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Contents

Special Topic: The history of the nutrition improvement in Japan

Japanese Nutrition Changed Food Policy into Nutrition Policy: No. 3 in a series

Teiji Nakamura
The President of Japanese Dietetics/ President of Kanagawa University of Human Service

Like other Asian countries, Japan was suffering from malnutrition due to poor food conditions before and after World War II. Because of the rice-dependent diet, carbohydrate intake was high, protein food intake was low due to poverty, and vitamins and minerals were lost through advances in grain processing technology. As a result of malnutrition, newborns and children had poor growth and development, were small in body size, were liable to various diseases related to malnutrition and there was a high incidence of infectious diseases such as tuberculosis, and the average lifespan was short.

Nutrition was introduced from Europe and the United States after the Meiji era helped to solve these problems. In particular, the nutrition improvement carried out after World War II achieved remarkable results. At that time, there was no food in our country because of the war, and we had to rely on food assistance from international institutions and charities. The main food supply was under government control and the country provided food, but it was not sufficient to provide the required nutrition. Many people, knowing that it was illegal, got food on the black market.

On the other hand, in the victorious United States, advances in agricultural technology had led to an excess of crops. The US government considered selling this excess food to foreign countries, and the target was Japan, which was suffering from food shortages. In 1954, a meeting was held between Japan and the United States on " the use of market development costs associated with the acceptance of surplus agricultural products in the United States. " However, there was no money in Japan to buy these products, and it was difficult for Japanese people who ate rice as their staple food to accept wheat bread and dairy products.

After discussions, the decision was made on the condition that the US government could take over the money that Japan purchases from American farmers for a while and use part of the money to promote and spread imported food. In recent years, some have argued that this was a long-term strategy to westernize the Japanese diet and make it dependent on American agricultural products. However, the only way to survive the severe hunger of the time was to rely on imported food from abroad. In particular, nutritionally inadequate Japanese food with highly nutritious Western food was an effective means of resolving malnutrition. Furthermore, the important point is that advertising funds were provided to promote unfamiliar imported food among the Japanese. Japan actually provided nutritional education to resolve malnutrition, although it was said that this was advertising expense for the United States.

In other words, the Japanese government with the money for advertising expenses, bought a "Kitchen Car" in which the rear part was converted into a kitchen for cooking demonstration, and dietitians boarded and provided nutrition education to every corner of Japan. This kitchen car is not a Food Truck that provides meals that can be seen in the United States, but a special car that can provide nutrition education that also serves as a cooking demonstration (photo).

Kitchen Car in Japan

Food Truck in American

"The Kitchen Car" is a nutrition education car that also serves as a cooking demonstration, and is different from the " Food Truck" , which is an American mobile restaurant. Nutrition improvement in Japan is characterized by the fact that it is based on nutrition education.

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Special Report: School Meal Program

Visit to a Japanese School Lunch: Perspective from a U.S. Registered Dietitian Nutritionist
No. 1 in a Series

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As a U.S. Registered Dietitian Nutritionist living in Japan, I was excited to have an opportunity to visit a Japanese elementary school and experience its lunch program. The program originated following World War II, and has since developed impressively and achieved global recognition for its putative roles in promoting health and helping to maintain the relatively low obesity prevalence among Japanese youth. Perhaps the most noteworthy feature of the Japanese school lunch program is that its purview goes beyond the management and nutritional aspects of the food served to encompass (and even emphasize) integration of the school meal into children' s educational, social, and cultural experiences. The purpose of this article is to share specific examples of this integration and inspire colleagues in the United States to consider how aspects of this program may be emulated in order to improve the health and the food and nutrition literacy of youth in the United States.

My Japanese school lunch visit was made possible through a connection with Shigeru Yamamoto, PhD, RD, Director of the Asian Nutrition and Food Culture Research Center at Jumonji University, where he is also Professor of International Nutrition. With an impressive academic career spanning more than 40 years, he is currently highly involved in promoting the Japanese school lunch program.

The visit was hosted by Nobitome Elementary School in the city of Niiza, northwest of Tokyo. Three of Dr. Yamamoto's graduate students in nutrition, two from Taiwan and one from Vietnam, also joined the visit.

Our guide for the afternoon was Ms. Yamaguchi, the school dietitian and nutrition teacher (Photo 1). In Japan there is a law with a provision stating that a dietetics and nutrition teacher is to give children practical guidance regarding the school lunch. Every school in Japan employs a school dietitian/nutrition teacher. School dietitians may hold a Nutrition Teacher License, which requires similar training as teachers of other subjects. A dietitian can obtain the license after accumulating 3 years of experience working in a school and 8-10 lecture credits. In 2014 there were more than 12,000 school dietitians; about 4,700 of those were also nutrition teachers.

Before entering the school, we changed out of our shoes into slippers. In Japan, shoes are not worn inside the home nor in some restaurants and other public buildings. Upon entering the school of 650 students, we were greeted with signs welcoming us in Chinese, Vietnamese, and English (Photo 2), as well as origami art featuring our native flags (Photo 3).

Our first stop was a peek into the kitchen to see the staff preparing homemade dashi (broth) in large cauldrons, using local vegetables and dried anchovies (Photo 4). Off to the side, racks of serving dishes decorated with small pictures of fruits and vegetables were piled into carts (Photo 5).

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Photo 1: Me (second from right) with the graduate students and Ms. Yamaguchi

Photo 2 (left): Welcome signs in the languages of the visitors; Photo 3 (right): Origami art prepared by the students, featuring the flags from the visitors' native countries.

Photo 4 (left): School lunch workers preparing dashi (broth). Photo 5 (right): Serving dishes ready for the lunch meal.

After the glimpse into the kitchen, Ms. Yamaguchi led us to the library to share some of her teaching practices and materials while we sipped green tea. As the only other English speaker, Dr. Yamamoto kindly served as my interpreter for most of the conversation and to explain the content themes of the materials we were reviewing. Ms. Yamaguchi explained that the school meal teaches children how to make healthy food choices and embeds food and nutrition education including agricultural practices, food production and distribution, cultural traditions, and more in other academic subjects. For example:

• Geography and science: students may calculate the distance that the meal's ingredients traveled to reach their plates, as well as the amount of fuel used and its effects on the earth's ecology.

• Biology: students chart their height and weight and learn about the nutritional contributors to their growth.

• English: students learn English words related to the daily menu, such as the names of foods, cooking methods, table manners, nutrients, etc.

The emphasis on integrating the school meal into children's formal educational environment is expressed in the concept of *shokuiku* (pronounced "show-coo-EE-coo"), a Japanese word meaning food and nutrition education. The Japanese national Shokuiku Basic Act became law in 2005 and in 2008 school curriculum guidelines were revised to include provisions related to the promotion of shokuiku.

One of Ms. Yamaguchi's responsibilities is to develop more than 200 menus for the school year. The menus must satisfy not only nutritional requirements but also student tastes and local and national food traditions and culture. Nutrition standards were established based on Japan's national nutrition surveys and recommended dietary reference intakes. A school lunch must provide one-third of daily nutrient needs, except for some nutrients with daily requirements that are more difficult to achieve (such as fiber); those nutrients are therefore provided in larger amounts. Photos 6 and 7 show examples of a meal calendar for Nobitome Elementary School. The calorie and protein content for each meal are listed at the bottom right of each box.

Photo 6 (top): Example of a monthly meal calendar for Nobitome Elementary School; Photo 7 (bottom): A closer look at the menu for the day of the visit (December 9, 2015).

Menu calendars are delivered to each student's family one month in advance so that family members know what the children are eating. This also provides an interesting and common topic for family conversation. Many schools also post the daily lunch menu on the school's website, along with children's comments about the meal. When a certain meal proves to be very popular, Ms. Yamaguchi prepares a note on the recipes used and sends it home with each student (Photo 8).

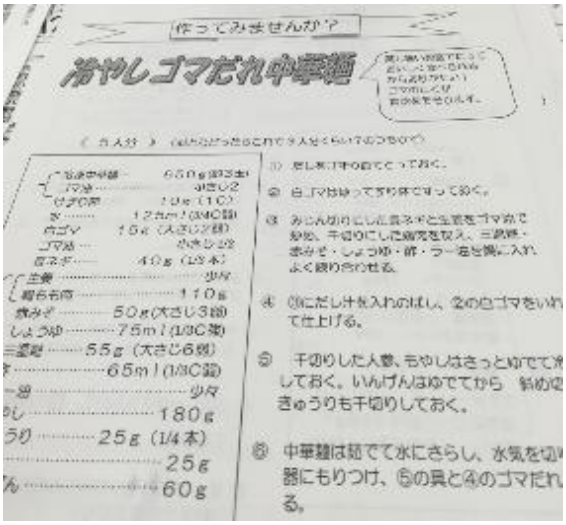

Photo 8: Example of one of Ms. Yamaguchi's recipe notes from a popular lunch menu.

Menus incorporate seasonal foods from local producers as much as possible. Packaged and processed foods are not commonly used in the meals. Sometimes meals even incorporate vegetables harvested earlier that day. Ms. Yamaguchi assembles a display of the ingredients (even the seasonings!) used in the day's lunch, labeled with the name and locations of the producers who supplied them. Photos 9, 10, and 11 are the display from my visit day.

Photos 9, 10, 11: Display of the ingredients used in the lunch meal on the day of my visit.

Local food producers are invited to visit the school and explain their trade to students. Students also visit food producers and become familiar with

how food is produced. This broad perspective on food and nutrition and connection with food producers helps instill in children a sense of gratitude and respect for the food they are eating as well as an appreciation for and interest in its origins. This practice may also be a contributor to the remarkably low levels of food waste reported by many schools.

After our discussion about meal ingredients, we joined a fourth-grade class for lunch. The students were excited to have visitors, and had prepared a colorful welcome mural for us on the chalkboard. After introducing ourselves to the students and hearing about their favorite foods, it was time to eat.

My own childhood experiences with school lunch had formed my expectation that we would eat in a cafeteria, so I was surprised as the classroom quickly transformed into a convivial setting for the meal. After a quick trip to the hallway sinks to wash our hands, the students quickly rearranged their desks and spread out colorful napkin cloths while the teacher put on music.

The fruit and vegetable dishes I'd seen in the kitchen earlier were rolled into the classroom alongside serving trays holding delicious-smelling food. A subset of students quickly donned blue sanitary smocks, hair caps, and cloth face masks as they took their places to dish up the meal for their classmates (Photo 12).

Photo 12: The lunch line in a fourth-grade classroom.

As is typical throughout Japan, younger children do not bring their own lunches from home. All the students are served the same meal, and à la carte options and vending machines are not usually available. Municipalities provide funding for the lunch program's labor costs, and parents/guardians of students pay for the food, an average $2.50/day USD.

The students waited until everyone had been served before they began eating. When everyone's meals had been placed at their desks, one student went to the front of the room and with clasped hands and a slight bow led everyone in a chorus of "Itadakimasu!," a common Japanese phrase spoken at the start of a in" or "bon appétit," but it also conveys an offering of thanks to the chef and to those who produced the ingredients, as well as an expression of gratitude for the food itself. The essence of the word is related to the Buddhist principle of respect for all living things; Buddhism is a prevalent religion in Japan.

The meal included milk, rice with light seasoning, miso soup with mixed seasonal vegetables, and maguro (a type of tuna) in a light breading and sauce with vegetables and peanuts (Photo 13). It was all delicious, but the tuna was my favorite (Photo 14). Overall, the meal was a thoroughly enjoyable experience (Photo 15).

Photo 13 (left): The lunch meal on the day of the visit: milk, rice, miso soup, and tuna with vegetables and peanuts; Photo 14 (right): Close-up of the tuna dish.

When everyone finished eating, the clean-up was executed as quickly as the set-up. Each student helped stack dishes and flattened their milk cartons. All around the room, I heard students saying "gochiso sama deshita," a Japanese expression of thanks for a good meal (literally, "it was a feast").

Ms. Yamaguchi explained that for the entire school (approximately 650 students), food waste averages around two cups per meal.

Before we departed, the students serenaded us with "The 12 Days of Christmas" in English as well as their school anthem, then we posed for a group photo (Photo 16).

As we prepared to leave the classroom, dozens of origami figures appeared from inside the desks and were pressed into our hands as parting gifts (Photo 17).

Photo 15: Here I am enjoying the meal with Dr. Yamamoto and some of the students.

Photo 16: The students and visitors.

Photo 17: The students presented the visitors with origami gifts at the end of the visit.

Photo 18: Example of a near-empty serving dish from a classroom at the school.

On the way to our last stop at the school, the principal' s office, Ms. Yamaguchi paused in the hallway where carts of used serving dishes from each classroom were waiting to be rolled back to the kitchen for cleaning. Any uneaten food from the students' dishes is placed back in the serving dishes so that it can be inventoried daily. As Ms. Yamaguchi pulled the lid off each serving dish, I was stunned to see how little food waste remained (Photo 18).

In the principal's office, we were served another round of green tea as we discussed current events influencing the school lunch. One of the discussion topics was related to the fact that funding for the 2020 Olympics (to be hosted in Tokyo) and funding for the school lunch program was housed in the same department of the Ministry of Education. Hosting the Olympics would be costly, and there was speculation that the school lunch program funding would be reduced as a result. As part of the effort to prevent this consequence, Dr. Yamamoto' s research center published a collection of short articles and essays about the school lunch program on the Asian Nutrition and Food Culture Website in hopes of increasing the Japanese public's and policymakers' recognition of of the value and significance of the program. Positive comments from foreigners will help make their efforts even more compelling.

The visit made clear to me that the Japanese school lunch program is commendable both for the quality of the food and the integration of the meal into the broader educational milieu. The program is truly outstanding in the context of global attempts to structure school settings and meals to cultivate students' knowledge and interest in food and nutrition, improve their health, and foster lifelong healthful eating habits.

Original Research

Nutritional Status and Nutritional Practice of Cirrhotic Patients at Hanoi Medical University Hospital, 2020

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ABSTRACT *Background and purpose.* Liver cirrhosis (LC) is one of the leading causes of mortality worldwide. Malnutrition frequently imposes a burden on patients with LC, and it is an independent predictor of lower survival. As a result, it is essential to manage LC patients' nutritional status and dietary intake for better treatment. However, in Vietnam, there are limited data regarding this issue. This study aimed to describe the nutritional status, dietary intake, and nutritional practice of cirrhotic patients at Hanoi Medical University Hospital (HMUH) in 2020. *Method.* A cross-sectional study was conducted among 40 patients who were admitted to the HMUH from December 2019 to April 2020. For nutritional status assessment, body mass index (BMI), subjective global assessment (SGA) questionnaire, and muscle strength by handgrip strength (HS) were measured. The 24-hour dietary recall method, as well as some open questions, were also collected for the nutritional practice assessment. *Results.* The prevalence of malnutrition determined by BMI was 12.5%; however, the rate was remarkably high from SGA with 60% and from HS with 75%. The mean energy and protein consumption per ideal body weight (IBW) were 24.6 ± 12.0kcal/IBWkg and 1.0 ± 0.5g/IBWkg, respectively. Moreover, 40% of the patients claimed that they restricted animal protein. The percentage of study's patients who had ≥4 meals/day and who ate a late evening snack was only 32.5% and 22.5%, respectively. As for those who took an LES, the average energy, carbohydrate, and protein in this study were only 140kcal, 19g, and 5.1g respectively. *Conclusion.* The prevalence of malnutrition in LC patients determined by SGA and HS was remarkably high. Considering this result, HS rather than BMI is a reliable, non-invasive, and effective tool for malnutrition assessment for cirrhotic patients in Vietnam's clinical settings. Consequently, the mean dietary intakes of LC patients were lower than the recommendation; therefore, nutritional education and a late-evening snack diet need to be provided to LC patients.

Key words: Cirrhosis, nutritional status, dietary intake, nutritional practice.

INTRODUCTION

Liver cirrhosis (LC) is one of the leading causes of mortality worldwide, and it is associated with a significant reduction in disabilities-adjusted life-years. In the report of Global Health Estimates (2016), LC was the 11th most common cause of death each year in the world with 2.1% of total deaths(1). According to Institute for Health Metrics and Evaluation (IHME), in 2019, LC ranked 7th among the top 10 most common causes of death in Vietnam with a 47.3% increment from 2009 to 2019(2). The etiologies of LC are most commonly alcohol, hepatitis B, hepatitis C, and non-alcoholic fatty liver disease or sometimes autoimmune hepatitis. Alcoholic liver disease and hepatitis B are the most common causes in most parts of Asia (3). According to the report of the World Health Organization (WHO) on hepatitis B in Vietnam, it is estimated that the number of cases of hepatitis B-related decompensated cirrhosis was 90,704 in 2017 and is projected to increase 10% by 2030(4). Cirrhosis is defined as the histological development of regenerative nodules surrounded by fibrous bands in response to chronic liver injury, which leads to portal hypertension and end-stage liver disease. In the asymptomatic phase of the disease, usually referred to as compensated cirrhosis, patients may have a good quality of life, and the disease may progress undetected for several years. The decompensation phase is regularly marked by ascites, gastrointestinal bleeding due to esophageal varices, hepatic encephalopathy (HE), and jaundice (5).

Malnutrition is frequently a burden in patients with LC; it is usually related to the clinical stage of chronic liver disease, increasing from 20% in patients with well-compensated disease to more than 60% in patients with advanced cirrhosis (6). Malnutrition and muscle mass loss (sarcopenia) are associated with a higher rate of complications such as susceptibility to infections, hepatic encephalopathy (HE), and ascites, as well as being independent predictors of lower survival in cirrhosis and in patients undergoing liver transplantation (7). Various mechanisms are considered to contribute to malnutrition in cirrhosis such as poor oral intake, increased intestinal protein loss, decrease protein synthesis, disturbances in substrate utilization,

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hyper-metabolism, and malabsorption(8). Therefore, assessment of nutritional status is essential to increase the number of recovering cases and decrease the mortality rate. It is recommended by the ESPEN guideline that subjective global assessment (SGA) should be used as a "gold standard" for malnutrition assessment in LC patients (6). In addition, handgrip strength (HS) is a reliable, non-invasive, and cost- effective tool to identify malnutrition in cirrhotic patients (9). However, in many of Vietnam's practical clinics, body index mass (BMI) is still widely used for nutritional assessment though it can be inaccurate due to ascites and/or edema in LC patients. As a consequence, the prevalence of LC patients in Vietnam has not been well-studied.

There has been controversy over the years about the amount of protein intake for LC patients with the old concept restricting the intake in order to limit the synthesis of ammonium and the deamination of protein to aromatic amino acids especially in patients with HE. However, malnourished and sarcopenic cirrhotic patients can experience protein depletion. Increased protein intake is generally well tolerated and safe in cirrhotic patients and ameliorates protein anabolism as shown in previous studies (10, 11). According to ESPEN's clinical nutrition practice guideline for LC patients in 2019, cirrhotic patients with conditions of increased energy expenditure (i. e. acute complications, refractory ascites) or malnutrition should ingest an increased amount of energy (30-35 kcal/kg/d of energy and 1.2-1.5 g/kg/d of protein (6). Nonetheless, in Vietnam's clinical setting, a restricted protein-diet is still recommended for LC patients (12).

In addition, several guidelines have recommended short periods of starvation with 4 - 6 meals a day, as well as a 50g carbohydrate and/or 15g protein-containing late evening snack thanks to its benefits to the level of serum albumin, liver enzyme, and nitrogen balance (7, 8, 13, 14). Hence, patients' practice with regard to food intake is also necessary for the investigation of an adequate supply of food and monitoring food consumption. With Vietnam's climbing number of new LC cases, it is crucial to evaluate the nutritional status and nutritional practice of these patients; however, there have been relatively limited studies on this issue. For these reasons, we decided to conduct this study to describe the nutritional status, dietary intake, and nutritional practice of cirrhotic patients at Hanoi Medical University Hospital in 2020.

METHODS

Settings and sample. A cross-sectional study was conducted from December 2019 through April 2020 at Hanoi Medical University Hospital (HMUH), a general hospital in Vietnam. All the newly admitted patients (within 0-24 hours) who met the inclusion criteria: (a) diagnosed with cirrhosis of any etiology (alcoholism, hepatitis C, cryptogenic/ NAFLD, autoimmune), (b) age 18 or over, and (c) agreeing to participate in this study were included in this study. The exclusion criteria involved: (a) patients with HE, active gastrointestinal bleeding, acute liver failure, hepatocellular carcinoma, (b) patients with other co-morbid conditions requiring dietary modification and restrictions for different reasons except for diabetes, hypertension, dyslipidemia, (c) patients with medical conditions that would prevent understanding for food record and/ or providing answers or anthropometric measurements. In the end, 40 patients were enrolled in the study.

Data collection. All the questionnaires were filled out by investigators. The investigators were dietitians who were trained to collect study data. The included information in this study is listed below.

Demographic data. The data were collected from medical records, caregivers, and subjects.

Nutritional status assessment. Bodyweight and height were measured in light clothing and without shoes. Body mass index (BMI) was computed as the ratio of weight (kg) per height squared (m2). A BMI <18.5 kg/m2 was considered underweight. 8 patients with ascites and/or edema were excluded from BMI evaluation. Subjective global assessment (SGA) questionnaire was also conducted. Patients with SGA classification A were labeled as well-nourished, and patients with classification B and C were labeled as malnourished (16). Handgrip strength (HS) is a non-invasive, simple, and quick method that has been used for the assessment of nutritional status especially because malnourished patients present with lean mass depletion and low muscle strength. Low handgrip strength is suggested as <26 kg for men and <18kg for women (17).

Nutritional practice. Assessment of individual patients' oral energy and protein intake was determined by 24 h diet recall one day before their hospitalization. The average intakes of energy and protein were recorded in calories and grams per day and grams per ideal body weight (IBW) per day, respectively. In addition, a 7-day food frequency and some open questions regarding nutritional practice were also collected.

Data analysis. Input data were entered into REDcap software. Stata version 15. 0 was used for data analysis. Data were expressed as mean ± SD, median, interquartile range (IQR). For comparison of categorical variables, chi-square was used, and for continuous variables, Student's t-test and Wilcoxon sign rank test were used, as appropriate. The probability level of $p < 0.05$ was set for statistical significance.

RESULTS

The total participants of the study were 40 patients, of which 35 (87.5%) were males and 5 (12.5%) were female. Figure 1 shows the prevalence of malnutrition according to BMI was 12.5% (4/32); at the same time, from HS 75% (30/40) of the patients were malnourished, and from SGA 60% (24/40).

The mean energy and protein consumption based on IBW were 24.6 ± 12.0kcal/IBWkg and 1.0 ± 0.5g/IBWkg (Table 1), respectively. Furthermore, males' intake was higher than females', though only the protein index was statistically significant. Regarding vitamins, dietary vitamin B1 was 1.2mg/d. As for mineral intake, the mean intake of iron from meals was 9.6mg/d and the median intake of zinc was 8.0 mg/d.

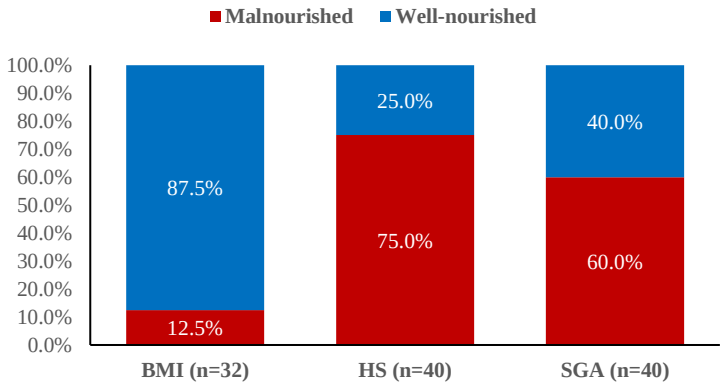

Fig 1. Nutritional status of LC patients by different methods *8 patients with edema and/or ascites were excluded from BMI evaluation

In general, the mean intakes of energy, protein, vitamins, and minerals by malnourished patients and well-nourished patients classified by BMI and HS were not significantly different (Table 2).

Nevertheless, in SGA classification, the mean intakes of energy, protein, carbohydrate, lipid, iron, and zinc by well-nourished patients were significantly higher than by malnourished patients.

Table 1. Dietary intake of LC patients (N = 40)

Dietary intake	Total	ESPEN guidelines2019	Vietnamese recommendation 2016
	Mean ± SD	Median (IQR)	
Energy (kcal/IBWkg)	24.6 ± 12.0	25 -35	30 -35
Protein (g/IBWkg)	1.0 ± 0.5	1.2-1.5	Compensated: 1.0-1.2 Decompensated: 0.8-1.0
Carbohydrate (g/IBWkg)	4.0 ± 0.3	50-60% of total energy	50-60% of total energy
Lipid (g/IBWkg)	0.45 (0.3; 0.6)	-	15-25% of total energy
Fiber (g/d)	5.6 (2.4; 7.7)	-	20-30
Fe (mg/d)	9.6 ± 5.7	-	Male: 7.9mg/day Female: 6.7mg/day
Zinc (mg/d)	8.0 (5.3; 11.4)	-	Male: 10.0mg/day Female: 8.0mg/day
Vitamin B1 (mg/d)	1.2 (0.7; 1.6)	-	Male: 1.2mg/day Female: 1.0mg/day

IBW: Ideal body weight; *p<0.05

Table 2. The dietary intake of LC patients as their nutritional status

Dietary intake	BMI (n=32)		HS (n = 40)		SGA (n = 40)	
	Malnourished (n = 4)	Well-nourished (n = 28)	Malnourished (n = 30)	Well-nourished (n = 10)	Malnourished (n = 24)	Well-nourished (n = 16)
			Mean ± SD; Median (IQR)			
Energy (kcal/IBWkg)	19.0 ± 7.3	28.4 ± 2.0	24.2 ± 1.8	25.9 ± 5.4	19.4 ± 2.1	32.4 ± 2.5*
Protein (g/IBWkg)	0.8 ± 0.3	1.1 ± 0.1	1.0 ± 0.1	1.1 ± 0.2	0.8 ± 0.1	1.3 ± 0.1*
Carbohydrate (g/IBWkg)	2.8 ± 1.0	4.7 ± 0.3	3.9 ± 0.7	4.0 ± 0.4	3.2 ± 0.4	5.3 ± 0.4*
Lipid (g/IBWkg)	0.4 (0.1; 0.8)	0.5 (0.4; 0.6)	0.45 (0.3; 0.6)	0.49 (0.1; 1.0)	0.4 (0.2; 0.5)	0.6 (0.4; 0.8)*
Fiber (g/d)	1.7 (1; 5.1)	6 (4.1; 7.8)	5.1 (3.0; 7.6)	6.0 (2.4; 7.8)	4.8 (1.7; 7.4)	6.1 (4.2; 7.7)
Fe (mg/d)	8.5 ± 6.7	11.1 ± 5.1	9.3 ± 5.0	10.5 ± 7.6	8.2 ± 5.4	11.8 ± 5.6*
Zinc (mg/d)	5.3 (3.6; 10.3)	9.4 (6.5; 11.5)	7.3 (5; 10.7)	10.5 (5.5; 15.1)	5.9 (3.3; 9)	11 (8.2; 13.5)*
Vitamin B1 (mg/d)	1.2 (0.6; 1.7)	1.4 (1.1; 1.7)	1.1 (0.7; 1.6)	1.6 (0.3; 1.6)	1.1 (0.6; 1.6)	1.3 (1.1; 1.6)

*8 patients with edema and/or ascites were excluded from BMI evaluation.

Figure 2 shows that alcohol, animal protein, and fat/oil had the highest number of patients who were restricted in eating them: 67.5%, 40%, 35%, respectively. Meanwhile, LC patients reportedly increased their intake of vegetables (25%), fruits (37.5%), and dairy (40%), and only 5% increased legumes. Most of the patients continued their intake of starch (87.5%) and confectionery/soft drinks (77.5%).

Figure 3 reveals that only 32.5% of patients had ≥4 meals/day and the number of respondents who had a late-evening snack (LES) was only 9 (22.5%). Moreover, the mean energy, carbohydrate, and protein of the late-evening snack were 140.4 ± 60.7kcal; 19.1 ± 9.0g; 5.1 ± 2.5g respectively (Table 3)

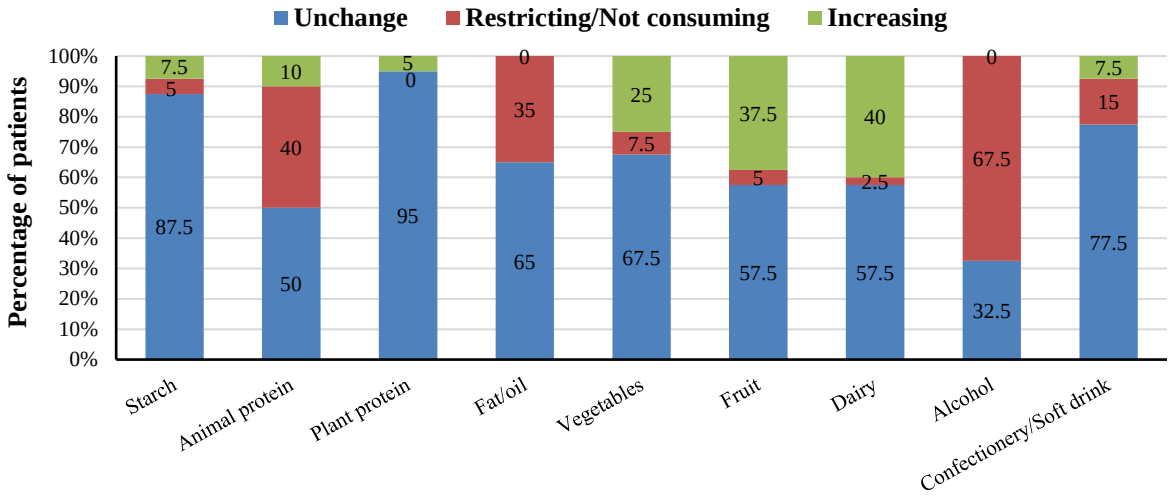

Fig 2. Nutritional practice characteristics of LC patients after being diagnosed with LC (N = 40)

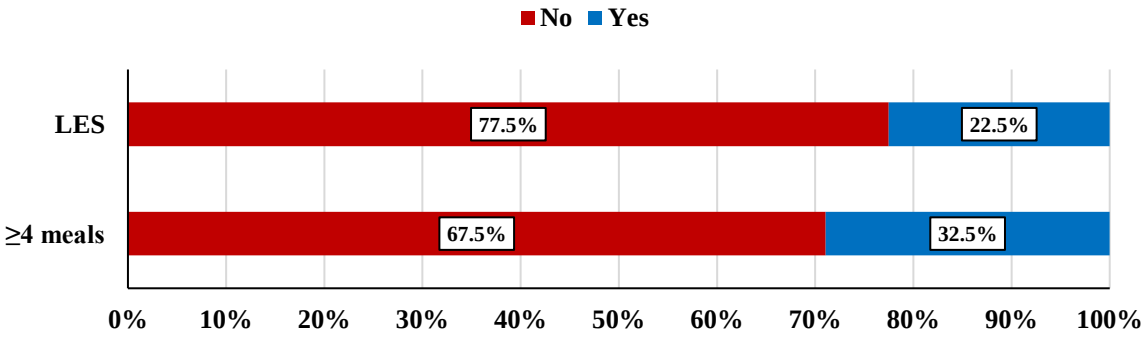

Fig 3. The number of meals/day that LC patients had and late-night snacks (LES) (N = 40)

Table 3. The energy intake of the late-evening snacks (LES) (n = 9)

	Male (n = 7)	Female (n = 2)	All (n = 9)	p
Energy (kcal)	151.7 ± 65.1	101 ± 11.3	140.4 ± 60.7	0.33
Carbohydrate (g)	19.0 ± 10.4	19.6 ± 1.6	19.1 ± 9.0	0.94
Protein(g)	5.8 ± 2.4	2.7 ± 1.6	5.1 ± 2.5	0.13

DISCUSSION

With the increasing burden of liver diseases on the world's and Vietnam's mortality, proper nutrition for hepatic patients has become a challenge, in order to achieve that appropriate nutritional assessment methods are also needed. In many international guidelines, SGA is considered as the "gold standard" for nutritional assessment and should be used for LC patients instead of BMI (6, 7). Unlike BMI, which is only considered about patients' anthropometry, SGA is relied on not only the aforementioned but also the process of losing weight, patients' dietary decrement, hypermetabolism, and clinical symptoms also (16). However, in most Vietnamese hospitals, BMI is the main method of malnutrition screening and

assessment for LC patients. In this study, as per SGA, 60% of Vietnamese LC patients were malnourished; however; as per BMI, only 12.5% of patients were found to be undernourished. This result was similar to Huisman and et al.'s study in 2011, in which the prevalence of malnutrition was 5% by modified BMI for ascites and/or edema patients, 58% by SGA, and 67% by HS (18). Furthermore, 75% of patients had impaired HS, a reliable, non-invasive, and cost-effective tool to identify malnutrition in cirrhotic patients (9, 19). The mean HS in this study was 20.7 ± 7.92kg (based on the Asian Working Group for Sarcopenia (AWGS) criteria), in which the means for males (21.5 ± 7.98kg) and females (15.2 ± 5.19kg) were both below the cut-off value (<26 kg for males and <18 kg for females), so their handgrip strength was classified as low (17). The mean value of HS in this study was roughly equal to that of D. K. Daphnee and colleagues (20.2 ± 7.9kg), which was used as the study's cut-off point, and 99% of patients were considered to have impaired HS (9). The correlation between HS and mortality is expected, as reduced intake is associated with reduced body protein mass and affects muscle function (19). Given these points, SGA and HS are considered to be the recommended assessment methods of malnutrition for LC patients rather than BMI in Vietnam's clinical facilities.

Despite the high prevalence of malnutrition, the calorie intakes of LC patients were lower than the recommended calorie intake (24.6 ± 12.0kcal/kg/d vs 35kcal/kg/d of energy) from ESPEN's latest clinical nutrition practice guideline for LC patients (2019) (6). Cirrhotic patients are usually in conditions of increased energy expenditure as cirrhosis is a catabolic disease, possibly associated with hypermetabolism (6). The fact that most patients had low-calorie intake confirms what the literature has shown, that chronic liver disease patients have a decreased food intake due to the disease's symptoms and dietary restrictions. The mean total daily energy intake of LC patients in this study was quite the same as a study in 2017 by D.K. Daphnee and et al. on 93 LC patients (1445.9 ± 727.7kcal/d and 1540.7 ± 309.3kcal/d) (9).

The mean protein intake per ideal body weight of the study's subjects (1.0 ± 0.5g/IBWkg) was lower than ESPEN's recommendation (1.2 – 1.5g/IBWkg) (6). In the past, there has been controversy about whether patients who had advanced cirrhosis or HE should undergo a transient restriction in protein intake, in order to limit the synthesis of ammonium and the deamination of protein to aromatic amino acids. However, increased protein intake is generally well tolerated and safe in cirrhotic patients and ameliorates protein anabolism, as shown in previous studies (10, 11). Thus, the recommended protein intake in patients with a diagnosis of liver cirrhosis is 1.2–1.5g/kg.BW/d to prevent loss of muscle mass and reverse muscle loss in those who are sarcopenic(6, 7). However, in Vietnam's clinical practice, LC patients' protein intake is still recommended within 0.8-1.2g/kg.BW/d (12). Considering the high prevalence of impaired HS, a sign of sarcopenia, it is essential to reconsider the protein intake recommendation for Vietnamese LC patients in future studies. Nonetheless, the low intake of protein can be the result of low energy intake; therefore, it is possible that LC patients with a proper energy intake can consume more protein. In future studies, how to increase energy and protein intake in Vietnamese LC's patients needs to be addressed.

As for the minerals, reduced zinc levels are quite common in cirrhotic patients, especially those with an alcoholic origin. Zinc deficiency leads to hyperammonemia, anorexia, and altered taste, which contributes to decreased intake and consequent malnutrition. In contrast to zinc, iron intake in cirrhotic patients needs to be treated cautiously as their iron regulation may be disturbed, and overdosing on iron could result in poisoning. However, the dietary iron of the study's respondents was higher than the RDA in both genders. This result can be due to the fact that the proportion of red meat (like beef and pork) and seafood (like fish, shrimp…) in their meals was high. Furthermore, vitamin B1 is also most likely to be reduced in liver diseases. This study's subjects' intakes of vitamin B1 intake met the requirement.

On analyzing dietary restriction patterns, 35% of the respondents were restricting fats in their diet. This figure was higher in the study of Nguyen Thanh Liem (2013), in which almost all the subjects had a good practice of restricting fat (83.3%) and avoiding greasy food (95%) (20). 67.5% of participants had a good practice of restricting alcohol. While only 5% of patients claimed to increase the intake of vegetable protein like beans and legumes, 40% of the patients reported that they restricted their animal protein intake as they believed that protein, in general, was harmful to the liver. In any case, the mean intake of protein by the current study's patients was still below the recommendation, which can be caused by the over-restriction of protein. When asked the reason for doing so, the answer was because of the advice of their relatives, friends, and/or from the media. As a result, nutritional education is ensured to deliver the correct information to the patients.

Not only is meal composition important, but also the number of meals that LC patients eat, which is preferably from four to six meals per day with three main meals and three snacks, especially a late evening snack (LES). A meta-analysis proved that LES intervention helped to improve liver biochemical parameters for albumin, ammonia, and prothrombin time, and liver enzymes including aspartate aminotransferase and alanine aminotransferase (21). LES also decreased skeletal muscle proteolysis (14); therefore it may help to reverse sarcopenia. In addition, increasing the number of meals can also help to increase the amount of dietary intake in LC patients. In a systematic review, Tsien et al. recommended a 200kcal with 50g carbohydrate late evening snack to minimize gluconeogenesis and preserve muscle mass (14), as well as 15g of protein(13). However, the practice of this aspect is poor among the study's patients as most of the subjects believed that a nocturnal snack would make them gain more fat mass and overwork their liver, as night is the time for the liver to rest. As for those who ate a LES, the average energy, carbohydrate, and protein in this study were only 140kcal, 19g, and 5.1g respectively, which were lower than the recommendation, and in a cohort study in Japan (22). In a Vietnamese hospital, the nutritional intervention regimen for LC patients consists only of 3 main meals (breakfast, lunch, and dinner). Owing to this fact, in future

studies, it is necessary to estimate the effect of an appropriate LES on Vietnamese LC patients' dietary intake, nutritional status and liver function.

There were several limitations in this cross-sectional study. The dietary intake of patients was collected by the 24- hour recall for only 1 day; however, a 7-day food frequency was used to help to reduce the non- representativeness. Moreover, the sample size of the study was limited due to the impact of the Covid19 pandemic.

In conclusion, the prevalence of malnutrition in Vietnamese LC patients was remarkably high from SGA with 60% and from HS with 75% . Considering this result, HS is a reliable, non-invasive, and effective tool for malnutrition assessment for cirrhotic patients in Vietnam' s clinical settings rather than BMI. Consequently, the mean dietary intakes of LC patients were lower than the recommendation with many Vietnamese LC patients restricting their protein intake, while few of them ate a late- evening snack. In future studies, appropriate nutritional management with a late-evening snack included in the menu to increase dietary intake needs to be provided to LC patients.

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Research Note

Free Drinking Water Provision at School Canteen and Sugar Sweetened Beverages Consumption among Junior High School Students in Tomohon City, Indonesia: A Cross-sectional Study

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ABSTRACT *Background:* Globally, concerns are raised about sugar-sweetened beverages (SSBs) as a risk factor for child obesity. In Indonesia, SSBs are commonly sold at schools while drinking water is hardly available for free. We investigated whether students in schools with free drinking water consume less SSBs at schools than their counterparts. *Methods:* We conducted a questionnaire survey, incorporating food frequency questionnaire, among 813 students in seven junior high schools with and without free drinking water at school canteen in the city of Tomohon, North Sulawesi Province. We compared their SSB consumption at schools with and without drinking water, using Mann Whitney U test or chi square test. The availability and sale of SBBs were also compared between schools with and without drinking water. *Results:* The proportion of students who reportedly drink SSBs at school at least once a day was not lower in schools with drinking water than in schools without drinking water, and so was the daily frequency of SSB consumption among daily SSB consumers. The number of SSB brands and varieties sold at school appeared to be higher in schools with drinking water than their counterparts. *Conclusions:* There was no difference in SSBs consumption among students between schools with and without free drinking water. To reduce their SSB consumption at schools, it may be necessary to provide alternative drinks or to restrict the sale of SSBs at schools.

Keywords: Drinking water; Sugar-sweetened beverages; Junior high school; Adolescent; Obesity

INTRODUCTION

Globally, there have been growing concerns about sugar-sweetened beverages (SSBs) as a risk factor for child obesity (1-3). While overall sugar intake is epidemiologically and clinically proven to trigger obesity and other metabolic adverse events such as high blood pressure and insulin resistance, the influence of sugars from SSBs is greater than those from solid foods because SSBs contain higher concentration of fructose than solid foods (4). SSBs promotes energy intake efficiently because it is available in liquid form and easy to consume. Despite such characteristics and potential health effects of SSB consumption, SSBs are widely available and accessible to children in any countries or regions irrespective of their income levels.

In Indonesia where the prevalence of obesity (BMI > +2 standard deviation above the median) among adolescents has largely increased in the recent past (by eight-fold from 0.6% in 1996 to 4.9% in 2016), the government has addressed the risk of excessive sugar intake among children through their SSB consumption at school (5-7). In schools, SSBs and bottled water are available at an affordable price for students. On the other hand, tap water available in schools is only for washing hands, since it is not safe to drink unless properly boiled (8). This situation prompts students to drink SSBs. Yet, there is noregulation to restrict the sale of SSBs at schools to date. According to the Global school-based student health survey in 2015, 28% of Indonesian students consume soft drink once or more daily (9).

Studies in the Western countries reported that the provision of drinking water at schools was effective to increase water consumption and to reduce overweight among students (10-12). In Indonesia, a few schools or food vendors in the schools voluntarily provide free drinking water for students. If students in such schools consume less SSBs at schools than those in the schools without drinking water, the provision of free drinking water at schools would be a sound approach to fight against child obesity in Indonesia as well. In the present study, we therefore tested this hypothesis among junior high school students in the city of Tomohon in North Sulawesi Province, Indonesia.

METHODS

Study Setting and Participants

This study was conducted in Tomohon City, North Sulawesi Province, Indonesia. The city has 105,000 residents in 2018, with 23% aged below 15 years (13). The majority of the population in the city is Protestant (73%), while the most of Indonesian population is Moslem (87%) (14-15). In 2017 academic year, there were 22 junior high schools with 5822 enrolled students in the city. Notably, the prevalence of obesity among junior high school students in the city is much higher than that of the whole country (10.4% vs. 2.5% in 2013) (16-17).

In Tomohon City, junior high schools start at 7 AM and finish around 1 PM with two recess time around 9 AM and 11 AM. In the schools, school

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breakfast or lunch program is uncommon, and most of schools provide foods and beverages through food vendors, where students can purchase foods and beverages freely during school recess time or after school.

The study was designed to describe school food environments in all 22 junior high schools in the city, and to investigate dietary intake and body mass index (BMI) among students (18). The sample size was calculated to estimate the proportion of students consuming SSBs once per day or more in Tomohon City to be 32.3%, following the School-based oral health survey guideline (19-20). Given 80% response rate and design effect of two, the required sample size turned to be 840. To achieve this sample size, we selected eight schools, using systematic sampling by urban/rural classification, district of the city, and the size of school, and recruited all 9th graders in the selected schools. The study was approved by the institutional review board of Sam Ratulangi University in Indonesia and the University of Tsukuba in Japan.

In the present study, we used the cross-sectional data from 813 participants in seven of eight selected schools to investigate whether students in the schools providing drinking water for free at canteen consumed less SSBs at schools than those in the schools without free drinking water. One school was excluded because SSBs were not sold in the school.

Data Collection

Data collection was conducted by the first author between July and October 2017 on typical school days among students with a written informed consent of both students and their parents. We asked students to fill out self-administered questionnaires in the classroom to provide information about their characteristics and dietary intake. At the same time, we measured their body weight and height. To obtain information about schools and the food vendors, we interviewed school principal (or designated teacher/staff) and vendors who sell foods regularly at school. We also observed the vendors to identify what were sold. For data collection, we visited schools twice, and students and vendors who were absent during our visits were excluded from the study.

Measurements

(1) School characteristics

School characteristics include type of school (public/private), number of students, availability of water server in the classroom, provision of free drinking water at canteen, and the number of beverage brands and varieties sold in school. Beverages were classified into SSBs and water. Some schools had water servers in the classrooms, but they were not free, and the installation of water servers depended on each class. Users have to pay for the water-refill fees to use.

(2) Student characteristics and SBB consumption

Student characteristics include sex, age, body height, body weight, socioeconomic status, frequency of and daily allowance for food purchase at school, and physical activity. Socioeconomic status was measured with the Family Affluence Score III, which has been validated in a previous study in Indonesia (21). The total score ranges from 1 to 13, where the higher score indicates higher socioeconomic status. Regarding physical activity, we asked the number of days per week students were engaged in moderate to vigorous-intensity physical activity for at least 60 minutes.

Body weight and height were measured using a body weight scale and a stadiometer with graduation of 0.1 kg and 0.1 cm, respectively. Students were wearing school uniform during weight measurement, so the approximate weight of school uniform was deducted from the measured weight. We calculated body mass index (BMI) by dividing the square of body weight (kg) by body height (m). Obesity, overweight, and thin are defined as z-score > 2 standard deviation (SD), 1SD < z-score ≤ 2SD, and z-score < -2SD from median, respectively, according to the WHO child growth standard for boys and girls (WHO, 2007) (22-23).

SSB consumption was evaluated using a food frequency questionnaire (FFQ) separately for consumption at school and outside school. FFQ assesses the consumption of beverages during previous 30 days with 9 levels of frequencies: (1) almost never; (2) one to three times per month; (3) once per week; (4) two to four times per week; (5) five to six times per week; (6) once per day; (7) two to three times per day; (8) four to six times per day; (9) more than six times per day, which was converted to the frequency of daily consumption (i.e., 0, 0.07, 0.1, 0.4, 0.8, 1.0, 2.5, 5.0, and 6.0, respectively) (24). For the present study, we developed the FFQ among 43 junior high schoolers in Tomohon City through three-day inconsecutive food records (two school days and a weekend day).

Analyses

First, we compared school and student characteristics between schools with and without free drinking water at canteen (as shown in Table 1 and Table 2, respectively). Then, we compared SSB consumption among students in schools with and without free drinking water at canteen (as shown in Table 3). Specifically, we compared the proportion of students who consumed SSBs at least once a day at school and outside school and among those who consume SSBs every day, we compared the daily frequency of SSB consumption at school and outside school.

For the comparisons between students in the school with and without drinking water, we performed Mann Whitney U test, t test, or chi square test, depending on the type of the variables to be compared. We showed effect size of Spearman's rho (ρ), Pearson's *r*, and phi (φ) or Cramer's V for these tests, respectively. Effect size of 0.2 for ρ, r, φ, and Cramer's V indicates a practically significant effect (25).

RESULTS

1. School characteristics

Table 1 compares the school characteristics between two schools with free drinking water at canteen and five schools without it. One of the two schools and one of the five schools were public schools. The median number of students in schools with and without free drinking water was 376 and 229, respectively. The number of SSB brands and varieties sold was much higher in schools with free drinking water than in schools without it. Such clear difference between the schools with and without free drinking water at canteen was not seen in the brands and varieties of water.

2. Student characteristics

In the schools with and without free drinking water at canteen, 251 and 562 students in the 9th grade completed the questionnaire survey and anthropometric measurements. Table 2 compares their characteristics. The proportion of male students was

higher in the schools with free drinking water (58%) than in the schools without it (45%). Mean body weight, height and BMI of the students were similar between the schools, though the proportion of overweight and obese students was higher in the schools without free drinking water (29%) than in the other schools (23%). Based on the effect size, there was no difference between the schools in students' characteristics including their family affluence, daily food allowance, food purchase at school, and physical activity.

Table 1. Characteristics of schools with and without free drinking water at canteen

	Free drinking water at canteen			
	Available (2 schools)		Not available (5 schools)	
Number of public schools	1		1	
Number of students per school (median [range [b]])	376	[374, 377]	229	[134, 1188]
Total number of students across schools	751		2011	
Number of schools providing water server in some classrooms	1		2	
Number of beverage brands/varieties sold in school (median [range [b]])				
SSBs	22	[19, 25]	2	[1, 8]
Water	1	[1, 1]	1	[1, 2]
Number of beverages sold per day per 100 students (median [range [b]])				
SSBs	61	[55, 67]	15	[6, 57]
Water	22	[18, 26]	19	[4, 47]
Daily sale of beverages per student (USD [a]) (median [range [b]])				
SSBs	0.21	[0.18, 0.24]	0.04	[0.02, 0.04]
Water	0.01	[0.01, 0.01]	0.01	[0.00, 0.11]

[a] USD 1 = IDR 13,574.00 (as of October 1st, 2017)
[b] Range shows minimum and maximum value of a variable

Table 2. Student characteristics of schools with and without free drinking water at canteen

	Free drinking water at canteen				
	Available (251 students)		Not available (562 students)		Effect size [a]
	n	%	n	%	Φ
Male	146	58.2%	254	45.2%	-0.120
Female	105	41.8%	308	54.8%	
Child growth standard [b]					Cramer's V
Normal	187	74.5%	392	69.8%	0.068
Overweight	31	12.4%	98	17.4%	
Obese	26	10.4%	60	11.7%	
Thin	7	2.8%	12	2.1%	
	Mean	(SD [c])	Mean	(SD [c])	R
Height (cm)	156.9	(7.1)	156.3	(7.2)	0.038
Weight (kg)	50.9	(11.1)	51.2	(12.6)	-0.012
BMI [c] (kg/m^2)	20.6	(4.0)	20.9	(4.3)	0.026
	Median	[IQR [c]]	Median	[IQR [c]]	P
Family affluence score [d]	5.0	[4.0, 7.0]	6.0	[4.0, 8.0]	-0.149
Daily food allowance (USD [e])	0.88	[0.74, 0.88]	0.88	[0.74, 1.47]	0.040
Food purchase at school (days/5 school days)	4	[3, 5]	4	[3, 5]	-0.019
60 mins or more PA (days/week)	3	[2, 5]	3	[2, 5]	-0.034

[a] Effect size of 0.2 indicates a practically significant effect; [b] Based on the WHO child growth standard, thin, normal, overweight, and obese are defined as z-score < -2SD, -2SD ≤ z-score ≤ 1SD, 1SD < z-score ≤ 2SD, z-score > 2SD from median, respectively; [c] SD: standard deviation, IQR: interquartile rage, BMI: body mass index
[d] Family affluence score ranges from 1 to 13; [e] USD 1 = IDR 13,574.00 (as of October 1st, 2017)

3. SSB consumption

Table 3 compares students' SSB consumption between the schools with and without free drinking water at canteen. The proportion of the students who reported to drink SSBs at least once a day in the school was higher in the schools with free drinking water (40%) than in the other schools (34%), while this proportion outside school was similar between the school with and without drinking water (57% and 55%, respectively). Among those who drink SSBs every day, the daily frequency of SSB consumption at school and outside school was also similar between the schools with and without drinking water. Based on the effect size, there was no difference between the schools in students' SBB consumption.

Table 3. SSB consumption among students in schools with and without drinking water at canteen

	Drinking water at canteen				
	Available (251 students)		Not available (562 students)		Effect size [a]
	n	%	n	%	φ
Once or more daily SSB consumption	184	73.3%	390	69.4%	0.040
At school	100	39.8%	193	34.3%	0.053
Outside school	142	56.6%	308	54.8%	0.016
	Median	[IQR]	Median	[IQR]	ρ
Frequency of daily SSB consumption of those who consume SSBs every day	2.5	[2.5, 5.0]	2.5	[2.5, 2.5]	0.033
At school	1.0	[1.0, 2.5]	1.0	[1.0, 1.0]	0.141
Outside school	1.0	[1.0, 2.5]	1.0	[1.0, 2.5]	0.094

[a] Effect size of 0.2 indicates a practically significant effect.

DISCUSSION

We found no discernable difference in SSB consumption among students regardless of free drinking water provision at their schools. This is somewhat contradictory to the findings in the Western countries that the provision of drinking water at schools would increase water consumption among students (10-12). In our study setting, it is possible that SSB consumption was not replaced by free drinking water because the sale of SSBs at schools was not restricted. In fact, previous studies reported that when SSBs and drinking water are both available, students tend to choose visually colorful SSBs because it is thought to be more thirst quenching than plain drinking water (26-27).

The impact of free drinking water provision on SSB consumption, if any, might have been cancelled due to the variety of SSBs sold. In fact, SSBs sold in the schools with free drinking water were more various than their counterparts. Previous studies show that having more varieties of SSBs in vending machine results in a higher number of SSBs sold (28-29). However, our study did not find such a relationship that more various SSBs sold in schools, more SSB consumption among students. This finding implies that students would consume SSBs irrespective of the variety of SBBs sold as long as SBBs are sold at schools.

To reduce sugar consumption from SSBs among students, it may be necessary to offer a healthier drinks at schools or totally ban the SBB sale. One option is to provide school feeding with low-fat milk or drinking water. Reportedly, school feeding can reduce students' purchase of snacks and SSBs (30). Besides, low-fat milk without added sugar has the same thirst-quenching effect as SSBs, and it will be a good calcium source (31). Another option is to allow SSBs with less sugar content to be sold at school. It might not reduce the consumption of SSBs, but it might potentially reduce sugar intake from SSBs while having the same thirst-quenching effect as regular SSBs (27). Ultimately, the ban of selling SSBs at school will prevent students to consume SSBs at school, but further investigation of its impact toward SSB consumption outside school should be kept in mind.

We acknowledge several limitations of this study. First, there is a lack of information on the amount and calorie content of SSBs students consume at school. We asked students to report only the frequency of SSB consumption based on a food frequency questionnaire. With this information, however, we could estimate the proportion of students who daily consume SSBs at school. Moreover, SSBs are sold in PET bottles (350 to 500 ml) or sealed cups (200 to 500 ml) at school, so this range of the amount is roughly consumed for one purchase. Second, we could not validate FFQ developed in this study. Still, self-report dietary survey tool like FFQ is useful to rank the tendency of predefined food (or food group) consumptions (32-33). In this study, FFQ was used to measure the consumption frequency of SSBs, which then categorized into more frequent and less frequent SSB consumption by cut-off of once per day consumption. Also, we chose this self-reporting method over food observation or other methods because it was the most feasible to obtain data of a long-term SSB consumption from a large sample (34).

The findings of this study may not be generalizable to other regions of Indonesia, and in this cross-sectional study, we are uncertain whether the provision of free drinking water at schools has any impact on SSB consumption among students. Yet, the lessons learned from this study should be still relevant to other regions or even beyond the country, because SSB consumption among children is highly prevalent globally.

In conclusion, there was no difference in SSB consumption among junior high school students between schools with and without free drinking water available at school canteen. To reduce their sugar intake through SSB consumption at schools, it is necessary to investigate the impact of providing alternative drinks or restricting the sale of SSBs at schools.

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Research Note

Investigation of Oral Lesion Outbreak among Two Boarding School Students in Thimphu

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ABSTRACT *Background:* The objective of the study is to determine the cause of oral lesion outbreaks among boarding school students and provide proper clinical diagnosis and treatment. Methods: This was a retrospective descriptive study. Data was collected from the affected students during our visit to the schools. Participants were students who had reported of various oral lesions including glossitis in two schools of Thimphu district. A total of 105 students who had oral lesions and glossitis were screened and provided symptomatic treatment. Around 20 students who had severe lesions were sent for blood investigation inclusive of C-reactive protein and micronutrient assays for serum iron, ferritin, folate and cobalamin. Oral swabs were collected and cultured to rule out any fungal growth. All the students were treated symptomatically with B-Complex multi-vitamin, analgesics and with amoxicillin in suspected bacterial super imposed infection. The students were followed up after 2 weeks and 4 weeks of the first visit. Results: Over two-third (70%) of the severely affected students were female and all blood investigation parameters were normal except for one student who had serum micro-nutrients level below the normal range. Microbial culture of oral swab did not isolate any pathogenic organism. All students reported improvement during the first visit and most students had recovered during the second visit with symptomatic treatment. Conclusion: All students reported improvement during the first visit and most students had recovered during the second visit with B-Complex multi-vitamin supplementation. Although the investigation was inconclusive, it strongly points towards riboflavin deficiency which is supported by glossitis outbreak investigation literature from various settings. The investigation recommends conducting a prospective study taking account of all the important micro-nutrients to establish the exact cause of deficiency.
Keywords: Oral lesions, glossitis, schools, students

INTRODUCTION

Oral health is an integral part of general health. It does not pose a major mortality threat but it substantially influences the general health and well-being of an individual (1). Mouth is the only gateway to the body and everything we eat or drink has to pass through it (2). Oral diseases are highly influenced by individual's belief, attitude, knowledge, skills, dietary habits, nutritional status, environment and day to day living practices (3). Oral hygiene is not perceived as an important procedure in most parts of the world including Bhutan and it is made worse by the inability to carry out normal daily procedures such as performing proper oral hygiene practices like tooth brushing or cleaning teeth and tongue due to various oral lesions and glossitis (4).

Oral lesions can be anything in the mouth that is not normal, an ulcer or breach on the mucosa etc. Glossitis is inflammation of the tongue generally characterized by redness and swelling. There are two major types; Benign Migratory Glossitis (BMG) and Atrophic Glossitis (AG) (5, 6). BMG or erythema migrans is an inflammatory condition characterized by focal areas of depapillation of filiform papilla. It is usually surrounded by an area of erythema or hyperkeratosis, resulting in a "map-like" appearance on the dorsal surface of the tongue most commonly which keeps changing in its color, size and position (5, 6). BMG has variable presentation and is asymptomatic in most cases. Very rarely it is associated with systemic diseases and psoriasis (7). Atrophic glossitis (AG) is characterized by the partial or complete absence of filiform papillae on the dorsum of the tongue. It is caused by nutritional deficiencies for a prolonged duration like riboflavin, niacin, pyridoxine, vitamin B12, folic acid, iron, zinc, and vitamin E. Helicobacter pylori (H. Pylori) infection, fungal infections, dry mouth and other metabolic diseases can also cause atrophic glossitis (8-11). Studies have also reported the association of glossitis as heredity, allergy, hormonal factors, and smoking and in association with syndromic diseases (7, 11, 12).

In the present study, students of two boarding schools in Thimphu district of Bhutan had been suffering from different types of oral lesions and glossitis for some time. Interestingly, lesions occurred within a few months after they come to school (April-May and September-October every year). This has been happening for past 2 years and got more severe in 2019 with some students requiring treatment and even hospitalization. Reports from school authorities and Ministry of Education indicate that it affected

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only boarding students and they improved during school vacations (13, 14). Over the years, it has become a concern for both the Health and Education Ministries (15). However, there is limited knowledge on the topic in the country. This study aimed to determine the cause of oral lesion outbreaks among boarding school students and provide proper clinical diagnosis and treatment.

METHODS

This is a retrospective descriptive study. Data were collected from the students during visit to the schools. Participants were students who reported of various oral lesions including glossitis in two schools of Thimphu district in Bhutan. A total of 105 students who complained of different oral lesions and glossitis in these two schools were screened by Oral Medicine Specialist. Twenty students presenting with severe oral lesions were sent for various blood tests inclusive of C-reactive protein (CRP), and micronutrient assays for serum iron, ferritin, folate and cobalamin. Oral swab samples were collected and cultured to rule out any fungal growth. All the students were treated symptomatically with vitamin B- Complex multi-vitamin, analgesics and with amoxicillin in suspected bacterial super imposed infection. The students were followed up after 2 weeks and 4 weeks of the first visit. Ethical clearance was granted by the Research Ethics Board of Health (REBH), Ministry of Health, Bhutan.

Data Management and Analysis

Data collected was double entered and validated using Epi- Data version 3. 1 and analyzed using Microsoft Excel. The characteristics of the participants are presented as frequencies, percent, mean and standard deviation (SD).

RESULTS

The mean age of students was 15.8 years (SD: 1.8) and 70% of the severely affected students were female. Microbial culture of oral swab did not isolate any pathogenic organism (Table 1).

Blood investigation findings are being presented in table 2. All the parameters were normal except for one female student who had serum micro- nutrients level below the normal range (Ferritin; 8.9 and Iron 8.6). All students (100%) reported improvement during the first visit while most (88.6%) of the students had recovered during the second visit with symptomatic treatment (Figure 1) which indicates that the outbreak was caused by micro-nutrient deficiency.

Table 1: Descriptive (n=20)

Variables	Category	Frequency	Percent
Age			
	≤ 15	11	55
	≥ 16	9	45
	Mean: 15.8, SD: 1.8, Minimum 13, Maximum 20		
Gender			
	Male	6	30
	Female	14	70
Oral Swab Culture: Pathogenic organism not isolated			

SD: Standard Deviation

Table 2: Blood Serum Parameters (n=20)

Parameter	Normal Range	Mean	SD	Minimum	Maximum
CRP (mg/dl)	<0.6	0.2	0.5	0.0	2.0
B12 (pg/ml)	130-700	498.8	218.3	246.5	988.4
Folate (ng/ml)	5.0-20	16.3	4.7	11.3	20.0
Ferritin (ng/ml)	F:13-150; M 30-400	40.9	26.8	8.9	107.3
Iron (mg/dl)	F:39-149; M;40-168	93.0	45.3	8.6	212.9

CRP: C-reactive protein, SD: Standard Deviation, F: Female, M: Male

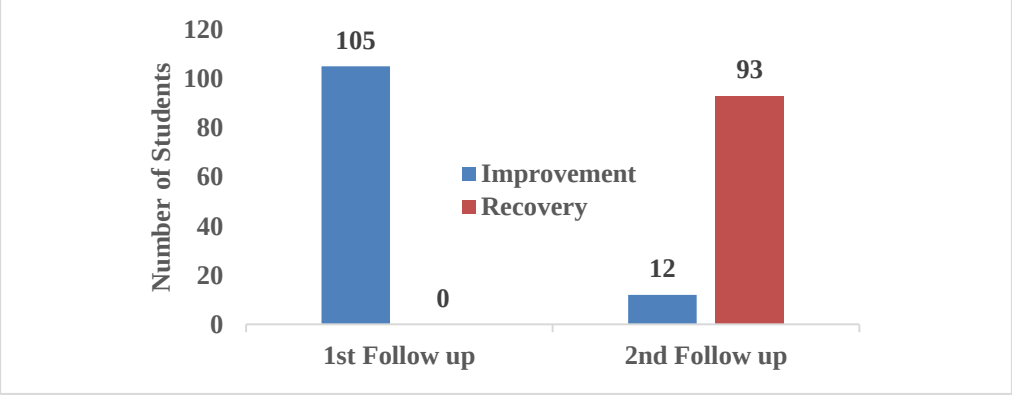

Figure 1: Improvement and recovery during follow up visits (n=105)

DISCUSSION

Students responding to B-Complex multi-vitamin supplementation indicates that the outbreaks could possibly be linked to micro-nutrient deficiencies. Past studies conducted in boarding schools have reported that that over 90% of the boarding school students were deficient in thiamine (16) and around 64% had deficiency of cobalamin (17). An investigation of meals provided in feeding schools across Bhutan found that meals had inadequate amount of proteins and micro-nutrients (18).

To address the huge burden of micronutrient deficiencies, fortified rice was introduced in feeding schools towards end of 2017. The rice was fortified with eight micronutrients (Vitamin A, vitamin B1, B3, B6, B9 and B12, iron and zinc) (19). Since the oral lesion / glossitis symptoms improved/reduced with Vitamin B complex supplementation, vitamin B2 (riboflavin) was suspected as the most likely cause of outbreaks as fortified rice lacked riboflavin but is present in vitamin B complex. Glossitis outbreak investigations conducted in different countries indicated that the outbreaks could be linked to riboflavin deficiency (20-22) Riboflavin deficiency is associated with glossitis, oral ulceration, hyperemia and swelling of mouth and throat, angular stomatitis and cheilitis. The main sources of riboflavin are meat and dairy products. Smaller amounts are also present in different cereals, food grains, seeds and green leafy vegetables (23).

LIMITATIONS

Due to urgency of the work, the investigation could not wait for resource mobilization thus, small sample size was a big limitation. The investigation also could not conduct serum assays of important micro-nutrients such as thiamine and riboflavin.

CONCLUSION

All students reported improvement during the first visit and most students had recovered during the second visit with B-Complex multi-vitamin supplementation. Although the investigation was inconclusive, it strongly points towards riboflavin deficiency which is supported by glossitis outbreak investigation literature from various settings. The investigation recommends conducting a prospective study taking account of all the important micro-nutrients to establish the exact cause of deficiency.

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Research Note

Medical Nutritional Therapy for COVID-19 Inpatients

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ABSTRACT *Introduction:* COVID-19 pandemic is a challenging period, which requires fast adaptation of the healthcare system. It is crucial for each of the patients to get access to medical nutrition therapy from dietitian due to disease progress itself will affect patient nutritional status. The study aims to identify nutritional status and diet intake of COVID-19 inpatients and to determine efficacy of method in delivering Medical Nutrition Therapy (MNT) and intervention done by dietitian. *Method:* An observational retrospective study which using convenience sampling for study population, which includes all records of the patients that fulfill the criteria. 30 Nutrition Care Process (NCP) records of COVID-19 patients warded in HTJS during COVID-19 pandemic from April 2020 to May 2020 were included. *Results:* Among 30 of COVID-19 subjects, there were 16 (53.3%) subjects given with Full COVID High Protein Diet, 3.3% (1) subject indented with Full COVID High Protein Diabetic Diet as well as Full 30 Normal Diet and Soft 30 Normal Diet each. About 36.7% (11) paediatric subjects given with Full COVID Paediatric Diet. Out of three assessment methods used, only 10% of subjects answered the questionnaire and another 90% via direct phone call due to subjects did not answered the questionnaire through *google form* after 48 hours of admission. *Conclusion:* Dietitian approach in delivering MNT should incorporate and adapt with the current new norms as align with advance technology in providing remote or virtual MNT. This study also showed that MNT still needed due to NCD factors that can elevate the risk of mortality among COVID-19 patients.

Key words: Medical nutrition therapy, pandemic, COVID -19, dietitian

INTRODUCTION

The breaking of a COVID-19 pandemic is posing unprecedented challenges and threats to patients and healthcare systems worldwide (2). The initial clinical sign of the SARS-CoV-2 related disease COVID-19 which allowed case detection was pneumonia (5). The disease primarily involves the respiratory tract but it may deteriorate to multi-organ failure and be fatal (12). In addition, death statistic reported by Crisis Preparedness and Response Centre (CPRC), Ministry of Health and Department of Statistic, Malaysia (DOSM) (20), shows that total death percentage among COVID-19 patients is 1.47% which most of them involved death among older population and person with underlying non-communicable disease (NCD). Mortality appears to be highest among older people and those with comorbidities, who are also often the most at risk of under-nutrition in society (18). Dietitian can play an important role in managing cases of NCD and under-nutrition. Identification and correction of under-nutrition is practical steps to COVID-19 patients to improve outcomes cost-effectively (20). During this pandemic period, there are number of services that were affected including dietetic profession. Based on the recent online opinion polls done among Malaysian dietitians, 57.4% to 60.7% of dietitian stated that most of the implementation of Medical Nutrition Therapy (MNT) among patients were done in appropriate steps accordingly with some constraint arising from the current situation (3). The same opinion poll also reported that 46.3% from 298 respondents among Malaysian dietitians think that dietitian could contribute towards care among infected COVID-19 patients.

There are only few guidelines available for dietitians regarding their roles during pandemic or outbreak to help them to overcome this issue. Screening is designed to be quick way of identifying those who are at significant risk of nutritional problems so that further detailed nutritional assessment can be undertaken and action can be put in place including dietary intervention via therapeutic diet alone or with oral nutrition supplement. weight and height measurements is the most crucial screening process usually carry out physically, however due to pandemic, reliable, reported values from patient need to be gained. Thus, there are a series of subjective criteria that can be used to help form an overall clinical impression of an individual's malnutrition risk category. Subjective criteria including clinical impression on body size and side effects of disease that affected oral intake. This study aims to provide baseline data on nutritional status and diet intake among COVID-19 inpatients and method in delivering MNT during pandemic.

METHODS

This is an observational retrospective study with convenience sampling. The study includes all the COVID-19 inpatients who able to tolerate orally and exclude critically ill COVID-19 patients on ventilator and were on Ryle's tube feeding. 30 out of 37 COVID-19 inpatients received Nutrition Care

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Process (NCP) by dietitians in HTJS during pandemic from April 2020 to May 2020. The data extracted from Dietetic Care Note (DCN) and Patient Management System (SPP) including age, comorbidity, class/category of Covid-19, medication prescribe for COVID-19 treatment, sign and symptoms related with COVID-19, biochemical data, estimated food plate waste, type of special therapeutic diet prescribed by dietitians for the patient, oral nutrition supplement regime (if available) and method of delivering MNT.

The data analysis done using the IBM SPSS Statistics Version 21. Descriptive data expressed as mean. standard deviation (SD) unless otherwise stated. One Way ANOVA used for normally distributed data. Kruskal-Wallis ANOVA used for non-normally distributed data. A value of $P< 0.05$ considered as statistically significant. The data collected analyzed using an intention-to-treat basis.

RESULTS

Socio-demographic characteristics of the subjects involved in this study were presented in Table 1, 37% (n=11) of the subjects were pediatric and 63% (n=19) were adult subjects. There were 43.3% male (n= 13) and 56.7% female (n= 17). Most of the subjects were age below 19 years old (n=12). The minimum age was 2 years old and maximum age was 67 years old. There were six subjects (20%) had comorbidities comprise of hypertension, cardiovascular disease, asthma, rhinitis, diabetes or combinations. 50% (n= 15) of subjects were categorized under COVID-19 Class 2A and 7 out of 15 subjects were pediatrics case.

Table 1: Social-demographic characteristics of the subjects

Variable	Male (n=13)	Female (n=17)
Age Group, years		
≤19	5(41.7)	7(58.3)
20-39	4(44.4)	5(55.6)
≥40	4(44.4)	5(55.6)
Comorbidities		
Hypertension	0(0.0)	1(100.0)
Cardiovascular	1(100.0)	0(0.0)
Asthma	1 (100.0)	0(0.0)
Rhinitis	1 (100.0)	0 (0.0)
Combination	1(50.0)	1(50.0)
NKMI	9(37.5)	15(62.5)
Class Covid		
Class 1	2(50.0)	2(50.0)
Class 2A	5(33.3)	10(66.7)
Class 3A	4(66.7)	2(33.3)
Class 3B	1(25.0)	3(75.0)
Class 4B	1(100)	0(0.0)

Out of 30 subjects, only 20 subjects measured for potassium level, (n=1) was pediatric subject who was on antiviral medication and balance (n=19) were adult subjects. Another (n=10) pediatric subjects were not any medications therefore blood potassium level not available. Majority of the subjects showed an improving trend in potassium level except for (n=4) subjects no further blood investigation prior to discharge. Other than that, no significance blood result parameter correlates with nutritional status.

According to COVID-19 Case Category by Infectious Disease Unit, Penang General Hospital, the categories were based on classification or presentation of symptoms (cough/SOB), fever, and pneumonia, oxygen dependent and critically ill with shock/MOF/ARDS. While based on Clinical Management of SARI when COVID-19 disease is suspected (interim guidance) by WHO, listed clinical syndromes in mild illness category which interfere with oral intake such as fever, fatigue, cough (with or without sputum), anorexia, malaise, muscle pain, sore throat, dyspnea, nasal congestion or headache. Rarely patients may also present with diarrhea, nausea and vomiting.

Table 2 shows that all subjects except from COVID-19 Class 1 were presented with runny nose, cough, fever and sore throat. Five subjects were accompanied with loose stool and another two had arthralgia and myalgia. Most of the subjects presented with clinical symptoms were treated with Hydroxychloroquine (HCQ) and different COVID-19 anti-viral medication known as Favipiravir except pediatric subjects, no medication was prescribed.

There were 14 specialized COVID-19 Diet developed during pandemic focusing on high protein diet with oral nutrition supplement (ONS) and high potassium fruit. The menu plans providing average energy 1600 Kcal – 1700 calorie and 70g – 75g protein per day. High protein diet category mainly consists of 15% ONS providing 220-300 calorie; 10-14g protein. If patient could not finish their meals whereby intake only quarter or half of meal served, they will be supplemented with ONS. Another two categories which are Full 30 / Soft 30 and Full 50 / Soft 50 each indicate patient require with 30% ONS (480-560 calorie; 20-24g protein) and 50% ONS (577-657 calorie; 40-44g protein). Product given either standard flavor formula with low GI plus protein concentrated or combination with peptide formula. High potassium fruit providing 131.2-262.4mg (2.5-6.7mmol) of potassium intake with additional 340mg (8.7mmol) potassium consumed if given 30% ONS or 50% ONS. All of the pediatric subjects were prescribed with Full Covid pediatric diet. Most of the adult subjects were indented with Full COVID High Protein Diet (n=16). Besides that, 7% (n=2) of the subjects were at risk of malnutrition and prescribed with Full 30 normal diet and Soft 30

normal diet. For individuals having difficulty coordinating breathing and chewing, beverages might be a better option to efficiently increase energy intake compared to solid food.

Table 2: Clinical data according to Class of COVID-19

Variable	Class 1 n (%)	Class 2A n (%)	Class 3A n (%)	Class 3B n (%)	Class 4B n (%)
Clinical Symptoms					
Runny Nose	0(0.0)	1(100.0)	0(0.0)	0(0.0)	0(0.0)
Cough	0(0.0)	3(100.0)	0(0.0)	0(0.0)	0(0.0)
Fever	0(0.0)	3(60.0)	1(20.0)	1(20.0)	0(0.0)
Combination		8(53.3)	3(20.0)	3(20.0)	1(6.7)
Asymptomatic	4(66.7)	0(0.0)	2(33.3)	0(0.0)	0(0.0)
Medications					
Hydroxychloroquine	0(0.0)	7(43.8)	5(31.3)	4(25.0)	0(0.0)
Other Antibiotic	0(0.0)	0(0.0)	1(100.0)	0(0.0)	0(0.0)
Combinations	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(100.0)
No Medication	4 (33.3)	8(66.7)	0(0.0)	0(0.0)	0(0.0)
Commorbidities					
Hypertension	0(19.5)	0(0.0)	1(100.0)	0(0.0)	0(0.0)
Cardiovascular	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(100.0)
Asthma	1(100.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Rhinitis	0(0.0)	1(100.0)	0(0.0)	0(0.0)	0(0.0)
Combinations	0(0.0)	1(50.0)	0(0.0)	3(50.0)	0(0.0)
NKMI	3(12.5)	13(54.2)	6(25.0)	2(8.3)	0(0.0)

Table 3: Specialized COVID-19 Diet

Special Diet	Number of Subjects (n)
Full Covi COVID High Protein Diet	16
Full COVID High Protein Diabetic Diet	1
Full COVID Pediatric Diet	11
Full 30 Normal Diet	1
Soft 30 Normal Diet	1

1600-1700 calorie; 70-75 gram protein		
HIGH PROTEIN DIET (additional commercial soybean/ full cream milk 2 pack/day + dates 20-40 g/day)	**SUPPLEMENT ONS 30%** (additional low GI flavored milk + protein concentrated 6g/day+ dates 20-40 g/day)	**SUPPLEMENT ONS 50%** (additional low GI flavored milk + protein concentrated 6g/day + 1 bottle 50 ml of peptide drink+ dates 20-40 g/day)
Full COVID High Protein Diet	Full 30 Normal Diet	Full 50 Normal Diet
Full COVID High Protein Diabetic Diet	Full 30 Diabetic Diet	Full 50 Diabetic Diet
Full COVID Pediatric Diet	Soft 30 Normal Diet	Soft 50 Normal Diet
Soft COVID High Protein Diet	Soft 30 Diabetic Diet	Soft 50 Diabetic Diet
Soft COVID High Protein Diabetic Diet		
Soft COVID Pediatric Diet		

DISCUSSION

With the increasing burden of liver diseases on the world' s and Currently, there is no nutrition guidelines specifically for patients with or at risk for COVID-19 infection, yet guidelines from Evidence Analysis Library is still applicable and can be used to provide guidance when working with COVID-19 infected patients. However, some adjustments might be required to meet the increased metabolic and functional needs caused by the COVID-19 infection and treatments.

Hence COVID-19 patient should have access to nutritional care as a part of healthcare services. This study used virtual assessment approaches through three main methods including self-answering questionnaire from *google form*, direct phone call to patient and or via call to ward staff. Self-answering questionnaire can be reached through link or QR Code stamped on patient's diet tray. For IT illiterate patients, the approaches were done through phone call or ward staff assistance. Out of these three methods, only 10% of subjects answered the questionnaire and another 90% via direct phone call due to subjects did not answered the questionnaire through *google form* after 48 hours of admission. The assessment included anthropometry, sign and symptoms, which may affect food intake and estimated current intake in ward. These approaches in line with Greenhalgh T et al (9), which state that every protocol made to avoid in-person assessment of patients with COVID-19. According to Deepa H et,al (11), due to limited resources and

staff during the COVID-19 pandemic, some nutrition screening procedures require flexibility to better meet the safety and operational needs of an organization. Special coordination such as conducting nutrition screening using patient-room telephones can be considered to minimize staff exposure.

Nutritional intervention should be tailored according to subject's needs by changing to specific diet for COVID-19 and it can be met by oral nutritional supplements (ONS). ESPEN in Expert Statements and Practical Guidance for Nutritional Management of Individuals with Sars-Cov-2 Infection stated that COVID-19 patients need more energy than normal. The patients require high calorie, high protein meals and snack for each mealtime to help prevent weight loss or further weight loss, and maintain lean muscle mass while helping the body to build better immune system to fight the infection. A study showed that the requirement for Covid-19 patients likely to be higher than normal due to the pathology of COVID-19 infection. According to MNT for COVID-19 Quick Guide energy and protein requirement for prevention and treatment of malnutrition in individuals at risk or infected with COVID-19 are as follows: Energy needs for polymorbid patients aged >65 years is 27 kcal/kgBW/day while for severely underweight polymorbid patients is 30 kcal/kgBW/day, this value also as guidance for energy intake in older persons. Protein needs in older person is 1g/kgBW/day meanwhile in polymorbid medical inpatients in order to prevent body weight loss, reduce the risk of complications and hospital readmission and improve functional outcome requirement should be more than > 1g/kgBW/day.

Luigia B et.al (15) stated that during hospitalization, oral nutrition supplement (ONS) are useful in case of malnutrition or for those cases which intake only 50-60% and as for dysphagia cases, it is mandatory to modify diet consistency in addition to ONS. Nutrient-dense food and beverages, including oral nutrition supplements are good methods to increase calorie and protein intake thus can help prevent weight loss and maintain lean muscle mass (11). The menu included full COVID high protein diet, full COVID high protein diabetic diet, soft COVID high protein diet, soft COVID high protein diabetic diet, full 30 normal diet, full 30 diabetic diet, full 50 normal diet, full 50 diabetic diet, soft 30 normal diet, soft 30 diabetic diet, soft 50 normal diet, soft 50 diabetic diet, soft COVID pediatric diet, and full Covid pediatric diet. Basically, all COVID -19 adult subjects were auto indented with full COVID high protein diet while COVID -19 pediatric subjects were auto indented with full COVID pediatric diet upon admission but subsequently changed to another type of diet depend on their needs after seen and intervened by dietitians. COVID -19 subjects who received full 30 and soft 30 were also received additional oral nutrition supplements (ONS) to increase their energy and protein intake. Since they unable to finish their meal on account of their health condition/symptoms which interfere with their oral intake. As part of dietary intervention, pediatric cases (n=4, 1-6years old), who were still bottle feeding were given with growing up formula and (n=3, ≥7years old) were given commercial full cream milk during supper which provided average energy and protein supplemented 338.6kcal; 11.5g and 150kcal; 8g respectively. All COVID -19 diet specially designed as high protein diet category providing up to 75 g protein per day. Another two categories which are Full 30 / Soft 30 and Full 50 / Soft 50 each indicate patient require with 30% ONS (480-560 calorie; 20-24g protein) and 50% ONS (577-657 calorie; 40-44g protein). Product given either in form of powder or ready to drink. This in line with the intervention done by Riccardo Caccialanza M.D et.al (4), which stated that if nutritional risk is detected after screening procedure, it is encouraged to prescribe the patient with oral nutrition supplement; two to three bottles (125/200 mL/d) of protein-calorie ONS (600/900 kcal/d; 3555 g/d of proteins) provided to patients, to be consumed between or immediately after meals.

There were few subjects developed hypokalemia during the stay. Hypokalemia is an electrolyte characterized by low serum potassium concentrations (normal range: 3.5 – 5.0 mEq/L). Hypokalemia is classified into stages of mild (3.0-3.4 mEq/L), moderate (2.5-2.9mEq/L) and severe (<2.5 mEq/L). Pathophysiology of COVID-19 infection itself might be the cause of hypokalemia in COVID -19 patients. COVID-19 infection develop when Sars-CoV-2 invades human cells via binding angiotensin I converting enzyme 2 (CE2) on the cell membrane (16). The final effect increases reabsorption of sodium and water, and thereafter increases blood pressure and excretion of potassium (K^+) (21). So, the dietitians provide dietary intervention for hypokalemia by providing high and moderate potassium food such as banana, milk, green leafy vegetables, dates and other potassium-containing food to the hypokalemic patients with average 131.2 – 262.4mg (2.5-6.7mmol) potassium.

According to contemporary review by Cohn J.N et.al (6), national council on potassium in clinical practice, for prevention of hypokalemia, a dosage of 20 mmol/d potassium in oral form is generally sufficient, and 40 to 100 mmol/d sufficient for its treatment A study by Aboujamous.H et.al (1) reveals that every 10 mEq of potassium administered increase serum potassium levels by a mean value of 0.13 mEq/L. The result of the study also further reveals that intravenous potassium appears to impact serum potassium levels similarly to the impact of oral potassium. After intervention done by dietitians and medical practitioners, there were improvement in subjects blood potassium level prior their discharge.

In conclusion, Medical Nutritional Therapy (MNT) is a fundamental aspect in managing malnutrition regardless of pandemic. Dietitians play a significant role and should proactively implement appropriate nutrition care plans (NCP) to assess, prevent and treat malnutrition among COVID -19 patient. The management and guidance provided in this study can assist dietitian in assessing and intervening patients infected with COVID -19 who are hospitalized. Although it has been created and done in response to the COVID -19 pandemic crisis, it could be suitable for every situation in the future that might limit the availability of healthcare system and adopt to the new norms and align with IR4.0 revolution.

COMPLIANCE WITH ETHICAL STANDARDS

This study approved by MREC with reference number KKM/NIHSEC/P20-1591 (4). No potential conflict of interest was reported by the authors.

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