, alongside hard-copy reports and other study data in a lockable safe. The laptop utilized for processing soft copies was password-protected and stored in a lockable safe when not in operation. Throughout the study, the researcher employed a coding system for the data, assigning numerical values in alignment with the questionnaire's design. Prior to submission, each completed questionnaire underwent a thorough review for accuracy, completeness, and presentation. During the data cleaning process, each variable was scrutinized for anomalous values. Following this, specific labels were assigned numerical symbols to facilitate data transfer to the statistical software. The data analysis was conducted using IBM SPSS version 29.0, with all tests performed at a 95% confidence level and a significance threshold of 0.05. The analysis included summary statistics and measures of central tendency, with categorical variables undergoing frequency analysis and continuous variables summarized accordingly. Frequency distributions were illustrated using percentage-based bar graphs and histograms. The Spearman correlation was used to determine factors that influences food waste in the study. The p-value was set at 0.05 for statistically significant relationships.

Results

Participants' Socio-demographics information

Participants were requested to specify their gender, and the results presented in Table 1 indicate that the majority of participants were male (58.4%), while the remaining 41.6% were female. The findings of the study further demonstrate that 10.3% of participants possessed an education level of Grade 11 or lower; 38.2% held a Grade 12 or matric certificate; 25% had post-matric certificates or diplomas; 19.1% obtained Baccalaureate degrees; and the remaining 7.4% held post-graduate degrees. Additionally, the results reveal that 18.2% of participants were employed in grocery food premises, 8.8% in deli food premises, 12.4% in bakeries, 10.2% in butcheries, 13.9% in the fruit and vegetable sector, 3.6% in fishmongers, while the remaining 32.8% indicated employment in various other food premises, including tuck shops, restaurants, takeaways, perishables, and coffee shops. Notably, all participants (100%) reported that their food premises generate food waste. Approximately 44.1% of participants indicated that they have more than 10 years of experience working with food waste, 21.3% reported 6 to 10 years of experience, 26.5% possessed 1 to 5 years of experience, and the remaining 8.1% indicated that they have less than 1 year of experience in this area.

Table 1: Participant's Demographics information.

Socio-Demographic		Frequency (n)	Percentage (%)
Gender	Female	57	41. 6
	Male	80	58.4
Education	No education	0	0
	Grade 11 or lower	14	10.3
	Grade 12	52	38.2

	Diploma	34	25.0
	Baccalaureate Degree	26	19.1
	Post-Graduate Degree	10	7.4
Food Premises	Groceries	25	18.2
	Deli	12	8.8
	Bakery	17	12.4
	Butchery	14	10.3
	Fruit & Veg	19	13.9
	Fish Monger	5	3.6
	Other	45	32.8
Experience in food waste	Less than 1 year	11	8.1
	1 to 5 years	36	26.5
	6-10 years	29	21.3
	More than 10 years	60	44.1

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Occurrence of perishable and non-perishable food waste in the study

Of the participants surveyed, 27.9% reported generating perishable food waste, 6.6% reported generating non-perishable food waste, while the remaining 65.4% indicated that they generate both perishable and non-perishable food waste.

Table 2: Occurrence of food waste

Occurrence of food waste	Number (n)	Percentage (%)
Experiencing perishable food waste		
Daily	72	52.9
A few times per week	14	10.3
Weekly	18	13.2
Biweekly	3	2.2
Monthly	15	11.0
Less than Monthly	9	6.6
No perishable food waste	5	3.7
Experiencing non-perishable food waste		
Daily	46	34.1
A few times per week	12	8.9

Weekly	7	5.2
Biweekly	7	5.2
Monthly	16	11.9
Less than Monthly	8	5.9
No non-perishable food waste	39	28.9
Quantity of food waste		
Less than 5 kg	50	36.5
5-10 kg	23	16.8
11-15 kg	15	10.9
16-20 kg	12	8.8
More than 20 kg	37	27.0
Insurance compensation		
Yes	79	58.1
No	57	41.9

Participants were surveyed regarding the frequency of perishable and non-perishable food waste in their food premises. As detailed in Table 4-2, 52.9% of respondents reported experiencing perishable food waste daily, while 10.3% reported a frequency of a few times per week, 13.2% weekly, 2.2% bi-weekly, 11.0% monthly, and 6.6% indicated a frequency of less than monthly; 3.7% reported no occurrence of perishable food waste. In terms of non-perishable food waste, 34.1% of participants reported daily occurrences, 8.9% a few times per week, 5.2% weekly and bi-weekly, 11.9% monthly, 5.9% less than monthly, and 28.9% indicated no occurrence. Furthermore, the data indicates that 27.0% of participants generate more than 20 kg of waste weekly, 8.8% report generating between 16-20 kg, 10.9% between 11-15 kg, and 16.8% between 5-10 kg, with the remaining 36.5% generating less than 5 kg of food waste weekly. Additionally, when asked about insurance compensation for food waste, 58.1% of participants confirmed having such insurance, while 41.9% reported lacking insurance coverage for food waste.

Causes of food waste in the study

Participants reported various factors contributing to food waste in their small business premises. The primary cause identified was the expiration of food items, with 13.9% of participants indicating that a very large extent of food waste was attributable to this issue, while 6.6% reported a large extent, 19.0% a moderate extent, 32.8% a small extent, and 27.7% claimed no extent of food waste was due to expiry. Overstocking of food products was another significant factor, with 30.7% of participants stating they experienced no food waste from this cause. Additionally, 32.1% indicated a small extent, 18.2% a moderate extent, 8.0% a large extent, and 10.9% a very large extent of food waste attributed to overstocking. Damage to food products contributed to food waste as well, with 15.6% of participants reporting no food waste due to damage, while 37.8% indicated a small extent, 19.3% a moderate extent, 16.3% a large extent, and 11.1% a very large extent. Rotting food items were noted as a cause of waste, with 45.3% of participants claiming no extent of food waste due to rotting, 28.5% indicating a small extent, 13.1% a moderate extent, 3.6% a large extent, and 9.5% a very large extent. Power outages, such as load shedding, were cited as a contributing factor, with 31.4% of participants experiencing no food waste, while 26.3% reported a small extent, 20.4% a moderate extent, 8.8% a large extent, and 13.1% a very large extent. Fridge failure was another issue, with 47.4% of participants indicating no food waste resulted from this cause, while 27.7% reported a small extent, 10.9% a moderate extent, 8.0% a large extent, and 5.8% a very large extent. Lastly, poor stock rotation was a factor, with 51.1% of participants indicating no food waste, 30.7% reporting a small extent, 12.4% a moderate extent, 2.9% a large extent, and 2.9% a very large extent attributed to this issue.

Impact of food waste in the study

Participants reported various impacts of food waste on their small businesses, with loss of profit identified as a significant concern. Specifically, 29.4% of respondents noted a very large extent of profit loss, while 16.2% indicated a large extent, 27.9% a moderate extent, and 22.8% a small extent. Only 3.7% stated that food waste had no impact on their profit. In terms of income reduction, 17.5% of participants indicated a very large extent of loss, 8.0% a large extent, 27.0% a moderate

extent, and 19.0% a small extent. Conversely, 28.5% reported that income loss due to food waste did not affect their business operations. Regarding the loss of food, 25.5% of respondents indicated a very large extent, 11.7% a large extent, 27.0% a moderate extent, and 25.5% a small extent of food loss. Only 10.2% claimed that food loss had no impact on their business. The loss of jobs was cited by 8.8% of participants as having a very large impact, 6.6% as a large impact, 13.1% as a moderate impact, and 27.7% as a small impact. Notably, 43.8% indicated that loss of jobs had no effect on their business. Loss of stock was also highlighted, with 29.4% of participants reporting a very large extent, 11.0% a large extent, 22.8% a moderate extent, and 27.2% a small extent. Only 9.6% indicated that stock loss had no impact on their business. Lastly, food poisoning as a consequence of food waste was acknowledged by 5.8% of respondents as having a very large extent of impact, 1.5% a large extent, 6.6% a moderate extent, and 13.9% a small extent. A significant majority, 75.8%, reported that food poisoning did not affect their business operations.

Disposal of food waste in the study

Participants were asked to report their methods of food waste disposal. The results indicated that 27.7% of participants received assistance from municipal Environmental Health Practitioners for safe food waste disposal, while 20.4% managed their own disposal at landfill sites. Additionally, 36.5% disposed of their food waste alongside general waste, 29.9% fed it to animals, and 19.3% employed alternative methods such as returning waste to suppliers, donating to charity, or hiring private companies for disposal assistance.

Factors for avoiding food waste

The results reveal that a substantial majority of participants recognize the importance of various practices in mitigating food waste. Specifically, 86.1% of respondents rated stock rotation as "very important," while 7.3% considered it "important," 3.6% remained neutral, 2.2% assigned it "low importance," and 0.7% deemed it "not important." In terms of backup facilities, 77.4% rated them as "very important," with 13.1% categorizing them as "important," 7.3% as neutral, 0.7% as "low importance," and 1.5% as "not important." Promoting appropriate food waste practices garnered a "very important" rating from 65.0% of the participants, while 8.8% rated it as "important," 16.8% as neutral, 5.8% as "low importance," and 3.6% as "not important." Avoiding overstocking was rated as "very important" by 71.6% of participants, with 17.2% rating it as "important," 4.5% as neutral, 5.2% as "low importance," and 1.5% as "not important." Careful handling of stock received a "very important" rating from 74.5% of participants, while 10.2% rated it as "important," 8.0% as neutral, and 6.6% as "low importance." Lastly, training staff on food handling was considered "very important" by 83.9% of respondents, with 7.3% rating it as "important," 4.4% as neutral, 3.6% as "low importance," and 0.7% as "not important."

Relationship between the occurrence, causes and practices of food waste

The analysis of the interrelationships among various forms of food waste and their associated factors reveals multiple statistically significant positive correlations. A noteworthy correlation coefficient of 0.325 indicates a substantial relationship between non-perishable and perishable food waste ($p < 0.001$). Furthermore, a significant correlation of 0.169 ($p = 0.049$) exists between the amount of food waste generated and its classification. The relationship between food expiry and the type of food waste demonstrates a positive correlation of 0.215 ($p = 0.012$), while the correlation between food expiry and the volume of food waste exhibits a coefficient of 0.268 ($p = 0.001$). The analysis reveals significant positive correlations between food poisoning and various aspects of food management. Specifically, food poisoning is positively correlated with the quantity of food waste ($r = 0.229$, $p = 0.007$), overstocking ($r = 0.266$, $p < 0.001$), damage ($r = 0.239$, $p < 0.001$), rotting ($r = 0.288$, $p = 0.011$), and inadequate stock rotation ($r = 0.182$, $p < 0.001$). Additionally, there are positive correlations with financial losses, including loss of profit ($r = 0.186$, $p = 0.030$), loss of income ($r = 0.365$, $p < 0.001$), loss of food ($r = 0.185$, $p = 0.030$), loss of jobs ($r = 0.626$, $p < 0.001$), and loss of stock ($r = 0.294$, $p < 0.001$). Moreover, a positive correlation is identified between food waste disposal in landfill sites and the type of food waste ($r = 0.414$, $p = 0.0032$).

Table 3: Correlations between the occurrence, causes, impacts and practices of food waste

	C7	C8	C9	C10	D11.1	D11.2	D11.3	D11.4	D11.5	D11.6	D11.7	D12.1	D12.2	D12.3	D12.4	D12.5	D12.6	E13.2
C7	1																	
C8	-0.100 (0.247)	1																
C9	-.780** (0.000)	0.325** (0.000)	1															
C10	0.169* (0.049)	-0.159 (0.064)	-0.059 (0.498)	1														
D11.1	0.215* (0.012)	-0.052 (0.548)	-.255** (0.003)	0.268** (0.001)	1													
D11.2	0.197* (0.021)	-0.075 (0.385)	-.271** (0.001)	0.267** (0.002)	0.601** (0.000)	1												
D11.3	0.201* (0.019)	-0.079 (0.365)	-.256** (0.003)	0.430** (0.000)	0.558** 0.000	0.599** (0.000)	1											
D11.4	-0.022 (0.797)	-0.036 (0.675)	0.025 (0.775)	0.360** 0.000	0.245** (0.004)	0.402** (0.000)	0.425** (0.000)	1										
D11.5	0.021 (0.807)	-0.019 (0.824)	-0.041 (0.639)	0.050 (0.559)	0.224** (0.008)	.330** (0.000)	.185* (0.031)	.281** (0.001)	1									
D11.6	0.008 (0.923)	-0.043 (0.619)	-0.090 (0.298)	0.133 (0.120)	0.350** (0.000)	0.435** (0.000)	0.278** (0.000)	0.387** (0.000)	0.609** (0.000)	1								
D11.7	0.045 (0.601)	-0.054 (0.530)	-0.119 (0.169)	0.114 (0.183)	0.367** (0.000)	0.487** (0.000)	0.378** (0.000)	0.313** (0.000)	0.248** (0.003)	0.554** (0.000)	1							
D12.1	0.013 (0.884)	-0.087 (0.311)	-0.060 (0.489)	0.280** (0.001)	0.259** (0.002)	0.317** (0.000)	0.276** (0.001)	0.258** (0.002)	0.282** (0.001)	0.338** (0.000)	0.156 (0.068)	1						
D12.2	0.161 (0.061)	-0.110 (0.201)	-0.124 (0.150)	0.178* (00.36)	0.262** (0.002)	0.317** (0.000)	0.255** (0.003)	0.193* (0.023)	0.224** (0.008)	0.263** (0.002)	0.163 (0.057)	0.508** (0.000)	1					
D12.3	0.230** (0.007)	0.036 (0.678)	-.216* (0.012)	0.329** (0.000)	0.348** (0.000)	0.317** (0.000)	0.393** (0.000)	0.114 (0.182)	0.067 (0.435)	0.181* (0.034)	0.138 (0.107)	0.600** (0.000)	0.455** (0.000)	1				
D12.4	0.083 (0.334)	-0.043 (0.616)	-0.099 (0.252)	0.101 (0.240)	0.272** (0.001)	0.258** (0.002)	0.207* (0.015)	0.249** (0.003)	0.173* (0.043)	0.154 (0.071)	0.150 (0.078)	0.321** (0.000)	0.561** (0.000)	0.315** (0.000)	1			
D12.5	0.138 (0.110)	0.015 (0.866)	-0.143 (0.098)	0.313** (0.000)	0.319** (0.000)	0.403** (0.000)	0.344** (0.000)	0.216* (0.011)	0.166 (0.052)	0.301** (0.000)	0.255** (0.003)	0.686** (0.000)	0.464** (0.000)	0.749** (0.000)	0.333** (0.000)	1		
D12.6	0.005 (0.956)	0.019 (0.826)	0.014 (0.868)	0.229** (0.007)	0.156 (0.067)	0.266** (0.007)	0.239** (0.007)	0.288** (0.007)	0.096 (0.264)	0.105 (0.221)	0.182* (0.032)	0.186* (0.030)	0.365** (0.000)	0.185* (0.030)	0.626** (0.000)	0.294** (0.000)	1	
E13.2	0.414* (0.032)	-0.147 (0.456)	-0.228 (0.244)	-0.070 (0.724)	0.143 (0.467)	-0.063 (0.751)	0.215 (0.273)	-0.101 (0.611)	0.095 (0.632)	0.013 (0.948)	0.151 (0.442)	0.143 (0.467)	0.155 (0.430)	0.154 (0.435)	-0.045 (0.822)	0.124 (0.529)	0.154 (0.435)	1

C7-Type of food waste, C8-Experiencing perishable food waste, C9-Experiencing non-perishable food waste, C10-Quantity of food waste, D11.1-Expiry, D11.2-Overstocking, D11.3-Damages, D11.4-Rotten, D11.5-Power outages, D11.6-Fridge failure, D11.7-Poor stock rotation, D12.1-Loss of profit, D12.2-Loss of income, D12.3-Loss of food, D12.4-Loss of jobs, D12.5-Loss of stock, D12.6-Food poisoning, E13.2-Own disposal at the landfill site, *- Correlation is significant at the 0.05 level (2-tailed), **- Correlation is significant at the 0.01 level (2-tailed).

Discussion

Occurrence of perishable and non-perishable food waste

100% of the participants indicated that their food premises generate food waste, whereas- 65.4% indicated that be generate both perishable and non-perishable food waste, 27.9% only generate perishable waste, while the remaining 6.6% generate non-perishable food waste only. Most premises generate both perishable and non-perishable food waste because they sell both perishable and non-perishable foodstuffs. Most participants indicated that they experience more perishable food waste than non-perishable food waste on a daily basis, this might be because perishable foodstuffs have a shorter shelf life as compared to non-perishable foodstuffs. 27.0% of participants indicated that their premises generate more than 20kg of waste in a week while 36.5% of participants indicated that they generate less than 5kg of food waste in a week whereas [15] that between 75 and 85 million kilograms of food can be wasted annually in the food industry. Most participants generate less food waste because they have adopted strategies such as stock rotation to reduce food waste as it was also indicated in the literature review in the study by [16] that it is essential to implement strategies to reduce food waste throughout the entire food supply chain.

Causes of food waste in the study

The results of the study revealed that some food waste is caused by damage. These damages happen during the receiving of stock, during the packing of foodstuffs on the shelves, and some damages are caused by customers while shopping inside the premises. These findings are similar to the findings in a study by Marais, Smit, Koen and Lötze [17] which revealed that 53.6% of food waste is caused by damage. Food waste was also found to be caused by power outages and expiry. Power outages caused by load-shedding in South Africa are a serious concern for small business premises as it affects the cold chain which results in food being unfit for human consumption and being discarded as food waste. A study by Dlomo [10] indicated in the literature review that cold chain failure is caused by fridge failure or power outages, resulting in food condemnation. The results also revealed overstocking as a cause of food waste These findings are similar to the findings by Dasanayake [7] which revealed that grocery stores contribute to food waste by overstocking shelves. A study by Wunderlich and Martinez [18] also reported similar findings that small businesses purchase products in large quantities and varieties of food types in order to receive discounts, therefore are forced to purchase more than they need and much of the overstocked food results in food waste. Some foods remain in the storeroom and on shelves for too long due to overstocking and end up expiring and being discarded as food waste. Another cause of food waste in the study was because of rotten food, which occurs mostly in fruit and vegetable premises. The least cause of food waste was found to be poor stock rotation because most of the food premises know the importance of rotating stock to avoid food waste. The findings in this study on overstocking, power outages and fridge failure are similar to the findings in the study by Dlomo [10] which also described these as the cause of food waste.

Impact of food waste in the study

The study revealed the impact of food waste as loss of profit, loss of stock, loss of food, loss of income and loss of jobs. The loss of profit, loss of income and loss of jobs contribute to the economic impact of food waste. The findings of this study are similar to the findings by Addai, 2021 [19] that revealed an economic impact of food waste (loss of income and loss of profit) for the restaurant where, on average, food waste was between 2% to 4% of its total yearly income and had recorded 2% of food waste in 2019 and that represented a substantial loss of income [19].

Management of food waste

The results for the disposal of food waste raise a big concern as many respondents indicated that they do their own disposal at the landfill site, while others indicated that they dispose of the food waste together with their general waste. The findings are similar to the findings by Nhemachena et al. [20] who revealed that less than 20% of small food premises within the Greater Tzaneen Local Municipality are serviced by private contractors who recycle food waste while the rest dispose and mix food waste with other solid waste collection. These findings are supported by the finding by Dlomo [10] that revealed a concerning situation in South Africa is that land disposal is still the most practical and the cheapest option for waste management, including food waste [10]. This is done without following the proper requirements for safe disposal, resulting in such food waste being taken and consumed by scavengers and waste pickers at the landfill, posing a serious public health concern. Managers and supervisors lack knowledge on proper safe disposal of food waste.

Participants have indicated important factors or strategies to consider for avoiding or reducing food waste. The factors included stock rotation, installing a back-up facility for electricity, running promotions, avoiding overstocking, careful

handling of stock to avoid or reduce foodstuff damage and training of staff on food handling and maintaining a cold chain to avoid or reduce food spoilage. Stock rotation is very important in ensuring that old stock must be bought first to avoid expiry. Installing a backup facility for electricity helps to maintain the cold-chain temperature during power outages. Running promotions assist in ensuring that stock is not kept for too long before being sold. Training of food handlers helps in minimizing damage caused by improper handling of foodstuff. This is supported by Girotto et al. [16] in the literature review who indicated that it is essential to implement strategies to avoid or reduce food waste throughout the entire food supply chain. 58.1% of participants indicated that they have insurance to compensate for food waste while 41.9% indicated that they do not have insurance to compensate for food waste. Having insurance for food waste assists in ensuring that business premises are compensated for losses due to food waste.

Relationship between the occurrence, causes, impact and practices of food waste

Correlation analyses were run to determine the relationship between occurrence, cause, impacts, and practices of food waste. The results indicated that there was a correlation between various variables. The variables that were analyzed were type of food waste, experiencing perishable food waste, experiencing perishable food waste, quantity of food waste, expiry, overstocking, damages, rotten, power outages, fridge failure, poor stock rotation, loss of profit, loss of income, loss of food, loss of jobs, loss of stock, food poisoning and own disposal at the landfill site. There was a positive correlation between overstocking and the quantity of foodstuff, rotting and expired foodstuff, this shows that an increase in overstocking results in an increase in the quantity of food waste, rotten and expired food stuffs. The increase in overstocking also increases poor stock rotation and food damage. This is supported by [8] in the literature review, which indicates that overstocking of foodstuffs results in an increase in food waste. The increase in food damage and rotten food results in an increase in the quantity of food waste generated. The increase in power outages results in an increase in damaged and rotten food. The increase in power outages also increases fridge failure. The increase in fridge failure increases damaged and rotten food. The increase in poor stock rotation increases expired foodstuff and damaged and rotten food. The increase in the quantity of food waste, expiry foodstuffs, food damages, overstocking, rotten food, power outages, fridge failure, and poor stock rotation has been shown to contribute to the increase in loss of profit, loss of income, loss of food, loss of jobs, loss of stock and food poisoning. This finding was supported by the findings in the study by [19] which revealed that food waste results in loss of income and loss of profit for restaurants. The increase in the type of food waste contributes to the increase in the number of participants disposing of their food waste in landfill sites. These findings are supported by the finding by [10] who revealed that a concerning case in South Africa is that land disposal is still the most practical and the cheapest option for waste management including food waste.

Conclusion

The understanding of and awareness of food waste need to be enhanced at retail and consumer levels. This is key to changing behavior towards the reduction of food waste. Awareness campaigns can assist small business premises to implement strategies to avoid or reduce food waste. Environmental health practitioners must also provide health education to small business premises on the management of food waste, such as safe disposal of food waste, as the results of this study have revealed unsafe disposal practices by most participants. Small business premises need to realize the importance of having insurance to compensate them after suffering losses due to food waste. When it comes to managing and running a small business, it is important to evaluate the type of food waste that is generated. Knowing the value of the small business premise's wasted food and why it is being discarded is important in establishing ways to reduce food waste. It can be concluded that most of the food waste in small business premises is caused by damage. Food waste has a negative impact on the economy of the country as it results in loss of profit, lack of jobs and loss of income. Lastly, it can be concluded that most managers and supervisors of small business premises lack sufficient knowledge on the safe disposal of food waste.

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