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ORIGINAL**Comparison of Measured Resting Energy Expenditure between Cancer Patients and Non-Cancer Controls**Chen Seong Ting^{*1}, Wong Wei Wen¹, Lydianis Bahari² and Ratha Krishnan Sriram³¹*Division of Nutrition & Department, International Medical University, Kuala Lumpur, Malaysia*²*Department Dietetics and Food Service, Hospital Tuanku Jaafar, Negeri Sembilan, Malaysia*³*Department of Surgery, Hospital Tuanku Jaafar, Negeri Sembilan, Malaysia*

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ABSTRACT *Background and purpose.* Resting energy expenditure (REE) is generally known to be increased in cancer patients, contributing to the development of malnutrition and cachexia. The objective of this study is to compare the difference in measured REE between cancer patients and non-cancer controls. *Methods.* A cross-sectional study was conducted from January to April 2018 to compare the REE between cancer patients and non-cancer controls. A total of 25 patients diagnosed with colorectal cancer and 19 non-cancer controls were recruited using purposive sampling method. Data collection included socio-demographic characteristics, anthropometric measurements, dietary data and REE measured by the Fitmate GS Indirect Calorimetry instrument. Statistical analyses used were independent sample T-test and one-way Analysis of Covariates (ANCOVA) to compare the difference in measured REE between the two groups. *Results.* There was no significant difference in measured REE ($p=0.053$) and REE/kilogram of Fat-Free Mass (REE/kg FFM) [$p=0.372$] between cancer and control groups. The one-way ANCOVA showed that there is no significant difference in measured REE ($p=0.100$) between cancer and control groups after controlling for the covariate of fat-free mass. Similar observation was also found in REE/kg FFM between the two groups after controlling for age ($p=0.486$). Unaltered REE found in colorectal cancer patients as compared to control group with strong confounding factors such as age and FFM controlled implicates the importance of a more reasonable and individualised approach in dietetics practice when caloric load is administered to cancer patients, as opposed to a conventional approach of supplying a caloric surplus beyond maintenance level.

Keywords: Resting energy expenditure (REE), cancer, indirect calorimetry.

INTRODUCTION

Cancer is a global epidemic, causing around 8.8 million deaths in 2015 according to World Health Organization (WHO) (1). It is a fourth leading cause of death in Malaysia according to Malaysian National Cancer Registry (MNCR). A total of 64,275 cancer deaths had been reported over the year of 2007 to 2011. The overall cancer incidence peaks at a total of 103,507 new cases from 2007 to 2011 (2). Cancer is a collection of genetic diseases characterised by uncontrolled cell growth, in which the cancerous cells exhibit genetic alterations such as DNA mutations. These genetic changes affect how the cells function and behave. Through their genetically altered functionality and physiology, cancerous cells form a mass of tissue called tumour, which invade and destroy other body parts through a process called metastasis.

Resting energy expenditure (REE) is the amount of energy required to sustain basal metabolism for a 24-hour period at rest (3). REE comprises the largest proportion of human energy output, accounting up to 60-75% of total daily energy expenditure (TDEE) (4). REE is reported to be abnormally altered in cancer patients. Depending on the type of cancer, patients were shown to exhibit either normal or increased REE values. Hypermetabolic activity as in increased REE contributes to weight loss through the creation of negative energy balance and progressive tissue wasting, which is a defining characteristic of malnutrition observed in 30 to 80% of cancer patients (5). REE alteration plays a significant role in accelerating weight loss, which then subsequently progresses the development of malnutrition and cachexia. Malnutrition and cachexia are poor prognostic factors for cancer patients, and studies have

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shown that it is a risk factor for negative outcomes, treatment response and quality of life (6). Furthermore, primary cause of deaths in cancer patients was suggested to be due to imbalances in nutrition metabolism (7). Ironically, despite the negative health outcome implicated and the benefits of nutritional intervention, malnutrition is often neglected in clinical settings (8). This demands an understanding of REE changes to facilitate the delivery of an optimal nutritional intervention. Determining the discrepancies of REE between cancer patients and non-cancer controls will allow us to administer an appropriate caloric load, to rectify the nutritional status in cancer patients without risk of underfeeding or overfeeding (9).

REE difference in cancer patients remains uncertain and unclear due to various methodological flaws such as heterogeneity in cancer type among studies. Also, most relevant scientific studies were not conducted locally. Therefore, we aim to compare the differences in REE between cancer patients and non-cancer controls for a better guidance of evidence-based practice by dietitians in improving the nutritional status of cancer patients.

METHODS

Study design

This study was a cross sectional study conducted from January to April 2018 among cancer patients and non-cancer controls. The study site was the Surgical Outpatient Department of the State Hospital of Negeri Sembilan. Ethical approval was obtained from the International Medical University Joint-Committee on Research and Ethics [IMU-BDN I-2017 -13] and from the National Medical Research Registry, Ministry of Health Malaysia (NMRR-17-3166-39347). Informed consent was obtained from all study participants before enrolment, consistent with the Helsinki Declaration and the guidelines of the institutional review committee.

Power and sample size

The sample size was calculated based on published data on REE in cancer patients (Khor SM, 2011) (10). A standard deviation of 178 for REE in cancer patients was used at 80% power with a type I error of 5% ($\alpha=5\%$) alongside with a detectable difference of 15, the estimated sample size is 31 per group taking into consideration of 10% drop-out.

Participants

Purposive sampling method was used to select study participants. Participants will be pre-screened by the attending surgeon for eligibility as per appointment to the surgical outpatient clinic, having fulfilled all the inclusion criteria and presenting none of the exclusion criteria. Participants were provided with the information sheet and explained by the research team regarding the study and written consent was obtained upon agreement to join the study. Participants were recruited if they were cancer patients and non-cancer controls, age 20 years old and above. For cancer patients, the inclusion criterion was the diagnosis of colorectal cancer. Participants were excluded if they were having severe endocrine abnormalities such as hypothyroidism or hyperthyroidism, using high-dose steroid medication, with presence of inflammatory diseases other than cancer or infection, and presence of oedema or ascites. Pregnant and breastfeeding women, smokers, individuals with diabetes or HIV, kidney, liver, heart or lung disease and

individuals who have experienced trauma or burn were excluded. Cancer patients who underwent surgery one month or anticancer treatment such as chemotherapy before the study participation were also excluded. These exclusion criteria were set based on their independent effects on energy expenditure.

Measurements

A self-administered questionnaire was designed to collect socio-demographic profile of the participants. It included gender, ethnicity, age, occupation, marital status, smoking status, education level, household monthly income and medical history.

For dietary assessment, the research team interviewed the participants on a 7-day dietary history to evaluate usual dietary intake. A structured interview method consisting of questions was used to prompt for the habitual intake of foods from food groups and frequency of consumption per week. Nutripro Software was then used to analyse the energy and macronutrient intake. A mean of energy and nutrient intake were recorded.

Weight was measured using a digital weighing scale (Tanita, Japan) and height was measured using a stadiometer (SECA, Hamburg, Germany). BMI was then calculated using the obtained weight and height measurements. BMI was classified according to the Asian Pacific cut-off criteria for adults and recorded. The body fat percentage of participant was measured using bioelectrical impedance analysis machine (OMRON Karada, Omron Healthcare, Japan). Fat-free mass (FFM) was calculated with subtracting the calculated fat mass from body fat percentage using the formula of $FFM = \text{Body weight (kg)} - [\text{Body fat percentage (\%)} \times \text{Body weight (kg)}]$. All measurements were taken two times and an average of the two readings was obtained and recorded.

REE was measured using Fitmate GS Indirect Calorimetry. Participant was informed to relax and lie down on a bed. They were requested not to sleep or talk during the analysis to avoid interference with normal breathing. The Fitmate Indirect Calorimetry was first calibrated and the blower unit was turned on. The first phase of REE measurement was initiated by placing the hood with veil on the patient's head. The veil was safely enclosed over the patient to minimise air leakage. After 5 minutes of default test phase, the data acquired was discarded. The data collected during the first phase was to ensure accuracy. Then, the actual data acquisition phase commenced for 10 minutes. Flow rate of the pump was required to be monitored so it achieves a FeO_2 between 19.50% and 20.25% by adjustments with the flow selector. After a default 15 minutes of data acquisition phase, the test was ended. The hood was removed from the patient and the blower unit was turned off. REE was expressed in REE (kcal) and REE/kg FFM (kcal/kg).

Statistical Analysis

Statistical analyses were performed using the IBM SPSS Statistics 24. Descriptive statistics were used to describe the baseline data. The parametric data were presented as mean \pm SD, where comparisons between groups were done using independent sample T-test for continuous variables. The non-parametric data were presented as median \pm IQR, where comparisons between groups were done using Mann-Whitney U test. Pearson's chi-squared tests were used for comparison between

groups for categorical data. The mean difference of measured REE (kcal) and REE/kg FFM (kcal/kg) between cancer patients and non-cancer controls were compared using independent sample T-test. The mean difference of measured REE (kcal) controlling covariate of FFM between cancer patients and non-cancer controls and REE/kg FFM controlling covariate of age between groups were analysed using one-way ANCOVA. All *p* values of less than 0.05 were statistically significant.

RESULTS

Twenty-five patients with colorectal cancer and nineteen control subjects were recruited in this study. Out of all the cancer patients, 22 of them have undergone tumour resection surgery, after which they are following up for check-up and palliative care, whereas the other 3 of them have not undergone any tumour resection. Table 1 shows the socio-demographic characteristics of 25 colorectal cancer patients and 19 control subjects. Independent sample *t*-test showed significant mean differences in age (65.4 ± 10.4 vs 45.0 ± 12.4 , $p < 0.001$) and in height (155.0 ± 9.1 cm vs 160.5 ± 8.2 cm, $p < 0.05$) between cancer and control group. Mean age of cancer patients was significantly older than the mean age of control subjects, and the mean height of cancer subjects was significantly shorter than that of the control subjects. In terms of REE and REE/kg FFM, there was no significant difference in measured REE (1188 ± 314 kcal/day vs 1372 ± 287 kcal/day, $p > 0.05$) and REE/kg FFM (28.7 ± 7.9 kcal/kg/day vs 30.6 ± 5.8 kcal/kg/day, $p > 0.05$) between cancer and control group. Pearson's chi-squared test also showed no statistically significant association for gender and ethnicity with cancer.

As for the comparison of energy and macronutrient intake between cancer and control group, Mann-Whitney U test showed a significant difference in fat intake between cancer and control group (46 ± 26 g/day vs 59 ± 23 g/day, $p < 0.05$). The control group had significantly higher fat intake than the cancer group. There was no significant difference in calories intake, carbohydrate intake and protein intake between cancer and control group.

Fat-free mass (FFM) is a strong determinant for REE in both genders (11). FFM is a heterogeneous component with higher metabolic activity than fat mass, as skeletal muscle mass and liver mass have been reported to significantly contribute to REE. In view of this, FFM has been proposed to overtake body weight as an adjustment factor in the determination of REE (12,13). Table 2 shows a one-way ANCOVA conducted to compare the difference in measured REE between cancer and control group whilst controlling for FFM. Levene's test, normality test, and homogeneity of regression were checked, and assumptions were met. Yet, there was no significant difference of measured REE between cancer and control group, after controlling for FFM ($p = 0.100$).

Age was significantly different between cancer and control group ($p < 0.001$) in this study. According to Elia et al, aging is associated with a progressive decline in REE of 1-2% per decade after 20 years of age. This decline is closely related to a reduction of fat-free mass (14). The one-way ANCOVA comparing the difference in REE/kg FFM between cancer and control whilst controlling for age (Table 3) shows no significant result ($p = 0.486$).

Table 1. Baseline data

Parameter	Cancer (n=25)	Control (n=19)	<i>P</i> value
Gender, Male : Female	11:14	8:11	0.900 ^b
Ethnicity, Malay : Chinese	12:13	4:15	0.066 ^b
Mean \pm SD			
Age, year	65.4 \pm 10.4	45.0 \pm 12.4	0.000 ^a
Weight, kg	62.0 \pm 12.5	69.4 \pm 16.9	0.099 ^a
Height, cm	155.0 \pm 9.1	160.5 \pm 8.2	0.048 ^a
BMI, kg/m ²	25.7 \pm 4.1	26.9 \pm 5.6	0.412 ^a
FFM, kg	42.8 \pm 10.9	46.3 \pm 12.0	0.320 ^a
mREE, kcal/day	1188 \pm 314	1372 \pm 287	0.053 ^a
REE/kg FFM, kcal/day/kg	28.7 \pm 7.9	30.6 \pm 5.8	0.372 ^a
Median \pm IQR			
Calories intake, kcal/day	1294 \pm 482	1308 \pm 406	0.678 ^c
Carbohydrate intake, g/day	176 \pm 102	148 \pm 79	0.084 ^c
Protein intake, g/day	55 \pm 29	60 \pm 25	0.546 ^c
Fat intake, g/day	46 \pm 26	59 \pm 23	0.030 ^c

^a Independent sample *t* test

^b Pearson Chi-Square test

^c Mann-Whitney U Test

REE: Resting Energy Expenditure; FFM: Fat free mass

Table 2. Comparison of measured REE between cancer and control group with and without adjustment of FFM using ANCOVA

	n	Mean	Mean difference	P value
Cancer	25	1188±314	-157.910	0.053 ^a
Control	19	1372±287		
Cancer	25	1208(1100, 1316) ^b	-116.325	0.100 ^c
Control	19	1346(1222, 1470) ^b		

Data are expressed as mean ± SD unless specified otherwise

^a Independent sample T test

^b Mean (Lower Boundary, Upper Boundary)

^c ANCOVA applied (adjustment for FFM)

Table 3. Comparison of REE/kg FFM between cancer and control group with and without adjustment of age using ANCOVA

	n	Mean	Mean difference	P value
Cancer	25	28.7±7.9	-1.95	0.372 ^a
Control	19	30.6±5.8		
Cancer	25	30.3(26.5, 30.0) ^b	-1.20 (-3.7, 7.7) ^d	0.486 ^c
Control	19	28.3(24.0, 32.6) ^b		

Data are expressed as mean ± SD unless specified otherwise

^a Independent sample t test

^b Mean (Lower Boundary, Upper Boundary)

^c ANCOVA applied (adjustment for FFM)

^d Mean difference (Lower Boundary, Upper Boundary)

DISCUSSION

Resting Energy Expenditure

Earlier studies reported that cancer patients had significantly increased REE and untreated leukaemia patients had been reported to exhibit elevated basal metabolism (15,16). However, recent studies have shown that actual energy expenditure of cancers were not accurately captured and inconsistent findings had been reported in a meta-analysis investigating changes of REE in cancer patients (17,18). There is an unresolved uncertainty due to discrepancy of results, which is a gap to be filled. Furthermore, very limited studies and information are currently available with regards to REE status in Malaysian colorectal cancer patients.

In this study, no significant difference was found in measured REE between cancer and control group. This finding is in agreement with a large-scale study by Cao et al featuring over 714 cancer patients and 642 controls (19) as well as other studies by Baidi et al, Fredrix et al, Ceolin Alves et al, Dempsey et al and Nixon et al (10,20,21-23). Fat-free mass consumes more energy at rest than their non-metabolically active counterparts such as adipose tissue. It is an important confounding variable that needs to be adjusted for in measurement of REE (24). Hence, for a more meaningful comparison of REE between individuals, expression of REE per kilogram FFM allows us to discover metabolic rate proportional to FFM and to eliminate this confounding variable. Upon adjusted expression of REE for FFM, the result of this study showed no significant difference of REE/kg FFM between cancer and control group.

Using one-way ANCOVA controlling for the covariate of FFM, no significant difference in measured REE between cancer and control group was observed. Since FFM is positively correlated with REE with statistical significance ($p < 0.001$), a lack of significant difference in REE after adjustment for FFM indicated that there was no elevated energy expenditure proportional to FFM in the presence of colorectal cancer. This result again, agrees with the study of Cao et al, which observed no significant difference in REE/kg FFM for colorectal cancer group, the homogeneous type of cancer subjects recruited in this study (19). In the study of Cao et al, no significant difference was observed in measured REE between different types of cancer and control group. Upon adjustment for FFM, significant differences of REE/kg FFM were observed between other types of cancer such as esophageal cancer, pancreatic cancer, gastric cancer and control group but no significant difference in REE/kg FFM was observed between colorectal cancer and control group. This implicated that adjustment for FFM is indicated for a correct interpretation of REE changes in different types of cancer, as logically reasoned by the effect of independent effects of FFM on REE.

Furthermore, Cao et al (19) also indicated that no elevated energy expenditure per kg FFM was present in colorectal cancer patients. Nonetheless, this was in conflict with the study finding of Baidi et al and Reeves et al, which found that significant difference in REE/kg FFM was observed between cancer and control after adjustment for FFM (10,25). Discrepancy in findings can be attributed to the heterogeneous feature of cancer group in the studies of Baidi et al and Reeves et al, which

included solid tumours of different cancer types and leukaemia patients. Considering REE was not altered upon adjustment for confounder and FFM was not significantly different from control in the presence of colorectal cancer, interpretation of these results implicates that REE is not uniformly elevated in all cancer patients, providing convincing support that REE experiences different degree of abnormal alteration in different clinical disease characteristic in cancer, as coherently suggested by the study of Fredrix et al which reported that the type of tumour plays an important determining factor of REE changes in cancer patients (20). Hansell et al reported in a study that in cancers with different type of tumour, different effect on fat-free mass was incurred and hence REE changes differed (26). Considering how energy metabolism alterations can be affected by FFM and differ from one type of cancer to another due to numerous factors affecting metabolic alteration in cancer (17), important considerations about the results presented in these studies involve controlling for homogeneity in clinical characteristics of cancer such as type of cancer as recommended by the study finding of Hansell et al and progression of disease and adjustment for significant confounding variable (26). As such, results generated from these studies also lack power to validly demonstrate a clear picture of the changes in REE of colorectal cancer patients.

Judging from a perspective for practicality from this study, the colorectal cancer patients in this study featured 88% (n=22) tumour-resected subjects who were in follow-up palliative care. Hence, results obtained may be less accurate or bear less meaningful generalisability for patients who are not under palliative care but facing a more aggressive or advanced stage of colorectal cancer as studies have repeatedly shown that presence of tumour, aggression as in metastases and stages of cancer may experience significantly elevated REE or metabolic rate (27-29).

Dietary intake

In our study, 88% (n=22) of the colorectal cancer subjects underwent surgical resection of tumour and were in routine follow-up care. Hence, an increased need for thoughtful nutrition care approach is implicated as a systematic review reported that adherence to quality nutrition is inversely associated with overall mortality in cancer survivors (30).

In our study, mean energy, carbohydrate and protein intake were assessed and no significant differences were found between cancer and control group. However, significant difference was observed in fat intake between cancer and control group. The healthy control group consumed significantly higher fat intake than the cancer group. This result does not agree with the cross-sectional study of Kim et al which reported that no significant difference was observed in total fat intake between colorectal cancer patients and healthy controls. The mean fat intake of cancer and control group were 46g and 58g, which amounts to 32% and 40% of total energy intake respectively. Fats intake in healthy control group exceeded the upper limit of 35% total energy intake for

fats set by RNI 2017 Malaysia (31). High diet quality index and healthy pattern of diet as defined in low intake of high fat foods were reported to be associated with a reduced risk of mortality in cancer survivors, whereas Western dietary pattern as defined by high fat intake was associated with higher risk of mortality in colorectal cancer survivor (30). Moreover, Meyerhardt et al reported in a study that colorectal patients who scored high for Western dietary pattern, who is characterized by high fat intake, refined grains, red and processed meat had 3-fold risk of cancer recurrence (32). The integrated interpretation of these differing studies indicates that a more prudent nutrition education post treatment in cancer patients would be an increase in energy and protein intake without corresponding increase in fat content or use of processed meats.

Limitation

There was limitations in this study as the sample size of colorectal cancer patients was small, which imposes technical limitation on statistical analysis in reducing power to detect differences that may, in fact, exist, and may not be representative of colorectal cancer patients, which is prerequisite for generalisability of results. As a result, the validity of the study was undermined, and extrapolation of results to other colorectal cancer patients have lacked in validity as well. Hence, a study with larger sample size should be used in the future.

In conclusion, colorectal cancer patients showed no significant difference in measured REE as compared to healthy, normal controls. Even after adjustment and control for FFM, no significant difference was observed in the REE/kg FFM between cancer and control group. Considering the limitations of our study, a study matched for socio-demographics, with a larger sample size and homogeneous feature of cancer clinical characteristics is implicated to validate the findings from this study and as well as providing clearer picture on the effect of cancer on REE. As cancer is most popularly believed to elevate REE, and together in reference with studies showing that excessive caloric prescription for cancer patients are detrimental and deleterious (33,34); clearly, unaltered REE in colorectal cancer patients implicates the importance of a more reasonable and individualised approach in dietetics practice when caloric load is being administered. A one-size-fit-all model of nutrition care is ill advised. Furthermore, in post-treatment cancer patients, nutrition education may prove to be of significant usefulness as dietary intake are associated with recurrence or survival in cancer survivors.

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ORIGINAL**Comparison of School Lunch Menus in Vietnam and Japan**

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ABSTRACT *Background and Objectives:* Vietnamese school lunch program needs improvements. For that purpose, this study aimed to compare Vietnamese and Japanese school lunch menus and food materials. *Methods and Study Design:* The study was a cross sectional study which data were collected throughout the year from elementary schools in both countries, categorized the menu items into six, numbered all food items, and tabulated the occurrence frequencies for each item. Each country had 190 lunches. *Results:* The menu diversities in Vietnam and in Japan was 23 and 190 with item numbers were 3 and 74 for staple foods, 26 and 95 for main dishes, 9 and 107 for vegetables, 14 and 53 for soups, 1 and 41 for desserts, 0 and 5 for beverages, and total 53 and 376. Standard deviations for items were small, indicating menus similarities from the chosen schools. Menus and food items numbers were different. *Conclusions:* The factors are discussed to develop future strategies for improving the Vietnamese school lunch.

Key Words : school lunch, menu, food items, primary school, children

INTRODUCTION

Since 1986, the Vietnamese economic system has changed and improved greatly, which resulted in easily available and abundant foods. Along with this, intake of high energy foods has been increasing, which contributes to obesity and other lifestyle-related diseases(1). This problem is growing in children, especially in big cities(2-6).

Until about a decade ago, children usually had lunch at home. Nowadays, parents are busy and the time to prepare lunches is limited(1,7). For this reason, many schools have started a school lunch program(1). However, the school lunch program is still under development because meals are prepared by ordinary people without a proper knowledge of nutrition(8). The repetition of items is frequent, making the menus monotonous(1). As a result, children tend not to eat well and to waste food.

In contrast, people all over the world rate the Japanese school lunch program very highly(7,9,10). It was established under the school lunch law of 1951(11,12). The school lunch program is managed by school dietitians, about half of whom also provide nutrition education through school lunch as nutrition teachers(10,11). Thus, the Japanese school lunch

system has developed from merely satisfying hunger to meeting several goals, especially for the health of children(11). In this study, we compared school lunch menus in Vietnam and Japan for the purpose of improving the school lunch program in Vietnam.

MATERIALS AND METHODS

We contacted public schools in each country randomly until three schools in each country agreed to cooperate for this study. The ethical consideration was not required. No human participation was included. The schools and students information were closed. The data needed for the research were the menus data. All the menus in the last year were collected from each school. After the collection, we classified items in the menus into 6 groups (Group 1: staple foods, Group 2: main dishes, Group 3: side dishes, Group 4: soups, Group 5: desserts, and Group 6: beverages). All the daily food items in each group throughout a year were entered in a table by school.

Statistical analyses Variables were checked for normal distribution and compared by unpaired Student *t*-test. *p*-values of less than 0.05 were considered statistically significant for all the analyses. The above statistical procedures were performed using Excel (Microsoft Excel version 10)

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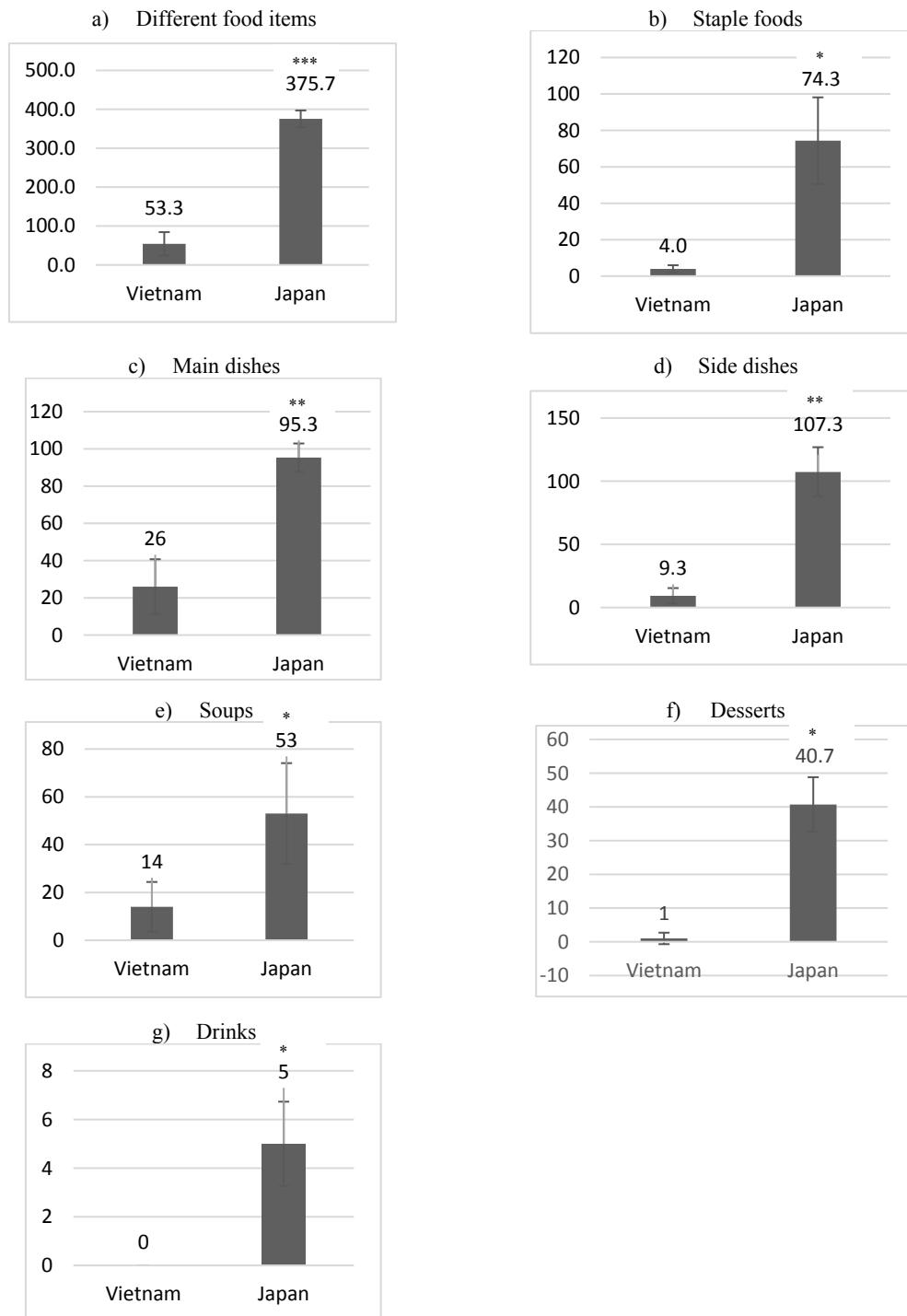


Fig1. Foods used in a year at schools in Vietnam and Japan (number)
 *, **, *** Significantly different at $p < 0.05$, 0.01 and 0.001, respectively.

RESULTS

Fig. 1 shows the numbers of a) different food items, b) staple food, c) main dish, d) side dish, e) foods in soup, f) dessert and g) drink. Values are means \pm SD. When p -values lower than 0.05 were considered statistically different between the two countries.

The numbers of different food items in Vietnam and Japan were, respectively 53.3 ± 30.1 and 375.7 ± 21.5 ($p=0.0002$) (Fig.1 a). The numbers of food items in Vietnam and Japan were 4.0 ± 2.0 and 74.3 ± 23.8 for staple foods ($p=0.05$), 26.0 ± 14.7 and 95.3 ± 7.6 for main dishes ($p=0.01$), 9.3 ± 6.1 and 107.3 ± 19.6 for

side dishes ($p=0.0006$), 14.0 ± 10.4 and 53 ± 21.1 for soups ($p=0.03$), 1.0 ± 1.7 and 40.7 ± 8.1 for desserts ($p=0.02$), and 0.4 ± 0.7 and 5.0 ± 1.7 for drinks ($p=0.04$) (Fig.1b-g).

Fig. 2 shows the frequency of occurrence of main dishes (%). The frequencies in Vietnam and Japan respectively were 85 ± 13 and 64.3 ± 4.2 for meat ($p=0.03$), 32 ± 3.5 and 32.7 ± 3.1 for fish ($p=0.41$), 21 ± 3.6 and 7.3 ± 2.5 for eggs ($p=0.002$) and 11.7 ± 2.9 and 11.3 ± 1.5 for soybean products ($p=0.43$). Frequencies of meat were higher in Vietnam than in Japan and frequencies of egg were vice versa. Frequencies of fish and soybeans were similar in the two countries.

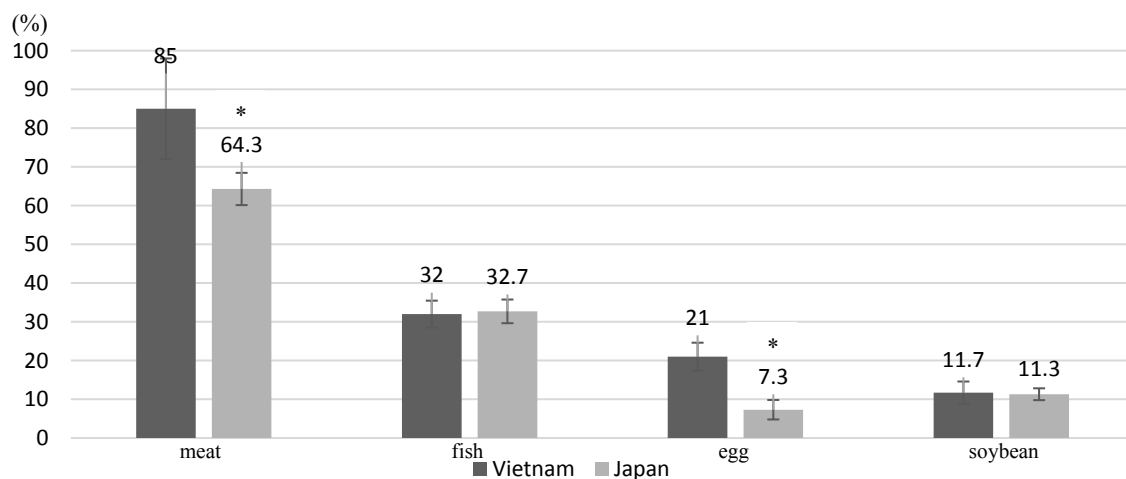


Fig.2 The frequency of occurrence of main dishes

* Significantly different at $p < 0.05$

DISCUSSION

Both Vietnam and Japan have 190 lunches. However, there were 23 menus in Vietnam and 190 menus in Japan. The number of food items in Vietnam and Japan, respectively were staple foods 4 and 74, main dishes 26 and 95, (side dishes 9 and 107, soups 14 and 53, desserts 1 and 41, and drinks 0 and 5. Total food items were 53 in Vietnam and 376 in Japan. This indicated that the two countries have a similar number of lunches, but Vietnam has fewer food items than Japan does. We can point to some factors for the differences which may be useful for the improvement of Vietnamese school lunches.

First, the placement of high quality professional staff should be considered for the Vietnamese school lunch program. The

Vietnamese school lunches are prepared by ordinary people with no educational background in nutrition, while professional school dietitians are available in basically every school in Japan(1,8,14,15). Furthermore, about half of these dietitians have their teacher's license and are officially designated as school nutrition teachers. As professionals, they are required to make nutritious, tasty, and educational menus, which essentially increase the variety of menus for Japanese school lunches (11,13).

The Vietnamese school lunches adopt cycled menus for two to four week periods(8). Obviously, menu variety is low and children might get bored with the meals offered. This may result in an increase in food waste. In Japan menu charts are given to every student's family a month in advance so that family members

know what their children will be eating(11). It is also recommended that the menu chart, along with the food items, be prominently posted at each student's home so that everyone in the family can easily refer to it(14). Parents and guardians can avoid serving the same items for lunch and dinner and it is also useful in preventing food allergy problems(11). This system motivates the school dietitians to take their task seriously. Consequently the variety of menu increases. Occasionally, professional school dietitians serve food that children dislike with the purpose of establishing good dietary habits(11,13). They try to use various cooking methods to provide good-tasting dishes for the children(7). With these trials, dietitians are capable of providing varied menus.

The Japanese government has recommended the use of locally available foods at home and in the community(14). School lunch is no exception(11). All children receive compulsory education for 9 years from 6 to 15 years old and 99% of elementary school students and 75% of junior high school students have school lunch(16). For locally produced items, the local agricultural association provides information about vegetables that will be available in following months(11). The use of locally available foods also increases their seasonal variation. Japan has spring, summer, fall, and winter. Food products, from vegetables to fish, thus vary according to the seasons. Consequently, the effort to use locally available foods increases variety in lunch menus.

Cost is an important factor for the variety of foods. The cost of school lunch in Vietnam is borne by parents, while in Japan parents need to pay only for food materials, which contributes to greater variety of materials(1,11). When locally available foods are included, the food materials cost will become less expensive(10). In Vietnam, the morning of each school day, kitchen workers go to markets and purchase the most economical foods they can find, which also the foods that are currently in season. This consequently decreases the variety of menus.

Dietary reference intakes (DRIs) for Japanese school lunches may increase food variety(11). Unfortunately, DRIs are not available in Vietnam, so the aim of the school meal program is just to satisfy hunger, which is easier to do with high energy foods. Cycle menus without DRIs and professional supervision may contribute to the frequent use of high energy

foods in the menus. Consequently, food variety is reduced. It is unlikely that good dietary habits can be formed under such conditions. DRIs with professional supervision are required for school meal programs in Vietnam to foster good food habits.

The use of greater food variety has been positively influenced legal developments(11). When the Second World War ended, Japanese suffered hunger(13). In 1945, the Head of Public Health and Welfare of GHQ suggested the introduction of a school lunch program to the Japanese government(13,17). In 1951, a national school lunch law was established(17). Under this law, Japanese school lunch has developed impressively, including the presence of a school dietitian in every school. In 2005, the Japanese National Shokuiku Basic Act became law(18). The law focusses on 'shokuiku', the Japanese word for food and nutrition education, and a good model for healthy daily meals is indicated inside(19).

A limitation of this study is the small number of schools surveyed but schools were concerned about student privacy. In order to collect data that would be closer to ordinary children we conducted the study in public schools. We contacted about 10 schools randomly in each country until three schools agreed to cooperate in this study. Standard deviations of all the results were small, suggesting that the three schools chosen had similar lunches and also suggesting that these schools were not special and the data may be representative.

Another limitation of this study arises from considering rice as a staple food. Vietnam has 4 types of rice while Japan has 36 types. This occurs because the Vietnamese use rice just the way it is, while the Japanese use rice mixed with vegetables or meats, which is counted as a staple food(1,11). Whether it is appropriate to count mixed rice as a staple food remains debatable.

In conclusion, in this study we found that the Vietnamese school lunch program should increase the variety of menus and food items. To achieve this, active participation by nutrition professionals in the management and preparation of school meals may be the most important factor.

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ORIGINAL**Acceptability of Fish Meat with Okara as School Lunch**

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ABSTRACT Background: At present in Japan, fish consumption is decreasing. It is desirable that through their school lunch children will learn that fish is tasty. Deficiency of fiber intake is also a problem in Japanese people. Supplying enough fiber is a difficult task in school lunch. Okara is a byproduct created during the process of tofu production. It is mainly fiber and has the potential for beneficial uses. Since in the past there has been little study on supplying fiber from main dishes, we were challenged to address this topic. **Purpose:** To develop tasty main dishes from fish meat with Okara. **Methods and results:** As a preliminary study, we conducted various trials to make a tasty base of “fish and Okara” that looked like hamburger shaped, that has one portion (80g) of the final base could supply 2.2g fiber. We named it “hamburger style of fish and Okara”. It was served to all the 349 children from the first to 6th grade in a school lunch at a Japanese school and evaluated by the comparison with ordinary Japanese-style meat hamburger (ordinary hamburger). Their evaluation about ordinary hamburger and “hamburger style of fish and Okara” were respectively; Overall taste is good 94 and 85%, good for easy to eat 90 and 77%, basic taste is good 93% and 83%, aroma is good 82 and 68%, appearance is good 89 and 76%. Although the results of ordinary hamburger were more favorable than those of “hamburger style of fish and Okara”, the evaluation of “hamburger style of fish and Okara” was high. Waste of them was only 2.2 and 4.6% by weight, respectively. **Conclusion:** “Hamburger style of fish and Okara” was highly evaluated by school students and these dishes helped to meet the fiber requirement from school lunch.

Keywords: Okara, fish, hamburger, fiber, school lunch.

INTRODUCTION

As a problem of the current Japanese dietary habits, there is a lack of dietary fiber intake. In the Japanese Dietary Reference Intake reported in 2015 by the Ministry of Health, Labor and Welfare, the target amount of dietary fiber was 20 g/day or more for men and 18 g/day or more for women aged 18 to 69 years (1), however, according to the National Health and Nutrition Survey in 2017, the average intake was as low as 14.6 g/day for men and 14.3 g/day for women, and it did not meet the target amount(2). There is a similar problem even in the young generation. The reference value of dietary fiber for school lunch is 4 g or more at 6-7 years old, 5 g or more at 8-9 years

old, 5 g or more at 10-11 years old, and 6.5 g or more at 12-14 years old(3). However, the actual intake was only 4.6 g at elementary school (6-11 years old), 5.9 g at junior high school (12-14 years old)(4). Dietary fiber is one of the nutrients that are difficult to meet the requirement. In school meals, opportunities to provide children with root dishes and legumes to increase fiber intake. The ingredients used for these side dishes are often foods which children dislike. This leads to an increase in waste of vegetables(5). “Okara” is generated as a by-product in the production of tofu(6). Okara is a food containing a lot of dietary fiber (11.5 g/100 g)(7), and its value to use as a source of dietary fiber is very high. However, in Japan, less than 1 % of Okara is being used for edible(8).

Another problem is the decreased intake of fish in

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Japan. Consumption of fish that has been eaten as a protein source has been decreasing for a long time(9), and meat intake exceeds that of fishes and shellfishes in 2010.







METHODS

Development of “hamburger style of fish and Okara” We tried to develop a mixture of Okara and fish meat as a hamburger-style main dish. However, fishy smell and rough mouth feeling of Okara's texture became a problem, so we examined whether it can be eliminated by cooking method. First of all, we examined the fish odor reduction about Surimi (paste) of Lizard fish, Surimi of Scabbard fish, Surimi of Alaska pollack and Otoshimi (fragment) of Alaska pollack which are easily available as materials. Five methods were compared, namely immersed in sake, immersed in mirin, dipped in milk, dipped in ginger root juice, and covered with salt. As the results we found that dipping in milk is the best for fish odor reduction. Next, for the reduction of roughness of texture, we tried three methods (weight reduction of Okara, increase of tofu, increase of milk) and found that the increase of milk was best. By the above studies, we concluded to use Alaska pollack paste as

a main source, dipping the fish paste in milk for odor reduction and increasing milk for making the product smooth mouth feeling. In order to adjust the solidness of the dough, we decided to add rice flour. In order to chew up and improve the coloring, carrots, edamame, burdocks were carved into about 7 mm.

In this way, we made the basic fabric and developed the “hamburger style of fish and Okara” as the main dish.

Preference test Subjects were the first to sixth grade (total of 349 people) elementary school children at a school near Tokyo. As a main dish school lunch, “hamburger style of fish and Okara”, and the tastes of ordinary hamburgers made from pork and chicken ordinary used were compared. Questionnaire 1 is about the taste of “hamburger style of fish and Okara” and Questionnaire 2 is about the taste of ordinary hamburger (Fig 1). The recovery rates were 95.7 % and 97.3 %, respectively. In order to make it easy for elementary school children to understand, questions items and their expression methods were examined. Evaluation was made in three levels about overall taste, easy to eat, basic taste, aroma and appearance. Three levels are: good, ordinary and bad.

<div style="text-align: center;">  Questionnaire about taste of “hamburger style of fish and Okara”  </div> <p>Please answer the question about “hamburger style of fish and Okara” or ☒ enter the appropriate one.</p> <ol style="list-style-type: none"> 1. What grade are you in _____. ☐male ☐female 2. Was the total taste favorable? ☐Good ☐ordinary ☐bad 3. Was it easy to eat? ☐Good ☐ordinary ☐bad 4. Was it tasty? ☐Good ☐ordinary ☐bad 5. How was the smell? ☐Good ☐ordinary ☐bad 6. How was the looking? ☐Good ☐ordinary ☐bad <p>Please write in the box below whatever you felt.</p> <div style="border: 1px solid black; height: 40px; margin: 10px 0;"></div> <p style="text-align: right;">Thank you very much for your cooperation. </p>	<div style="text-align: center;">  Questionnaire about taste of “hamburger”  </div> <p>Please answer the question about “hamburger” or ☒ enter the appropriate one.</p> <ol style="list-style-type: none"> 1. What grade are you in _____. ☐male ☐female 2. Was the total taste favorable? ☐Good ☐ordinary ☐bad 3. Was it easy to eat? ☐Good ☐ordinary ☐bad 4. Was it tasty? ☐Good ☐ordinary ☐bad 5. How was the smell? ☐Good ☐ordinary ☐bad 6. How was the looking? ☐Good ☐ordinary ☐bad <p>Please write in the box below whatever you felt.</p> <div style="border: 1px solid black; height: 40px; margin: 10px 0;"></div> <p style="text-align: right;">Thank you very much for your cooperation. </p>
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Questionnaire 1.

Taste of hamburger style of fish and Okara

Questionnaire 2.

Taste of ordinary hamburger

Fig 1. Questionnaire

Table 1 shows the food material weight of “hamburger style of fish and Okara”. For one person is about 80 g. Table 2 shows the food material weight of ordinary hamburger. For one person is about 45 g.

Table 1. Food sources and their weights in 1 portion (80g) of “hamburger style of fish and Okara”

Food material	Weight (g)
Alaska pollack Surimi	22.7
Okara (law)	13.6
Tofu (Momen)	9.1
Bread crumb	3.0
Rice powder	2.0
Milk	6.3
Egg	3.8
Onion	12.1
Carrot	2.3
Burdock	2.3
Green soybean	2.3
Nutmeg	0.05
Salt	0.5
Pepper	0.05

Table 3 shows energy and nutrient concentrations. Calculated in Standard Tables of Food Composition in Japan (2015)(7).

Table 2. Food sources and their weights in 1 portion (45g) of ordinary hamburger

Food material	Weight (g)
Pork (thigh)	0.8
Chicken (thigh)	18.0
Onion	12.0
Ginger	0.8
Egg	6.0
Bread crumb	3.2
Miso (red)	2.4
Sugar	0.8
Sesame	0.8

Table 3. Energy and nutrient concentrations of “hamburger style of fish and Okara” and ordinary hamburger

	Energy kcal	Protein g	Lipids g	Ca mg	Fe mg	Fiber g	Salt g
Hamburger style of fish and Okara	81	7.0	1.8	37	0.4	2.2	0.8
Ordinary hamburger	157	11.7	9.3	23	0.6	0.6	0.4

Statistical analysis Statistical analysis was conducted by Chi-square test using Excel Statistics.

Ethical considerations We explained to the school the purpose and methods of the research and that would make every effort so that nobody can identify the school and individuals. We used only common foods. The school explained the above information to the teachers and parents and obtained their agreement.

RESULTS

Their evaluation about ordinary hamburger and “hamburger style of fish and Okara” were respectively; Overall taste is good 94 and 85 %, good for easy to eat 90 and 77 %, basic taste is good 93 and 83 %, aroma is good 82 and 68 %, appearance is good 89 and 76 %. Fig 2 shows the comparison of taste between ordinary hamburger and “hamburger style of fish and Okara”. Although the results of ordinary hamburger were more favorable than those of “hamburger style of fish and Okara”, the evaluation of “hamburger style of fish and Okara” was also high.

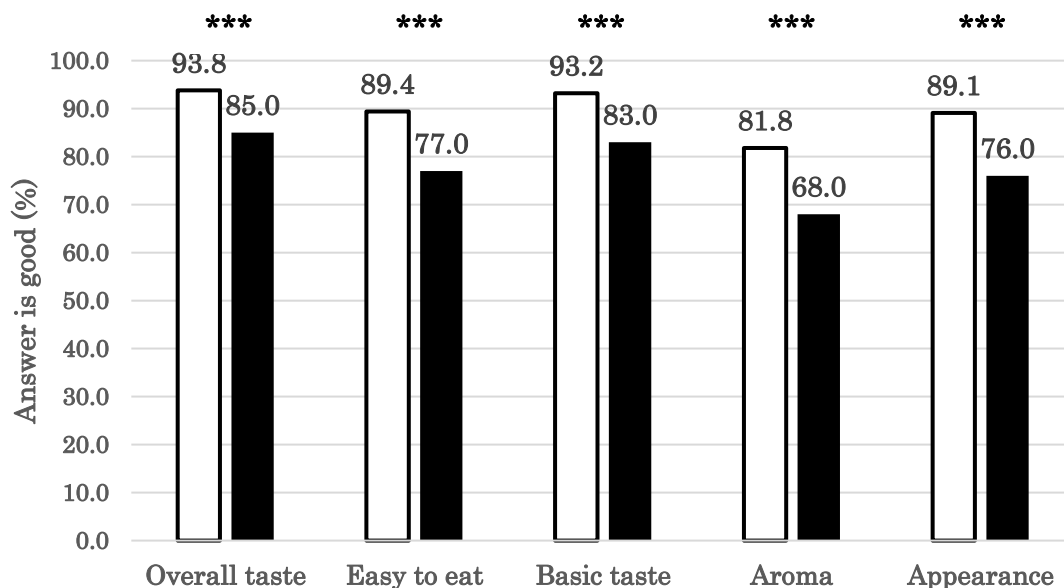


Fig 2. Comparison of taste between ordinary hamburger (□) and "hamburger style of fish and Okara" (■)
 *** Significantly different by *Chi*-square test at $p < 0.001$

Out of 43.49 kg of the total amount of "hamburger style of fish and Okara", the amount of waste was 2.01 kg and the waste rate was 4.6 %. On the other hand, out of the total volume of ordinary hamburger 26.7 kg, the amount of waste was 0.6 kg and the waste rate was 2.2 %. From Table 3, it was found that 2.2 g of dietary fiber is contained in 80 g of "hamburger style of fish and Okara". This indicates that it contains dietary fiber about 4 times more than ordinary hamburger.

DISCUSSION

"Hamburger style of fish and Okara" developed by us was able to obtain high evaluation as a result of providing it as school meal to elementary school students. Fish and Okara contain nutrients that are likely to be deficient in modern society, and various advantages can be considered, but their utilization is insufficient. Especially Okara is discarded in making tofu, but it is a food containing a lot of dietary fiber. In order to use fish and Okara as school lunch, it was an issue how to deliciously cook the odor of fish and the texture of Okara.

Dietary fiber is one of the nutrients deficient in school lunch(4,5). Root crops and legumes have many dietary fiber, but it is difficult to ingest dietary fiber sufficiently from these vegetables because there are many children left behind. It is possible to use staple food such as brown rice, but it is not realistic because it requires a special rice cooker. Pre-germinated brown rice can be cooked with ordinary rice cooker, but the price becomes somewhat higher. For these reasons, it is desired that intake of dietary fiber is taken from the main dish.

In this research, "fish and Okara" was main dishes and we examined how to make delicious dishes with them. Surimi (paste) of Alaska pollack had a considerable fish odor. We examined using sake, mirin, milk, salt and ginger. Alcohol contained in sake has the function of evaporating trimethylamine which is a component of the fish odor. Mirin also has a similar function(10). Colloidal particles of milk protein and fat tend to adsorb odor components(11). Salt exerts moisture rich in trimethylamine out of fish body due to osmotic pressure effect. Strong fragrance ginger component cineol becomes a component without smell when mixed with trimethylamine. For these reasons, we tried five methods. As a result, we were able to confirm that milk is a food ingredient that eliminates of the fish odor. It was considered that the evaluation of "aroma" is high because it was able to suppress the fish odor.

We studied the use of Okara to increase dietary fiber. Okara has three types: 1) Okara obtained by traditional production method and contains 81.1 g / 100 g of water(12), 2) Okara obtained by the new manufacturing method and contains 75.5 g / 100 g of water(7,12), and 3) Okara obtained by drying and contains 7.1 g / 100 g of water(7).

In this study, Okara number 2) was used. This Okara has a characteristic that the fiber is long, and I expected a role as a "tether" such as croquette and hamburger. In order to reduce roughness due to Okara, the blending ratio of Okara, tofu and milk was examined. As a result, milk was most effective. It is thought to be an effect by lipid contained in milk.

In the cooking process, we were aware of adding salt to surimi. The fish meat has the property that when it is well kneaded by adding salt, the binding property increases(13). As a result, I was able to alleviate more roughness.

In order to regulate the firmness of the dough, the ingredients and its blending amount were examined. As a result, 3 g / 80 g of bread crumbs and 2 g / 80 g of rice flour gave the soft texture of the dough. It seems that the characteristics of the rice flour were also related. The rice flour used this time is made in Japan, sucks water well and thinks it was connected to a soft texture(14).

We examined the addition of vegetables to add texture, crunchy, coloring to this fabric. A combination of carrots, burdocks, and green soybeans was evaluated with good texture and color. As a result of examining the composition of the seasoning, it was the best evaluation with salt 0.5 g / 80 g, nutmeg and pepper 0.05 g / 80 g of the dough.

We conducted a preference study of “hamburger style of fish and Okara”. The target school is a medium-sized elementary school with 349 children (1st to 6th grade children), the ratio of men and women is almost the same. Even in comparison with the results such as surveys of family situations and students' tastes, physique of height/weight, lifestyle surveys such as sleeping hours and absence of breakfast(15), national physical fitness · exercise ability · exercise habit survey(16) etc. that school was the average school in the area.

In this research, we aimed to be able to ingest “fish” and “dietary fiber” lacking in the eating habits of present children at the same time, and to be able to offer development of “delicious main dish” especially for lunch. The evaluation about ordinary hamburger and “hamburger style of fish and Okara” were respectively; Overall taste is good 94 and 85 %, good for easy to eat 90 and 77 %, basic taste is good 93 and 83 %, aroma is good 82 and 68 %, appearance is good 89 and 76 %. Although the results of ordinary hamburger were more favorable than those of “hamburger style of fish and Okara”, the evaluation of “hamburger style of fish and Okara” was high. The lowest evaluation among Okara hamburger is aroma (68%). However, the evaluation means that 68 % of the children answered that they smelled good. It can not be said that “hamburger style of fish and Okara” is not tasty. In addition, “hamburger style of fish and Okara” contains 2.2 g of dietary fiber per 80 g. This suggests that “hamburger style of fish and Okara” may meet the requirement of dietary fiber. However, I think that whether Surimi of Alaska pollack can obtain the necessary amount at a price that can be used for school lunches throughout the year is a major task and a limit to incorporate into the menu as new meal.

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Research Note

Roles and Requirements of Japanese Dietitians in International Cooperation Initiatives

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ABSTRACT *Background and purpose:* Nutrition-related health problems in developing countries have been discussed for decades, but the problem is increasing owing to many factors and there is yet no solution. Many efforts have been made in this regard, from community to governmental levels, by numerous countries, including Japan. The knowledge that Japanese dietitians who have had experience as Japan Overseas Cooperation Volunteers (JOCV) working in developing countries would have useful skills in developing education programs for not only Japanese dietitians but also dietitians of other nationalities who are interested in working internationally or working for developing countries as well. Therefore, in this study we would like to determine how Japanese dietitians can fulfil requests for assistance from developing countries; and to consider both the nature of the requests and the skills and knowledge required of dietitians to fulfil requests. *Methods:* The study design was a cross-sectional study. Requests (n=94) made by developing countries for nutrition-related assistance from Japanese volunteer dietitians during a 5-year period (2009-2013) were compiled and analysed by geographic region (Asia, Africa, Oceania, Central/South America). *Results:* A breakdown of the requested number of nutrition-related activities for a five-year period by country area was 21 in Asia, 22 in Africa, 11 in Oceania and 40 in South and Central America. Activities of volunteers were requested for 7 fields, such as community health and nutrition, mother and child care, hospital meal service and administration, and others. The most commonly requested activities involved community health and nutrition, mother and child care, and hospital meal service and administration. For instance, school nutrition was requested most often in Asia (11%), hospital meal service and administration in Africa (32%), and research in Oceania (14%); Central/South America had a variety of requests. *Conclusion:* In conclusion, to fulfil requests, dietitians need to combine total nutrition management with specialised knowledge based on knowledge of nutrition education.

Keywords: Nutrition, dietitians, community health, developing countries, Japan.

INTRODUCTION

The State of Food Security and Nutrition in the world, 2017 stated ‘in 2016, the number of undernourished people in the world increased to an estimated 815 million, up from 777 million in 2015 but still down from about 900 million in the year 2000’(1). However, health issues relating to excess energy consumption, such as obesity and non-communicable diseases, have also recently increased in developing countries. It also mentioned that ‘the worrisome trend in

undernourishment indicators is, however, not reflected in nutritional outcomes. Evidence on various forms of malnutrition points to continued decreases in the prevalence of child stunting etc. At the same time, overweight among children under five is becoming more of a problem in most regions, and adult obesity continues to rise in all regions. Multiple forms of malnutrition therefore coexist, with countries experiencing simultaneously high rates of child undernutrition and adult obesity (1).

For instance, from 1980 to 2008, the number of people affected by health issues of excess energy consumption has more than tripled, from 250 to 904 million. Currently, over one third of all adults worldwide (1.46 billion) are obese or overweight (2).

These nutrition-related health problems in developing countries have been discussed for decades, but the problem is increasing owing to many factors and there is yet no solution. To address this issue, the Second International Conference on Nutrition (ICN2) was held in Rome at the headquarters of the Food and Agriculture Organization of the United Nations (FAO) (3). The conference held discussions on how to develop national policies that address issues like malnutrition and obesity. Following these discussions, the ICN2 developed and issued “The Rome Declaration on Nutrition and the Framework for Action” which concluded that developed and developing countries must work together more effectively to address these nutrition issues. To this end, the Academy of Nutrition and Dietetics recognises the importance of working with other organisations to promote sustainable agriculture and improve global health outcomes (4). This strategy promotes nutritional security by building a healthy food system, reducing the prevalence of malnutrition and nutrition-related chronic diseases.

Many efforts have been made in this regard, from community to governmental levels, by numerous countries, including Japan (5). Japanese dietitians and the National Society of Dietitians have valuable experience that is useful for addressing international nutrition issues. However, at present, most Japanese dietitians work only for domestic agencies and rarely engage internationally, so their expertise remains unavailable to developing countries (6). Japanese dietitians who act as volunteers in an international context are members of the Japan International Cooperation Agency (JICA) and are known as Japan Overseas Cooperation Volunteers (JOCVs). Since this initiative began in 1965, there has been constant demand for Japanese dietitians in developing countries (7). Despite this long history of volunteerism, there is little accessible information concerning the dietitians’ activities in the host countries (7, 8). Studies have been published on support requirements during in-country service and self-efficacy among returning JOCV dietitians (9-11), but reports using historical data on the activities requested of volunteer dietitians are scarce. The typical JOCV contract/working term in the field is 2 years. The system of sending volunteers from Japan to a host country is first to draw up a contract between the host country and Japan, then the host country/local government requests what kind of volunteers they need. That request(s) can also be classified as “new” or “continuing”. A “new” means that a volunteer is newly requested. On the other hand, a “continuing” means that the activity has already started and it is necessary for a new volunteer to continue the work of a

previous volunteer. Both “new” and “continuing” requests are decided between the staff in each host organization/institute or working place and the in-country office of JOCV/JICA. If a project/activity related to a volunteer is highly rated, the in-country JICA office and local government may extend it by involving professionals/experts and increasing the budget and other resources. In such cases, the scope of the project can become regional or national. By analysing the countries’ requests, we aim to clarify what activities are requested and the characteristics of the requests (“new”/“continuing”) as a function of geographical region (12, 13).

This knowledge will be useful in developing education programs not only for Japanese dietitians but also for dietitians of other nationalities who are interested in working internationally or working for developing countries as well. Educational materials for these dietitians are being currently developed in Japan (14, 15) but suffer from an ineffective sharing of information within the professional community. Moreover, the educational material that does exist on Japanese nutrition-related international experiences is not widely consulted. We propose incorporating this material into an internationally accessible database to which dietitians of all nationalities can contribute and share knowledge. This could be used to track requests for assistance made by developing countries and serve as a useful resource for improving health and nutrition. It will also allow us to identify the knowledge and skills required to fulfil requests from developing countries and maximise the contribution of the Japanese (and other) dietitians. Here, we contribute to this initiative by compiling information on the nature of requests made by developing countries to JOCV over a recent 5-year period, and use this information to determine the knowledge and skills required by dietitians to fulfil these requests.

METHODS

Requests for assistance from JOCV dietitians during a 5-year period (2009–2013) were compiled and analysed by geographic region. Survey data were provided by JICA for countries where two-way technology agreements were in place between Japan and a recipient country. Countries requesting the assistance of Japanese dietitians were grouped into four regions as follows: Asia (Vietnam, Kyrgyzstan, the Kingdom of Bhutan, Nepal, Indonesia), Africa (Rwanda, Ghana, Morocco, Nigeria, Malawi, Mali, Zambia, Kenya, Botswana), Oceania (Solomon Islands, Fiji, the Marshall Islands, Samoa), and Central/South America (El Salvador, Brazil, Ecuador, Panama, Honduras, Guatemala, Bolivia). The activities included in the requests were classified into one the following seven categories (some requests included multiple activities):

- 1) Community health and nutrition: targeting local residents and/or health center staff in the area. Volunteer dietitians

assist local residents with nutrition improvement initiatives, personal/group nutrition education, nutrition project management (plan and implementation), and nutrition workshops. Workshops are structured to empower medical/co-medical staff in a health center to improve their nutrition skills and knowledge.

2) Mother and child care: targeting expectant and nursing mothers, mothers with infants, and malnourished children. Conducted with local dietitians and/or medical/co-medical staff, involving personal/group nutrition education and management workshops and occasionally empowerment and education for medical/co-medical workers.

3) School nutrition: mostly targeting pupils in elementary and junior high schools. Involving nutrition education, nutrition improvement activities, follow-up activities for continuing projects, and improvement of schoolteacher knowledge of nutrition.

4) Hospital meal service and administration: involving nutrition education/counselling for inpatients and outpatients, hospital meal services, nutrition and hygiene administration, hospital meal service management support, and advice for local dietitians. If nutrition education was involved, the activity was classified as community health and nutrition.

5) Research: involving advice on nutrition research and conducting nutrition research.

6) Product development: involving development of products such as local agriculture products.

7) Other: including, but not limited to, instruction on nutrition counselling for medical/co-medical workers, providing nutrition information to locals, education on cooking using locally available foods, and school curriculum reviews.

Activities were analysed in terms of the frequency of requests and by geographic region. Each request was also classified as 'new' or 'continuing', and connected to a JICA project or not. If connected to JICA, the project content was also analysed. It was also recorded whether the activity was conducted by a single JOCV dietitian, or whether other JOCVs or local health workers were also involved.

RESULTS

A total of 94 requests were made to JOCV by developing countries from 2009 to 2013. A breakdown of requested number of nutrition-related activities for a five-year period by country area was 21 in Asia, 22 in Africa, 11 in Oceania and 40 in South and Central America.

The overall frequencies of activities requested are given in Figure 1 (requests often involved multiple activities; hence, the number of activities exceeds the number of requests).

The most commonly requested activities involved community health and nutrition, mother and child care, and hospital meal service and administration. A breakdown of the frequency of activities by country area is given in Figure 2.

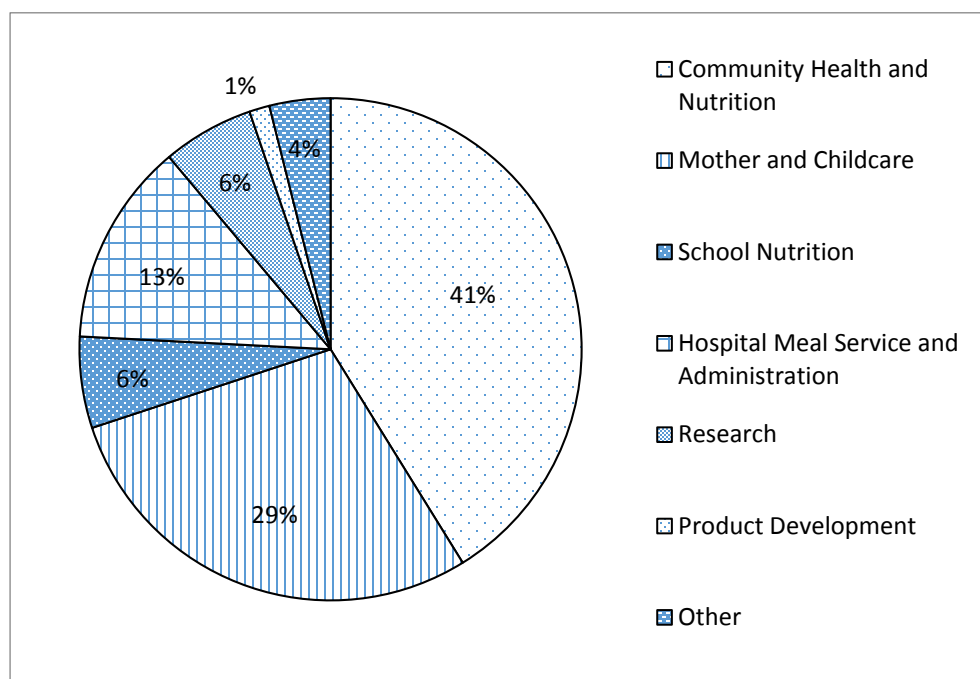


Figure 1. Activity ratio for five-year period (2009–2013) by activity category.

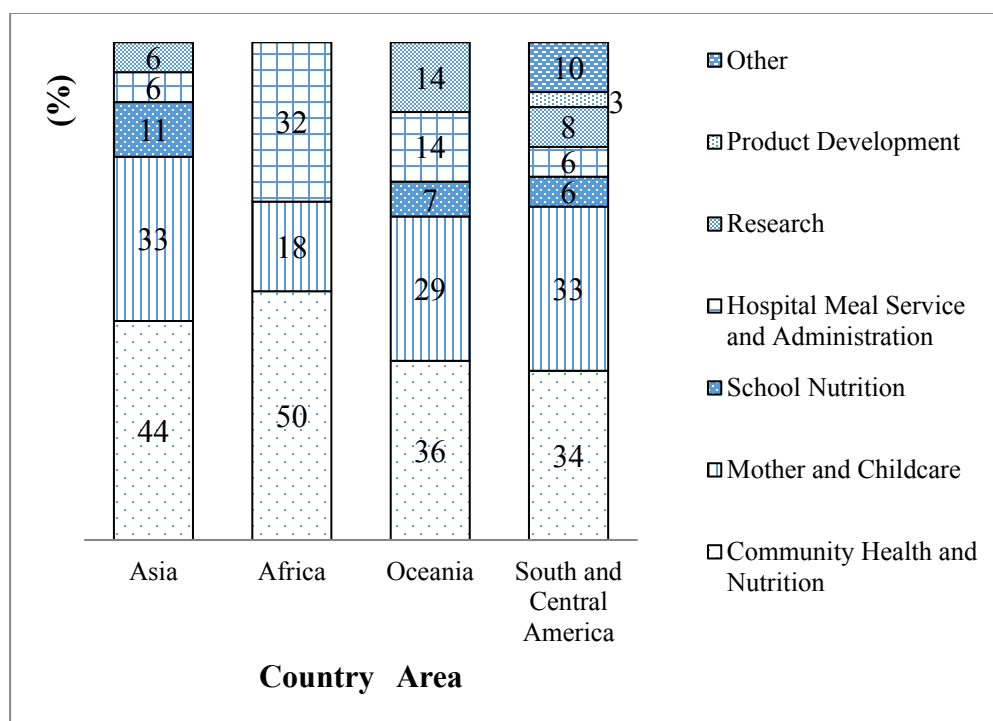


Figure 2. Ratio of nutrition-related activity requests by activity category and country area.

Aside from the 2 most commonly requested activities, “community health and nutrition” and “mother and child care”, results revealed that there were area-specific requests for particular activities. For instance, school nutrition was requested most often in Asia (11%), hospital meal service and administration in Africa (32%), research in Oceania (14%), and Central/South America had a

variety of requests. In general, however, most requests were for activities in community health and nutrition (Figure 1 and 2).

Of the 94 requests, 62 requests (66%) were “new” and 32 (34%) were “continuing” requests from previous activities.

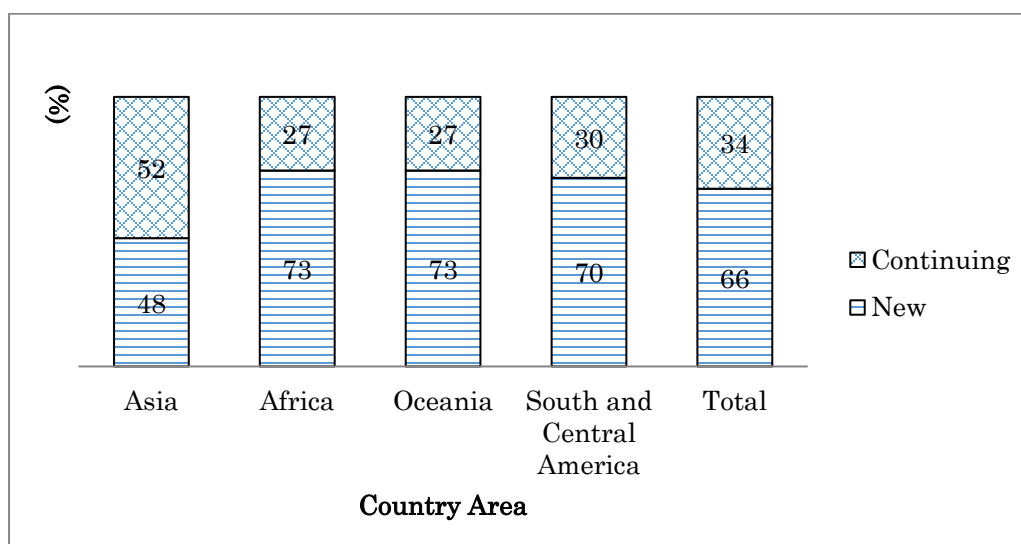


Figure 3. Ratio of new and continuing requests for nutrition-related activities by country area.

There were 79 out of the 94 requests (84%) required one dietitian only (individual), with the remaining 15 requests (16%) involving cooperation between dietitian(s) and local personnel on “cooperative projects”. Cooperative projects involved a JOCV dietitian working together with one or more local workers with different occupations. There was seen no case of cooperative work or projects in Africa.

DISCUSSION

The requirements of Japanese dietitians volunteering in developing countries included contributions to community health and nutrition activities together with more specialised nutrition activities, such as clinical nutrition. These results suggest that to meet the requirements, dietitians need to combine total nutrition management for the promotion of community health with specialist knowledge. They must also incorporate local communities’ requests and perspectives on nutritional issues in their area.

The most common request from developing countries was for input from Japanese dietitians in community health and nutrition activities. One reason for this is that requests for community health and nutrition activities typically included other activities. For example, a request from Malawi (Africa) required the dietitian to work in a hospital and carry out general hospital duties (i.e., planning meals tailored for patients with different ailments and caring for these patients) in addition to providing mothers with nutrition education on balanced meal for children, and visiting communities with local health workers to conduct nutrition improvement activities. Likewise, a request from the Kingdom of Bhutan (Asia) required the dietitian to work in a hospital and carry out routine hospital activities (meal service management) as well as provide the community with nutrition education and disease prevention advice **in their daily life**. Another reason why community health and nutrition activities are requested most often by developing countries is financial. Budget shortages lead to inadequate human resources and facilities (hospitals, community health centers) to meet demand. Existing resources must be used to their fullest extent and community nutrition improvement can be difficult to achieve.

In the past, requests and their accompanying activities were relatively straightforward. For instance, hospital-related requests typically involved managing hospital meal services and administration and private or group nutrition counselling (12). However, in recent years, requests have expanded to include nutrition improvement activities, implementation of awareness programs, and work in the community providing care and advice for both inpatients and outpatients.

Knowledge of community health and nutrition is also increasingly relevant to dietitians working in Japanese society. The population of elderly people in Japan is increasing. Elderly persons hospitalised for treatment and then discharged require transfer of their nutrition support service from hospital to community systems. Likewise, community health staff may encounter elderly persons requiring clinical nutrition support or transfer to a hospital. Here, the clinical dietitians and community health workers must work cooperatively to ensure the provision of necessary support.

Dietitians working in different fields (e.g., clinical nutrition, public nutrition) require both basic knowledge and field-specific knowledge developed through work experience. For instance, dietitians working in the community health field also need knowledge of clinical nutrition, which is difficult to acquire without work experience in clinical nutrition. The question of how to acquire knowledge and skills from different fields remains unanswered, although dietitians working internationally need to do so to fulfil international requests.

Health promotion occurs when there is definitive and effective community action toward setting priorities, making decisions, and planning and implementing strategies to achieve better population health. Health promotion can be defined as the process of enabling people to increase control over and improve their health (16). Community nutrition activities are a central aspect of health promotion, and good nutrition is one of the United Nations’ Millennium Development Goals and Sustainable Development Goals (17). However, despite increasing evidence of community nutrition programs improving the nutritional status of communities and contributing to their development and self-sufficiency, the success of these programs is relatively limited, mainly because of inappropriate planning, implementation and evaluation (18). Accordingly, it is essential that we train dietitians willing to work in developing countries to promote better nutrition and food support. Dietitians from developed countries have discussions to identify considerations for new initiatives. For example, for effective public health nutrition practice, a consensus on essential competencies required (19) is needed to be developed and reviewed, and to assess and investigate a conceptual framework for the implementation and evaluation of strategies that enhance the practice of capacity building approaches (20). As dietitians, we need to be aware of and engaged with health issues affecting developing countries as well as those affecting developed countries.

Developing countries to which JOCV dietitians are dispatched frequently have no trained dietitians; therefore, the JOCV counterpart may not be educated as a dietitian. For

JOCV, operational experience is often required of dietitians wanting to join. There is also an age limit, where JOCV candidates must be younger than 39 years of age when they take the program entrance examination. As a result, dietitians with 3–5 years of operational experience are the primary JOCV applicants and participants (9), but this experience may be insufficient to fulfil international requests. There are always dietitians interested in becoming JOCVs (8), suggesting that some Japanese dietitians have an existing interest in international nutrition issues and want to contribute their expertise to the efforts of international cooperation. The 2006 World Health Organization world health report asserted the importance of “working together for health”. In this report, development of human resources was identified as the most important factor for advancing health and medical activities. Accordingly, nutrition is included as a key Sustainable Development Goal, signifying the importance of human resource development in this field. Overall, this may contribute to nutrition and food support in developing countries (21, 22).

To contribute to international initiatives, it is important for Japanese dietitians to have practical experience in Japan. This will help to prepare them to participate in the fields of international cooperation and nutrition. Thus, it is necessary to incorporate the requests of developing countries in situations of international cooperation to build a system for human resource development that equips dietitians with the necessary knowledge and skills (11).

In this study, we classified requests as “new” or “continuing” and examined the content of the requests. Continuing requests arose when a JOCV, working with their local counterpart, identified nutrition-related problems in the community and reported them to the host organisation. If the problem warranted input from a higher/broader level, the JOCV, their local counterpart and other members of the host organisation devised a plan of action for the local community and government to implement. The local government requests the opinions of professionals who are experts in the field and may suggest embarking on projects of longer duration, beyond the capacity of JOCV, such as a JICA technical project. This course of action generally indicates that the local government is genuinely interested in solving the problem.

The majority of requests in our study were new (62 of 94 requests). “New” and “continuing” requests associated with JICA technical projects were only found in Central/South America. These projects were JOCV activities that occurred as part of a JICA technical project involving experts or after the completion of a JICA technical project, as JOCV-developed smaller scale activities. These activities were national or regional, and continued as community-based projects. However, this form of project development was not

found in the other areas. There are two possible reasons why requests were not continued. First, the recipient country found the volunteer dietitians’ activities ineffective and not worth continuation. Second, the dietitian found that the requested activity was not a good fit for the community’s situation, the activity was unnecessary at the site, or that the community was not prepared to begin the activity and the dietitian’s participation was premature. Since previous reports have indicated that the self-efficacy of returning JOCV dietitians was low (10), we suggest that these situations occurred frequently, and that there is a need to identify what problems dietitians are having and where. Appropriate knowledge and skills for dietitians as well as positive perceptions of their activities will contribute to the health of communities. Thus, it is essential to define the knowledge and skills required by volunteer dietitians. The causes of the problem of low self-efficacy of returning JOCV dietitians should be identified and addressed when planning their activities. In this way, JOCV will be involved in work that is satisfactory for both the volunteer and the host organisation. It is likely that dietitians would feel higher self-efficacy if their efforts are successful in making a positive contribution to the community, and they receive a positive response from the host organisation.

The dietitians and the countries requesting their services have recognised that their effectiveness in this regard requires that: 1) dietitians have sufficient applied skills and real experience in their field of specialisation, and 2) dietitians have advanced training to develop the skills and knowledge required of a public health dietitian (e.g. health promotion, nutrition epidemiology). Currently, there is a need for educational institutions to train dietitians not only for domestic careers but also for service abroad. They should also encourage students to study abroad during their training and actively recruit international students for study in Japan, so that Japanese dietitians could also be more outward-looking and work more effectively.

A limitation of this study was that, although the JOCV has a long history, only data from a recent 5-year period were analysed. Therefore, our findings may not be representative of previous periods. However, our analysis of recent requests is relevant to the development of the next generation of dietitians who want to contribute to the fields of international cooperation in nutrition and international nutrition. In addition, when activity plans are developed with the countries making the requests for assistance, it is necessary to consult recent activity-related feedback and establish criteria for evaluation. Our study results will contribute to this process.

In conclusions, Japanese dietitians volunteering in developing countries are requested to provide assistance with community health and nutrition activities as well as

activities within other specialised nutrition fields. To fulfil requests, dietitians need to combine total nutrition management for community health with nutrition-related field-specific knowledge. It is also essential that they take into account the local community's perspectives on the region-specific nutrition issues being addressed.

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