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Contents

Original

Introducing A Floor Cleaner with Dust Collection Function for Hospital Kitchen

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ABSTRACT *Background and purpose.* In Japan, recent soaring prices and labor cost hikes have put pressure on hospital food service operations, and cost-cutting measures are challenging. We believe that cost-effectiveness can be improved by changing a kitchen with a dry systemized floor cleaning from 4 processes (conventional method) such as mop and squeegee (drainage) to 1 process (FD method) with a floor cleaner with dust collection function. We tried to clarify this question in this research. *Methods.* This research was conducted in a kitchen with a dry systemized a 457-bed acute care hospital in Tokyo (49 kitchen employees, providing approximately 1,000 meals per day). Data include retrospectively summarized data from daily "hospital meal work diary" records in 2022, so comparative research of the first 6 months (conventional method) and the latter 6 months (FD method). The target of the floor cleaning was the non-contaminated area (cooking room) with a total of 134.2m^2, cleaning once a day, with cleaning, sanitizing, and brushing once a month. *Results.* The total work time for cleaning and disinfection was 559.5 hours for the conventional method and 182.5 hours for the FD method, with a difference of 377 hours. This difference can be said to have reduced the cleaning labor time by 33%. Assuming that one employee works 8 hours a day, work will be reduced by 47 days. Personnel costs were 1,035,075 yen for the conventional method and 337,625 yen for the FD method. Labor costs for cooking assistants vary depending on years of experience. Therefore, the calculation was based on the average wage according to the "Salary Contract Schedule". Detergent and disinfectant costs were 73,000 yen for the conventional method, and 37,778 yen for the FD method, and tool costs were 9,000 yen for the conventional method and 30,000 yen for the FD method. The total cost for six months was 1,117,075 yen for the conventional method and 405,403 yen for the FD method, with a difference of about 712,000 yen. The FD purchase cost was thus offset in about 2.4 months. *Conclusion.* By changing from the conventional method to the FD method for cleaning a kitchen with a dry systemized floor area of 134.2 m^2, we were able to reduce the work time by 377 hours and the cost by about 712,000 yen over 6 months.
Keywords: a floor cleaner, hospital kitchen floor cleaning, cost-effectiveness

INTRODUCTION

In Japan, recent soaring prices and labor cost hikes have put pressure on hospital food service operations, and cost-cutting measures are challenging. However, there are few reports on solutions, and the government has not approved support for capital investment.

Hospital meals in Japan are hygienically managed according to the sanitation management manual for mass cooking facilities by Hazard Analysis Critical Control Points (HACCP) (1), as in other countries (2). It stipulates that kitchen floors should be cleaned at least once a day and, if necessary, washed, and disinfected. However, no specific cleaning or washing/sanitizing methods are specified. Furthermore, it is also stated that "it is desirable to actively promote a dry system. Not only hospitals but also the kitchens of group feeding facilities, including school lunches, should introduce dry systems and if they have not been introduced, it is clearly stated that a dry operation should be attempted (3). With the aging of the working population in Japan (4), most of the employees responsible for cleaning kitchen floors are middle-aged and elderly. For them, cleaning floors daily is a whole-body job, and it takes a long time to complete the four steps. In addition, the monthly cleaning, sanitizing, and brushing work requires strength when handling the large automatic washer for commercial use (used not only in the kitchen but throughout the hospital) because it is large and heavy. Therefore, we thought that the work time could be shortened by introducing floor cleaners with a dust collection function (FD). However, FD has a high capital investment cost as a cleaning tool, and there is yet no verification of whether labor efficiency will increase when it is introduced for cleaning floors in hospital kitchens. Therefore, in this research, a kitchen with a dry

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systemized floor cleaning was changed from 4 processes (conventional method) such as mop and squeegee (draining) to 1 process (FD method), This was carried out to clarify the cost-effectiveness of the change.

MATERIALS AND METHODS

The hospital under research is a Tokyo hospital with 457 beds, and 49 kitchen employees, and serves approximately 1,000 meals per day. The floor cleaning area under research was a dry systemized non-contaminated area (cooking room), with a total floor cleaning area of 134.2 m^2 (excluding the area of cooking equipment and cooking tables installed directly and fixed above the floor), The research period was 6 months from January to June 2022 for the conventional method and 6 months from July to December 2022 for the FD method, Data was collected from daily "hospital meal work diary" records.

The cleaning and washing/sanitizing method (conventional method) was performed as follows. At least once a day: 1) Remove dust with a broom and dustpan, 2) Wipe with a mop soaked in a neutral detergent (for severe oil stains, use a special cleaning agent for oil stains), 3) Wipe a well-washed mop, 4) Drain with a squeegee or wipe dry with a dry mop. In addition, once a month, for cleaning, sanitizing, and brushing: 1) Remove dirt and dust with a large commercial floor cleaner, 2) Brushing and collect sewage while spraying a neutral detergent containing a floor disinfectant such as sodium hypochlorite in a large automatic washer for commercial use, and 3) Wipe dry with a drainer or a dry mop.

In the FD method, a floor cleaner with dust collection function for cleaning the dry zone (Karcher BR 30/4 C Bp https://www.kaercher.com/jp/professional/pro_hygiene.html) was used.
The instruction manual for this product explains that the water supply tank is 4 L and consumes 1 L of water per minute. Therefore, we decided to stop using the water supply tank and use the FD to wash the floor after sprinkling a cleaning and sanitizing solution on the floor. Because this FD is small and cordless, it is easy to handle. In general cleaning, 4 processes and once a month, for cleaning and disinfection are required, but this FD is equipped with a dust collector, it can vacuum floor debris while simultaneously cleaning and sanitizing the floor with a cleaning and sanitizing solution and brush. In addition, it can also collect sewage. This means that daily and monthly cleaning and sanitizing can be completed in one process

RESULTS

Table 1 shows a comparison of the cleaning time and various costs of the conventional method and the FD method. The floor cleaning was the non-contaminated area (cooking room), which used a dry system, with a total floor cleaning area of 134.2m^2 (excluding the area of cooking equipment and cooking tables installed directly and fixed above the floor).

Table 1. Comparison of time and cost spent on kitchen floor cleaning with conventional and FD methods

			Conventional method	**FD method**
Floor space:134.2m^2			Broom, neutral detergent, mop, disinfectant,…	A floor cleaner with dust collection function,…
Floor cleaning time	1 (day) 1 (month) 6 (months) 1 (year)	hours	3 90 + 2* 547.5 + 12* 1,095 + 24*	1 30 + 0** 182.5 + 0** 365
labor cost [Average hourly wage 1,850 yen]	1 (day) 1 (month) 6 (months) 1 (year)	yen	5,550 170,200 1,035,075 2,070,150	1,850 55,500 337,625 675,250
Detergent/ disinfectant fee	1 (day) 1 (month) 6 (months) 1 (year)	yen	400 12,000 73,000 146,000	207 6,210 37,778 75,555
Tool/equipment cost	All equipment fee	yen	55,000 [3 years of useful life]	300,000 [5 years of useful life]
	1 (month) 6 (months) 1 (year)	yen	1,500 9,000 18,000	5,000 30,000 60,000
Total cost	1 (month) 6 (months) 1 (year)	yen	183,700 1,117,075 2,23,4150	66,710 405,403 810,805

*Major cleaning once a month, **No monthly cleaning required

The cleaning work hours for 6 months are 559.5 hours for the conventional method (90 hours/month × 6 months = 547.5 hours, plus 2 hours of disinfection cleaning once a month, 2 hours × 6 months = 12 hours) and 182.5 hours for the FD method (30 hours/month × 6 months, plus 0 hours of disinfection cleaning once a month).

Since the labor cost was the average wage according to the "Salary Contract Schedule" 1,850 yen/hour, it cost 1,035,075 yen for the conventional method and 337,625 yen for the FD method for 6 months. The cost of detergent and disinfectant was 73,000 yen (12,000 yen per month × 6 months) with the conventional method; the FD method was 37,778 yen (6,210 yen per month × 6 months). The cost of tools and equipment for the conventional method (broom, dustpan, mop, bucket, squeegee) was 9,000 yen (the total tool cost was 55,000 yen, the hospital sets the depreciation period at 3 years, 1,500 yen per month × 6 months), but for the FD it was 30,000 yen (FD 300,000 yen, the depreciation period at 5 years, 5,000 yen per month × 6 months. The total cost for six months was 1,117,075 yen for the conventional method and 405,403 yen for the FD method, with a difference of about 712,000 yen. The FD purchase cost was thus offset in about 2.4 months. In addition, the cleaning work time for 6 months was 559.5 hours for the conventional method and 182.5 hours for the FD method, with a difference of 377 hours.

DISCUSSION

Switching kitchen floor cleaning from the conventional method to the FD method has resulted in a reduction in the cleaning work time and improved cost efficiency.

This research is a "retrospective observational research" based on one-year records. Retrospective research can sometimes lead to ambiguous results, however, we believe that the present case is based on time, wage, expenses, etc. management records from the "hospital meal work diary" and "Salary Contract Schedule," which provide objective and accurate data. There are no daily variations because employees are working according to the rules. Therefore, numerical values are understood as being exact and directly comparable.

The cost of hospital kitchen cleaning is not a small burden for many hospitals. However, we could not find any papers about differences in the time and cost by changing the method as in this research. It is hoped that this paper will serve in the future as a good example of research on daily activities.

When kitchen employees changed the tools, they used to clean floors with traditional brooms, mops, and squeegees to a floor cleaner with dust collection function, The cleaning work time for 6 months was 559.5 hours with the conventional method and 182.5 hours with the FD method, for a difference of 377 hours. This means that the working hours needed for one employee have been reduced by 33%, and if one person works 8 hours a day, the working hours have decreased by 47 days in 6 months.

kitchen employees were able to save two hours of work per day. Since the wage of the kitchen employees responsible for cleaning work is an average wage of 1,850 yen per hour, it means that about 697,000 yen was saved in half a year and about 1.39 million yen in a year.

For the kitchen employees responsible for cleaning work, this not only reduced time, but it may have also reduced the physical and mental burden. If you assume that cleaning work takes 1 hour to process and that it takes 3 hours for 4 processes, everyone will choose the former. This is because the physical and mental burden would be reduced by one-third. With the aging of the working population in Japan (4), most of the employees responsible for cleaning kitchen floors are middle-aged and elderly. For them, cleaning floors daily is a whole-body job and takes a long time because it involves four processes. In addition, the monthly cleaning, sanitizing, and brushing work requires strength when handling the large automatic washer for commercial use (used not only in the kitchen but throughout the hospital) because it is large and heavy. For this reason, even if hospital kitchens recruit employees, the lack of applicants is a chronic problem. The reduction of mental and physical burdens by introducing FD will help solve the important issue of securing employees.

The reduction in mental and physical effort improves the quality of each task, and the time saved helps [the cooking staff, which in turn leads to the provision of improved meals. Hospital kitchen operations are part of the medical service industry. Whether or not shortening working hours has a direct meaning for a service should be considered on a case-by-case basis. For example, in the case of the manufacturing industry, shortening working hours means increasing production efficiency. In service industries such as cooking and cleaning, shortening working hours not only reduces costs but also improves employee satisfaction at work. We believe that this will lead to the provision of better meals with a high degree of patient satisfaction.

Teamwork is important in kitchen work. If everyone isn’t working together with the same purpose, teamwork will be skewed. A kitchen operation that places a physical and emotional burden on only certain tasks is a source of frustration and stress for the employees who are responsible for them, leading to poor relationships and making it difficult for the team to have the same purpose. This will have the adverse effect of increasing the turnover rate. We believe that hospital dietitians must not only improve the quality of

meal service but also contribute to teamwork. To do so, they may have to overcome many difficulties. However, We believe that working diligently toward this goal will lead to the trust and respect of those around them and, as a result, enrich the dietitian's own life.

Regarding hygiene management, the FD can provide safer meals than the conventional once-a-month sterilization cleaning because the FD is always cleaned, sanitized, and brushed daily at the same time. At the hospital under research, mops were conventionally soaked in neutral detergent and wiped on the floor during daily cleaning. Even when neutral detergent with floor sanitizer was used, monthly sanitizing cleaning by the brushing function of a large commercial floor washer was still necessary.

Purchase of FD requires permission from the hospital because the price at the time of purchase is higher than equipment such as conventional brooms. To justify the purchase, it is necessary to demonstrate the benefits of buying FD. We believe this research will help explain the benefits of purchasing FD for many hospital dietitians.

While time and cost savings are important, we believe the most important factor is the motivation and physical and mental health of kitchen employees. Today, AI, robots are progressing at an accelerated pace worldwide. However, hospital meals are highly diverse, because of factors such as the specific disease, food type, presence or absence of allergies, preferences, and anorexia. No matter how much we consult with AI about the menu, it will only give me a notice and it will not work as a business. We believe that AI cannot handle the complexity and diversity of hospital meals or the kitchen work that is responsible for school lunches for the growth and health of children.

We believe that creating a kitchen system that motivates kitchen employees to "make delicious meals for patients," and that also takes care of their physical and mental well-being, will improve the quality of meals and increase the job satisfaction of the dietitians themselves.

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REFERENCES

1. Ministry of Health, Labour and Welfare. Sanitation Management Manual for Large-Scale Food Preparation Facilities. Accessed November 15, 2022.
2. Barbara M. Lund, Sarah J. O'Brien, Microbiological safety of food in hospitals and other healthcare settings, Journal of Hospital Infection 73, 109 – 120. 2007.
3. Ministry of Education, Culture, Sports, Science and Technology. School Food Hygiene Management Standards. Accessed November 15, 2022.
4. Ministry of Health, Labour and Welfare; The 2020 White Paper on Health, Labor and Welfare: Social Security and Work Styles in the Age of 2020. Accessed November 15, 2022.

Original

A Fully Automatic Rice Cooker Was Cost-Effective in A Hospital Kitchen

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ABSTRACT *Background and purpose.* Recent soaring prices and labor cost hikes have put pressure on hospital meal service operations, and cost-cutting measures are challenging. In this research, we assessed cost-effectiveness by changing from a conventional gas-type automatic rice cooker (conventional) to a fully automatic rice cooker (FARC). *Methods.* This research was conducted in the kitchen of a 457-bed acute care hospital in Tokyo (49 kitchen employees, providing approximately 1,000 meals per day). The data include retrospectively compiled data from a diary, comparative research of the conventional method (6 months from April to September 2022,) and the FARC method (6 months from October 2022 to March 2023) with a staff of 6 cooks. *Result.* The average time for rice-cooking operations for the two methods was 57.5 ±3.09 minutes for the conventional method and 11.3 ±1.53 minutes for the FARC method, with a difference of 46.2 minutes. If this difference is extrapolated on the assumption of preparing rice 3 times a day (breakfast, lunch, and dinner), the reduction in preparation time will be 2.3 hours a day, or 847.8 hours a year. This difference reduced rice-cooking labor by 106 days. The difference in total cost (yen) is 2,717,328. The FARC purchase price can thus be offset in about 2 years. *Conclusion.* This research showed how working time could be shortened, costs reduced and the initial cost would be offset in 2 years if kitchen equipment was changed from the conventional gas-powered automatic rice cooker to the FARC. The cook's workload could also be significantly reduced.
Keywords: a fully automatic rice cooker, cost-effectiveness, Japanese hospital kitchen

INTRODUCTION

The most important staple food in Japan is rice. According to the Diet and Lifestyle Survey - FY2022 by the Ministry of Agriculture, Forestry and Fisheries (1), rice was the most common staple food at 40%, followed by bread at 16%. In previous research, we reported that approximately 61.5% of patients over 65 years of age admitted to an acute care hospital who were prescribed a normal diet were malnourished (2). In such cases, the previous study has reported that soft rice or porridge is prescribed for medical safety reasons (3). Therefore, cooking rice is done three times a day, every day, as cooked rice, soft rice, and porridge are often prescribed as staple foods for hospital meals. In addition, it has been our experience that in acute hospitals with more than 300 beds, cooks have to come to work around 4:00 a.m. to prepare breakfast, contributing to cook shortages and labor cost hikes.

Placing heavy pots of rice on a wheeled cart requires considerable physical effort, especially for female cooks. Preparation for cooking rice can be done the day before, but for sanitary reasons, weighed, washed, and watered rice must be stored in the refrigerator if it is not cooked immediately after soaking. As for cooking rice for breakfast, the first thing the cook has to do when they arrive is to take all the pots of rice out of the refrigerator, put them in the rice cooker, and start the cooking process. This is one of the reasons why the cook has to come so early, and one of the factors responsible for cook shortages and labor cost hikes.

This research aims to clarify how time for rice-cooking operations can be shortened and costs reduced if the kitchen equipment is changed from a conventional gas-powered automatic rice cooker (conventional) to a fully automatic rice cooker (FARC), taking advantage of the hospital's move to a new building.

MATERIALS AND METHODS

This research was conducted in the kitchen of a 457-bed acute care hospital in Tokyo (49 kitchen employees, providing approximately 1,000 meals per day). We compared the average time for rice-cooking operations and labor costs required for cooking rice with the two types of rice cookers (Fig. 1) based on the working hours recorded in the "hospital meal work diary". Both periods were 6 months (the conventional method; April to

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September 2022, the FARC method; October 2022 to March 2023). Six cooks were involved in the rice cooking. For rice cooking, two conventional automatic rice cookers (6 pots) and one fully automatic three-dimensional rice cooker (6 pots) were used. About 10 kg of rice was used for each meal, and three types of rice were cooked: cooked rice, soft rice, and porridge. The pots weighed 4.0 kg/ per pot and with rice and water, it becomes 12-14 kg. Five pots were needed to cook one batch of rice.

In the conventional method, apart from the automatic rice cooking, weighing, washing the rice, adjusting the amount of water, and moving the pot were all done manually. With the FARC method, simply setting an empty kettle was all that was required, and weighing, washing the rice, adjusting the amount of water, moving the pot, and cooking rice were all done automatically. Time for rice-cooking operations was calculated from the daily "hospital meal work diary". Labor costs were calculated from the “salary contract schedule”. Accommodation costs were calculated from “rental contracts”. Equipment costs were calculated from the equipment manufacturer's invoice.

Ethics: Subjects were informed of the purpose of the survey, their right not to participate in the survey, considerations for personal information protection, and data handling, and consent was obtained. For the implementation of this research, a research protocol was prepared and approved by the Research Ethics Committee of the hospital.

Fig 1. Conventional gas-type automatic rice cooker (left), and new FARC (right).

Fig 2. Moving the pots of a conventional type of rice cooker

Fig 3. Photographs show a) FARC, b) feeding rice into the silo, c) inside of the rice and water supplier, and d) putting in/taking out a pot.

RESULTS

The average time for rice-cooking operation was 57.5 ±3.09 minutes for the conventional method and 11.3 ±1.53 minutes for the FARC method, with a difference of 46.2 minutes. If this difference is calculated for preparing rice 3 times a day (breakfast, lunch, and dinner), the reduction in preparation time will be 2.3 hours a day, or 847.8 hours per year. This difference can be said to have reduced rice cooking labor by 80%. Assuming that the cook works 8 hours a day, total labor will be reduced by 106 days. When converted to labor cost, the cost of the conventional method is 3,662,000 yen per year (labor cost plus accommodation cost) and that of the FARC method is 416,100 yen per year (no accommodation), so the difference is about 3,245,900 yen per year. The difference in total cost (yen) was 3,947,714 – 1,230,386 = 2,717,328. The FARC purchase price/difference of total cost = 5,700,000 / 2,717,328 = 2.1. Thus the FARC purchase price can be offset in about 2 years.

In addition, the workload of cooks can be significantly reduced. In the conventional process, apart from the automatic rice cooking, weighing, washing the rice, adjusting the amount of water, and moving the pot were all done manually. The cooks had to leave for work at 4:00 a.m. to prepare breakfast. At the hospitals under research, for such cooks, accommodation was prepared. With the FARC method, once the empty pot was set the day before and the reservation program for the rice cooking operation was set, weighing, washing the rice, adjusting the amount of water, moving the pot, and cooking the rice were all done automatically. So in the case of the FARC method, cooks could come at 7:00 a.m. and start cooking rice. No accommodations were needed.

Table 1. Work time and various costs at the hospital kitchen

			The Conventional method	The FARC method
Time for rice-cooking operation	1 (round)	hours	57.5±3.09 (minutes)	11.3±1.53 (minutes)
	1 (day)		2.88	0.57
	1 (month)		86.25	16.95
	1 (year)		1,051.20	203.40
Labor cost	1 (day)	yen	5,760	1,140
	1 (month)		172,500	34,200
	1 (year)		2,102,000	416,100
Accommodation cost	1 (month)	yen	130,000	Unnecessary
	1 (year)		1,560,000	
Equipment cost	Cost*	yen	2,000,000	5,700,000
	1 (month)		23,810	67,857
	1 (year)		285,714	814,286
Total cost	1 (month)	yen	326,310	102,057
	1 (year)		3,947,714	1,230,386

*Cost depreciation: 7 years

DISCUSSION

This research revealed that (1) equipment costs were high, but time for rice-cooking operations and labor costs were saved; (2) the cooks' relationships with each other improved as their mental and physical workload was reduced; (3) the cooks themselves began to pursue meal quality by making use of the saved working hours.

(1) Equipment costs were high, but time for rice-cooking operations and labor costs were saved.

The FARC is expensive, so it is usually difficult to obtain approval from hospital management departments. The price of the conventional is 2 million yen, The FARC is 5.7 million yen. Before applying, we conducted a thorough cost comparison between the conventional method and the FARC method. The cost comparisons shown in Table 1 are accurate from accounting reports. Labor costs were calculated from the “salary contract schedule”. Accommodation costs were calculated from “rental contracts”. Equipment costs were calculated from the equipment manufacturer's invoice. Time for rice-cooking operations was calculated from the daily "hospital meal work diary". During periodic government audits, the "hospital meal work diary" records the start and end times of work each day and is checked to see if it is signed by a person who confirms it. If this is not done, the government will not be able to pay medical insurance (meal expenses) to the hospital, so these numbers are highly reliable. The start time and end time of the work will be determined according to the "work process chart". The "work process chart" is a table that lists all the work tasks in the kitchen. If work is not started and completed according to the "work process chart"," meals cannot be provided according to the time set by the government (7:30 a.m., 12:00 noon, and 6:00 p.m.). The above results revealed that the FARC purchase price can be offset in 2 years due to lower overhead costs. However, what is not included in this calculation is that installing the new FARC would require renovations to the kitchen, which would further increase costs. In the case of this hospital, it can be said that it was fortunate that the system was introduced at a time when the kitchen was being rebuilt.

On the other hand, when it comes to capital investment in acute care hospitals, high-priced medical equipment is prioritized, and kitchen equipment that is not directly related to treatment is likely to be subject to budget cuts. So, We calculated the costs of the unprecedented implementation of expensive cooking equipment in the hospital kitchen and determined whether the initial costs could be offset in a short period and whether labor could be further reduced. I explained this to the hospital management department many times and obtained their approval. It took a lot of effort, time, and effort. This research was intended to confirm whether that explanation was indeed correct. Fortunately, we were able to confirm our expectations in this research.

In the future, when introducing a FARC, it is desirable to take advantage of the renovation period. We would be happy if our results could serve as a reference for those who are considering installing a FARC.

(2) The cooks' relationships with each other improved as their mental and physical workload was reduced.

Cooking rice seems like a simple task at first glance, as it is a daily routine in every household. However, cooking rice in hospitals is not so easy, especially when cooking rice for breakfast. The rice is prepared, washed, and added water the day before, stored in the refrigerator, and then started cooking at 4:00 a.m. the next day. Each pot containing rice and water weighs 12 to 14 kg, and five pots must be moved. In particular, removing the rice cooker from the refrigerator and setting it in the rice cooker is hard work, and cannot be done by workers of short stature or middle-aged or elderly female cooks with limited strength. The switch to start cooking must be made by the cooks, sometimes the dietitians in charge of food preparation. To arrive at the hospital at 4:00 a.m., one must leave home at 2:00 or 3:00 a.m. That is when public transportation such as trains and buses is not in operation. There are times when there are typhoons and times when there is heavy snow. For this purpose, the hospital needs to prepare accommodation, and the cost for this will exceed 1.5 million yen per year. In addition, the physical and mental stress caused by early morning work and heavy workloads makes it impossible to protect their healthy minds and bodies, and it is becoming increasingly difficult to secure employment for dietitians and cooks. After introducing a FARC, the breakfast cooks told us, "The rice-cooking process is now completely automated, so I can come in at 7:00 a.m. and start the cooking process. I don't want to leave this kitchen because, in other hospital kitchens, the rice cooking process starts at 4:00 a.m." "Since I started working at 7:00 a.m., I have been able to enjoy about two hours to myself after I get home. When I used to work at 4:00 a.m., I was so tired and sleepy when I got home that I just went to bed immediately. I didn't know what on earth I was working for." "When I was on duty, which required me to be at work at 4:00 a.m., it was difficult to get other cooks to suddenly change their duty. Now I am free from the pressure of what to do if I suddenly get sick or oversleep." "It was very scary and stressful because every time I asked another cook to move heavy pots of rice, they would give me a disapproving look or ignore me. Now I don't have to ask because I don't have to carry heavy pots of rice. Thanks to this, we have a good relationship, always smiling and cooperating." We received such positive feedback.

A challenge in hospital meal service operations is the daily conflicts between kitchen employees. Most of the causes are emotional stress such as fatigue, which is also the biggest reason for leaving the job. The kitchen

employee who causes the conflict may be older than the dietitian, and the dietitian's mediation and guidance may lead to resentment. If conflicts are left unresolved, communication errors can lead to human error, which can lead to the dietitian bearing the brunt of the responsibility of leaving the company. In this research, it was not possible to prove the extent to which stress was reduced, based on a survey of kitchen employee satisfaction. However, the cooks have been happily working since 7:00 a.m., humming to each other, and smiling, talking, and helping each other, regardless of whether they are seniors or juniors, including the dietitians. With the introduction of the FARC, the cooks were relieved of their mental and physical pressure and experienced the experience of engaging in cooking tasks with a smile, helping each other, and being kind to patients, those around them, and the dietitians.

(3) The cooks began to pursue meal quality by using the saved working hours.

Kitchen employees tend to be passive as they faithfully work according to the "work process chart" and detailed hygiene rules. We therefore hold regular meetings to improve the menu and quality of meals. As a result, the progress of improvement is slow, and during this time patients are provided with unimproved meals. With the introduction of the FARC, the cooks, who now have more time to work, are encouraged to discuss and reflect on their own with the dietitians, accept the dietitians' opinions honestly, and improve the quality of their meals promptly.

This research did not show the results of the preference survey, so it was not possible to prove the extent to which the quality of meals had improved. However, we feel that the quality of the meals has improved through the feedback from the patients and the opinions of the physicians and the dietitians based on the food inspection. Of course, we have received numerous comments from the patients, the physicians, and the dietitians that rice cooked in the FARC tastes great. For hospital meals, Three types of rice are cooked each time: cooked rice, soft rice, and whole porridge. The FARC does not require any human intervention from preparing the rice to cooking it. The precision equipment built into the FARC does everything, so the measurement of water depending is particularly accurate. It is assumed that the optimum amount of moisture each time results in delicious rice. In this way, being able to cook the same quality and delicious food every time helps to relieve the stress on the mind and body of the cooks.

In Japan, given the social backdrop of a declining workforce, an aging population, and soaring prices, there is a tendency to focus on cost reduction, work automation, and AI. Although they are expensive, cooking equipment can increase production. However, even with high salaries offered, the number of hospital cooks continues to decline. I think that hospital dietitians should not make the mistake of prioritizing what is important and in what order when managing hospital food service operations.

Medical treatment for injuries, illnesses, etc. is called “treatment”. It includes placing the palm or fingertips of the hand on the affected area to check the condition, which is a universal medical practice. I think it's the same with hospital meals. Ultimately, the hospital meals are delicately prepared using the palms and fingertips of a person and then served to the patient. Isn't it up to the hospital dietitian to bring life into the hands of the cooks? We think so.

In conclusion, this research showed how working time could be shortened and costs reduced, the cook's workload could also be significantly reduced if kitchen equipment was changed from the conventional gas-powered automatic rice cooker to the FARC, taking advantage of the hospital's move to a new building.

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REFERENCES

1. Ministry of Agriculture ; Forestry and Fisheries' "Survey on Dietary Habits FY2022" 188-191. https://www.maff.go.jp/j/zyukyu/survey/attach/pdf/lifestyle-2.pdf (accessed May 25, 2023)
2. Hirose K, Tran PT, Yamamoto S: Decreasing Salt in Hospital Meals Reduced Energy Intake in Elderly Japanese Inpatients. J Nutr Sci and Vitaminol, 67 : 105-110, 2021.
3. Ueshima J, Shimizu A, Maeda K, et al: Nutritional Management in Adult Patients With Dysphagia: Position Paper From Japanese Working Group on Integrated Nutrition for Dysphagic People. J Am Med Dir Assoc. 23(10): 1676-1682, 2022.

Original

School Lunches Have the Potential to Improve Food Awareness not only for Children but also for Their Families

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ABSTRACT *Background and purpose.* With a view to reaching out to parents through school lunch, we conducted a survey to clarify whether first-graders experiencing school lunch for the first time and their families improve their awareness and attitudes toward eating and food through the provision of school lunches. *Methods.* The subjects of the survey were the parents of 822 children who entered 11 elementary schools in Matsumoto City, Nagano Prefecture in April 2021. The survey was conducted in April before the start of eating school lunches and in June, July, and October after the start of school lunches. Responses were collected on paper or online (Microsoft Forms). *Results.* Even in October, when the novelty had worn off after six months of eating school lunches, 69.1% of the children still talked about school lunches at home. In the October survey, 47.3% of children increased awareness in eating and food, and 52.8% of children increased talking about meals and food. In the October survey, 53.4% of families' awareness in eating and food increased since stared eating school lunches. 56.5% of families' talking about eating and food increased. In families where children talk to their families about school lunches, there was a significant increase in family awareness in eating and food, and talking about meals and food compared to families where children did not (both $p<0.001$). *Conclusion.* We were able to clarify that eating school lunches causes changes in children's attitudes toward food and behavioral changes such as talking about food, and that this also changes the attitudes of families.
Keywords: school lunch, 1st grade elementary school student, effect on family, food awareness, Japan

INTRODUCTION

School lunch in Japan is not only to contribute to proper nutritional intake for children and students, but also to play an important role in helping children cultivate a correct understanding and the ability to make appropriate decisions regarding food, according to the School Lunch Law (1). In FY2021, the complete school lunch coverage rate in elementary schools was 98.7%, and 89.1% in junior high schools, with a very large number of children eating school lunch during their compulsory education period (2). In the third section on "Matters Concerning Comprehensive Promotion Including Activities to Promote *Shokuiku* [meaning food and nutrition education]" in the fourth basic plan for the promotion of *Shokuiku* (3), it is also mentioned that the government endeavor to educate guardians about the importance of shokuiku and knowledge of proper nutritional management, etc. in schools. There have been studied on nutritional aspects of school lunch (4,5) and nutrition education using school lunch for children (6). These studies include those that examined the educational effects of school lunch in relation to learning attitudes and motivation, and those that examined the role of school lunch in the formation of eating behavior during childhood. Murai et al. (7) reported that in fifth- and sixth-grade students, those who were more interested in school lunch had higher attitudes and motivation toward learning. Asahina et al. (8) reported that school lunches play a role in changing eating behavior in 6th graders through eating the same meal with their peers. However, few studies have examined the effects of school lunch provision on the healthy dietary practices of children and families, and the educational value of school lunch from this perspective is not clear.

Globally, studies have been conducted on child-to-family or child-to-parent approaches in health-related education. Daudet IT et al. (9) conducted a systematic review and meta-analysis of child-to-parent communication of stroke information and reported that this approach was effective in educating families. Feng JH et al. (10) reported that an app-based educational program delivered through elementary schools using a child-to-parent approach was effective in lowering salt intake and systolic blood pressure in adults.

Therefore, in this study, we conducted a survey to verify whether the provision of school lunches improves children's own interest and awareness of food, and whether it improves the awareness and attitude of families towards healthy eating habits through children. In April (at the beginning of the school year), June (two months after the start of school

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lunch), July (three months after the start of school lunch), and October (six months after the start of school lunch), we conducted a questionnaire survey on the attitudes and awareness of first graders and their families toward eating. This paper focuses on the changes in the families in October, six months after the start of school lunches.

METHODS

1. Subjects and survey methods

The subjects were the parents of 822 children who enrolled in April 2021 in 11 elementary schools served by the Western School Meal Service Center in Matsumoto City, Nagano Prefecture.

Questionnaire surveys were conducted four times in April, June, July, and October of 2021. A description of the survey months is given in the introduction. The focus of this paper was to examine whether the provision of school lunches improves family's awareness and attitudes toward eating, using the results of the survey conducted primarily in April at the time of school entrance and in October six months later.

The questionnaires were distributed to each elementary school by the school lunch centers, and then distributed to the children by their classroom teachers. Responses were made either by survey sheet or online (Microsoft Forms). For survey sheet responses, the sheets were submitted by the children to their classroom teachers and collected by the food service center for each class.

2. Contents of the survey

Responses to the questionnaire were requested from those who were doing the most meal preparation at home. The April questionnaire asked about the respondents and their families, including their demographics, and their status related to eating together at breakfast and dinner. We also asked about the frequency of talking about eating and food in the family, with four options of Likert scale ranging from "very often" to "not at all". To determine whether the provision of school lunches was a new experience for the family, we also asked whether the subject children had older siblings. Additionally, to determine the impact of the preschool lunch experience prior to entering elementary school, we also asked whether the children had ever been offered lunches at a preschool or other school.

In the surveys conducted in June, July, and October, we asked respondents about changes in their children as seen by parents and in families' changes, since their children started eating school lunch. First, we asked how often children talk about school lunches at home. We asked if children talk about school lunch, with five points of Likert scale "fairly applicable", "slightly applicable", "neither", "slightly different", and "fairly different". Similarly, we asked about changes in children as seen by parents about four items, i.e., "increased awareness in eating and food", "increased talking about meals and food themselves", "decreased in food likes and dislikes", and "changed to enjoy eating more" using a five points Likert scale. These questions are based on the Ministry of Education, Culture, Sports, Science and Technology's "Food Guidance Guide (Second Revised Edition)" (11), which indicates the goals, teaching methods, and evaluation of instruction from the perspective of promoting *Shokuiku* in schools. In this guide, examples of goals for teaching lower grade elementary school students (1st and 2nd graders) are "to be able to enjoy eating with interest and concern for food" and "to be able to think about the importance of eating without liking or disliking food". We also asked responders about changes in their families as a result of their children eating school lunch, i.e., "families' awareness in eating and food" and "families' talking about eating and food, with a five points Likert scale "increased considerably", "slightly increased", "neither", "slightly decreased", and "decreased considerably".

In addition, we asked whether parents had read the monthly school lunch menus and the school lunch newsletters which contain information on school lunches and nutrition. We asked these items with four options: "I read with a strong interest", "I read with a little interest", "I am not interested but I read", and "I rarely read". The school lunch newsletters distributed between April and October contained information on the ingredients used in school lunches, nutritional balance, and milk (Table 1).

3. Method and Analysis

Families included in the analysis were those with April and October survey forms and matched respondents. The 5-point Likert scale used for questions such as changes in children and families was graded in order from 5 points for a positive response to 1 point for a negative response. When asked whether they read the monthly school lunch menus and school lunch newsletters, the points were assigned in order from 4 points for "I read with a strong interest" to 1 point for "I rarely read". Mann-Whitney's U test was used with Likert scale scores for comparisons between the two groups, including the presence or absence of lunch services at preschool before entering elementary school and presence or absence of older siblings. To examine the relationship between changes in children and changes in families, we divided the children's changes into two groups: a positive response (fairly/slightly applicable) and no change group, and a negative response (neither and fairly/slightly different) group. Similarly, to examine the relationship between parental interest in monthly school lunch menus and newsletters and families' changes, respondents were divided into interested (strong/ a little interest) and no

interested groups. The Mann-Whitney U test was then performed using the Likert scale scores of the responses to the questions. The effect size r was obtained from the test statistic of the Mann-Whitney U test as $r=Z/\sqrt{N}$. The effect sizes were judged to be 0.10 (small), 0.30 (medium), and 0.50 (large) (12). IBM SPSS Statistics 27 was used for the analysis, and $p<0.05$ was considered significant.

4. Ethical Considerations

Written explanation of free participation and anonymization process was provided in a letter accompanying the questionnaire, and consent was assumed to have been obtained upon submission of the questionnaire. This study was conducted with the approval of the Matsumoto University Ethics Committee (Approval No. 114).

Table 1 Contents of the school lunch newsletters

April	Ingredients for school lunch (rice, bread wheat, soup stock, milk)
	Preparation of clothing for serving school lunch
	How to wash hands
	Setting of tableware
	Recommended recipe (Japanese radish and small fish salad)
May	Sample of Nutritionally Balanced Meals "School Lunch" Three Color Food Groups
	Explanation about the work of the school lunch center
	Recommended recipe (Stamina-boosting, deep-fried bonito)
June	Encouraging Eating Together
	Notice Regarding Panel Exhibit on Nutrition Education
July	Information about milk
	Explanation about the work of the school lunch center
	Notice about the Miso Soup Contest with a variety of ingredients
	Recommended recipe (Wakame seaweed salad like a starry sky)
August	Chrono-nutrition
	Efforts of school lunch centers (visiting schools, guidance on breakfast)
	Recommended recipes (hijiki seaweed salad, broccoli salad)
September	The Shinshu ACE Project *
	Impressions after eating special school lunch
	Recommended recipe (natto salad)
October	Nutritionally balanced meal (staple, main and side dishes)
	Ingredients used in school lunch (story about local apple farmer's cooperation)

* The Shinsyu ACE Project is the Nagano Prefecture's Health Promotion Plan

RESULTS

1. Respondents' demographics and the status of the target families at the time of enrollment

A total of 401 matched respondents (valid response rate: 48.8%) to questionnaires submitted in April and October were included in the analysis.

Respondents included 8 fathers (2.0% of the valid responses, the same below), 389 mothers (97.0%), and 4 grandmothers (1.0%) of the children. There were 178 children (44.7%) with older siblings. In April, 88 families (22.3%) indicated that their child often eats breakfast by children only and 11 families (2.8%) indicated that their child often eats alone. However, 389 families (98.7%) reported that their child often eats dinner by the whole family together or with adults. Regarding talking about eating and food, responses of 64 families (16.2%) were "very often" and those of 210 families (53.3%) were "occasionally". A total of 306 children (76.9%) had experienced lunch service prior to entering elementary school (Table 2).

2. Changes in children and families since their children started eating school lunch

We asked how often children talk about school lunches at home with five points of Likert scale. Parents who answered fairly/ slightly applicable were 266 out of 360 valid responses (73.9%) in June, 230 out of 329 (69.9%) in July, and 277 out of 401 (69.1%)

in October. Almost 70% of the children talked about school lunches with their families at home. No significant change was seen in the six months from the start of school lunches.

We asked about changes in children as seen by parents with a five points Likert scale. In October, children who increased interest in eating and food were 35 (8.8%) as "fairly applicable" and were 154 (38.5%) as "slightly applicable". Children who increased talking about meals and food themselves were 41 (10.3%) as "fairly applicable" and were 170 (42.5%) as "slightly applicable". Children who decreased food likes and dislikes were 32 (8.0%) as "fairly applicable" and were 114 (28.5%) as "slightly applicable". Children who changed to enjoy eating more were 43 (10.7%) as "fairly applicable" and were 136 (33.9%) as "slightly applicable" (Table 3). Although there were differences depending on the items, it was found that parents felt that their children had changed regarding awareness and attitude toward food after they started eating school lunches.

We also asked about changes in their families since their children started eating school lunch with a five points Likert scale. In October, 39 (9.8%) families increased their awareness in eating and food considerably and 174 (43.6%) families increased slightly. As families' change in talking about eating and food in the family, 43 (10.8%) families responded, "increased considerably" and 182 (45.7%) families responded, "increased slightly" (table 3).

There was no significant association between the presence or absence of having received lunch service at a preschool before entering elementary school and the frequency of talking about school lunches at home as of October (p=0.675). There was also no significant association between the presence or absence of having received lunch service at a preschool and children's change due to eating school lunch (increased awareness in eating and food p=0.243, increased talking about meals and food themselves p=0.551, decreased food likes and dislikes p=0.549, changed to enjoy eating more p=0.193) (Table 4).

3. Families' changes in October, six months after the child started eating school lunch

There was no significant relationship between the presence or absence of older siblings among the surveyed children and the families' change in awareness in eating and food (p=0.063). However, families with older siblings were significantly increased talking about eating and food more than families without siblings (p=0.016) (Table 5).

Table 2 Respondent demographics and the status of the target families at the time of the child's enrollment

			The number of people	Percentage of total number of people*
Respondent's relationship to enrolled child		father	8	2.0
		mother	389	97.0
		grandmother	4	1.0
Siblings of enrolled children	older sibling	presence	178	44.7
		absence	220	55.3
	younger sibling	presence	180	45.2
		absence	218	54.8
Status related to eating together at breakfast		child often eats by the whole family together	80	20.3
		child often eats with adults, but not with the whole family	215	54.6
		child often eats by children only	88	22.3
		child often eats alone	11	2.8
		does not eat	0	0.0
Status related to eating together at dinner		child often eats by the whole family together	171	43.4
		child often eats with adults, but not with the whole family	218	55.3
		child often eats by children only	4	1.0
		child often eats alone	0	0.0
		does not eat	1	0.3
Do families talk about eating and food at home?		very often	64	16.2
		occasionally	210	53.3
		not very often	108	27.4
		not at all	12	3.0
Lunch for children before admission of elementary school		lunch service **	306	76.9
		others	92	23.1

n=401

* Percentage of valid responses for each question item

** Children were receiving food service at preschool.

Table 3 Changes in children and families since their children started eating school lunches in October

the number of people (%)

Changes in the children as seen by the parents since their children started eating school lunches in October						
	fairly applicable	slightly applicable	neither	slightly different	fairly different	total
Talked about school lunches at home	83(20.7)	194(48.4)	83(20.7)	28(7.0)	13(3.2)	401(100.0)
Increased awareness in eating and food	35(8.8)	154(38.5)	204(51.0)	7(1.8)	0(0.0)	400(100.0)
Increased talking about meals and food themselves	41(10.3)	170(42.5)	177(44.3)	10(2.5)	2(0.5)	400(100.0)
Decreased food likes and dislikes	32(8.0)	114(28.5)	239(59.8)	13(3.3)	2(0.5)	400(100.0)
Changed to enjoy eating more	43(10.7)	136(33.9)	214(53.4)	8(2.0)	0(0.0)	401(100.0)
Changes in the families since their children started eating school lunches in October						
	increased considerably	slightly increased	neither	slightly decreased	decreased considerably	total
Families' awareness in eating and food	39(9.8)	174(43.6)	184(46.1)	2(0.5)	0(0.0)	399(100.0)
Talking about meals and food in family	43(10.8)	182(45.7)	171(43.0)	2(0.5)	0(0.0)	398(100.0)

Table 4 Association between changes in children as seen by parents since their children started eating school lunches and experience of lunch service before entering elementary school

Changes in children as seen by parents since their children started eating school lunches in October	Experience of lunch service before entering elementary school				p-value*	effect size**
	presence (n=306)		absence (n=92)			
	median (minimum - maximum)	mean rank	median (minimum - maximum)	mean rank		
Talked about school lunches at home	4 (1-5)	198.26	4 (1-5)	203.61	0.675	0.02
Increased awareness in eating and food	3 (2-5)	195.68	4 (3-5)	210.00	0.243	0.06
Increased talking about meals and food themselves	4 (1-5)	200.72	3.5(1-5)	193.29	0.551	0.03
Decreased food likes and dislikes	3 (1-5)	197.34	3 (2-5)	204.49	0.549	0.03
Changed to enjoy eating more	3 (2-5)	195.80	4 (2-5)	211.80	0.193	0.07

* Mann-Whitney's U test

The 5-point Likert scale used for each question was graded in order from 5 points for a positive response to 1 point for a negative response.

**The effect size r was obtained from the test statistic of the Mann-Whitney U test as r=Z/sqr(N).

The effect sizes were judged to be 0.10 (small), 0.30 (medium), and 0.50 (large)

Table 5 Relationship between changes in children and changes in families since their children started eating school lunch

		Families' awareness in eating and food					Families' talking about eating and food			
		median (minimum - maximum)	mean rank	*p-value* ‡	effect size§		median (minimum - maximum)	mean rank	*p-value* ‡	effect size§
Presence or absence of older siblings from the perspective of the subject child										
Older siblings	presence (n=177)	4(2-5)	209.25	0.063	0.09	presence (n=177)	4(2-5)	211.6	0.016	0.12
	absence (n=219)	3(2-5)	189.81			absence (n=218)	4(3-4)	186.96		
Changes in children as seen by parents since their children started eating school lunches*										
Talked about school lunches at home	positive (n=276)	4(2-5)	226.62	<0.001	0.38	positive (n=275)	4(3-5)	235.06	<0.001	0.51
	no change and negative (n=123)	3(2-5)	140.28			no change and negative (n=123)	3(2-5)	119.99		
Increased awareness in eating and food	positive (n=188)	4(3-5)	258.71	<0.001	0.54	positive (n=187)	4(3-5)	258.39	<0.001	0.54
	no change and negative (n=120)	3(2-5)	146.49			no change and negative (n=210)	3(2-5)	146.12		
Increased talking about meals and food themselves	positive (n=209)	4(3-5)	247.12	<0.001	0.48	positive (n=208)	4(3-5)	256.37	<0.001	0.58
	no change and negative (n=189)	3(2-5)	146.84			no change and negative (n=189)	3(2-5)	135.87		
Decreased food likes and dislikes	positive (n=145)	4(3-5)	263.26	<0.001	0.46	positive (n=144)	4(3-5)	251.49	<0.001	0.38
	no change and negative (n=253)	3(2-5)	162.96			no change and negative (n=253)	3(2-5)	169.12		
Changed to enjoy eating more	positive (n=177)	4(3-5)	250.88	<0.001	0.44	positive (n=176)	4(3-5)	248.04	<0.001	0.41
	no change and negative (n=222)	3(2-5)	159.43			no change and negative (n=222)	3(2-5)	161.02		
Parents' interest in school lunch menus and school lunch newsletters †										
school lunch menus	interested (n=302)	4(2-5)	208.17	0.006	0.14	interested (n=301)	4(2-5)	208.19	0.003	0.15
	no interested (n=97)	3(3-5)	174.55			no interested (n=97)	3(3-5)	172.54		
school lunch newsletters	interested (n=285)	4(2-5)	210.44	0.002	0.16	interested (n=284)	4(2-5)	211.88	<0.001	0.19
	no interested (n=114)	3(3-5)	173.90			no interested (n=114)	3(3-5)	168.66		

* The respondents of changes in children were divided into a positive response group (fairly/slightly applicable) and no change and a negative response group (neither and fairly/slightly different).

† The respondents were divided into an interested group (strong/ a little interest) and no interested group.

‡ Mann-Whitney's U test

The 5-point Likert scale used for each question was graded in order from 5 points for a positive response to 1 point for a negative response.

§ The effect size r was obtained from the test statistic of the Mann-Whitney U test as r=Z/sqr(N).

The effect sizes were judged to be 0.10 (small), 0.30 (medium), and 0.50 (large)

In the positive group in which children talk about school lunches at home, both family's interest in eating and food and talking about eating and food increased significantly compared to the negative group (both $p<0.001$) (Table 5). A similar relationship was found among the positive groups of children's changes as a result of eating school lunch as seen by parents: "Increased awareness in eating and food", "Talking about meals and food themselves", "decreased food likes and dislikes" and "Changed to enjoy eating more" (all $p<0.001$) (table 5).

62 parents (15.5%) read monthly school lunch menus with strong interest, 240 (59.9%) read with a little interest, 52 (13.0%) were not interested but read, and 45 (11.2%) rarely read. Regarding school lunch newsletters, 39 parents (9.7%) read with strong interest, 246 (61.3%) read with a little interest, 53 (13.2%) were not interested but read, and 61 (15.2%) rarely read. The group that was interested in the school lunch menus showed significantly greater awareness in eating and food, and talking about meals and food than the group that was not interested ($p=0.006$ and $p=0.003$, respectively). Similar results were found for "school lunch newsletter" ($p=0.002$ for awareness and $p<0.001$ for talking) (table5).

The effect size for the comparison of the presence or absence of interest in school lunch menus and school lunch newsletters were small, ranging from 0.14 to 0.19. On the other hand, the effect sizes for the comparison of positive and negative groups of children's changes as seen by parents were relatively large, ranging from 0.38 to 0.58 (Table 5).

DISCUSSION

1. Changes in children since started eating school lunch

In the provision of school lunches, the Ministry of Education, Culture, Sports, Science and Technology's "Food Guidance Guide (Second Revised Edition)" is referred to as the policy. In this guide, examples of goals for teaching lower grade elementary school students (1st and 2nd graders) are "to be able to enjoy eating with interest and concern for food" and "to be able to think about the importance of eating without liking or disliking food" (11). With regard to children who had experienced school lunch for six months, 47% of parents perceived that their children's interest in food had increased. In addition, 53% of parents perceived that their children had been more likely to talk about food themselves, and 45% of parents perceived that their children changed to enjoy eating more. We speculate that these results are the educational effects of school lunches. Regarding the decrease in likes and dislikes, Furushima et al. (13), in their one-year observation of first-grade school lunches, reported that the number of foods that even children with dislikes increased due to school lunch rules and encouragement from friends and teachers, and that this experience increased their self-confidence and motivation to eat. Similarity, in the results of this study, school lunch, which is eaten in an environment different from that of the home, is assumed to have increased the children's self-efficacy through the experience of eating food that they had never eaten before or disliked.

It is assumed that school lunches are a subject of great interest to children as soon as they start eating school lunches, and that they have many opportunities to talk about school lunches to their families after they return home. However, even in October, six months after the start of eating school lunches, nearly 70% of the children were talking about school lunches at home. This situation was not significantly different from June, two months after the start of eating school lunches. Preschools also have guidelines on *Shokuiku* (14), and lunch services are provided based on these guidelines. However, the presence or absence of lunch service experience at a preschool, was not related to the change since their children started eating school lunch. These findings indicate that many children continue to have an interest in school lunch after entering elementary school. In addition, we found that regardless of the children's experience with lunch service prior to entering school, school lunch provided an opportunity for them to learn something new about eating and food.

Children who have just entered elementary school are in a period of rapid growth, both physically and mentally, and it is natural that their attitudes and awareness will change as they grow. However, in this survey we asked parents about changes in their children's attitudes and awareness in eating and food after they started eating school lunch. Therefore, we considered that even if changes due to growth are subtracted, the effects of school lunch on children's attitudes and awareness in eating and food were sufficient.

2. Changes in families since their children started eating school lunch

More than half of the parents perceive that their family's awareness in eating and food has increased since their children started eating school lunch, and that they have more opportunities to talk about eating and food with their families. In the group that read the monthly school lunch menus and school lunch newsletters with interest, more families showed an increase in their awareness in eating and food, and talking about eating and food in family than in the group that did not. However, rather than providing such information, the presence or absence of changes in children since eating school lunches as seen parents had a larger effect size on changes in families. In addition, families' awareness in eating and food increased regardless the subject children had older siblings. Based on these results, we speculate that even

if school lunches were not the first experience for the families, it may have been stimulating for the families to have their first-grade children eat school lunch for the first time. On the other hand, families with older siblings also showed a significant increase in talking about eating and food compared to families without older siblings. Although not shown in the results, there was also a description in the free description that the siblings often talked about school lunches. It was speculated that in families with older siblings, school lunches became a common experience among siblings, and food-related topics were likely to become a topic of conversation at home. Based on the findings obtained in this study, we consider that more appropriate information should be provided by nutrition teachers and more appropriate educational materials on school lunch should be developed in the future.

Worldwide, studies have been conducted on the child-to-family or child-to-parent approach to health-related education. Daudet IT et al. (9) and Feng JH et al. (10) reported child-to-family approaches that have been implemented for education about stroke, salt intake and systolic blood pressure. School lunches in Japan, unlike these approaches, are not a simple issue-focused approach. However, this study found that eating school lunch improved children's attitudes toward food and changed their behaviors, such as talking more about food, and that these factors also changed the attitudes of their families. It was suggested that it is possible to improve more appropriate ways of eating for a wide range of families through the child-to-family method through school lunches in Japan. It has been reported that parents of elementary school students in the 20s to 40s generation are less motivated than other generations to improve their own dietary habits (15). We believe that school lunch management that is also conscious of reaching out to parents help improve the eating habits of this generation of parents.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

REFERENCES

1. Ministry of Education. School Lunch Program Act. https://www.pref.nagasaki.jp/shared/uploads/2013/07/1374575257.pdf (Access date: January 23, 2023) (in Japanese)
2. Ministry of Education. The survey of school lunch implementation status. https://www.mext.go.jp/content/20230125-mxt-kenshoku-100012603-1.pdf (Access date: August 19, 2023) (in Japanese)
3. Ministry of Agriculture, Forestry and Fisheries. The Fourth Basic Plan for Promotion of Shokuiku. https://www.maff.go.jp/j/syokuiku/attach/pdf/kannrennhou-30.pdf (Access date: January 23, 2023)
4. Kyoko Morimot, Kimiko Miyahara. Nutrition Management Implemented at School Lunch Programs in Japan Based on the Change in Criteria for Provision of School Lunches. The Japanese journal of nutrition and dietetics 76: S23-S37. 2018.
5. Hideko Nagura, Sumiko Takahashi. Survey of a Japanese Elementary School Lunch Program Menu Planning, Quality Control and Nutrition Management: A Case Study. The Japanese journal of nutrition and dietetics 76: S38-S49. 2018.
6. Yoko Hosoyamada, Kimiko Miyahara. Trends in Intervention Studies on Food and Nutrition Education in Japan Utilizing the School Lunch–A Systematic Review. The Japanese journal of nutrition and dietetics 76: s50-s63. 2018.
7. Eriko Koshikawa, Toyoko Okuda, Yoko Murai. The Relation between Education through School Lunch to Health and Learning Attitude and Motivation. The 59th Annual Meeting of Japan Society of Home Economics. 51-51. 2007. (in Japanese)
8. Reiko Asahina, Takae Yoshihara. *Jidouki no syokukoudoukeisei niokeru katei deno syokuji, gakkoukyuusyoku no tokutyou to yakuwari* [Characteristics and Roles of Home Meals and School Lunches in the Formation of Childhood Eating Behaviors (Translated from Japanese)]. Research abstracts on the annual meeting, regular meeting and seminar of the Japan Association of Home Economics Education 46 (0), 49-49. 2003. (in Japanese)
9. Daudet Ilunga Tshiswaka, Laura E Sikes, Juliet Iwelunmor, et al. Transferring Stroke Knowledge from Children to Parents: A Systematic Review and Meta-Analysis of Community Stroke Educational Programs. J Stroke Cerebrovasc Dis 27(11):3187-3199. 2018.
10. Feng J He, Puhong Zhang, Rong Luo, et al. App based education programme to reduce salt intake (AppSalt) in schoolchildren and their families in China: parallel, cluster randomised controlled tria. BMJ 376: e066982. 2022.

11. Ministry of Education, Culltur, Sports, Science and Technology. *Shoku ni kansuru shido no tebiki. Dai ni ji kaitei ban* [Guidance on Dietary Education. Second Revision (Translated form Japanese)]. p.16-22. 2019. Higashiyama Shobo Co.,Ltd., Kyoto (in Japanese)
12. Atsushi Mizumoto, Osamu Takeuchi. Basics and Considerations for Reporting Effect Sizes in Research Papers. Studies in English Language Teaching 31:57-66, 2008. (in Japanese)
13. Sonoe Furushima, Kayoko Kaneko. The study of dietary behavior at school lunch of the first grade primary school children. Journal of the College of Education, Yokohama National University, The educational sciences 8: 15-31, 2006. (in Japanese)
14. Ministry of Health, Labour and Welfare. *Tanosiku taberu kodomo ni. -Shoku kara hajimaru sukoyaka gaido-* [To Nurture Children Who Enjoy Eating -A Guide to Health Promotion Beginning with Eating- (Translated from Japanese)] https://www.mhlw.go.jp/shingi/2004/02/dl/s0219-4a.pdf (Access fate: April 6, 2023) (in Japanese)
15. Ministry of Health, Labour and Welfare. National Health and Nutrition Survey 2019. https://www.mhlw.go.jp/content/000710991.pdf (Access date: January 23, 2023)

Original

Comparison of Nutrient Intake in Vietnamese Children Calculated by Three Different Food Composition Tables

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ABSTRACT *Background and purpose.* Food Composition table is an indispensable tool in dietary study. Vietnamese food composition table is published based on domestic researches and foreign references. However, data are not up to date, which could lead to inaccurate nutrient intake estimates and are not comparable with data from other countries. Therefore, this study was conducted to calculate the nutrient intakes of Vietnamese children using different food composition tables from Vietnam, Japan and Thailand and to clarify the influence of these differences on calculated nutrient intakes. *Methods.* Dietary survey was conducted by 24-hour recall method, at a primary school in suburban of Hanoi city, Vietnam on 3 non-consecutive days (2 school days and 1 weekend day). The subjects were 10 year old children, 21 boys, and 15 girls. Energy and nutrient intakes was calculated using Vietnamese food composition table (FCT), Japanese FCT and Thai FCT. *Results.* Dietary fiber intake was significantly lower when Vietnamese FCT was used for calculation than Japanese and Thai FCT. The difference could be due to the different analysis of dietary fiber in each country. There were no significant differences between FCTs in energy, protein, fat, and carbohydrate intake. *Conclusion*. This study suggests that the low dietary fiber intake of Vietnamese children may be due to the problem of Vietnamese FCT. Further research is needed to develop internationally comparable national FCT.

Keywords: Food composition table, Vietnamese children, nutrient intake, low fiber intake

INTRODUCTION

Food composition tables (FCTs) are an essential resource for nutrition research, public health policy, and clinical practice. FCTs are used to estimate nutrient intakes in dietary surveys, assess dietary adequacy, and develop evidence-based recommendations for healthy diets. They are also used to examine the relationship between diet and health outcomes, such as chronic diseases. Many countries have a national or regional FCT, but on the other hand, there are still many developing and some developed countries without such tables. These countries rely on data from other sources such as the United States Department of Agriculture or FCTs from neighboring countries. The Vietnamese FCT was published based on domestic research and analysis and with reference to a number of international ingredient databases (1). The Vietnamese FCT was first published in 1972 and has been revised three time. The latest version as of 2023 was published in 2017. However, there is very little updated data, and the reference documents are very old such as Southeast Asia FCT 1972 – Food composition for international use, ASEAN FCT 2000. "Inadequate food composition data and their use may then lead to erroneous research results, wrong policy decisions (particularly in nutrition, agriculture and health), misleading food labels, false health claims and inadequate food choices" (2).

FCTs vary from country to country due to technical differences such as food descriptions, nutrient definitions, and analytical methods. A comparable FCT is critical for accurate international comparison of energy and nutrient intakes. Unfortunately, when comparing dietary data across countries, the importance of FCTs is often overlooked and people focus solely on survey methods, which can lead to various errors. For instance, we found that 10-year-old Vietnamese children consumed significantly less dietary fiber compared with Japanese children (about 4 g and 12 g, respectively) without considering the comparability of FCTs (3,4). However, when examining the FCTs, we found that the fiber content of the same food was very different in the two countries. For example, the Vietnamese FCT specifies 0.3 g of dietary fiber in 100 g of flour, whereas the Japanese FCT specifies 2.7 g. This discrepancy highlights the lack of comparability in fiber intake of children in these two countries.

Japan and Thailand are the Asian countries that generate and disseminate their own food composition tables. It is possible that the foods in Vietnam, Japan, and Thailand are quite similar. Therefore, this study was conducted to calculate the nutrient intake of Vietnamese children using different food composition tables from Vietnam, Japan, and Thailand and to

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clarify the influence of these differences on the calculated nutrient intake.

MATERIALS AND METHODS

Dietary survey

Dietary survey was conducted by 24-hour recall method, at a primary school in suburban of Hanoi city, Vietnam on 3 non-consecutive days (2 school days and 1 weekend day). The subjects were 10 year old children, 21 boys, and 15 girls. Researchers interview each child using standard food measures and a food photobook published by the Vietnamese National Institute of Nutrition to estimate portion size. When children did not remember exactly what they ate, we contacted their parents to reconfirm.

The protocol had been approved by the Hanoi Medical University ethics committee. Before we conducted the survey, all the parents and children were introduced to the nature of the project, and signed a consent form.

Food composition tables

Vietnamese Food Composition Table 2017 (1), Japanese Food Composition Table 2020 (5) and Thai Food Composition Table 2015 (6) were used to calculate energy, protein, lipid, carbohydrate and fiber intake.

Statistical analysis

Mean, standard deviation were calculated and the differences of means were tested by ANOVA and Tukey-Kramer post-hoc. The Spearman correlation analyses were performed to estimate the association between the FCTs. p-value smaller than 0.05 was considered to be statistically significant. Statistical analyses were performed using IBM SPSS statistics 26.

RESULTS

Table 1 shows the comparison of energy and nutrient intake of Vietnamese children calculated by 3 different FCTs. Energy, protein, lipid and carbohydrate intakes have no significantly difference. Fiber intakes was significantly lower when calculated by Vietnamese FCT. Moreover, Spearman's correlation coefficient. All nutrients were significantly correlated between each FCT.

Table 1: Comparison of energy and nutrient intake of Vietnamese children (n=36) calculated by Vietnamese FCT, Japanese FCT and Thai FCT

	Vietnamese FCT		Japanese FCT		Thai FCT		p value[1]	p value[2]	Spearman's correlation coefficient[3]		
	Mean	SD	Mean	SD	Mean	SD			V-J	V-T	J-T
Energy (kcal)	1851	400	1838	399	1918	424	>0.05		0.97	0.96	0.98
Protein (g)	76.9	18.8	72.7	20.0	71.1	19.9	>0.05		0.90	0.92	0.98
Lipid (g)	58.6	22.7	53.4	19.0	58.1	22.6	>0.05		0.78	0.71	0.92
Carbohydrate (g)	260.1	52.6	274.3	54.6	272.6	58.3	>0.05		0.98	0.96	0.98
Fiber (g)	4.1	1.8	7.9	4.3	9.6	4.1	<0.0001	<0.0001[VJ,VT,JT]	0.72	0.73	0.82

[1]ANOVA; [2]Tukey-Kramer;

V: Vietnamese food composition table, J: Japanese food composition table, T: Thai food composition table ;

[3]all p values of correlation coefficients are <0.001

DISCUSSION

In this study, we used the food composition table from Vietnam, Thailand, and Japan to analyze the dietary intake of Vietnamese children. We found that, when calculated by Vietnamese FCT, fiber intake of children is lower than when calculated by other FCTs suggests that low fiber intake of Vietnamese children may be caused by problem of Vietnamese FCT. Moreover, energy and nutrient intake correlated strongly across all FCTs.

Fiber intake calculate by 3 FCTs was very different. Several factors may contribute to this difference.

First, the reason for this could be the disparities in measurement methods and the inclusion of specific fiber types. Fiber is commonly classified as soluble or insoluble. The fiber content listed in the Vietnamese FCT is actually crude fiber – insoluble fiber. Initially, fiber was considered an indigestible component and referred to as "crude fiber." They were determined by measuring the residues in plant foods that remained after extraction with solvent, dilute acid, and dilute alkali (7). However, this method of measuring crude fiber content has been found to grossly underestimate the actual fiber content of human foods (8). The error in the crude fiber method arises from the sequential extraction process, which dissolves 50 to 90% of the lignin, 85% of the hemicellulose, and 0 to 50% of the cellulose. This error through loss can be as high as 700%, depending on the proportions of lignin, cellulose, and hemicellulose in the fiber (9). On the other hand, fiber in Thailand and Japanese FCT includes both soluble and insoluble fiber and follows Association of Official Analytical Chemists (AOAC) Official Method to analyze. Thailand used enzymatic-gravimetric method to analyze fiber composition. The method provides a measure of total dietary fiber (insoluble dietary fiber; high molecular weight soluble dietary fiber) by enzymatic removal of available starch and solubilization and extraction of a portion of the protein; the remaining residue is dried, weighed, and corrected for crude protein and ash contents (10). In Japan, in addition to the enzymatic-gravimetric

method, people also use the Liquid Chromatography method to determine low molecular weight soluble dietary fiber (11). Due to significant variations in analytical methods and type of fiber, comparison of fiber consumption results among the three countries may not be possible. Further research is needed to establish harmonized definitions and measurement methods for dietary fiber to ensure accurate assessment and comparison of fiber intake across countries.

Second, environmental, genetic, and processing differences such as feed, soil, climate, genetic resources, storage conditions, processing, and fortification could be one of the factors. However since protein, lipid and carbohydrate intake had no significant differences between countries and they were analyzed by the same method, suggesting that the food sources are relatively similar. Minatsu Kobayashi et al. also found that protein and carbohydrate intake were similar and fiber intake was different when calculated by Thailand and Japanese FCT. Nevertheless, the reason of differences was not pointed out (12).

When using Vietnamese FCT to calculate, the amount of fiber intake was underestimated. This may lead to inaccuracies in providing dietary guidelines and nutrition interventions. Although children's fiber intake was higher when calculated using Japanese and Thai FCTs, it is still below the Vietnamese recommended intake of 20-22g (13) and compared with Japanese children's intakes of 11.9 in boys and 12.6 in girls (4). This highlights the need for additional strategies to increase fiber intake in children. One viable method is to intervene in school meals. To give you an idea, Diep et al. were able to increase the fiber intake of 10-year-old children in school lunch from 1.1g to 1.9g (calculated by Vietnamese FCT) by increasing the number of materials and changing the cooking method without increasing the cost (14).

Vietnamese FCT still lacks information, and the data are not up-to-date. When comparing nutrient intakes between countries, it is better to use the better value of another country if the FCT completion rate of one country is low. In this study, intake levels of energy and all nutrients were highly correlated between different FCTs suggesting that the Thailand FCT or Japanese FCT can be used to calculate nutrient intakes of Vietnamese. However, Vietnamese FCT should be improved. It should be generated according to international guidelines so that it is comparable and reliable.

The study is limited by a relatively small sample size of 36 participants. In addition, the study did not compare the vitamin and mineral contents of the different food composition tables, which may differ significantly.

CONCLUSION

This study suggests that the low fiber intake of Vietnamese children may be caused by the problem of Vietnamese FCT. Differences in nutrient values in different food composition tables may affect the accuracy of nutrient intake assessments and make comparisons between different studies difficult. To ensure accurate and comparable nutrient intake assessments, additional research is needed to develop uniform techniques for nutrient analysis and to establish standardized food composition databases.

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REFERENCES

1. National Institue of Nutrition, Ministry of Heath. Vietnamese Food Composition Table, Common Nutrients. Hanoi, Vietnam: Medical Publishing House; 2017.
2. U. Ruth Charrondiere. Food composition challenges. [Internet]. 2022. Available from: http://www.fao.org/infoods/infoods/food-composition-challenges/en/
3. Phuong NM, Giang NH, Diep N Van, Thu TT, Yamamoto S. Low Physical Activity May Lead to Obesity Rather than High-Energy Intake in Vietnamese Children. Asian J Diet 4(4):77–82. 2022.
4. Giang NH, Phuong NM, Diep N Van, Sarukura N, Takeichi H, Sano A, et al. Energy and Nutrient Intakes and Recommendations from a Survey of Children in a Coastal City in Central Japan. Asian J Diet 3(3):95–103. 2021.
5. Ministry of Education, Culture, Sports, Science and Technology, Japan. Standard Tables of Food Composition in Japan 2020. Eighth Rev. 2020.
6. Puwastien P, Judprason K, Sridonpai P, Saiwan T. Thai Food composition Tables 2015. Institute of Nutrition, Mahidol University. 2015.
7. Dai FJ, Chau CF. Classification and regulatory perspectives of dietary fiber. J Food Drug Anal 1;25(1):37–42. 2017.
8. Dhingra D, Michael M, Rajput H, Patil RT. Dietary fibre in foods: a review. J Food Sci Technol 49(3):255. 2012
9. Van Soest PJ. Dietary fibers: their definition and nutritional properties. Am J Clin Nutr 31(10 Suppl). 1978.
10. McCleary B V. Measurement of Dietary Fiber: Which AOAC Official Method of AnalysisSM to Use. J AOAC Int 106(4):917–30. 2023.
11. Ministry of Education, Culture, Sports, Science and Technology J. Regarding changes in the analytical method for dietary fiber in the food

composition table. 2018.
12. Kobayashi M. Estimation of Nutrient Intake in Thailand: Influence of Differences in Food Composition Tables on Estimated Intake. J Nutr Med Diet Care 31;3(1). 2017.
13. National Institue of Nutrition, Ministry of health. Vietnam Recommended Dietary Allowances. Hanoi, Vietnam: Medical Publishing House; 2016.
14. Diep NV, Phuong NM, Giang NH, Ngoc TT, Hien NTT, Trang NT, et al. Improvement of the Vietnamese school lunch menu. Asian J Diet 5(1):5–9. 2023.

Original

The Prevalence and Factors Associated With Cardiometabolic Risk Among Urban in-School Adolescents in Harare, Zimbabwe

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ABSTRACT *Background:* Obesity and cardiometabolic health risks (CMR) an emerging health problem in Zimbabwe. Nutrition education for adolescents plays a pivotal role in preventing both obesity and CMR. *Objective:* To assess the prevalence and factors associated with CMR among adolescents in Harare, Zimbabwe. *Method:* A cross-sectional survey using a questionnaire was carried out with 320 in-school adolescents. Blood measures for blood pressure (BP), glucose (FG), and total cholesterol (TC) were assessed using standard methods, and body mass index (BMI), and waist-to-hip ratio (WHR), waist-to-height ratio (WtHR) were calculated. Pearson`s Chi-square and binary logistic regression were used to test for associations and explored factors associated with CMR ($p < 0.05$). *Results:* The median and IQR range age for the participants was 16 (14;19) years. The prevalence of obesity was 17.1% and CMR was 24.7%, both of which were higher among girls compared to boys. CMR was significantly associated with living in high economic status (HES) neighbourhoods [OR = 3.09(1.29, 7.38), $p = 0.011$], inadequate nutrition knowledge score [OR = 1.38(1.96-7.77), $p < 0.001$], inadequate physical activity [OR = 2.28(1.25-4.15), $p = 0.007$] and increased BMI [OR = 1.18(1.10-1.27), $p < 0.001$]. *Conclusions:* The prevalence of obesity and high CMR appears to be higher among girls compared to boys, particularly from affluent neighborhoods. This gender disparity could be due to socio-cultural beliefs which may hinder the translation of nutrition knowledge to practice. Therefore, community-based nutrition interventions to raise obesity and CMR awareness are needed to improve nutrition knowledge while promoting healthy eating habits to increase fruit and vegetable consumption to reduce the prevalence of obesity and CMR among adolescents.
Keywords: Obesity, adolescents, diabetes, hypertension, CMR, Zimbabwe

INTRODUCTION

Adolescents are aged between 10-19 years (1). Although this stage is seen as a healthy stage of life, risks of preventable diseases, illnesses, and conditions like obesity exist (2). Overweight and obesity are caused by excess fat accumulation in the body which presents health risks (3) and is commonly measured using the body mass index (BMI) (4, 5). Obesity is a global public health problem that is often associated with several non-communicable diseases (NCDs) and increased cardio metabolic risk (CMR) attributable to nutrition transition and poor dietary habits (6-8),.

Low-income countries are facing an emerging problem of obesity which often co-exists with hunger, micronutrient deficiencies, and undernutrition, *"multiple burdens of malnutrition."*(9) In Africa, the prevalence of obesity among children and adolescents ranges from 5% to 16.5% (10, 11). In Zimbabwe, the rate of obesity has exponentially increased over the years with prevalence ranging from 5.8% to 27.3% (12-15). CMR is a pattern of metabolic imbalances manifested as central obesity, hypertension, hypercholesterolemia, and hyperglycaemia (16, 17). The presence of any one or two of these constitutes early markers of the risk (18). CMR and its early markers occur in adolescents; however, its magnitude has not been determined in Zimbabwe. It is critical to estimate the magnitude and the factors associated with CMR across the life course considering that Zimbabwe is experiencing nutrition transition and rapid urbanization (19). Nutrition transition is a dietary shift from the consumption of wholesome and healthy foods to ultra-processed energy-dense foods. Due to modernization, eating away from home has become popular (20). In Zimbabwe, ready-to-eat sweetened, or fried and salty foods are commonly available, especially in tuck-shops near schools or on the roadside where students easily purchase these foods on the way to and from school (21).

Interestingly, sedentary lifestyles and the consumption of unhealthy foods are the key drivers of obesity among adolescents in urban areas (14). Although limited studies and data exist on the factors associated with obesity and/or CMR in Zimbabwe, socio-cultural practices and community perceptions that an increase in body fat "obesity" is a sign of wealth, social status, and beauty still exist (22). As a result, there is a lack of urgency regarding CMR screening among adolescents, *"the neglected age*

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group", as there is still a belief that CMR only affects adults and the elderly (23). Therefore, the purpose of this study was to assess the prevalence of obesity, CMR, and associated determinants among in-school adolescents and to propose interventions to tackle obesity and promote healthy dietary behaviors among adolescents in Harare, Zimbabwe. and propose interventions to tackle obesity and promote healthy eating targeting the adolescents.

METHODS

Study setting and participants

The study was carried out in Harare, the capital of Zimbabwe, lying in the northeastern part of the country. The city was founded in 1890 and has an area of 940 km^2 (371 mi^2) and a population of 15,178,979 in the 2022 census (24). The participants were adolescents aged 14 to 19 years with signed informed consent forms and attending secondary schools in Harare. Harare has 299 high schools with a total of 355,633 adolescents (25).

Sample size and sampling technique

The sample size was calculated using the Dobson formula (26) where Z-value = 1.96, p is the percentage of picking a choice expressed as decimal = 0.05, and c is the confidence interval = 0.95. A sample size of 437 adolescents was found to be sufficient, and with a 25% attrition adjustment, the final sample size was 380. After data cleaning and consent, 320 school adolescents successfully participated in the study. A stratified random sampling technique was used to select ten high schools from the registry of The Ministry of Primary and Secondary Education. The schools were further divided into strata based on their locations and socio-economic zones, class level (form 2 to form 6) based on the Zimbabwean education system, and age groups (14–16 years and 17–19 years). Recruited participants were asked to remain in the classrooms, and they received an in-depth orientation about the study's objectives, finger prick sampling procedure, weight, and height measurements for BMI calculations, waist and hip circumference measurements, and how long it would take to fill in the self-administered questionnaire. The participants were informed that no incentive would be offered for participation, there would be no penalties for dropping out of the survey, and participation in the study was for participants with signed consent forms. Three hundred and twenty (320) participants were successfully enrolled in this study and on the survey day, a team of research assistants and one nurse were always present during the administration and blood sampling. This survey was carried out in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Research instruments and data collection methods

Structured questionnaire: An interviewer-administered questionnaire was used to collect demographic data, food habits, nutrition knowledge, and information on physical activity (PA). The final questionnaire had four sections. Socio-demographic and anthropometry (10 questions), nutrition knowledge (20 questions), food habits (23 questions), and physical activity (7 questions). The questionnaire was adapted and scored as follows:

Nutrition Knowledge: This questionnaire was adapted from (27) and was categorized as inadequate (NKS <50%) or adequate (NKS ≥50%). The instrument was a practical and easy-to-administer tool with acceptable reliability among high school students. This section had three subscales: adequate and balanced nutrition, essential nutrients, and malnutrition-related diseases and the questions consisted of complete sentences of correct or incorrect statements. The Cronbach's alpha coefficient was 0.85 overall. An example of the nutrition knowledge question was, "We should drink at least 8-10 glasses of water every day" with (true, false, and not sure) answer options.

Food habits: This questionnaire was adapted from (28) and it had an internal reliability of Cronbach's α = 0.82. The FHS was calculated as follows:

FHS = No. of healthy responses × (23 No. of items completed)

Inadequate was (FHS < 50%) and adequate was (FHS ≥ 50%). An example of a food habits question was, "I try to ensure I eat plenty of fruit and vegetables."

Physical activity: This questionnaire was adapted from(29) and the physical activity score (PAS) responses were structured in different ways according to each question. The total score of the PA section was categorized as inadequate (PAS < 50%) or adequate (PAS ≥ 50%). It had an internal reliability Cronbach's alpha of 0.71. An example of a physical activity question was, "Do you usually practice any form of physical activity?"

Anthropometry: Height was measured to the nearest 0.1 m using the stadiometer (Leceister® Height Measure, Seca, UK), weight was measured using an electronic bathroom weighing scale (Sunbeam, South Africa), and waist and hip circumferences using the non-elastic tape measure, (Goldfish, UK). The nutritional status of the participants was determined using WHO standard protocols for children 5–19 years (30). Body Mass Index (BMI), kg/(m^2) was converted to *z*-scores using WHO *AnthroPlus*. BMI-for-age *z-scores* were categorized into underweight (<−2 SD), normal (≥−2 to ≤+1SD), overweight (≥1 to +2SD), and obese (>+2SD). While waist circumference (WC) ≥90th

percentile for children and adolescents is defined as abdominal obesity (31). Waist hip ratio (WHR) was classified as abnormal in males if the ratio was ≥0.9 and ≥0.85 in females. Waist-to-height (WHtR) was classified as at high risk of abdominal obesity if the ratio was ≥0.5 (32).

Blood measures: Single-use disposable nonsterile gloves were used, and a single-use disposable lancet device was used for each participant and all tests were carried out as per the manufacturer's instructions. The adolescents cooperated and fasted overnight. Blood pressure (BP) was measured using an automated sphygmomanometer (Braun, UK). Three measurements were taken 10 minutes apart, and the average was taken as the blood pressure. Blood pressure was classified such that normal BP: was < 120/< 80 mm Hg. Elevated BP: 120/< 80 to 129/ < 80 mm Hg (30) Elevated BP, Stage 1 (130/80 to 139/89 mmHg) and Stage 2 (≥ 140/90 mmHg) (33). Glucometers were used for the blood glucose (Accu-Answer®, LBM-01, South Africa) and rapid total cholesterol meter (Accu-Answer®, LBM-01, South Africa). Fasting blood sugar levels (mmol/L) were classified as normal (3.9 and 5.6 mmol/L), impaired glucose tolerance (5.6 to 6.9 mmol/L), and elevated (≥11 mmol/L) (34). While cholesterol was classified such that normal cholesterol is ≤170 mg/dL, moderate as >170 mg/dL and <200 mg/dL, and abnormal as ≥200 mg/dL (35).

RESULTS

Cardiometabolic indices (CMI) included fasting glucose (FG) and total cholesterol (TC), blood pressure (BP) waist-to-hip ratio (WHR), and waist-to-height ratio (WtHR). Cardiometabolic health risk was categorized as low risk and high risk. Low risk was defined as the presence of any two high cardiometabolic indices and high risk was defined as the presence of three or more indices.

Table 1: Prevalence of cardiometabolic health risk across participants' demographics

		Cardiometabolic health risk			
Variable		**Total n (%)**	**Low Risk n (%)**	**High Risk n (%)**	***p*-value**
Gender	**Male**	122 (38.6)	93_a (38.6)	29_a (38.7)	0.990
	Female	194 (61.4)	148_a (61.4)	46_a (61.3)	
Age Group	**14-16 years**	181 (56.6)	133_a (54.5)	48_a (63.2)	0.184
	17-19 years	139 (43.4)	111_a (45.5)	28_a (36.8)	
Education level of HH	**No formal education**	6 (1.9)	6_a (2.5)	0_a (0.0)	0.544
	Primary education	5 (1.6)	4_a (1.6)	1_a (1.3)	
	Ordinary education	126 (39.4)	97_a (39.8)	29_a (38.2)	
	Tertiary education	183 (57.2)	137_a (56.1)	46_a (60.5)	
Employment status of HH	**Formally employed**	173 (54.1)	133_a (54.5)	40_a (52.6)	0.957
	Unemployed	21 (6.6)	16_a (6.6)	5_a (6.6)	
	Entrepreneur	126 (39.4)	95_a (38.9)	31_a (40.8)	
Family Structure	**Both parents**	211 (65.9)	166_a (68.0)	45_a (59.2)	0.159
	Single parent	58 (18.1)	38_a (15.6)	20_b (26.3)	
	Relatives/guardians	44 (13.8)	33_a (13.5)	11_a (14.5)	
	Child headed	5 (1.6)	5_a (2.0)	0_a (0.0)	
	Other	2 (0.6)	2_a (0.8)	0_a (0.0)	
Household Size	**Average**	273 (85.3)	207_a (84.8)	66_a (86.8)	0.666
	Above Average	47 (14.7)	37_a (15.2)	10_a (13.2)	
Place of Residence	**HES**	40 (12.5)	26_a (10.7)	14_a (18.4)	**0.011***
	Intermediate	78 (24.4)	53_a (21.7)	25_b (32.9)	
	LES	202 (63.1)	165_a (67.6)	37_b (48.7)	

Notes: Cardiometabolic risk: Low risk <2 indices, high risk >3 indices *P-value is Pearson's Chi-squared test, in cases where cell values less than 5, Fisher's Exact test was used. Where HH= Household head. HES – high economic status, LES- low economic status. Different subscript letter and (*) indicates that the CMR categories differ significantly ($p<0.05$).

Socio-demographic characteristics

The summary of sociodemographic characteristics of the participants are summarized in **Table 1.** The median and IQR range for the participants was 16 (14;19) years. Most of the participants were female (61.4%, p = 0.990) and in the 14-16 years age group (56.6%, p = 0.184). Concerning the household heads, most attained tertiary education (57.2%) and were formally employed (54.1%). Most of the adolescents were staying with both parents (65.9%, p = 0.157), within an average household size of at least 5 family members (85.3%, p = 0.666), and lived in low socio-economic neighbourhoods (63.1%, p = 0.011). A

greater proportion of the adolescents from the LES neighbourhood were in the low-risk category (67.6%). However, overall, adolescents who were in the high-risk category were living in LES neighbourhoods (48.7%).

Cardiometabolic health risk by nutrition knowledge, food habits, and physical activity levels

Table 2 shows the relationship between CMR and nutrition knowledge score (NKS), food habits, and PA. CMR was significantly associated with NKS. Most adolescents with inadequate knowledge were in the high-risk CMR category (30.3%, p = 0.014). Adolescents with inadequate food habits (56%, p = 0.029), particularly skipping meals (90.8%, p = 0.021), were in the high-risk category and were significantly associated with CMR. Lastly, adolescents with inadequate PA were in the high-risk category and had a significant association with CMR (55.3%, p = 0.034).

Table 2: The interplay between cardiometabolic health risk by nutrition knowledge, food habits, and physical activity levels

		Cardiometabolic health risk			
Variable		**Total n (%)**	**Low Risk n (%)**	**High Risk n (%)**	***p*-value**
Nutrition Knowledge Score	**Inadequate**	65 (20.3)	42_a (17.2)	23_b (30.3)	**0.014***
	Adequate	255 (79.7)	202_a (82.8)	53_b (69.7)	
Malnutrition related	**Inadequate**	175 (54.7)	131_a (53.7)	44_a (57.9)	0.520
diseases knowledge	**Adequate**	145 (45.3)	113_a (46.3)	32_a (42.1)	
Essential nutrients	**Inadequate**	264 (82.5)	195_a (79.9)	69_b (90.8)	**0.029***
knowledge	**Adequate**	56 (17.5)	49_a (20.1)	7_b (9.2)	
Balanced nutrition	**Inadequate**	233 (72.8)	170_a (69.7)	63_b (82.9)	**0.024***
knowledge	**Adequate**	87 (27.2)	74_a (30.3)	13_b (17.1)	
Food Habits Score	**Inadequate**	202 (63.1)	146_a (59.8)	56_b (73.7)	**0.029***
	Adequate	118 (36.9)	98_a (40.2)	20_b (26.3)	
Health Choices	**Inadequate**	192 (60.0)	140_a (57.4)	52_a (68.4)	0.086
	Adequate	128 (40.0)	104_a (42.6)	24_a (31.6)	
Sugars	**High**	151 (47.2)	113_a (46.3)	38_a (50.0)	0.574
	Low	169 (52.8)	131_a (53.7)	38_a (50.0)	
Fats	**High**	243 (75.9)	187_a (76.6)	56_a (73.7)	0.599
	Low	77 (24.1)	57_a (23.4)	20_a (26.3)	
Fruits and Vegetables	**Low**	206 (64.4)	163_a (66.8)	43_a (56.6)	0.104
	High	114 (35.6)	81_a (33.2)	33_a (43.4)	
Skipping Meals	**Inadequate**	262 (81.9)	193_a (79.1)	69_b (90.8)	**0.021***
	Adequate	58 (18.1)	51_a (20.9)	7_b (9.2)	
Physical Activity Level	**Inadequate**	143 (44.7)	101_a (41.4)	42_b (55.3)	**0.034***
	Adequate	177 (55.3)	143_a (58.6)	34_b (44.7)	

Notes: Cardiometabolic risk: Low risk <2 indices, high risk >3 indices. *P-value is Pearson's Chi-squared test at p=0.05. NKS (nutrition knowledge score): <50% is inadequate and ≥50% is adequate. Food habits score<5 is inadequate and ≥5 is adequate. PAL (physical activity level) is adequate at≥ 60 minutes and inadequate at <60 minutes. Different subscript letter and (*) indicates that the CMR categories differ significantly (p<0.05).

Nutrition status of the adolescents

The results of the current study (**Figure 1)** revealed that obesity affected 17.1% of adolescents with high proportions among girls compared to boys (p=0.030), while the underweight status (23.0%) was higher among boys than girls (p=0.030)

Summary of the cardiometabolic indices for adolescents

Cardiometabolic indices (CMI) were clustered with a high proportion among the 14-16-year-old age group and more pronounced in girls, i.e., overweight and obesity (21.6%, p=0.030) than WHtR (13.8%, p=0.012), TC (29.4%, p=0.023) and FG (98.9%, p=0.210). Notably, BP (58.7%, p=0.038) and WHR (18.0, p=0.0023) were more pronounced among boys **(Table 3).**

Factors associated with cardiometabolic risk among adolescents.

CMR was significantly associated with home location; HES [OR = 3.09(1.29, 7.38), p = 0.011], Intermediate [OR = 2.16(1.08-4.30), p = 0.029], inadequate food habits score [OR= 0.66(1.02-3.64), p = 0.043, inadequate nutrition knowledge score [OR = 1.36(1.96-7.77), p<0.001]. Inadequate PA was also significantly associated with CMR [OR = 2.28(1.25-4.15), p = 0.007]; and BMI [OR = 1.18(1.10-1.27), p<0.001] **(Table 4).**

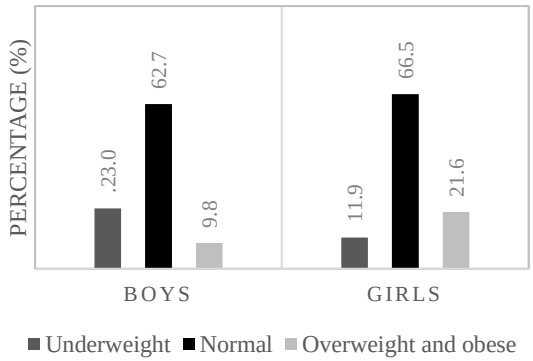

Figure 1: The distribution of nutrition status of adolescents by sex

Table 3: Clustering of cardiometabolic indices among adolescents by sex and age group

		Gender						Age Group			
Variable		**Total n (%)**	**Male n (%)**	**Female n (%)**	***p*-value**	**Variable**		**Total n (%)**	**14-16 years n (%)**	**17-19 years n (%)**	***p*-value**
BMI	**Underweight**	51 (16.1)	28_a (23.0)	23_b (11.9)	**0.030***	**BMI**	**Underweight**	52 (16.3)	37_a (20.4)	15_b (10.8)	0.064
	Normal	211 (66.8)	82_a (67.2)	129_a (66.5)			**Normal**	212 (66.3)	115_a (63.5)	97_a (69.8)	
	Overweight and obese	54 (17.1)	12_a (9.8)	42_b (21.6)			**Overweight and obese**	56 (17.5)	29_a (16.0)	27_a (19.4)	
WtHR	**Low Risk**	278 (89.7)	116_a (95.1)	162_b (86.2)	**0.012***	**WtHR**	**Low Risk**	282 (89.8)	156_a (88.1)	126_a (92.0)	0.265
	High Risk	32 (10.3)	6_a (4.9)	26_b (13.8)			**High Risk**	32 (10.2)	21_a (11.9)	11_a (8.0)	
BP	**Low risk**	152 (48.7)	50_a (41.3)	102_b (53.4)	**0.038***	**BP**	**Low risk**	155 (49.1)	91_a (51.1)	64_a (46.4)	0.402
	High risk	160 (51.3)	71_a (58.7)	89_b (46.6)			**High risk**	161 (50.9)	87_a (48.9)	74_a (53.6)	
WHR	**Low risk**	276 (87.3)	100_a (82.0)	176_b (90.7)		**WHR**	**Low risk**	280 (87.5)	154_a (85.1)	126_a (90.6)	0.136
	High risk	40 (12.7)	22_a (18.0)	18_b (9.3)	**0.023***		**High risk**	40 (12.5)	27_a (14.9)	13_a (9.4)	
TC	**Low risk**	237(75.0)	100_a (82.0)	137_b (70.6)	**0.023***	**TC**	**Low risk**	240 (75.0)	130_a (71.8)	110_a (79.1)	0.134
	High risk	79 (25.0)	22_a (18.0)	57_b (29.4)			**High risk**	80 (25.0)	51_a (28.2)	29_a (20.9)	
FG	**Low risk**	6 (1.9)	4_a (3.4)	2_a (1.1)	0.210	**FG**	**Low risk**	6 (1.9)	3_a (1.7)	3_a (2.2)	0.999
	High risk	302 (98.1)	115_a (96.6)	187_a (98.9)			**High risk**	306 (98.1)	170_a (98.3)	136_a (97.8)	

Notes: FG- fasting glucose, TC- total cholesterol, BP- Blood pressure, WHR- waist-hip ratio, WtHR - Waist to height ratio. Values are above cut-off points (at-risk category). WC for females, normal is <80 and risky when ≥80; for males, normal is <94 and risky when ≥94· FG: normal is 5.6-6.9mmol/L and at risk is ≥7.2. BP: normal is ≤139/89mmHg, and at risk ≥140/90mmHg. TC: normal >170>120mg/dl and risky when >200mg/dl. WtHR: normal ratio 0.5, at risk >0.5. Different subscript letter and (*) indicates that the CMR categories differ significantly (p<0.05).

Table 4. Factors associated with cardiometabolic health risk.

Variable	B	S.E.	*p*-value	Odds Ratio (OR)	95% CI (OR) Lower	95% CI (OR) Upper
Age (years)	-0.07	0.12	0.549	0.93	0.74	1.18
Formally employed	-0.49	0.31	0.121	0.62	0.33	1.14
Unemployed	0.35	0.60	0.560	1.42	0.44	4.56
Location (HES)	1.13	0.44	0.011*	3.09	1.29	7.38
Location (Intermediate)	0.77	0.35	0.029*	2.16	1.08	4.30
HH Size (<5 people)	0.32	0.42	0.451	1.38	0.60	3.15
NKS (Inadequate)	1.36	0.35	<0.001*	3.90	1.96	7.77
Food habits (Inadequate)	0.66	0.32	0.043*	1.93	1.02	3.64
Physical activity (Inadequate)	0.82	0.31	0.007*	2.28	1.25	4.15
BMI (kg/(m^2))	0.17	0.04	<0.001*	1.18	1.10	1.27
Constant	-5.26	2.17	0.015	0.01		

Notes: Goodness of fit: Nagelkerke $R^2 = 0.249$, Hosmer and Lameshow test p=0.842 Where; HH- Household, NKS - Nutrition Knowledge Score, BMI – Body Mass Index, HES- high socioeconomic status.

DISCUSSION

This study was designed to assess the prevalence and factors associated with CMR among in-school adolescents in Harare, Zimbabwe. Our findings show that the prevalence of obesity was (17.1%) and high CMR (24.7%) among this age group. The results showed that overweight and obesity (17.1%) with higher proportions among girls and underweight (15.9%) with higher proportions among boys. These results are in line with findings from recent Zimbabwean studies, (13, 14, 36) and studies from other African countries (37, 38).

However, considering that 23.0% of the adolescents were underweight, our results confirm that the "double burden" of malnutrition exists in Zimbabwe. The emerging problem of obesity and associated increased CMR is postulated to be mainly driven by nutrition transition and an increasingly obesogenic environment (39-42). Our findings show that higher percentages of adolescents are consuming high-fat and sugar foods and low fruits and vegetables. This is problematic, particularly in school environments where adolescents can easily access more ultra-processed snacks and limited fruits and vegetables. A national survey showed only 13% of the adult population in Zimbabwe consumed at least 400 g per day of fruits and vegetables recommended by WHO (36). Despite the enormous benefits and existing dietary recommendations, most Zimbabwean adults do not meet the daily requirements and adolescents can easily adopt the behaviour in a family setting (43).

A recent study on adolescent obesity in Zimbabwe revealed that adolescents lack obesity awareness and it is not as serious as other health problems and conditions (44). This shows the need to set up interventions to tackle obesity, promote PA, and encourage healthy eating among adolescents utilizing community-themed social behavior change activities informed by the social-ecological model (44, 45). It has been observed that the rate of obesity is higher among girls than boys (13,46, 47). However, the finding that CMR risk appears to be higher in girls compared to boys as well is a cause for concern as this could indicate problematic dietary behaviours within this sex. On the contrary, it is reported that boys are more obese than girls in developed countries like North America and Japan (49, 50). Although the cause is not well understood, it can be speculated that the differences in obesity prevalence and associated CMR may be driven by societal gender perspectives on body weight, dietary habits as well as sex-related determinants, such as body composition and hormones. Hormonal fluctuation particularly women across the lifespan influence appetite and body fat distribution (48, 49). This argument may be true considering that in the African context, a mother is perceived to be big and curvy *"Bigger is better myth"* is a reflection that the husband is taking good care of his wife (51). In Japan, girls in higher-grade classes and young women generally want to be thin (52) due to media influences on this body ideal (53) however, in Zimbabwe girls want to be plump and curvy as they believe it makes them more attractive (12, 51). Additionally, it is a common belief that a plump child is healthy, and a slim child is unhealthy. Therefore these beliefs result in parents overfeeding their children, while adolescents voluntarily overeat (12, 44). Therefore, future studies are required to explore these important societal risk factors, to perspectives from adolescents and adults on; *"What is a 'good' desirable, beautiful, impressive body?"*. Consequently, health promotion interventions for this age group should take into account the array of factors that maintain these preferences.

Place of residence and CMR: It is known that socioeconomic environments have a huge influence on obesity and cardiometabolic health (57). Our results showed that adolescents who live in affluent

suburbs and families have a higher CMR risk. However, in developed countries like the USA and Japan adolescents from affluent families are slimmer while the risk of obesity and CMR is high among adolescents from low-income families (58, 59). In many African countries including Zimbabwe, people believe that when they earn more, they should eat more because wealth and happiness are physically shown by being fat (22). In addition to socio-cultural beliefs, this contrast between Zimbabwe and other developed countries could be a result of the nutrition transition. Zimbabwe is between stages 3 and 4 of the nutrition transition, (12) and is far behind most developed countries regarding health behavioural change. Stages 3 and 4 are characterised by social and economic changes which cause receding famine and a decline in nutritional deficiencies together with a dietary shift from natural and wholesome foods to ultra-processed foods resulting in the rise in obesity rate and CMR risk (60, 61). Therefore, we recommend that social behaviour change (SBCC) themed interventions for health promotion, obesity, and CMR prevention in affluent communities for adolescents and families and communities raise obesity and CMR awareness while promoting healthy shopping and eating habits (57, 58).

Inadequate nutrition knowledge and CMR: Nutrition knowledge is a key element for health behavior change by providing an individual with a cognitive understanding of healthy eating habits (64). The result contradicts a recent finding from Harare, Zimbabwe that reported that the majority of the adolescents had adequate nutrition knowledge but were obese (13). Although it was previously reported to be adequate, it is possible that it is not always translated into practice (15). To the best of our knowledge, our paper is the first to report that essential nutrients ($p=0.029$) and balanced diet ($p=0.024$) knowledge were lacking among urban Zimbabwean adolescents. This should help in the choice of nutrition messages targeting this age group in a country where most nutrition interventions and health promotion programs and policies are still biased toward stunting and undernutrition (15, 43). Understanding the kind of nutrition knowledge that adolescents need, and how that knowledge can be put into practice is the genesis of sustainable and effective nutrition interventions to reduce obesity and the associated CMR (65).

Obesity, food habits, and CMR: The finding that higher BMI was a significant determinant of high CMR is understandable. It is known that obesity or fatness is a factor of poor dietary choices, low physical inactivity or sedentaryism, genetics, and sociocultural influences. Notably, our finding that negative consumption patterns particularly low fruit and vegetable consumption and skipping breakfast were associated with obesity and high CMR warrants further research to understand dietary habits among adolescents from low-income countries like Zimbabwe. In an obesity perceptions study among urban adolescents in Zimbabwe, it was stated that "people are obese because they don't know what's in their food" (44). Nutrition education programs particularly basic knowledge in essential nutrients could prove beneficial in promoting healthy food choices by eating nutrient-dense traditional and wholesome foods and less ultra-processed foods. Additionally, practical nutrition education for a balanced diet using Zimbabwe's food guidelines could help adolescents create healthy, balanced meals—whether served on a plate or packed in a lunch box. It is anticipated that these findings will enable dieticians and nutritionists in Zimbabwe to consider obesity and CMR as health threats and plan nutrition activities accordingly.

Strengths and limitations

Our study adds to the limited literature on cardiometabolic risk factors and their clustering among adolescents in the Zimbabwean context. This is the first study to assess the combined cardiometabolic health risk burden by assessing all six cardiometabolic health indices. However, there were some limitations. Although the participants were asked to fast for blood measurements, we had no means to verify compliance. In addition, we relied on the less invasive finger prick blood sampling, and we did not collect venous blood for the measurements which provides more definitive results. We also acknowledge the potential for recall bias in the estimation of food habits and any other recall-based questions.

CONCLUSIONS

Our results show different occurrences compared to other developed countries where the prevalence of obesity and CMR appears to be higher among girls compared to boys. This gender disparity of obesity and/or underweight and CMR could be explained by socio-cultural beliefs which may hinder the translation of nutrition knowledge to practice. The significant factors associated with CMR among adolescents in this study were staying in HES (affluent) neighborhoods, inadequate nutrition knowledge, low physical activity, and higher BMI (obesity). Therefore, community-based interventions to raise obesity and CMR awareness are needed to provide basic nutrition education for essential nutrients and practical education for balanced diets while promoting healthy eating habits to increase fruit and vegetable consumption. These strategies should help to reduce the prevalence of obesity and CMR among adolescents.

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CONFLICTS OF INTEREST (COI)

The authors have no conflicts of interest to disclose.

REFERENCES

1. World Health Organization (WHO). Adolescent health. https://www.who.int/health-topics/adolescent. Accessed 2 November 2022.
2. World Health Organization (WHO). Handout Module; An Introduction. https://www.who.int/publications/i/item/9241591269. Accessed 28 November 2022.
3. World Health Organization (WHO). Obesity System. https://www.who.int/activities/controlling-the-global-obesity-epidemic. Accessed 13 December 2022.
4. National heart lung and blood institute. Obesity, Nutrition obesity, and Physical Activity https://www.nhlbi.nih.gov/science/ -nutrition-and-physical-activity. 2019.
5. Piedmont healthcare. Does BMI Accurately Determine Body Fat? https://www.piedmont.org/media/file. Accessed 18 December 2022.
6. Cao Y, Huynh Q, Kapoor N, Jeemon P, Mello, G.T.d. Associations between Dietary Patterns and Cardiometabolic Risk Factors—A Longitudinal Analysis among High-Risk Individuals for Diabetes in Kerala, India. Nutrients 14(3): 662. 2022.
7. He Y, Li Y, Yang X, Hemler EC. The dietary transition and its association with cardiometabolic mortality among Chinese adults, 1982-2012: a cross-sectional population-based study. Lancet Diabetes Endocrinol 7(7): 540-548. 2019.
8. Murni IK, Sulistyoningrum DC, Susilowati R, Julia M, Dickinson KM. The association between dietary intake and cardiometabolic risk factors among obese adolescents in Indonesia. BMC Pediatr 22(1): 1–9. 2022.
9. Sunuwar, D.R., Singh, D.R. & Pradhan, P.M.S. Prevalence, and factors associated with double and triple burden of malnutrition among mothers and children in Nepal: evidence from 2016 Nepal demographic and health survey. BMC Public Health 20(1): 405. 2020.
10. World Health Organization (WHO). Obesity is rising in Africa 1. https://www.afro.who.int/news/obesity-rising-africa-who-analysis-finds. Accessed 28 December 2022.
11. World Health Organization (WHO). Obesity rising in Africa 2. https://www.afro.who.int/news/obesity-rising-africa-who-analysis-finds. Accessed 28 December 2022.
12. Mangemba NT, San Sebastian M. Societal risk factors for overweight and obesity in women in Zimbabwe: A cross-sectional study. BMC Public Health 20(1): 1–8. 2020
13. Mapfumo PT, Muderedzwa TM, Matsungo TM. Prevalence and determinants of overweight and obesity among in-school adolescents in Harare, Zimbabwe. North African J Food Nutr Res 6(13): 29–38. 2022.
14. Muderedzwa TM, Matsungo TM. Nutritional status, physical activity and associated nutrition knowledge of primary school learners. Nutr Health 26(2): 115–25. 2020.
15. Pencil A, Matsungo TM, Hayami N. Determinants of overweight and obesity among adolescents in Zimbabwe: A scoping review. North African J Food Nutr Res 5(12): 112–21. 2021.
16. Agirbasli M, Cakir S, Ozme S, Ciliv G. Metabolic syndrome in Turkish children and adolescents. Metabolism 55(8): 1002–6. 2006.
17. Mehairi AE, Khouri AA, Naqbi MM, Muhairi SJ, Maskari FA, Nagelkerke N. Metabolic Syndrome among Emirati Adolescents: A School-Based Study. PLoS One 8(2):e56159. 2013.
18. Lwabukuna WC, Mgonda Y. Early clinical markers of metabolic syndrome among secondary school adolescents in dar es salaam, tanzania. Tanzan J Health Res 22(1): 1–7. 2021.
19. Chopera P, Zimunya PR, Mugariri FM, Matsungo TM. Facilitators and barriers to the consumption of traditional foods among adults in Zimbabwe. J Ethn Foods 9(5). 2022.
20. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev 70(1): 3-21. 2012.
21. Adiele D. An Unhealthy, Obesogenic Lifestyle: A Case Study of Urban Primary School Children in Kwekwe, Zimbabwe. Sci J Public Heal 6(2): 35. 2018.
22. Renzaho AMN. Fat, rich and beautiful: Changing socio-cultural paradigms associated with obesity risk, nutritional status and refugee children from sub-Saharan Africa. Heal Place 10(1): 105–13 2004.
23. Matsungo TM, Chopera P. Nutrition in contemporary Zimbabwe: a situational analysis. North African J Food Nutr Res 4(9): S25–35. 2020.
24. United Nations population fund (UNFPA) Zimbabwe. https://www.unfpa.org/data/transparency-portal/unfpa-zimbabwe. Accessed 3 January 2023.
25. Ministry of Primary and Secondary Education. Zimbabwe School Health Policy: Harare, Zimbabwe 1–38. Available online: http://www.mopse.co.zw/sites/default/file

s/public/downloads/ZSHP%20final%20signed%20March%202018.pdf. Accessed on 7 January 2023.
26. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian J Psychol Med 35(2): 121–6. 2013.
27. Oz F, Aydin R, Onsuz MF, Metintas S, Emiral GO. Development of a reliable and valid adolescence nutritional knowledge questionnaire. Prog Nutr 18(2): 125–34. 2016.
28. Johnson F, Wardle J, Griffith J. The adolescent food habits checklist: Reliability and validity of a measure of healthy eating behaviour in adolescents. Eur J Clin Nutr 56(7): 644–9. 2002.
29. Silva DR, Werneck AO, Collings PJ, Fernandes RA, Barbosa DS, Ronque ERV, et al. Physical activity maintenance and metabolic risk in adolescents. J Public Heal 40(3): 493–500 2018.
30. World Health Organization. BMI-for-age (5–19 years) Growth Reference data for 5-19 years. Available from: https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age. Accessed 18 January 2023.
31. Palacio-Agüero A, Díaz-Torrente X, Quintiliano Scarpelli Dourado D. Relative handgrip strength, nutritional status and abdominal obesity in Chilean adolescents. Plos one 15(6): e0234316. 2020.
32. Bacopoulou F, Efthymiou V, Landis G, Rentoumis A, Chrousos GP. Waist circumference, waist-to-hip ratio and waist-to-height ratio reference percentiles for abdominal obesity among Greek adolescents. BMC Pediatr 15(1): 2015. 2015.
33. Riley M, Hernandez AK, Kuznia AL. High blood pressure in children and adolescents. Am Fam Physician 98(8): 486–94. 2018.
34. American Diabetes Association. Classification and Diagnosis of Diabetes: Standards of Medical Diabetes 42(Suppl 1): S13-S28. 2019.
35. Dabelea D, Hamman RF, Knowler WC. Diabetes in Youth. Diabetes in America. 3rd edition. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases (US). https://www.ncbi.nlm.nih.gov/books/NBK567997.2018.
36. Zimbabwe Demographic and Health Survey Statistics (ZDHS). http://www.zimstat.co.zw/sites/default/files/img/publications/Health.Accessed 8 February 2023.
37. Irelosen, A. K., Eno Etim, N., & Babatunde, A. S. Adolescent obesity: An emerging public health crisis in an urban city in South-South Nigeria. Annals of Clinical and Biomedical Research 2(2). 2021.
38. Nwosu, E., Fismen, AS., Helleve, A. *et al.* Trends in prevalence of overweight and obesity among South African and European adolescents: a comparative outlook. BMC Public Health 22(1):2287. 2022.
39. Popkin BM. The Nutrition Transition and Global Food System Dynamics: The Accelerating Speed of Change and Global Challenges We Face for Creating a Healthier Global Diet. Glob food Res Progr 10 Suppl: S13-8. 2017.
40. Debeila S, Modjadji P, Madiba S. High prevalence of overall overweight/obesity and abdominal obesity amongst adolescents: An emerging nutritional problem in rural high schools in Limpopo Province, South Africa. Afr J Prim Health Care Fam Med 13(1): e1-e9. 2021.
41. Sanyaolu A, Okorie C, Qi X, Locke J, Rehman S. Childhood and Adolescent Obesity in the United States: A Public Health Concern. Glob Pediatr Health 6:2333794X19891305. 2019.
42. Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber. The South African national health and nutrition examination survey. p. 1–423. http://hdl.handle.net/20.500.11910/2864. 2012.
43. Pencil A, Matsungo TM, Hongu N, Hayami N. Prevalence of Obesity and the Factors Associated with Low Obesity Awareness among Urban Adolescents in Harare, Zimbabwe. Nutrients 15(10): 2302. 2023.
44. Brown SL. Using a social-ecological model to examine obesity interventions for children and adolescents. 2011.
45. Ohri-Vachaspati P, DeLia D, DeWeese RS, Crespo NC, Todd M, Yedidia MJ. The relative contribution of layers of the Social Ecological Model to childhood obesity. Public Health Nutr 18(11): 2055–66. 2015.
46. Kambondo G, Sartorius B. Risk factors for obesity and overfat among primary school children in Mashonaland west province, Zimbabwe. Int J Environ Res Public Health 15(2): 249. 2018.
47. Sirikyi IH, Eliason S, Ghartey FN, Ekenam E, Pereko KKA, Okai E, et al. Anthropometric indices and cardiometabolic risk factors in a Ghanaian adolescent population. J Pediatr Endocrinol Metab 34(1): 35–44. 2021.
48. Shah B, Tombeau Cost K, Fuller A, Birken CS, Anderson LN. Sex and gender differences in childhood obesity: Contributing to the research agenda. BMJ Nutr Prev Heal 3(2): 387–90. 2020.
49. Zhang J, Zhai Y, Feng XQ, Li WR, Lyu YB, Astell-Burt T, Zhao PY, Shi XM. Gender Differences in the Prevalence of Overweight and Obesity, Associated Behaviors, and Weight-related Perceptions in a National Survey of Primary School Children in China. Biomed Environ Sci. 31(1): 1-11. 2018.

50. Pradeilles R, Holdsworth M, Olaitan O, Irache A, Osei-Kwasi HA, Ngandu CB, et al. Body size preferences for women and adolescent girls living in Africa: a mixed-methods systematic review. Public Health Nutr 25(3): 738–59. 2022
51. Hughes E. "I'm Supposed To Be Thick": Managing Body Image Anxieties Among Black American Women. J Black Stud 52(3): 310–30. 2021.
52. Itoh H, Kaneko H, Kiriyama H, Kamon T, Fujiu K, Morita K, et al. Metabolically healthy obesity, and the risk of cardiovascular disease in the general population Analysis of a nationwide epidemiological database. Circ J 85(6): 914–20. 2021.
53. Quinn RC, Campisi SC, McCrindle BW, Korczak DJ. Adolescent cardiometabolic risk scores: A scoping review. Nutr Metab Cardiovasc Dis (12):2669–76. 2022.
54. Shafiee G, Qorbani M, Heshmat R, Mohammadi F, Sheidaei A, Motlagh ME,et al. Socioeconomic inequality in cardio-metabolic risk factors in a nationally representative sample of Iranian adolescents using an Oaxaca-Blinder decomposition method: the Caspian-III study. J Diabetes Metab Disord 18(1):145-153. 2019.
55. WHO. Social determinants of health 19 years People born in high. https://www.paho.org/en/topics/social-determinants-health. 2022.
56. Wyszyńska J, Ring-Dimitriou S, Thivel D, Weghuber D, Hadjipanayis A, Grossman Z, et al. Physical Activity in the Prevention of Childhood Obesity: The Position of the European Childhood Obesity Group and the European Academy of Pediatrics. Front Pediatr 8:535705. 2018.
57. Chung RJ, Touloumtzis C, Gooding H. Staying Young at Heart: Cardiovascular Disease Prevention in Adolescents and Young Adults. Curr Treat Options Cardiovasc Med 17(12): 61. 2015.
58. Raeside R, Partridge S, Singleton A, Redfern J. Cardiovascular Disease Prevention in Adolescents: eHealth, Co-Creation, and Advocacy. Med Sci. 7(2):34. 2019.
59. Liu KSN, Chen JY, Sun KS, Tsang JPY, Ip P, Lam CLK. Adolescent Knowledge, Attitudes and Practices of Healthy Eating: Findings of Qualitative Interviews among Hong Kong Families. Nutrients 14(14): 1–18. 2022.
60. Vaitkeviciute R, Ball LE, Harris N. The relationship between food literacy and dietary intake in adolescents: A systematic review. Public Health Nutr 8(4): 649–58. 2015.
61. Slaght JL, Wicklow BA, Dart AB, Sellers EAC, Gabbs M, Carino M, et al. Physical activity and cardiometabolic health in adolescents with type 2 diabetes: A cross-sectional study. BMJ Open Diabetes Res Care 9(1): 1–7. 2021.
62. World Food Program (WFP). Home-grown school feeding book. 79. https://docs.wfp.org/api/documents/WFP-0000074274/download. 2008.

Original

A Successful Innovative Meal Ordering System for Hospital Patient-Centered Food Service in Taiwan

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ABSTRACT *Background and purpose.* A general hospital in northern Taiwan was the first to establish an electronic ordering system in 1982. However, the system requires nurses to place orders based on physicians' diet prescriptions and patients' preferences, whereas patients can not order meals by themselves. *Methods.* An innovative meal ordering system (iMOS) was launched at this general hospital to revolutionize the meal ordering process by adopting information technology and providing diverse meals. In addition to the traditional cycle menu, a selective menu of stew dishes, light meals, noodle sets, and other culinary choices were included. Patients whose diet order was non-therapeutic could order meals using their own electronic devices or make an order on meal monitors at the nursing station. The patient satisfaction and ordering rates pre- and post-implementing iMOS were analyzed during 2016-2022. *Results.* The findings indicated a significant improvement in flavor (3.7 vs. 4.3), presentation (3.9 vs. 4.5), and satisfaction(4.0 vs. 4.3) after iMOS was implemented. The rate of ordering diverse meals rose from 7.3% in 2017 to 18.6% in 2022. *Conclusion.* the iMOS meal ordering system successfully improved patient satisfaction and enhanced the meal ordering rate, indicating that an innovative patient-centered foodservice model could be achieved by applying information technology.

Keywords: innovative meal ordering system, hospital patient food service

INTRODUCTION

Nutrition is crucial for patient care, and food service plays a pivotal role in mitigating malnutrition by providing patients with adequate meals. Hospital food service also impacts patients' perception of their entire hospital experience, enhancing their satisfaction (1-3). Studies have demonstrated that electronic menu systems could improve dietary intake while maintaining cost-effectiveness, reducing waste, and ensuring satisfaction.

Jamison et al. (4) found that patients preferred the electronic-based meal ordering system (eBMOS) over the traditional menu (TM) due to factors such as interest, curiosity, convenience, availability, satisfaction, and motivation. McCray et al.(5) and Maunder et al. (6) conducted surveys regarding patient preferences for menu ordering systems. They observed that a significant proportion of patients preferred the eBMOS to the TM in both studies, with percentages of 84% vs. 16% and 80% vs. 15%, respectively.

Since its inception in 1982, a general hospital in Taipei, Taiwan, has been at the forefront of healthcare institutions by implementing an electronic ordering system for patient meals. In this system, dietitians designed cycle menus based on physicians' diet prescriptions. The electronic ordering system offers an array of options, including staple foods such as rice, porridge, steamed buns, and mixed grain rice as well as dietary avoidance of pork, beef, chicken, seafood, dairy, and sweets. Nurses assist patients in making their selections, subsequently transmitting these choices to the nutrition department for meal preparation.

Despite these strengths, the system has notable limitations. It lacks the capacity to display detailed menu contents or provide diverse meal choices, and it does not allow patients to make autonomous dish selections. In recent years, the hospital has faced challenges related to a shortage of nursing staff and kitchen aides. Therefore, addressing these shortcomings and implementing a more user-friendly system that grants patients greater autonomy in choosing from a diverse array of meal options is imperative.

This project aims to design a web-based meal ordering platform for patients and dietitians in partnership with nurses to provide a diverse selection of meals for patients on non-therapeutic diets and eventually to increase patient satisfaction and meal ordering.

MATERIALS AND METHODS

The innovative meal ordering system (iMOS) is created by dietitians to allow patients taking non-therapeutic diets, such as regular, soft, pediatric, and tocolytic diets, to place diverse meal orders by themselves, as well as enables nurses to place meal orders based on the physician's diet prescriptions.

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The iMOS has been developed with two distinct meal-ordering models. The first model is to order traditional meals, comprising three daily meals and adhering to the cycle menu. The second model offers diverse meal choices based on the patient's preferences, such as stew dishes, light meals, noodle sets, and other culinary options. Orders for both models can be placed by nurses, patients, or caregivers, as illustrated in Photo 1.

Patient satisfaction is evaluated via a comprehensive questionnaire. A 5-point Likert scale is used to assess the quality of the hospital's food service. The survey was conducted biennially between July 2016 and 2022, excluding patients in the intensive care unit and psychological wards. All inpatients on non-therapeutic diets were surveyed during data collection periods. The patients or their caregivers answered the survey questionnaire.

The statistical analysis methods to analyze the data obtained from patient satisfaction surveys and meal order rates, including descriptive statistics, chi-square test, t-test, and ANOVA, were performed using statistical software packages of SPSS.

Photo 1. Diverse meals for patient selection

RESULTS

The iMOS provides flexibility in terms of devices for meal ordering. Patients or caregivers can place meal orders using their own electronic devices, including smartphones, pads, or monitors at the nursing station, and nurses operate the system using computers in the nurse station or on mobile nursing carts, as depicted in Figure 1.

To promote iMOS, social media by LINE accounts and instructional videos are developed to guide patients using the website for ordering meals via the hospital's WiFi network. The nursing station's notice board displays the QR code for the LINE account, as illustrated in Photo 2.

A total of seven instruction videos are developed, guiding patients on meal selection, WiFi connectivity, adding food items, recipe selection, meal set choices, a la carte ordering, and bill checking (Photo 3). In addition, diverse meal options are made available for guest trays. The menu for the iMOS is also featured on the LINE accounts.

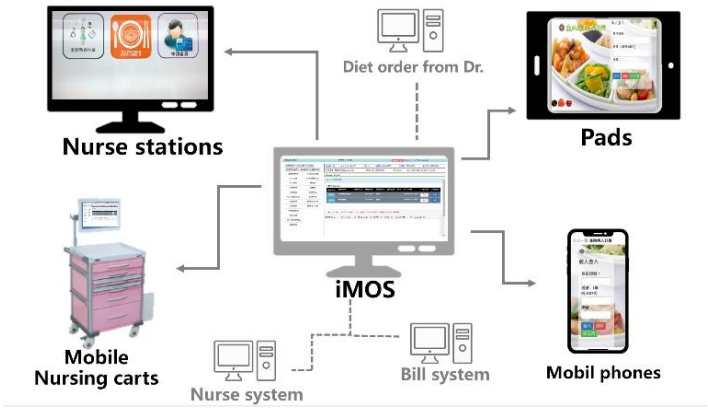

Fig 1. Meal order devices

Photo 2. LINE QR code for meal ordering at the nurses' station

Photo 3. Seven instruction videos for meal-ordering operations on the LINE

Table 1. Characteristics of participants in the patient satisfaction survey

Variables \ Years		2016	2018	2020	2022	*p*
		Pre- iMOS	Post-iMOS			
Total n=1298		33.8%	66.2%			
Sex	male	240 (54.7) [a]	176 (59.5) [a]	230 (70.1) [b]	122 (51.9) [a]	<.001
	female	199 (45.3) [a]	120 (40.5) [a]	98 (29.9) [b]	113 (48.1) [a]	
Age	<=29	21 (4.8) [a]	30 (10.1) [b]	16 (4.9) [ab]	17 (7.2) [ab]	<.05
	30-49	81 (18.5) [a]	59 (20.0) [a]	50 (15.2) [a]	38 (16.2) [a]	
	50-69	199 (45.3)	130 (43.9)	145 (44.2)	111 (47.2)	
	>=70	138 (31.4)	77 (26.0)	117 (35.7)	69 (29.4)	
Education	Primary school	110 (25.1)	52 (17.6)	72 (22.0)	52 (22.1)	<.05
	Junior and High school	195 (44.1)	114 (38.5)	142 (43.2)	104 (44.3)	
	College and University	134 (30.5) [a]	130 (43.9) [b]	114 (34.8) [ab]	79 (33.6) [ab]	
Participants	Patient	368 (83.8) [a]	284 (95.9) [b]	265 (80.8) [a]	194 (82.6) [a]	<.001
	Relatives	68 (15.5) [a]	10 (3.4) [b]	47 (14.3) [a]	36 (15.3) [a]	
	Caregiver	3 (0.7) [a]	2 (0.7) [a]	16 (4.9) [b]	5 (2.1) [ab]	

Data presented by n(%), 2016 (n=439), 2018 (n=296), 2020 (n=328), 2022 (n=235)
Chi-square was used by analyzed data and significantly different marked by [ab] (p<.05)

The patient satisfaction survey involved 439 patients in 2016, 296 patients in 2018, 328 patients in 2020, and 235 patients in 2022. The demographic characteristics of these patients are summarized in Table 1.

There is a significant improvement in flavor, presentation, and satisfaction of non-therapeutic diet order patients after iMOS implementation (Table 2). Compared with pre-iMOS (2016), the flavor, presentation, and satisfaction ratings in the post-iMOS period (2018, 2020, and 2022) exhibited a significant increase. (P<0.001)

Table 3 reveals a significant difference in flavor and satisfaction with age but not in presentation after implementing the iMOS system. Patients aged between 30 and 49 exhibit significantly lower scores of flavor and satisfaction than other age groups.

Table 4 displays the diverse meal order rate of 7.3% in 2017, 13.2% in 2018, 13.8% in 2019, 15.9% in 2020, 19.1% in 2021, and 18.6% in 2022. The results suggest an increasing trend from 2017 to 2022.

Table 2. Comparison between Pre and Post-iMOS

Years	Variables	Flavor Mean (SD)	*p*	Presentation Mean (SD)	*p*	Satisfaction Mean (SD)	*p*
2016 vs 2018	2016	3.7 (0.87)		3.9 (0.90)		4.0 (0.72)	
	2018	4.2 (0.82)***		4.5 (0.68)***		4.4 (0.71)***	
2016 vs 2020	2016	3.7 (0.87)	<.001	3.9 (0.90)	<.001	4.0 (0.72)	<.001
	2020	4.0 (0.75)***		4.3 (0.73)***		4.3 (0.58)***	
2016 vs 2022	2016	3.7 (0.87)		3.9 (0.90)		4.0 (0.72)	
	2022	4.5 (0.68)***		4.7 (0.52)***		4.5 (0.74)***	
Pre vs Post	2016	3.7 (0.87)	<.001	3.9 (0.90)	<.001	4.0 (0.72)	<.001
	2018-2022	4.3 (0.80)***		4.5 (0.72)***		4.3 (0.71)***	

Data presented by Mean (SD), 2016 (n=439), 2018 (n=296), 2020 (n=328), 2022 (n=235)
Paired t-test was used by analyzed data and significantly different marked by ***p<.001

Table 3. Comparison by age group for flavor, presentation, and satisfaction in post-iMOS

Ages	Number	Flavor Mean (SD)	*P*	Presentation Mean (SD)	*P*	Satisfaction Mean (SD)	*P*
<=29	47	4.2 (0.76)^{ab}		4.4 (0.69)		4.3 (0.72)^{ab}	
30-49	97	4.1 (0.96)^{b}		4.4 (0.76)		4.2 (0.78)^{b}	
50-69	333	4.3 (0.78)^{a}	<.005	4.5 (0.70)	0.149	4.4 (0.71)^{a}	<.001
>=70	198	4.4 (0.73)^{a}		4.5 (0.68)		4.4 (0.66)^{a}	

Data was presented by Mean (SD), which was analyzed by one-way ANOVA and pointed out the significant difference as "ab" by Tukey post hoc analysis. ($p<0.05$)

Table 4. Diverse meal order rate of the non-therapeutic diet

Years	Diet order numbers from physician's prescription (A)	Meal order numbers from patients (B)	Diverse meal order numbers from patients (C)	Diverse meal order rate (D)=C/B
2017	341822	166831	12146	7.3%
2018	414827	220591	29164	13.2%
2019	387262	216089	29734	13.8%
2020	370335	219852	35001	15.9%
2021	321160	200422	38230	19.1%
2022	321683	211781	39459	18.6%

DISCUSSION

The results confirm that implementing this iMOS has significantly increased the satisfaction of non-therapeutic diet order patients. Other investigators in their studies have also demonstrated that patients perceived greater involvement and information regarding their meal selection decisions, resulting in higher satisfaction (7-11).

Furthermore, this iMOS has progressively increased hospital meal order rates, including diverse meal ordering rates. Roberts et al. (12) have indicated that patients value the flexibility and convenience offered by meal-ordering systems, which enables them to access nutritional information and make informed menu selections. Similarly, Ottrey and Porter (13) have demonstrated that spoken and visual menu systems can help patients have better meal experiences by supporting them in making correct menu selections and delivering a more individualized meal-ordering service. The current project implementing an innovative computerized meal ordering system in hospitals allows patients to make their own meal decisions, resulting in more individualized service and steadily increasing patient meal order rates. However, in 2022, the diverse meal order rate experienced a decline that could be attributed to the severe spread of COVID-19 in Taiwan, which resulted in a shortage of hospital kitchen workers and paused iMOS's diverse meal service for two months.

An interesting finding of this project reveals that younger patients, particularly those aged 30 to 49, exhibit lower levels of satisfaction and flavor than their older counterparts. The younger patients have had ample opportunities to make meal choices before being admitted to the hospital and are proficient in using electronic meal order systems. In this regard, Hussien and Mansour (14) found that younger customers, especially those aged 25-34, were inclined to use food applications, placing a higher value on convenience and control than their older customers, who expressed a greater need for human interaction. As a solution, Hussien and Mansour's study suggests providing a call center with human interaction to encourage older customers to use applications for additional assistance.

The limitation of this project underscored the importance of promoting the iMOS approach to younger patients to inform them of this service in the hospital. Meanwhile, providing online meal ordering assistance to elderly patients could also be a strategy for improving their nutritional status during their hospital stay. With the advancement of technology, the meal ordering system should continuously update the version of the menu selection according to the patient's needs.

Barrington et al. (15) observed a statistically significant rise in mean daily energy and protein intake in patients using a patient-directed eBMOS compared to a TM. Furthermore, McCray et al. (8) discovered that a considerably more significant proportion of patients who used eBMOS fulfilled their estimated energy and protein needs and showed a substantial decline in plate waste compared to the TM. Future research directions may investigate the dietary intake of inpatients in Taiwan who choose from a diverse meal to clarify whether there is a discernible trend of increased daily energy and protein dietary consumption among inpatients who utilize an electronic ordering system for meal selection.

CONCLUSION

Implementing an innovative, patient-centered food service model through a meal ordering system can improve patient satisfaction and increase meal ordering rates. The crucial point of success lies in empowering patients to make diverse meal selections using a convenient device, ultimately enhancing patients' satisfaction and nutrition care.

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REFERENCES

1) Ottrey E, Porter J. Hospital menu interventions: a systematic review of research. Int J Health Care Qual Assur. 29(1):62-74. 2016.
2) Allison SP. Hospital food as treatment. Clin Nutr. 22(2): 113-114. 2003.
3) Dijxhoorn DN, Mortier MJMJ, Van Den Berg MGA, Wanten GJA. The currently available literature on inpatient foodservices: systematic review and critical appraisal. J Acad Nutr Diet. 119(7):1118-1141. 2019.
4) Jamison J, Bednar C, Alford B, Hsueh A. A computerized interactive menu selector system for hospitals. J Am Diet Assoc. 96(10):1046-1047.1996.
5) McCray S, Maunder K, Norris R, Moir J, MacKenzie-Shalders K. Bedside menu ordering system increases energy and protein intake while decreasing plate waste and food costs in hospital patients. Clin Nutr ESPEN. 26, 66-71.2018.
6) Maunder K, Lazarus C, Walton K, Williams P, Ferguson M, Beck E. Energy and protein intake increases with an electronic bedside spoken meal ordering system compared to a paper menu in hospital patients. Clin Nutr ESPEN. 10(4):e134-e139. 2015.
7) Wadden K., Wolf B., and Mayhew A. Traditional

versus room service menu styles for pediatric patients. Canadian Journal of Dietetic Practice and Research 67(2): 92-94. 2006.
8) McCray S., Maunder K., Krikowa R., and MacKenzie-Shalders K.. Room service improves nutritional intake and increases Patient Satisfaction while decreasing food waste and cost. Journal of the Academy of Nutrition and Dietetics 118, no. 2: 284-293. 2018.
9) Elliott E, Mannik L, Goodwin J, et al. Implementation of an electronic spoken menu system at St. Michael's Hospital, Annual Dietitians of Canada National Conference. 2012.
10) Kuperberg K,Caruso A, Dello S, et al. How will a room service delivery system affect dietary intake, food costs, food waste, and Patient Satisfaction in a pediatric hospital? A pilot study, J. Foodserv. 19, 255–261. 2008.
11) Doorduijn AS, van Gameren Y., Vasse E. et al. At your Request® room service dining improves Patient Satisfaction, maintains nutritional status, and offers opportunities to improve intake, Clin. Nutr. 35, 1174–1180. 2016.
12) Roberts S, Marshall A, Gonzalez R., et al. Technology to engage hospitalized patients in their nutrition care: a qualitative. J Hum Nutr Diet 30, 563–573. 2017.
13) Ottrey E, Porter J. Exploring patients' experience of hospital meal-ordering systems. Nursing Standard 31(50):41-51. 2017.
14) Hussien FM, Mansour NM. Factors Affecting Customer Satisfaction towards Mobile Food Ordering Applications (MFOAs). JFTH.17(1):17-35. 2020.
15) Barrington V, Maunder K, Kelaart A. Engaging the Patient: improving dietary intake and meal experience through bedside terminal meal ordering for oncology patients. J Hum Nutr Diet. 31(6):803-809. 2018.

Report

Workshops for Enhancing the Collaboration Skills and Self-efficacy of Japanese Administrative Dietitians

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ABSTRACT *Background and purpose*. We conducted workshops to enhance the collaboration skills and self-efficacy of administrative dietitians working in local governments. This study presents the results of a post-workshop questionnaire administered to the workshop participants, which evaluated the workshop program. *Methods*. Participants of the workshops were asked to answer a reflection sheet about their career. The workshops consisted of lectures and exercises, and participants were asked to respond to questionnaires at the end of the workshop. Free-text descriptions were analyzed using reflexive thematic analysis. *Results*. A total of 61 and 43 administrative dietitians participated in the workshops held in prefectures A and B and prefectures B and C, respectively. Participants in all the workshops expressed their willingness to collaborate with multiple divisions and improve the preconditions for self-efficacy. Participants found satisfaction in reflecting on their work by interacting with other administrative dietitians. *Conclusion*. Workshops similar to ours should be held throughout Japan to promote a nutrition policy that accounts for everyone and achieves sustainable societies.
Keywords: collaboration, self-efficacy, workshop, administrative dietitian, Japan

INTRODUCTION

In Japan, health promotion efforts involve a variety of specialized professionals, including registered dietitians. National and local governments are required to develop these human resources (1). Administrative dietitians in Japan provide nutritional guidance for residents of local governments and work in prefectural offices, public health centers, and municipal health centers. The duties of administrative dietitians vary depending on the organization they work for, but can be organized into the following five categories:1) developing organizational structures, 2) clarifying health and nutrition issues and promoting measures based on the management cycle, 3) promoting measures to prevent the onset and severity of non-commutable diseases, 4) promoting measures to maintain and improve functions necessary for independent social life, and 5) promoting a social environment through food and nutrition (2). Although the work of administrative dietitians varies greatly, the number of administrative dietitians working in a single institution is small. For example, on average, 2.0 dietitians work at a health center established by a prefecture, and 1.1 dietitians work at a municipal health center (3). Therefore, administrative dietitians need to collaborate with a wide variety of stakeholders to maximize the results of adopted measures.

The perception of one's potential to perform a behavior is called self-efficacy; the stronger one's self-efficacy, the more likely one is to perform that behavior. In addition to the four sources of information, Bandura identified the following antecedents of self-efficacy (4) - enactive mastery experience, vicarious experience, verbal persuasion, and physiological-emotional state - the following have been identified: meaningfulness or need for behavior (5, 6), behavioral strategies (7), causal attributions (8), social support (9), and health status (10). Self-efficacy has been shown to increase the probability of achieving a behavior (11), of challenging the targeted behavior, and of achieving the behavior in similar situations (12) and reduce anxiety and fear (13). However, Japanese administrative dietitians working at municipal health

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centers tend to have low self-efficacy (14). Most Japanese administrative dietitians consistently lack confidence in their work, do not know who to talk to about work and resolving problems, and face uncertainty about their future (14). The competencies and skills necessary for administrative dietitians to perform their work have been indicated (15). Increasing the self-efficacy of administrative dietitians may be crucial for acquiring and utilizing these competencies and skills.

In Japan, workshops for administrative dietitians have been conducted by the national and local governments, professional associations such as the Japan Dietetic Association and the Japanese Association of Public Health Center Registered Dietitians, and research institutions such as the National Institute of Public Health. Administrative dietitians working in municipal health centers reported that they did not have a high sense of self-efficacy in carrying out their work. However, few workshops have been conducted with the aim of improving collaboration with diverse stakeholders and enhancing self-efficacy.

Our study examined the current conditions of Japanese administrative dietitians and reviewed existing human resource development for them. Based on our research, we designed a plan for developing human resources for Japanese administrative dietitians. Therefore, we conducted workshops to enhance the collaboration skills and self-efficacy of administrative dietitians working in local governments. This study presents the results of a post-workshop questionnaire administered to workshop participants, which evaluated the workshop program.

MATERIALS AND METHODS

1. Workshops aimed at enhancing collaboration skills

Workshops aimed at enhancing the skills to collaborate with diverse stakeholders were held in Prefecture A in September 2022 and Prefecture B in November 2022, in collaboration with prefectural staff.

Participants

The prefectural staff recruited administrative dietitians from the prefecture for both workshops. A total of 24 and 37 prefectural or municipal administrative dietitians participated in the workshops conducted in Prefectures A and B, respectively.

Programs

Prior to the workshops, participants were asked to fill out a "reflection sheet (similar to a lifeline chart, a sheet used to track changes in happiness (fulfillment) from the time of employment to the present, including affiliation, position, major accomplishments, efforts and achievements focused on, competencies acquired, milestones and impressions)." Additionally, they were asked to note their "daily concerns and issues in working," and "issues and daily thoughts regarding human resource development for administrative dietitians in their organizations," and to bring these reports to the workshop.

The workshops consisted of lectures on practical examples and collaboration skills, and exercises with cases that required collaboration with diverse stakeholders. The contents of the exercises were determined by the situation in which the workshops were held and the organizations to which the workshop participants belonged. The schedule for the workshops held in Prefectures A and B is presented in Table 1.

Table 1. The timetable of the workshop for enhancing collaboration skills

Time	Contents	Lecturer
10:35~11:05	Lecture 1: Our research findings, roles of mid-career workers, and what they need to learn	University faculty
11:05~11:50	Lecture 2-1: How to build a strategy for administrative dietitians: practical "strategic devices" for mainstreaming nutrition.	Nutrition technical officer of the Ministry of Health, Labour, and Welfare
11:50~12:00	Lecture 2-2: How to build a strategy for administrative dietitians: How to proceed with policy-making, which I learned while on secondment at the Ministry of Health, Labour, and Welfare.	Nutrition technical officer of the Ministry of Health, Labour, and Welfare
13:00~13:40	Lecture 3: Organization and work practices	University faculty
13:40~14:50	Exercise 1: Issue clarification and negotiation skill	University faculty
15:00~16:00	Exercise 2: Dietitians in the organization	Administrative dietitian of the prefecture
16:00~16:25	Encouragement and Summary	All staff and participants

The workshops conducted in prefectures A and B featured identical lectures. Lecture 1 outlined the introduction to the workshop. The 30-minute lecture explained the positioning of the workshop, our research findings for the development of training programs for public health dietitians working in local governments, the roles of mid-career administrative dietitians (more than ten years of work experience), and what administrative dietitians should acquire during and after the mid-career stage. Lecture 2 consisted of two parts. The first section presented examples of the practice of cooperation and

collaboration with various stakeholders. The lecturer explained the actual activities and their background by the nutrition technical officer of the Ministry of Health, Labour and Welfare (MHLW), including 1) how to formulate strategies, 2) the role and significance of the administrative dietitians (purpose), 3) the mainstreaming of nutrition implemented at the MHLW, by illustrating the creation of healthy and sustainable food environments with an example (16), and 3) useful ideas such as the outside-in and inside-out approach, value promotion, and mindset. The second section featured a lecture from the technical officer seconded from the prefecture to the MHLW, who talked about her experiences involving policymaking at the MHLW. We included this lecture as we believed she could be a role model for the workshop participants. Lecture 3 was a 40-minute lecture on career management, clarifying objectives, effective communication skills for mid-career staff, and how to negotiate, which served as an introduction to collaboration skills.

In the workshop held in Prefecture A, the groups were initially divided according to the organization in which they worked and further divided so that the organization they worked for was in the same neighborhood. In the workshop held in Prefecture B, the groups were divided according to the region of the organization such that administrative dietitians from the prefecture and administrative dietitians from the municipality were mixed.

Although the main theme in exercise 1 was common, the specific content was changed according to the situation of the location where the workshop was held. Exercise 1 of the workshop conducted in Prefecture A consisted of 55 minutes of group work using SWOT analysis and a 3-minute presentation by each group on the integrated implementation of health services for the elderly (a group consisting of administrative dietitians from municipalities) or the development of a disaster preparedness system for food service facilities (a group consisting of administrative dietitians from the prefecture or city with a public health center). SWOT analysis is a strategic planning and strategic management technique used to help a person or organization identify Strengths, Weaknesses, Opportunities, and Threats related to business competition or project planning.

In 2018, the basic policy on economic and fiscal management and reforms stated that the government would consider structures to be implemented in an integrated manner by municipalities in partnership with prefectures and others. Such initiatives include preventing the need for long-term care and countermeasures against frailty focused mainly on venues frequented by elderly people, the prevention of illnesses like lifestyle-related diseases preventing said illnesses from increasing in severity and supporting people's participation in work and society. It will also apply incentives in aiming to eliminate the regional disparities in the length of healthy lifespans (16). Based on this policy, municipalities implemented integrated health services for older adults. As there are multiple laws and different departments in charge of each municipality, implementation tends to be segregated. Although medical specialists coordinate the entire program and prepare laws for collaboration, these policies must be implemented in cooperation with medical insurance personnel, nursing care insurance personnel, and medical institutions.

One of the duties of administrative dietitians working at public health centers in prefectures or cities with public health centers is to provide guidance and support based on monitoring and evaluating nutritional management conditions at specified food service facilities (2). Health crisis management duties related to specific food service facilities managed by public health centers were announced by the MHLW (18). According to these guidelines, nutritionally balanced meals should be provided safely even in disaster situations. Therefore, such facilities should be prepared for disasters at all times and should ensure that they are able to provide help during emergencies. Currently, there is a need for a practical disaster support system in which public health center dietitians play a coordinating role in health crisis management for their communities, and for measures to strengthen their collaboration skills.

Exercise 1 of the workshop conducted in Prefecture B consisted of 55-minute group work and 3-minute presentations by each group, in which participants considered internal and external environmental issues in promoting the creation of a food environment in the region using SWOT analysis. The creation of a food environment requires cooperation and collaboration not only between prefectural and municipal health and sanitation departments but also among a wide range of food-related businesses, from food production to distribution and sales (16).

Exercise 2 was identical in the two workshops. The exercise consisted of 40 minutes of group work and 3-5 minutes of presentations by each group on three points: what they thought after listening to the lectures, issues, and solutions, and what they "can do" and "want to do" from tomorrow. After a summary and encouragement session between the lecturers and all participants, the workshop concluded.

Questionnaire survey

A self-administered questionnaire was administered at the end of the workshops. The survey included the following information: organization, age, years of experience in community health, years of experience as a dietitian, understanding of and comments on each lecture and exercise (free text), reasons for attending the training, results of attending the workshop, and what was impressive about the

workshop (free text).

Survey items other than the free-text responses were calculated. Free-text descriptions were analyzed using reflexive thematic analysis (17). The reflexive thematic analysis consisted of the following six recursive stages: 1) familiarization with the data, 2) initial coding, 3) generation of the first theme, 4) review and development of the theme, 5) refinement and naming of the theme, and 6) writing. Specifically, the first author read the free-text descriptions of the data (Stage 1) and generated the codes (Stage 2). The codes were then aggregated into subcategories of potential semantic patterns, which were further aggregated into categories (Stage 3). The relationships between the categories and their conformity to the presupposed story were subsequently examined (Stage 4), and the scope and content of the themes were refined (Stage 5).

The survey completed by the participants included free text, which was divided into sentences that could have several meanings in the analysis, which were subsequently converted into data. The unit of analysis for this study was the text, which was structured by deleting unnecessary words, generalizing, and consolidating the writing style, and supplementing explanations. The subcategories were created by collectively classifying and naming them. A subcategory is the smallest unit of data that can be analyzed and has the potential to be grouped into a single category. A category is the largest unit that can be analyzed, with the subcategories grouped together and given appropriate names. Categories and subcategories were added to the above procedure and the frequencies were noted.

At the end of the workshop, written and oral explanations regarding the purpose of the study, voluntary participation and cooperation for the study, appropriate handling of data, and publication of research results were provided. Responding to the questionnaire was deemed as informed consent. This study was approved by the Ethics Committee of Osaka Metropolitan University (application number 22–29; approved 25 July 2022). The study complied with the code of ethics of the World Medical Association (Helsinki Declaration).

2. Workshops for enhancing self-efficacy

Workshops for enhancing self-efficacy were held in Prefecture B in November 2022 and Prefecture C in December 2022, in collaboration with prefectural staff.

Participants

For both workshops, prefectural staff recruited administrative dietitians from the prefecture. A total of 30 prefectural or municipal administrative dietitians participated in the workshops held in Prefecture B, and 13 prefectural administrative dietitians participated in the training session held in Prefecture C.

Programs

The schedule for the workshops is presented in Table 2. Prior to the workshops, participants were asked to fill out a "reflection sheet same as the workshop 1 from the time of employment to the present, including affiliation, position, major accomplishments, efforts and achievements focused on, competencies acquired, milestones and impressions)." Additionally, they were asked to note their "daily concerns and issues in working," and "issues and daily thoughts regarding human resource development for administrative dietitians in their organizations," and to bring these reports to the workshop.

Table 2. The timetable of the workshop to enhance self-efficacy

Time	Contents	Lecturer
10:35~10:45	Introduction: Human resource development in the prefecture	Administrative dietitian of the prefecture
10:45~11:15	Lecture 1: New training program for administrative dietitians: what should be learned based on their career ladder	University faculty
11:15~12:15	Group work 1: Problems in daily work	Administrative dietitian of the prefecture
13:15~14:25	Group work 2: Reflection on daily work	Administrative dietitian of the prefecture
14:25~15:10	Lecture 2: Thinking about how to draw a career plan to reach your goals	University faculty
15:10~16:20	Group work 3: What kind of work do you want to do in the future?	Administrative dietitian of the prefecture
16:20~16:30	Encouragement and Summary	All staff and participants

The workshop comprised two lectures and three group sessions. Lecture 1 primarily introduced the training, the image of administrative dietitians from the perspective of themselves and other professionals, and the competencies required for administrative dieticians according to their career. Lecture 2 lasted 45 minutes and focused on the need to improve prior requirements to increase self-efficacy and the need for someone to consult with in order to improve and respond to the environment to prevent lowering self-efficacy.

The workgroups were arranged such that the region

of the organizations where they worked was a neighboring municipality, and at least one administrative dietitian from mid-career onward was assigned to each group, who served as the facilitator of group work. Group Work 1 was a 60-minute group work session on the challenges encountered during daily work. Group Work 2 involved reflecting on their work. Group Work 3 focused on how they wanted to work henceforth.

Questionnaire survey

The questionnaire survey was conducted as shown in Section 1.3.

RESULTS

1. Workshops aimed at enhancing collaboration skills

Questionnaires were completed and submitted by all 61 participants. Twenty-one (34%) participants belonged to prefectures, 12 (20%) to cities with health centers, and 28 (46%) to municipalities. Of the participants in the workshops held in prefectures A and B, 40-year-olds were the most common age group, and most of them had over 20 years of experience as dietitians (Table 3).

The understanding of participants of the workshop aimed at enhancing collaboration skills is shown in Table 4.

Table 3. Participants of the workshop to acquire the skill of collaborating with multiple stakeholders (n=61)

Working organization	Prefecture (21, 34%), City with public health centers (12, 20%), Municipality (28, 46%)
Age	20s (9, 15%), 30s (9, 15%), 40s (29, 48%), 50s or over (14, 23%)
Years of experience in community health	≤5 years (19, 31%), 6-10 years (7, 11%), 11-15 years (11, 18%), 16-20 years (11, 18%), >20 years (13, 21%)
Years of experience as a dietitian	≤5 years (9, 15%), 6-10 years (7, 11%), 11-15 years (7, 11%), 16-20 years (10, 16%), >20 years (28, 46%)
Reasons for attending the workshop (multiple responses)	・ Because I wanted to think about my growth and how I want to work in the future during the training (25, 41%) ・ Because I wanted to get some hints for training junior staff and developing my organization's human resource development system (12, 20%) ・ Because I thought that understanding leadership theory and organizational theory was important for policy development (12, 20%) ・ Because the lecturers were attractive (9, 15%) ・ Because I was interested in the "administrative dietitian training program focusing on public health" (6, 10%)
Outcome of attending the workshop (multiple responses)	・ I realized anew the importance of learning and decided to learn more than ever before (37, 61%) ・ I was able to think about my position and role in the organization (36, 59%) ・ I was able to think about how I want to work in the future (31, 51%) ・ My daily worries and anxieties were relieved a little (27, 44%) ・ I found what I "can do" and "want to do" from tomorrow (20, 33%) ・ I was able to better visualize my future growth (11, 18%)

Participants described comments of lecture 1 that application to the workshop and learning; expressing personal intent and removing inhibiting factors for enhancing self-efficacy; recognition of the nutrition department and role compared to other professions; understanding of the workshop content and expectations for our developing program; enhancing self-efficacy and improving skills; collaboration with other professions and skill enhancement; expectation for the evaluation system and the program; and recognition of nutritional skills and expectations for skill development.

Participants described comments of Lecture 2-1 that professional development and strategic thinking: impactful insights and inspiration; broadening perspectives and knowledge; collaboration and interdisciplinary approach; personal growth and motivation; strategic thinking and professional vision; learning opportunity and self-reflection; purpose and collaboration; and empowering vision and skill development.

Participants described comments of Lecture 2-2 that policy enthusiasts; challenges and importance of creating impactful materials; the necessity of a broad range of knowledge and skills beyond nutrition; the significance of incorporating field perspectives; and the essential foundations for personal growth and skill development.

Participants described comments of Lecture 3 and Exercise 1 that impression and motivation; importance of attitude and continuous learning; preparation and practical examples; enhancing negotiation skills; and

collaboration and communication.

Participants described comments of Exercise 2 that mutual support and fresh perspectives; networking and collaboration; learning from different perspectives; personal and professional growth; and building connections and finding encouragement.

Participants described what was impressive about the workshop application and learning; relevance and implementation; and networking and collaboration.

Table 4. Understanding of workshop to acquire the skill of collaborating with multiple stakeholders (n=61)

	Understood well	Understood	Somewhat poorly understood	Not understand at all
Lecture 1: What our research has revealed, roles of mid-career workers, and what they need to learn after mid-career	34 (56%)	26 (43%)	1 (2%)	0 (0%)
Lecture 2-1: How to build a strategy for administrative dietitians: practical "strategic devices" for mainstreaming nutrition.	19 (31%)	38 (62%)	4 (7%)	0 (0%)
Lecture 2-2: How to build a strategy for administrative dietitians: How to proceed with policy-making, which I learned while on secondment at the Ministry of Health, Labour and Welfare.	28 (46%)	33 (54%)	0 (0%)	0 (0%)
Lecture 3: Organization and work practices and Exercise 1: Issue clarification and negotiation skill	35 (57%)	25 (41%)	2 (3%)	0 (0%)
Exercise 2: Dietitians in the organization	30 (49%)	30 (49%)	1 (2%)	0 (0%)

2. Workshops for enhancing self-efficacy

Questionnaires were completed and submitted by all 44 participants. A total of 31 participants participated in the workshop in prefecture B; 7 (23%) belonged to prefectures, 4 (13%) to cities with health centers, and 13 (46%) to municipalities. Of the participants in the workshops held in prefectures B and C, 30-year-olds were the most common age group (Table 5).

According to the answer of outcomes of the workshop, most or all participants answered "yes" or “somewhat yes” to the following question: "Have the workshop relieved any of worries and anxieties in your daily life?" "Have you been able to think about your position and role in the organization?” Have you been able to reflect on your past efforts and deepen your thoughts about your strengths and weaknesses?” Have you been able to think about how you want to work in the future?” “Have you been able to visualize your future growth and development?”, “Do you think the contents of today’s workshop will be useful for the human development of administrative dietitians in your organization?”, “Have you found what you "can do" and "want to do" from tomorrow?” (Table 6)

Table 5. Participants of the workshop for enhancing self-efficacy (n=43)

Working organization	Prefecture (23, 53%), City with public health center (9, 21%)、Municipality (11, 26%)
Age	20s (7, 16%)、30s (12, 28%)、40s (13, 30%)、50s or over(11, 26%)
Years of experience in community health	≤5 years (16, 37%), 6-10 years (6, 14%), 11-15 years (5, 12%), 16-20 years (7, 16%), >20 years (11, 26%)
Years of experience as a dietitian	≤5 years (7, 16%), 6-10 years (10, 23%), 11-15 years (6, 14%), 16-20 years (6, 14%), >20 years (14, 33%)
Reasons for attending the workshop (multiple responses)	・ Because I wanted to think about my growth and how I want to work in the future during the training (28, 65%) ・ Because I wanted to know the role and perspective of the new term and mid-career (18, 42%) ・ Because I was struggling with how to conduct my day-to-day business (15, 35%) ・ Because I was interested in the “administrative dietitians training program focusing on public health (15, 35%)

Table 6. Outcomes of the workshop for enhancing self-efficacy (n=43)

	Yes	More or less yes	More or less no	No
Have the workshop relieved any of worries and anxieties in your daily life?	17 (40%)	23 (53%)	3 (7%)	0 (0%)
Have you been able to think about your position and role in the organization?	18 (42%)	22 (51%)	2 (5%)	1 (3%)
Have you been able to reflect on your past efforts and deepen your thoughts about your strengths and weaknesses?	25 (58%)	18 (42%)	0 (0%)	0 (0%)
Have you been able to think about how you want to work in the future?	17 (40%)	24 (56%)	2 (5%)	0 (0%)
Have you been able to visualize your future growth and development?	6 (14%)	25 (58%)	9 (21%)	1 (3%)
Do you think the contents of today's workshop will be useful for the development of administrative dietitian in your organization? †	12 (28%)	27 (63%)	3 (7%)	0 (0%)
Have you found what you "can do" and "want to do" from tomorrow?	12 (28%)	29 (67%)	2 (5%)	0 (0%)

† One participant did not answer

Participants described comments of the relief provided by the workshop to some of their worries and anxieties in their daily life promoting collaboration and support in individual work settings; empathy and insights from cross-regional dietitians; seeking guidance and techniques for effective work approaches; shared concerns and lightened burdens; encouragement and empowerment through mutual understanding; learning from peers; sharing experiences and challenges; building communication channels for dietitians in different municipalities; discovering solutions and strategies for personal weaknesses; overcoming anxieties through professional networking; strengthening self-perception and problem-solving skills; exploring common worries and fostering supportive connections.

Participants described comments of the idea of contemplating your position and role in the organization has been evident that understanding personal roles and expectations; self-reflection and growth within the organization; recognizing positions and responsibilities; enhancing collaboration and professional development; aligning roles with organizational growth; navigating roles and responsibilities as dietitians; building competencies and strengthening connections; bridging administrative skills and dietitian roles; addressing career gaps and skill development; perspectives and positioning among peers; sharing insights and building a common understanding; embracing challenges and defining roles; strengthening collaboration through effective communication; embracing office support and strengthening competencies; assessing competencies; and planning for growth.

Participants described comments of reflection on their past efforts and the deepening their thinking about their strengths and weaknesses that finding strengths and weaknesses through group collaboration; examining work objectively using reflection sheets; discovering personal growth through self-reflection; self-assessment for personal improvement; recognizing strengths and weaknesses for career development; enhancing self-awareness for skill development; deepening thoughts through reflection and career sheets; overcoming weaknesses; and embracing strengths through reflection.

Participants described comments of considering their desired approach to work in the future that promoting work-life balance by utilizing information and communication technology and telecommuting, expanding perspectives and career planning through reflection, nurturing junior staff, enhancing the role of dietitians, self-reflection, and clarifying personal aspirations, and exploring expertise and adapting flexibly.

Participants described comments of visualizing their future growth and development building knowledge and expertise; setting goals and visualizing growth; acting and leveraging strengths; continuous improvement and policy advocacy; and exploring future possibilities.

Participants described comments of useful contents of today's workshop for the human development of administrative dietitians in their organization that implementing strategies for self-efficacy and skill enhancement; promoting collaboration and understanding across professions; setting goals and envisioning growth; cultivating teaching roles and career planning; enhancing understanding and collaboration in the workplace;

future growth and career guidance; utilizing training and developing programs; establishing a talent development system; and seeking practical implementation.

Participants described comments of findings on what they can do and want to do from tomorrow's professional development strategies; goal clarity and time management; communication and networking skills; knowledge acquisition and confidence building; long-term planning and policy collaboration; mentorship and career growth; task prioritization and staffing advocacy; effective communication and self-evaluation; leadership development and talent management; excellence in job performance and growth opportunities; career expansion; and educational pursuit.

Participants described what was impressive about the workshop as visionary career planning, balancing responsibilities, skill acquisition for leadership, work-life integration, and long-term goal setting.

DISCUSSION

Based on the responses to the questionnaire, it seems that most of the objectives of the workshops were understood. Reflecting on one's activities seemed particularly effective. Kolb presented an experiential learning model comprising concrete experience, reflective observation, abstract conceptualization, and active experimentation (20). Reflection has great significance as a tool for self-discovery, learning, critical thinking, and interpersonal growth. By engaging in regular reflection, we can gain valuable insights, make better choices, and evolve as individuals. The practice of reflection has been frequently reported in nursing, but not by dietitians (21). The comments described in our workshops suggest that although it is difficult for Japanese administrative dietitians to reflect on their work environments, active reflection is necessary.

Nutrition is the process by which living organisms receive food necessary for their growth and health. Food is provided by various groups, including businesses engaged in the manufacturing, processing, distribution, or sale of foods, or the provision of meals. Nutrition is a critical component of health and development. Better nutrition is related to improved infant, child, and maternal health; stronger immune systems; safer pregnancy and childbirth; lower risk of non-communicable disease; and longevity. A person in one department or team should be ready for active involvement and contribution to another department or team, which is crucial for fostering cooperation and collaboration within an organization. The benefits of contributing to other departments include knowledge and experience sharing, understanding the organization's overall vision, career growth, and expanded opportunities. The Ottawa Charter noted that health promotion extends beyond healthcare, and places health on the agenda of policymakers in all sectors and at all levels, directing them to be aware of the health consequences of their decisions and to accept their responsibilities for health (22). Nutrition is linked to this in several ways. Administrative dietitians are not only required to collaborate with such organizations and professions but also can collaborate with them.

The MHLW has provided pioneering examples of multi-departmental and multi-professional collaboration in its annual report on the progress of nutrition improvement efforts in Japan based on the Tokyo Nutrition Summit 2021 (23). Human resource development in the basic policy of Healthy Japan 21 (third term) also indicates that support should be provided to promote multidisciplinary collaboration (1). As the importance of multidisciplinary collaboration has been recognized, skill-building for collaboration is needed.

Administrative dietitians must not only collaborate with other professions and organizations (24) but also with dietitians in other organizations and with other administrative dietitians. In all workshops, participants stated that it was good to interact with other administrative dietitians. This is because an organization rarely has more than one dietitian (3), and dietitians find few opportunities to interact with other dietitians in the same administrative area during daily work. Consultations related to the work of municipal administrative dietitians are usually restricted to the workplace, and although health centers are not utilized frequently, they could possibly strengthen cooperation and support services with municipal health center dietitians (25). One of the duties of prefectural administrative dietitians is to provide support to municipalities within their jurisdiction (2). To dispel the sense of isolation among administrative dietitians, a system of mutual collaboration, led by prefectural administrative dietitians, should be established.

The basic policy of Healthy Japan 21 (third term) calls for the comprehensive promotion of national health through the development of health promotion that leaves no one behind, and the promotion of more effective measures toward the realization of a sustainable society in which all people can live healthy and enriched lives (1). At the Tokyo Nutrition Summit, the Japanese government committed to developing a nutrition policy that leaves no one behind (26). Accounting for all individuals, especially administrative dietitians, who are key players in nutrition policy is necessary for achieving this. Both types of workshops were conducted in only two prefectures; however, it is hoped that they will also be conducted in other prefectures.

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REFERENCES

1. Ministry of Health, Labour and Welfare: Revision of a basic direction for comprehensive implementation of national health promotion. https://www.mhlw.go.jp/content/001102474.pdf
2. Ministry of Health, Labour and Welfare: Basic guidelines for health promotion and improvements of nutrition and dietary habits by administrative dietitians in the community. https://www.mhlw.go.jp/content/10900000/000637215.pdf
3. Ministry of Health, Labour and Welfare: Overview of regional health and health promotion project reports in 2019. https://www.mhlw.go.jp/toukei/saikin/hw/c-hoken/19/dl/R01gaikyo.pdf
4. Self-Efficacy: The Exercise of Control (Bandura A). 1997. W.H. Freeman.
5. Minouchi Y. The effect of perceived task importance on the generality of self-efficacy. Jpn J Educ Physiol 41: 57‐63. 1993.
6. Fujiu H. A study on the relationships between kyosyu (hand raising), self-efficacy, outcome-expectancy and outcome value. Jpn J Educ Physiol 39: 92-101. 1991.
7. Ito T. Self-efficacy, casual attribution and learning strategy in an academic achievement situation. Jpn J Educ Physiol 44: 340‐349. 1996.
8. Schunk DH. Ability versus effort attributional feedback: differential effects on self-efficacy and achievement. J Physiol 75: 848-856. 1983.
9. Major B, Cozzarelli C, Sciacchitano AM et al. Perceived social support, self-efficacy, and adjustment to abortion. J Personal Soc Physiol 59: 452-463. 1990.
10. Conn VS. Older adults and exercise: path analysis of self-efficacy related constructs. Nursing Res 47: 180-189. 1998.
11. Bandura A, Schunk DH. Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. J Pers Soc Psychol 41: 586-598. 1981.
12. Bandura A, Cervone D. Self-evaluative and self-efficacy mechanisms governing the motivational effects of goal systems. J Pers Soc Psychol 45: 1017-1028. 1983.
13. Bandura A, Reese L, Adams NE. Microanalysis of action and fear arousal as a function of differential levels of perceived self-efficacy. J Pers Soc Psychol 43: 5-21. 1982.
14. Igarashi M, Yoshida T. Project management self-efficacy and related factors in municipal dietitian. Jpn J Nutr Diet 69: 148–159. 2011.
15. Ishikawa M, Abe K, Yoshiike N, et al. The competencies according to career ladder required for administrative dietitians -summary of on the output from group work activity in training session by public health division of the Japan Dietetic Association-. J Jpn Diet Assoc 58: 726-735. 2015.
16. Ministry of Health, Labour and Welfare: Strategic initiative for a healthy and sustainable food environment. https://sustainable-nutrition.mhlw.go.jp/en
17. Cabinet Office. Basic policy on economic and fiscal management and reform 2018～realizing sustainable economic growth by overcoming the decreasing birth rate and aging population～. https://www5.cao.go.jp/keizai-shimon/kaigi/cabinet/honebuto/2018/2018_basicpolicies_en.pdf
18. Ministry of Health, Labour and Welfare. Guidance and support for nutrition management at specified food service facilities. https://www.mhlw.go.jp/content/10900000/000637208.pdf
19. Campbell KA, Orr E, Durepos P. Reflexive thematic analysis for applied qualitative hearth research. Qual Rep 26: 2011-2028. 2021.
20. Morris TH. Experiential learning–a systematic review and revision of Kolb's model. Interact Learn Environ 28: 1064-1077. 2020.
21. Beam RJ, O'Brien RA, Neal M. Reflective practice enhances public health nurse implementation of nurse-family partnership. Public Health Nurs. 27: 131-139. 2010.
22. World Health Organization. The Ottawa Charter for Health promotion. https://www.paho.org/en/documents/ottawa-charter-health-promotion
23. Ministry of Health, Labour and Welfare. Nutrition policy in Japan to leave no one behind - for achieving sustainable societies - pioneering examples of multi-sectoral collaboration in 2023. https://www.mhlw.go.jp/content/001092503.pdf
24. Sudo N, Sawaguchi M, Yoshiike N. Nationwide survey on municipalities' preparedness for provision of food and nutrition assistance and technical support from public health centers after disasters. Jpn J Public Health. 58: 895-902. 2011.
25. Yoshita K. Investigation and utilization of data through cooperation between prefectures and cities. J Natl Inst Public Heath 61: 424-429. 2012.
26. Ministry of Health, Labour and Welfare. Nutrition policy in Japan to leave no one behind - for achieving sustainable societies - https://www.mhlw.go.jp/content/000847743.pdf

Note

Data Analytics to Explore the Influence of Nutritional Factors on Adverse Reactions after Vaccination

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ABSTRACT *Background and purpose.* In order to contribute to the elucidation of nutritional approaches to reduce adverse reactions to vaccines, this study examined the influence of nutritional factors on the occurrence of adverse reactions after mRNA-1273 vaccination using a data analysis method based on a free, open-source application that is easy to use in clinical practice. *Methods.* We decided to use a workstation to process a large amount of data, and used MySQL to create a database of data on side effects that occurred after vaccination and nutritional intake, and used R to perform data extraction and statistical analysis. *Results and conclusion.* The results suggest that the intake of some nutrients (ash, VB1, VB2, VB6, VC, and sodium equivalents) over the past month or two, as estimated by the Food Frequency Questionnaire (FFQ), may be somehow related to the development of adverse effects, that thinness may promote the development of adverse effects, and that low physical activity level (PAL) may promote the development of adverse effects. However, it is difficult to rationally understand the mechanism by which nutrients affect the occurrence of adverse effects from this survey alone, and more detailed collection and analysis of large amounts of data using survey techniques that can accurately determine nutrient intake is needed in order to gather clinical knowledge in the future. As a research technique for this purpose, the analysis of large amounts of data using data analytics is expected to become increasingly important in the future.

Key words: mRNA-1273, Adverse Reactions, Nutritional Factors、Food Frequency Questionnaire (FFQ), Data Analytics

INTRODUCTION

Against the backdrop of the rapid development of computer networks, digital transformation has rapidly spread throughout society and has also penetrated the field of academic research.

Digital research technologies such as data science and data analytics are beginning to be introduced into research on diet therapy, nutritional intake, and food safety, which are central themes in nutritional science. Technology for monitoring an individual's physical condition using biometric sensors, smart wearable devices, and mobile applications (1) is already well established, and in the field of nutrition research, some companies are now offering online services (2) that use AI engines to automatically calculate nutritional intake from food image processing. Nutritional research and its clinical applications, which deal with a large number of nutrient intakes, require efforts that make full use of the analysis of vast amounts of data, and it is expected that so-called data science and data analytics methods will be increasingly used. However, in the field of nutrition, the use of data analytics and data science methods has lagged behind, and data analytics techniques that can be easily used in clinical settings have not yet been established. Therefore, this time, we attempted a clinical nutrition research design using data analytical methods, using as an example the analysis of a large amount of data on side effects and nutrition of female students collected during mass vaccination of mRNA-1273 vaccine conducted at Nishikyushu University.

In response to the urgent global need for a safe and effective vaccine to prevent coronavirus infection 2019 (COVID-19), declared a pandemic by the World Health Organization (WHO) on March 11, 2020, and to protect people at high risk of complications, a mRNA vaccine(mRNA-1273 and BNT162b2) was developed. In Japan, a university-led mass vaccination program was implemented from 2021 to 2022 to promote emergency vaccination with these COVID-19 vaccines. This mass vaccination program was also carried out at Nishi-Kyushu University, where the authors work, and used the mRNA-1273 vaccine (3, 4, 5), which is known to be highly effective in preventing infection and severity of COVID-19. This mRNA-1273 vaccine produces a high frequency of mild adverse reactions after vaccination (6), but the adverse

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reactions are, for the most part, mild and temporary (4,7). However, since a certain number of people are hesitant to be vaccinated because of adverse reactions, it is assumed that reducing adverse reactions will be an issue for vaccine dissemination in situations where sufficient vaccine is available. Since adverse reactions are physiological immune responses of the human body, nutritional approaches may be effective in reducing adverse reactions.

Therefore, in this study, in order to help elucidate nutritional approaches to reduce vaccine side effects, this study examined the effects of nutritional factors on the occurrence of adverse reactions after mRNA-1273 vaccination by means of a data analytics approach using a free, open-source application that is easy to use in clinical practice.

MATERIALS AND METHODS

In this mass vaccination program, known as the university-based vaccination program, vaccinations were administered to students, faculty, staff, and residents of the surrounding area at vaccination sites set up on the university campus. The subjects of this study were 1452 female university students who received two doses of mRNA-1273 vaccine through Nishikyushu University's university-based vaccination program.. After the first vaccination, a second vaccination was administered 28 days apart. In this study, we conducted a questionnaire survey to examine the frequency of adverse reactions and nutritional intake among students who had completed the second vaccination of the mRNA-1273 vaccine. The questionnaire was anonymous, and responses were requested online using Microsoft Forms (Microsoft Co. Ltd.). The questionnaire was conducted two weeks after the second vaccination day. The survey on adverse effects used the same items as the "Survey on Health Status after Ingestion of the New Corona Vaccine (Cohort Survey)" conducted by Juntendo University (8). There are 8 questions, and if there are symptoms of adverse reactions, the answer method is to select the details of the symptoms and the period during which the symptoms were observed from the drop-down list. The survey on nutritional status was conducted by means of the Food Frequency Questionnaire (FFQ), which estimates energy and nutrient intakes over the past month or two based on 30 food groups and 10 cooking methods. The FFQ response results were analyzed using FFQ analysis application software (FFQg Ver. 6, Kenpakusha Co. Ltd.), and nutritional intake was calculated.

Data from 690 university students who responded to both a survey on adverse reactions and a survey on nutritional status were confirmed, and data from 459 students whose responses were all deemed valid was analyzed using a series of data analytics methods. We attempted analysis using several laptops and personal computers so that they could be easily operated in clinical settings, but none of them had the processing power to handle the large amount of data we had, so we decided to use a workstation (Processor ; Intel Core i9-3.00GHz 64bit, RAM: 256 GB, SSD: 20TB) was purchased and used for analysis. The results of adverse reactions and dietary records were cleansed, personal data were divided into separate tables, and each data was stored in a database with ID as the primary key. MySQL 8.0.33 was used as the relational database management system (RDBMS). Information on the presence or absence of adverse reactions and nutritional intake status was extracted from the database, and statistical analysis was performed using R Ver 4.3.1 (9). Fisher's exact test (Fisher's exact probability test) and Welch's t-test (difference of means test) were used for statistical analysis.

This study was conducted in accordance with the Declaration of Helsinki (1964) (Tokyo revision (1975) and Venice revision (1983)) and with the approval of the Ethics Committee of the University of Western Kyushu (No. 21YBP04).

RESULTS

The frequency of occurrence of adverse reactions after the first and second vaccination with mRNA-1273 vaccine is shown in Table 1. The frequency of systemic side effects increased 1.8-fold from 39% after the first vaccination to 72% after the second vaccination. In particular, those who complained of fever after the second vaccination increased 2.5 times more than after the first vaccination. The frequency of adverse reactions at the vaccination site was high, 77% after the first vaccination and 75% after the second vaccination, with no significant difference between the first and second vaccinations. A particularly high number of people complained of pain after both the first and second vaccinations, reaching around 70%. Next, about half of the respondents complained of a warm sensation, and redness and swelling were reported by about 30%.

The relationship between the occurrence of adverse effects after the first and second doses of mRNA-1273 vaccine and nutrient intake during the past month or two, as estimated by the FFQ, is shown in Table 2. After the first vaccination, there was no clear difference in nutrient intake between those who developed systemic or vaccination site adverse reactions and those who did not (Table 2-a). Furthermore, even after the second vaccination, no difference in nutrient intake was observed between those who developed systemic adverse reactions and those who did not. However, there was a statistically significant difference of around 10% in the intake of many nutrients such as ash, VB1, VB2, VB6, VC, and Sodium Equivalent between those who developed adverse effects at the intake site and those who did not (Table 2-b).

Table 1　Frequency of occurrence of adverse reactions after first and second vaccination with mRNA-1273 vaccine in female university students

Number of female university students who received mRNA-1273 vaccine: n=459			
		Number (percentage) of who complained of adverse reactions after vaccination	
		After the 1st vaccination	After the 2nd vaccination
Persons who complained of systemic symptoms		179 (39.0%)	330 (71.9%)
	Fever	125 (27.2%)	312 (68.0%)
	Headache	111 (24.2%)	248 (54.0%)
	Fatigue	150 (32.7%)	297 (64.7%)
	Snot	5 (1.1%)	22 (4.8%)
Persons who complained of injection site symptoms		352 (76.7%)	344 (74.9%)
	Redness	119 (25.9%)	121 (26.4%)
	Swelling	133 (29.0%)	148 (32.2%)
	Induration	52 (11.3%)	56 (12.2%)
	Pain	335 (73.0%)	316 (68.8%)
	Warmth	179 (39.0%)	287 (62.5%)
	Itch	106 (23.1%)	107 (23.3%)

Table 2 Relationship between incidence of adverse reactions and nutritional intake after the first and second doses of mRNA-1273 vaccine (n=459)

(a) After the 1st vaccination

	Systemic symptoms					Injection site symptoms				
	With symptoms		No symptoms		p value	With symptoms		No symptoms		p value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Energy (kcal)	1731	688	1674	676	0.375	1710	702	1652	606	0.411
Protein (g)	58.7	24.2	56.9	24.7	0.435	58.0	24.9	56.2	23.1	0.502
Fat (g)	60.9	29.3	59.0	27.4	0.472	60.7	29.2	56.5	24.2	0.132
Carbohydrate (g)	229	90.6	221	90.8	0.381	225	92.8	222	84.0	0.778
cholesterol (mg)	297	131	282	151	0.264	290	147	278	132	0.425
ash (g)	13.0	5.5	12.6	5.5	0.446	13.0	5.80	12.0	4.4	0.069
RAE #	359	174	346	187	0.434	356	187	333	166	0.211
VD (μg)	3.9	2.5	3.6	2.4	0.125	3.6	2.4	3.9	2.5	0.394
VB_1 (mg)	0.92	0.42	0.89	0.39	0.464	0.91	0.41	0.87	0.38	0.332
VB_2 (mg)	0.99	0.40	0.95	0.41	0.351	0.98	0.42	0.92	0.36	0.190
Niacin (mg)	12.7	6.4	12.3	6.3	0.463	12.5	6.4	12.3	6.1	0.735
Niacin Equivalent (mg)	24.5	11.1	23.7	11.1	0.463	24.2	11.3	23.5	10.6	0.534
VB_6 (mg)	0.91	0.41	0.88	0.42	0.497	0.90	0.42	0.86	0.38	0.301
VB_{12} (μg)	4.05	2.53	3.79	2.55	0.277	3.87	2.56	3.95	2.51	0.766
VC (mg)	56	31	54	29	0.398	56	31	51	26	0.134
Sodium Equivalent (g)	7.4	3.4	7.2	3.4	0.434	7.4	3.6	6.9	2.8	0.144

(b) After the 2nd vaccination

	Systemic symptoms					Injection site symptoms				
	With symptoms		No symptoms		p value	With symptoms		No symptoms		p value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Energy (kcal)	1687	629	1720	801	0.678	1715	707	1638	593	0.246
Protein (g)	57.3	22.5	58.2	28.9	0.763	58.5	25.2	54.9	21.9	0.141
Fat (g)	59.8	26.4	59.6	32.3	0.970	61.0	29.2	56.1	24.5	0.081
Carbohydrate (g)	222	84.3	229	106	0.483	225	94.1	221	80.1	0.595
cholesterol (mg)	288	135	286	164	0.919	293	147	272	131	0.162
ash (g)	12.6	4.8	13.1	7.0	0.455	13.0	5.80	11.8	4.35	0.018 ※
RAE #	353	172	346	205	0.735	360	189	325	159	0.056
VD (μg)	3.6	2.2	3.9	3.0	0.235	3.7	2.5	3.7	2.3	0.870
VB_1 (mg)	0.90	0.38	0.91	0.45	0.933	0.99	0.42	0.91	0.35	0.042 ※
VB_2 (mg)	0.97	0.38	0.97	0.47	0.949	0.91	0.43	0.83	0.34	0.047 ※
Niacin (mg)	12.3	5.8	12.8	7.5	0.533	12.6	6.5	11.9	5.6	0.247
Niacin Equivalent (mg)	23.9	10.2	24.5	13.2	0.646	24.4	11.5	22.9	9.8	0.154
VB_6 (mg)	0.89	0.38	0.90	0.50	0.778	0.91	0.43	0.83	0.34	0.047 ※
VB_{12} (μg)	3.81	2.22	4.09	3.23	0.368	3.93	2.63	3.75	2.29	0.473
VC (mg)	55	27	54	37	0.961	56	32	50	24	0.017 ※
Sodium Equivalent (g)	7.1	3.0	7.6	4.3	0.258	7.4	2.6	6.8	2.8	0.045 ※

Retinol Activity Equivalent (μg)

Table 3 Crosstabulationtable of frequency of adverse reactions and BMI（Body Mass Index） after the first and second rounds of mRNA-1273 vaccination (n=459)

(a) After the 1st vaccination

Number (percentage) of who complained of adverse reactions after vaccination							
	Systemic symptoms			Injection site symptoms			N
	With symptoms	No symptoms	P value	With symptoms	No symptoms	P value	
BMI＜ 18.5 kg /m^2	28 (42.4%)	38 (57.6%)	0.586	54 (81.8%)	12 (18.2%)	0.346	66
18.5 kg /m^2 ≦ BMI	151 (38.4%)	242 (61.6%)		298 (75.8%)	95 (24.2%)		393
Total	179 (39.0%)	280 (61.0%)		352 (76.7%)	107 (23.3%)		459 (100.0%)

(b) After the 2nd vaccination

Number (percentage) of who complained of adverse reactions after vaccination							
	Systemic symptoms			Injection site symptoms			N
	With symptoms	No symptoms	P value	With symptoms	No symptoms	P value	
BMI＜ 18.5 kg /m^2	57 (86.4%)	9 (13.6%)	0.005 ※※	54 (81.8%)	12 (18.2%)	0.219	66
18.5 kg /m^2 ≦ BMI	273 (69.5%)	120 (30.5%)		290 (73.8%)	103 (23.7%)		393
Total	330 (71.9%)	129 (28.1%)		344 (74.9%)	115 (25.1%)		459 (100.0%)

The effect of Body Mass Index (BMI) on the frequency of adverse effects is shown in Table 3. Since only 3 subjects were judged to be obese based on BMI values, the influence of obesity could not be examined. On the other hand, since those judged to be thinness accounted for more than 14% of the total number of subjects, the incidence of adverse reactions was divided into 2 groups: those who were thinness (BMI < 18.5) and those who were not (BMI ≥ 18.5) and compared between the groups. The results showed no clear difference in BMI between those who developed systemic or vaccination site adverse reactions and those who did not after the first vaccination (Table 3-a). There was also no difference in BMI between those who developed adverse reactions at the vaccination site and those who did not, even after the second vaccination. However, there was a suggested effect of BMI between those who developed systemic side effects and those who did not, with those who were thinness having a significantly higher incidence of systemic side effects than those who were not (Table 3-b).

Table 4 Frequency of adverse reactions after the first and second rounds of mRNA-1273 vaccination in relation to physical activity level (PAL) (n=459)

(a) After the 1st vaccination

	Systemic symptoms					Injection site symptoms				
	With symptoms		No symptoms		p value	With symptoms		No symptoms		p value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
PAL #	2.19	0.71	2.21	0.71	0.795	2.18	0.71	2.30	0.69	0.123

(b) After the 2nd vaccination

	Systemic symptoms					Injection site symptoms				
	With symptoms		No symptoms		p value	With symptoms		No symptoms		p value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
PAL #	2.19	0.71	2.24	0.70	0.550	2.16	0.71	2.35	0.69	0.010 ※

physical activity level

The effect of physical activity level (PAL) on the frequency of adverse effects is shown in Table 4. After the first vaccination, there was no clear difference in PAL between those who developed systemic or vaccination site adverse reactions and those who did not (Table 4-a).

There was also no difference in PAL between those who developed systemic adverse reactions and those who did not after the second vaccination. However, there was a slight difference in PAL between those who developed side effects at the ingestion site and those who did not, and a significant difference was observed (Table 4-b).

DISCUSSION

The mRNA-1273 vaccine is a vaccine that introduces mRNA encoding part of the spike protein of the SARS-CoV-2 virus into the body, thereby triggering an immune response against the spike protein synthesized by body cells, producing antibodies and immune cells to strengthen the infection defense response (10). Vaccine injections stimulate skin and muscle tissue, including localized tissue damage, causing a localized inflammatory response. This inflammatory response is well known to activate the immune system, which includes the release of inflammatory cytokines and proliferation of immune cells, and promotes immune processes that generate antibodies and immune cells. When inflammation resolves, immune cells and growth factors that promote tissue repair and recovery are involved, and pain and swelling gradually decrease over a few days.

As shown in Table 1, the frequency of systemic adverse reactions increased 1.8-fold from 39% after the first vaccination to 72% after the second vaccination, while the frequency of adverse reactions at the site of inoculation was nearly 80% both after the first and second vaccinations. This result is almost the same as that of Ali et al. (4), and may indicate a certain degree of reliability of this survey methodology conducted using Microsoft Forms. The relationship between the incidence of adverse reactions after vaccination and nutrient intake is shown in Table 2, where the nutrient intakes indicated represent the nutrient intakes during the past one to two months from the date of the survey, as estimated by a survey using the Food Frequency Questionnaire (FFQ). There was no clear difference in nutritional intake between those who developed systemic or vaccination site side effects after the first vaccination and those who did not, nor was there any difference in nutritional intake between those who developed systemic side effects and those who did not after the second vaccination. On

the other hand, after the second inoculation, there was a statistically significant difference of about 10% in the intake of many nutrients, including ash, VB1, VB2, VB6, VC, and sodium equivalents, between those who developed adverse reactions at the site of intake and those who did not (Table 2-b). There is insufficient information to draw any inference from the results of this study as to how differences in the intake of these nutrients in the month or two prior to vaccination affect the occurrence of adverse reactions at the vaccination site, and no similar studies have been reported, so future research is expected. When the incidence of adverse reactions was compared separately for thinness (BMI <18.5) and not-thinness (BMI ≥18.5) individuals, the incidence of systemic adverse reactions was significantly higher in thinness individuals than in not-thinness individuals after the second vaccination (Table 3-b). This result appears to contradict the short-term nutritional results above, but if thinness is understood as a long-term nutritional deficiency, it could be that the malnourished state promotes adverse reactions by reducing normal resilience to immune responses, but again, it is difficult to infer this solely from the results of this study. The PAL of those who developed intake site side effects after the second vaccination was significantly lower (Table 4-b), which may suggest that balancing nutrient expenditure and nutrient intake at a high level is effective in reducing the incidence of side effects.

CONCLUSION

The results of this study, which indicate that the intake of some nutrients may affect the incidence of adverse reactions by means of an FFQ that estimates nutrient intake over the past month or two, do not contain enough information to infer how individual nutrients may affect the mechanism of adverse reactions, but they do suggest that adequate nutrient intake may have some effect on the immune response elicited by mRNA- 1273 vaccination may have some effect on the immune response elicited by vaccination. However, it is difficult to rationally understand the mechanism by which nutrients affect the occurrence of adverse effects from this survey alone, and more detailed collection and analysis of large amounts of data using survey techniques that can accurately determine nutrient intake is needed in order to gather clinical knowledge in the future. As a research technique for this purpose, the analysis of large amounts of data using data analytics is expected to become increasingly important in the future.

REFERENCES

1. Snyder M, McLaughlin T, Zahedani A, Palmisano S, Saberi M, Woodward M, Joselevitz R, Ruan J, Romasko H, Agarwal S, Tripathi S. Machine learning-based digital health application integrating wearable data and behavioral patterns improves metabolic health. Research Square, https://doi.org/10.21203/rs.3.rs-2362590/v1. 2023.
2. Tsunemi A, Sato J, Sugimoto S, Iwagaki Y, Enomoto M, Someya Y, Kiya M, Matsuhashi E, Wakabayashi Y, Funayama T, Mita T, Uchida T, Miyatsuka T, Azuma K, Shimizu T, Kanazawa A, Satoh H, Watada H. A Pilot Study of Intervention with a Mobile Application Visualizing the Macronutrient Content for Type 2 Diabetes at a Japanese Center. J. Clin. Med. 13(8):425-433. 2021.
3. Polack PF, Thomas TS, Kitchin N, Absalon J, Gurtman A, Lockhart S, Perez LJ, Marc PG, Moreira DE, Zerbini C, Bailey R, Swanson AK. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med 383: 2603-2615. 2020.
4. Ali K, Berman G, Zhou H, Deng W, Faughnan V, Coronado-Voges M, Ding B, Dooley J, Girard B, Hillebrand W, Pajon R, Miller MJ, Leav B, McPhee R. Evaluation of mRNA-1273 SARS-CoV-2 Vaccine in Adolescents. N Engl J Med 385: 2241-2251. 2021.
5. Baden RL, Sahly MH, Essink B, Kotloff K, Frey S, Novak R, Diemert D, Spector AS, Rouphael N, Creech B, McGettigan J, Khetan S. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine. N Engl J Med 384: 403-416. 2021.
6. Kadali R, Janagama R, Peruru S, Gajula V, Madathala RR, Chennaiahgari N, Malayala VS. Non-life-threatening adverse effects with COVID-19 mRNA-1273 vaccine: A randomized, cross-sectional study on healthcare workers with detailed self-reported symptoms. J Med Virol 93: 4420-4429. 2021.
7. Kitagawa H, Kaiki Y, Sugiyama A, Nagashima S, Kurisu A, Nomura T, Omori K, Akita T, Shigemoto N, Tanaka J, Ohge H. Adverse reactions to the BNT162b2 and mRNA-1273 mRNA COVID-19 vaccines in Japan. J Infec. Chemother. 28: 576-581. 2022.
8. Naito T, Tsuchida N, Kusunoki S, Kaneko Y, Tobita M, Hori S, Ito S. Reactogenicity and immunogenicity of BNT162b2 or mRNA-1273 COVID-19 booster vaccinations after two doses of BNT162b2 among healthcare workers in Japan: a prospective observational study. Ex pert Rev Vaccines 21(9): 1319-1329. 2022.
9. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0
10. Verbeke R, Lentacker I, Smedt S, Dewitte H. The dawn of mRNA vaccines: The COVID-19 case. J Control. Release 333: 511-520. 2021.

Case report

Nutrition Management with Crohn's Disease – Semi Elemental Hydrolyzed Whey Protein (HWP): A Case Report Study

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ABSTRACT *Background and purpose*. Individual with Crohn's disease is at risk of malnourish. Case report aimed to describe the clinical practice on a Crohn's disease adolescence, presented with sign and symptoms of malnourished with the underlying frequent loose stool. *Case presentation.* A 16 years old, male adolescence patient with Crohn's disease, presented malnourished: weight-for-age and BMI-for-age were below the 5th percentile (underweight), and stunted (<5th percentile) for height-for-age; with frequent loose stool (5 times/day). A normal level of renal profile, blood calcium, phosphate, and magnesium level; except for a lower value of albumin (19 g/dL) and hemoglobin (10.2 g/dl) was shown. A total of 2400kcal with 62g of protein can be consumed by patient in a day; yet, patient still experience continuous of weight loss. During the hospitalization, oral nutrition supplementation with semi-elemental hydrolyzed whey protein was implemented, twice in a day; along with balanced, healthy diet. There was improvement shown on patient anthropometry measurement such as body weight (gained 7.7kg) and mid-upper arm circumference (increased 5cm on both left and right arm). There was also clinically improve on the frequency of loose stool (reduced to 2 times/day). *Discussion and conclusion.* Patient with Crohn's disease has high risk of becoming malnourish. As conclusion, malnutrition screening is recommended for early detection of malnourish and followed by a proper assessment and intervention with semi-elemental hydrolyzed whey protein to improve nutritional status.

Keywords: Semi elemental hydrolyzed whey protein, protein energy malnutrition, Crohn's disease, case study.

INTRODUCTION

Crohn's disease is related to a group of conditions named inflammatory bowel diseases (IBD) (1). The most common clinical symptoms are abdominal pain, loose stool, experience lethargy, loss of weight, fever, anemia, or lesions on the perianal (1). Complications of Crohn's disease comprising intestinal obstruction, fistulas, abscesses, anal fissures, ulcers, inflammation in other areas of the body, and malnutrition (1). Malnutrition arises in Crohn's disease when the incidence of poor oral intake, malabsorption, severe deficit of proteins, and outgrowth of intestinal bacteria occur (2). It was reported that the rate of malnutrition that occurs in IBD patients varies from 20% to 85% (3,4). And this was also reflected in patients' weight, where IBD patients experienced a weight loss of 70% to 80% (5).

Malnutrition is more severe in Crohn's disease as compared to other IBD due to it can affect any region of the digestive tract and is more common in children than in adults (6). Factors that imply protein energy malnutrition (PEM) in Crohn's disease consist of reduce in oral intake, underlying physiological causes that rise the problem of malabsorption, an increase in catabolism effects, and as well side effects from different treatment strategies (2,7). It was also a rise in concern when deficiencies such as vitamin D, iron and trace elements happened in individuals with Crohn's disease (4).

Henceforth, nutritional care is essential as part of the treatments to prevent severe PEM and as well to optimize healthy growth and development, especially in children (6). Enteral nutrition (EN) therapy, either taken orally or prescribed through tube feeding, can help in optimizing or restoring the nutrients that had lost by an individual. There are three types of enteral nutrition formulas that are widely used in clinical settings – elemental, semi elemental, and polymeric amino acid (6). Among all these, semi elemental enteral nutrition can offer a better outcome to an individual with severe malnourishment given the peptides based amino acid and the medium-chain triglyceride that can ease nutrient absorption (7).

CASE PRESENTATION

Medical History

No known medical illness and past medical history.

Nutritional Assessment and In-Patient Diagnosis

A 16-year-old, secondary school Indian boy was admitted to the hospital with complaints of pain in the perianal area, swelling, lethargy, bleeding with discharge, and with loose stools after food intake.

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Upon assessment, the patient's height was 148cm, with a body weight of 25.8kg. Severe malnourished was reflected in this child as the weight-for-age and BMI-for-age were below the 5th percentile (underweight) and stunted (<5th percentile) for height-for-age. The patient shows a normal level of renal profile, blood calcium, phosphate, and magnesium level; except for a lower value of albumin (19 g/dL) and hemoglobin (10.2 g/dl). The patient then proceeded with a gastroscopy and colonoscopy procedure. The patient was then diagnosed with Crohn's disease complicated by a complex perianal fistula. The patient was referred to dietitian team for nutrition management in view of frequent loose stool and malnourished.

A dietary assessment recall was carried out with both the patient and the caretaker (mother). From the dietary assessment, the patient can consume a high calorie diet, an average of 2400kcal/day, with 62g of protein intake. There isn't any sign of a picky eater from this patient. According to the caretaker, the patient's appetite had improved after taking multivitamins from a primary care setting. Yet, there is still no increment in his body weight. Besides that, the patient also experienced very frequent loose stool every time after a meal.

A comparative standard dietary requirement of 80kcal/kg current body weight was prescribed for the patient. This requirement was calculated based on Dorothy's formula for failure-to-thrive. The protein requirement was calculated to be 62g – 77.4g/day.

Table 1. Anthropometry measurement

Weight (kg)	25.8kg
Height (m)	1.48
Body mass index (BMI) kg/m^2	11.8 kg/m^2
Weight-for-age	
BMI-for-age	< 5th percentile
Height-for-age	

Table 2. Comparative standard dietary requirement

Dosing weight (kg)	25.8kg
Energy (kcal)	80kcal/kg (body weight)
Protein (g)	62g – 77.4g

Medical Nutrition Therapy

First Visit

After the nutritional assessment, in view of the underlying causes that leads to malabsorption from his usual diet intake, a balanced, semi elemental HWP enteral nutrition formula was prescribed for the patient as an oral nutrition supplement. The purpose of the enteral nutrition prescription is to provide additional calories and protein yet ease in absorption for his underlying Crohn's disease. This patient was prescribed 7 scoops of the enteral nutrition formula, twice per day.

Other than the prescription, the patient was also required to follow a balanced diet that consists of varieties of carbohydrates, proteins, vegetables, and fruit; but with lower usage of cooking oil preparation method and as well avoid sweetened beverages and foods.

Follow up

A total of 6 follow-up sessions were carried out with the patient and his caretaker upon his visitation to the surgical clinic department in view of his logistic limitation. During these follow-up sessions, the body weight was weighed, and as well the measurement from both left and right mid-upper-arm-circumference (MUAC) as shown in Table 3 below. There was no biochemical data for revision as it was not reassessed by the surgeon. A simple and quick dietary assessment was also carried out. The patient can follow and consume the enteral nutrition prescription. A total of 7.7kg weight was gained by patient, and increment of 5cm in both left and right MUAC. For the stool frequency, the patient's caretaker claimed that there had been a reduction in the patient's loose stool as compared to the previous (from 5 times per day to 2 times per day); and will only trigger when the patient eats high fat food preparation (eg: deep fried) and spicy. The stool texture also improved from Bristol chart Type 6 to Bristol chart Type 4. The patient's caretaker also claimed that it was a big challenge for the patient when need to restrict from these food preparation choices. Follow-up sessions ended for the sixth time as the patient was scheduled by the surgical department after 1 year

.

Table 3. Body weight and mid-upper-arm-circumference during follow-up sessions

Number of follow-up sessions	Weight (kg)	BMI (kg/m^2)	Mid-upper-arm-circumference (cm)	
			Left arm	Right arm
1	29.5	13.0	15	15
2	29.9	13.2	17	17
3	30.5	13.5	17.5	17.5
4	30.8	13.6	18	19
5	31.3	13.8	19	19
6	33.5	14.8	20	20

DISCUSSION

This case study presents the nutritional issues of malnourished in the setting of Crohn's disease. We present a case of a 16-year-old teenage boy with severe malnourished due to underlying Crohn's disease, and an improvement in his nutritional status after starting with semi elemental HWP as nutritional management.

When the patient was diagnosed with Crohn's disease and referred to dietitian team for nutritional management, we decided to provide him with semi elemental HWP enteral nutrition formula. In this case study, the semi elemental HWP was associated with improvement in patient's nutritional status and reduced stool frequency, and improved stool texture.

According to the ESPEN guideline 2017, exclusive enteral nutrition is effective and is recommended as the first line of treatment for children and adolescents with acute active Crohn's disease (6). There are three different types of enteral nutrition formulas that are categorized based on their nitrogen size – elemental, semi elemental, and polymeric. Elemental enteral nutrition formula is a type of formula that can be easily absorbed by the body (8). They are made in the form of amino acids for the protein and medium-chain triglycerides (MCT) for the fat (8). Whereas semi elemental enteral nutrition formula, consists of peptides in different chain lengths and MCT (9,10) that helps in digestion, protect the intestine mucosal and better nutrient absorption (7). Polymeric, consists of whole protein with long-chain triglycerides that need further breakdown by our body for the nutrient absorption. Semi elemental enteral nutrition formula is more expensive than polymeric but has better taste preference when compared with elemental enteral nutrition formula (8).

Over the years, some studies looked into the effect of semi elemental formula in patients with Crohn's disease. This clinical evidence showed that semi elemental HWP is able to tolerate well by the patients in terms of digestion and absorption and results in weight gain and growth, aids in the anti-inflammatory process, reduction in mortality rates, and lower healthcare expenses (8). In addition to this, do not forget about the role of peptide based HWP. According to DeLegge (11), there were several possible benefits such as aids in nitrogen or amino acid absorption and usage, maintenance of intestinal homeostasis by mucosal barriers, reduction in the passage of viable bacteria from the gastrointestinal tract to extra-intestinal sites, aids in visceral protein combination and supports the immune system.

A piece of promising evidence was also seen recently through a prospective observational study by Ferriro et al (12). In this study, the subjects underwent 12 weeks of nutritional management intervention by using semi elemental HWP. It was noticed that the subjects' body mass index and mean albumin levels improved, and a significant decrease in their Harvey-Bradshaw Index and as well the frequency of loose stools (12). They believed that hydrolyzed whey protein is one of the important sources of bioactive peptides, which participate in a wide range of biological processes, including intestinal anti-inflammatory activities.

Nutritional intervention had slowly become one of the alternative treatments as compared to conventional (medication) intervention. Studies have shown that nutritional management for Crohn's disease can be more cost-effective than traditional pharmacological therapies or surgery, as it can help in reducing hospital readmissions and healthcare costs while improving patient outcomes (13,14). One study published in the Journal of Crohn's and Colitis in 2017 found that exclusive enteral nutrition (EEN), a type of nutritional therapy, was more cost-effective than corticosteroids for inducing remission in pediatric patients with Crohn's disease (15).

CONCLUSION

In conclusion, this case study highlights the importance of nutritional management in patients with Crohn's disease, particularly those who are malnourished. Semi elemental HWP can be an effective nutritional intervention for improving nutritional status, reducing stool frequency, and improving stool texture in these patients. The use of semi elemental HWP should be considered in nutritional management guidelines for patients with Crohn's disease. However, individualized nutritional management plans should also be developed for each patient, taking into consideration factors such as comorbidities, medication use, and dietary preferences. Overall, this case study emphasizes the importance of a multi-disciplinary approach in managing Crohn's disease, including collaboration between healthcare professionals such as dietitians, surgeons, and nurses

to ensure the possible care for patients. By implementing evidence based nutritional management strategies such as semi elemental HWP, we can help improve outcomes and quality of life for patients with Crohn's disease.

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REFERENCES

1. Roda G, Chien Ng S, Kotze PG, Argollo M, Panaccione R, Spinelli A, et al. Crohn's disease. Nat Rev Dis Prim 6(1). 2020. Available from: http://dx.doi.org/10.1038/s41572-020-0156-2
2. Balestrieri P, Ribolsi M, Guarino MPL, Emerenziani S, Altomare A, Cicala M. Nutritional aspects in inflammatory bowel diseases. Nutrients 12(2). 2020.
3. Goh J, O'Morain CA. Review article: Nutrition and adult inflammatory bowel disease. Aliment Pharmacol Ther 17(3):307–20. 2003.
4. Donnellan CF, Yann LH, Lal S. Nutritional management of Crohn's disease. Therap Adv Gastroenterol 6(3):231–42. 2013.
5. Hartman C, Eliakim R, Shamir R. Nutritional status and nutritional therapy in inflammatory bowel diseases. World J Gastroenterol 15(21):2570–8. 2009.
6. Bischoff SC, Escher J, Hébuterne X, Kłęk S, Krznaric Z, Schneider S, et al. ESPEN practical guideline: Clinical Nutrition in inflammatory bowel disease. Clin Nutr 39(3):632–53.2020.
7. Forbes A, Escher J, Hébuterne X, Kłęk S, Krznaric Z, Schneider S, et al. ESPEN guideline: Clinical nutrition in inflammatory bowel disease. Clin Nutr 36(2):321–47. 2017.
8. Alexander DD, Bylsma LC, Elkayam L, Nguyen DL. Nutritional and health benefits of semi elementaldiets: A comprehensive summary of the literature. World J Gastrointest Pharmacol Ther 7(2):306. 2016.
9. Diklar M. Elemental and Semi elementalFormulas: Are They Superior to Polymeric Formulas? Gastroenterology 59–72. 2005.
10. Chen PQ. Enteral nutrition and acute pancreatitis. World J Gastroenterol 7(2):185. 2001. [cited 2023 Feb 17]. Available from: /pmc/articles/PMC4723520/
11. Brody JK. Enteral feeding. Am J Nurs 110(1):13. 2010.
12. Ferreiro B, Llopis-Salinero S, Lardies B, Granados-Colomina C, Milà-Villarroel R. Clinical and nutritional impact of a semi elementalhydrolyzed whey protein diet in patients with active crohn's disease: A prospective observational study. Nutrients 13(10). 2021.
13. Guariso G, Gasparetto M. Treating children with inflammatory bowel disease: Current and new perspectives. World J Gastroenterol 23(30):5469–85. 2017.
14. Schwermer M, Fetz K, Längler A, Ostermann T, Zuzak TJ. Complementary, alternative, integrative and dietary therapies for children with Crohn's disease – A systematic review. Complement Ther Med 52:102493. 2020.
15. Gomollón F, Dignass A, Annese V, Tilg H, Van Assche G, Lindsay JO, et al. 3rd European Evidence-based Consensus on the Diagnosis and Management of Crohn's Disease 2016: Part 1: Diagnosis and Medical Management. J Crohns Colitis 11(1):3–25. 2017. [cited 2023 Apr 25]. Available from: https://pubmed.ncbi.nlm.nih.gov/27660341/

Special Report: The Cambodian Food Culture

The Introduction of "The Fermented Fish Paste" No. 1 in a Series

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Cambodian food may be an underrated food among other Asian countries. Perhaps, there are many hidden charms within the overlooked dishes of Cambodia. This article will be dedicated to the delicacy of Cambodian traditional food, and its potential to be wildly renounced its uniqueness and magnificence. Talking about Cambodian food, fermented fish paste is one of the core ingredients in many of the dishes. The smell and the pungent taste make it stand out. In Khmer words **"Prahok"** or fermented fish is the core ingredient of most soups and can also be eaten by themselves. It is used to give the Umami that boosts the extra flavor so that the food can be enjoyed thoroughly. Since Cambodia has many different types of fish, fermented fish can also be made from many kinds of fish. The price can vary range on how rare or delicious the fish are. Fermented fish paste production can also be widely found along the local area next to the Tonle Sap or Mekong River. Since, it is not widely available in other countries, almost all of the products are domestic products. As the taste is deeply carved into the Cambodian heart and with a pinch of creativity, there are so many dishes that can be made using fish paste.

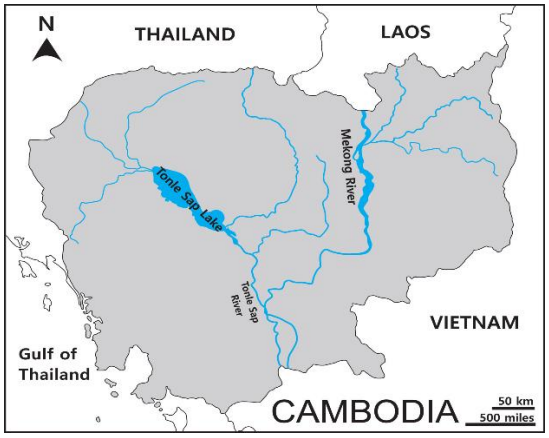

Photo1: Map of Cambodia

With its good geographical condition, Cambodia is prone to rivers and lakes, which means most of the food sources are fish. As time passed by, Cambodians started using their creativity to create many types of dishes from fish. No exception, the fermented fish paste was invented and it has changed the way Cambodian food tastes since then. There's no exact document or research that studies since when it was invented but the recipe has been passed down from generation to generation and is still wildly consumed by modern-day Cambodians. Globally speaking, different countries use different types of seasoning to boost the umami. For instance, Japan uses "Hondashi" for umami, the fermented fish or "Prohok" is the equivalent Of "Hondashi" in Cambodia. Both are made from fish but the techniques and approach is somehow different. The purpose of this article is to spread the potential of Cambodian dishes that were made using fermented fish paste as a seasoning or as a main dish

How to make "fermented fish paste"

Fishes that were freshly caught from rivers, such as the Mekong River and Tonle Sap River mostly small-scale fish scientifically known as small mud carps (Henicorhynchus Entmema /H. Siamensis*)* Their heads are removed and their remaining bodies are cleaned with fresh water until all the slime coat is completely gone. Then, it is soaked in clean water for one day. The following day, the fish are taken out of the soaking water and put in a container that has holes, so then all of the excess water can be extracted by pressing heavy objects on it. Then it is sundried for around 1 day and when it is dried the fish is mixed with salt, the salt and fish mixture is pounded softly so that the fish can absorb the saltiness. The fish are tightly put in a sealed glass container for fermentation. The paste is stored for up to 3 months for its deliciousness and uniqueness.

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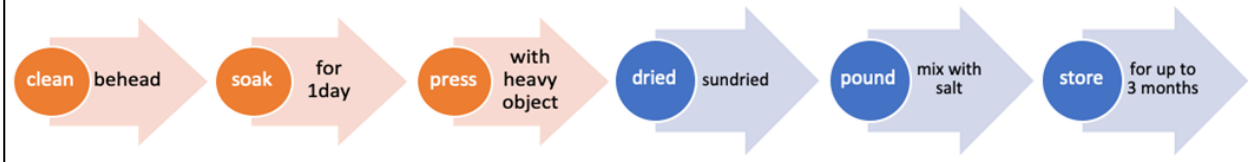
Photo 2: Small mud Carps fish

Photo 3: Fermented fish paste

Figure 1: The process of making Fermented Fish Paste



Recipes using fermented fish paste

1. Prahok chav/ Raw fermented fish

Ingredients:

- Fermented fish paste (prahok)
- Ferroniella Lucida
- Lemongrass
- Galanga
- Garlic
- Shallot
- Red chili
- Sugar
- MSG

Photo 5: Ferroniella Lucida

How to make:

All the ingredients (Fermented fish paste, Ferroniella Lucida, lemongrass, Galanga, Garlic, shallot, and chili) are all being minced together until they become one paste. The saltiness in the fermented fish is mixed with the sourness of the Ferroniella Lucida.

Sugar and MSG are then added to balance out all the flavors. This dish is normally eaten with a variety of vegetables and a dipping paste. With a bowl of hot steamed white rice, Cambodians can happily enjoy this low-cost meal.

2. Somlor Mju trokoun/

Morning Glory Sour Soup Ingredients:

- Morning Glory
- Fresh water Fish
- Fermented fish paste
- Tamarind
- Green herb
- Salt

How to make:

Boiled water in a pot, after boiling put the fermented fish in, and strain the paste in a strainer making sure that there are no fish bones in the broth. Fish that have been cleaned and cut will be put into the broth. Then, close the lid and let it simmer until the fish is cooked. Then the tamarind is also put in the broth for a hint of sourness since the soup is called a “Sour Soup”.The Morning Glory is then added along with a little bit of salt. Green herbs are added as a last-touch garnish. The food then can be served hot to eat along with rice.

In conclusion, the above information is about the introduction and recipes of how Cambodian fermented fish “Prahok” is used in a dish. Along with how it is made. Though this article is short, as a writer I hope that readers can enjoy reading and understanding what is so different about Cambodian dishes.