



Original

Evaluation of factors affecting plate waste of inpatients in different healthcare settings

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Abstract

Introduction/aims: Satisfaction of inpatients with served food within a hospital care system still constitutes one of the main attempts to modernize food services. The impact of type of menu, food category, hospital centre and timetable on the meals wastage produced in different Spanish healthcare settings, was evaluated.

Methods: Meal wastage was measured through a semi-quantitative 5-point scale (“nothing on plate”; “1/4 on plate”; “half on plate”; “3/4 on plate” and “all on plate”). The study was carried out in two periods of three months each in 2010 and 2011. A trained person took charge of measuring plate waste classified into 726 servings belonging to 11 menus. In total 31,392 plates were served to 7,868 inpatients. A Kruskal-Wallis non-parametric test ($P < 0.05$) was applied to evaluate significant differences among the variables studied.

Results: The menus were satisfactorily consumed because more than 50% of the plates were classified as “nothing on plate”. Regarding food categories, 26.78% of the plates corresponded to soups and purées, while pasta and rice, and prepared foods were only distributed in 4-5% of the servings. Desserts were mostly consumed, while cooked vegetables were less accepted by the inpatients evaluated. Other factors such as hospital centre influenced plate waste ($P < 0.05$) but timetable did not ($P > 0.05$).

Conclusion: Visual inspections of plate waste might be useful to optimize type and quality of menus served. The type of menu served and the food category could have a great influence on food acceptability by the inpatients studied.

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Key words: Plate waste. Hospital. Food acceptability. Inpatients. Food quality.

EVALUACIÓN DE FACTORES INFLUYENTES SOBRE EL DESECHO DE ALIMENTOS POR PARTE DE PACIENTES PROCEDENTES DE DIFERENTES RECINTOS HOSPITALARIOS

Resumen

Introducción/objetivos: La satisfacción de los pacientes con el servicio de comidas continúa siendo uno de los principales retos dirigidos a la modernización de los sistemas de distribución de alimentos. En el presente estudio se evaluó el impacto del tipo de hospital, horario, categoría de alimento y tipo de menú sobre el desecho de comida producido en diferentes recintos hospitalarios españoles.

Métodos: El desecho de alimentos se midió a través de una escala semi-cuantitativa con 5 niveles para evaluar la aceptabilidad del alimento (“nada en plato”; “1/4 en plato”; “mitad en plato”; “3/4 en plato” y “todo en plato”). El estudio se llevó a cabo en dos periodos de tres meses cada uno durante 2010 y 2011. Una persona entrenada se encargó del pesaje de platos, los cuales se clasificaron en 726 servicios pertenecientes a 11 menús diferentes. En total, se sirvieron 31.392 platos a 7.868 pacientes. Como prueba estadística se utilizó un test estadístico no paramétrico de Kruskal-Wallis ($P < 0,05$).

Resultados: Los menús se consumieron de forma satisfactoria ya que más del 50% de los platos se clasificaron dentro de la categoría “nada en plato”. Con respecto a las categorías de alimento, un 26,78% de los platos servidos se correspondieron con sopas y purés, mientras que los platos de pasta, arroz y alimentos listos para el consumo fueron distribuidos en un 4-5% de los servicios. Los postres fueron los platos más consumidos, mientras que los vegetales hervidos fueron menos aceptados. Otros factores como el tipo de hospital influyeron sobre el desecho de alimentos ($P < 0,05$) aunque el horario de servicio de comidas no ($P > 0,05$).

Conclusión: La inspección visual del desecho de alimentos puede ser útil a la hora de optimizar el tipo y calidad de los menús servidos. El tipo de menú y la categoría de alimento podrían tener una gran influencia sobre la aceptabilidad de los platos por los pacientes.

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Palabras clave: Desecho de alimentos. Hospital. Aceptabilidad de alimentos. Pacientes. Calidad de alimentos.

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Abbreviations

ANOVA: Analysis of Variance.

DEFRA: Department for Environment, Food and Rural Affairs.

ESPEN: European Society for Clinical Nutrition and Metabolism.

HACCP: Hazard Analysis and Critical Control Points system.

KW: Kruskal-Wallis non-parametric test.

Introduction

Food intake in hospital food services is nowadays of great importance since it is mainly destined to a susceptible population sector.

According to the Department for Environment, Food and Rural Affairs (DEFRA, UK), sustainable food production must ensure better nutrition. Additionally, it should also be indicated where the raw material comes from, and how food is produced and served to inpatients. To this end, satisfaction of inpatients with an acceptable quality of meals within a hospital care system constitutes one of the main attempts to be addressed in order to modernize food services. Hospital undernutrition could delay patients' recovery, thus extending the length of the stay and contributing to its worsening.¹

In Spain, there are relatively few studies, however, investigating the food quality of hospital meals upon which most inpatients rely on their nutritional requirements. Most published works in other countries are focused on the administration of questionnaires to improve the quality of menus and accelerate food delivery.² Food temperature, flavor, taste, cleanliness of forks and meal presentation are often evaluated. However, adequate food choices are not always available in daily menus, thereby reducing the satisfaction degree and patient's perception. These problems have been also reported by the European Society for Clinical Nutrition and Metabolism (ESPEN) for specific groups of hospitalized inpatients.³

Nevertheless, alternative methods can better quantify the acceptability of a given menu, such as measuring meal wastage. Plate waste in hospitals is defined as the amount of uneaten served food by inpatients. This is greatly affected by the staff capacity to address patient choice. Generally, when daily menus cannot offer all food choices and automatically serve vegetables or other standardized portions, meal wastage increases.⁴

Quantification of the weight lost in served trays could be correlated to food consumption. This definitely helps to the improvement in the design of alternative menus (within the diet code), avoiding undernutrition, environmental and economical losses.^{5,6} This is normally measured by weighting food or by visual estimation of the amount of food remaining on the plate. Results are presented as the percentage by weight of the served food, or by qualitative estimation methods

(i.e. classifying the plate into several categories according to the weight lost). In addition, measures of plate waste have been used to evaluate the adequacy of food intake and the efficiency of meal provision.⁶ This practice is fully justified because in hospitals plate waste is reported to be much higher than in other food service settings such as restaurants or schools.⁷

Through the study of meal wasting, hospital menus could then be more attractive and tasty for inpatients, encouraging food consumption. Thus it is widely recommended to regularly monitor food wastage, with modification of policies as necessary.⁸

Although food wastage should be a part of the quality management system of every hospital, these studies have not been extensively reported in literature, since they are labor intensive and produce a disruption in normal foodservice operations.

This study aims to evaluate the impact of additional factors contributing to meal wastage such as type of menu, food category, hospital centre and timetable (lunch/dinnertime) in three regional Spanish hospitals located in Andalusia: civil hospital, maternity and children's hospital and general hospitals.

Material and methods

Study design and inpatients selection criteria

Throughout this study, three different health-care institutions were evaluated, all of them located within the same hospital complex: general hospital, civil hospital and maternity and children's hospital. Inpatients located at the three facilities had different medical profiles. At the civil hospital, 100 meals are daily served, mainly to inpatients who normally present minor pathological problems. The maternity and children's hospital (400 meals/day) is mainly destined to children and adolescents (from 1 to 16 years old) as well as pregnant women. The general hospital (600 meals/day) is destined to elderly inpatients and other immune-depressed people (apart from pregnant women and children).

During this study, no personal details were collected from the inpatients evaluated since the hospital wanted to maintain a data protection policy. Therefore, it was not submitted to an ethics committee. Besides, in order to avoid biased results, inpatients located on the same floor were randomly selected according to the following criteria:

- All inpatients selected for the study (7,868) corresponded to different people. In other words, the same person was not evaluated twice.
- Immune system and/or nutritional requirements of inpatients did not prevent the intake of any type of meal.
- Immune-depressed people and inpatients with some type of mental disease were discarded from the study.

- Basal (normal) diets were only considered in this studied (not therapeutic).

Additionally, some considerations were taken into account:

- Demographic and social variables like age of inpatients, sex, socio-economic status etc., were out of the scope of this study. It should be noted that the main purpose was neither to evaluate nutritional requirements nor to collect epidemiological information from the selected inpatients.
- Inpatients did not know beforehand the purpose of this study in order not to interfere with food consumption. However, the same diet code was kept as if they would not have taken part in the study.
- Food intake was controlled by the technical staff of the hospital in such a way that inpatients remained alone during mealtime. Afterwards, all meal wasting (if any) was collected from the inpatients' rooms to avoid biased results when measuring plate waste.
- Inpatients had the opportunity to choose between the different meals daily prepared in the hospital central kitchen. They were allowed choosing 2-3 starters, 2-3 main courses, 1-2 side dishes and 1-2 desserts.
- The same food service company in collaboration with the technical staff of the hospital prepared all menus.

The study was carried out during 2010-2011 (April-June) in two different periods as described below:

In 2010:

- April: 65 inpatients evaluated/day * 20 days = 1,300 inpatients.
- May: 65 inpatients evaluated/day * 20 days = 1,300 inpatients.
- June: 58 inpatients evaluated/day * 23 days = 1,334 inpatients.

In 2011:

- April: 65 inpatients evaluated/day * 20 days = 1,300 inpatients.
- May: 65 inpatients evaluated/day * 20 days = 1,300 inpatients.
- June: 58 inpatients evaluated/day * 23 days = 1,334 inpatients.

Overall, 726 servings grouped into 11 menus were evaluated. Each menu consisted of 2-3 starters, 2-3 main courses, 1-2 side dishes and 1-2 desserts. Foods on the same menu were distributed to inpatients in accordance to the diet specifications followed by each hospital. In total 31,392 plates were served to 7,868 inpatients (4 plates/menu/inpatient). For the purpose of this study, foods served were classified into 9 categories as follows: 'soups and purées' (i.e. tomato soup, pumpkin puree etc.), 'eggs and egg-based dishes' (i.e. boiled eggs, Spanish omelet etc.), 'meat' (i.e. beef

steak), 'fish' (i.e. calamari, fried hake etc.), 'pasta and rice' (i.e. macaroni, paella etc.), 'desserts' (i.e. seasonal fruit, yogurt), 'salads' (i.e. mixed salads or lettuce-based salads), 'cooked vegetables' (i.e. cauliflower, boiled vegetables) and 'prepared foods' (i.e. cooked meat products, cheese etc.).

Additionally, two timetables were considered (lunchtime and dinnertime) to evaluate significant differences among them.

Storage, elaboration and distribution of meals

The subcontracted food service company received raw materials in the same week of elaboration. They were stored in refrigeration and frozen cameras; or at room temperature until the day before elaboration. Afterwards, these raw materials were transferred to the hospital storage facilities. Meals or ready-to-eat foods chilled-served were prepared in conditioned rooms at refrigeration temperature (10-15° C). Once prepared, they were stored up to the preparation of trays. Hot meals were elaborated in the hospital central kitchen. They mainly consisted on cooked foods in the oven, grilled, fried and boiled foods.

Data collection

Once elaborated, both chilled and hot meals were placed on the trays and a trained person assessed standardized portions of individual plates just before transport to the hospital centres. Each tray submitted to evaluation, was codified with the type of menu, food category, food type, hospital centre and timetable. Afterwards, the trays were distributed to inpatients. One hour after, trays were collected (after lunchtime or dinnertime), and a systematic assessment of the food portions remaining on each plate was carried out. Plate waste was then visually calculated as the volume or percentage of the food served that was discarded. Complete tray waste due to over-ordering and discharge from the ward or death was excluded from the study. A scale was used to measure approximately what proportion of the food was left. A 5-point scale⁹ was considered as follows: 'all on plate' (when plates arrived in the same state as they were prepared, so that no food was consumed), "¾ on plate" (when only a mouthful or a bite was consumed), "½ on plate" (when approximately half of the meal was consumed), "¼ on plate" (when most of the meal was consumed but a small portion remained on the plate) and "nothing on plate" (absence of food in the plate). A same trained person took charge of measuring the weight lost throughout the whole study so that the same criterion to classify plate waste was achieved. It should be noted that, although visual estimations are subjective measurements, they have been validated against quantitative data giving reasonably good approximations.¹⁰

Data analysis

Data analysis was carried out using Microsoft Excel (Microsoft Corporation®) and Statistica for Windows software v10.0 (Statsoft Iberica, Portugal). The whole number of plates classified as ‘nothing on plate’; ‘¼ on plate’; ‘½ on plate’; ‘¾ on plate’ and ‘all on plate’ were pooled into a dataset. Then, different subgroups were made per type of menu (1-11), food category (1-9), hospital centre (1-3) and timetable (1-2). Within each subgroup, the descriptive statistics such as mean, standard deviation, and confidence intervals (95%) were calculated. Besides, average proportions (%) belonging to the five evaluated scales (‘nothing on plate’; ‘¼ on plate’; ‘½ on plate’; ‘¾ on plate’ and ‘all on plate’) were estimated for each independent variable (type of menu, food category, hospital centre and timetable).

To evaluate significant differences among independent variables; a non-parametric test (Kruskal Wallis, KW) was performed. A one-way ANOVA may yield inaccurate estimates of the P-value when the data are very far from normally distributed. The KW test does not make assumptions about normality. Like most non-parametric tests, it is performed on ranked data, so the measurement observations are converted to their ranks in the overall data set. In order to find significant differences in the mean ranks, a P value of 0.05 was selected.

Results

In this study, meal wastage was measured as a function of different variables such as menu, type of menu, food category, hospital centre and timetable.

A total of 726 servings classified into 11 menus (66 servings/menu) were evaluated (242 servings for each hospital centre, i.e. civil, maternity and children’s and general hospital). Out of these servings, 121 servings per hospital were destined to lunchtime and dinner-time, respectively. As mentioned above, each serving corresponding to an individual menu consisted of 4 different dishes (starter, main course, side-dish and dessert) so that the total number of inpatients evaluated was 7,868. Out of the 31,392 plates evaluated, 15,720 (50.08%); 4,028 (12.83%); 3,364 (10.72%); 2,113 (6.73%) and 6,167 (19.64%) were classified as ‘nothing on plate’; ‘¼ on plate’; ‘½ on plate’; ‘¾ on plate’ and ‘all on plate’, respectively.

The statistical results of the non-parametric KW test are shown in table I. As it can be seen, significant differences in mean ranks were observed for the independent variables menu and hospital centre (KW > 20.61; P < 0.05). On the contrary non-significant differences were found for timetable (KW < 2.90; P > 0.05). Regarding food category, significant differences were found for ‘nothing on plate’; ‘¼ on plate’; ‘½ on plate’ and ‘all on plate’ (KW > 19.47; P < 0.05), but they do not for ‘¾ on plate’ (KW = 9.45; P = 0.306).

Plate waste obtained as a function of the evaluated menus (1-11)

The results obtained showed significant differences in plate waste among the 11 menus evaluated. Table II shows the average proportions (%) of plates ± confidence intervals at 95% CL classified as ‘nothing on plate’, ‘¼ on plate’, ‘½ on plate’, ‘¾ on plate’ and ‘all on plate’.

Table I

Statistical results of the non-parametric Kruskal Wallis test (KW), degrees of freedom (df) and P-values for the grouping variables menu, centre, timetable and food category classified into each of the five proportions studied of plate wate (nothing on plate, ¼ on plate, ½ on plate, ¾ on plate and all on plate), P-values in italics reflect statistical differences among the mean ranks

Grouping variable	Independent variable	KW	df	P-value
Menu	Nothing on plate	20.61	10	0.024
	¼ on plate	36.66	10	< 0.001
	Half on plate	21.82	10	0.016
	¾ on plate	24.07	10	< 0.001
	All on plate	30.66	10	< 0.001
Center	Nothing on plate	25.63	2	< 0.001
	¼ on plate	14.34	2	< 0.001
	Half on plate	58.87	2	< 0.001
	¾ on plate	143.50	2	< 0.001
	All on plate	93.96	2	< 0.001
Timetable	Nothing on plate	0.46 x 10 ⁻³	1	0.983
	¼ on plate	2.90	1	0.088
	Half on plate	1.80	1	0.180
	¾ on plate	0.25	1	0.619
	All on plate	1.32	1	0.251
Food category	Nothing on plate	97.11	8	< 0.001
	¼ on plate	31.07	8	< 0.001
	Half on plate	19.47	8	0.013
	¾ on plate	9.45	8	0.306
	All on plate	23.66	8	0.003

Table II
Average proportions (%) of plates \pm confidence intervals at 95% CL obtained from the menus evaluated, classified as “nothing on plate”, “ $\frac{1}{4}$ on plate”, “ $\frac{1}{2}$ on plate”, “ $\frac{3}{4}$ on plate” and “all on plate”

	“Nothing on plate”	“ $\frac{1}{4}$ on plate”	“ $\frac{1}{2}$ on plate”	“ $\frac{3}{4}$ on plate”	“All on plate”
Menu 1	55.69 \pm 14.73	12.48 \pm 2.96	8.76 \pm 2.27	5.80 \pm 1.79	17.27 \pm 4.46
Menu 2	43.14 \pm 10.95	15.70 \pm 3.07	11.70 \pm 2.41	8.47 \pm 2.15	21.00 \pm 5.48
Menu 3	47.22 \pm 15.67	12.87 \pm 3.20	11.76 \pm 3.11	6.95 \pm 2.22	21.20 \pm 7.84
Menu 4	44.66 \pm 11.82	15.11 \pm 4.02	13.21 \pm 2.91	9.13 \pm 2.74	17.88 \pm 6.48
Menu 5	48.94 \pm 14.08	14.01 \pm 3.22	11.74 \pm 3.48	7.40 \pm 2.64	17.91 \pm 8.03
Menu 6	45.47 \pm 14.89	14.46 \pm 4.49	11.68 \pm 3.36	6.16 \pm 2.25	22.23 \pm 10.32
Menu 7	52.80 \pm 16.14	13.73 \pm 3.78	8.49 \pm 2.48	7.74 \pm 2.50	17.24 \pm 5.74
Menu 8	55.86 \pm 17.11	8.86 \pm 2.34	9.10 \pm 2.90	6.32 \pm 2.19	19.86 \pm 6.56
Menu 9	55.54 \pm 19.97	10.57 \pm 3.54	10.36 \pm 3.20	4.47 \pm 1.65	19.06 \pm 5.50
Menu 10	50.58 \pm 16.31	11.03 \pm 3.28	10.78 \pm 3.01	5.72 \pm 2.19	21.89 \pm 6.23
Menu 11	51.44 \pm 17.22	12.03 \pm 3.29	10.61 \pm 3.10	5.41 \pm 2.01	20.51 \pm 8.32
Total:	50.05 \pm 15.24	12.86 \pm 3.35	10.72 \pm 2.90	6.75 \pm 2.21	19.62 \pm 6.71

Overall, menus evaluated were satisfactorily consumed by inpatients since most of the plates were classified as ‘nothing on plate’, indicating that all food was consumed (50.05%) (table II). At the same time, it was found a higher average proportion of plates belonging to “all on plate” (19.62%) than the intermediate categories; $\frac{1}{2}$ on plate, $\frac{1}{4}$ on plate and “ $\frac{3}{4}$ on plate”.

According to the type of menus, menu 8 was preferred according to the average proportion (55.86%), followed by menus 1 and 9 (55.69% and 55.54%, respectively). Meals contained in these menus for lunchtime corresponded to ratatouille with eggs, leek purée, potato purée (starters), boiled rice, salad (side-dishes), beef with vegetables, grilled fish, meat croquettes (main courses) and seasonal fruit (dessert). For dinnertime meals were vegetable soup, rice soup, boiled egg with beans (starters), grilled swordfish, grilled pork loin (main courses), vegetable stew, boiled potatoes and salad (side-dishes) and yogurt (dessert).

On the contrary, menus 6 and 10 were those that presented the highest proportions of “all on plate”, i.e. food was not consumed by the inpatients. Meals contained in these menus for lunchtime corresponded to white beans, rice soup (starters), fish croquettes, grilled cod, braised ham (main courses), vegetable stew, boiled potatoes, mushrooms (side-dishes) and seasonal fruit (dessert). For dinnertime meals were pumpkin purée, pasta soup, pasta salad (starters), Spanish omelet, cooked ham/fresh cheese (side-dishes), fried swordfish, roasted chicken (main courses) and compote (dessert).

Mean values of number of plates, together with confidence intervals (95%), outliers and extremes are represented in figures 1a-b for “nothing on plate” and “all on plate”, respectively. Regarding “nothing on plate”, maximum values were observed for the measured number of plates in menus 3 and 9 (200 and 198, respectively). In both the cases, seasonal fruit coming from these menus was totally consumed. For

the proportion “all on plate”, the highest value was from menu 3 (111), corresponding to pumpkin purée.

Plate waste obtained as a function of the evaluated food categories

The total percentage of meals belonging to each food category evaluated indicated that soups and purées were served in 26.78% of the servings, followed by cooked vegetables (19.67%) and fish (11.72%). Pasta and rice, and prepared foods were present only in 4-5% of the servings.

Table III shows the average proportions (%) of plates \pm confidence intervals at 95% CL classified as “nothing on plate”, “ $\frac{1}{4}$ on plate”, “ $\frac{1}{2}$ on plate”, “ $\frac{3}{4}$ on plate” and “all on plate”.

As described above, the highest proportion corresponded to “nothing on plate” (52.30%). Among the food categories, it can be seen that desserts were mostly accepted by the inpatients since 71.93% of the plates were fully consumed. This can be explained because fruits were seasonal, and they were mostly served as small cut pieces being more attractive to the inpatients. In addition, other desserts like yogurts or peaches in syrup were highly accepted in all menus served. Other food categories such as salads, prepared foods, fish, and egg/egg-based dishes were classified in more than 50% cases into “nothing on plate”.

On the other hand, pasta and rice; and cooked vegetables were the food categories less accepted by the inpatients (26.76% and 26.41% classified as ‘all on plate’, respectively). Mean values of number of plates, together with confidence intervals (95%), outliers and extremes are represented in figure 2a for the proportion ‘nothing on plate’. The highest values for the number of plates corresponded to desserts, in detriment of soups and purées in which all meals were below 80 (fig. 2a). For ‘all on plate’, results presented in figure 2b show that soups and purées had the highest values, indicating less acceptance among inpatients.

Table III
Average proportions (%) of plates \pm confidence intervals at 95% CL obtained from the food categories evaluated, classified as “nothing on plate”, “1/4 on plate”, “1/2 on plate”, “3/4 on plate” and “all on plate”

	“Nothing on plate”	“1/4 on plate”	“1/2 on plate”	“3/4 on plate”	“All on plate”
Soups and purées	41.48 \pm 6.61	13.56 \pm 2.17	11.66 \pm 1.99	9.00 \pm 1.81	24.30 \pm 6.92
Egg and egg products	51.87 \pm 29.06	14.06 \pm 4.65	10.90 \pm 3.94	6.10 \pm 2.59	17.07 \pm 6.52
Meat	48.76 \pm 10.97	14.03 \pm 2.53	12.65 \pm 2.60	6.47 \pm 1.78	18.09 \pm 4.04
Fish	50.95 \pm 12.58	14.06 \pm 3.06	10.97 \pm 2.54	7.00 \pm 1.92	17.02 \pm 4.23
Pasta and rice	39.30 \pm 17.80	13.00 \pm 5.52	12.32 \pm 4.09	8.62 \pm 3.88	26.76 \pm 9.81
Desserts	71.93 \pm 14.81	9.49 \pm 2.05	5.51 \pm 1.21	2.67 \pm 0.85	10.40 \pm 2.81
Salads	61.58 \pm 21.10	10.00 \pm 3.81	10.84 \pm 4.20	5.21 \pm 2.57	12.37 \pm 4.10
Cooked vegetables	40.33 \pm 8.15	13.70 \pm 2.47	11.66 \pm 2.19	7.90 \pm 1.67	26.41 \pm 5.33
Prepared foods	50.14 \pm 27.65	12.16 \pm 5.86	12.55 \pm 5.48	6.78 \pm 3.34	18.37 \pm 9.89
Total:	52.30 \pm 16.82	12.51 \pm 3.54	10.61 \pm 3.02	6.30 \pm 2.19	18.28 \pm 5.83

According to timetables, similar values were obtained for lunchtime and dinnertime. Then it can be concluded that timetables did not influence the consumption of the plates served.

Discussion

Throughout this study, food acceptability was measured by several visual inspections of meals wastage belonging to different menus served. Overall, results obtained indicated high acceptability of the menus, according to the number of plates measured into the proportion “nothing on plate”. These results confirmed what other studies have previously shown with the application of questionnaires to inpatients about food consumption. In one study performed in a Turkish Armed Forces training hospital¹¹ it was observed that 44.4% of inpatients examined responded that they consumed all food, while the proportion not consuming any food was only 3.2%. The implementation of Hazard Analysis and Critical Control Points (HACCP) system was carried out in the hospital and, among their main principles, the improvement of meal quality served in the menus was included. The application of quality control systems has been demonstrated to improve, over time, satisfaction with menus served in relation to some factors such as portion sizes, temperatures and cooking quality procedures.^{12,13}

However, in our study, “all on plate” was the second highest proportion according to the mean number of plates collected, indicating different perception among inpatients regarding food consumption. Other published studies have used inpatient interviews or observational methods to understand the issues affecting food consumption in hospital. In one UK study, low appetite accounted for 40% of all inpatients’ reasons for leaving food; meal quality issues made up 27%, and 19% stated it was because portion sizes were too large.¹⁴

Loss of appetite was the most common reason in a US study which found that this, along with taste loss,

made up 28% of the reasons inpatients consumed less than half of the main starter.¹⁵ In a Swiss study, half of the inpatients declared they had less appetite than at home.² This is not unexpected, since illness can often affect appetite and the senses of taste or smell. Reduced activity while in hospital, and drugs causing anorexia, nausea or gastrointestinal symptoms, can also interfere with the normal desire to eat. Many diet prescriptions, such as texture modification or low salt, reduce the sensory appeal of food, and it has been estimated that being on a special diet doubles the risk of insufficient energy intake.¹⁶

Nutritional and sensory quality have been related to patients’ satisfaction with hospital meals^{11,17,18} and are useful benchmarks of the effectiveness of food service systems.¹⁹ There are several factors influencing acceptability of inpatients, which could result in high meal wastage. Manipulation of ambience factors, such as number of people in the room, color, lighting or ambient sounds can alter food intake as shown in previous studies.²⁰

Additionally, loss of taste and smell in older inpatients is of particular interest due to its direct association with reduced appetite and enjoyment of foods. Impairment in smell and taste is very common in older people and is usually worsened by disease and medication.²¹ However, other related factors such as family escorting are not influencing meals intake of hospitalized inpatients.²²

Meal waste in hospitals could also be caused by alterations in the sensorial quality of foods served²³. In our study, the hospitals evaluated the in-house catering, where food is prepared and cooked within the catering department of the hospital was applied. This means that, for some cases food temperature is not totally satisfactory for the inpatients, thus causing meal rejection.² Food preparation, transport and serving must assure that all food is presented to the patient in a way, which optimizes its consumption.

Regarding food categories evaluated, desserts were mostly consumed by the inpatients evaluated, while

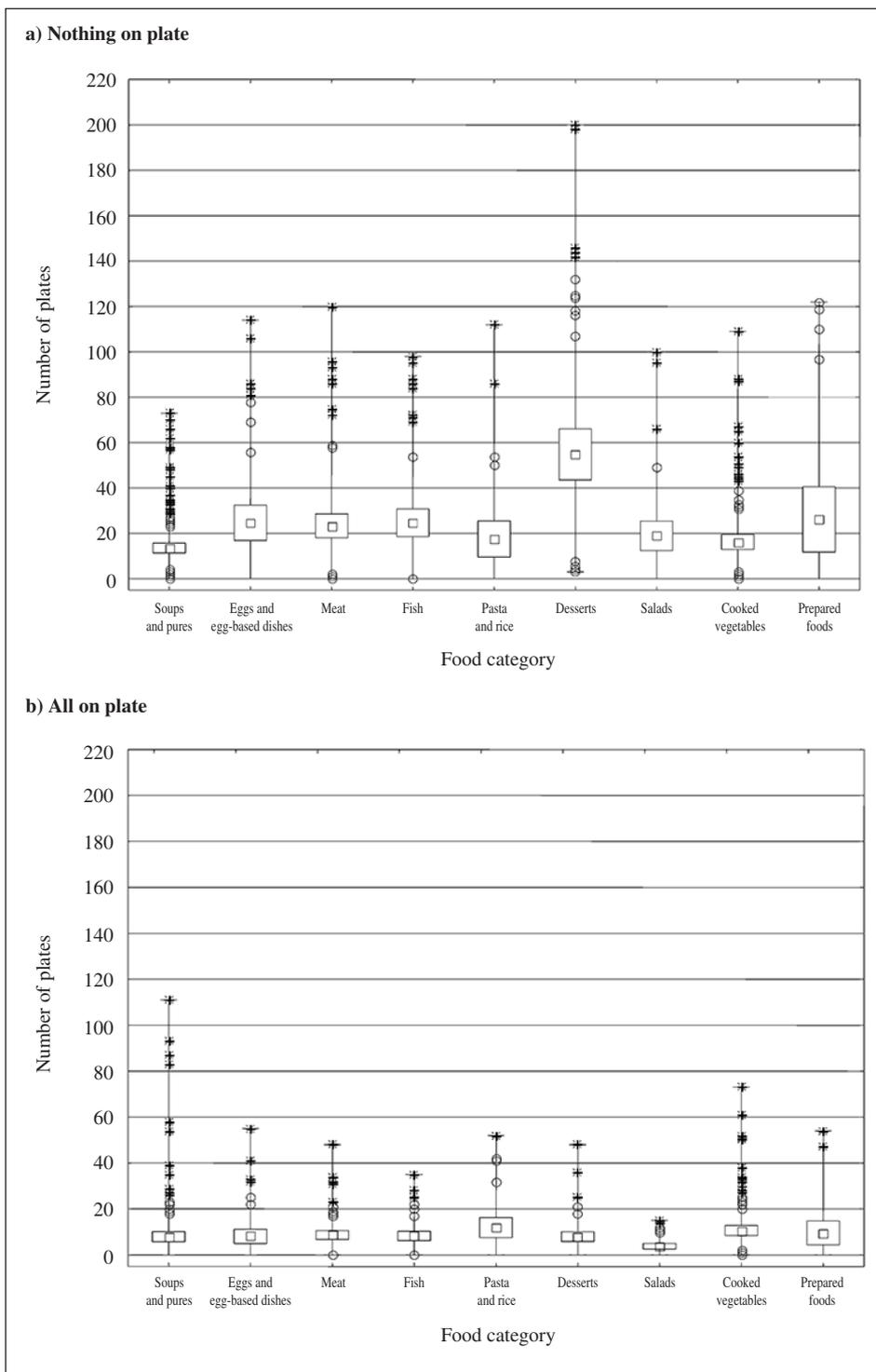


Fig. 2.—Mean values (inner boxes), confidence intervals 95% (outer boxes), outliers (circles) and extreme values (asterisks) of number of plates served belonging to food categories 1-9 classified as “nothing on plate” (fig. 2a) and “all on plate” (fig 2b).

cooked vegetables or salads and soups and purées were less accepted.

This fact may be because much more waste of vegetables is usually obtained in comparison to main meat/fish dishes. Other studies²⁴ found over 40% of vegetables served remained uneaten compared to only 18% of starters, and other surveys have found a similar pattern. This may reflect a generally lower liking for vegetables by

inpatients or it might be a result of poor cooking practices.

Consumers in contrast to what was observed for the general hospital mostly accepted meals served to the maternity and children’s hospital. This could be explained since inpatients located at the general hospital were mainly elderly people or inpatients with relatively longer health diseases, which are typically associated to low ingestion of meals.²⁵

Lastly, changes in menus between lunch and dinner-times did not influence meal wastage so it is concluded that this was not a significant variable to be considered in the improvement of hospital food. This is in disagreement to what was reported by Stanga et al.² who obtained that food preferences varied among timetables evaluated (breakfast, lunch and dinner). In our study, inpatients preferred a full menu for both lunchtime and dinnertime, but differences could be related to the hospital facility, type of meals served and population characteristics.

To our best knowledge this is the first study on evaluation of meal wastage in Spanish hospitals. Although a high degree of consumption was observed according to plate waste, published studies performed in other healthcare settings concluded that there is evidence to suggest that a more personalized meal service system in hospitals has the ability to improve energy intakes and patient satisfaction. Additionally, further research is necessary to evaluate the long-term implications on cost-effectiveness. At the same time it is necessary to assess the meal production processes and develop strategies that encourage the inpatients to eat.

There have been some limitations in this study as the representativeness of the population (results may not be extrapolated to other hospital's population), the localization of hospitals and the semi-quantitative scores applied which could have some degree of inaccuracy, as reported in other similar studies.¹¹

However, throughout this study, it was shown that visual inspections of plate waste might be useful to quantify meals wastage and to optimize type and quality of menus served.

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