

Examining the Benefits of Digitally Selectable Meals Called “À La Carte Digital-Select” in Cancer Chemotherapy Patients

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ABSTRACT: We explored the benefits of a digitized bedside terminal with a touchscreen for selectable hospital meals called “à la carte digital-select” in cancer chemotherapy patients. The subjects used “à la carte digital-select” for 35 days, from November to December 2015. On average, 253 (between 196 and 288) patients accessed this system per day, and 40 patients used it daily (15.9%). Subjects included 75 patients (cancer chemotherapy: chem-digital-select patients, female: 47) and 12 patients (concurrent chemo radiotherapy: CRT-digital-select patients, female: 6) with a repeat rate of 87% (65) and 100% (12). The average length of hospital stay in chem-digital-select patients was 6 days (1-35), the average number of days using “à la carte digital-select” was 3 days (1-24); a correlation was observed between these factors ($r = .80$; $P < .01$). The eating rate of chemotherapy patients and CRT-digital-select patients was high (81%, 81%), and no differences were observed between the rate in the cisplatin group (80%) with 28 patients, the non-cisplatin group (81%) with 47 patients, CRT-digital-select patients (81%) with 12 patients ($P = .59$; ANOVA). Registered dietitians provided no nutritional intervention in any of the cases. We found that “à la carte digital-select” can contribute to supporting cancer chemotherapy and the dietary needs of cancer patients undergoing chemotherapy.

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Introduction

There are reports referring to the prevalence of malnutrition in cancer patients.¹ In Japan, there has been a recent drive for digitization due to societal changes, such as reforms in working styles associated with the decreasing population.² In Japan, there are no digital systems available in other hospitals or countries. According to a systematic review by Prgomet et al in 2019, there is a link between lower food waste rates and higher eating rates in ordering on touch screens (voice menus, room service, and self-service) for hospital food. It has been reported³ Cancer treatment can cause various adverse conditions to develop,^{4,5} and it is thought that there are greater food-related requirements among cancer patients.^{6,7} Unfortunately, there has been little discussion about digitally selectable meals for hospital food services.^{8,9}

Marín et al.¹⁰ and Ravasco et al.¹¹ have reported that nutritional interventions for cancer patients lead to the maintenance and improvement of quality of life. Furthermore, the Oncology Nursing Society of America favored nutritional interventions as evidence-based care supporting oral intake against inappetence in patients undergoing chemotherapy as part of cancer treatment.¹² The European Society for Clinical Nutrition and Metabolism guidelines suggested proactive nutritional interventions since there have been no reports of nutrition therapy causing cancer growth in cancer patients.¹³

The dietary department (serving approx. 1000 meals per day) at the Shizuoka Cancer Center (615 beds; the proportion of patients registered as having cancer in 2015 who were 60 years and over was 85% among males and 63% among females)¹⁴ modified its traditional Japanese meals (soup and 3

side dishes)¹⁵ to a French à la carte style system since opening in 2002 and introduced a digitized bedside terminal with a touchscreen for selectable hospital meals (digital-select). In 2006, due to the lack of clinical significance, selectable meals were removed as part of medical care in Japan while remuneration for medical services was being calculated; however, according to a nationwide hospital survey in 2016 by the Japan Dietetic Association,¹⁶ the implementation rate of selectable meals was 42.3% at regular hospitals, and 79.7% at advanced treatment hospitals providing patient-focused services. However, evidence for the clinical efficacy and cost-versus-efficacy of cancer patients using selectable meals is still poorly defined.^{8,9} Research to date has conducted nutritional interventions focusing on adherence,^{7,17-20} but has not explored whether “digital-select” has been adapted to the dietary needs of cancer chemotherapy patients as part of their intermittent therapy. In this study, we hypothesized that the eating rate of users would be maintained, given the convenience of digital-select, and that cancer patients could easily create meal combinations to their liking from a device using a touchscreen (à la carte). We aimed to explore the benefits of digital-select by investigating the eating rate of cancer chemotherapy patients who use digital-select.

Materials and Methods

Subjects

Of the patients who could use digital-select (food types: normal, soft foods, decreased immunity meals, child meals, half meals), the subjects included in the study were the patients



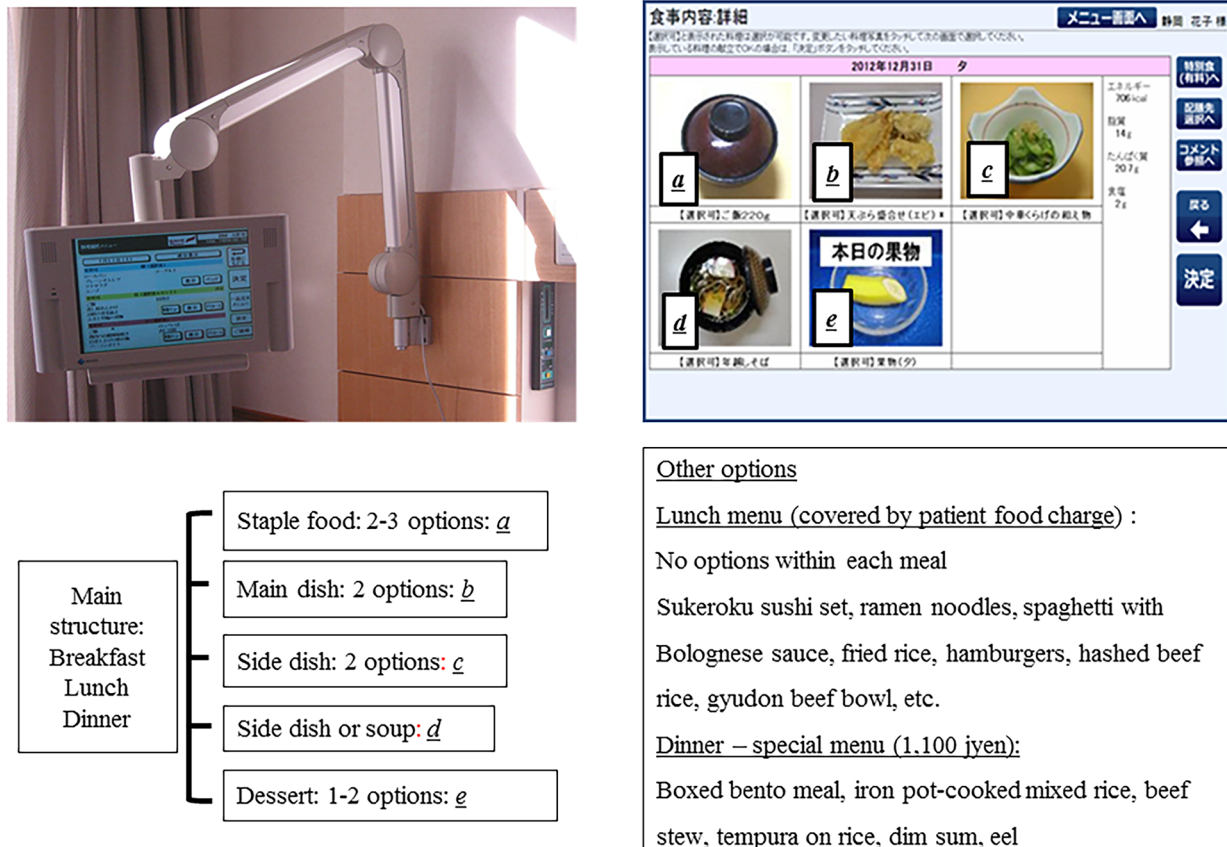


Figure 1. Overview of the digital-select system. Upper left: The digital-select bedside terminal. Upper right: Digital-select screen. The options are displayed by touching photos of staple foods and main dishes. Lower left: Main structure of digital-select system. There are various options for staple foods and side dishes for each of the 3 meals, and the patient can freely make their selections. Lower right: For lunch only, it is possible to select a daily lunch set (a set meal with no à la carte option, included in meal-based treatment costs at the time of hospitalization). For dinner, special menu items can be selected (separate costs apply: 1100 JPY). The deadline for order selection is 4 p.m. on the day before, and selections can be made up to a week in advance.

admitted for cancer chemotherapy (chem-digital-select patients) and concurrent chemo radiotherapy (CRT-digital-select patients) used cisplatin²¹ between November 4, 2015, and December 7, 2015, for 35 menu cycles (35 days; not including special event meals).

Methods

Figure 1 shows an overview of the digital-select system. At this medical center, digital-select is explained in a hospital guide leaflet (“About hospital meals”), and in another pamphlet placed in each room that provides specific information about using digital-select. Patients who are able to use digital-select can voluntarily use it (fees apply to some services).

Patient characteristics were investigated in cancer patients who used digital-select. The number of patients who could use digital-select and the number of patients who used it per day were investigated, and the proportion was calculated (number of digital-select patients/number of patients able to use digital-select). Sex, age, and meal type were also examined in chem-digital-select patients and CRT-digital-select patients.

Other options

Lunch menu (covered by patient food charge) :

No options within each meal

Sukeroku sushi set, ramen noodles, spaghetti with Bolognese sauce, fried rice, hamburgers, hashed beef rice, gyudon beef bowl, etc.

Dinner – special menu (1,100 jyen):

Boxed bento meal, iron pot-cooked mixed rice, beef stew, tempura on rice, dim sum, eel

The number of hospitalization days and number of days using digital-select were investigated, and their association was assessed. The number of chem-digital-select patients and CRT-digital-select patients who repeatedly used digital-select and the repeat rate were sought (repeat rate: repeats within a single day were not included). The number of chem-digital-select patients and CRT-digital-select patients per treatment department was also investigated. The eating rate was calculated out of 100 during the patient admission period (amount provided – amount consumed/amount provided × 100). Adverse events that hamper oral intake often occur with cisplatin, the most commonly used chemotherapy drug.^{21,22} For this reason, a comparison was made between the eating rate of a group using cisplatin with its high emetic effect (cisplatin group), the eating rate of a group not using cisplatin (non-cisplatin group) and CRT-digital-select patients (CRT group). The antiemetics used and the number of days in the course were examined.^{21,22} Examined the severity of the disease (stage),^{21,22} the average number of days using digital-select and the eating rate. The above data were obtained by reviewing electronic patient records and the associated system (CLISTA! SEARCH®).

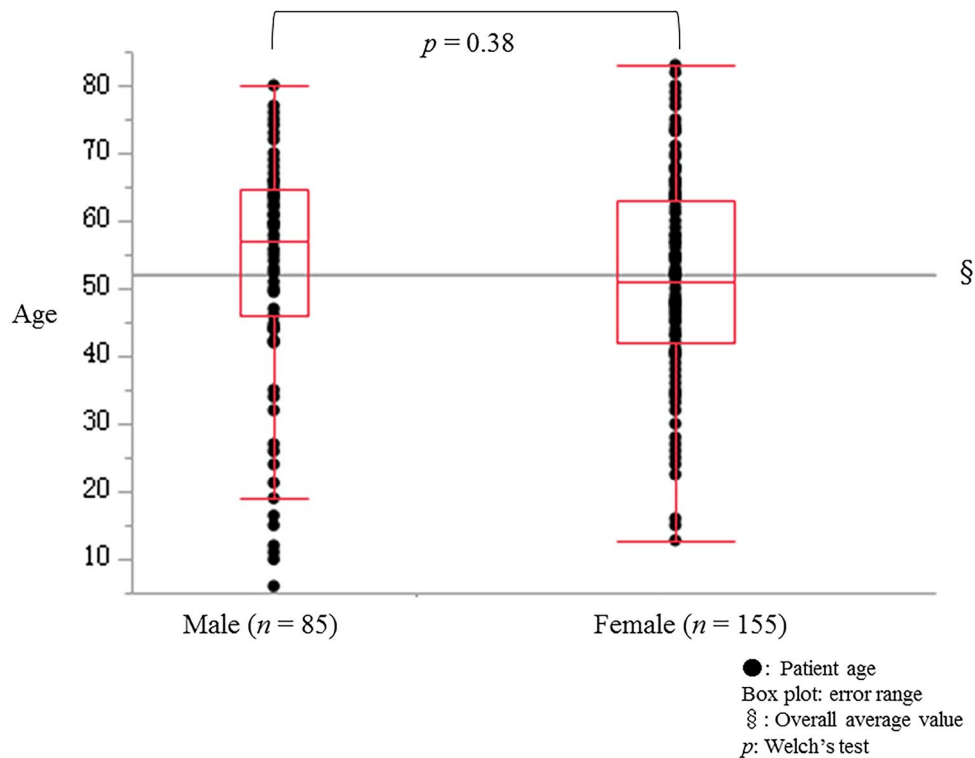


Figure 2. Age distribution of digital-select users according to gender.

Statistical analyses

The median value (minimum-maximum) was obtained for all items that were investigated, and the Shapiro–Wilk test was used to assess normality.²³ Welch's test and ANOVA was used to compare patient age and between non-cisplatin and cisplatin, CRT-groups and severity of the disease (stage). Pearson's product-moment correlation coefficient was used to examine any connection between the number of hospitalization days and the number of times digital-select was used. JMP version 12.0® (SAS Institute, USA) was used as the statistical analysis software, and significance was set at $P < .05$.

Ethical considerations

This clinical study was approved by the institutional review board (IRB) of the center, and the study design was a retrospective exploratory observational study (IRB approval number: 28-J37). Patient consent was obtained using the IRB.

Results

Differences between the sexes were not observed in the cases using digital-select during this period (Figure 2).

The chem-digital-select patients and CRT-digital-select patients were the largest group of users, consisting of 75 patients (males: 28 cases, 37%; females: 47 cases, 63%) and 12 patients (males: 6 cases, 50%; females: 6 cases, 50%) with an average age of 55 years (10–82) and 47 years (6–70) in Table 1. Meal-types

for this group included: chem-digital-select patients; 60 normal meals, 5 decreased immunity meals, 5 child meals, and 5 half meals, CRT-digital-select patients; normal 11meals, and half 1meals. The average admission period for chem-digital-select patients was 6 days (1–35), the average number of days using digital-select was 3 days (1–24), and an association was observed in both groups ($r = .80$, $P < .01$, Figure 3). The average admission period for CRT-digital-select patients was 18 days (7–32) and 9 days (2–27), and an association was observed in both groups ($r = .16$, $P = .65$). Regarding the number of times a chem-digital-select patient and CRT-digital-select patients used the system, 65 and 12 patients used the system twice or more (repeat rate: 87%, 100%). The chem-digital-select patients and CRT-digital-select patients were divided by organ treatment department, as shown in Table 2.

The eating rate of chem-digital-select patients and CRT-digital-select patients was 81% (17–100: $P < .01$) and 81% (15–100: $P = .09$). Of the chemotherapy regimens, the eating rate of the 28 cases in the cisplatin group was 80% (17–100: $P < .01$), the eating rate in the non-cisplatin group of 47 cases was 81% (28–100: $P < .01$), and the CRT group of 12 cases was 81% (15–100: $P = .09$); thus, no difference was observed ($P = .59$; ANOVA, Figure 4). In all cases, antiemetics were administered on the first day of anti-cancer drug administration (day 1). The drugs administered were a 5-HT₃ receptor antagonist antiemetic, a neurokinin receptor antagonist drug, and an adrenocortical hormone formulation.

Table 1. Usage of the digital-select system over a 35 days menu cycle.

		P-VALUE
Number of patients able to use digital-select per day (range)	253 (196-288)	.34
Number of patients who used digital-select per day, rate (range)	40 (31-58), 15.9% (11.6-21.0)	.27, .44
Total number of patients who used digital-select once or more over the 35-day period (range)	240 (male 85: 35%, female 155: 65%)	
Age of digital-select patients (range)	53 (6-88), male: 57 (6-80), female: 51 (13-83)	<.01, <.01, .52
Number of days patients used digital-select (range)	6 days (2-29)	
Breakdown of digital-select patients according to treatment	Chemotherapy: 75 Surgery: 59 Emergency hospitalization: 31 Palliative treatment: 16 Radiation therapy: 13 Diagnostic imaging treatment: 12 Concurrent chemo radiotherapy: 12 Inspection: 7 Hematopoietic stem cell transplantation: 5 Other: 10	
The range of time to start chemotherapy, body weight, body mass index	Chemotherapy: 52 days (0-2158), 54.0 kg (26.1-83.0), 21.9kg/m ² (9.3-31.3) Concurrent chemo radiotherapy: 15 days (0-628), 56.6kg (29.3-75.7), 22.6kg/m ² (15.0-27.8)	<.01 .42 .28 <.01 .86 .75

P-value: Shapiro-Wilk test.

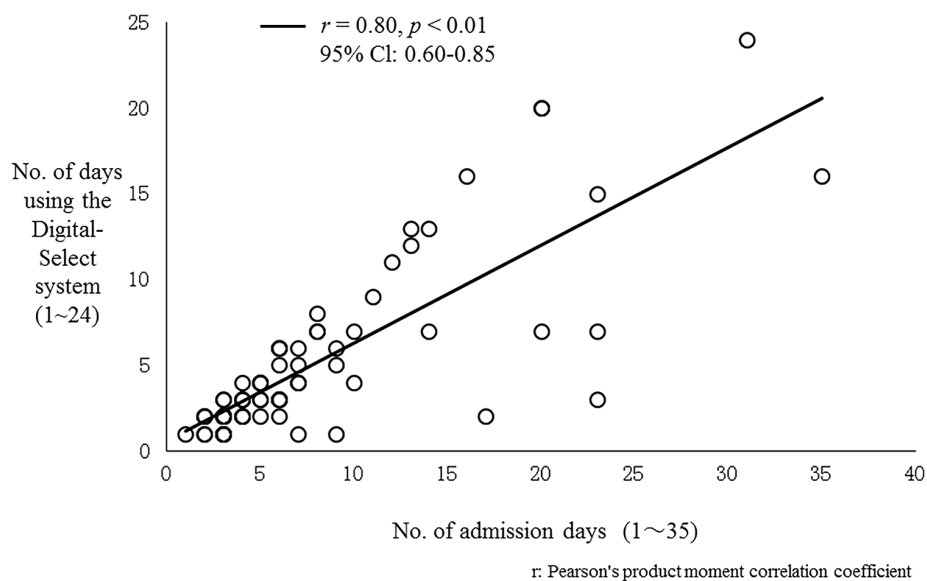
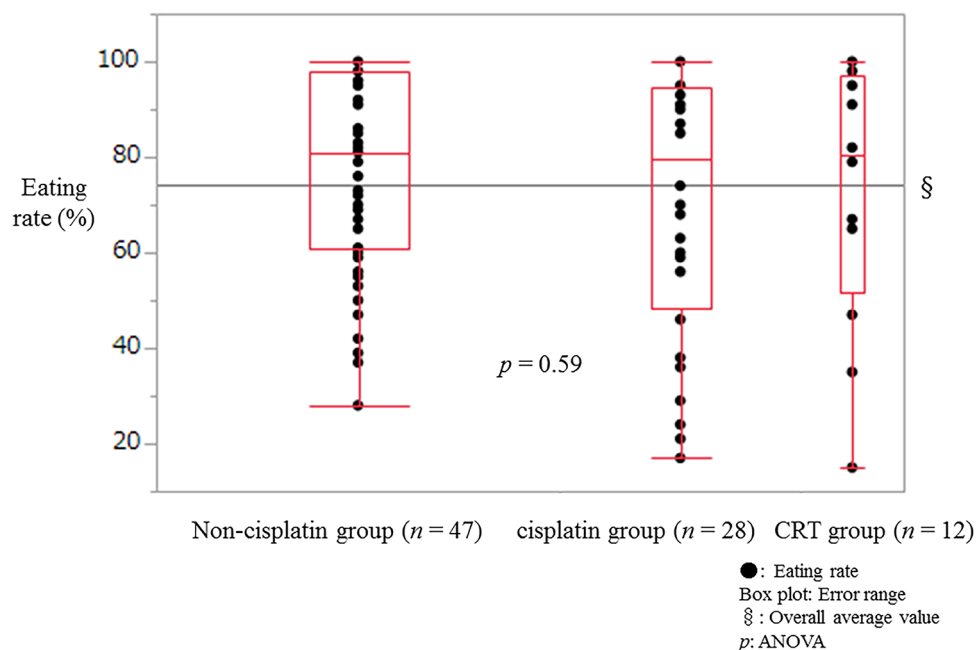
**Figure 3.** Number of hospitalization days and number of usage days for digital-select users (multiple uses over a single day are counted as 1 use).

Table 2. Number of chem-select patients and CRT-digital-select patients according to organ treatment department (n=75, n=12).

	CHEM-SELECT PATIENTS		CRT-DIGITAL-SELECT PATIENTS	
	MALE (N: 28) (%)	FEMALE (N: 47) (%)	MALE (N: 6) (%)	FEMALE (N: 6) (%)
Gynecology	0 (0)	22 (47)	0 (0)	3 (50)
Respiratory medicine	10 (36)	8 (17)	1 (16.6)	1 (16.6)
Blood/stem cell transplantation	9 (32)	7 (15)	0 (0)	0 (0)
Orthopedics	2 (7)	5 (11)	0 (0)	1 (16.6)
Gastroenterology	3 (11)	3 (6)	4 (66)	1 (16.6)
Pediatrics	3 (11)	1 (2)	1 (17)	0 (0)
Urology	1 (3)	0 (0)	0 (0)	0 (0)
Breast surgery	0 (0)	1 (2)	0 (0)	0 (0)

Abbreviation: CRT, concurrent chemo radiotherapy.

**Figure 4.** Comparison of eating rates for digital-select users in the cisplatin, non-cisplatin groups, and CRT-groups.

Of the severity of the disease (stage) in Chem-select patients, the using rate of digital-select and the eating rate were stage I 10 cases, 80% (33-100; $P < .05$) and eating rate 81% (29-100; $P = .17$), stage II 4 cases, 76% (40-100; $P = .87$) and eating rate 84% (17-92; $P < .05$), stage III 8 cases, 71% (50-100; $P = .25$) and eating rate 88% (46-100; $P = .06$), stage IV 30 cases, 63% (11-100; $P = .30$) and eating rate 78% (21-100; $P < .05$), and stage unclear 23 cases (hematopoietic tumor 14, sarcoma 4, other 5), 67% (13-100; $P = .10$) and eating rate 73% (24-100; $P < .05$); thus, no difference was observed (using rate of digital-select; $P = .39$ eating rate; $P = .96$; ANOVA). Of the severity of the disease (stage) in CRT-digital-select patients, the using rate of digital-select and the eating rate were stage I one cases, 93% and eating rate 79%, stage II one cases, 14% and eating rate 98%, stage III 4 cases, 40% (29-100; $P = .05$) and eating

rate 66% (35-98; $P = .77$), stage IV 4 cases, 21% (10-71; $P = .14$) and eating rate 93% (82-100; $P = .88$), and stage unclear 2 cases (sarcoma 2), 92% (85-100; $P = 1.00$) and eating rate 31% (15-47; $P = 1.00$); thus, no difference was observed (using rate of digital-select; $P = .13$ eating rate; $P = .06$; ANOVA).

Discussion

This retrospective exploratory observational study investigated the connections between digital-select and cancer chemotherapy patients. The number of digital-select patients per day over a 35 days menu cycle was 40 out of 253. The average age of the patients was 53 years, and no difference was observed between the sexes. The daily rate of digital-select usage was 15.9%. According to a report by Hartwell et al,⁸ the introduction of touchscreen selectable meals in a hospital in

the UK (3000 meals/day) showed patient satisfaction, but the issue remained that the older the patient, the more difficulty using the system. In addition, it was reported that there were many errors in the touch screen in a randomized trial of dietary records of elderly people in Taiwan.²⁴ Considering the results of this study, patient age is believed to have affected the low usage rate of digital-select, as reported in previous studies.^{8,14} However, society is becoming increasingly digitized, and as the current younger generation reaches old age, there is a possibility for active growth in digital-select patients.^{1,25,26}

The repeat rate for chem-digital-select patients and CRT-digital-select patients was high at 87% and 100%. A strong correlation was observed between the number of days of admission and the number of days of using digital-select. The eating rate was high at 81% (chem-digital-select patients) and 81% (CRT-digital-select patients), and no difference was observed between the cisplatin group (strong emetic effects), the non-cisplatin group and CRT group. Antiemetics were administered on the same day in all cases. Based on these results, it was found that a longer admission period resulted in higher versatility of digital-select, and the convenience of digital-select was beneficial for the maintenance/improvement of QOL in hospitalized cancer patients.^{10,11} The clinical significance of digital-select was confirmed with a high eating rate of 81% and 81% regardless of the emetic effect (Figure 4). Investigated to group patients based on the severity of the disease and then analyze the data. The severity of the disease not affected the patient's ability to choose food. Young and Farrah⁹ reviewed various research papers related to clinical efficacy and evidence for the cost-effectiveness of substituting hospital meals with room service and food delivery, but there was no reference to the efficacy of digitized touchscreen selectable meals for cancer patients. Additionally, Munk et al²⁷ reported on the introduction of 24-hour à la carte selectable meals as hospital meals for malnourished patients, and found improvements in total caloric value depending on time of day. Taking these reports into account, it is thought that evidence for clinical efficacy (sufficient utilization of the system to maintain a high eating rate in over 80% and 81% of patients) and cost-effectiveness can be obtained in chemotherapy patients and CRT patients using digital-select.^{3,28-30} In all likelihood, the reason a high eating rate was obtained in this study was because patients actively selected what they wanted to eat despite their cancer treatment. Hopefully future discussions will focus on how the desire to eat something affects patients' food selections. Furthermore, despite a relatively low daily digital-select usage rate, the fact that positive factors were observed (a correlation between admission period and frequency of use, eating rate, and repeat rate) was likely due to the potential for information exchange about digital-select between patients. Also, while the usage rate for digital-select was low in this study, beneficial aspects were observed, such as the lack of need for registered dietitians to implement face-to-face nutritional interventions,^{8,20-23} and the

support of oral intake in cancer patients. This study will be an examining digital and modern facilities to improve the malnutrition problem of cancer patients.

One limitation of this study was that only digital-select users were analyzed, which could affect study bias.

Conclusions

Although the usage rate of digital-select was low, support for the system was observed among chem-digital-select patients and CRT-digital-select patients in terms of high eating rates, regardless of the level of toxicity of chemotherapy (emetic effect). It is thought that digital-select has various benefits for cancer patients and can play a supportive role during chemotherapy.

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Author Contributions

Takashi Aoyama performed the experiments, data analysis, and interpretation and drafted the manuscript. Takashi Aoyama read and approved the final manuscript.

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