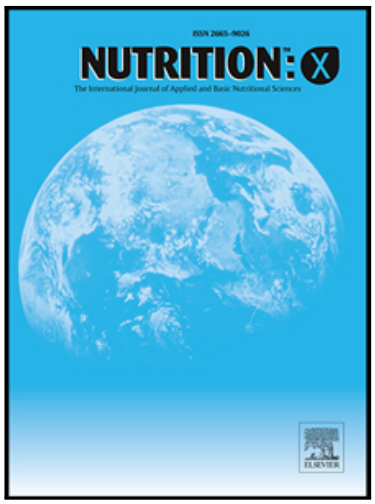


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# Orange napkins increase food intake and satisfaction with hospital food service: a randomized intervention

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Key Words: meal context; dietary intake; hospitalized patients; patient satisfaction; health outcomes

## Background

Elevated malnutrition risk prevalence is greater than 30% in newly hospitalized adults in Israel, increasing to more than 50% among patients older than 79 years of age (1). Malnutrition is devastating to patients, increasing infection and organ failure rates, slowing recovery and increasing difficulties in functioning (2-4).

Improving the appearance of food served is one method to encourage increased food intake. In one study, hospital food service workers worked with culinary experts from the Institut Paul Bocuse to craft new, more attractive meal presentations using the identical ingredients normally used by the hospital to create meals. This method increased food intake and reduced the rehospitalization rate. However, this method necessitated time-consuming retraining of hospital kitchen and food service staff, making it a somewhat inefficient choice (5).

A simpler approach to increasing food intake among hospitalized patients might be alterations to the food context. For example, the color of the crockery on which food was served was found to significantly influence food consumption among residents in nursing homes (6). The color orange, often associated with warmth, shelter, comfort and satisfaction, can also increase appetite (7, 8). But these prior studies have addressed the color of the food itself rather than as a component of the meal context.

It was hypothesized that adding an orange napkin to the meal tray might represent a simple, low-cost, non-labor-intensive method to increase dietary intake during the hospitalization.

## Objectives

The present study was designed to estimate the effect of orange napkin color on 1) food intake at lunchtime and 2) patient satisfaction with the meal. Secondarily, the study examined the influence of napkin color on each of the meal components as identified on the modified Comstock Scale.

**Study Design**

The present intervention study randomized patients to one of two conditions: an orange napkin, or the usual white napkin, on the lunch tray.

**Ethics**

The study was approved by the Institutional Ethics Board (Helsinki Committee) of the E. Wolfson Medical Center. An explanation of the study methods and goals were posted in the department during data acquisition periods. Each participant provided signed, informed consent.

**Study Location**

The study was conducted in Internal Medicine Department E at E. Wolfson Medical Center, Holon, Israel.

**Study Population**

The study population was comprised of all individuals newly admitted to Internal Medicine Department E consuming their first hospital lunch at the time of data acquisition.

**Inclusion criteria**

All adult patients hospitalized in Internal Medicine Department E who were present for

the meal at which measures were performed were approached for participation. Patients interested in participation and capable of responding to study questionnaires, which were available in Hebrew or Russian, were included.

**Exclusion criteria**

Subjects with dementia or other cognitive alterations which preclude comprehension and/or cooperation were excluded from study participation. Patients receiving partial or total parenteral nutrition or PEG were precluded from study participation.

**Study Procedures**

Internal Medicine Department E is structurally divided into two sections. Sections were randomized to intervention (napkin color) by the food delivery staff on the day of data acquisition using a coin toss. Thus, all patients hospitalized in the section randomized to the study intervention received trays with an orange napkin while all patients hospitalized in the section randomized to the standard food service presentation received usual food trays with a white napkin and served as controls. Subjects received their assigned meal service (regardless of study participation). Only data for the first meal consumed by a given study participant was recorded. Patients present for subsequent meals received their assigned trays but the data was not documented.



**Data Acquisition**

The following data were extracted from the patient medical record: medical history, including reason for hospitalization (chronic, infectious) and presence of comorbidities (diabetes, cancer, cardiovascular disease); demographic information including age, sex and family status; anthropometric information including height and weight, from which BMI was calculated as $kg/m^2$; dietary information including type of diet (regular vs.

special); texture modification; prescription for oral nutrition supplements; and whether the patient consumed food other than food served by the hospital.

**Estimating Plate Waste/Food Intake**

Patient food trays were photographed by a single investigator (AN) approximately 45 minutes after luncheon meal delivery, immediately prior to lunch tray collection.

Each main meal plate was digitally captured and labelled using a Canon PowerShot A495 10.0 mega pixel camera, item code 4259B001 (Cannon USA Inc., Melville, New York), a compact digital still camera with built-in flash. Manufacturer specifications include 10.0 megapixel, 1/2.3-inch type charge coupled device, TTL Autofocus, 2.5-inch type LCD monitor and approx. 115,000 dots LCD pixels. All images were taken with the photographer standing in front of the tray, shooting down, so that the main meal plate was centered and occupied the entire frame.

The Modified Comstock Plate Waste Scale was used with digitally captured images of plate waste, which were later viewed in the camera viewer screen (9). Using the modified Comstock Scale, the rater indicated the proportion of the menu item remaining on the plate: 0%, 25%, 50%, 75%, 90% or 100%. The option, “Item not offered” was also available. This rating was performed for each of the following meal components: vegetable, starch and main course. Additionally, these values were averaged for a measure of total meal intake.

Food consumed was calculated by subtracting the proportion remaining on the plate from 100%. The investigator used this information to calculate the total energy consumed at a given meal. Total energy intake was estimated for each meal by

calculating intake as described above and multiplying this value by the caloric value (as estimated by Ministry of Health). Proportion of energy consumed

**Satisfaction with Food Service**

The Utah State University Hospital Food Service Patient Satisfaction Survey was completed on the intervention day(10). Originally published in English, the survey was translated into Hebrew and Russian by native speakers, and the translated versions were assessed by registered dietitians who were native speakers of either Hebrew or Russian for content and accuracy. These versions were then translated back to English and assessed by a native English-speaking registered dietitian who compared the versions for accuracy, thus obtaining translation validity (11). In the present study, participants were asked to indicate the degree to which they agreed with 19 statements about satisfaction with the lunchtime meal on a 5-point Likert scale. The statements were: 1) Hospital food looks good; 2) Lunch is my favorite meal at the hospital; 3) My food was tasty; 4) I had a good appetite before meal 5) My Plate looked good; 6) The lunch tray looked attractive; 7) The cold food was served cold 8) The hot food was served hot; 9) Breakfast was served on time; 10) Lunch was served on time; 11) Dinner was served on time; 12) I had adequate time to consume my meal 13) The food servers are clean; 14) I can choose a healthy meal option; 15) The food servers are kind; 16) The food server helps me eat; 17) The meal had an unpleasant smell; 18) Lunch looked tasty; 19) Lunch was tasty.

**Sampling Procedures**

On each day of data acquisition, food delivery staff randomized department sections to intervention: experimental (orange napkin) or standard food tray (control: white napkin). Regardless of whether patients elected to participate in the study, they

received food trays consistent with their section's food presentation assignment. Data were recorded only for those patients who volunteered to participate. All patients admitted to Internal Medicine Department E who met inclusion criteria were approached for study recruitment. This study thus utilizes a convenience sample based on volunteers.

**Randomization**

The assignment of department section to exposure (orange vs. white napkin) was made randomly using a coin flip conducted by food delivery staff on each day of data acquisition.

**Blinding**

Participants were not blind to the study intervention; however, they did not know which napkin color was hypothesized to increase dietary intake. The individual responsible for data acquisition was not blind because she photographed the meal trays, many of which still had the assigned napkin at the conclusion of the meal. The investigator who performed data analysis was blinded to treatment assignment since napkin color was numerically coded and not revealed until the conclusion of data analysis.

**Statistical Analysis**

Data were analyzed on SPSS Statistical Analysis Software (v25). Descriptive statistics were calculated and are presented as n (%) for nominal data and mean ± standard deviation for continuous data. Distributions of continuous variables were tested for normality using the Kolmogorov-Smirnov test. With the exception of weight and height, all continuous variables had distributions significantly deviating from normal. Thus, these were compared by intervention (orange vs. white napkin) using the Mann-

Whitney U, and the normally distributed continuous variables were compared by intervention using the t-test for independent samples. Nominal variables were compared by intervention using the chi square test. Because baseline differences were detected by intervention, these differences were included in a general linear model of each outcome to control for their possible confounding effects. All analyses are intention-to-treat and all tests are two-sided and considered significant at $p<0.05$.

**Sample Size and Study Power**

The present study was powered to detect a between group difference in food intake, measured as caloric intake at the lunchtime meal. With a sample size of 63 patients in each group, the present study had 80% power to detect a true, between-group difference of 10%±20% in total energy intake.

**Results**

A total of 131 participants were included. Figure 1 presents the dispensation of participants in a Consort Diagram. As can be seen, 137 individuals were hospitalized in the participating internal medicine department at the time of the experiment. Of these, six were not included because they did not meet inclusion criteria (Table 1 shows the characteristics of the study population by intervention group: white (n=65) vs. orange napkin (n=66). Despite randomization, significant differences were detected by napkin color such that participants in the orange napkin group were significantly younger and fewer were on special or texture modified diets or received oral nutrition supplements. By-group differences in sex, family status, malnutrition risk, reason for hospitalization, anthropometric measures and comorbidities were not detected.

**Proportion of food consumed**

Table 2 shows the proportion of food consumed during hospitalization by intervention group (orange vs white napkin). The orange napkin group consumed 17.6 % more food than the white napkin (control) group, driven by the significantly greater proportion of the carbohydrate side dish and vegetable dish eaten. Participants in the orange napkin group also consumed significantly more food not provided by the hospital compared to patients in the white napkin group.

Because patients in the white napkin (control) group were significantly older and a significantly greater proportion received special or modified diets and oral nutrition supplementation, general linear modeling (GLM) was performed to control for these confounders. After adjusting for these covariates as well as age and sex as shown in Table 3, the proportion of lunch consumed remained greater in the orange napkin group than in the white napkin (control) group (54.34±4.08 vs 31.86±4.12, p=0.004).

**Satisfaction score**

Table 4 presents food service satisfaction score by intervention group. Total satisfaction with the hospital food service was significantly greater in the orange napkin vs. white napkin group. Patients in the orange napkin group had higher food service satisfaction scores for all aspects queried except pre-meal appetite; temperature of hot food; ability to select healthy food options; unpleasant food aroma; cleanliness of food servers; and feeding assistance by food servers, none of which differed by intervention exposure. Interestingly, tray attractiveness also did not differ by napkin group; rather, the meal itself was perceived as more attractive.

Table 5 presents the food service satisfaction score after adjusting for relevant covariates. Even after adjustment for age, sex, type of diet, diet texture modification and oral nutrition supplementation, food service satisfaction score remained

significantly greater in the orange napkin group than in the white napkin group.

**Discussion**

Findings of the present study indicate that a simple alteration to the meal tray, like an orange napkin costing approximately US $0.05 each, can improve not only food consumption during hospitalization but can increase food service satisfaction scores. This increased satisfaction with hospital food service persisted even after controlling for covariates including age, sex, kind of diet, diet texture modification and nutrition supplementation, and the orange napkin emerged as a significant predictor of both proportion of food consumed and food service satisfaction score in internal medicine departments.

Improved food presentation has been shown to improve dietary intake and reduce readmission rates among hospitalized patients. In a previous study, investigators worked with hospital food service personnel to arrange food in a more visually appealing manner than the way in which the meal was usually plated and served to patients. This method did not require additional direct costs to perform (identical foodstuffs were used to create the meals); however, this method does require retraining of kitchen personnel (5).

Another low-cost method for improving dietary intake and food service satisfaction includes playing music during mealtime, which has been associated with increased energy intake among residents of extended care facilities (12, 13). This method also increased mealtime energy intake among nursing home residents with dementia by prolonging the amount of time the resident spent consuming the meal; further, agitation and aggression were reduced while relaxation was enhanced (14). Meals in hospital

internal medicine departments are typically served to patients in their beds, making a music selection at mealtime less feasible.

Family-style meal service permits diners to serve themselves from a large serving dish on the table. In the Netherlands, two randomized clinical trials compared family-style meal service to pre-plated meal service among extended care facility residents. At the end of the six-month study period, family-style meal service was associated with significantly greater energy and macronutrient intake, body weight, quality of life and physical performance as well as significantly reduced risk for malnutrition (15, 16). The hospital stay in Israel is typically 4.6 ± 0.1 days (17), likely inadequate time to cause weight gain; moreover, group meals may not be prudent in populations with communicable disease and other acute conditions.

A buffet-style dining experience has also been tested in residents of extended care facilities in which staff assisted participants with food selection and encouraged them to return to the buffet table for additional servings. In this multi-level intervention, the dining room was enhanced with tablecloths, china plates, centerpieces and music. For residents requiring self-feeding assistance, special utensils were provided. Body weight and biochemical markers of nutrition status were compared between residents exposed to this improved meal experience and residents who were exposed to the typical meal experience. The investigators did not detect any significant difference between the groups for any outcome tested (18). Even if outcomes had differed by meal experience, buffet service and dining tables are less practicable in hospital internal medicine departments and in many cases would require hospitals to invest in considerable remodeling. Further, interventions appropriate for residents of long term care facilities are not necessarily applicable to the acute care setting of a hospital internal medicine

department.

In the present study, participants who were randomized to the orange napkin indicated that their meal was tastier, and they consumed more food, though these patients received meals identical to those served to the control (white napkin) group. Table décor, including serving utensils, dishes and silverware, have been shown to influence food intake by altering taste perception (19). For example, sweet popcorn was perceived to be saltier and salty popcorn was perceived to be sweeter when served in colored bowls compared to popcorn served in white bowls (20). In another study designed to test the influence of serving dish color on taste perception, participants tasted four samples of hot chocolate, each served in one of four colored cups: red, orange, white and dark cream. A more intense chocolate flavor was reported by subjects when the hot chocolate was served in the orange or dark-cream colored cups. The dark-cream cup was also associated with greater sweetness and a more intense chocolate aroma (21). It is interesting that the color orange was one of the colors associated with altered taste perception.

**Limitations**

Findings of the present study must be considered in the framework of the study limitations. This experiment was performed only at the lunch-time meal; thus, findings cannot be generalized to breakfast or dinner. Further, the experiment was performed only among patients hospitalized in an internal medicine department; it is thus not possible to generalize these findings to other types of inpatient departments such as surgical, intensive care or maternity. Importantly, baseline differences were detected between intervention groups despite randomization. These differences were not systematic and can be attributed to probability. Also, they were accounted for in the

GLM models, in which napkin color remained a significant predictor of both food intake and food service satisfaction after controlling for these potential confounders.

Improved food context has been shown to enhance both food service satisfaction and food intake; however, while previous studies have presented evidence for an association between the physical food context (including tray décor) and improved food intake among extended care facility residents (22) and among healthy adults (19, 23), this is the first report studying the effect of an alteration in tray décor (orange napkin) among hospitalized patients. In conclusion, findings of the present study suggest that the addition of an orange napkin to the hospital meal tray is a low-cost, simple strategy for increasing dietary intake among patients hospitalized in internal medical departments. However, further studies should investigate this intervention among individuals hospitalized in other inpatient departments; at all meals (not only lunch); and over time.

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**Table 1 Characteristics of study population by napkin color**

| Measure | White Napkin (Control) N=65 | Orange napkin (Experimental) N=66 | p value |
|---|---|---|---|
| Age (years) | 79 (19) | 68 (28) | 0.037 |
| Sex | | | |
| Female (%) | 55.4 | 9.4 | 0.067 |
| Male (%) | 44.6 | 60.6 | |
| Family Status | | | |
| Married (%) | 56.9 | 63.9 | 0.152 |
| Widowed (%) | 24.6 | 12.1 | |
| Single (%) | 6.2 | 3.0 | |
| Other (%) | 12.3 | 21.2 | |
| Diet modification | | | |
| Special diet (%) | 73.8 | 40.9 | <0.0001 |
| Texture modified diet (%) | 16.9 | 10.6 | 0.001 |
| Oral nutrition support (%) | 32.3 | 15.2 | 0.021 |
| MUST score on day admitted to hospital (%) | | | |
| Low Risk (MUST score=0) | 73.8 | 60.6 | 0.205 |
| Medium Risk (MUST score=1) | 18.5 | 31.8 | |
| High Risk (MUST score = 2) | 7.7 | 7.6 | |
| Reason for hospitalization | | | |
| Chronic (%) | 92.3 | 84.8 | 0.180 |
| Infectious (%) | 7.7 | 15.2 | |
| Comorbidities | | | |
| Cancer (%) | 20.0 | 12.1 | 0.219 |
| Diabetes (%) | 47.7 | 34.8 | 0.135 |
| Cardiovascular disease (%) | 43.1 | 31.8 | 0.183 |
| BMI ($kg/m^2$) | 23.6 (6.3) | 25.9 (5.4) | 0.615 |

MUST = Malnutrition Universal Screening Tool

*Continuous variables are presented as median (interquartile range) and were compared by intervention group (orange vs. white napkin) using the Mann-Whitney U test due to distribution skewing.*

**Table 2. Food consumed at lunchtime during hospitalization by napkin color**

| **Measure** | White napkin (Control, n=65) | Orange Napkin (Experimental, n=66) | p-value |
|---|---|---|---|
| Total proportion of lunch consumed (%) | 33.3 (50) | 60 (50) | 0.002 |
| Main Dish Consumed (%) | 50 (88) | 62.5 (90) | 0.104 |
| Starch Consumed (%) | 25 (75) | 50 (71) | 0.015 |
| Vegetable Consumed (%) | 10 (63) | 50 (100) | 0.022 |
| Consumed food not provided by hospital (%) | 44.6 | 27.3 | 0.039 |
| Total lunch energy intake (kcal) | 218 (327) | 392.4 (327) | 0.050 |
| Estimated protein intake (g) | 13.5 (23.6) | 16.9 (24.3) | 0.115 |
| Energy from oral nutrition supplements (kcal) | 0 (251) | 0 (0) | 0.099 |
| Protein from oral nutrition supplements (g) | 0 (13) | 0 (0) | 0.113 |

*Continuous variables are presented as median (interquartile range) and were compared by intervention group (orange vs. white napkin) using the Mann-Whitney U test due to distribution skewing.*

**Table 3. GLM univariate analysis of variance of total proportion of food consumed**

| Measure | p-value |
|---|---|
| Corrected Model | 0.004 |
| Intercept | 0.013 |
| Sex (male/female) | 0.333 |
| Age (years) | 0.593 |
| Kind of diet (modified/regular) | 0.287 |
| Texture of food (texture modified/regular) | 0.092 |
| Oral nutrition supplement (yes/no) | 0.090 |
| Napkin color (orange/white) | <0.000 |

**Table 4. Food service satisfaction score by napkin color**

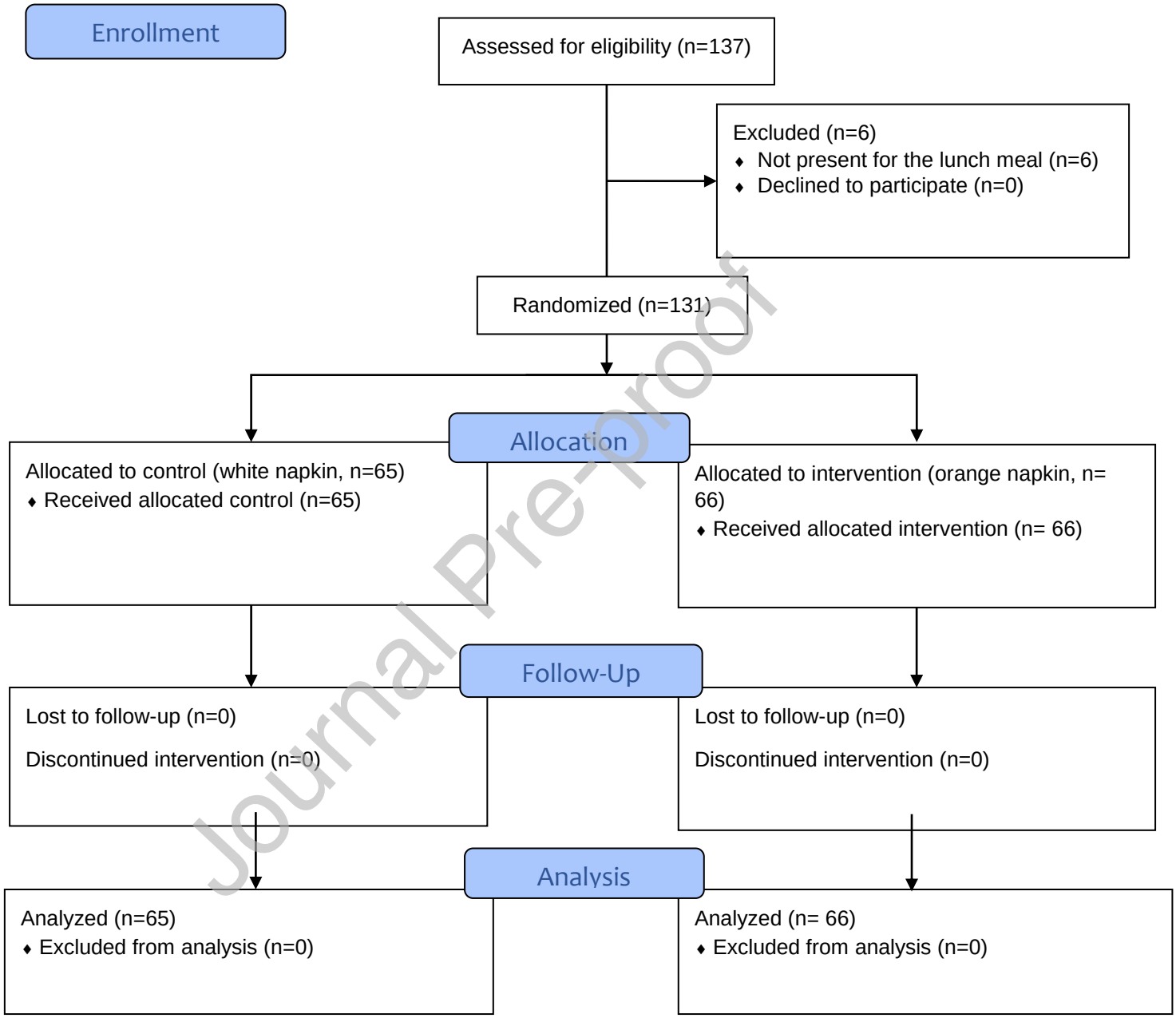
| | White napkin (control, n=65) | Orange napkin (experimental, n=66) | p-value |
|---|---|---|---|
| Food service satisfaction score | 3 (1) | 4 (1) | <0.0001 |
| Hospital food looks good | 2 (1) | 4 (1) | <0.0001 |
| Lunch is my favorite meal at the hospital | 2 (1) | 3 (1) | <0.0001 |
| My food was tasty | 2 (1) | 4 (2) | <0.0001 |
| I had a good appetite before my meal | 4 (2) | 4 (2) | 0.54 |
| My plate looked good | 2 (1) | 4 (1) | <0.0001 |
| My tray was attractive | 3 (3) | 4 (4) | 0.503 |
| The cold food was served cold | 2 (1) | 3 (1) | <0.0001 |
| The hot food was served hot | 3 (1) | 3 (1) | 0.74 |
| Breakfast was served | 2 (1) | 3 (1) | <0.0001 |
| Lunch was served | 2 (1) | 3 (1) | <0.0001 |
| Dinner was served | 2 (1) | 3 (1) | <0.0001 |
| I had adequate time to consume my meal | 3 (1) | 4 (0) | <0.0001 |
| The food servers were clean | 4 (1) | 4 (2) | 0.08 |
| I can choose healthy meal options | 1 (0) | 1 (0) | 0.68 |
| The food servers help me eat | 4 (1) | 4 (1) | 0.38 |
| The food has an unpleasant smell | 4 (3) | 4 (2) | 0.30 |
| Lunch looks tasty | 3 (2) | 4 (1) | <0.0001 |
| Satisfaction Score Category (%) | | | |
| Low (<2 points) | 46.2 | 0.0 | <0.0001 |
| Medium (3 point) | 46.2 | 25.8 | |
| High (>4 points) | 7.7 | 74.2 | |

*Continuous variables are presented as median (interquartile range) and were compared by intervention group (orange vs. white napkin) using the Mann-Whitney U test due to distribution skewing.*

**Table 5. GLM univariate analysis of variance of food service satisfaction score**

| Measure | p value |
|---|---|
| Corrected Model | <0.0001 |
| Intercept | <0.0001 |
| Sex (male/female) | 0.001 |
| Age (years) | 0.943 |
| Type of diet (modified/regular) | 0.450 |
| Texture of food (texture modified/regular) | 0.482 |
| Nutrition support (yes/no) | 0.276 |
| Napkin color (orange/white) | <0.0001 |

**Figure 1. Participant Dispensation CONSORT Diagram**




**These patients may have been absent from the lunch meal due to a test or other procedure; or may have simply exited the department during the meal*