



Original article

At Your Request[®] room service dining improves patient satisfaction, maintains nutritional status, and offers opportunities to improve intake



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SUMMARY

Background: Malnutrition in hospitals may be combatted by improving the meal service.

Aim: To evaluate whether At Your Request[®], a meal service concept by Sodexo with a restaurant style menu card and room service, improved patient satisfaction, nutritional status, and food intake compared to the traditional 3-meals per day service.

Methods: We prospectively collected data in Hospital Gelderse Vallei (Ede, the Netherlands) before (2011/2012; n = 168, age 63 ± 15 y) and after (2013/2014; n = 169, 66 ± 15 y) implementing At Your Request[®].

Results: Patient satisfaction increased after implementing At Your Request[®] from 7.5 to 8.1 (scale 1–10) and from 124.5 to 132.9 points on a nutrition-related quality of life questionnaire (p < 0.05). Body weight and handgrip strength did not significantly change in both periods. At admission, more patients in the At Your Request[®] period had risk of malnutrition (MUST ≥ 1; 47 vs 37). MUST scores improved in 18 patients in both periods. With At Your Request[®] 0.92 g protein per kg (g/kg) bodyweight was ordered. Protein intake based on food records from patients on an energy and protein enriched diet was 0.84 g/kg during At Your Request[®] (n = 38) versus 0.91 g/kg during the traditional meal service (n = 34).

Conclusion: At Your Request[®] is a highly rated hospital menu concept that helps patients to maintain nutritional status. The concept offers options for improving the intake of specific nutrients and foods, which should be evaluated in further studies.

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1. Introduction

Proper nutritional care and food services in hospitals have beneficial effects on recovery and quality of life of patients [16]. However, hospital food has a widespread negative image and patients often expect poor quality, even before tasting the food [4,12]. The negative image might not necessarily be related to the food itself [4]; limited choice in meals, fixed mealtimes, and choosing a meal one day ahead all reduce the appreciation of hospital food [12,20]. Patient satisfaction improves if the hospital food resembles food at home [14]. Furthermore, personal contact with catering staff is an important factor in patient satisfaction [18].

Several studies have shown that nutritional intake increases when the meal is appreciated [14,28]. Increasing intake is beneficial, as malnutrition is a common and serious problem in hospitalized patients. About 25% of hospitalized patients suffers from malnutrition [22] caused by reduced intake, increased losses, increased requirements, or a combination of these factors. Besides energy, protein intake has priority in preventing and treating malnutrition. Many studies suggest that protein requirements among hospitalized patients are higher than the 0.8 g/kg bodyweight (BW) for healthy individuals. Estimates range from 1.1 to 1.7 g/kg BW depending on the method and patient group [10,30,37]. In the Netherlands, a protein intake of 1.2–1.5 g/kg BW is considered optimal for hospitalized patients [15], where body weight of patients with a BMI higher than 27 kg/m² is corrected to a body weight fitting a BMI of 27 to avoid overconsumption.

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Although the recommendations for patients are higher than for healthy individuals, intakes are usually lower. Published data on protein intake in hospitals differ between 0.34 and 0.99 g/kg BW [1,2,7]. The low protein intake is only partly explained by low energy intakes: mean energy intake in these studies was about 1700 kcal/day which was close to the calculated recommendation of 1800 kcal/day in two of those studies [1,2,7].

Various initiatives have been developed to stimulate protein intake, such as providing fortified meals and between-meal protein-rich snacks or drinks [5]. Reorganizing the hospital catering, giving patients more choice and flexibility in what they eat and when, is another option [9]. In the USA, the catering concept At Your Request[®] has been implemented by Sodexo in many hospitals. At Your Request[®] offers patients to choose what they eat, when they eat and where they eat their meals. In the Netherlands, Gelderse Vallei Hospital (500 beds) implemented At Your Request[®] in November 2012 as the first hospital in Europe. Its ambition was to improve patient satisfaction and nutritional status, while maintaining costs.

The aim of our study was to compare patient satisfaction, nutritional status, and food intake before and after introduction of At Your Request[®]. The same methods were used to prospectively collect patient data during both periods.

2. Methods

2.1. Study design

We performed an observational prospective study in Hospital Gelderse Vallei (Ede, the Netherlands). The measurements for the traditional meal service were done between October 2011 and March 2012. In November 2012, At Your Request[®] was implemented and measurements were done from October 2013 to January 2014 (Fig. 1). Data were collected at six wards: Cardiology, Geriatrics, Oncology, Surgery, Neurology, and Acute Admission, because patients at these wards have a relative high risk of developing malnutrition.

Participants were recruited at their day of admission. The inclusion criteria were age ≥ 18 years, an expected admission time of ≥ 4 days and a good understanding of the Dutch language. Patients who required parenteral or enteral feeding or who were too weak to respond to our questions were excluded from the study. Criteria for drop out were: discharge within 4 days, relocation to a non-participating ward, being too ill to continue participation, or death.

The study was approved by the hospital research board; the Medical Ethics Committee (MEC) of UMC Utrecht decided that no

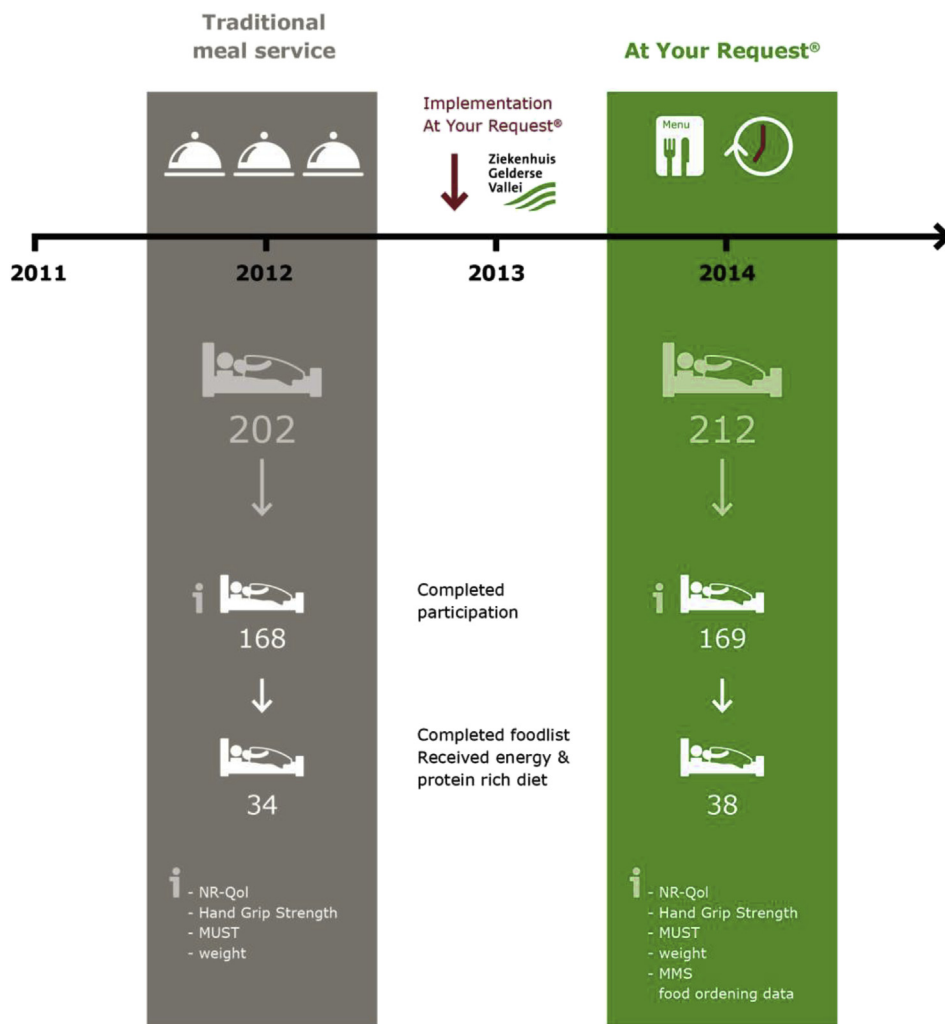


Fig. 1. Study design. Patient satisfaction, nutritional status, and food choice were compared between two periods in time. Detailed food intake data from food lists was only available for patients receiving an energy and protein enriched menu (bottom beds).

formal approval by an MEC was required. Patients all gave written informed consent.

2.2. Menus and meal ordering

2.2.1. Traditional meal system

Three main meals were served at the bedside at 7:15, 12:15 and 17:15. Breakfast and lunch consisted of cold dishes, e.g. cold sandwiches or cereals with milk or yoghurt. The evening meal was served hot, by reheating meals cooked 1–2 days before and chilled for storage until being served. Drinks were served with the meals. In between the main meals, patients were served drinks three times a day. Patients had to decide before 10.00 am what they wanted to eat the next day. Patients who required an energy- and protein enriched diet received extra in-between-meal snacks high in protein (e.g. cubes of cheese, salmon on toast, boiled egg).

2.2.2. At Your Request[®] meal service concept

Between 7 am and 7 pm, patients can order foods and drinks from a menu card by placing a telephone call to trained operators of the nutrition call center. The operator sees information about the caller on a computer screen, including type of diet and previous orders, and helps patients to choose when necessary. The operator then enters the order in the Menu Management System (MMS) which sends the data to the hospital kitchen. Kitchen staff prepare and serve the orders on trays which are delivered within 45 min. Patients who required an energy- and protein enriched diet could still receive the extra in-between-meal snacks high in protein, but they now had to choose them from a special menu card. They are advised to take three of those options in addition to their main meals.

2.3. Patient satisfaction

To obtain an overall estimate of patient satisfaction, we asked patients to rate the meal service on a scale from 1 to 10. To obtain insight in the different factors that influence this rating, we asked students of the master programme Human Nutrition and Epidemiology of Wageningen University to develop and evaluate a suitable questionnaire. This so-called Nutrition Related Quality of Life Questionnaire (NR-QoLQ) consisted of six clusters; general wellbeing, food supply, food quality, presentation, service and autonomy. Each cluster contained two to eight questions that were rated from 1 to 6. The total score ranged from 27 to 162 with higher scores reflecting more satisfaction. All participants received the questionnaire between day 4 of hospital stay and the day before discharge. When patients were discharged unexpectedly, the questionnaire with a return envelope was sent to their home address.

2.4. Nutritional status

Body weight was measured to the nearest 0.1 kg by a nurse on one of the six wards. Patients did not have to fast and usually wore light clothing.

Handgrip strength was measured using a Jamar hydrolic hand dynamometer (Lafayette Instrument Company, Lafayette, IN 47903 USA). Three consecutive measures of handgrip strength at the dominant hand were recorded to the nearest kg with subjects sitting in an upward position and the arm in a 90-degree angle position. The maximum strength effort was reported [3]. All measurements were done on the day of admission, and the day before discharge.

Risk for undernutrition was screened with the Malnutrition Universal Screening Tool [34] that includes weight loss, BMI, and

expected food intake. The MUST has high sensitivity and specificity [24,31]. Patients with a MUST score ≥ 1 are determined as being at risk for malnutrition.

2.5. Food choice and food intake

With the traditional meal service, food choices were made on paper forms and not digitally stored. Therefore, no food ordering data were available.

With At Your Request[®], all food orders per patient per day are digitally stored. To calculate nutrient intakes, we used the food composition table provided by Sodexo. A random selection of products was compared to the nutritional values of the Dutch food composition table [29]. Most of the products had almost identical nutritional values, except for some products that were freshly prepared.

Because not all foods that are ordered are eaten and not all foods and drinks that are consumed are ordered through At Your Request[®], we validated whether we could use food order data as a measure of food intake. This separate validation study was done from April to August 2013 in 63 patients (MSc thesis, unpublished). Ordering data were compared to detailed food intake lists recorded by researchers. Caloric intake based on the food lists was 1493 ± 536 kcal/d against 1403 ± 524 kcal/d based on the ordering data (underestimation by At Your Request[®] ordering data 90 kcal $\approx 6\%$, $p = 0.728$). For protein, recorded consumption was 64.5 ± 23.3 g/d against 60.8 ± 24.5 g/d based on ordering data (underestimation 3.7 g $\approx 6\%$, $p = 0.975$). Based on these results we concluded that, on a group level, food order data were a good reflection of food intake. Protein consumption in gram per day was converted to g/kg BW to compare actual intakes with recommended intakes. For patients with a BMI >27 kg/m², body weight was recalculated using their recorded height and a BMI of 27 kg/m² resulting in lower body weights.

2.5.1. Detailed food lists (subsample)

Food intake was recorded two times per week on food lists for patients who required an energy- and protein enriched diet. These were usually patients from the surgical ward and patients with a MUST score ≥ 1 . In both periods, nurses recorded all consumed foods and drinks in household measures (e.g. 1 glass, 1 cup) at six moments during the day. We calculated mean intakes based on 62 lists from 34 patients for the traditional meal service and 64 lists from 38 patients for At Your Request[®].

2.6. Statistical methods

Patient numbers were based on a desired difference in change in handgrip strength during hospital stay of 2 kg. Using an SD of 6 kg (unpublished data from the study of Dronkers et al. [8]), an α of 0.05 and a power of 0.90 we calculated that we needed 155 patients in each group.

All data was tested for normality using the Kolmogorov–Smirnov test. An independent samples t-test was used to compare group means. Means and standard deviations within groups were compared using an one-way ANOVA. A two-tailed P-value <0.05 was considered as statistical significant. All data were analysed with SPSS Statistics 21.0.

3. Results

3.1. Patient characteristics

A total of 337 patients took part in the study. The two patient groups were comparable with small, non-significant differences in

Table 1

Characteristics of patients included in the traditional meal service (2011–2012) and At Your Request[®] data collection (2013–2014) on the day of admission.

Variables	Traditional meal service n = 168	At Your Request [®] n = 169
Male, n [%]	87 [52]	78 [46]
Age, mean (SD), years	63.3 (15.4)	66.1 (14.5)
Length of stay, mean (SD), days ^a	8.9 (6.8)	7.3 (4.1)
Bedridden, n [%]	41 [24.4]	40 [23.7]
Surgery, n [%] ^a	70 [41.7]	44 [26.0]
Ward, n [%]		
Cardiology	22 [13.1]	26 [15.4]
Geriatrics	22 [13.1]	23 [13.6]
Oncology	17 [10.1]	18 [10.7]
Surgery	40 [23.8]	34 [20.1]
Neurology	36 [21.4]	37 [21.9]
Acute admission	31 [18.5]	31 [13.8]
BMI, mean (SD), kg/m ²	28.2 (6.1)	26.8 (5.8)
BMI > 27, n [%]	83 [50]	71 [42]

^a Statistically significant $P < 0.05$.

mean age and BMI (Table 1). The percentage of surgical patients was significantly smaller during At Your Request[®] (26% versus 42%, $p = 0.01$). The length of hospital stay decreased by 1.6 days, from 8.9 days during the traditional meal service to 7.3 days during At Your Request[®] ($p = 0.038$).

3.2. Patient satisfaction

Patients were already quite satisfied with the traditional meal service, which they rated with a 7.5 on a scale of 1–10. However, they rated At Your Request[®] with a 8.1 which was significantly higher ($p = 0.008$).

Table 2 shows the patient satisfaction scores from the Nutrition-Related QoL questionnaire. The overall score significantly increased from 124.5 to 132.9 points with At Your Request[®] ($p = 0.009$). A significant increase was seen on four of the six participating wards. Patients found the food choice with At Your Request[®] more comparable to food at home ($p = 0.031$). Food supply, presentation, and autonomy showed the largest increase in score. The score for quality of the food did not increase, due to an equal score for taste, a lower score for food temperature, and a higher score for freedom to order food. At Your Request[®] was found to offer better choices for appetizers ($p = 0.027$), snacks ($p = 0.023$) and desserts ($p = 0.043$).

Table 2

Patient satisfaction scores for the traditional meal service and At Your Request[®]. Scores were calculated per hospital ward and for each cluster of the questionnaire.

	Traditional meal service n = 168	At Your Request [®] n = 169	Max score
Overall (SD) ^a	124.5 (14.1)	132.9 (9.5)	162
Scores per ward			
Cardiology (SD) ^a	121.1 (12.7)	135.2 (9.7)	162
Geriatrics (SD) ^a	125.2 (11.5)	137.0 (7.5)	162
Oncology (SD)	124.1 (16.1)	131.2 (11.9)	162
Surgery (SD) ^a	126.9 (14.7)	135.3 (7.6)	162
Neurology (SD)	125.2 (14.7)	128.4 (8.8)	162
Acute admission (SD) ^a	122.9 (14.1)	131.6 (9.5)	162
Scores per cluster of the NR-QoL			
General (SD) ^a	13.0 (2.2)	13.7 (2.3)	18
Supply (SD) ^a	36.8 (6.1)	39.7 (4.8)	48
Quality (SD)	14.3 (1.8)	14.3 (1.7)	18
Presentation (SD) ^a	8.8 (1.7)	9.6 (1.2)	12
Service (SD) ^a	24.5 (2.9)	26.1 (2.0)	30
Autonomy (SD) ^a	27.1 (3.9)	29.5 (2.5)	36

^a Statistically significant $p < 0.05$.

Table 3

Mean (SD) body weight, handgrip strength and number of patients for different MUST scores during hospital stay during the traditional meal service or At Your Request[®].

	Traditional meal service n = 168		At Your Request [®] n = 169	
	Day 1	End ^a	Day 1	End
Body weight (kg)	83.7 (20.1)	83.5 (19.5)	77.6 (18.1)	77.4 (18.0)
HGS ^b (kg)	30.2 (12.6)	30.5 (12.9)	30.2 (13.0)	30.6 (13.3)
MUST 0	131	139	122	129
MUST 1	10	12	16	16
MUST ≥ 2 (n)	27	17	31	24

^a End = day before discharge.

^b HGS = handgrip strength.

3.3. Nutritional status

3.3.1. Body weight

Patients receiving the traditional meal service were about 6 kg heavier and more often had a BMI > 27 kg/m² (Table 3). With the traditional meal service, body weight during hospital stay decreased with 0.2 ± 2.7 kg from 83.7 to 83.5 ($p = 0.824$). With At Your Request[®], body weight decreased with 0.2 ± 2.6 kg from 77.6 kg to 77.4 kg ($p = 0.851$). The body weight change was not statistically different between the two periods.

3.3.2. Handgrip strength

Both groups started with a handgrip strength of 30.2 kg (Table 3). On the day before discharge, handgrip strength in the two groups was about the same, 30.5 and 30.6 kg. The handgrip change between admission and day before discharge was not statistically significant between the two meal services.

3.3.3. MUST score

At admission to the hospital, 37 patients in the traditional meal service were at risk for malnutrition against 47 patients in the At Your Request[®] group (Table 3). The MUST score increased (=became worse) in 4 patients during the traditional meal service and in 6 during At Your Request[®]. The score decreased (=improved) in 18 patients in both groups mainly because most patients had a better food intake when leaving the hospital than at admission.

3.4. Food choice and food intake

3.4.1. Food choice, At Your Request[®]

Bread and coffee or tea were the most frequently ordered food items. In terms of calories, the most prominent food items were bread and cereal products, while dairy products contributed most to protein intake. When comparing the amount of ordered foods with daily amounts as recommended by the Health Council [11], we found that recommendations were not met by most patients (Table 4).

Table 4

Ordered versus recommended amounts (g/day) of a selection of foods and drinks during the At Your Request[®] period (n = 169).

Food product	Group	At Your Request [®]	Recommendation
Bread and bread products	Male	122	175
	Female	126	140
Dairy products	Male	411	650
	Female	429	650
Fruits	Male	87	200
	Female	122	200
Vegetables	Male	106	200
	Female	120	200
Meat and fish	Male	105	125
	Female	107	100

Table 5
Mean (SD) energy and protein content of the food ordered from At Your Request[®] on day 4 of hospital stay, calculated for men and women and for the risk groups of malnutrition (using the Malnutrition Universal Screening Tool MUST).

	Energy (kcal)	Protein (g)	Body weight (kg)	Corrected body weight ^a	Protein (g/kg)
Total group (n = 169)	1630 (492)	66.2 (21.3)	77.6 (18.1)	72.0	0.92
Men (n = 78)	1727 (544) ^b	69.9 (22.8)	82.2 (14.6)	78.5	0.89
Women (n = 91)	1548 (428) ^b	63.5 (20.0)	74.0 (20.1)	66.5	0.95
Malnutrition risk groups					
MUST 0 (n = 122)	1660 (490)	66.9 (20.3)	82.7 (17.3)	75.2	0.89
MUST 1 (n = 16)	1500 (447)	61.4 (26.0)	64.6 (8.0)	63.9	0.96
MUST ≥2 (n = 31)	1580 (520)	67.3 (23.7)	66.5 (11.6)	63.7	1.06

^a Used to calculate protein intake in g/kg/day. Body weight for patients with a BMI higher than 27 was recalculated using their height and a BMI of 27. This (lower) corrected body weight is also used for protein recommendations.

^b Difference between men and women statistically significant $p < 0.05$.

3.4.2. Food intake based on At Your Request[®] orders

Energy content of the ordered food on day 4 was 1630 kcal (Table 5) and less for women than for men: 1548 kcal versus 1727 kcal ($p = 0.423$). The amount of protein of the ordered food on day 4 was 66.2 g; 63.5 g for women and 69.9 g for men ($p = 0.091$). Patients who were screened as having a risk for malnutrition (MUST 1) ordered 61.4 g protein, while patients with a MUST score ≥ 2 ordered 67.3 g, which was higher than in the MUST 0 and 1 groups (Table 5). Using the food order data as intake data, protein intake was 0.92 g/kg corrected BW for the total group of patients, with small, non-significant differences between men (0.89 g/kg BW) and women (0.95 g/kg BW). On day 4, 67% of women and 60% of men were able to reach the recommendation for healthy adults of 0.8 g/kg BW. Protein intake in g/kg corrected BW was lowest in the MUST 0 group, slightly higher in the MUST 1 group, and highest in the MUST ≥ 2 group (Table 5). Moreover, about 85% of patients in the MUST ≥ 2 group reached a protein intake of 1.2 g/kg bodyweight (Fig. 2).

3.4.3. Detailed food lists

During the traditional meal service, recorded energy intake in patients receiving an energy and protein rich menu was 1461 ± 538 kcal, which was slightly higher than the 1378 ± 597 kcal during the At Your Request[®] period (Table 6). However, during At Your Request[®] the recommended protein intake of 1.2 g/kg BW was reached in 30% of recorded days versus 36% during the traditional meal service. In both periods, about half of the patients who received an energy and protein enriched diet was classified as having a risk of malnutrition (MUST ≥ 1). During At Your Request[®], this group had a significantly higher intake of energy (1606 ± 637 kcal vs 1152 ± 538) and protein (66 ± 22.8 g vs 51 ± 23.3 g protein) than the MUST 0 group. Moreover, in the

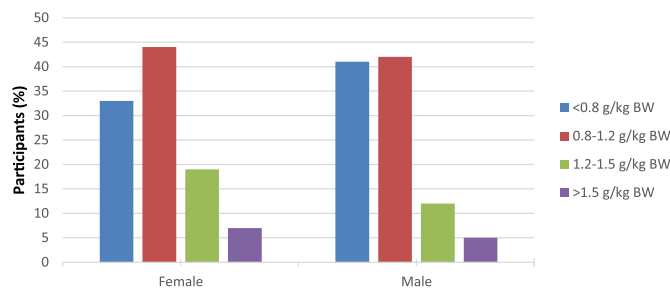


Fig. 2. Protein intake, derived from the food ordering data, in g/kg BW after correction for BMI > 27 kg/m² of the patients receiving the At Your Request[®] meal service divided in three groups of risk for malnutrition (MUST 0 = no risk, MUST 1 = risk on malnutrition, MUST ≥ 2 = severe risk on malnutrition).

MUST ≥ 1 group, patients reached a protein intake of 0.8 g/kg BW on 53% of the recorded days against 37% in the MUST 0 group (Fig. 3). This is in contrast to the traditional meal service, where the difference between MUST groups was the other way around (data not shown).

4. Discussion

Our study showed that At Your Request[®], a hospital meal concept that allows patients to order food from a menu card throughout the day, was better appreciated than the traditional meal service with three meals per day. The new meal service was not able to improve nutritional status in terms of body weight, handgrip strength and MUST score compared to the traditional meal system. Intake of energy and protein per g/kg BW did not differ between the two meal systems in a subgroup of patients receiving an energy and protein enriched diet.

Although the comparisons were not made in a randomized controlled trial but in a comparative study with two groups that were two years apart, we think that bias of the results will be small because the patient groups were large and similar and recruited in the same wards. Moreover, to prevent seasonal differences, measurements were done in the same months. The number of surgical patients was lower in the At Your Request[®] period because of a temporary closure of the surgical ward due to NORO virus.

Hospital stay was significantly shorter during the At Your Request[®] period. This is a trend in many hospitals [27] and should not be attributed to a better meal service. However, the short hospital admission time may have impaired finding effects on nutritional status.

Table 6

Subgroup of patients who received an energy- and protein-enriched menu (including oral nutritional supplements) during the two study periods and their energy and protein intake as calculated from multiple 1-day food lists collected by nurses.

	Traditional meal service n = 34	At Your Request [®] n = 38
Male, n [%]	17 [50]	16 [42]
Age, mean (SD), years	65.2 (13.3)	68.9 (9.7)
BMI, mean (SD), kg/m ²	25.8 (4.0)	26.2 (5.57)
MUST score, n [%]		
0	18 [53]	19 [50]
1	4 [12]	4 [11]
≥ 2	12 [35]	15 [39]
Patients using ONS, n	8	13
Energy in kcal (SD)	1461 (538)	1378 (597)
Protein intake in g/kg BW ^a (SD)	0.91 (0.43)	0.84 (0.46)

^a Calculated using corrected body weights.

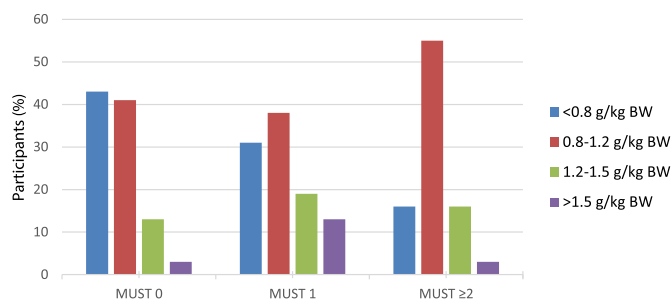


Fig. 3. Protein intake estimated from detailed food lists against protein recommendations calculated as 1.2 g per kg corrected body weight in patients receiving an energy and protein rich diet. For the traditional meal service (left) 62 food lists from 34 patients were available; for At Your Request (right) 64 lists from 38 patients.

4.1. Patient satisfaction

For patient satisfaction a newly developed quality of life questionnaire was used. We did this because no validated questionnaires suitable for our purpose could be found. The questionnaire was pretested among hospital patients for clarity of questions. The increase in NR-QoL score went together with an increased rating on a 1–10 scale. This suggests that the questionnaire was valid for tracking changes in patient satisfaction. The higher scores for satisfaction in At Your Request[®] were partly due to wider availability of foods, which is comparable to the situation at home and an important aspect of patient satisfaction [14,28]. Meal temperature was rated worse and this should be improved, as sensory characteristics such as temperature, texture, flavour and appearance are found to be the most important for hospital patients [6,12].

4.2. Nutritional status

In this study, changes in body weight, handgrip strength and MUST during hospitalization were measured. These parameters are part of the recommended assessment methods for malnutrition by the Academy of Nutrition and Dietetics and the American Society for Parenteral and Enteral Nutrition [35]. In hindsight, time of hospital stay may have been too short to see an effect on these parameters, especially on HGS [25]. For future evaluation studies, it would be good to include these measurements as baseline characteristics, but not as outcome markers.

In general, patients loose muscle weight during hospitalization and many patients, especially elderly, leave the hospital weighing less than before [17]. In our patient groups, body weight was retained which suggests that both meal services provided enough energy.

We did not find differences in HGS between the two periods and this might be due to the fact that more than 60% of our study population was over 50 years of age. In younger adults HGS is found to be a useful tool for detecting change in muscle strength during nutritional interventions whereas findings in studies with elderly persons are not consistent [25]. In addition, handgrip strength varied between the six participating wards, so for future research it is important to differentiate between patient groups.

MUST scores improved in many patients on both meal systems, mainly because more patients were able to eat their meals at the end of hospital stay as compared to when they were admitted. Patients who deteriorated usually did so because of further weight loss.

Unfortunately, we did not have data on body composition or fluid disturbances that could have influenced body weight and

MUST measurements. However, we think that on a group level these effects will have balanced out.

4.3. Food choice and food intake

Although the time window for improving nutritional status may be too short, improvement of food intake appears feasible. The average protein intake of 0.92 g/kg corrected BW found during At Your Request[®] is higher than in other studies with hospitalized patients [1,2,7] but less than the recommended 1.0–1.25 g/kg BW for elderly [36] or 1.2–1.5 g/kg BW for hospitalized patients. Also energy intakes were less than the average 1800 kcal a day recommendations for healthy individuals [1,2,7]. Most patients did not meet the recommended amounts for vegetables, meat, and starchy foods (rice, pasta, or potatoes) as advised by the Dutch Health Council [11], but this is also seen in Dutch community dwelling elderly [26]. Although some researchers argue that the time spent in hospital could be used to teach patients healthy eating behaviours, the time window to do this is short and effectiveness has been debated. However, food intakes in terms of protein and energy and certain food groups could be improved further. Actively offering protein-rich snacks, as was done during the traditional meal service, is a strategy that was shown to be effective in other institutions as well [13,21,23].

Another effective way to increase protein intake is suggesting patients to take a protein-rich product when they call to order their food. A recent study conducted in our hospital found that protein content of ordered foods increased when this strategy was used [38].

Patients who are *not* at risk of malnutrition should receive the same attention as patients who are at risk. These patients, who comprise more than 70% of all hospital patients, also have increased protein needs because of their disease, but we found that this group ordered less foods and drinks than the at risk groups.

With At Your Request[®] more of the ordered food was actually consumed than the 60–70% which is usually reported in the literature [2,32]. This is in accordance with a pilot study that showed that after introducing At Your Request[®] in Gelderse Vallei Hospital the amount of food waste was reduced substantially from 77 to 36 kg per day because more patients finished their meals [19].

Accurate food intake data from hospital patients are scarce and often subject to recall bias. The At Your Request[®] food order data were close to actual intake data which makes the system not only suitable for monitoring individual patients but also for research.

5. Conclusion

Patients were more satisfied with the meal service after introduction of the At Your Request[®] meal service concept than with the traditional system with three meals that need to be chosen one day ahead. Moreover, the meal service concept is able to maintain nutrition status and food intake. Further fine-tuning to stimulate the intake of protein-rich foods appears feasible and should be evaluated in the future.

Conflict of interest

None.

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