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Special report: Thinking about the ideal roles of dietitians

What Dietitians Need for the Future: Evidence-Based Dietetics

Shigeru Yamamoto
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I attended the Annual Convention of **NUTRITIONIST - DIETITIANS' ASSOCIATION OF THE PHILIPPINES (NDAP) on Feb 21-25.** A symposium entitled "Dietitians and Physicians: Building Collaboration and Synergy Using the NCP" chaired by Dr. Varsha from India was very exciting. Speakers were Dr. Eloisa Villaraza from Philippine, Dr. Esther Myers from USA (former president of the International Federation and Dietetic Association) and Ms. Sylvia Klinger (USA). The lecture by Dr. Esther Myers was "Using NCP to Demonstrate RD vs MD in Medical Nutrition Therapy". There was a role playing by Ms. Sylvia Klinger and Dr. Esther Myers about "Dynamics of Collaboration vs. Competition (Role Playing to Address Various Scenarios)".

The social role of a dietician is first and foremost to assist people through foods. In other words, it involves practical ability. If we look at educational requirements for the field at universities and other institutions, the average number of hours for an internship in Japan is 180 hours, which is too low compared to the International Federation of Dietetic Association (IFDA) standard of 500 hours (Fig.1). The United States and the Philippines require more than 1000 hours. In the Philippine, Thailand and Taiwan, I am sure that dietitians are trusted and respected by the people around them (Fig. 2).

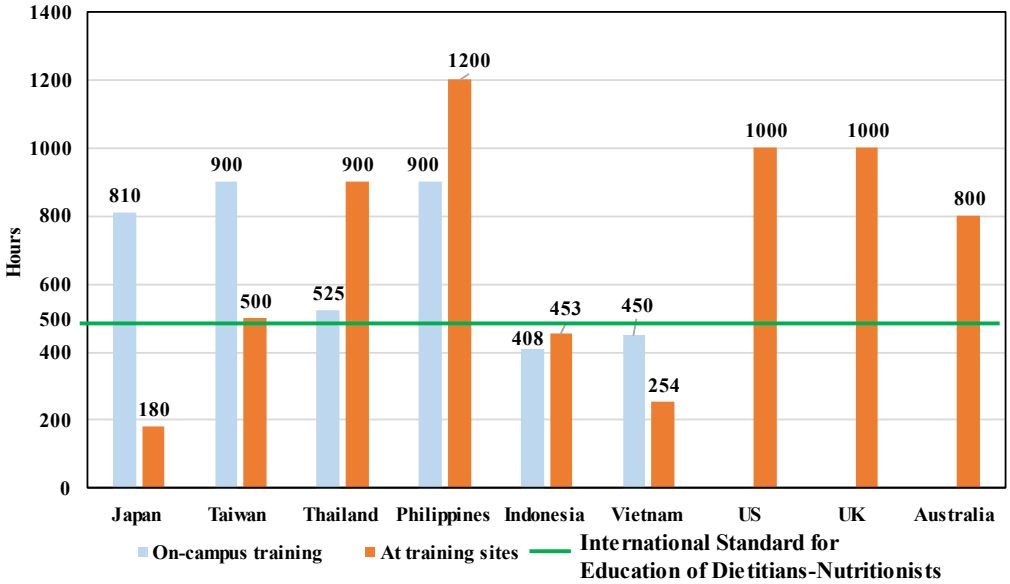

Fig. 1 Practice hours during Bachelor of Dietician/RD program in some Asian countries and others

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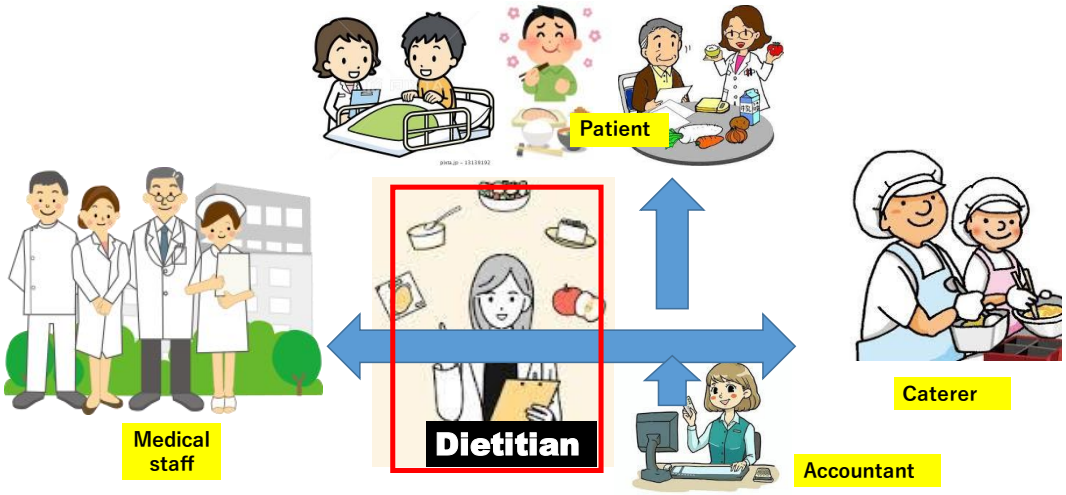

Fig. 2 Dietitians are trusted and respected by those around them for their role as practitioners.

Next, let's think about the necessity of research. When we look at the authors of journal articles related to clinical nutrition, most of them are medical doctors (MD), and there are few dietitians. If we look at nutrition journals, we find many food scientists as authors. The number of papers reflects the number of faculty members in university. I believe that the reason why there are few dietitians among faculty members at universities is that there is insufficient research and few papers (Fig. 3 and 4).

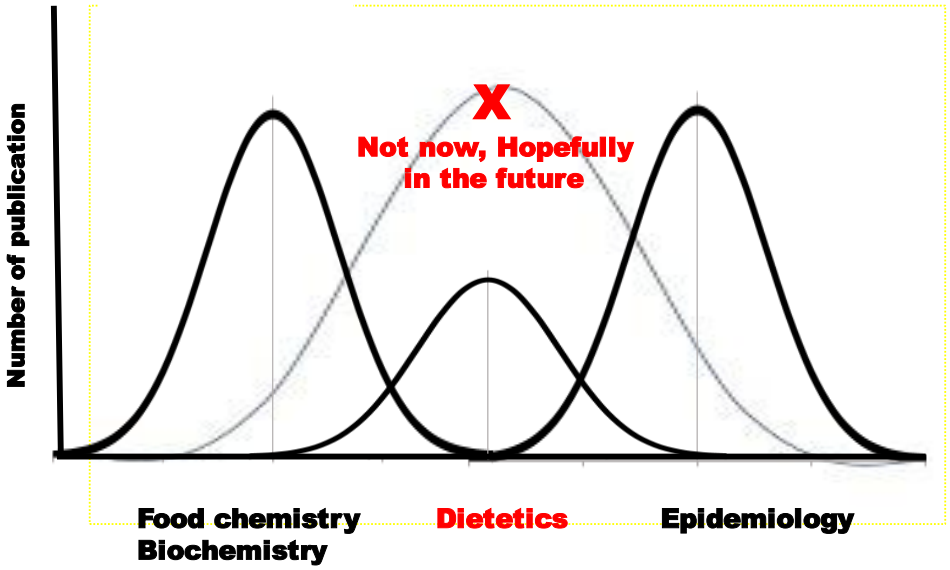

Fig. 3 Publications by faculty members of dietetic course

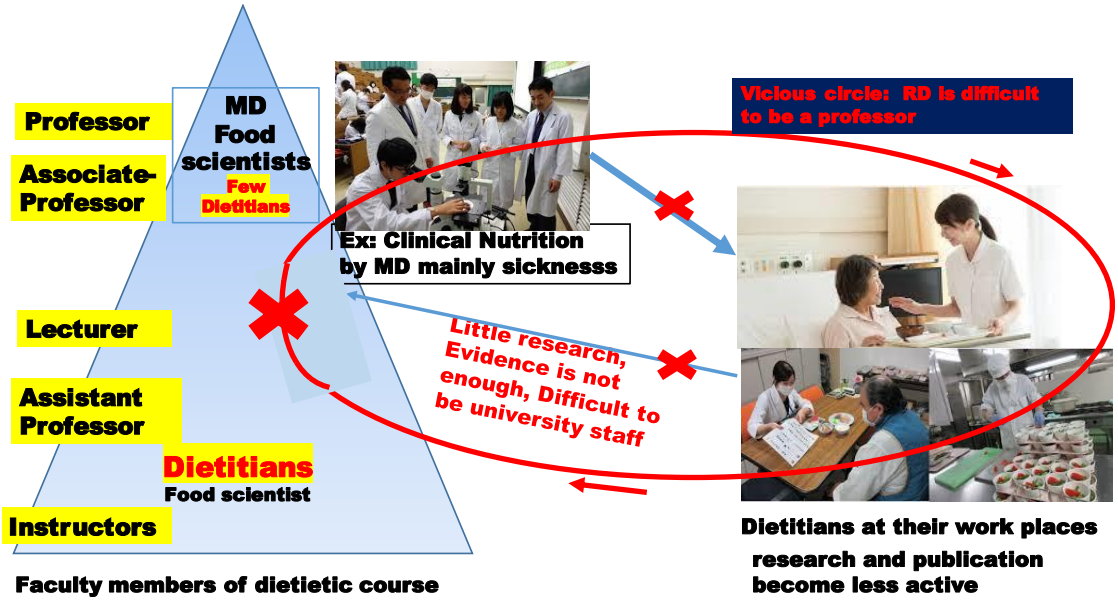

Fig. 4 Vicious circle of dietetic education and research & publication

Obesity is often taken up as a research theme. The cause of obesity is simple. It is because the amount of energy taken in is greater than the amount consumed. Despite this simple fact, no country in the world has succeeded in controlling obesity rates. This reality speaks to the difficulty of obesity research. The difficulty is similar for MDs. Controlling obesity is a seemingly simple subject, but it is a broad and complex subject encompassing dietetics, nutrition, medicine, physiology, biochemistry, psychology, sociology, economics, and philosophy. It resembles the humanities. Most of the work by dietitians involves such fields. Therefore, I would like to say that dietetics is like the humanities. In current science, evidence is always sought. It is not easy to produce evidence in obesity research. Even in modern society where AI has reached a high level, it seems that human behavior has not progressed at all. The war between Russia and Ukraine would be a good example.

So let's think about the kind of research that dietitians should do. In modern hospitals where the number of elderly patients has increased, there are many cases where we have no choice but to rely on meals as treatment. For example, diet problems such as frailty, sarcopenia and dysphagia are important. For hospital nutrition management, medical staff from various fields discuss how to treat patients (Fig;4). This is termed the Nutrition Support Team. The Team will ask for a rationale for a given treatment policy. We can call this Evidence-based Dietetics (EBD). Note that it's not Evidence-based Nutrition. I make a clear distinction between Nutrition and Dietetics. That is, the title dietician is only for those with an RD license, while a nutritionist does not require a license. EBD requires advanced knowledge and research methods.

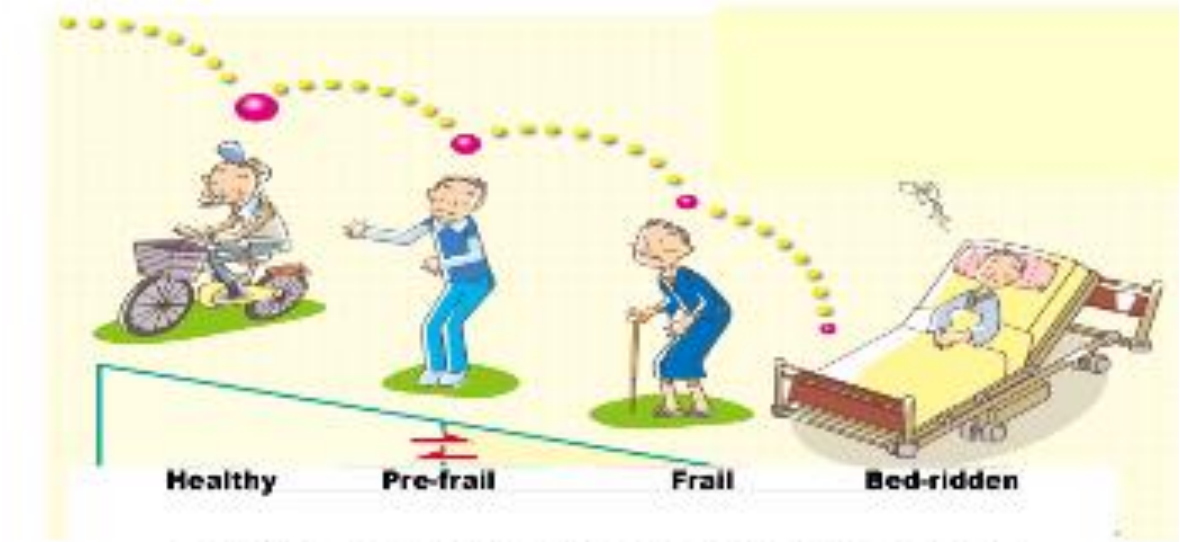

Fig.5 Changes in health condition by aging
(source: www.pref.kanagawa.jp)

About fifteen years ago, I was on the Review Board for the Nutrition Education Curriculum. At that time, a law was enacted that states that MDs can teach about diseases but not clinical dietetics, so they cannot become clinical nutrition teachers. At the same time, a law was enacted that of the 8 fields in the dietitian training course, the teachers in 4 fields must be RDs, and among 5 assistants 3 must be RDs. I think this law is very sound. However, it is not easy to quickly change the long history of the term dietitian, and it cannot be said that it has been successful as yet.

In other words, faculty members with RD do not have as many publications as non-RD members in fields such as food science, biochemistry, and epidemiology. In other words, dietetic course students do not learn how to conduct research at dietitians' workplaces. Even if RD practitioners return as university faculty members, if they do not have adequate research or papers, they will not be able to secure high status and will not be able to give guidance to students on the research methods that RDs should apply. In Japan and other countries RDs must get out of this vicious cycle.

Original

Improvement of the Vietnamese school lunch menu

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ABSTRACT: *Background and purpose:* School lunch programs have been developed and implemented in various countries with the purpose of contributing to healthy mental and physical development of children. In Vietnam, primary school lunch program started in 1980 but effects of this program are still limited. At present, in public schools in Vietnam, there is no school dietitian, so school lunches are not well-planned and not attractive to children. As a result, there is a large amount of food waste, especially vegetables, and many children do not eat lunch at school. From our previous experiences, we thought that factors for poor taste were; 1) lack of food materials and 2) rough cutting. In this study, we made new menus by improving such points while maintaining cost and evaluated acceptability of students. *Methods*: The study was conducted by cross-over design at a public primary school in a suburb of Hanoi, Vietnam. Fifty students in 5th grade were randomly divided into 2 groups. Five new best menus were developed by increasing variety of materials and choosing suitable cutting methods. To maintain the cost, we reduced quantity of each material but still guaranteed that energy, nutrients, and total amount of vegetables were similar between the 2 menus. One group ate the new menus in first week (5 days) and ate the current menus in second week 2 (5 days). The other group had menus vice versa. Food intake survey and sensory test were conducted every day. *Results*: With the sensory test, the new menus had higher scores for all features: color, smell, taste, texture, and overall ($p < 0.05$). Compared to the current menus, by the new menus, food waste was significantly decreased. Intakes with the current menu and new menus were: energy 509 and 592 (kcal), protein 20.9 and 25.6 (g), lipid 16.7 and 20.1 (g), carbohydrates 69 to 77 (g), fiber 1.1 and 1.9 (g), and vegetables 54.7 and 79.0 (g), respectively. We increased the variety of food ingredients, but by reducing the amount, we could keep the similar cost. The work of cooks increased, but the children enjoyed the food, which encourage cooks to work harder within the working time and the cost did not increase. *Conclusion:* By increasing the variety of food and choosing suitable cutting methods, we were able to make the meals tastier and more attractive with similar cost, and the food consumption of children was increased. We recognized from this study that the placement of school dietitian is the key to improve school lunch.
Keywords: School lunch, menu, food variety, food consumption.

INTRODUCTION

School lunch programs have been developed and implemented in various countries with the purpose of contributing to the healthy mental and physical development of children. In Vietnam, the primary school lunch program was started in 1980 but the effects of this program are still limited because of difficulties in terms of society and human resources. One of these dificulties is the lack of qualified dietitians to design meals that could provide balanced and tasty meals. At public schools, meals are prepared based on the experiences of the kitchen staff members. However, kitchen staff members are not fully trained in nutrition; they receive only basic knowledge of nutrition and food hygiene from short-term training courses or learn by themselves from textbooks (1). Therefore, although the meals usually consist of 5 dishes such as: a staple food, 2 main dishes, a side dish and a soup, the dishes are monotonous, use a small number of food materials, and have poor food combinations. According to a study comparing school lunches in Vietnam and Japan, while both countries have a similar number of school lunches about 200 times, Vietnam used only 53 different ingredients but 376 ingredients were used in Japan (2). As a result, with the simple meals and frequent repetition, children tend not to eat well and to waste food, especially vegetables. Moreover, for the same reason, many children decide not to have lunch at school.

Eating a variety of foods is one factor that has been shown to increase food intake (3–6). In addition, food variety is considered a good indicator of nutritional adequacy; it ultimately increases the range of nutrients consumed and the likelihood that a well-balanced diet is achieved. Combining various foods may help to improve school meals in Vietnam. However, in Vietnam, parents must pay for all the school meals and don't receive supports from government. Besides, in each locality, the local government has its own policy on what materials are allowed to be used. Hence, when planning menus, these aspects need to be considered.

In this situation, we thought that if it were possible to combine more food materials to make new menus but still maintain costs and the allowed materials then the school could adopt it and students would consume more. With this hypothesis, we tried to develop some new menus and this study was

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conducted to evaluated the acceptability by students at a public primary school in a suburb of Hanoi.

METHODS

This was a crossover study performed between September and October 2020 at one public primary school in Dong Anh district – suburban of Hanoi, Vietnam.

Participants: Fifty students in 5th grade

From a list of 5th grade students who ate the school lunch, we randomly chose 50 children and divided them into 2 groups; each group had 25 children. Written informed consent was obtained from parents, and verbal assent obtained from the children.

Procedure

Step 1: Developing new menus

We collected the current menus and the list of the ingredients that the school allows us to use. Based on this, we developed 10 new menus by increasing the variety of materials (more than 10 kinds/meal) and choose suitable cutting methods to make new food combinations (vegetables with meat/egg/fish, vegetables with rice, and meat/egg). We still used the same seasonings with current menus. To maintain the cost, we reduce the quantity of each material but still guarantee that the energy, nutrients, and total amount of vegetables are unchanged between the 2 menus. After that, we conducted a sensory test with 5 students and chose the best 5 menus.

Step 2: Intervention

One group ate new menus for study week 1 (5 days) and ate the current menus for study week 2 (5 days). The other group had menus vice versa.

All the ingredients were provided from the same suppliers for the school in the morning and then were cooked in the school kitchen. The two groups ate lunches in different rooms. After lunch, food waste measurement and a sensory test for both menus were conducted.

Instrumentation

Nutrient intake and vegetable consumption:

A total of 5 data collectors, who were graduate students in the nutrition field, were trained to conduct food measurements for the study. For each day of measurement, each ingredient of each dish was weighed after dividing into the same portions and after eating by a digital kitchen scale (Tanita KD-160) with an accuracy of 0.1g. Energy, protein, fat, carbohydrate, and dietary fiber intake were calculated based on the Vietnam Food Composition table 2007 by Microsoft Excel 2016.

Sensory test:

Sensory tests were conducted while the new menus were being developed and also during the intervention using a Hedonic 5 point scale. Color, Smell, Taste, Texture, and Overall were evaluated.

Data Analysis

IBM SPSS Statistics 26 was used to analyze the data. The normality test was used. The variables were compared by unpaired Student *t*-test and the Mann-Whitney U test. P-values less than 0.05 were considered statistically significant for all the analyses.

Table 1. Examples of a current menu and a new menu

Current Menu		New Menu	
Dishes	**Ingredients**	**Dishes**	**Ingredients**
White rice	Rice 130g	**Mixed rice**	Rice 110g Egg 17g Chayote 10g Carrot 10g
Fried egg	Egg 40g	**Meat ball**	Minced meat 35g Onion 5g Carrot 5g Tomato 15g Scallion 2g
Stir-fried chicken	Chicken 75g	**Stir-fried chicken and vegetables**	Chicken 30g Choysum 30g Carrot 15g
Stir-fried vegetable	Choysum 85g		
Soup	Spinach 15g	**Soup**	Spinach 8g

RESULTS

Table 2 shows the comparison of the cost and number of food materials between current menus and new menus. Both menus had a similar price, about 14,000 VND but the new menus had more kinds of food materials.

Figure 1 shows the comparison of vegetable intake in the current and new menus. In both menus, we served 100g of vegetables but in the current menu, children only consumed 54.7g vegetables while in the new menu consumed 79g vegetables.

The comparison of the energy and nutrient supply and intake in the current menu and the new menu is presented in Table 3. The amount of supply between current menus and new menus had not significantly difference. However, protein, lipid, and carbohydrate intake in the new menu were higher than in the current menu. As a result, the energy intake in the new menu was also higher. The fiber intake in the current menu was 1.1±0.3g, lower than 1.9±0.2g in the new menu. All the data had significantly difference.

Figure 2 shows the average scores of the sensory test for both menus. The average scores are the score of 5 menus so the sample sizes (n) is 5. All the features of the new menus were evaluated significantly higher than the current menus.

Table 2. Comparison of cost and number of food materials between 5 current menus and 5 new menus

	Current menus (Mean ± SD) (n=5)	New menus (Mean ± SD) (n=5)
Cost (VND)	14021 ± 1528	14320 ± 937
Food materials (number)	5.8 ± 0.4	10.8 ± 0.8*

* $p<0.05$, paired Student *t*-test

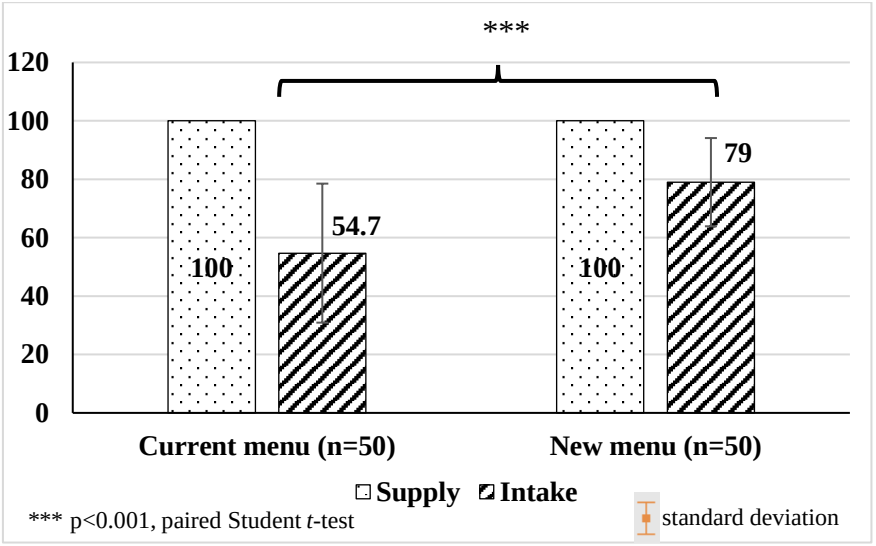
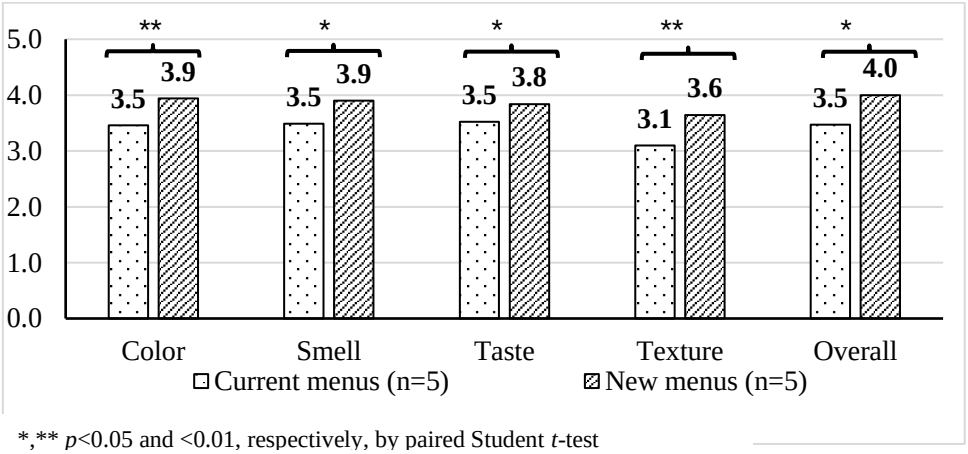


Figure 1. Comparison of vegetable intake in the current and new menus

Table 3. Comparison of energy and nutrient supplies and intakes in the current and new menus

	Supply		Intake	
	Current menu (Mean ± SD) (n=50)	New menu (Mean ± SD) (n=50)	Current menu (Mean ± SD) (n=50)	New menu (Mean ± SD) (n=50)
Energy (kcal)	612 ± 34	639 ± 32	509 ± 64	592 ± 40*
Protein (g)	25.5 ± 2.4	27.7 ± 4.1	20.9 ± 2.2	25.6 ± 1.5*
Lipid (g)	20.0 ± 3.8	20.7 ± 2.2	16.7 ± 0.9	20.1 ± 0.5*
Carbohydrate (g)	82.4 ± 4.3	85.4 ± 7.5	69.1 ± 13.6	77.2 ± 8.0*
Fiber (g)	1.7 ± 0.6	2.2 ± 0.4	1.1 ± 0.3	1.9 ± 0.2*

* p<0.05, paired Student *t*-test



*,** $p<0.05$ and <0.01, respectively, by paired Student *t*-test

Figure 2: Average scores of the sensory test for current menus and new menus

DISCUSSION

This study has found that students in the new menu group had higher energy, nutrients, and vegetable intakes than the current menu group, suggesting that improving menus by increasing the number of food materials and changing the way of cutting but still maintain the cost to increase the food consumption for children is feasible.

Leftover food from school lunches is a major problem in Vietnam at present. Children waste a lot of food, mainly vegetables. The reason is taste. Although there are 5 dishes in each meal: a staple food, 2 main dishes, a side dish and a soup, the dishes were very simple and monotonus: only 5-6 types of ingredients are used for the whole meal; meat and vegetable are almost always cooked separately; and over-all the appearance of the meals is not eye-catching. Hence, students don't like school meals and tend not to eat well. Moreover, instead of eating at school, many children go home for lunch. With the aim of improving the above limitations, our research group, who are dietitians, designed new menus but still kept the similar price and used ingredients from the list that the school allows to use. We learnt some recipes and food combinations from Japanese school meals, and adapted them to the Vietnamese school.

First, we made the meals more varied, or in other words, we increased the number of food materials. In one meal, we used more vegetables, and increased the total ingredients in the whole meal to more than 10, in accordance with the recommendations of Vietnam National Institure of Nutrition. Food variety is important for the ingestion of a good balance of nutrients and variety within a meal is known to be one of the most powerful ways to increase energy intake. Some studies have explained this behavior by the mechanism of sensory-specific satiety: in a situation with variety, the new foods will be relatively more pleasant than the foods already eaten and thus relatively more is consumed (3,4,7,8). In addition, Wilkinson has argued that variety may affect the cognitive representation of food quantities, which in turn may increase the portions served (9). Similarly, Rolls has shown that having a variety of foods presented in succession during a meal enhances intake, and the more different the foods are the greater the enhancement is likely to be (3). For vegetables, Mennella, Parizel, and Meengs have shown that offering a variety of vegetables in a meal can increase vegetable acceptance compared to offering only one vegetable (10–12).

Secondly, along with the diversity of ingredients, we made more food combinations. Some kinds of vegetable were mixed together and/or mixed with meat/ fish/ egg in the staple food, main dishes and side dishes. The increase in acceptance of food combinations might have been caused by offering a variety of foods differing in color, flavor and texture compared to offering a single food only. Food combinations are emphasized in Japanese school lunches and it has been specified in the School Lunch Act (13) that the combination of foods should always be improved when preparing menu. The newest combination we made was a combination in the staple food that we learnt from Japanese school lunches. In Vietnam, normally the staple food is plain rice only; we changed this to mixed rice, like "mazegohan" in Japan. We mixed rice with meat or egg and vegetables and then added some spice. This dish provided children with a new sensation; they could taste not just rice but also many assorted flavors and textures blended together. Children were really excited with this dish and ate a lot. Next, De Moura has suggested that even disliked vegetable might become acceptable when they are part of a tasty mixture(14). Thus, we mixed vegetable with some favorite foods of children like meat balls or fried eggs and as a result, students definitely enjoyed them. Baxter has found that size affects children's acceptance of vegetables: small vegetables were preferred to large varieties (15), so in our study, vegetables were cut into small pieces made them easier to eat and they could be hidden inside the meat/egg, or mixed well with other food and spices, making the food more delicious and eye catching. Moreover, Zeinstra has shown that children prefer crunchiness in vegetables (16), so we tried to combining crunchy vegetables like carrots or chayote with a non-crunchy vegetables to increase acceptance. Also, when cooking, we tried to keep the crunchiness of vegetables or to make them crunchier by making tempura.

Last but not least, we had to find suitable cutting methods for each food combination. "Cut" means to make the ingredients easy to cook and eat. Depending on how you cut it, the way the fire passes, the texture, and the way it tastes will change, so we need to choose the cutting method that suits the type and purpose of the dish. If the size is uniform, it will look beautiful and delicious. For vegetables, the taste changes depending on whether they are "cut along the fiber" or "cut off the fiber". For example, in the case of bell peppers, if you slice them horizontally to cut off the fibers, the cells will break and the bitterness will be more likely to occur, and if you cut along the fibers, the bitterness will be suppressed. In the case of onions, the opposite is true. If you cut the fibers so that they are cut off, the area that comes into contact with the air is large, so the spiciness is easily removed, and if you cut along the fibers, the spiciness remains. Thus, for each dish, we tried many cutting methods to choose the best one. Furthermore, Baxter has found that size affects children's acceptance of vegetables: small vegetables were preferred to large varieties (15), so in our study, vegetables were cut into small pieces made them easier to eat and they could be hidden inside the meat/egg, or mixed well with other food and spices, making the food more delicious and eye-catching.

When applied those points to improve the meals, people might think the cost of the meals will increase. However, we could maintain it. In terms of food materials, to increase the number of materials, we reduced the quantity of each kind but still ensure that the energy and nutrients intake and the total amount of vegetables were the same. For example, both menus used 100g of vegetables, but in the current menus, they only used 2 kinds of vegetables with a big amount, while in the new menus we divided into 6-7 kinds and the amount of each kind was little. In terms of labor, it is certain that the cooking staff needed more time than before to prepare and cut the materials thoroughly. However, the extra time was still within their working time, and they were happy

and enthusiastic to do the work when they saw that children ate more, and the leftover was reduced. Therefore, the labor cost remained the same.

After changing the menus, both menus provided an equal amount of vegetables, but the amount of vegetables consumed in the new menu group was 25.7g higher than in the current menu group. This proved not only the effectiveness of the new menus but also the effort of the dietitians in improving the quality and quantity of the diet for children. On the other hand, in both groups, children still wasted food, especially vegetables. This is similar to the study by Gray: children only eat about 79% of the vegetables on the tray (17). However, children in the current menu group wasted more vegetables than the new menu group did, similar to Sharma's results: while the children in the control group wasted 74.6g of vegetables and fruits, the children in the menu intervention group wasted 63.0g of vegetables and fruits (18). These results provide additional evidence that schools should focus on the diversification of ingredients as well as increasing appetizing foods to increase nutrient intake by children.

School lunch has been considered as a factor in controlling obesity rates in children in Japan. School lunch not only provides well-balanced lunch for children but also conveys an understanding of portion size, meal balance, and gratitude for the food and for the people who make it (13,19,20). Therefore, school lunch may be important in controlling overweight. Especially important is the role of the dietitian in the school, not only to develop menus for children but also to develop educational programs to teach children (13). However, at present, in public schools in Vietnam, there is no school dietitian, so school lunches are not well-planned and not attractive to children. It is desirable to improve, spread school lunches and establish a school dietitian system in Vietnam so that all children can enjoy nutritious school lunches and have a good nutrition education by a dietitian to change food consumption behavior.

The limitation of this study was the short intervention time. We had only assessed student acceptance of the new menus but did not observe whether schools can adopt these menus. Hence, a study with a longer time is needed to evaluate how school applies those menus and how long they can apply, as well as establish more menus and expand to more school.

CONCLUSIONS

By increasing the variety of food and choosing suitable cutting methods, we were able to make the meals tastier and more attractive with similar cost, and the food consumption of children was increased. We recognized from this study that the placement of school dietitian is the key to improve school lunch.

REFERENCES

1. Son Nguyen Trung Le D. School meal program in Ho Chi Minh city, Vietnam: reality and future plan. Asia Pac J Clin Nutr 21. 2011.
2. Thuan NT, Indri KS, Miho N, Noriko S, Yuriko I, Thao NT, et al. Comparison of School Lunch Menus in Vietnam and Japan. Asian J Diet 1(2):29–33. 2019.
3. Rolls BJ, Rowe EA, Rolls ET, Kingston B, Megson A, Gunary R. Variety in a meal enhances food intake in man. Physiol Behav 26(2):215–21. 1981.
4. Rolls BJ, Rowe EA, Rolls ET. How sensory properties of foods affect human feeding behavior. Physiol Behav 29(3):409–17. 1982.
5. BJ R, PM VD, ET R. Pleasantness changes and food intake in a varied four-course meal. Appetite 5(4):337–48. 1984.
6. HL M, C deGraaf, LL L. The effects of variety and monotony on food acceptance and intake at a midday meal. Physiol Behav 70(1–2):119–25. 2000.
7. Hollis JH, Henry CJK. Dietary variety and its effect on food intake of elderly adults. J Hum Nutr Diet 20(4):345–51. 2007.
8. Spiegel TA, Stellar E. Effects of variety on food intake of underweight, normal-weight and overweight women. Appetite 15(1):47–61. 1990.
9. Wilkinson LL, Hinton EC, Fay SH, Rogers PJ, Brunstrom JM. The 'variety effect' is anticipated in meal planning. Appetite 60(1):175–9. 2013.
10. Mennella JA, Nicklaus S, Jagolino AL, Yourshaw LM. Variety is the spice of life: Strategies for promoting fruit and vegetable acceptance during infancy. Physiol Behav 94(1):29–38. 2008.
11. Parizel O, Labouré H, Marsset-Baglieri A, Fromentin G, Sulmont-Rossé C. Providing choice and/or variety during a meal: Impact on vegetable liking and intake. Appetite 108:391–8. 2017.
12. Meengs JS, Roe LS, Rolls BJ. Vegetable Variety: An Effective Strategy to Increase Vegetable Intake in Adults. J Acad Nutr Diet 112(8):1211–5. 2012.
13. Ministry of Education, Culture, Sports, , Culture, Sports S and T. School Lunch Program Act. 2009.
14. De Moura SL. Determinants of food rejection amongst school children. Appetite 49(3):716–9. 2007.
15. Baxter IA, Schröder MJA, Bower JA. Children's perceptions of and preference for vegetables in the west of Scotland: The role of demographic factors. J Sens Stud15(4):361–81. 2000.
16. Zeinstra GG, Koelen MA, Kok FJ, de Graaf C. The influence of preparation method on children's liking for vegetables. Food Qual Prefer 21(8):906–14. 2010.
17. Gray C, Lytle LA, Mays R, Taylor G, Perry C, Story M. Foods on students' trays when they leave the cafeteria line as a proxy for foods eaten at lunch in a school-based study. J Am Diet Assoc 102(3):407–9. 2002.
18. Sharma S, Marshall A, Chow J, Ranjit N, Bounds G, Hearne K, et al. Impact of a Pilot School-Based Nutrition Intervention on Fruit and Vegetable Waste at School Lunches. J Nutr Educ Behav 51(10):1202-1210.e1. 2019.
19. Tanaka N, Miyoshi M. School lunch program for health promotion among children in Japan. Asia Pac J Clin Nutr 21(1):155–8. 2012.
20. Ishida H. Role of school meal service in nutrition. J Nutr Sci Vitaminol (Tokyo) 61:S20–2. 2015.

ORIGINAL

Rice Facilitates Salt Control in Japanese School Lunches

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ABSTRACT *Background and purpose*. Japanese dietitians exert considerable influence over the nation's school lunch program. Because of the well-recognized relationship between nutrition and children's health, increasing attention has been directed at the high salt content of school lunches in Japan. *Methods.* We examined school lunch menus from all prefectures, and 34 municipalities, focusing on the salt content of included menu items. We examined the relationship between salt values and the frequency with which certain foods (rice, seafood dishes, soup, and fruits or jelly) were served. Five municipalities complied with Japan's preestablished salt content standards (<2.0 g average per month). *Results.* According to linear regression analysis, salt values were independently negatively associated with the number of rice servings (P = 0.003). The adjusted R-squared for this linear regression model was 0.305. Many elementary schools remain non-compliant with recommended salt content, as established by the school lunch program's nutritional standards; however, these schools could comply by increasing the frequency with which rice is served in schools. *Conclusion.* Our results may have been biased due to the small number of menus that included average salt values. Elementary schools in Japan should publish their lunch menu's average salt values to further improve the nutrition of the Nation's schoolchildren.

Keywords: salt, rice, school lunch, elementary school, Japan

INTRODUCTION

Japanese school lunches have existed for more than 100 years. Free school lunches were introduced in 1889 in the Yamagata Prefecture to assist poor families. The 1954 School Lunch Act positioned school lunches as a key educational component. Later, after a period of rapid economic growth, rice lunches were introduced in 1976, and in 2009, the Revised School Lunch Act added *Shokuiku*, a Japanese philosophy of nutritional awareness, to school lunch objectives. Article 8 of the School Lunch Act establishes menu criteria which are used by dietitians for menu planning. In Japan today, approximately 190 school lunches are served throughout the country each year.

Japanese schoolchildren enjoy better nutrition on days when school lunches are provided (1). However, school lunches are often high in salt. Reducing salt and tobacco product intake is important for reducing the prevalence of non-communicable diseases (NCDs) *(2)*. The 2019 National Health and Nutrition Survey found that Japanese citizens consume an average of 10.1 g of salt per day. While this issue is widely recognized, many Japanese still exceed the recommended daily salt intake (3).

Japan requires school lunch programs to meet the recommended daily intake levels for 13 nutrients. These nutritional standards were revised in 2018, when the recommended daily salt intake was reduced from <2.5 g per serving to <2.0 g per meal *(4)*. Meanwhile, according to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) School Meal Nutrition Report, the salt intake of elementary school students in 2019 was 2.3 g (5). This makes it necessary to find out what kind of school lunch is being served; however, little is known about how much salt is contained in Japanese school lunches (6). This study examined school lunch menu conformance with Japan's school lunch program nutritional standards. The results generate examples and recommendations for planning school lunch menus that better meet Japan's nutritional guidelines.

MATERIALS AND METHODS

Study design. Historically, school lunch menus were only distributed to the students' families. Recently, these menus have been placed on school websites and are available to all. Despite this, there are no rules regarding the format or the labeling of nutritional information. We examined school lunch menus that list the average salt equivalent per month or day. The menu collection procedure is shown in **Figure 1**. The menu list was obtained using a web search between November 29 and December 3, 2021. The author calculated the one-month average if only daily salt values were listed. Since the average monthly salt intake would be skewed during months with fewer school lunches, we used October (rather than November or December) menu lists closer to the search date. We attempted to eliminate regional bias by sampling one menu item list from all prefectures in Japan. The survey began with "city," and the search keywords were "~city AND elementary school AND menu list." The next municipality was searched if the menu list was not found after scrolling down to the second page. If a school lunch menu was found for a municipality (including towns) other than the one searched, it was still adopted. Once a school lunch menu was identified within a prefecture, the next prefecture was searched. A similar search for towns was conducted if the menu list was not found after searching for all cities in a prefecture using the search terms. If a school lunch menu containing salt information was still not found, the search proceeded to the next prefecture and did not search villages.

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These procedures were used to examine all 47 prefectures. Since this study did not involve human subjects, and all menu lists obtained were publicly available on the Internet and accessible to anyone, and were not obtained privately from nutrition teachers or others, this study was considered exempt from ethics committee review. Out of an abundance of caution, municipality names are not disclosed.

Analysis method. To identify which menus complied with the recommended salt content per Japanese nutritional standards. We used multiple regression analysis with salt as the objective variable and menu items as the dependent variable. First, explanatory variables were selected for multiple regression analysis. Seasonings account for 56% of Japanese salt intake, followed by seafood, soups, noodles, pickles, and bread (7). Using this as a reference, we identified the number of times seafood was the main ingredient in a menu item. We additionally counted the number of times noodles and bread were served; however, because some municipalities serve a combination of bread and pasta or rice and udon on the same day, the count was bracketed by the number of times rice was served (otherwise, bread or noodles or bread and noodles were served on the same day). If rice and noodles were served on the same day, they were counted as rice. Fruits and jellies were also included in the analysis because they do not contain salt. Thus, the four explanatory variables were rice, soup, seafood dishes, and fruit or jelly. We counted the number of times each menu list included these four variables. The author determined which dish corresponded to which dish from the name on the menu list. Stew, clam chowder, and pot-au-feu were counted as soups. Pork beans and oden were excluded from soups. When seafood was only part of the dish—such as Ishikari nabe and salmon gratin—the dish was not considered a "seafood dish." We used statistical analysis software HAD (8) for all analyses and a two-tailed significance level of 5%.

RESULTS

Menu lists were obtained from municipalities in 34 prefectures. Of these, 15 municipalities prepared school lunches at the schools themselves, while 19 municipalities prepared them in central kitchens. Five municipalities complied with salt standards (<2.0 g per serving). The median salt values were 2.2 [2.03–2.40] g. Similarly, rice was served 14.0 [13.0–17.0] times, soup 14.0 [11.0–15.0] times, seafood dishes 5.0 [3.25–8.0] times, and fruit or jelly 3.0 [2.0–5.5] times. (**Table 1**)

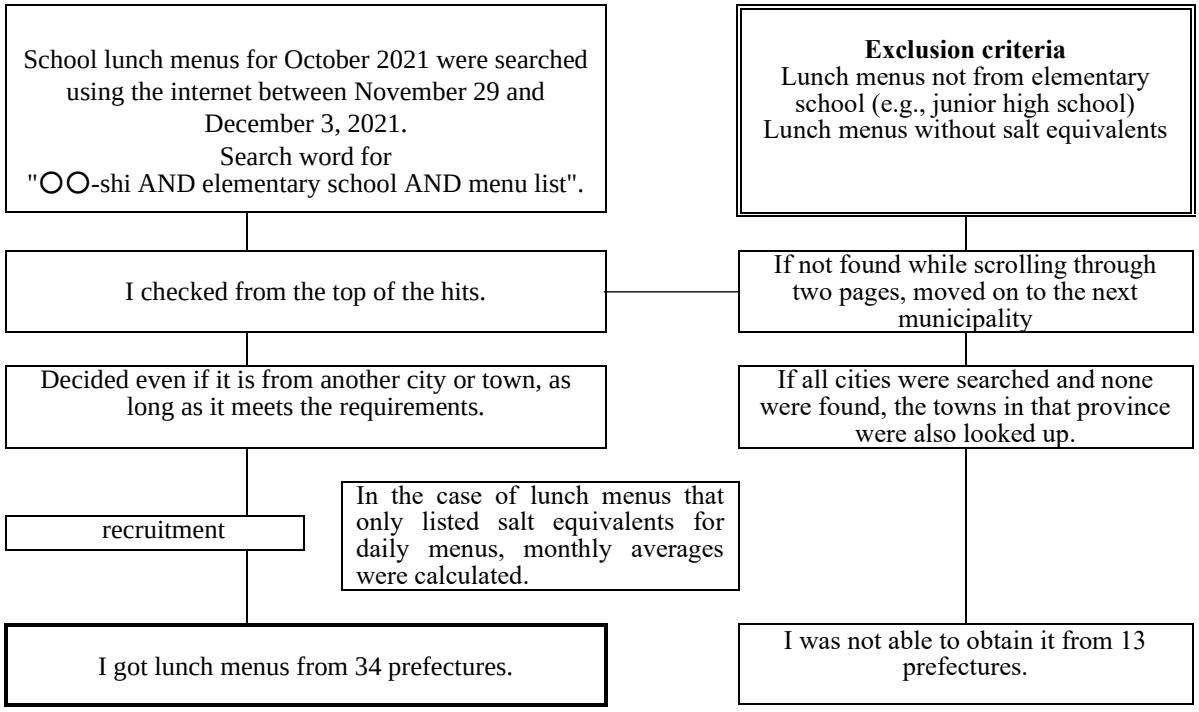

Figure 1. Process for obtaining lunch menus with salt equivalents

Table 1. Characteristics of municipalities that supplied school lunch menus for this study

prefectures*	average salt per month(g)	meal counts per month	number of dishes served				
			rice†	bread or noodles	soup‡	seafood dishes	fruits or jelly
No.1	2.9	18	10	8	11	3	4
No.2	2.2	21	17	4	19	9	8
No.3	2.8	19	12	7	16	7	3
No.4	2.3	21	15	6	15	5	8
No.5	2.2	20	14	6	16	6	2
No.6	2.4	18	10	8	15	6	1
No.7	2.0	20	16	4	15	8	2
No.8	2.2	20	16	4	16	8	6
No.9	2.1	18	17	1	8	4	3
No.10	2.3	19	11	8	15	8	4
No.11	2.3	21	13	8	12	6	3
No.12	1.7	21	16	5	12	9	6
No.13	2.2	21	17	4	14	1	7
No.14	1.9	21	20	1	12	10	2
No.15	2.4	21	17	4	12	8	6
No.16	2.4	21	13	8	10	8	3
No.17	1.9	21	21	0	19	9	2
No.18	2.1	21	17	4	9	2	4
No.19	2.0	21	13	8	8	2	1
No.20	2.4	20	11	9	14	5	4
No.21	2.5	20	13	7	11	5	2
No.22	1.9	21	16	5	11	6	8
No.23	2.4	20	12	8	16	5	6
No.24	2.5	21	13	8	15	9	6
No.25	2.0	21	17	4	10	4	2
No.26	2.1	21	13	8	14	3	0
No.27	2.5	21	13	8	16	4	3
No.28	1.9	21	17	4	6	5	2
No.29	2.2	20	15	5	8	3	2
No.30	2.1	21	20	1	14	9	2
No.31	2.5	20	14	6	11	4	3
No.32	2.0	20	11	9	11	3	3
No.33	2.4	21	13	8	14	3	3
No.34	2.3	20	12	8	14	3	1
Mean	**2.24**	**20.3**	**14.6**	**5.8**	**12.9**	**5.6**	**3.6**

*Fifteen municipalities prepared school lunches in the schools, while 19 municipalities prepared them in central kitchens.

†If rice and noodles were served together, I counted it as rice.

‡ Pot-au-feu and stew counted.

The multiple regression analysis results are shown in Table 2, including the average amount of salt per month as the objective variable and the number of menu items that were served (rice, soup, seafood dishes, fruit or jelly) as the explanatory variable. Salt values decreased significantly on menus where rice was served more frequently ($P = 0.003$). The coefficient of determination for this multiple regression analysis was 0.389 (adjusted $R2 = 0.305$). Finally, a scatter plot of salt content and the number of times rice was served is depicted in **Figure 2**. The number of times rice was served was significantly associated with salt content ($R = -0.614$, $P < 0.01$).

Table 2. Linear regression analysis results of average salt per month and the number of menu items served

Explanatory variable	Partial regression coefficient	95% CI		P-value	
Intercept	2.732	2.137	3.327	0.000	
Rice	−1.069	−1.735	−0.404	0.003	**
Soup	0.425	−0.159	1.009	0.148	
Seafood dishes	−0.143	−0.924	0.638	0.712	
Fruit or jelly	0.204	−0.567	0.974	0.593	

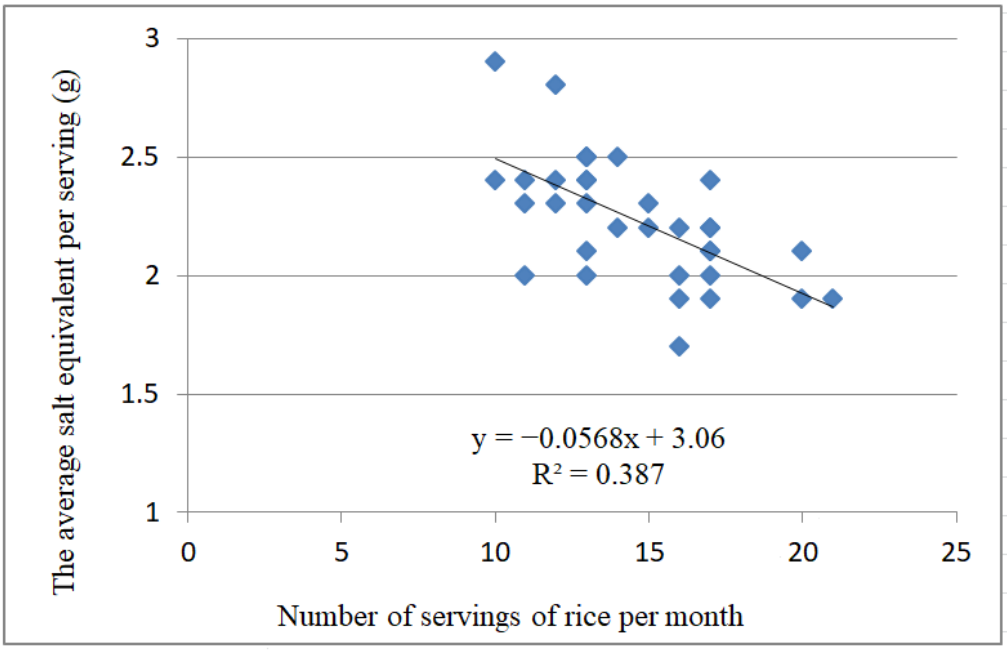

Figure 2. Correlation between average salt content and number of times rice was served during the month. HAD was used for statistical analysis.

DISCUSSION

Japan's school lunch nutritional standards were revised over three years ago. Although many municipalities could meet the previous standard of <2.5 g, only five had met the current standard of <2.0 g. Compared to similar prepared meals that are common in Japan, vegetable-focused prepackaged lunches from convenience stores had 484 kcal (±115) of energy and 5.0 g (±1.2) of *salt (9).* Meanwhile, junior high school lunches had 637 kcal (±43.51) and 2.7 g (±0.34) of salt (10). Both meals exceeded the recommended salt content established by the Japanese government. Looking at other countries, lunches served to Finnish preschoolers contained 1.37 MJ (±0.51) of energy and 1.6 g (±0.7) of salt *(11).* In South Korea, a typical school lunch for a fourth grader includes 2.44 g (±0.73) of salt (12), higher than recommended. Compared to other nutrients, it can be more difficult to meet salt standards established for school lunches (13). In Japan, seafood is the second-most-common ingredient (after seasonings) responsible for high dietary salt (7); however, the average amount of salt per serving did not increase even when seafood dishes were served more frequently. Thus, cooks and dietitians can find ways to limit dietary salt, even for dishes where fish is the main ingredient.

School lunch nutrition attracted increasing attention in Japan, even before national nutrition standards were introduced. Recommendations that elementary and junior high school meals contain <4 g salt emerged in 1995 (14). On the other hand, school lunches also play a role in Japan's food culture. For example, it would be difficult to strictly limit miso and soy sauce (both of which are high in salt), given the importance of these ingredients to the Japanese diet. MEXT, in its 2011 report "Establishment of School Meal Intake Standards," recognized the need to acclimate young children and adolescents to less-salty menu items without substantially limiting the use of miso and soy sauce, critically important to the nation's food culture (15). Unfortunately, if

dieticians don't set out to reduce salt content of school menu items, such improvements may be limited.

Since rice has been served in school lunches since 1976, the percentage has been gradually increasing; in 2009, MEXT announced its promotion of rice lunches at schools. According to the MEXT School Lunch Survey, in fiscal year (FY) 2021, Japanese schoolchildren are, on average, served rice in school 3.5 times per week. In-compliance municipalities included rice in their school lunches 3.8–5.0 times per week. Thus, options other than increasing the number of rice servings are available. However, since it is difficult to comply with recommended salt standards if rice is only served a few times per week, rice should be added to reduce the salt content of school lunches in Japan.

According to the Tables of Food Composition in Japan (8th revision), 100 g of bread or cobbler bread contain 1.2 g and 1.3 g of salt equivalent, respectively. Since approximately 70 g is given to third- and fourth-grade students in Japan, we estimate that each piece of bread provides ~0.8 g of salt equivalent. On the other hand, according to the United Kingdom's Food Composition tables, 100 g of bread would contain 380–400 mg of sodium, a salt equivalent of 0.96–1.1 g (16), about 20% less than in Japan. The United Kingdom has reduced the salt content of bread by about 20% over 10 years. In 2001, the salt content in 100 g of bread was 1.23 ± 0.19 g (17). A similar could help Japanese schools comply with Japan's revised nutritional standards.

The Japanese Food Labeling Law controls what information is included on food labels. Since 2015, pre-packaged processed foods must display nutritional information, including salt equivalent content. On the other hand, there are no rules governing what is included in school menus; each local government has its own rules. Consequently, the menus varied widely in energy, protein, fat, salt, and calcium. Some listed no nutrients at all. Notably, we failed to obtain menu lists from 13 prefectures with nutritional labels for salt. Today, school lunches serve as "living teaching materials" that can help schoolchildren learn about nutrition while providing additional information to families. We tried to obtain school lunch menus from across the country; however, the results may be biased because only some of the menus included average salt values. However, given the lack of prior school lunch menu studies, our results will likely inform future efforts to reduce the salt content of school lunch menu items. Future, large-scale studies are needed to advance this area of research. In Japan, our results may encourage more municipalities to publish the nutritional information from school lunches.

CONCLUSION

Five municipalities complied with salt standards (< 2.0 g one-month average). The amount of salt was significantly negatively correlated with the number of rice servings. The results suggest that although many elementary schools are still not in compliance with the salt standards for school lunches, it may be possible to achieve this by increasing the number of rice servings.

CONFLICTS OF INTEREST

The author has no conflict of interest to declare.

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REFERENCES

1. Asakura K, Sasaki S. School lunches in Japan: their contribution to healthier nutrient intake among elementary-school and junior high-school children. Public Health Nutr 20: 1523–1533. 2017.Wardle J. Parental influences on children's diets. Proc Nutr Soc 54:747-758. 1995.
2. Beaglehole R, Bonita R, Horton R, et al. Priority actions for the non-communicable disease crisis. Lancet 377: 1438–1447. 2011.
3. Fauzi M, Kartiko-Sari I, Poudyal H. Trends of dietary intakes and metabolic diseases in Japanese adults: assessment of national health promotion policy and national health and nutrition survey 1995-2019. J Clin Med 11: 2350. 2022.
4. Ministry of Education, Culture, Sports, Science and Technology, Japan: Partial recision of Criteria for Provision of School Lunches. (July, 31, 2018). (in Japanese). https://www.mext.go.jp/content/20210212-mxt_kenshoku-100003357_1.pdf (Accessed January, 12, 2023)
5. Ministry of Education, Culture, Sports, Science and Technology, Japan: School Lunch Nutrition Report (FY) 2019. (in Japanese). https://www.mext.go.jp/content/20200619-mxt_kenshoku-000008019_1.pdf (Accessed February, 4 2023)
6. Nagura H, Yamazaki Y, Kurisaki J, et al. Examination of the quality control of 5 school lunch menus. J Jpnese Soc Shokuiku 11: 25–34. 2017.
7. Asakura K, Uechi K, Masayasu S, et al. Sodium sources in the Japanese diet: difference between generations and sexes. Public Health Nutr 19: 2011–2023. 2016.
8. Hiroshi S. An introduction to the statistical software HAD: Suggestions to improve teaching, learning and practice data analysis. JMIC. 1: 59–73. 2016.
9. Namba T, Kushida O, Murayama N. The relationship between amount of vegetables energy, percentage energy from fat, and sodium chloride equivalent in the boxed meals soled in the convenience stores. Niigata J Health Welf 12: 28–34. 2012.
10. Horinishi E, Maruyama S: The study of make lunch environmental for femalestudent at junior high school –Salt distribution of Lunch box-. Treatises Stud Fac Kinjô Gakuin Univ 17–22. 2019.
11. Korkalo L, Nissinen K, Skaffari E, et al. The contribution of preschool meals to the diet of finnish preschoolers. Nutrients. 11: 1531. 2019.
12. Ahn S, Park S, Kim JN, et al. Salt content of school meals and comparison of perception related to sodium intake in elementary, middle, and high schools. Nutr Res Pract. 7: 59–65. 2013.
13. Crepinsek MK, Gordon AR, McKinney PM, et al.

Meals offered and served in US public schools: do they meet nutrient standards? J Am Diet Assoc. 109: S31–S43. 2009.
14. Morimoto K, Miyahara K. Nutritional management implemented at school lunch programs in Japan based on the changes in criteria for provision of school Lunches. Jpn J Nutr Diet Suppl 1: S23–S37. 2018.
15. Research Study Collaborator Conference on Formulation of Dietary Reference Intake of School Children in School Lunch Program: Formulation of the School Lunch Intake Standards (Report). Ministry of Education, Culture, Sports, Science and Technology, Japan. (2011). (in Japanese). https://www.mext.go.jp/b_menu/hakusho/nc/__icsFiles/afieldfile/2013/03/21/1332086_2.pdf (Accessed January, 12, 2023)
16. Composition of foods integrated dataset (CoFID): https://www.gov.uk/government/publications/composition-of-foods-integrated-dataset-cofid.
17. Brinsden HC, He FJ, Jenner KH, et al. Surveys of the salt content in UK bread: progress made and further reductions possible. BMJ Open 3: 1–7. 2013.

Original

The Risk of Refeeding Syndrome in ICU COVID-19 Patients and Some Association Factors in the COVID-19 Hospital in Vietnam

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ABSTRACT: *Background and purpose*: Many COVID-19 patients in ICU suffer from acute respiratory distress syndrome (ARDS), which requires urgent respiratory and hemodynamic support. In these patients, nutrition support plays a pivotal role and should be combined with comprehensive treatment as early as possible. Also, there are several nutrition-specific issues in ICU COVID-19 patients that need to be taken into consideration and one of them was the risk of refeeding syndrome (RFS). In this study, we aimed to describe the risk of refeeding syndrome in severe and critically ill COVID-19 patients at The COVID-19 Patients Treatment Hospital (COVID-19 hospital) in 2021-2022. *Methods:* A cross-sectional study was conducted among 460 patients with moderate and severe conditions admitted to the COVID-19 hospital from September 2021 to May 2022. The risk of refeeding syndrome was evaluated by ASPEN 2020 criteria. *Results*: The percentage of patients who had the risk of refeeding syndrome was 55.3%, of which the moderate risk was 43%, and 12.3% for severe risk; 16.9% of patients were diagnosed with the refeeding syndrome. The most common comorbidities were hypertension and diabetes, which occurred in 56.6 and 38.5 percent of patients respectively. There was a statistically significant association between age, oxygen therapy, feeding method (EN and no EN), nutrition status, COVID-19 condition of patients, propofol usage, and the risk of refeeding syndrome with $p < 0.05$. *Conclusion*: RFS is a severe complication of nutritional intervention, therefore, early diagnosis and preventive treatment of refeeding syndrome will help prevent feeding complications in severe and critically ill patients.
Keywords: COVID-19 patients, malnutrition, Refeeding syndrome, COVID-19 Patients Treatment Hospital

INTRODUCTION

The COVID-19 pandemic is an ongoing global pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1). This pandemic has been responsible for millions of deaths all over the world. Researches show that up to 30% of COVID-19 patients presenting with acute respiratory distress syndrome (ARDS) require urgent respiratory and other life support in the intensive care unit (ICU) (2). In these patients, nutrition support plays a pivotal role and should be combined with comprehensive treatment as early as possible. Regarding nutritional management, there are several nutrition-specific issues in COVID-19 patients in the ICU that need to be taken into consideration and one of them was refeeding syndrome (RFS). The refeeding syndrome is defined by the disturbance of vital electrolytes and minerals like potassium, magnesium, and phosphorus,..and its clinical sequelae that happened when moderate and severely malnourished patients, often in ICU, responded to nutritional re-introduction (3). If treated inappropriately, RFS can cause serious complications to patients, including seizures, heart failure, and comas (4).

RFS is closely related to the critical condition of ICU patients (5). In the context of COVID-19 patients in the ICU, the management of RFS play an important role in the overall treatment of these patients. COVID-19 patients in ICU are often vulnerable (old and weak) and with comorbidities such as diabetes, hypertension, or other chronic diseases (6). Patients are also staying in ICU for long periods, ranging from 6-15 days, and are ventilated for most of their time (6-7). Therefore, it is expected that COVID-19 patients who survived ICU would present severe malnutrition and muscle mass loss. As a consequence, COVID-19 patients in ICU were susceptible to RFS and can suffer from its complications.

Although there were many researches about refeeding syndrome in ICU patients (5, 8-9), there were few studies in the field of COVID-19 patients in ICU. In this study, we aim to evaluate the risk of RFS in these patients with two objectives:

1. Describe the risk of RFS in severe and critically ill COVID-19 patients in the ICU at COVID-19 Patients Treatment Hospital 2021-2022.
2. Identify some associated factors that can contribute to the risk of RFS in these COVID-19 patients in the ICU.

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MATERIAL AND METHODS

Settings and Sample

The study was designed as a cross-sectional study that involved the convenience sampling of a total of 342 patients in the ICU at the COVID-19 Patients Treatment Hospital from September 2021 to May 2022. The inclusion criteria were patients diagnosed with, severe and critical COVID-19 status. The study excluded patients who could not get enough anthropometric measurements.

Data collection

We collected data on a convenience sample in two ICU departments in the COVID-19 Hospital for six months from September 2021 to May 2022.

Variables

Demographic characteristics: age, gender, comorbidities, the ability for self-feeding skills and method (independent, partial support, complete support), oral feeding, enteral nutrition (EN), parental nutrition (PN), oxygen therapy (invasive mechanical ventilation (IMV), Noninvasive positive pressure ventilation (NIV), high flow nasal cannula (HFNC), oxy mask, nasal cannula, room air). The data were collected from electronic medical records, medical staff (nurses, doctors, dietitians), and subjects.

Non-volitional weight loss: we asked patients or caregivers by mobile-phone or previous medical staff to know patients' weight loss status.

Reduced muscle mass: nurses or doctors or dietitians would examine or observe some positions on patients' bodies. These are the temples, clavicle, shoulder, scapula, thenar, thigh/knee, and calf. In terms of Subcutaneous fat loss, we examine or observe some body's locations such as orbital fat pads, buccal fat pads, and triceps.

Reduced food intake or assimilation: we asked patients or caregivers or previous medical staff to know patients' intake status or observed patients' eating during the initial 24 hours of entering the hospital if we could not obtain any information from patients or caregivers or previous medical staff.

COVID-19 patients stay in an inflammation condition.

Screening refeeding syndrome according to ASPEN guideline 2020

Screening refeeding syndrome: we based on the ASPEN 2020 recommendation for screening refeeding syndrome. There are two levels of refeeding syndrome, which have moderate and severe levels.

Statistical Analysis

The data were entered by using Microsoft Access (Microsoft Corporation, Hanoi, Vietnam) and Stata 14.0 statistical software (Stata Corp LLC, California) for analysis. The intergroup comparisons were performed using the Chi-squared test, Fisher's exact test, and the Mann-Whitney U test. Statistical differences were considered significant at $p < 0.05$.

Ethics Approval

The study has been approved by the research review board of Hanoi Medical University. The study was approved by the Board of Directors of Hanoi Medical University Hospital and the Board of Directors of Hanoi Medical University under Decision No. 1469/QD-ĐHYHN dated May 20, 2022.

RESULTS

Table 1 showed that the total participants of the study were 342 patients at age of 18 to 103 years old, and the mean of age was 72.3 ±16.1. Elderly patients who were more than 65 years old accounted for 70.3% of the total patients. In terms of gender, males accounted for 53.2% and females accounted for 46.8%. For the COVID-19 condition in the first 24-48h of ICU admission, 39.8% of patients were in severe condition and 60.2% in critically ill condition. Regarding comorbidity, only 9.4% of ICU patients did not have any comorbidity disease. On the contrary, the percentage of patients who suffered from ≥3 comorbidities was the highest, at 39.2%. Hypertension accounted for the highest percentage with more than 70 percent of ICU patients having this comorbidity. The percentage of patients who had Diabetes or Obesity was lower, at approximately 50.8 and 14 percent respectively. When assessing the nutritional assessment of these COVID-19 patients in the ICU based on GLIM criteria, about 78.4 percent of these patients suffered from malnutrition, of which 47.7 percent were moderate and 30.7 percent for severe malnutrition. In the first 24 to 48 hours of hospital admission, only 7% of patients did not need any kind of oxygen support. The percentage of patients who needed oxygen through masks was the highest, at 38.9%. The figure for invasive mechanical ventilation (IMV) was the second highest, at 30.6%.

Table 1: The characteristics of COVID-19 patients in ICU (n=342)

n=342	X ± SD	Min	Max
Age	71.3 ± 16.06	18	103
Height	159.8 ± 7.60	140	185
Weight	57.2 ± 11.4	35	100
BMI	22.3 ± 3.5	14.8	38.1
Time from COVID-19 detection to ICU admission	4.1 ± 3.6	1	25

		n	%
Gender	**Male**	182	53.2
	Female	160	46.8
Condition of patients in ICU	**Severe**	135	39.8
	Critical ill	204	60.2

Oxygen support	**Room air**	24	7
	Oxy mask	133	38.9
	Nasal-cannula	46	13.5
	HFNC	18	5.3
	NIPPV	16	4.7
	IMV	105	30.6
	None	32	9.4
Comorbidity	**1**	69	20.2
	2	107	31.2
	>=3	134	39.2
Most common comorbidity	**Hypertension**	252	73.7
	Diabetes	177	51.8
	Obesity	48	14
Propofol usage	**Yes**	109	31.9
	No	233	68.1
Malnutrition diagnosis based on GLIM criteria	**Normal condition**	74	21.6
	Moderate malnutrition	163	47.7
	Severe malnutrition	105	30.7

Table 2. The risk of refeeding syndrome

Assessment criteria (ASPEN) (n=342)		**n**	**Rate (%)**
Low BMI (kg/m^2) (n= 342)	**< 16.0**	6	1.8
	16-18.5. kg/m^2	40	11.7
Weight loss (n= 342)	**Moderate loss**	120	26.1
	Severe loss	6	1.3
Loss of muscle mass/loss of subcutaneous fat (n= 342)	**Mild to moderate loss**	135	39
	Severe loss	25	7.2
Caloric intake (n= 342)	**< 75% estimated energy requirement**	132	38.2
	< 50% estimated energy requirement	24	7
Low potassium levels (n = 57)	**> 30%**	6	1.8
	≤ 30%	40	11.7
Low phosphorus levels (n = 14)	**> 30%**	5	35.7
	≤ 30%	9	64.3

Table 2 showed the ASPEN evaluation of COVID-19 patients in the ICU. Nearly half of ICU patients suffered from losing muscle mass and subcutaneous fat, of which about 40 percent had a moderate loss and 7 percent had a severe loss. Similarly, more than 40 percent of patients had reduced caloric intake, mostly lower than the 75% estimated energy requirement.

Based on figure 1, the risk of refeeding syndrome in COVID-19 patients was 55.3% overall. Of these, 42.3% of patients had a moderate risk of RFS, and 12.3% with severe risk. Of these patients who had the risk of RFS, 16.9% of patients were diagnosed with the refeeding syndrome, of which 43.7 percent for severe RFS and 37.5 percent for moderate RFS.

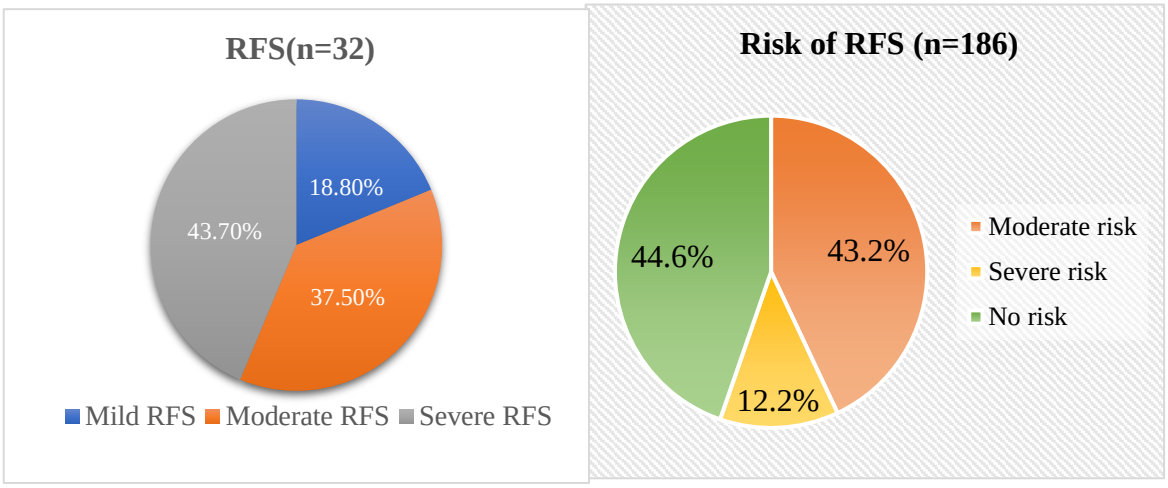

Figure 1. Patients at risk of refeeding syndrome and RFS diagnosis

Table 3: The risk of RFS in different aged groups and comorbidities

		Risk of RFS n (%)	No risk of RFS n (%)	p	OR (95% CI)
Sex	**Male**	99 (54.4)	83 (45.6)	0.73*	1.07 (0.70 – 1.65)
	Female	90 (56.3)	70 (43.8)		
Age		72.4 ±16.6	69.8±15.4	**0.04** ♀	
	<65	43 (22.75)	47 (30.7)	0.096*	1.51 (0.93 – 2.45)
	≥65	146 (77.25)	106 (69.3)		
Comorbidities	**≥ 3**	69 (51.5)	65 (48.5)	0.26*	0.77 (0.50 – 1.21)
	< 3	120 (57.7)	88 (42.3)		
Common comorbidity	**Hypertension**	102 (56)	89 (61.2)	0.29*	0.79 (0.50 – 1.23)
	Diabetes	74 (41.8)	67 (47.2)	0.34*	0.80 (0.51 – 1.26)
	Obesity	14 (7.4)	34 (22.2)	**0.000***	0.28 (0.14 – 0.55)

*: Chi-square test

♀: Mann Whitney test

Table 3 shows that sex, hypertension, and diabetes comorbidities are not associated with the risk of RFS while age and obesity comorbidity are associated with the risk of RFS.

Table 4: The risk of refeeding syndrome and clinical condition of patients

	Variables	Risk of RFS	No risk of RFS	p	OR (95%CI)
Oxygen support	**IMV**	90 (74.4)	31 (25.6)	**0.000***	3.58 (2.15 – 5.95)
	Oxy mask	99 (44.8)	122 (55.2)		
Condition of COVID patients	**Critical ill**	131 (64.2)	73 (35.8)	**0.000***	2.53 (1.60 – 4.00)
	Severe	56 (41.5)	79 (58.5)		
GLIM	**Malnutrition**	188 (70.2)	80 (29.9)	**0.000***	171.55 (15.17 – 1940000)
	Normal	1 (1.4)	73 (98.7)		
ICU time	**≥ 7 days**	42 (53.9)	36 (46.2)	0.775*	0.93

	< 7 days	147 (55.7)	117 (44.3)		(0.56 – 1.54)
Propofol usage	**Yes**	75 (68.8)	34 (31.2)	**0.001***	2.30 (1.41 – 3.76)
	No	114 (48.9)	119 (51.1)		
Nutrition feeding route	**No EN**	97 (45.5)	116 (54.5)	**0.000***	0.34 (0.21 – 0.55)
	EN (bolus)	92 (71.3)	37 (28.7)		
	PN	7 (87.5)	1 (12.5)	0.085**	6.13 (0.59 – 63.68)
	EN + PN	16 (53.3)	14 (46.7)		

*: Chi-square test

**: Fisher‘s exact test

Table 4 showed that the types of oxygen support, condition inpatients, malnutrition condition, propofol usage, and nutrition feeding route are associated factors with the risk of RFS, and these associations are significant ($p<0.05$).

DISCUSSION

The research was carried out on 342 severe and critically ill COVID-19 patients at COVID-19 Hospital 2021 of Hanoi Medical University Hospital. The median age was 71.3 years old (ranging from 18-103 years old). A total of 182 males and 160 females participated in the research. The mean age was higher than that of a similar Korean study (57.5 years) (10). The severity of COVID-19 was classified as pneumonia without oxygen treatment (7%), pneumonia with oxygen treatment by nasal cannula (13.5%), oxy mask (38.9%), and HFNC (18%). Additionally, 35.3% of patients needed mechanical ventilation support (both NIPPV and IMV). In terms of comorbidity, the most common comorbidities were hypertension (73.7%), diabetes mellitus (51.8%), and obesity (14%). These figures were different in composition of comorbidities than that of Ye Minn Htun’s study In Myanmar in 2021 (58.3% for hypertension, 29.8% for diabetes mellitus) (11). These comorbidities cause the COVID-19 disease more severe and increase the risk of death in patients.

In terms of RFS, RFS is historically described as a range of metabolic and electrolyte alterations occurring as a result of the reintroduction and/or increased provision of calories after a period of decreased or absent caloric intake. In patients experiencing refeeding syndrome, a dangerous shift in fluids and electrolytes occurs within the body, resulting in compromised cardiovascular status, respiratory failure, seizures, and even death. RS diagnostic criteria are outlined as the following: A decrease in any 1, 2, or 3 of serum phosphorus, potassium, and/or magnesium levels by 10%–20% (mild RFS), 20%–30% (moderate RFS), or >30% and/or organ dysfunction resulting from a decrease in any of these and/or due to thiamin deficiency (severe RFS). And occurring within 5 days of reinitiating or substantially increasing energy provision. Overall, in our research, 55.3 percent of patients in the ICU had the risk of RFS. This percentage was higher than that of the Boot R study (36.8%) and lower than the Zahra study in 2022(82%) (7, 12). This can be explained by that we had taken a wider patient spectrum (severe and critically ill patients) than that of the Zahra study (only critically ill patients). More specifically, 18.8% of patients suffered from severe RFS, of which 5 of them had reduced blood phosphorus of more than 30%; 37.5% of patients suffering from moderate RFS with 9 patients had reduced blood phosphorus under 30%. Reduced blood phosphorus can lead to disorientation, encephalopathy, areflexic paralysis, seizures, coma, tetany, cardiac, hypotension, shock, decreased stroke volume, and hematologic. In addition, the condition of diaphragmatic weakness, and respiratory failure leads to patients having difficulty weaning off the ventilator support. Consequently, the prevention and treatment of RFS play an important role in the overall therapeutic strategy of COVID-19 patients.

Regarding the exploration of associated factors, we assessed the association between demographic variables, medical history, and clinical indicators with RFS risk. There are some similarities and complementarities in the results when compared with Zahra's study (12). As for the similarities, both studies showed that gender was not an associated factor, while malnutrition was strongly associated with RFs risk. This is because while malnutrition happened when a patient had been malnourished for a long period of time, the action of reintroduction of food to them can lead to RFS. Similarly, both studies found a correlation between age and the risk of RFS. As a complement to Zahra's study, there were differences in results when assessing associations with comorbidity, and feeding routes. While Zahra reported that comorbidity was a risk factor for the occurrence of RFS, our study found no association, with the exception of Obesity. The reason for these differences is that the classification of the variables is different. In terms of comorbidity, Zahra concluded that having one or more comorbidities was a risk factor, and our results add to the information that patients with 3 or more diseases had no difference in the risk of RFS compared with patients with 1 or 2 diseases. Our study also found that there is a correlation between patients who also had obesity and the risk of RFS. Regarding the feeding route, when only comparing the risk of RFS between the two groups of PN and PN+EN routes, no association was found. However, we further compared the EN group with the no EN group showing that no EN group is a risk factor for RFS. In addition, mechanical ventilation was a risk factor for RFS compared with oxygen with an OR = 1.83. Our study also found that the propofol usage of patients is also related to the risk of RFS with an OR = 2.30.

CONCLUSION

In conclusion, this study investigated the refeeding syndrome and some of its associated

factors in severe and critically ill COVID-19 patients in the ICU. The results showed that nearly half of these patients with COVID-19 had the risk of RFS and some of the patients were diagnosed with RFS. We also found that while sex, type of oxygen support, and the feeding route of patients required in ICU, the COVID-19 condition of inpatients is associated with the risk of RFS, the difference in sex and comorbidity showed no association. Therefore, we suggest that malnutrition and RFS may favor the onset of COVID-19 and increase the severity of COVID-19 disease. Recognizing the risk and identifying, stratifying, avoiding, and managing RFS should be included in the overall treatment of COVID-19. Further research is needed on the impact of malnutrition and refeeding syndrome in COVID-19.

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REFERENCES

1. Zhu N, Zhang D, Wang W, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med 382(8):727-733. 2020.

2. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet Lond Engl 395(10223):497-506. 2020.

3. Runde J, Sentongo T. Refeeding Syndrome. Pediatr Ann 48(11):e448-e454. 2019.

4. Wirth R, Diekmann R, Janssen G, et al. [Refeeding syndrome : Pathophysiology, risk factors, prevention, and treatment]. Internist 59(4):326-333. 2018.

5. Boot R, Koekkoek KWAC, van Zanten ARH. Refeeding syndrome: relevance for the critically ill patient. Curr Opin Crit Care 24(4):235-240. 2018.

6. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet Respir Med 8(5):475-481. 2020.

7. Vignaud M, Constantin JM, Ruivard M, et al. Refeeding syndrome influences outcome of anorexia nervosa patients in intensive care unit: an observational study. Crit Care Lond Engl 14(5):R172. 2010.

8. Olthof LE, Koekkoek WACK, van Setten C, Kars JCN, van Blokland D, van Zanten ARH. Impact of caloric intake in critically ill patients with, and without, refeeding syndrome: A retrospective study. Clin Nutr Edinb Scotl 37(5):1609-1617. 2018.

9. Im JH, Je YS, Baek J, Chung MH, Kwon HY, Lee JS. Nutritional status of patients with COVID-19. Int J Infect Dis IJID Off Publ Int Soc Infect Dis 100:390-393. 2020.

10. Htun YM, Thiha K, Aung A, et al. Assessment of depressive symptoms in patients with COVID-19 during the second wave of epidemic in Myanmar: A cross-sectional single-center study. PLoS ONE 16(6):e0252189. 2021.

11. Vahdat Shariatpanahi Z, Vahdat Shariatpanahi M, Shahbazi E, Shahbazi S. Refeeding Syndrome and Its Related Factors in Critically Ill Coronavirus Disease 2019 Patients: A Prospective Cohort Study. Front Nutr 9:830457. 2022.

Original

Nutritional status and associated factors of gastrointestinal surgical patients at Hanoi Medical University Hospital between 2021 and 2022

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ABSTRACT: *Background/Purpose*: In patients following gastrointestinal surgery, a poor early post-operative nutritional status or risk is linked to a longer post-operative length of stay. Thus, this study aimed to examine the prevalence of nutritional status and the some related factors of gastrointestinal post-operative patients. *Methods:* A cross-sectional study was conducted on 101 patients with gastrointestinal surgery at the Department of General Surgery, Hanoi Medical University Hospital from October 2021 to July 2022. We used the Global Leadership Initiative on Malnutrition (GLIM) criteria (1), for the diagnosis of malnutrition,which includes the identification of a phenotype and an etiology. Besides, we used some laboratory tests for hemoglobin (Hb), serum albumin, and pre-albumin to evaluate nutritional status. *Results:* The proportion of malnutrition according to GLIM was 66.3%, of that, 44.5% of patients were classified as severe malnutrition. Malnutrition according to BMI was 32.7%. The majority of gastrointestinal surgical patients have low levels of albumin and prealbumin. Surgical diseases with obstruction (eg: pyloric stenosis induced by gastric cancer/tumor, intestinal obstruction) increased the odds of malnutrition by 3.23 times, compared to diseases without obstruction. *Conclusion:* This study determined that the prevalence of malnutrition in GI surgical patients was very high. Surgical diseases with obstruction (eg: pyloric stenosis induced by gastric cancer/tumor, intestinal obstruction increased the odds of malnutrition. Therefore, surgical patients need to be evaluated nutritional status in order to give reasonable nutrition intervention.
Keywords: nutritional status**,** gastrointestinal surgical patients, malnutrition, Hanoi Medical University Hospital.

INTRODUCTION

The nutritional status is one of the independent factors that influence post-operational outcomes. An often present complication of perioperative sickness is malnutrition (2). This is possibly due to intolerance to oral foods, and clinical manifestation includes symptoms such as nausea, vomiting, and/or diarrhea. In malnourished or at-risk malnutrition patients, the organic response to surgical trauma has greater repercussions and negatively influences the results. According to studies, 40% to 50% of surgical patients admitted to the hospital are undernourished (3-4). In particular, patients undergoing gastrointestinal surgery are at risk of malnutrition as a result of anorexia, dietary restriction, malabsorption or increased intestinal losses.

Various methods for nutritional evaluation have been proposed, using clinical, biochemical, and anthropometric evaluation tests, as well as corporal composition exams. In general, the anthropometric methods are practical, simple, non-invasive and without additional costs and, when associated with other objective parameters (laboratory, for example), they improve precision and the accuracy of the diagnosis of the nutritional disorder.

In Vietnam, only one research suggests that patients undergoing surgery for gastrointestinal (GI) are particularly at risk of malnutrition in Bach Mai Hospital (4). At Hanoi Medical University Hospital (HMUH), malnutrition has been noticed more frequently in every specialty. There is limited data on the nutritional status of gastrointestinal surgical patients. And in these patients, which type of surgery could be at higher risk of malnutrition as compared to the others is an unclear question. Because malnutrition and its associated complications are a substantial issue for surgical patients with GI, further research is needed to determine which associated factors can predict patients' nutritional status outcomes. Thus, this study aimed to examine the prevalence of nutritional status and some related factors of gastrointestinal surgical patients to establish a rationale and direction for future research in this area.

METHODOLOGY

Study design and subjects

A cross-sectional study was conducted on postoperative patients with gastrointestinal surgery at the Department of General Surgery, Hanoi Medical University Hospital from October 2021 to July 2022. Patients who were 18 years of age or older; (2) staying conscious and stable hemodynamic; (3) length of stay at the department ≥ 48 hours; (4) patients who have complete information and laboratory results in the

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electronic medical record were included in our study. We excluded patients requiring postoperative transfer to the ICU or pregnancy.

We applied convenience sampling to recruit participants. Post-operative patients met the above-mentioned inclusion criteria were invited to participate in the study. Thus, the total number of selected patients was 101.

Nutritional status of all participants was evaluated within 24 – 48 hours right after the transmission from operation room to the General Surgery Department. Demographic and medical information including sex, age, date of admission of the department, admission diagnosis, history of diseases, and some laboratory tests regarding nutritional status were collected.

Assessment of nutritional status

Anthropometry

Anthropometric indices of participants were evaluated by height and weight. Bodyweight and height were measured when participants had light clothing without shoes. We used a Tanita scale and a wooden parameter with an accuracy of 0.1 kg and 0.1 cm to measure the weight and height of participants. Body Mass Index (BMI) was computed as the ratio of weight (kg) per height squared (m^2). According to the Asia-Pacific classification of BMI, BMI <18.5 kg/m^2 was considered underweight, 24.9 > BMI ≥ 23 was overweight, and BMI ≥ 25 was obesity.

GLIM criteria

We followed the Global Leadership Initiative on Malnutrition (GLIM) (1), the diagnosis of malnutrition includes both the identification of a phenotype and an etiology. Phenotypic criteria involve unintentional weight loss, low BMI, and reduced muscle mass. Etiology includes reduced food intake or assimilation and disease burden. Patients eligible for at least one phenotypic criterion and one etiologic criterion would be diagnosed as malnutrition. Then, we classified the severity of malnutrition based on phenotype as follows:

Phenotype	Weight loss (%)	Low body mass index (kg/m2)	Reduced muscle mass
Stage 1/Moderate Malnutrition (Requires 1 phenotypic criterion that meets this grade)	5-10% within the past 6 mo, or 10 -20% beyond 6 mo	<20 if < 70 yr, <22 if ≥ 70 yr	Mild to moderate deficit [a]
Stage 2/Severe Malnutrition (Requires 1 phenotypic criterion that meets this grade)	>10% within the past 6 mo, or >20% beyond 6 mo	<18.5 if < 70 yr, <20 if ≥ 70 yr	Severe deficit [b]

a, b: Due to the unavailability of validated assessment methods such as bioelectrical impedance analysis (BIA), CT or MRI, and dual-energy absorptiometry, we used physical examination to evaluate muscle mass loss (5))

Determination of energy requirements: energy target was set at 25 kcal/kg/day, as it is recommended by the European Society of Parenteral and Enteral Nutrition (ESPEN) (6). We determined the reduction of caloric by the proportion of actual oral intake and total energy requirement.

Laboratory tests

We used hemoglobin (Hb), serum albumin, and pre-albumin to evaluate nutritional status. According to the World Health Organization, anemia is that Hb is less than 130g/L in adult males, and less than 120g/L in adult females (7). Serum albumin < 35g/L (8) was classified as hypoalbuminemia, and pre-albumin < 20 mg/dL was classified as low level (9).

Statistical analysis

EpiData version 3.1 was used to enter all variables, data of general information, anthropometry, weight loss, prefeeding serum potassium, phosphorus, or magnesium, type of surgery, admission diagnosis. All variables are listed in table 2.1.

Stata version 15.0 will be used for data analysis. Data screening will be done before analyzing the data. Data were expressed as mean ± SD, n, %. For comparison of categorical variables, chi-square was used, and for continuous variables, student T-test and Mann – Whitney U test were used, T-test was for normal distribution and Mann – Whitney for non-normal distribution. The probability level of $p < 0.05$ was set for statistical significance. Logistic regression analysis test will be used to determine the association between malnutrition and some factors such as types of surgery and locations of surgery.

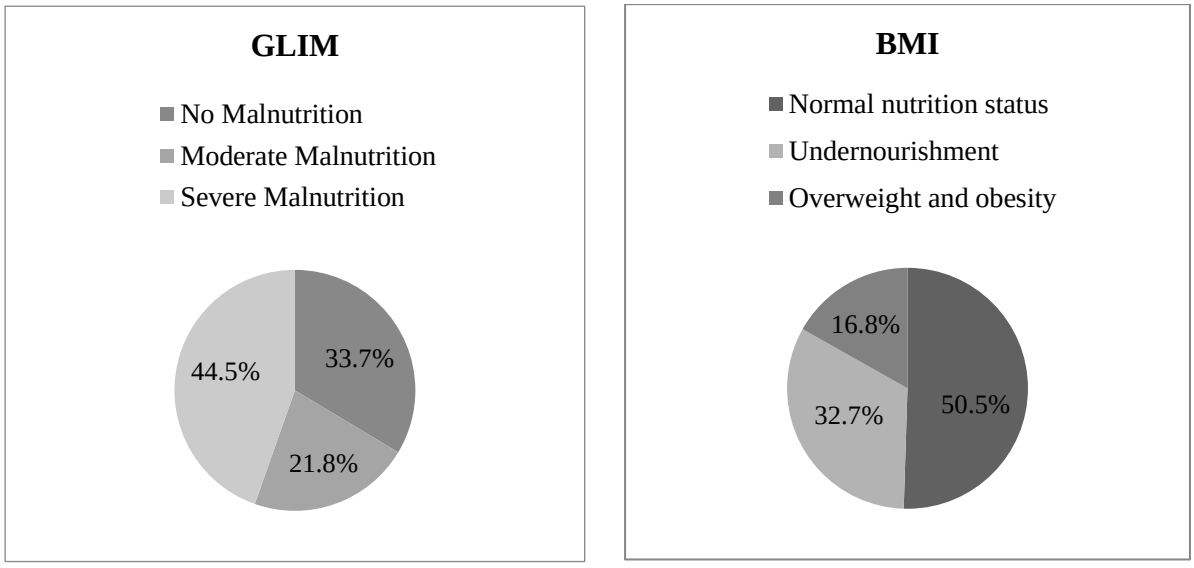
RESULTS

Table 1 includes demographic information, admission diagnosis and history of diseases of all patients. The majority of patients were male (62.4%). Mean age was 60.91 ± 15.1 years old. In terms of admission diagnosis, colorectal cancer was the most common disease, followed by acute diseases such as peritonitis of bowel obstruction. The proportion of gastric cancer accounted for the lowest figure, which was 11.9%. There were only 1% of patients having more than 3 comorbidities, the majority of patients had 1 comorbidity. Among these, hypertension was the most common comorbidity.

Table 1. General characteristics of the study participants

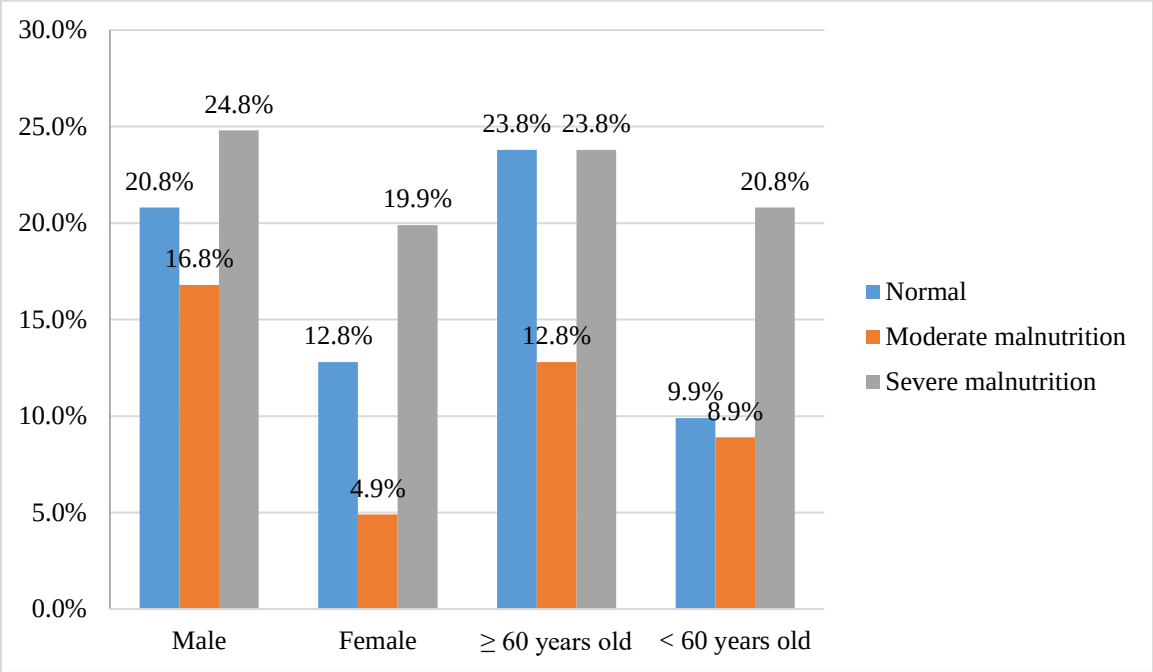
General information		n (%)	
Sex	**Male**	63 (62.4)	
	Female	38 (37.6)	
Admission diagnosis	**Esophageal cancer**	16 (15.8)	
	Gastric cancer	12 (11.9)	
	Colorectal cancer	28 (27.7)	
	Pyloric/duodenal stenosis	20 (19.8)	
	Peritonitis/ bowel obstruction	25 (24.8)	
History of diseases	**Hypertension**	22 (22.2)	
	Diabetes	17 (17.2)	
	Cirrhosis	2 (2.0)	
	1 comorbidity	43 (42.6)	
	2-3 comorbidities	21 (20.8)	
	More than 3 comorbidities	1 (1)	
	$\bar{X}$ ± SD	**Min**	**Max**
Age	60.9 ± 15.1	28	94

Figure 1: The prevalence of malnourished patients by GLIM and BMI.



The proportion of malnutrition according to GLIM was 66.3%, of that, 44.5% was classified as severe malnutrition. Malnutrition according to BMI was 32.7%. There was 17% of patients classified as overweight and obesity according to BMI.

Figure 2: The prevalence of malnourished patients (GLIM) by gender, age (%)



It can be seen that severe malnutrition was distributed similarly in all genders and age groups. The proportion of moderate malnutrition was seen as the highest in males (16.8%) and the lowest in females (4.9%).

Table 2. The percentage of symptoms according to malnutrition of GLIM criteria

Symptoms		n	%
BMI	**Moderate: <20 if < 70 yr, <22 if 70 yr**	20	19.8
	Severe: <18.5 if < 70 yr. <20 if 70 yr	37	36.6
Weight loss in >= 6 months	**Moderate**	23	22.8
	Severe	27	26.7
Reduced muscle mass	**Mild to moderate**	22	21.8
	Severe	22	21.8
Reduced food intake	**< 50% of ER**	13	12.9
	< 75% of ER	6	5.9
Inflammation		74	73.3

Table 2 shows the percentage of individual symptoms according to thresholds for severity grading of malnutrition of GLIM criteria. Regarding phenotypic criteria, severe BMI and weight loss were more common than severe muscle mass reduction. The percentage of severe and moderate muscle mass reduction was the same (21.8%).In terms of etiologic criteria, 12.9% of patients had an oral intake of less than half of their energy requirement, and 73.3% of patients had malignant diseases, categorized as inflammation.

Table 3. Biochemical tests of all participants classified by gender

		Male (n, %)	Female (n, %)	Total (n, %)
Hemoglobin	Amenia	32 (32.3)	17 (17.2)	49 (49.5)
	No anemia	30 (30.3)	20 (20.2)	50 (50.5)
Albumin	Hypoalbuminemia	30 (39.5)	22 (28.9)	52 (68.4)
	No hypoalbuminemia	17 (22.4)	7 (9.2)	24 (31.6)
Pre-albumin	Low prealbumin	19 (48.7)	13 (33.3)	32 (82.7)
	Normal prealbumin	6 (15.4)	1 (2.6)	7 (17.9)

The proportion of anemia among all study participants was very high (49.5%), of that, males had higher percentage of anemia than females. Malnutrition according to albumin and pre-albumin accounted for 68.4% and 82.7% respectively. Males had higher proportion of malnutrition according to both albumin and pre-albumin.

Table 4. Malnutrition and some associated factors

		Malnutrition			
		Yes (n, %)	**No (n, %)**	**p**	**OR (95% CI)**
Locations of GI surgery (n=101)	**Upper GI (n= 48)**	34 (70.8)	14 (29.2)	0.37	1.47 (0.63 – 3.42)
	Lower GI (n= 53)	33 (62.3)	20 (37.7)		
Types of surgery (n=101)	**Emergency surgery (n= 25)**	19 (76)	6 (24)	0.24	1.85 (0.65 – 5.24)
	Elective surgery (n= 76)	48 (63.2)	28 (36.8)		
Characteristics of surgical diseases (n=101)	**Total/partial obstruction (n= 45)**	36 (80)	9 (20)	**<0.01**	3.23 (1.26 – 8.23)
	No obstruction (n=56)	31 (55.4)	25 (44.6)		

*Chi-square test

Some associations between surgical characteristics and malnutrition was indicated in table 4. We found that surgical diseases with obstruction (eg: pyloric stenosis induced by gastric cancer/tumor, intestinal obstruction) increased the odds of malnutrition by 3.23 times, compared to diseases without obstruction.

DISCUSSION

Our rate of 32.7% for undernourishment of BMI and 66.3% for malnutrition of GLIM. The report rates of malnutrition in patients with undergoing gastrointestinal operations vary from 14% to 55%, with the rate higher in patients with malignancy (2) (10-11). This means that our study reveals that the prevalence of malnutrition in GI surgical patients was very high. However, there was an inconsistency of the prevalence between GLIM and BMI. Specifically, the proportion according to GLIM was doubled than that of BMI. This is because GLIM involves BMI criteria, of that, the threshold of BMI of GLIM was wider than that of isolated BMI. Besides, the rate of undernourishment of BMI in our study is 33%, which was slightly lower than the study in Bach Mai Hospital has 48% of participants with BMI<18.5 (4). In each case when BMI is less than 15 kg/m2, there is a noticeable rise in morbidity. On the other hand, this study showed that moderate malnutrition was more common in males (16.8%), which was the same in other studies (12-13).

Our study found manifestations of severe malnutrition accounted for a loud proportion of BMI and weight loss (36.6% and 26.7%, respectively). Malnutrition was associated with a significant risk of anastomotic leakage and wound infection. One research reported that preoperative malnutrition increased the rate of anastomotic leakage in which patients underwent low anterior resection (12). In that research, anastomotic leakage increased hospital length and cost. Kang et al. further supported this finding that malnutrition (OR, 2.81; 95% CI, 2.32-3.40), on multivariate analysis, was an independent risk factor for anastomotic leakage after anterior resection for rectal cancer in patients (14). Another study reported that malnutrition is a significant risk factor for postoperative infectious and wound complications in patients undergoing major surgery (15).

In the present study, both albumin and pre-albumin in GI surgical patients are at low levels. Multiple regression analyses showed that post-operative complications correlated positively with old age, recent weight loss, low serum albumin, and infrequent nutritional support, which corroborated findings from other studies (16). A few studies found that the other indicators of poor preoperative nutritional status, such as low serum albumin and preoperative weight loss, were also adversely associated with longer lengths of stay (17-19). Acknowledged that these findings should be interpreted with caution because there are limitations to the use of these parameters in assessing nutritional status. Low albumin levels may reflect an inflammatory response related to disease severity (20); however, albumin can still provide a significant marker of patients at risk of a problematic recovery who may benefit from nutrition intervention.

This study determined that pyloric/duodenal stenosis was more frequent in malnutrition patients (p=0.049), and the rate of malnutritional patients with and without colorectal cancer are the same (p=0.031). But other studies have demonstrated that patients at nutritional risk have higher complication rates after surgery for colorectal cancer (21). In surgical patients, the use of nutritional support was the attempt to correct malnutrition and, consequently, the malnutrition-associated adverse effects such as postoperative complications reduce.

CONCLUSION

This study determined that the prevalence of malnutrition in GI surgical patients was very high. Nutritional status is a significant modifiable preoperative risk factor associated with poor surgical outcomes. And some related elements with the nutritional status are admission diagnosis, and characteristics of surgical diseases. Therefore, if we want to improve the nutritional status of surgical gastrointestinal patients, we must enhance our capacity to detect patients at risk for perioperative malnutrition before surgery and use approaches for nutrition optimization based on scientific data.

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REFERENCES

1. Mignini EV, Scarpellini E, Rinninella E, et al. Impact of patients nutritional status on major surgery outcome. Eur Rev Med Pharmacol Sci 22(11):3524–33. 2018.
2. Garth AK, Newsome CM, Simmance N, Crowe TC. Nutritional status, nutrition practices and post-operative complications in patients with gastrointestinal cancer. J Hum Nutr Diet 23(4):393–401. 2010.
3. White JV, Guenter P, Jensen G, et al. Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). JPEN J Parenter Enteral Nutr 36(3):275–83. 2012.
4. Young LS, Huong PTT, Lam NT, et al. Nutritional status and feeding practices in gastrointestinal surgery patients at Bach Mai Hospital, Hanoi, Vietnam. Asia Pac J Clin Nutr 25(3):513–20. 2016.
5. LN GVDW MS, RDN. Nutrition-Focused Physical Exam (NFPE): A Beginner's Guide [Internet]. Dakota Dietitians. 2018 (cited 2023 Mar 27). Available from: https://dakotadietitians.com/nutrition-focused-physical-exam/
6. Weimann A, Braga M, Carli F, et al. ESPEN guideline: Clinical nutrition in surgery. Clin Nutr Edinb Scotl 36(3):623–50. 2017.
7. Debra Sullivan. Normal Hemoglobin Levels and Ranges for Women, Children, and Men [Internet]. Healthline. 2020 (cited 2023 Mar 27).Available from: https://www.healthline.com/health/normal-hemoglobin-levels
8. Gounden V, Vashisht R, Jialal I. Hypoalbuminemia. StatPearls. Treasure Island (FL): StatPearls Publishing. 2023 (cited 2023 Mar 27). Available from: http://www.ncbi.nlm.nih.gov/books/NBK526080/

9. Beck FK, Rosenthal TC. Prealbumin: a marker for nutritional evaluation. Am Fam Physician 65(8):1575–8. 2002.
10. Schiesser M, Müller S, Kirchhoff P, Breitenstein S, Schäfer M, Clavien P-A. Assessment of a novel screening score for nutritional risk in predicting complications in gastro-intestinal surgery. Clin Nutr Edinb Scotl 27(4):565–70. 2008.
11. Guo W, Ou G, Li X, Huang J, Liu J, Wei H. Screening of the nutritional risk of patients with gastric carcinoma before operation by NRS 2002 and its relationship with postoperative results. J Gastroenterol Hepatol 25(4):800–3. 2010.
12. Leandro-Merhi VA, de Aquino JLB, Sales Chagas JF. Nutrition status and risk factors associated with length of hospital stay for surgical patients. JPEN J Parenter Enteral Nutr 35(2):241–8. 2011.
13. Leandro-Merhi VA, de Aquino JLB. Determinants of malnutrition and post-operative complications in hospitalized surgical patients. J Health Popul Nutr 32(3):400–10. 2014.
14. Kang CY, Halabi WJ, Chaudhry OO, et al. Risk factors for anastomotic leakage after anterior resection for rectal cancer. JAMA Surg 148(1):65–71. 2013.
15. Putwatana P, Reodecha P, Sirapo-ngam Y, Lertsithichai P, Sumboonnanonda K. Nutrition screening tools and the prediction of postoperative infectious and wound complications: comparison of methods in presence of risk adjustment. Nutr Burbank Los Angel Cty Calif 21(6):691–7. 2005.
16. Bozzetti F, Gianotti L, Braga M, Di Carlo V, Mariani L. Postoperative complications in gastrointestinal cancer patients: the joint role of the nutritional status and the nutritional support. Clin Nutr Edinb Scotl 26(6):698–709. 2007.
17. Moghadamyeghaneh Z, Hwang G, Hanna MH, et al. Even modest hypoalbuminemia affects outcomes of colorectal surgery patients. Am J Surg 210(2):276–84. 2015.
18. Testini M, Margari A, Amoruso M, Lissidini G, Bonomo GM. [The dehiscence of colorectal anastomoses: the risk factors]. Ann Ital Chir 71(4):433–40. 2000.
19. Lakananurak N, Gramlich L. The Role of Preoperative Parenteral Nutrition. Nutrients 12(5):1320. 2020.
20.Ohsugi Y. Recent advances in immunopathophysiology of interleukin-6: an innovative therapeutic drug, tocilizumab (recombinant humanized anti-human interleukin-6 receptor antibody), unveils the mysterious etiology of immune-mediated inflammatory diseases. Biol Pharm Bull 30(11):2001–6. 2017.
21. Schwegler I, von Holzen A, Gutzwiller J-P, Schlumpf R, Mühlebach S, Stanga Z. Nutritional risk is a clinical predictor of postoperative mortality and morbidity in surgery for colorectal cancer. Br J Surg 97(1):92–7. 2010.

Original

Knowledge and practice patterns of nutrition-focused physical examination in dietitians in Malaysia after an in-person training workshop with 1-year online follow-up

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ABSTRACT *Background:* Nutrition-focused physical examination (NFPE) is a component of nutrition assessment performed by dietitians. Globally, research on NFPE practices of dietitians is limited. *Purpose:* This study explored changes in NFPE knowledge and practices over 12-months among clinical dietitians in Malaysia who completed a hybrid NFPE training program. *Methods:* This was secondary analysis of data from a 2019 prospective cohort pilot study. Participants attended a 2-day in-person workshop in Malaysia with quarterly online follow-up over 12 months. A 50-item multiple-choice knowledge test was completed by participants before and immediately, 6- and 12-months post-training. Data collection forms with self-reported frequencies of conduct of 43 NFPE practice tasks conducted during patient assessments were completed before and 6- and 12-months post-training. Statistical analyses included descriptive statistics, one-way repeated-measures ANOVA for knowledge assessment scores, and Chi-square tests for changes in frequencies of NFPE performance for the study population. *Results:* Of the 16 clinical dietitian participants, 81.3% (n = 13) completed the study. Participants had a mean of 9.3±6.4 years of clinical practice; 81.3% (n = 13) had no prior NFPE training. Mean NFPE knowledge scores increased significantly from before (33.8±3.9) to immediately post-training (44.0±3.2; $p < 0.001$) and were maintained for 12-months post-training (43.3±2.9; $p < 0.001$). Performance of all 43 NFPE practice tasks increased significantly from before to 12-months post-training ($p < 0.001$). *Conclusion:* Clinical dietitian participants demonstrated an improvement in their knowledge scores and frequency of use of NFPE from before to 12-months post-training. Future research should include a control group to examine the effectiveness of a hybrid NFPE training program.
Keywords: *Dietitians, Nutrition-focused physical examination, knowledge, practice, allied health*

INTRODUCTION

Physical examination of a patient involves a head-to-toe examination using visual observation, palpation, auscultation, and percussion (1). Nutrition-focused physical examination (NFPE), conducted by a dietitian, includes the examination of body composition (muscle and subcutaneous fat stores and fluid accumulation); inspection of the skin, hair, and nails; examination of posture and functional status, and the head, neck, select cranial nerves and oral cavity and dysphagia screening (2, 3). An NFPE allows the dietitian to identify factors impacting a person's ability to consume foods and fluids and signs and symptoms of nutrient deficiencies and malnutrition (1).

The Academy of Nutrition and Dietetics (Academy) Nutrition Care Process (NCP) for registered dietitians states that the NFPE should be included as part of a nutrition assessment (4). The NCP has been adopted by dietitians practicing in countries in the Asia-Pacific region, including Australia, New Zealand, and Singapore (5, 6). Dietitians in these countries have reported that the benefits to patient care support the use of the NCP in practice (6). Dietetics educators and clinical dietitians in Malaysia have also incorporated the NCP into their dietetics curricula (7) and clinical practice, respectively (8). However, before 2019, clinical dietitians in Malaysia do not use NFPE as part of the NCP. Instead, they commonly use the Subjective Global Assessment (SGA) to conduct nutrition assessments which includes a physical examination of subcutaneous fat tissue, muscle stores, and the presence of edema and/or ascites to identify malnutrition (9). Thus, clinical dietitians in Malaysia could have been practicing some components of NFPE.

Registered dietitians (RDs) in the U.S. have described inadequate training and lack of confidence as barriers to performing NFPE (3, 10-12). After receiving NFPE training, U.S RDs reported increased knowledge, confidence, and use of NFPE in clinical practice (3, 11). Two prior studies explored changes in the practice of dietitians following NFPE training in Africa and the Middle East (2, 13). Wright found that dietitians in Ghana demonstrated a significant increase in knowledge, application of the malnutrition diagnosis criteria, and confidence scores in diagnosing malnutrition after completing NFPE

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training (13). Similarly, Brody et al explored changes in the knowledge and practice of dietitians working in long-term care settings in Israel and found that participants demonstrated increased knowledge and performance of NFPE after completing NFPE training (2). However, there is a paucity of published research on the adequacy of training and other factors affecting the knowledge and practice of NFPE in Asia and other regions outside the United States.

The primary aims of this secondary analysis were to examine the changes in NFPE knowledge and practices for clinical dietitian participants in Malaysia who attended an in-person NFPE workshop and completed 12-months of online follow-up training.

MATERIALS AND METHODS

Study Design

This study is a secondary analysis of data from one of two cohorts, comprising 16 clinical dietitian participants from the original prospective cohort pilot study by Tomesko et al (14). For inclusion in the pilot study, dietitian participants had at least 1 year of clinical work experience and could attend a 2-day in-person NFPE training workshop conducted at International Medical University (IMU) in Kuala Lumpur, Malaysia in January 2019, and participated in the 12-months of online follow-up.

Recruitment and Study Implementation

Sixteen clinical dietitian participants enrolled in the original study; 13 who completed all study components, including knowledge tests and NFPE data collection forms, were included in this secondary analysis. Participants were invited to participate in an information session about the study via an email invitation sent through the Malaysian Dietitian Association (MDA) listserv or were selected by Malaysia's Ministry of Health (MOH) Head of Professions. Participants who agreed to participate in the study signed consent forms after the information session.

Study participants enrolled in a Canvas Learning Management System (LMS) module entitled "Nuts and Bolts of NFPE" (15) that included the NFPE training module, training resources, and ZOOM links for online follow-up sessions. In January 2019, participants attended a 2-day in-person NFPE workshop conducted by 3 faculty from Rutgers University. Day 1 consisted of didactic lectures with hands-on demonstrations, role-modeling by the instructors, and mentored practice of NFPE techniques. Day 2 focused on the evaluation of skills acquisition. At the end of Day 2, clinical dietitian participants completed the first knowledge post-test and a skills competency assessment. Live online sessions were conducted quarterly for 12-months post-training via ZOOM (16), using case studies to reinforce NFPE skills. The skills competency assessment was repeated virtually at 6- and 12-months post-intervention to assess skill acquisition and retention. Study investigators, who are experts in NFPE, evaluated the competency assessments.

Data collection tool

Knowledge tests: Participants completed a knowledge pre-test with demographic questions administered by Qualtrics (17) and the knowledge test before and immediately, 6, and 12-months post-training. These tests consisted of 50 questions related to NFPE. Participants were awarded 1 point for each correct answer and no points for incorrect or missing answers, with a possible minimum score of 0 and a maximum score of 50 points. The knowledge pre- and post-tests had the same questions, but the order of the questions and their multiple-choice options were scrambled each time the test was administered.

NFPE data collection form: Study investigators instructed the participants to complete 25 data collection forms 2 weeks before the workshop. The form consisted of 43 NFPE practice tasks, comprised of a patient interview, examination of the skin, fluid, muscle, and fat stores; cranial nerve and intra-oral examination tasks, based on the *Stepwise Approach to the Conduct of the Nutrition Focused Physical Examination* developed by the Rutgers School of Health Professions' Department of Clinical and Preventive Nutrition Sciences (RU, SHP, DCPNS). This guide was used as a training tool during the workshop to teach participants how to conduct a physical examination.

Post-training, participants were asked to complete one form for each patient they conducted a nutrition assessment on and return up to 25 forms at 6- and 12-months. If participants completed the NFPE practice task, they indicated "performed exam" and if they did not complete the NFPE practice task, participants indicated they "did not perform exam" on the form.

The knowledge tests and NFPE data collection tool were subjected to face and content validity testing with 4 NFPE experts from RU, SHP, DCPNS, and 2 dietetics educators from IMU. The knowledge tests and NFPE data collection tools have also been used with other dietitians globally (2, 3). This study received expedited ethics approval by the Health Sciences IRB Newark at Rutgers University (protocol #2018000733), IMU Joint-Committee on Research and Ethics (IMU R 209/2018), and Malaysian Ministry of Health National Medical Research Registry (NMRR18-2857-44374 (IIR)).

Statistical Analyses

Descriptive statistics were used to describe the sample, responses to the knowledge tests, and self-reported NFPE practices at each time point of data collection. One-way repeated-measures ANOVA with Bonferroni's post-hoc analysis analyzed the change in NFPE knowledge scores over time. Chi-square or Fisher's exact test was used to analyze changes in practice task performance from before to 6- and 12-months post-training, and from 6- to 12-months post-training. Changes in NFPE practice task performance were based on the number of NFPE data collection forms returned at each time point of data collection and not by comparing individual clinical dietitian participants' responses. We did not conduct matched paired analysis because the same individual

did not return the same number of forms at each timeframe. For these analyses, the 'n' reported is the number of times a clinical dietitian participant reported that they performed or did not perform a task on the data collection form.

RESULTS

Sample Description

Of the 16 clinical dietitian participants who consented to the study, 81% (n = 13) completed the study. Ninety-two percent (n = 12) were female. Participants had a mean age of 33.8±4.0 years and a mean of 9.1±4.9 years of clinical practice; 76.9% (n = 10) reported that they had never received NFPE training before this study.

Knowledge scores

Participant knowledge scores for those who completed knowledge tests at all 4 time points were 33.8±3.9 before training, 44.0±3.2 immediately post-training, 42.9±3.6 at 6 months post-training, and 43.3±2.9 at 12-months post-training out of a maximum possible score of 50 points. There was a statistically significant increase in total knowledge scores from 33.8 before training to 44.0 immediately post-training. This increase was sustained at 6- and 12-months post-training ($p < 0.001$) (Figure 1).

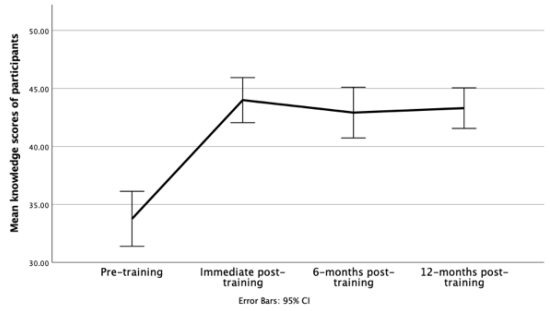

Figure 1: Graph of change in mean knowledge scores over time of clinical dietitian participants (N = 13)

More than 50% of participants selected incorrect answers for 14 of the 50 knowledge questions of the knowledge pre-test. At baseline, all participants selected the correct answers for questions related to applying NFPE and the SGA in clinical practice, the physical identification of landmarks for examining upper body muscle and subcutaneous fat stores, and intra-oral examination. All participants selected the correct responses for these questions at all 4 time points of knowledge assessment (Table 1).

Questions with the lowest proportion of correct responses before training were questions related to malnutrition diagnosis using the Academy/ASPEN consensus statement, extra-oral examination, and examination of muscle stores. The number of correct responses to these questions initially increased from before to immediately post-training but decreased at 6- and 12-months post-training. At the end of 12-months, questions related to malnutrition diagnosis, extra-oral examination, and examination of muscle and fat stores continued to have the lowest proportion of correct responses (Table 1).

NFPE practice tasks

The participants returned a mean of 18 forms each pre-training and a mean of 15 forms each at 6- and 12-months post-training. Self-reported conduct of NFPE practice tasks on the NFPE data collection forms was used as a surrogate measure for participants' conduct of each NFPE task. There were 43 NFPE tasks, grouped into 4 categories: "Patient Presentation and Interview" (9 tasks), "Skin, Fluid, Muscle and Fat Assessment Components" (19 tasks), "Cranial Nerve Examination" (7 tasks), and "Intra-Oral Examination" (8 tasks).

The self-reported conduct of all 9 "Patient Presentation and Interview tasks" by participants was completed less than 50% of the time before training. *Polypharmacy* questions were self-reported as conducted least often (17.1%, n = 42) in this category. In the "Skin, Fluid, Muscle and Fat Assessment Components" category, 16 of the 19 tasks were self-reported as performed 10% of the time or less at baseline (Table 2). At the end of 12-months, the self-reported conduct of all 19 NFPE practice tasks in the "Skin, Fluid, Muscle and Fat Assessment Components" increased significantly from being performed less than 10% before training to more than 70% of the time ($p < 0.001$) (Table 2). The assessment of the *Cough reflex and Swallow* NFPE practice tasks increased from being performed 7.9% and 12.0% of the time before training, to 69.5% and 79.5% at 12-months post-training. Performance of all 7 "Cranial nerve examination tasks" increased from 0.0% before training, to between 46.3-50.2% at 12-months post-training ($p < 0.001$) (Table 2). For the 8 "Intra-oral exam tasks," self-reported conduct increased significantly from being performed less than 10% of the time before training to 58.0% to 85.0% at 12-months post-training ($p < 0.001$) (Table 2). At 12-months post-training, there were statistically significant increases in self-reported conduct of all 43 NFPE tasks from before to 12-months post-training ($p < 0.001$) (Table 2).

DISCUSSION

NFPE knowledge

Eighty-one percent of the dietitian participants completed all components of the study. This was a higher retention rate than Brody et al. (60%) at the end of their one-year study with dietitians in Israel (2). Of the 3 participants that withdrew from the study, 2 did so due to changes in job roles and one could not fulfill study requirements.

There was a significant increase in knowledge scores from before to immediately post-training ($p < 0.001$), which was sustained at 12-months post-training. This finding is consistent with similar studies that explored changes in NFPE knowledge in dietitians after completing NFPE training (2, 11).

Participants answered questions about the SGA and the physical identification of landmarks for examining upper body muscle and subcutaneous fat stores correctly 92.3-100% of the time from before to 12-months post-training. In contrast, less than 60% of participants selected the correct answers before training for questions related to cranial nerve

examination, oral manifestations of nutrient deficiencies, and identification of intra- and extraoral cavity structures. Six months post-training, more than 70% of participants selected the correct responses for questions related to these same topics, and by 12-months post-training, only one question related to cranial nerve examination had less than 60% of participants select the correct answer. Similarly, Brody et al. found that the proportion of correct responses to questions related to cranial nerve examination, oral manifestations of nutrient deficiencies, and identification of intra- and extraoral cavity structures increased from baseline to 12-months post-training in long-term care dietitians in Israel (2).

NFPE performance

There was a significant increase in participants' self-reported conduct of all 43 NFPE practice tasks from before to 12-months post-training (Table 2), which is similar to previous research that explored changes in NFPE knowledge and practices post-training. Consistent with our findings, Brody et al reported significant increases in self-reported conduct of NFPE tasks from before to 6 months post-training in dietitians in Israel (2).

Although dysphagia screening includes an examination of 7 cranial nerves, participants reported performing assessment of the *Cough reflex* and *Swallow* more frequently post-training (69.5% and 79.5% of the time, respectively) than the 7 cranial nerve examination tasks (45.3% to 50.2%). This finding is consistent with prior research where dietitians in Israel who received NFPE training significantly increased their performance of cranial nerve examination practice tasks and swallow screening but performed swallow screening more often than cranial nerve examination tasks.

Participants in this study reported significantly increasing performance of intra-oral examination tasks from baseline to 12-months post-training ($p < 0.001$) (Table 2). Similarly, dietitians working in long-term care in Israel who had received NFPE training related to intra- and extra-oral examination also significantly increased their performance of intra-oral examination tasks before to 6 months post-training (2). Dietitians who performed intra-oral examinations reported that they were significantly more likely to refer the patient to a relevant healthcare professional if abnormalities were observed during intra-oral examinations ($p < 0.001$) (2).

Strengths and limitations

Although this pilot study had a small sample size, the retention rate was high, reflecting the feasibility of using a hybrid approach with in-person training and virtual ZOOM follow-up for teaching NFPE. The US investigators' experience in developing training programs and conducting NFPE training globally was also a strength (2, 3, 14). Their collaboration with the investigators in Malaysia ensured the teaching materials and content used were culturally appropriate and reflected the local practice in Malaysia (14). As a result of this study, Malaysia's MOH now requires dietitians to include NFPE as part of their professional requirements. However, this study also has some limitations. The generalizability of the study results are limited due to the small sample from one geographical location in Malaysia. Selection bias is possible as recruited participants had volunteered via MDA's listserv or were selected by the MOH's Head of Profession and may already have an interest in NFPE. Since this was a pilot study with no control group, it was not possible to determine the effect of training on NFPE knowledge and practice in the clinical dietitian participants.

As knowledge test questions were identical at all time points, participants may have become familiar with the questions and reported answers from memory. To minimize this, questions and multiple-choice options were scrambled each time the knowledge test was administered. It is also possible that the ZOOM sessions and the continued documentation of NFPE practice tasks over the 1-year follow-up could have also reinforced knowledge retention and skill acquisition (14). The potential for recall bias cannot be ruled out since the conduct of NFPE practice tasks was self-reported (18). As participants were aware that the study was examining changes in NFPE practice after training, they could have reported the conduct of more NFPE tasks. Although the clinical dietitian participants' actual performance of NFPE practice tasks was not observed, the hands-on demonstration and practice of NFPE skills during the workshop and virtual follow-up sessions provided participants with the opportunity to practice and apply the skills taught.

The findings from this study demonstrate that clinical dietitians in Malaysia who completed an in-person NFPE training with 12-months of online follow-up sessions increased their NFPE knowledge scores from before training to immediately post-training, and sustained it for up to 12-months post-training. Self-reported conduct of NFPE tasks in clinical practice likewise increased significantly from before to 12-months post-training. Future research may include expanding this training program's reach to dietitians in other countries throughout Southeast Asia. Including a control group in future studies will help determine if increases in NFPE knowledge and dietitians' practice can be attributed to the training.

Table 1: Distribution of correct and incorrect responses for knowledge tests before and immediately, 6- and 12-months post-training (N=13)

	Question	Before training				Immediately post-training				6m post-training				12-m post-training			
		Correct		Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		Incorrect	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1.	NFPE scope of practice	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
2.	Academy and A.S.P.E.N.[a] consensus statement malnutrition diagnostic criteria	1	7.7	12	92.3	8	61.5	5	38.5	3	23.1	10	76.9	1	7.7	12	923
3.	Identifying abnormalities during intra-oral exam	6	46.2	7	53.8	10	76.9	3	23.1	13	100.0	0	0.0	12	92.3	1	7.7
4.	Using the SGA in nutrition assessment	13	100.0	0	0.0	12	92.3	1	7.7	12	92.3	1	7.7	12	92.3	1	7.7
5.	Identifying validated nutrition screening tools	9	69.2	4	30.8	11	84.6	2	15.4	10	76.9	3	23.1	13	100.0	0	0.0
6.	Recognition of causes that result in failure of the soft palate to rise	8	61.5	5	38.5	11	84.6	2	15.4	11	84.6	2	15.4	11	84.6	2	15.4
7.	Identifying normal appearance of the gingiva	12	92.3	1	7.7	12	92.3	1	7.7	13	100.0	0	0.0	11	84.6	2	15.4
8.	Identifying functions of the Wharton's and Stenson's ducts	9	69.2	4	30.8	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
9.	Identifying correct fat and muscle assessment techniques in NFPE	9	69.2	4	30.8	12	92.3	1	7.7	10	76.9	3	23.1	11	84.6	2	15.4
10.	Identification of occlusion	5	38.5	8	61.5	10	76.9	3	23.1	13	100.0	0	0.0	13	100.0	0	0.0
11.	Definition of edentulism	4	30.8	9	69.2	12	92.3	1	7.7	13	100.0	0	0.0	13	100.0	0	0.0
12.	Identification of factors that hide orbital fat pad wasting	7	53.8	6	46.2	6	46.2	7	53.8	2	15.4	11	84.6	8	61.5	5	38.5
13.	Identification of clavicle for muscle assessment	12	92.3	1	7.7	13	100.0	0	0.0	12	92.3	1	7.7	13	100.0	0	0.0
14.	Identification of acromion for muscle assessment	13	100.0	0	0.0	13	100.0	0	0.0	12	92.3	1	7.7	13	100.0	0	0.0

Question	Before training				Immediately post-training				6m post-training				12-m post-training			
	Correct		Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		Incorrect	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
15. Identification of bicep for muscle assessment	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
16. Recognition of the appearance of a normal tongue	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
17. Identification of the impact of hyposalivation	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0	12	92.3	1	7.7
18. Identification of the correct method for upper arm fat stores assessment	4	30.8	9	69.2	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
19. Identification of the causes of angular cheilitis	2	15.4	11	84.6	11	84.6	2	15.4	11	84.6	2	15.4	9	69.2	4	30.8
20. Proper documentation of the appearance of lesions on the palate	11	84.6	2	15.4	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
21. Identification of the function of anterior teeth	11	84.6	2	15.4	13	100.0	0	0.0	12	92.3	1	7.7	11	84.6	2	15.4
22. Identification of appearance of fat wasting in the thoracic/ lumbar region	12	92.3	1	7.7	11	84.6	2	15.4	13	100.0	0	0.0	13	100.0	0	0.0
23. Identification of the appearance of the temporalis muscle in a well-nourished individual [b]	13	100.0	0	0.0	13	100.0	0	0.0	11	84.6	1	7.7	11	84.6	2	15.4
24. Identification of the impact of a TMJ disorder	8	61.5	5	38.5	12	92.3	1	7.7	13	100.0	0	0.0	12	92.3	1	7.7
25. Facial examination	12	92.3	1	7.7	12	92.3	1	7.7	8	61.5	5	38.5	8	61.5	5	38.5
26. Extra-oral examination	4	30.8	9	69.2	12	92.3	1	7.7	13	100.0	0	0.0	12	92.3	1	7.7
27. The appearance of muscles in well-nourished individuals	11	84.6	2	15.4	12	92.3	1	7.7	10	76.9	3	23.1	9	69.2	4	30.8

Question	Before training				Immediately post-training				6m post-training				12-m post-training			
	Correct		Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		Incorrect	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
28. Recognition of altered cranial nerve function	5	38.5	8	61.5	12	92.3	1	7.7	13	100.0	0	0.0	12	92.3	1	7.7
29. Identification of signs and symptoms of dysphagia	5	38.5	8	61.5	8	61.5	5	38.5	7	53.8	6	46.2	9	69.2	4	30.8
30. Muscle examination technique	6	46.2	7	53.8	13	100.0	0	0.0	11	84.6	2	15.4	12	92.3	1	7.7
31. Steps of dysphagia screening	8	61.5	5	38.5	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
32. Identification of the hard palate	10	76.9	3	23.1	12	92.3	1	7.7	12	92.3	1	7.7	12	92.3	1	7.7
33. Identification of the soft palate	7	53.8	6	46.2	12	92.3	1	7.7	11	84.6	2	15.4	11	84.6	2	15.4
34. Identification of the buccal mucosa	11	84.6	2	15.4	13	100.0	0	0.0	13	100.0	0	0.0	12	92.3	1	7.7
35. Identification of the oropharynx	11	84.6	2	15.4	13	100.0	0	0.0	12	92.3	1	7.7	12	92.3	1	7.7
36. Identification of the uvula	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0	13	100.0	0	0.0
37. Identification of type of dentures	5	38.5	8	61.5	10	76.9	3	23.1	10	76.9	3	23.1	11	84.6	2	15.4
38. Identification of appearance of severe muscle wasting	13	100.0	0	0.0	12	92.3	1	7.7	13	100.0	0	0.0	12	92.3	1	7.7
39. The appearance of interosseous muscle	11	84.6	2	15.4	13	100.0	0	0.0	10	76.9	3	23.1	11	84.6	2	15.4
40. Proper muscle examination techniques	8	61.5	5	38.5	10	76.9	3	23.1	11	84.6	2	15.4	12	92.3	1	7.7
41. Steps in dysphagia risk screening	11	84.6	2	15.4	11	84.6	2	15.4	13	100.0	0	0.0	13	100	0	0.0

Question	Before training				Immediately post-training				6m post-training				12-m post-training			
	Correct		Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		Incorrect	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
42. Identification of muscle appearance during the examination	3	23.1	10	76.9	6	46.2	7	53.8	7	53.8	6	46.2	4	30.8	9	69.2
43. Examination of cranial nerves	4	30.8	9	69.2	13	100.0	0	0.0	10	76.9	3	23.1	7	53.8	6	46.2
44. Identification of cranial nerves	1	7.7	12	92.3	11	84.6	2	15.4	11	84.6	2	15.4	13	100.0	0	0.0
45. Examination of muscle stores in malnutrition	10	76.9	3	23.1	12	92.3	1	7.7	12	92.3	1	7.7	12	92.3	1	7.7
46. Identification of the degree of muscle wasting	9	69.2	4	30.8	10	76.9	3	23.1	9	69.2	4	30.8	11	84.6	2	15.4
47. Steps of intra-oral examination	10	76.9	3	23.1	12	92.3	1	7.7	13	100.0	0	0.0	13	100.0	0	0.0
48. Identification of the degree of muscle wasting	12	92.3	1	7.7	10	76.9	3	23.1	11	84.6	2	15.4	13	100.0	0	0.0
49. Identification of the use of handgrip strength	10	76.9	3	23.1	9	69.2	4	30.8	8	61.5	5	38.5	10	76.9	3	23.1
50. Malnutrition diagnosis using the SGA	8	61.5	5	38.5	7	53.8	6	46.2	9	69.2	4	30.8	9	69.2	4	30.8

[a] Academy-Academy of Nutrition and Dietetics; A.S.P.E.N.-American Society of Enteral and Parenteral Nutrition; BMI-Body Mass Index; MNA-Mini Nutrition Assessment; MST-Malnutrition Screening Tool (MST); NFPE-Nutrition-focused Physical Examination; SGA-Subjective Global Assessment
[b] Missing response for Question 23 at 6 months post-training

Table 2: Change in performance of NFPE practice tasks by clinical dietitian participants over time (N = 13)

NFPE Clinical Practice Tasks	Before training					6months post-training[a]					12-months post-training[a]				
	Not performed		Performed		Total	Not performed		Performed		Total	Not performed		Performed		Total
	n[b]	%	n	%	n	n	%	n	%	n	n	%	n	%	n
Patient Presentation and Interview Tasks															
Physique and posture	149	60.1	**99**	**39.9**	248	12	6.3	**178**	**93.7**	190	9	4.5	**192**	**95.5**	201
Functional status	152	61.3	96	38.7	248	22	11.6	**168**	**88.4**	190	9	4.5	**192**	**95.5**	201
Cognition	140	57.4	**104**	**42.6**	244	14	7.4	**176**	**92.6**	190	5	2.5	**195**	**97.5**	200
Polypharmacy	203	82.9	42	17.1	245	66	34.6	125	65.4	191	79	39.7	120	60.3	199
Xerostomia	190	77.6	55	22.4	245	31	16.3	159	83.7	190	28	13.9	173	86.1	201
Altered taste	163	66.0	84	34.0	247	34	18.0	155	82.0	189	24	11.9	177	88.1	201
Oral pain	173	70.3	73	29.7	246	33	17.8	152	82.2	185	25	12.5	175	87.5	200
Changes in ability to bite, chew and swallow	136	56.2	**106**	**43.8**	242	29	15.5	158	84.5	187	22	11.1	176	88.9	198
Use of dentures to eat	148	61.4	93	38.6	241	34	19.3	142	80.7	176	22	12.4	156	87.6	178
Skin, Fluid, Muscle and Fat Assessment Components															
Dorsal hand region	219	92.0	**19**	**8.0**	238	37	20.6	**143**	**79.4**	180	26	13.1	**173**	**86.9**	199
Biceps, triceps	221	92.5	18	7.5	239	39	21.3	**144**	**78.7**	183	25	12.4	**176**	**87.6**	201
Acromion process and deltoid muscle region	220	92.1	19	7.9	239	47	25.4	**138**	**74.6**	185	29	14.4	**172**	**85.6**	201
Scapula	224	93.7	15	6.3	239	66	35.7	119	64.3	185	39	19.5	161	80.5	200
Clavicle	218	91.6	**20**	**8.4**	238	50	27.0	135	73.0	185	33	16.4	168	83.6	201
Ribs	222	93.3	16	6.7	238	67	36.6	116	63.4	183	41	20.4	160	79.6	201
Patellar region	221	92.9	17	7.1	238	58	31.4	127	68.6	185	39	19.5	161	80.5	200
Anterior thigh region	220	92.4	18	7.6	238	59	32.1	125	67.9	184	35	17.5	165	82.5	200
Posterior calf region	217	91.9	**19**	**8.1**	236	58	31.5	126	68.5	184	35	17.5	165	82.5	200
Fluid, skin hair and nails															
Edema or dehydration	201	84.8	**36**	**15.2**	237	35	19.1	**148**	**80.9**	183	19	9.6	**179**	**90.4**	198
Color and temperature	206	90.4	22	9.6	228	41	22.2	**144**	**77.8**	185	32	16.0	168	84.0	200
Texture, dryness and brittleness	206	91.2	20	8.8	226	44	23.2	146	76.8	190	26	13.1	173	86.9	199
Potential micronutrient deficiencies and toxicities	168	97.7	4	2.3	172	47	25.5	137	74.5	184	46	23.0	154	77.0	200
Orbital fat pads	212	88.7	**27**	**11.3**	239	21	11.0	**170**	**89.0**	191	2	1.0	**199**	**99.0**	201
Temporalis muscle	217	90.8	22	9.2	239	34	17.8	157	82.2	191	8	4.0	**193**	**96.0**	201
Temporomandibular joint (TMJ)	224	93.7	15	6.3	239	72	38.1	117	61.9	189	71	35.3	130	64.7	201
Muscles of mastication	224	93.7	15	6.3	239	69	36.3	121	63.7	190	69	34.5	131	65.5	200

NFPE Clinical Practice Tasks	Before training					6months post-training[a]					12-months post-training[a]				
	Not performed		Performed		Total	Not performed		Performed		Total	Not performed		Performed		Total
	n[b]	%	n	%	n	n	%	n	%	n	n	%	n	%	n
Cough reflex	220	92.1	19	7.9	239	67	35.3	123	64.7	190	61	30.5	139	69.5	200
Swallow	198	88.0	**27**	**12.0**	225	49	25.8	141	74.2	190	41	20.5	159	79.5	200
Cranial nerve examination tasks															
Trigeminal Nerve V: motor	239	100.0	0	0.0	239	94	49.5	**96**	**50.5**	190	108	53.7	93	46.3	201
Trigeminal Nerve V: sensory	239	100.0	0	0.0	239	102	54.0	87	46.0	189	108	53.7	93	46.3	201
Facial Nerve VII: motor	239	100.0	0	0.0	239	94	49.7	95	50.3	189	100	49.8	**101**	**50.2**	201
Facial Nerve VII: sensory	239	100.0	0	0.0	239	90	48.1	**97**	**51.9**	187	102	50.7	**99**	**49.3**	201
Glossopharyngeal/ Vagus Nerve IX/X: motor	239	100.0	0	0.0	239	96	50.3	95	49.7	191	109	54.2	92	45.8	201
Hypoglossal Nerve XII: motor	239	100.0	0	0.0	239	92	48.2	**99**	**51.8**	191	107	53.5	**93**	**46.5**	200
Accessory Nerve XI: motor	236	100.0	0	0.0	236	98	51.3	93	48.7	191	108	53.7	93	46.3	201
Intra-oral exam tasks															
Dentition:															
Edentulism	218	91.6	**20**	**8.4**	238	48	25.8	138	74.2	186	36	18.1	163	81.9	199
Occlusion	223	93.7	15	6.3	238	48	25.7	139	74.3	187	37	18.6	162	81.4	199
Dentures	218	91.6	20	8.4	238	47	25.1	**140**	**74.9**	187	30	15.0	**170**	**85.0**	200
Soft tissue:															
Labial mucosa	238	100.0	0	0.0	238	92	49.2	**95**	**50.8**	187	84	42.0	116	58.0	200
Buccal mucosa	238	100.0	0	0.0	238	98	52.4	89	47.6	187	84	42.0	116	58.0	200
Floor of mouth	238	100.0	0	0.0	238	97	51.9	90	48.1	187	84	42.0	116	58.0	200
Hard and soft palates	238	100.0	0	0.0	238	96	51.5	**90**	**48.4**	186	83	41.5	**117**	**58.5**	200
Tongue	235	99.6	**1**	**0.4**	236	94	50.5	**92**	**49.5**	186	82	41.2	**117**	**58.8**	199

[a] Analyses were conducted using Chi-squared tests. All NFPE practice tasks had a significant change in performance over time, $p < 0.001$; Bold-faced' n' values and frequencies indicate the NFPE tasks with the highest frequencies of performance at each time point; [b] "n" refers to the number of forms submitted by participants at each time point. As clinical dietitian participants may not complete all NFPE tasks on the data collection form, the distribution (n) varies for each task

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CONFLICTS OF INTEREST (COI)

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REFERENCES

1. Touger-Decker R. Physical assessment skills for dietetics practice: The past, the present, and recommendations for the future. Top Clin Nutr 21(3): 190-198. 2006
2. Brody RA, Touger-Decker R, Radler DR, Parrott JS, Rachman SE, Trostler N. A novel approach to oral health assessment training for dietitians in long-term care settings in Israel: A pilot study of changes in knowledge and practice. Top Clin Nutr 29(1): 57-68. 2014
3. Desjardins S, Brody R, Touger-Decker R. Nutrition-focused physical examination practices of registered dietitian nutritionists who have completed an in-person NFPE course. Top Clin Nutr 33(2): 95-105. 2018
4. Myers E. Nutrition Care Process and Model Part I: The 2008 Update. J Am Diet Assoc 108(7): 1113-1117. 2008
5. Lövestam E, Steiber A, Vivanti A, Boström A-M, Devine A, Haughey O, et al. Use of the Nutrition Care Process and Nutrition Care Process Terminology in an International Cohort Reported by an Online Survey Tool. J Acad Nutr Diet 119(2): 225-241. 2019
6. O'Sullivan TA, Lo J, Vivanti A. Predictors of nutrition care process and terminology use, applicability and importance within Asia-Pacific dietitians. Nutr Diet 76(4): 455-461. 2019
7. Karupaiah T, Reinhard T, Krishnasamy S, Tan S-P, Se C-H. Incorporating the Nutrition Care Process model into dietetics internship evaluation: A Malaysian university experience. Nutr Diet 73(3): 283-295. 2016
8. Jamil JbA. Case Study with NCP tips. Diet Link - Official Newsletter of the Malaysian Dietitians' Association. 2019.
9. Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? JPEN J Parenter Enteral Nutr 11(1): 8-13. 1987
10. Mordarski BA, Hand RK. Patterns in Adult Malnutrition Assessment and Diagnosis by Registered Dietitian Nutritionists: 2014-2017. J Acad Nutr Diet 119(2): 310-322. 2019
11. Mordarski BA, Hand RK, Wolff J, Steiber AL. Increased Knowledge, Self-Reported Comfort, and Malnutrition Diagnosis and Reimbursement as a Result of the Nutrition-Focused Physical Exam Hands-On Training Workshop. J Acad Nutr Diet 117(11): 1822-1828. 2017
12. Stankorb SM, Rigassio-Radler D, Khan H, Touger-Decker R. Nutrition focused physical examination practices of registered dietitians. Top Clin Nutr 25(4): 335-344. 2010
13. Wright L, Marrero A, Thompson L, Zeola S, Boateng L, Epps J, et al. Culturally Adapted, Hands-on Malnutrition Workshop for Dietitians in Ghana Increases Self-efficacy, Knowledge, and Skills. Top Clin Nutr 35(2): 116-120. 2020
14. Tomesko J, Brody R, Chen S-T, Chee Siew Swee W, Sackey J, Sullivan J, et al. Nutrition-Focused Physical Examination Knowledge and Practice Changes in Clinical Dietitians and Dietetic Educators Who Completed a 12-Month Hybrid Training Program in Malaysia: A Pilot Study. Top Clin Nutr 37(1): 2-14. 2022
15. The Canvas Learning Management Platform 2020 [Available from: https://www.instructure.com/canvas/k-12/platform.
16. Zoom for video, conference rooms and phones 2020 [Available from: https://www.zoom.us.
17. Qualtrics. Online Survey Software Provo, Utah, United States: Qualtrics; 2021 [
18. Lewis-Beck MS, Bryman, A., Futing Liao, T. , editor. Selection Bias. 2004. SAGE Publishing.