

Investigation of the Volume of Food Waste in Qaem and Imam Reza Hospitals in Mashhad, Iran

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Introduction: Food waste is a growing concern that contributes to the reduction of energy and protein intake. The present study aimed to investigate the volume of food waste in different wards of Qaem and Imam Reza Hospitals in Mashhad, Iran.

Methods: This cross-sectional study was conducted during one week in Imam Reza and Qaem Hospitals in Mashhad in 2016. Research population consisted of 425 patients in the selected wards of the hospitals. Participants were selected non-randomly from the hospitalized patients. Rate of food waste was measured at lunchtime using the food residual observational checklist. Data analysis was performed in SPSS version 16 using descriptive statistic to define the baseline characteristics. In addition, independent samples t-test was used for the comparison of food waste between the main course and appetizer. Crosstab and Chi-square were applied to compare the main course and appetizer waste based on gender, hospital, and ward, and analysis of variance (ANOVA) was used for the comparison of age with various degrees of food waste.

Results: In total, 13.9% of the patients left their food in the plate entirely. Food wastage in the appetizer was significantly higher than the main course ($P<0.001$). Moreover, the number of the patients who entirely left their food was lower in Qaem Hospital compared to Imam Reza Hospital (27.84% versus 22%) ($P=0.003$). Food wastage was significantly higher in the cardiac ward compared to the other wards ($P=0.006$).

Conclusion: According to the results, food waste varied in different hospitals and hospital wards. Therefore, serving meals based on wards and patient requirements could be an effective solution to decrease food waste.

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Introduction

Healthy feeding and appropriate nutritional status during hospital stay play a key role in patient treatment (1). As such, nutrition departments are among the most important sections in hospitals (2). Poor nutritional status of hospitalized patients and severity of underlying diseases may increase morbidity rates and the length of hospital stay (3). Recently, undernutrition in hospitals has been

proposed as a critical issue (4). According to McWhirter, $40\pm50\%$ of patients in five different specialized units within a university hospital had some degree of undernutrition (5).

Food wastage is a growing concern; 89 million tons of food are wasting each year, which may increase to 126 million tons by 2020 (6), contributing to the reduction of energy and protein intake and leading to the complications

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associated with malnutrition (6).

Food waste in hospitals occurs for various reasons, such as anorexia, pain, stress, poor quality/quantity of food, and inappropriate environment and time for food serving (7). Reducing food waste is a major challenge within hospital foodservice operations (8). Some strategies have been adopted for controlling food waste in hospitals, including changing the portion sizes, increasing food choices, better feeding assistance for patients, and improving the meal delivery system (9). Minimizing food waste increases the access of patients to the required nutrients for their health through assuring food safety (10).

Few studies have been focused on food waste in the hospitals in Iran. Given the importance of food waste in improving the nutritional status of hospitals and controlling hospital-related costs, the present study aimed to investigate the volume of food waste in different wards of Qaem Hospital and Imam Reza Hospital in Mashhad, Iran. This study is the first step toward further investigations to identify the causes and conditions associated with food wastage in hospitals.

Material and methods

Participants

This cross-sectional study was performed during one week in Imam Reza and Qaem Hospitals in Mashhad in 2016. Research population consisted of 425 patients (220 males and 205 females) admitted to the general surgery, cardiac, internal medicine, thoracic, pediatric, cerebrovascular, oncology, burns, skin, poisoning, and accidents wards.

Inclusion criteria were the patients who were hospitalized in the mentioned wards of the selected hospitals and consumed the hospital foods with no age limit. Exclusion criteria of the study were adherence to a soft diet and being in the pre-operation phase in the surgery ward.

The study protocol was approved by the Ethics Committee of Mashhad University Medical Sciences, and written informed consent

was obtained from all the participants.

Data Collection

Rate of food waste was measured at lunchtime using the food residual observational checklist (7). Validity and reliability of the checklist have been assessed by Tabibi (2011) (2). In the checklist, rate of food waste was defined within a range of 0-1, with code zero indicating that the patient eats all the food in the plate, code 1/4 indicating that the patient leaves 1/4 of the food in the plate, code 1/2 showing that the patient leaves 1/2 of the food in the plate, code 3/4 showing that the patient leaves 3/4 of the food in the plate, and code 1 indicating that the patient leaves all of the food in the plate (7).

Measurement of food waste in the patients was performed by observing and taking photos of the amount of the main course and appetizer that remained in their plates after lunchtime and comparison with their food plates before eating.

Statistical Analysis

Data analysis was performed in SPSS version 16 (SPSS Inc., Chicago, IL, USA) using descriptive statistic to define the baseline characteristics and independent samples t-test for the comparison of food waste between the main course and appetizer. In addition, crosstab and Chi-square were used to compare the main course and appetizer waste based on gender, hospital, and ward. Analysis of variance (ANOVA) was applied for the comparison of age in various degrees of food waste.

Results

During one week, the food waste of 425 patients (286 in Qaem Hospital and 139 in Imam Reza Hospital) at lunchtime was measured. Mean age of the participants was 47.27 ± 20.66 years. Baseline characteristics of the participants are presented in Table 1.

In the present study, 44.6% of the patients ate all the food in their plates, and 13.9% left their entire food in the plate (Table 2).

Table 1. Baseline Characteristics of Participants

Hospital	Qaem	Imam Reza	Total
Age (year) (Mean \pm SD)	47.23 \pm 20.78	47.42 \pm 20.55	47.27 \pm 20.66
Gender (N; %)	Male 147 (51.4) Female 139 (48.6)	73 (52.5) 66 (47.5)	220 (51.8) 205 (48.2)
Total (N; %)	286	139	425 (100)

*SD: standard deviation; values expressed as mean \pm SD for quantitative data and number and percentage for qualitative data

Table 2. Total Food Waste (Main Course and Appetizer Waste) in Total Population

Food Waste	N	%
0	359	44.6
1/4 of Food	93	11.6
1/2 of Food	161	20.0
3/4 of Food	80	9.9
Entire Food	112	13.9
Total	805	100

*Values expressed as number and percentage

According to the results, 36% of the patients ate their entire main course, while 14%, 17%, and 16% of the patients left 1/4, ½, and 3/4 of their main course respectively, and 17% left their entire main course. As for appetizer, 53% of the patients ate their entire appetizer. Mean main course waste was estimated at 41.4%, which was significantly higher than appetizer waste

(27.84%) ($P<0.001$) (Table 3).

No significant association was observed between age and main course waste ($P=0.20$), as well as gender and main course waste ($P=0.72$). In Qaem Hospital, 38.3% of the patients ate their entire main course, while this rate was 30.9% in Imam Reza Hospital, which was significantly lower than Qaem Hospital. Moreover, 14% of the patients in Qaem Hospital left their entire food, which was significantly lower than the estimated rate in Imam Reza Hospital (22%) ($P=0.003$) (Table 4). With regard to appetizer waste, no significant difference was observed between the selected hospitals ($P=0.07$) (Table 5).

In the surgery ward, 37.9% of the patients ate their entire main course, which was

Table 3. Comparison of Main Course Waste and Appetizer Waste

Food Waste	N	Mean	SD*	P-value
Main Course Waste	381	41.40	37.95	
Appetizer Waste	422	27.84	34.47	<0.001

*SD: standard deviation; values expressed as number and mean \pm SD; normal distribution determined based on t-test

Table 4. Main Course Waste in Studied Hospitals

Main Course Waste	Hospital		Total	P-value
	Qaem	Imam Reza		
0	N	93	43	136
	%	38.3	30.9	35.5
1/4 of Food	N	45	10	55
	%	18.5	7.2	14.4
1/2 of Food	N	37	27	64
	%	15.2	19.4	16.7
3/4 of Food	N	34	28	62
	%	14	20.1	16.2
Entire Food	N	34	31	66
	%	14	22.3	17.2
Total	N	243	139	383
	%	100	100	100

*Values expressed as number and percentage using Chi-square

Table 5. Appetizer Waste in Studied Hospitals

Appetizer Waste	Hospital		Total	P-value
	Qaem	Imam Reza		
0	N	161	62	223
	%	57.1	44.6	53
1/4 of Food	N	25	13	38
	%	8.9	9.4	9
1/2 of Food	N	55	42	97
	%	19.5	30.2	23
3/4 of Food	N	10	8	18
	%	3.5	5.8	4.3
All of Food	N	31	14	45
	%	11	10.1	10.7
Total	N	282	139	421
	%	100	100	100

* Values expressed as number and percentage using Chi-square

Table 6. Main Course Waste in Different Wards of Hospitals

Ward	Main Course Waste					Total	P-value
	0*	1**	2***	3****	4*****		
Internal	N %	29 31.9	16 17.6	21 23.1	11 12.1	14 15.4	91 100
	N %	25 34.2	2 2.7	19 26	11 15.1	16 21.9	73 100
Cardiac	N %	39 37.9	22 21.4	11 10.7	14 13.6	17 16.5	103 100
	N %	43 37.1	15 12.9	13 11.2	26 22.4	19 16.4	116 100
Surgery	N %	136 35.5	55 14.4	64 16.7	62 16.2	66 17.2	383 100
	N %	136 35.5	55 14.4	64 16.7	62 16.2	66 17.2	383 100

Values expressed as number and percentage using crosstab and Chi-square; *Eating entire food, **leaving 1/4 of food, ***leaving 1/2 of food, ****leaving 3/4 of food, *****leaving entire food

Table 7. Appetizer Waste in Different Wards of Hospitals

Ward	Appetizer Waste					Total	P-value
	0*	1**	2***	3****	4*****		
Internal	N %	54 54.5	13 13.1	22 22.2	2 2	8 8.1	99 100
	N %	36 49.3	5 6.	20 27.4	7 9.6	5 6.8	73 100
Cardiac	N %	74 56.1	12 9.1	25 18.9	6 4.5	15 11.4	132 100
	N %	59 50	8 6.8	30 25.4	3 2.5	18 15.3	118 100
Surgery	N %	223 52.8	38 9	97 23	18 4.3	46 10.9	422 100
	N %	223 52.8	38 9	97 23	18 4.3	46 10.9	422 100

Values expressed as number and percentage using crosstab and Chi-square test; *Eating entire food, **leaving 1/4 of food, ***leaving 1/2 of food, ****leaving 3/4 of food, *****leaving entire food

significantly higher than the rate in the other wards. In the cardiac ward, 21.9% of the patients left their entire main course, which was significantly higher than the other wards (Table 6). Therefore, a significant difference was denoted in the rate of main course waste between various wards of the hospitals ($P=0.006$) (Table 5). As for appetizer waste, no significant difference was observed between various wards ($P=0.18$) (Table 7).

Discussion

Nutrition is essential to the care processes of patients. Food waste in hospitals is an important issue since it shows the nutritional status of patients and wastage of the financial sources. According to the present study, 44.6% of the patients ate the entire food in their plates, and 13.9% left their food in the plate entirely. In the study by Frakes et al., which was conducted on 611 patient in 20 hospital wards, the food waste in breakfast, lunch, and dinner was evaluated, and the mean food waste for all the served food was reported to be 21.9% (9).

Another study in this regard was performed

by Tabibi et al. (2011) in Boali Hospital in Tehran (Iran). The results indicated that 41.6% of the patients did not waste any of their lunch, while 30.5% wasted $\frac{1}{4}$ of their food, 9.4% wasted $\frac{1}{2}$ of their food, 2.7% wasted $\frac{3}{4}$ of their food, and 5.5% wasted all of their food (2). Our findings demonstrated that 55.4% of the patients left some of their food (did not eat their entire food). In the study by Hirsch et al., which was performed in 11 hospitals in the United Kingdom, 55.8% of the patients left some of their food (11). As can be seen, the obtained mean value in the present study is in line with the findings of Hirsch et al.

According to the current research, appetizer waste was lower compared to main course waste. No prior studies have determined the difference between main course waste and appetizer waste, while some findings have shown that food wastage is lower in breakfast compared to lunch and dinner. This could be due to the low appetite of patients and their difficulty in chewing and swallowing food in the main course rather than the appetizer.

In the current research, the volume of food

waste had no significant differences between various age groups and genders, while in the study by Roberto S. et al., food wastage was higher in the wards where the patients were older (1). Similarly, the results obtained by Hamilton K. et al. indicated that food waste was higher in female patients compared to males regardless of the type of regimen (12).

In the present study, 14% of the patients in Qaem Hospital left their entire food, which was significantly lower compared to the rate in Imam Reza Hospital (22%) due to different factors, such as food quality/quantity, food making methods, and variety of food. Further investigation is required to find the main causes of high food wastage in Imam Reza Hospital compared to Qaem Hospital.

Regarding the difference in the rate of food wastage in various wards of the selected hospitals, food waste was significantly higher in the cardiac wards compared to the other wards. On the other hand, food waste was lower in the surgery ward than the other wards. This could be due to the fact that after surgery, patients often have higher energy and protein requirements and must have high calorie and protein intake in their regimen. Therefore, they must eat more food in order to receive adequate calories and protein. In this regard, Roberto S. et al. stated that medical rehabilitation and surgery wards had the highest and lowest food wasting, respectively, which is consistent with the results of the present study (5). In another research, Barton A. et al. measured the rate of food waste in four wards based on food weight, reporting food wastage to be 32% in the medical ward, 32% in the surgery ward, 35% in the orthopedic ward, and 41% in the geriatric ward (4). Therefore, it could be inferred that serving food based on the requirements of each ward could be an effective solution to decrease food waste in hospitals.

Conclusion

Food waste is an important issue in hospitals, the reduction of which requires basic strategies and programs. According to the results, food waste may vary in different hospitals and wards due to several factors. Therefore, it is recommended that food serving be performed in accordance with the requirements of each ward in order to decrease

food wastage in hospitals.

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Conflict of interest

The authors declare that they have no competing interests.

Author's contribution

Study concept and design: Abdolreza Norouzy, Zahra Dehnavi and Milad Faghani. Analysis and interpretation of data: Zahra Dehnavi, Milad Faghani and Zahra Khorasanchi. Drafting of the manuscript: Zahra Dehnavi, Mina Safari bidokhti. Critical revision of the manuscript for important intellectual content: Najme Seifi and Abdolreza Norouzy. Statistical analysis: Zahra Dehnavi, Milad Faghani, Najme Seifi.

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