Food Waste in Hotel Restaurants: Causes, Reducing Practices and Barriers

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Keywords	Abstract
Food Waste (FW). Hotel Restaurants. FW Causes. FW Reducing Practices and Barriers.	Food waste (FW) generation has become a global topic that plays an important role in food security and the sustainability of the food system. The availability of safe and nutritious food for human consumption will be improved by reducing FW. Reducing waste is the first option that should be considered. This research aims to explore FW causes, reducing practices and barriers in three, four, and five-star hotel restaurants. The researchers used the quantitative approach with questionnaire survey for a sample of restaurant managers in three, four, and five-star hotels at Hurghada city. A total of 88 questionnaires forms were conducted among hotel restaurants managers. The research data was analyzed using descriptive statistics, One-way ANOVA test, and independent sample T-test. Results reveal that there are causes of FW in hotel restaurants, such as neglecting customer desires when modifying menus; and lack of customer awareness at the consumption stage. Results indicate that there are FW reducing practices are applied in hotel restaurants, such as revising menus regularly after analyzing menus items that usually have most leftovers; identifying which buffet items are regularly wasted and reduce the quantity when prepared; posting informational signs encourage customers to take only enough food; and awareness campaigns for staff about FW and the related opportunities to reduce. The results also show the barriers faced hotel restaurants while reducing FW such as poor menu planning; buffet service; lack of restaurant staff training on FW reducing practices; and lack of customers' awareness towards FW issue.

1. Introduction

In this era, people are facing a very troubling problem, and that is FW. FW started happening decades ago and is still happening today. FW not only comes from large-scale food and beverage production but, also comes from people's behavior (Zakarya et al., 2021). Approximately one-third of the total produced food (32% or 1.3 billion tonnes) is lost or wasted somewhere between the field and the fork each year around the world (Food and Agriculture Organization (FAO), 2011; Göbel et al., 2015; Grandhi and Singh, 2016; Bauer et al., 2018; Saputri et al., 2018; Heller, 2019, and Li et al., 2021). One-fourth of the world's FW would be enough to feed the world's population and the FW costs the world about 1 trillion dollars ($) a year (Timmermans, 2014; Tuppen, 2014; HOTREC Hospitality Europe, 2017; and Lasaridi et al., 2017). It is estimated that hotels, restaurants, and the catering industry account for approximately 14% of the total annual FW created (Bio Intelligence Service, 2010). There will be some FW even in the best-run kitchens- the goal is to reduce the amount of food that is wasted whilst considering how best to dispose of unavoidable waste (Hurst, 2017). FW generated at retail, food service, and consumer or household sectors can be potentially reduced. Study on behaviors related to food consumption, storage, and disposal is the approach to explore the causes of FW and its possible reduction (Saputri et al., 2018). This research will try to explore FW causes, reducing practices and barriers in hotel restaurants.

2. Literature Review

2.1. FW definitions

FW is defined as "Food discarded at the end of the food chain (i.e. retail and final consumption), resulting from decisions to discard food that is still valuable or relates to retailers' and consumers' behavior" (Parfitt et al., 2010; FAO, 2011; and Marra, 2013). Also FW is defined as "Organic waste, which has its origin in food. It can be divided between avoidable and unavoidable FW. Avoidable FW was edible at some point before disposal (e.g. a slice of bread, plate residues, etc.). The avoidable FW from the hospitality sector could be further divided into waste from the kitchen (e.g. preparation of meals) and waste from the guests (plate residue). Unavoidable FW is not-edible FW from the preparation and consumption of food (e.g. bones, eggshells, etc.)" (Marthinsen et al. 2012; Lasaridi et al., 2017).

2.2. FW Causes

Herszenhorn et al. (2014) stated that FW occurs across the supply chain from farm to fork. Alegre and Berbegal-Mirabent (2018) noted that hotels, restaurants, cafes, and bars annually generate thousands of tons of FW. This FW consists of items such as peelings and inedible by-products (e.g. bones, coffee grounds, tea leaves) but most of them are perfectly good food.

FW causes during consumption are as follows: more food is wasted in summer (Seasonal factors) (Gallo, 1980), lack of knowledge about preparation and appropriate

portion sizes (Buzby et al., 2009), consumers get confused about "use-by" and "best before" dates so that food is discarded while still safe to eat (Parfitt et al., 2010), psychological tastes, attitudes, and preferences leading to plating waste (e.g., refusal to eat food for religious reasons) (Zeigler and Floros, 2011), spillage, excessive trimming, excessive or insufficient heat, inadequate storage (Lipinski et al., 2013), and industry or government standards can lead to the rejection of some products for human consumption (e.g. plate waste cannot be reused in restaurants) (Buzby et al., 2014). Monier et al. (2010) demonstrated the diversity of FW causes within the foodservice sector as follows:

- Portion Sizes: Consumers eat 92% of the food they serve themselves. Where portion sizes are imposed, in cafeterias/canteens, e.g., FW is generated that might have been avoided by allowing customers to serve themselves and pay for their serving by weight. The preponderance of single-serving items in hotels and many catering facilities, (jams, cereals, juice, and milk cartons, e.g.), lead to FW that could easily be avoided by allowing customers to serve themselves from central containers.

- Buffets: Where food is served via a buffet, customers often expect that nothing will run out, particularly in the luxury market, causing businesses to prepare and cook substantially more than will be consumed. Free or all-you-can-eat buffets may furthermore increase the amount of food taken and not consumed by customers.

- Attitudes: The practice of taking home restaurant leftovers is not universally accepted a practice that would enable a substantial reduction of restaurant FW.

- Preferences: many (often nutritious) parts of the food are discarded due to personal taste (e.g. apple skins, potato skins, bread crusts).

Marra (2013) stated that consumer behavior is still generating a high amount of FW. Wealth and easy access to food allowed consumers to waste more. Tuppen (2014) and Hurst (2017) notified that FW in hotels comes from a variety of sources such as food production processes; spoiled or out of date food; inedible by-products - bones, coffee grounds, tea leaves; human factor (portion control errors, ensuring enough food is available, ordering miscommunications); and plate waste. According to Gandhi et al. (2017), the amount in which food is taken by hotel customers in plates depends on the hunger, plate size, emotions and speed of eating, etc. House of Commons (2017) stated that a large proportion (approximately 30%) of the total FW generated in the hospitality sector was a result of large portion sizes and resulting waste left on customers' plates and food was not used in time. The most common foods thrown were items such as chips, bread rolls, and coleslaw. Gunders and Bloom (2017) stated that plate waste is a significant contributor to FW, mainly caused by large portions and undesired accompaniments. Also, extensive menu choices make proper inventory management difficult since large menus often need more inventory to be on hand. Alegre and Berbegal-Mirabent (2018) noted that the probability of leaving part of the main dish while consuming more than one course is high, because people also want to consume a starter or a dessert. Plate fillers such as salads, vegetables, or chips are the most likely to remain uneaten.

2.3. FW Reducing Practices

Hollins (2013) showed that businesses that are successful in wasting less FW; use FW monitoring data regularly to set menus, address over-portioning, improve demand forecasting, and help for staff motivating and training. FW monitoring helps foodservice operations to identify where the waste arises, such as spoilage FW, preparation FW, unserved food, and plate FW. United States Environmental Protection Agency (USEPA) (2014) stated that in reducing FW, measuring and tracking the amount, type of, and reason for the FW is the first step. It is important to determine the quantity of the total FW generated to create successful policies that reduce FW.

2.3.1. Menu Planning

Hollins (2013) stated that menu planning is an important key to reduce FW. It is important to provide a wide range of menu items to attract customers while reducing the waste associated with the less popular choices. According to Hollins (2013), customers should be asked for feedback to improve menu planning and compare waste rates across different menu types and cycles to reduce the quantity of FW. USEPA (2014) stated that it is necessary to identify which menu items are being wasted regularly and reduce the quantity or portions of those items prepared. USEPA (2014) declared that FW tracking systems can help managers to identify which dishes customers frequently send back to the kitchen or leave uneaten. This information enables managers to modify the menu to satisfy customers and generate less waste. Gandhi et al. (2017) stated that it is important to revise the menu regularly after analyzing the menu items that usually have the most leftovers. Alegre and Berbegal-Mirabent (2018) stated that menus should be with different sizes of portions (consumers pay by size) or menus where customers can choose their favorite plate filler.

2.3.2. Food Portioning and Serving

Portion control aims to reduce plate FW, where the food portion must be large enough to satisfy customers. If too much food is served, this is likely to end up in the bin and, even though the customer has paid for the meal, this creates an avoidable financial cost to the business. Accurate food portion control is particularly difficult where food is served on self-service buffets, smaller plate sizes should be used to reduce FW for buffets (Hollins, 2013 and Fan et al., 2021). Foodservice managers can reduce FW by avoiding the use of inedible garnishes unless requested; For serviced food counters, using the "ask first" policy for side dishes and garnishes; reducing the serving size to reduce FW while still satisfying a customer's relish (USEPA, 2014); serve a standard portion of vegetables or side dishes; encourage staff to assist customers in ordering the right amount and monitoring plate waste to help identify savings opportunities; and consider offering to customers the option of taking unfinished food home (Resource Efficient Scotland, 2014). During buffet service, identify which buffet items are regularly wasted and reduce the quantity of those items prepared; implement a tray-less system; and reduce serving utensil size (USEPA, 2014).

2.3.3. Customer Awareness Toward FW Issue

People who leave food, feel no sense of ownership or responsibility for the food they leave (Food Standards Agency, 2002). Foodservice managers can post informational

signs at such a buffet-style food service that encourages customers to take only enough food to match their relish. Trays motivate customers to take more food than they can eat. Discourage customers from wasting food by going tray-less or by using smaller trays (USEPA, 2014). Putting clear and fun posters at waste collection points in restaurants and cafes to encourage guests to put FW in FW bins, in addition running campaigns such as "Love Food Hate Waste" by catering operations (Hurst, 2017). Using written messages such as "Eat what you take", "Eat more and waste less", "Eat less waste nothing" and "Stop FW" etc. at the places where ever necessary (Gandhi et al., 2017). Customer's attitudes and awareness toward FW should be improved to mitigate the FW problem (Saputri et al., 2018). Increasingly, restaurants are offering the possibility to ask for a container to take leftovers home - by taking this action, FW can be reduced at the end of a meal out (Alegre and Berbegal-Mirabent, 2018). Excessive portion sizes are a clear source of FW by customers in food-service providers (Searchinger et al., 2019).

2.3.4. Staff Behavior Toward FW Issue

Staff behavior is a key that can positively influence FW. Making staff aware of all the key of FW generation and the related opportunities to reduce will encourage them to help overcome it (Hollins, 2013). Managing FW requires that all operational staff be educated about company policy and their FW legal responsibilities. Staff training should include instructions on how it is necessary to reduce FW and emphasize the need to keep FW out of general bins, drains, and sewers. (Resource Efficient Scotland, 2014). Foodservice managers should train their staff on basic steps to minimize FW such as; plating practices to reduce unnecessary food (USEPA, 2014). FW reduction training programs should be developed and implemented for food service staff (Broderick and Gibson, 2015). Regular briefings and updates should be given to food service staff about waste management from purchasing to disposal, and ongoing training and monitoring of portion sizes should be throughout all the catering operations (Hurst, 2017). Staff should share their ideas regarding the ways to reduce FW; showing them posters and signage regarding managing FW (Gandhi et al., 2017).

3. Methodology

The research adopts the quantitative approach using questionnaire survey for a sample of hotel restaurants managers (88 participants) in three, four, and five-star hotels at Hurghada city. The questionnaire includes four major sections. Section one is general data about hotels. Section two includes one question with a three-dimensional Likert scale about the causes of generated FW. It achieves the first objective and answers the first question of the research. Section three included one question with a three-dimensional Likert scale about the applied practices of FW reducing; it achieves the second objective and answers the second question of the research. Also, Section four included four questions with a three-dimensional Likert scale about the barriers that hotel restaurants managers face while reducing FW. It achieves the third objective and answers the third question of the research. The research depended on the cluster random sample in the field research. Taro Yamane equation (Yamane, 1967) was applied in the research to calculate the sample size as follows:

Where, N: the population size (112), n: the sample size (88), and e: the acceptable sampling error (0.05). According to the Egyptian Hotel Association (2016); the

number of five, four and three star hotels in Hurghada city is 112 hotels, so the total number of population is 112 hotel restaurants managers. By applying the data of the research population in the previous formula, the optimal sample size of the research was calculated (88 participants). The research questionnaire was distributed in hard forms handed to 88 hotel restaurants managers. Out of this number, there are 69 forms that are valid to be analyzed (representing 78.4 % response rate) (see table 1).

Table (1): Research population and sample

Category	Number
Population	112
Targeted sample	88
Respondents	77
Valid	69
Response rate	**78.4%**

Source: **Developed by the researchers.**

3.1. Research Aim and Objectives
This research aims to explore FW causes, reducing practices and barriers in three, four, and five-star hotels. To achieve the research aim; there are some objectives were targeted as follows:
1. To detect causes of generated FW in hotel restaurants.
2. To determine the applied practices of FW reducing in hotel restaurants.
3. To reveal the barriers that hotel restaurants managers face while reducing FW.
4. To find out if there are differences or not between the three, four and five-star hotel restaurants regarding FW causes, reducing practices and barriers.
5. To find out if there are differences or not between chain and independent hotel restaurants regarding FW causes, reducing practices and barriers.

3.2. Research Questions
1. What are the causes of generated FW in hotel restaurants?
2. What are the applied practices of FW reducing in hotel restaurants?
3. What are the barriers that hotel restaurants managers face while reducing FW?
4. Are there differences between the three, four and five-star hotel restaurants regarding FW causes, reducing practices and barriers?
5. Are there differences between chain and independent hotel restaurants regarding FW causes, reducing practices and barriers?

3.3. Validity of the research
In order to collect opinions and suggestions about the research tool, a panel of experts in hospitality management field was consulted. The research adopted face validity to ensure the data collection instrument validity. Through this method, each research objective was matched with its question. Also, factor analysis was used to improve the strength of components.

3.4. Reliability of the Research
Cronbach's alpha coefficient was tested for survey statements reliability, and it exceeded 0.7 for all variables as shown in table (2); this means that all items are reliable, referring to suitable measurement reliability. Hair *et al*. (2010) stated that Cronbach's α level of more than 0.7 is suitable for reliability.

Table (2): Reliability

The Axis	No. of statements	Alpha Coefficient
FW causes during menu planning.	3	0.840
FW causes during food portioning and serving.	6	0.848
FW reducing practices during menu planning.	4	0.831
FW reducing practices during food portioning and serving.	6	0.830
FW reducing practices that affect customers' awareness of FW	6	0.830
FW reducing practices that affect restaurants staff behavior towards FW issue.	6	0.829

4. Results and Discussion

4.1. The Sample Characteristics

Table (3): The sample characteristics (hotel data)

Variable	Response	Frequency	Percent	Rank
Hotel ownership	Independent hotel	41	59.4	1
	Chain hotel	28	40.6	2
Hotel class	Three-star	24	34.8	2
	Four-star	28	40.6	1
	Five-star	17	24.6	3

The previous table shows that 59.4% of the respondent sample are independent hotels (41 hotels) and 40.6% are chain hotels (28 hotels). Furthermore, 40.6% of the respondent sample are four-star hotels (28 hotels), 34.8% are three-star hotels (24 hotels), and 24.6% are five-star hotels (17 hotels).

4.2. Causes of Generated FW

The purpose of this variable is to detect the causes of generated FW in hotel restaurants. It achieves the first objective and answers the first question of the research.

Table (4): Factor analysis of generated FW causes

Statements	Loading
Neglecting customer reviews about food items.	0.89
Neglecting customer desires when modifying menus.	0.81
Not identifying menus items that usually have the most leftovers.	0.66
The large portion size of customer plate.	0.93
Undesired accompaniments of food.	0.92
Buffets service.	0.79
Food items available at cheap rates.	0.75
Lack of customer awareness at the consumption stage.	0.87
Wrong staff behavior towards food.	0.79
Sums of squared loadings	**0.82**

Factor analysis shown in the previous table attempts to identify key variables that explain the pattern of correlations within a set of observed variables. Fabrigar et al.

(1999) stated that statistical loading should not be less than 0.6. Factor analysis declares that all of the nine statements are loaded on one factor explained 82% of the variance in the underlying variable of research. In other words, the previous nine statements are responsible for the variance in causes of generated FW with a percentage of 82%.

Table (5): Statistics of generated FW causes

FW causes during menu planning	Response	Freq.	Percent	Mean *	SD	Sig.	Rank
Neglecting customer reviews about food items	Agree	21	30.4	2. 00	0.79	0.00	3
	Neutral	27	39.2				
	Disagree	21	30.4				
Neglecting customer desires when modifying menus	Agree	36	52.2	2.30	0.81	0.00	1
	Neutral	18	26.1				
	Disagree	15	21.7				
Not identifying menus items that usually have the most leftovers	Agree	30	43.5	2.22	0.78	0.00	2
	Neutral	24	34.8				
	Disagree	15	21.7				
Overall				**2.17**	**0.79**	**0.00**	**-**
FW causes during food portioning and serving							
The large portion size of customer plate	Agree	42	60.9	2.57	0.58	0.00	4
	Neutral	24	34.8				
	Disagree	3	4.3				
Undesired accompaniments of food	Agree	51	73.9	2.65	0.64	0.00	3
	Neutral	12	17.4.				
	Disagree	6	8.7				
Buffets service	Agree	57	82.6	2.74	0.61	0.00	2
	Neutral	6	8.7				
	Disagree	6	8.7				
Food items available at cheap rates	Agree	21	30.4	1.96	0.81	0.00	5
	Neutral	24	34.8				
	Disagree	24	34.8				
Lack of customer awareness at the consumption stage	Agree	63	91.4	2.87	0.45	0.00	1
	Neutral	3	4.3				
	Disagree	3	4.3				
Wrong staff behavior towards food	Agree	18	26.1	1.96	0.76	0.00	5
	Neutral	30	43.5				
	Disagree	21	30.4				
Overall				**2.46**	**0.64**	**0.00**	**-**

*Mean of benefits of FW monitoring; Where 1= disagree, 2 = neutral and 3= agree. SD = Standard Deviation and Sig. = significance degree of one-sample T-Test.

According to table (5) in the variable "FW causes during menu planning", the most effective cause is "neglecting customer desires when modifying menus", where the

mean value is (2.30) and the standard deviation is (0.81). On the other hand, the least effective cause is "neglecting customer reviews about food items", where the mean value is (2.00) and the standard deviation is (0.79). The overall mean of the statements is (2.17), the standard deviation of means values is (0.79) and the p-value of the one-sample T-test is (0.000) which indicates that there are significant differences between FW causes during menu planning and the test value (3). In other words, respondents' awareness of all statements is less than the test value. These results are consistent with USEPA (2014); FW tracking systems can help managers to identify which dishes customers frequently send back to the kitchen or leave uneaten. This information enables managers to modify the menu to satisfy customers and generate less waste. Moreover, in the variable "FW causes during food portioning and serving", the most effective cause is "lack of customer awareness at the consumption stage", where the mean value is (2.87) and the standard deviation is (0.45). On the other hand, the least effective causes are "food items available at cheap rates", where the mean value is (1.96) and the standard deviation is (0.81), and "Wrong staff behavior towards food", where the mean value is (1.96) and the standard deviation is (0.76). The overall mean of the statements is (2.46), the standard deviation of means values is (0.64) and the p-value of the one-sample T-test is (0.000) which indicates that there are significant differences between FW causes during food portioning and serving and the test value (3). In other words, respondents' awareness of all statements is less than the test value.

4.3. The Applied Practices of FW Reducing

The purpose of this variable is to define the applied practices of FW reducing in hotel restaurants. This variable aims to achieve the second objective and answer the second question of the research.

Table (6): Factor analysis of the applied practices of FW reducing

Statements	Loading
Designing menus with different sizes of portions.	0.89
Modifying menus to satisfy customers.	0.90
Revising menus regularly after analyzing menus items that usually have the most leftovers.	0.86
Planning to use surplus food as part of the menu where it does not compromise food safety.	0.83
Offering smaller portions for a slightly reduced price.	0.86
Using smaller plate sizes for buffets.	0.83
Using the "ask first" policy for side dishes and garnishes.	0.91
Allowing customers to serve themselves from central containers and pay for their serving by weight.	0.73
Decreasing buffet timings.	0.93
Identifying which buffet items are regularly wasted and reduce the quantity of those items when prepared.	0.73
Encouraging customers to take leftovers home or room.	0.89
Conducting awareness campaigns about how to reduce FW.	0.75
Reward guests with hotel loyalty points if they reduced FW.	0.90
Posting informational signs encourages customers to take only enough	0.87

food.	
Putting up cards on tables describing global FW statistics to encourage customers to reduce FW from plates.	0.93
Fining customers who waste food.	0.75
Awareness campaigns for staff about FW generation and the related opportunities to reduce.	0.94
Creating handbooks, guides, posters, and signage to help staff in FW reducing.	0.89
Providing training programs about FW prevention skills.	0.94
Engaging staff in the quantification of the FW they generate.	0.92
Sharing staff ideas regarding the ways to reduce FW.	0.92
Providing regular briefings and updates to staff about FW management from purchasing to disposal.	0.94
Sums of squared loadings	**0.87**

Factor analysis is shown in table (6) states that all of the twenty two statements are loaded on one factor explained 87% of the variance in the underlying variable of the research. In other words, the previous twenty two statements are responsible for the variance in the applied practices of FW reducing with a percentage of 87%.

Table (7): Statistics of the applied practices of FW reducing

FW reducing practices during menu planning	Response	Freq.	Percent	Mean *	SD	Sig.	Rank
Designing menus with different sizes of portions	Completely Applied	27	39.1	2.17	0.77	0.00	3
	Partially Applied	27	39.1				
	Not Applied	15	21.7				
Modifying menus to satisfy customers	Completely Applied	30	43.5	2.30	0.69	0.00	2
	Partially Applied	30	43.5				
	Not Applied	9	13				
Revising menus regularly after analyzing menus items that usually have the most leftovers	Completely Applied	39	56.6	2.52	0.58	0.00	1
	Partially Applied	27	39.1				
	Not Applied	3	4.3				
Planning to use surplus food as part of the menu where it does not compromise food safety	Completely Applied	36	52.2	2.30	0.81	0.00	2
	Partially Applied	18	26.1				
	Not Applied	15	21.7				
Overall				**2.32**	**0.71**	**0.00**	**-**
FW reducing practices during food portioning and serving							
Offering smaller portions for a	Completely Applied	30	43.5	2.22	0.78	0.00	2

slightly reduced price	Partially Applied	24	34.8				
	Not Applied	15	21.7				
Using smaller plate sizes for buffets	Completely Applied	33	47.8	2.22	0.84	0.00	2
	Partially Applied	18	26.1				
	Not Applied	18	26.1				
Using the "ask first" policy for side dishes and garnishes	Completely Applied	33	47.8	2.13	0.91	0.00	3
	Partially Applied	12	17.4				
	Not Applied	24	34.8				
Allowing customers to serve themselves from central containers and pay for their serving by weight	Completely Applied	9	13.1	1.57	0.72	0.00	5
	Partially Applied	21	30.4				
	Not Applied	39	56.5				
Decreasing buffet timings	Completely Applied	21	30.4	1.96	0.81	0.00	4
	Partially Applied	24	34.8				
	Not Applied	24	34.8				
Identifying which buffet items are regularly wasted and reduce the quantity of those items when prepared	Completely Applied	45	65.2	2.57	0.65	0.00	1
	Partially Applied	18	26.1				
	Not Applied	6	8.7				
Overall				**2.11**	**0.79**	**0.00**	**-**
FW reducing practices that affect customers' awareness of FW							
Encouraging customers to take leftovers home or room	Completely Applied	9	13.1	1.48	0.72	0.00	5
	Partially Applied	15	21.7				
	Not Applied	45	65.2				
Conducting awareness campaigns about how to reduce FW	Completely Applied	27	39.1	2.17	0.77	0.00	2
	Partially Applied	27	39.1				
	Not Applied	15	21.8				
Reward guests with hotel loyalty points if they reduced FW	Completely Applied	15	21.7	1.57	0.83	0.00	4
	Partially Applied	9	13.1				
	Not Applied	45	65.2				
Posting informational signs encourages customers to take only enough food	Completely Applied	39	56.5	2.30	0.86	0.00	1
	Partially Applied	12	17.4				
	Not Applied	18	26.1				
Putting up cards on tables	Completely Applied	21	30.4	1.74	0.90	0.00	3

describing global FW statistics to encourage customers to reduce FW from plates	Partially Applied	9	13.1				
	Not Applied	39	56.5				
Fining customers who waste food	Completely Applied	6	8.7	1.43	0.65	0.00	6
	Partially Applied	18	26.1				
	Not Applied	45	65.2				
Overall				**1.78**	**0.79**	**0.00**	**-**
FW reducing practices that affect restaurants staff behavior towards FW issue							
Awareness campaigns for staff about FW generation and the related opportunities to reduce	Completely Applied	54	78.3	2.78	0.42	0.00	1
	Partially Applied	15	21.7				
	Not Applied	-	-				
Creating handbooks, guides, posters, and signage to help staff in FW reducing	Completely Applied	48	69.5	2.52	0.78	0.00	3
	Partially Applied	9	13.1				
	Not Applied	12	17.4				
Providing training programs about FW prevention skills	Completely Applied	48	69.6	2.65	0.56	0.00	2
	Partially Applied	18	26.1				
	Not Applied	3	4.3				
Engaging staff in the quantification of the FW they generate	Completely Applied	24	34.8	2.09	0.78	0.00	5
	Partially Applied	27	39.1				
	Not Applied	18	26.1				
Sharing staff ideas regarding the ways to reduce FW	Completely Applied	27	39.1	2.13	0.80	0.00	4
	Partially Applied	24	34.8				
	Not Applied	18	26.1				
Providing regular briefings and updates to staff about FW management from purchasing to disposal	Completely Applied	24	34.8	2.09	0.78	0.00	5
	Partially Applied	27	39.1				
	Not Applied	18	26.1				
Overall				**2.38**	**0.69**	**0.00**	**-**

*Mean of uses of surplus edible food; Where 1= never, 2 = sometimes and 3= always. SD = Standard Deviation and Sig. = significance degree of one-sample T-Test.

Table (7) indicates that in the variable "FW reducing practices during menu planning", the most applied practice is "revising menus regularly after analyzing menus items that usually have the most leftovers", where the mean value is (2.52) and

the standard deviation is (0. 58). This result is consistent with Gandhi et al. (2017); it is important to revise the menu regularly after analyzing the menu items that usually have the most leftovers. On the other hand, the least applied practice is "designing menus with different sizes of portions", where the mean value is (2.17) and the standard deviation is (0.77). This result is consistent with Alegre and Berbegal-Mirabent (2018); menus should be with different sizes of portions. The overall mean of the practices is (2.32), the standard deviation of means values is (0.71) and the p-value of the one-sample T-test is (0.000) which indicates that there are significant differences between FW reducing practices during menu planning and the test value (3). In other words, respondents' awareness of all statements is less than the test value. In the variable "FW reducing practices during food portioning and serving", the most applied practice is "identifying which buffet items are regularly wasted and reduce the quantity of those items when prepared", where the mean value is (2.57) and the standard deviation is (0.65). This result is consistent with USEPA (2014); during buffet service, identify which buffet items are regularly wasted and reduce the quantity of those items prepared. On the other hand, the least applied practice is "allowing customers to serve themselves from central containers and pay for their serving by weight", where the mean value is (1.57) and the standard deviation is (0.72). This result is consistent with Monier et al. (2010); FW is generated that might have been avoided by allowing customers to serve themselves and pay for their serving by weight. The overall mean of the practices is (2.11), the standard deviation of means values is (0.79) and the p-value of the one-sample T-test is (0.000) which indicates that there are significant differences between FW reducing practices during food portioning and serving and the test value (3). In other words, respondents' awareness of all statements is less than the test value. Furthermore, in the variable "FW reducing practices that affect customers' awareness of FW", the most applied practice is "posting informational signs encourages customers to take only enough food", where the mean value is (2.30) and the standard deviation is (0.86). This result is consistent with USEPA (2014); foodservice managers can post informational signs at such a buffet-style food service that encourages customers to take only enough food to match their relish. On the other hand, the least applied practice is "fining customers who waste food", where the mean value is (1.43) and the standard deviation is (0.65). The overall mean of the practices is (1.78), the standard deviation of means values is (0.79) and the p-value of the one-sample T-test is (0.000) which indicates that there are significant differences between FW reducing practices that affect customers' awareness of FW and the test value (3). In other words, respondents' awareness of all statements is less than the test value. Also, in the variable "FW reducing practices that affect restaurants staff behavior towards FW issue", the most applied practice is "awareness campaigns for staff about FW generation and the related opportunities to reduce", where the mean value is (2.78) and the standard deviation is (0.42). On the other hand, the least applied practices are "engaging staff in the quantification of the FW they generate", where the mean value is (2.09) and the standard deviation is (0.78), and "providing regular briefings and updates to staff about FW management from purchasing to disposal", where the mean value is (2.09) and the standard deviation is (0.78). The overall mean of the practices is (2.38), the standard deviation of means values is (0.69) and the p-value of the one-sample T-test is (0.000) which indicates that there are significant differences between FW reducing practices that

affect restaurants staff behavior towards FW issue and the test value (3). In other words, respondents' awareness of all statements is less than the test value.

4.4. Barriers of FW Reducing

The purpose of this variable is to reveal the barriers that hotel restaurants managers face while reducing FW. This variable aims to achieve the third objective and answer the third question of the research.

Table (8): Statistics of the FW reducing barriers at menu planning stage

Variable	Frequency	Percent	Rank
Poor menu planning	19	27.6	1
Neglecting customer reviews about food items	11	15.9	4
Existence of many food items in menu	17	24.6	2
Not identifying menu items that usually have the most leftovers	12	17.4	3
Diversity of customer food habits	10	14.5	5
Total	**69**	**100**	**-**

Table (8) shows that 27.6% of the sample (19 hotel restaurants managers) mentioned the barrier "poor menu planning", 24.6% of the sample (17 hotel restaurants managers) mentioned the barrier "existence of many food items in menu", 17.4% of the sample (12 hotel restaurants managers) mentioned the barrier "not identifying menu items that usually have the most leftovers", 15.9% of the sample (11 hotel restaurants managers) mentioned the barrier "neglecting customer reviews about food items", and 14.5% of the sample (10 hotel restaurants managers) mentioned the barrier "diversity of customer food habits".

Table (9): Statistics of the FW reducing barriers at portioning and serving stage

Variable	Frequency	Percent	Rank
Buffet service	24	34.8	1
All inclusive service	6	8.7	4
Presence of unwanted food items by customers	16	23.2	3
Side dishes that are not consumed by customers	6	8.7	4
The large portion size of customer plate	17	24.6	2
Total	**69**	**100**	**-**

Table (9) shows that 34.8% of the sample (24 hotel restaurants managers) mentioned the barrier "buffet service", 24.6% of the sample (17 hotel restaurants managers) mentioned the barrier "the large portion size of customer plate", 23.2% of the sample (16 hotel restaurants managers) mentioned the barrier "presence of unwanted food items by customers", 8.7% of the sample (6 hotel restaurants managers) mentioned the barrier "all inclusive service", and 8.7% of the sample (6 hotel restaurants managers) mentioned the barrier "side dishes that are not consumed by customers".

Table (10): Statistics of the FW reducing barriers concerning staff behavior in restaurants towards FW issue

Variable	Frequency	Percent	Rank
Lack of restaurant staff training on practices of	43	62.3	1

reducing FW			
Lack of restaurant staff awareness towards FW issue	18	26.1	2
Wrong staff behavior towards food	8	11.6	3
Total	**69**	**100**	**-**

Table (10) shows that 62.3% of the sample (43 hotel restaurants managers) mentioned the barrier "lack of restaurant staff training on practices of reducing FW", 26.1% of the sample (18 hotel restaurants managers) mentioned the barrier "lack of restaurant staff awareness towards FW issue", and 11.6% of the sample (8 hotel restaurants managers) mentioned the barrier "wrong staff behavior towards food".

Table (11): Statistics of the FW reducing barriers concerning customers' awareness of FW issue

Variable	Frequency	Percent	Rank
Lack of customers' awareness towards FW issue	38	55.1	1
Diversity of customers' food habits and nationalities	31	44.9	2
Total	**69**	**100**	**-**

Table (11) shows that 55.1% of the sample (38 hotel restaurants managers) mentioned the barrier "lack of customers' awareness towards FW issue", and 44.9% of the sample (31 hotel restaurants managers) mentioned the barrier "diversity of customers' food habits and nationalities".

4.5. One-way ANOVA

This test was used to find out if there are statistically significant differences between the three, four and five-star hotel restaurants concerning FW causes and reducing practices at the significance level of .05. This test achieves the fourth objective and answers the fourth question of the research.

Table (12): Differences between the three, four and five-star hotels restaurants concerning FW causes and reducing practices

FW Causes and Reducing Practices	Hotels Grades	
	F	Sig.
FW causes during menu planning.	0.412	0.664
FW causes during food portioning and serving.	0.454	0.637
FW reducing practices during menu planning.	0.321	0.727
FW reducing practices during food portioning and serving.	1.618	0.206
FW reducing practices that affect customers' awareness of FW.	0.537	0.587
FW reducing practices that affect restaurants staff behavior towards FW issue.	0.029	0.971

Table (12) presents the one-way ANOVA to analyze the differences between three, four and five-star hotel restaurants concerning FW causes and reducing practices. The results show that the significance levels for all variables are more than 0.05. This means that there are no statistically significant differences between three, four and five-star hotel restaurants concerning FW causes and reducing practices.

4.6. Independent Sample T-Test

The purpose of this test is to find out if there are statistically significant differences or not between chain and independent hotel restaurants concerning FW causes and reducing practices at the significance level of.05. This test achieves the fifth objective and answers the fifth question of the research.

Table (13): Differences between chain and independent hotel restaurants concerning FW causes and reducing practices

Variable	Group	Mean *	SD	Levene's Test		T-Test for Equality of Means	
				F	Sig.	t	Sig.
FW causes during menu planning	Independent Chain	2.28 2.01	0.63 0.71	2.240	0.139	1.680	0.098
FW causes during food portioning and serving	Independent Chain	2.52 2.36	0.33 0.37	0.961	0.331	1.842	0.070
FW reducing practices during menu planning	Independent Chain	2.35 2.29	0.51 0.47	0.633	0.429	0.557	0.579
FW reducing practices during food portioning and serving	Independent Chain	2.15 2.05	0.58 0.59	0.120	0.731	0.642	0.523
FW reducing practices that affect customers' awareness of FW	Independent Chain	1.85 1.68	0.63 0.54	3.386	0.070	1.134	0.261
FW reducing practices that affect restaurants staff behavior towards FW issue	Independent Chain	2.48 2.23	0.48 0.68	11.647	0.001	1.751	0.085

From the results shown in table (13), it is noted that there are no statistically significant differences between independent and chain hotel restaurants concerning FW causes during menu planning, where Levene's Sig. is (0.139) and t-test Sig. is (0.098) which is more than (0.05). There are no statistically significant differences between independent and chain hotel restaurants concerning FW causes during food portioning and serving, where Levene's Sig. is (0.331) and t-test Sig. is (0.070) which is more than (0.05). There are no statistically significant differences between independent and chain hotel restaurants concerning FW reducing practices during menu planning, where Levene's Sig. is (0.429) and t-test Sig. is (0.579) which is more than (0.05). There are no statistically significant differences between independent and chain hotel restaurants concerning FW reducing practices during food portioning and serving, where Levene's Sig. is (0.731) and t-test Sig. is (0.523) which is more than (0.05). There are no statistically significant differences between independent and

chain hotel restaurants concerning FW reducing practices that affect customers' awareness of FW, where Levene's Sig. is (0.070) and t-test Sig. is (0.261) which is more than (0.05). Finally, There are no statistically significant differences between independent and chain hotel restaurants concerning FW reducing practices that affect restaurants staff behavior towards FW issue, where Levene's Sig. is (0.001) and t-test Sig. is (0.085) which is more than (0.05).

5. Conclusion

The research aims to explore FW causes, reducing practices and barriers in the three, four, and five-star hotels. The research adopted the quantitative approach using a questionnaire survey for a sample of hotel restaurants managers (88 participants) in the three, four, and five-star hotels at Hurghada city. The researchers used a three-dimensional Likert scale in the research. The reliability and validity of the research tool were practically measured by using both the Cronbach's alpha coefficient and factor analysis test. In order to calculate the optimal sample size, Yamane formula was used. The data collected was analyzed statistically using SPSS version 20. Concerning its questions, the current research revealed some interesting findings; 59.4% of the sample are independent hotels and 40.6% of the sample are chain hotels, 40.6% of the sample are four-star hotels, 34.8% are three-star hotels, and 24.6% of the sample are five-star hotels. Concerning generated FW causes, "neglecting customer desires when modifying menus" is the most effective cause of FW in the variable "FW causes during menu planning", moreover, in the variable "FW causes during food portioning and serving", the most effective cause of FW is "lack of customer awareness at the consumption stage". Regarding the applied practices of FW reducing, "revising menus regularly after analyzing menus items that usually have the most leftovers" is the most applied practice of FW reducing in the variable "FW reducing practices during menu planning", in the variable "FW reducing practices during food portioning and serving", the most applied practice of FW reducing is "identifying which buffet items are regularly wasted and reduce the quantity of those items when prepared", in the variable "FW reducing practices that affect customers' awareness of FW", the most applied practice of FW reducing is "posting informational signs encourages customers to take only enough food", moreover, in the variable "FW reducing practices that affect restaurants staff behavior towards FW issue", the most applied practice of FW reducing is "awareness campaigns for staff about FW generation and the related opportunities to reduce". With regard to the barriers of FW reducing, "poor menu planning" is the most mentioned barrier at menu planning stage, "buffet service" is the most mentioned barrier at portioning and serving stage, "lack of restaurant staff training on practices of reducing FW" is the most mentioned barrier concerning staff behavior in restaurants towards FW issue, and "lack of customers' awareness towards FW issue" is the most mentioned barrier concerning customers' awareness of FW issue. The research confirmed that there are no statistically significant differences between three, four and five-star hotel restaurants concerning FW causes and reducing practices. Also, there are no statistically significant differences between independent and chain hotels concerning FW causes and reducing practices.

6. Limitations and Further Research

This research has several limitations. Firstly, this research was limited to hotels' restaurants managers in independent and chain hotels. Secondly, this research was limited to hotels' restaurants managers in three, four and five-star hotels in Hurghada city. Also, there is limitation was related to use of the quantitative approach although its effective results but using the qualitative approach would have provided more diverse and enriching results. Finally, Further researches should have to focus on FW reducing practices in kitchens, and food stores in hotels.

7. Implications and Recommendations

Based on the previous results, hotels' restaurants managers should apply the FW reducing practices as a part of managing FW in hotels. This research suggests some recommendations for hotel restaurants managers to reduce FW as follows:

1. Paying close attention to FW issues.
2. Participating in designing menus with different sizes of portions.
3. Taking into account customer reviews and desires about food items.
4. Reducing menus items that usually have the most leftovers such as side dishes and salads.
5. Offering smaller portions for a slightly reduced price.
6. Using smaller plate sizes for buffets.
7. Decreasing buffet time.
8. Using the "ask first" policy for side dishes and garnishes.
9. Fining customers who waste food.
10. Encouraging customers to take leftovers home or room.
11. Rewarding guests with hotel loyalty points if they reduced FW.
12. Putting up cards on tables describing global FW statistics to encourage customers to reduce FW from plates.
13. Conducting awareness campaigns for customers about how to reduce FW.
14. Posting informational signs encourages customers to take only enough food.
15. Providing regular briefings to staff about managing FW.
16. Engaging staff in the quantification of FW they generate.
17. Creating handbooks, guides, posters, and signage to help staff in reducing FW.
18. Providing training programs for staff about FW reduction skills.

Also this research suggests some recommendations for hospitality stockholders and academics; hospitality stockholders should pay close attention to FW issues. They also should provide adequate financial support to hotels to be able to manage FW. They are encouraged to provide donation matching software to help hotels in donating surplus food. Academics should try to cooperate with government institutions to fund conducting of studies on managing FW. Also, besides using questionnaires, researchers should use other research tools such as personal observation checklist and document analysis when conducting studies on managing FW.

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هدر الأغذية فى مطاعم الفنادق: أسبابه، ممارسات ومعوقات الحد منه

الملخص

أصبح حدوث هدر الأغذية موضوعًا عالميًا يلعب دورًا مهمًا في الأمن الغذائي واستدامة النظام الغذائي. الحد من هدر الأغذية سيحسن توفيرالأغذية الآمنة والمغذية للاستهلاك البشري. ويعتبر الحد من الهدر هو الخيار الأول الذي يجب النظر فيه. يهدف هذا البحث إلى استكشاف أسباب حدوث هدر الأغذية، وممارسات ومعوقات الحد منه في مطاعم فنادق الثلاث والأربع والخمس نجوم. وقد استخدم الباحثون المنهج الكمي مع استبانة لعينة من مديري المطاعم فى فنادق الثلاث والأربع والخمس نجوم في مدينة الغردقة. تم توزيع عدد ٨٨ استبانة بين مديري مطاعم الفنادق. وقد تم استخدام الإحصاءات الوصفية واختبار أنوفا أحادي الاتجاه واختبار ت للعينة المستقلة لتحليل البيانات. كشفت النتائج أن هناك عدة أسباب لحدوث هدر الأغذية فى مطاعم الفنادق مثل إهمال رغبات العملاء عن أصناف الطعام المقدمة لهم وقلة وعيهم فى مرحلة الاستهلاك. كما أشارت النتائج إلى أن هناك عدة ممارسات للحد من هدر الأغذية يتم تطبيقها في مطاعم الفنادق مثل مراجعة قوائم الطعام باستمرار بعد تحليل الأصناف الأكثر إحداثا للهدر، تحديد أصناف طعام البوفيهات التى يتم إهدارها بانتظام لتقليل الكمية التى يتم إعدادها منها، نشر لافتات إعلامية لتشجيع العملاء على تناول ما يكفيهم فقط من الطعام ، وعقد حملات توعية للعاملين حول هدر الأغذية وفرص الحد منه. أظهرت النتائج أيضًا أن هناك بعض المعوقات التي تواجه مطاعم الفنادق عند الحد من هدر الأغذية مثل التخطيط الغير جيد لقوائم الطعام، إنتشار خدمة البوفيهات، قلة تدريب العاملين على ممارسات الحد من هدر الأغذية، قلة وعي العملاء تجاه قضية هدر الأغذية.

الكلمات المفتاحية: هدر الأغذية – مطاعم الفنادق – أسباب هدر الأغذية – ممارسات ومعوقات الحد من هدر الأغذية.

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