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Current Issue: COVID-19 and Dietetics

The Indispensable Role of Dietitians in Asia during the COVID-19 Crisis

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Dear Editor: The coronavirus disease (COVID-19) pandemic has rapidly spread to at least 200 countries and territories around the world. According to the WHO Situation Report, there were more than 3.4 million confirmed cases and 240 thousand deaths as of May 4, 2020.

We, as dietitians, must stay alert while fighting this coronavirus infection. Although the current morbidity and mortality rates in Europe and North America are higher than those in Asia, there is no room for complacency. Because the outbreak of COVID-19 occurred in Asia weeks ahead of its appearance on other continents, successive waves of its reoccurrence may surface sooner in Asia than in Europe and North America, for example.

As the pandemic spreads, countries have declared states of emergency. Measures have been taken to contain the transmission of the coronavirus such as: self-quarantine, isolation, staying at home orders, lockdowns, social- distancing, and the closing of businesses and schools. All of these measures have impacted daily life with changes in diet and food availability, in many instances causing panic buying.

People have become instantly vulnerable during this pandemic, thrust into a situation in which they have limited preparation, limited resources, and little to no experience. This is the time for dietetic organizations to step forward and to provide reliable nutrition advice to the general public and to practicing dietitians.

"Never let a good crisis go to waste". Nutrition is vital in managing any health crisis. Let's team up to share information and tactics, which can better prepare us as nutrition care professionals to combat the unprecedented pandemic.

Inspire the public about proper nutrition to support strong immune systems in order to safeguard health

Openly discussing topics dealing with everyday dietetic issues is most helpful, such as: healthy meal planning, grocery shopping tips during long-term home stays, meal preparation, easy and affordable recipes, proper hygiene, and safe food handling in the kitchen and food delivery services. Specific nutrition advice should also be readily available to the elderly, pregnant women and breastfeeding mothers, as well as to people at risk of malnutrition and those suffering from chronic diseases who are especially vulnerable to infection.

Support dietitians with guidance on medical nutrition therapy for COVID-19 patients

In the field: Health care providers and patients alike are overwhelmed by the sudden outbreak and the soaring number of suspected and confirmed cases. Among the many challenges are the demand for food services to supply the mobile hospital units which have been erected to accommodate the swarm of patients. The need for appropriate dietary recommendations and interventions is critical.

In hospitals: Among severely infected hospitalized patients, there is higher morbidity and mortality among the malnourished, the immunocompromised and the elderly with comorbidity. These patients require specialized nutrition considerations. The dietitian is an important member of this treatment team.

The Handbook of COVID-19 Prevention and Treatment edited according to the clinical experience in China, published online in ten languages, points out that in some VID-19 patients, the intestinal microbiological balance is broken. This may lead to secondary infection. In this case, probiotics and nutrition support are important means to restore this intestinal balance.

Recommendations proposed by both the European Society for Clinical Nutrition and Metabolism (ESPEN) and the American Society for Parenteral and Enteral Nutrition (ASPEN) suggest nutrition assessment and nutrition intervention are essential to sustain adequate nutrition and to overcome malnutrition for COVID-19 patients in hospitals and those recovering at home.

Dietitians should apply the best available evidence-based guidance and resources in practice. Information from diversified sources, however, is often hard to follow, as when information is written in a foreign language. The Indian Dietetic Association (IDA) and the Thai Dietetic Association (TDA) have websites with user-friendly documents about safety and protocols of medical nutrition therapy for COVID -19 patients. The TDA also sends messages to its members through LINE, a free app, which can instantly communicate with members on their mobile devices.

As COVID-19 is a new health issue, dietitians are encouraged to submit AJD journal papers about firsthand nutrition care experiences of COVID-19 patients.

An Action Plan to Cope with the New Normal

To a large extent, COVID-19 has changed our lives, regardless of our age, gender, race and culture. Family reunions, holidays, special events and festivals are always occasions for gatherings - but not this year. Beginning with the lockdown of Wuhan, China, on January 23, 2020, a day prior to Chinese New Year′s Eve, there have been strict measures in place to curtail the spread of the pandemic. Social gatherings related to significant events all over the world have been canceled or restricted, including, but not limited to: Holi in India, Cherry Blossom Festival in Japan, Buddha's Birthday and Songkran in Thailand, Holy Week and Easter in the Philippines, and holy month of Ramadan in Indonesia and Malaysia, only to name a few. There is virtually no public gathering allowed, no travelling, no homecoming, no pilgrimage, and no mass gatherings in temples, churches, mosques, concert halls, stadiums, etc., until further notice.

Social distancing is a new etiquette. Face masks have become an integral piece of fashionwear and the Thai "Wai" greeting has replaced handshaking and hugging. Looking to the near future, we probably will continue living this way until all restrictions are lifted.

Having been constrained for so long, people everywhere desperately want to go back to a normal way of life. How can we turn the worst of times into the best of times? We can approach this in three ways.

1. Be prepared with emergency relief schemes

In Asia, we often suffer from natural disasters such as earthquakes, tsunamis, typhoons, floods, and volcanic eruptions, which claim thousands of victims in need of emergency feeding and nutrition care.

The Japan Dietetic Association (JDA) formed the Japan Assistance Team after the Tohoku earthquake and tsunami occurred in 2011. Trained dietitian volunteers are now at the ready to be dispatched for emergency relief. Dietitians in Asia could also be trained and organized to serve as an extra workforce for urgent epidemic outbreaks.

With the emergence and rapid spread of COVID-19, there was an urgent call in North America and in Europe for retired medical staff and new graduates to supplement the much-needed supply of specially trained hospital personnel. There is an apparent and pressing need to expand nutrition care capacity and preparedness for large-scale emergencies.

2. Apply new technology at work

The COVID-19 pandemic has seen a rapid change in the way health care professionals communicate with their patients. Telehealth visits and nutrition counseling via audio and video equipment provide a safe way to communicate and to interact with sick patients while eliminating the risk of infection.

Applying new technology is an inevitable trend. The widespread COVID-19 pandemic has accelerated the application of artificial intelligence (AI) devices in healthcare facilities. With regards to dietary services, for example, using a robot to deliver patient meals in a hospital minimizes person to person contact and the likelihood of disease transmission.

3. Increase professional competency

The Deep Knowledge Group recently ranked Korea, Taiwan, Singapore, Hong Kong and Japan among the top ten countries displaying safety and treatment efficiency related to the COVID-19 pandemic. This could be greatly attributed to the lessons drawn from precious combat experience in Singapore, Taiwan and Hong Kong with 2003 SARS, and in Korea with 2015 MERS.

Since 2007, postgraduate and licensure programs for all healthcare professionals in Taiwan, including dietitians, have required classes related to infection control. Considering the frequency and magnitude of epidemic outbreaks and natural disasters in recent years, it is imperative to incorporate these subjects into curricula to educate dietitians who will be competent in dealing with crisis. No one knows how long the pandemic will last. Hopefully, with confidence and solidarity, no matter how long the night may be, the arrival of the morning is soon to come.

Current Issue: COVID-19 and Dietetics

Nutrition Management in a Japanese Acute-Care Hospital during the COVID-19 Pandemic

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Dear Editor:

Japan, like the rest of the world, is facing a pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Japan has postponed the 2020 Olympics and has declared a state of emergency beginning in April 2020 with about fifteen thousand infected cases, about one third of them in the Tokyo area. The number of deaths as of May 3 is about 500. Many health facilities, especially acute-care hospitals, are becoming overwhelmed. Nerima Hikarigaoka hospital is an acute-care hospital that belongs to the Japan Association for the Development of Community Medicine (JADECOM), with 342 beds located in Nerima Ward, Tokyo. In April 2020, the hospital recorded the first fifty-two coronavirus cases, including both medical staff members and inpatients. The hospital had to temporarily stop receiving outpatients and emergency patients.

Japanese hospitals' food supply system always has to follow the Hazard Analysis and Critical Control Points (HACCP) system. All staff members have to be trained to implement proper procedures. The HACCP system helps to minimize risk when supplying food; especially in the hospital environment there are many risks of disease, so compliance with the HACCP system is critical. COVID-19 is a new type of virus; there is no vaccine or medicine as yet; and it is highly infectious in the community, especially among elderly people and people with poor resistance. Nerima Hikarigaoka hospital's kitchen staff includes mainly elderly people and unfortunately, we early detected one case of a part-time kitchen cleaning staff member with coronavirus; isolation was quickly implemented. Coronavirus anxiety covered workplace is unavoidable. In this situation, the nutrition department immediately had to have a further solution to ensure maintenance of a safe food supply for patients and to prevent spread of the nosocomial infection.

Japan is used to natural disasters such as earthquakes and tsunamis, so nutrition management manuals for these cases are available. However, COVID-19 is new; there is no manual and it is a new situation for us. Our current experience which is shared below is still being gradually improved and needs to be flexible depending on each hospital's situation. We hope this experience will be useful for other nutrition departments in hospitals in dealing with the pandemic.

1. Human resources

Health check: for dietitians and kitchen workers, besides the usual health check list, we implemented a health check list for symptoms of COVID-19 such as fever, cough, headache, muscle ache, chills, smell disturbance, vomiting in staff members and people who live with them to be followed and reported to the hospital every day. If people have any abnormal symptom, stopping work for inspection and tracking is required.

Teamwork: Dietitians were also divided into two teams to be in the hospital to work in different days, and to implement distancing when communicating. Meetings are conducted online. Kitchen staff also work in shifts and teams. Changing the food supply system will help to reduce the number of kitchen staff members as much as possible to limit possible viral transmission in the members.

2. Hygiene

Almost all viruses (except norovirus) including coronavirus will die at about 80 degrees Celsius. This means that all hygiene activities have to reach at least 80 degrees including sanitation by alcohol, drying tableware, steaming food, etc.

The food supply system in hospitals needs to guarantee the HACCP system. Hospitals must still maintain the HACCP system in this pandemic.

However, because kitchen and medical staff members may be temporarily replaced by new emergency staff who are not familiar with our procedures, we posted reminders that all staff must strictly follow procedures. Below are some examples

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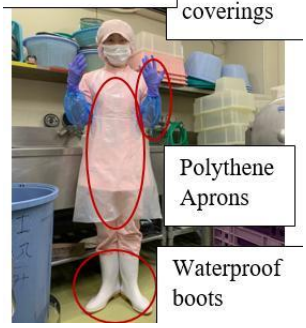
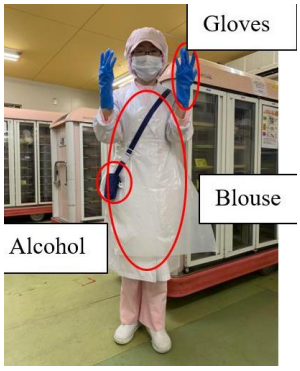
Before	After
At entrance of nutrition department	
 Red line to distinguish safe and dangerous areas	 Red circle: memo to disinfect goods and hands before coming in nutrition department Green circle: Do not use your outside shoes to step into this area Yellow cross line: dangerous area
At food material input gate	
 Alcohol Red line to distinguish safe and dangerous areas Slipper change	 Announcement and more alcohol was set up.
At toilet gate	
	 Remove hat, change clothes, slippers Washing hand with soap and sanitize with alcohol
Announcement for nurses when using hot & cold serving carts to deliver meals for patients	
	 Announcement to change into simpler menus and plastic tableware for pandemic After patients finish meals, please throw all plastic tableware in ward Please disinfection the tray by alcohol and keep them at own ward.

- **Dietitian's clothes**

When coming to kitchen to check	When supporting cleaning in kitchen
 Hat, mask Gloves Alcohol Room shoes/slipper	 Hand and arm coverings Polythene Aprons

- **Kitchen staff's clothes**

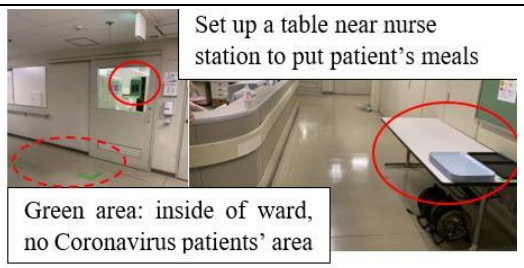
Cooking	Cleaning	Using elevator to transfer meal to ward
		

- **In hospital ward**

Divide into 3 areas: Yellow, Green and Red areas

Food serving carts cannot be in red area (Coronavirus patients' area)

Yellow area: outside of ward, preparation place to wear protective cloth before entering ward



Set up a table near nurse station to put patient's meals

Green area: inside of ward, no Coronavirus patients' area

Red area: inside of ward, Coronavirus patient's area

Deliver food: Change the tray from kitchen tray to ward tray.

These ward trays are always kept and sanitized in ward by nurses.

- **Hygiene in nutrition department and kitchen**

Nutrition department:

+ Exchange room air frequently, use plastic separator between work desks

+ Clean shared things such as computer keyboard, printer button, telephone, kettle, door knobs, floor… frequently with alcohol or hot steam (at least 80 degrees)

+ Always consciously wear mask and wash your hands with the message: "1 Push 1 Action" and "1 Wash 1 Action"

Kitchen:

+ Maintain hygiene according to HACCP system

+ Set up an alcoholic mat before food elevator to transfer serving cart from kitchen to ward. This will help clean shoes of kitchen staff and wheels of serving carts

3. Food supply system

Because of coronavirus anxiety, our hospital decided to change temporarily to an outside food supply system. With this system, the kitchen staff can have more time to rest and maintain psychological stability.

- Change to outside food supply system:
  + Commercial food stored at room temperature (Pic. 1)
  + Frozen foods can be stored for some days (Pic. 2)
  + Outside food center kitchen ships to hospital every day (Pic. 3)
- Change menus: need to change the menus according to outside food supplement companies which have three main meal types including normal meal, soft meal and mixed meal. All use one-time plastic tableware. (Pic. 4)
  Hospital top management had to agree and all medical staff need to know these modified menus before supplying them to patients.
- Change nutrition products for enteral nutrition from paper type to one-time bag type to reduce risk of infection for patients and nurses. (Pic. 5)
- The nutrition software including food orders, doctor orders, etc. also need to be adjusted according to new menus.
- The individual menus paper need to change content (Pic. 6)

Pic. 1

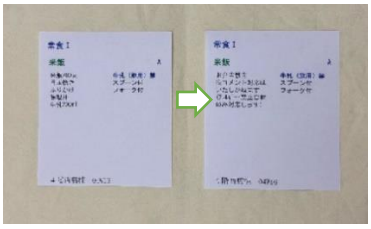
Normal meal | Soft meal | Mixed meal

Pic. 4

Pic. 2

Pic. 5

Pic. 3



Change from cooked food to food box and use all plastic tableware

Pic. 6

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Review

Effect of the Ghana School Feeding Programme on Nutrient Intake, Nutritional Status and Education of Children: A Review

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ABSTRACT The Ghana School Feeding Programme (GSFP) was initiated by the Government in 2005 to reduce hunger and malnutrition, and increase school enrolment, attendance and retention. It was also intended to boost domestic food production in deprived communities by increasing demand for farm produce to service the programme. This review was carried out to determine whether the GSFP had achieved the objectives related to nutrition and education. A desk review of 22 peer-reviewed publications emanating from studies of the GSFP over a ten-year period (2010 to 2019) was undertaken. Outcomes measured included dietary adequacy, nutritional status and educational enrolment, retention and performance of children. Assessment of the effect of the GSFP on nutritional outcomes showed mixed results. Some studies reported improved nutritional status of pupils in GSFP schools compared to non-GSFP schools. While under-nutrition and anaemia remained prevalent in several schools with and without the GSFP, there was evidence that the GSFP offered protection from hunger for some children and had a greater effect on the nutritional status of children from poorer communities. School-based program evaluation studies consistently reported increased enrolment with partial increases in attendance, retention and punctuality. Better targeting of beneficiaries, reliable funding and comprehensive approaches to addressing the nutritional needs of all school-age children, including inculcation of positive nutrition-related behaviors in children for long-term impact are recommended. Additionally, further studies which employ robust methodology to assess the impact of the GSFP on nutrition and education outcomes are needed.

Keywords: Ghana, school feeding program, nutrient intake, nutritional status

INTRODUCTION

School feeding programs provide an opportunity to improve the nutritional status of children, encourage school enrolment, improve performance and mitigate the effects of poverty globally (1,2,3,4). They involve providing meals such as breakfast, lunch or snacks to children in school (2). The meals are either prepared in schools or by a centralized kitchen or assigned caterer, often using ingredients obtained from local farms and thereby impacting the local economy (1,2). Over time, school feeding programs have been shown to offer a regular source of nutrients to vulnerable children, build human capital and provide savings of up to 10% of the household income of poor families (1). According to the World Food Program (WFP), about 0.25 USD is needed for a meal per child and studies have shown that each US dollar invested in school feeding yields a 3-10 USD return on the investment resulting from improved health, education and productivity (*2*).

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The Ghana School Feeding Program (GSFP) was established in 2005 as a social protection intervention to provide children in selected schools in deprived communities with one nutritious meal in a day, using locally grown foods and caterers in their locality (*5,6,7*). The program was instituted as part of the government's efforts to achieve the Millennium Development Goals (MDGs) 1, 2 and 3 to reduce poverty, provide food security, increase school enrolment at basic level and to promote gender equality by providing an incentive to attract girls to school. Currently, it contributes directly to the Sustainable Development Goals (SDGs) 2, 4 and 5 which aim at achieving zero hunger, quality education and gender equality respectively, and indirectly to goals to 1, 8 and 10 which aim at ending poverty, providing decent work and economic growth as well as reducing inequalities (*8*). The program began as part of the Comprehensive African Agricultural Development Program (CAADP) with initial pilots carried out in ten [10] basic schools, mainly primary and kindergarten, in the most deprived areas of the country (*6*). The GSFP was extended to cover 1695 public schools with 656,624 pupils nation-wide by the end of 2009 and cost over US$200 million for 4 years (*7*). By 2015, the program had reached a total of 1,728,681 pupils (*6*).

The GSFP was initially implemented by the Ministry of Local Government and Rural Development (MLGRD) until 2015 when oversight responsibility for the programme was transferred to the Ministry of Gender, Children and Social Protection (MoGCSP) (*5,6*). Currently, the Programme operates under the supervision of a Multi-Sectoral Technical Advisory Committee (MTAC) of the MoGCSP, with representatives from the Ministries of Finance, Education, Health, Food and Agriculture, Trade and Industry, and Local Government and Rural Development (*5*) with the support of Development partners (*9*).

Ghana's school feeding programme has been in operation for 14 years, during which period there have been several studies and reports on its impact. The objective of this review is to examine the effect of the Ghana School Feeding Programme (GSFP) on child nutritional status, school enrolment, attendance and retention.

METHODS

A desk review was carried out which involved the collection, assessment, analyses and synthesis of information from published literature. The review was structured to examine the effects of the GSFP on specific measurable nutrition and education outcomes. Computerised bibliographic medical databases were searched for relevant articles from 2010-2019. These databases included MEDLINE (Pubmed version), the Cochrane Central Register of Controlled Trials, Google, Google scholar, Hinarii, Scopus and Science Direct. Key words used to identify the relevant articles were Ghana, school feeding programme, school meals, school feeding policy, impact, effects, education, attendance, enrolment, nutrition and nutritional status. Abstracts of the identified studies were retrieved and studied. Irrelevant articles were excluded and full text of the remaining articles obtained.

The reference lists of these articles were also reviewed and relevant articles identified in the lists were obtained. The Bibliography from reports of UN agencies such as the World Health Organization (WHO), UNICEF, World Food Programme (WFP) and Food and Agriculture Organization (FAO) were also searched for relevant articles.

The inclusion criteria for studies included in this review were as follows: quantitative, mixed designs or evaluation studies with measurable outcomes collected in sufficient detail to allow assessment of a change in status or effect size to assess the effects of the GSFP on nutrition and education; comparative studies involving schools with and without school feeding programmes reporting an outcome measure of interest; studies with measures of growth that were made at least 8 weeks or more from the time of intervention were included; children aged ≤17 years were included since recipients of the GSFP were pre-school and school-aged children aged 3 -17 years. This review also included studies in which school meals were assessed for their nutritional value. Studies which failed to meet the inclusion criteria as well as the following exclusion criteria were excluded; unpublished studies such as student dissertations and thesis; studies with a school feeding programme that was less than a year; and those with a sample size of less than 10 subjects.

The outcome measures assessed were as follows: 1) Nutrition outcomes such as i) Nutrient content and adequacy of meals served in the GSFP and nutrient intake of school children participating in the GSFP; ii) Nutritional status of children using anthropometric measures for assessing growth such as weight (wt), height (ht), weight for age z score (WAZ), height for age z score (HAZ), weight for height z score (WHZ), BMI for Age z score (BAZ) and mean weight gain (MWG); and biochemical indices such as measures of haemoglobin (Hb) and soluble transferrin receptor (sTfR) if reported in the articles reviewed. 2) Outcome measures related to education were changes in school enrolment, female enrolment, school attendance, retention, drop-out rates and school performance. These outcome measures are listed in Table 1.

Table 1. Nutrition and Education Outcomes and Measures

Outcome	Outcome Measures
1) Nutrition Outcomes	
i. Dietary Adequacy	Nutrient content and Probability of Adequacy (PA) for selected nutrients, Nutrient intake, percentage of Recommended Dietary Intake (RDI), Recommended Nutrient Intake (RNI)
ii. Nutritional Status: Anthropometric and Biochemical Indices	Weight (wt), height (ht), height-for-age z-score (HAZ), weight-for-age z-score (WAZ), Weight for Height z score (WHZ), BMI for Age z score (BAZ), mean weight gain (MWG), haemoglobin (Hb) and soluble transferrin receptor (sTfR).
2) Education Outcomes	School enrolment, female enrolment, attendance, retention, drop-out rates and school performance.

RESULTS

A total of 50 articles and reports on the Ghana School Feeding Programme were obtained, of which 28 papers were excluded, guided by the exclusion criteria, resulting in a total of 22 publications being included in this review. These included a Randomised Controlled Trial (RCT), descriptive and cross-sectional studies, mixed designs with quantitative and qualitative components, case studies, evaluation studies, quasi-experimental designs and modelling.

Dietary Adequacy and Nutritional Status of Children

Nutrient Intake and Adequacy of Meals

A study by Danquah et al (2012) at Atwima-Nwabiagya found that the meals served in the GSFP did not provide the expected one-third RNI of 720 kcal from school meals, but rather an average weekly intake of

460.4 kcal (64%), with a mean intake range of 59% – 68%, which was attributed to the small amounts of meals served *(10)*. Even though the meals had excess carbohydrates from staples such as rice, corn and cassava, energy requirements were not met. Additionally, the school meals provided more than two-thirds (11.4 +/- 0.9 g) of the recommended protein intakes (14g) in GSFP schools, with significantly higher intakes in schools which consumed cowpeas and groundnuts (P<0.05). But there was limited use of animal protein. The mean weekly intake of thiamine was 0.3 mg in all schools which corresponded to 75% of the RNI from the school lunch. This was also attributed to the intake of cowpeas. Observed adequate iron intakes were also attributed to the use of legumes such as cowpea in the diet. However, riboflavin, calcium and vitamin C intakes were inadequate. Zinc requirements were also not met, but the diet supplied two-thirds (2.1 +/- 0.2mg) of the recommended intake of 3.0mg. With respect to Vitamin A intake, all the meals in the three schools supplied an average of 628.3 +/- 85.2 ug RE, which is more than the one-third of the RNI requirement of 200 ug RE, possible due to the use of palm oil in the meals. Vitamin C in the school menus was derived mainly from pulses and seeds such as cowpeas and groundnuts, which supplied 59.4% of the RNI on average.

A cross-sectional survey of 383 school children aged 5-13 years in the Tolon-Kumbungu district of the Northern Region compared nutrient intake among children participating in the GSFP with those who did not *(11)*. They found that children in the GSFP had significantly higher energy intakes (2397kj; P<0.001). The proportion of children whose energy intake were below requirement was 4·7% in GSFP schools compared to 21·8% in non-GSFP schools (P< 0·001). Protein intake was adequate in both schools (median = 19.0g). However, intake of animal sources of protein was higher in GSFP pupils (5% vs 3%; P<0·001). The probability of adequacy (PA) for Fe, Zn, Ca and vitamins A, C and folate was also significantly higher in GSFP schools (mean PA 0·61 (SD 0·13) vs 0·18 (SD 0·11) P<0·001). The use of a cereal-based multiple-micronutrient-fortified corn soya blend was found to be a key contributor to micronutrient adequacy in the GSFP group. However, the GSFP pupils had a smaller median portion size of meals taken at home than pupils in the non-GSFP group (456 vs 1037 g; P<0·001) *(11)*. A similar observation was made in a nationwide study by Gelli & Aurino (2019), which found that 4% of children in the GSFP reported meal sharing with siblings at home and 23% reported receiving less food at home on days in which they had school meals *(12)*.

Parish et. al. (2015) analysed 170 meals from the school feeding programme in 34 districts of 7 regions in Ghana *(13)*. The adequacy of the diet in relation to nutrient content and cost of the meals were determined through a linear modelling analysis of menus obtained from the 34 districts using the Government's allocated budget of GHC 0.40 (USD $0.26) per child per meal and prices of commodities from markets in Accra (southern Ghana) and Tamale (northern Ghana). They found the dietary protein and fat content of the meals to be adequate, providing 30% of the Recommended Dietary Intake. However, vitamin A (3.08%) and iron contents (18.97%) were inadequate. The caloric content was considered adequate only if meals were procured at the prices in the Northern Region.

A study in the La Nkwatanang-Madina District of the Greater Accra Region compared the nutrient intakes of children in a GSFP school with those in a private school feeding programme *(14)*. The study found higher intakes of energy (2413 ± 626 kcal vs. 1988 ± 627 kcal; P<0.001), protein (63 ± 17 g vs. 53 ± 19 g; P<0.001), and zinc (10 ± 3 mg vs. 9 ± 3 mg; P=0.004) in the private feeding programme compared to the GSFP. Intakes of iron, vitamin C and A were similar in the two feeding programmes. However, although calcium intakes were low in both programmes, they were higher in the private feeding programme.

In a study at La Nkwatanang in the Greater Accra Region using meal observations, the average weights of a week's meal were converted to energy and nutrient equivalence and compared among the GSFP and a private school feeding programme by Prembaf, a non-governmental organisation *(15)*. The private school feeding programme was found to have higher nutrient content and met the energy (776 ± 427 kcal vs 315 ± 24 kcal; P=0.042), protein (20 ± 14g vs 8 ± 2g; P=0.087), and fat (17± 8g versus 6 ± 2; P=0.019) recommendations provided by the World Food Programme, but the GSFP did not. There were no significant differences in the micronutrient content of meals in both schools; even though the portion sizes from the private school were larger (416 ± 96 g vs. 243 ± 50g, P=0.007) and at a higher cost per meal/child - 70 pesewas ($0.36 in 2013) vs 40 pesewas ($0.21in 2013) than the GSFP.

Goldsmith et. al. (2019) determined the nutrient composition of a serving of rice and tomato stew - a common menu of the GSFP in the Tamale metropolis of the Northern Region, in which the serving size ranged from 232 - 273g with an average of 254g *(16)*. Although they found significant variation in the macro and micronutrients content of the food served, probably due to caterers' discretion and methods used to prepare the same meal for children aged 4-8 years, the tomato stew met 46% of their carbohydrate requirements; 68 % of sodium requirement, 32% of protein requirement, 31% of vitamin D requirement, more than 20% of Vitamin B6, B12 and E requirements and only 7% of iron and 2% of calcium requirements. For children aged 9 - 13 years, it only provided 18% of their protein requirement. They recommended the use of soy flour as a substitute for locally produced protein to increase the protein content and lower cost.

A study by Bigson et. al. (2019) investigated the nutrient content of school meals in 20 GSFP schools, 12 in Wa and 8 in Cape Coast municipalities in the Upper West and the Central regions, respectively *(17)*. Findings on the nutritional quality of meals served in upper primary schools revealed that the meals in both Municipal schools did not meet the FAO/WHO (2004) nutrient recommendations. With the exception of carbohydrates (90.6 ± 6.3g vs 69.3 ± 5.2g) and Vitamin A (726.4 ± 85.2 vs 548.2 ± 75.1ug RE) which far exceeded the reference limits, levels of calories, protein, calcium, vitamin C, thiamine, riboflavin, iron and zinc in the diets were less than one-third of RNI values and therefore considered inadequate *(16)*.

Agbozo et. al. (2018) examined the nutrient content of school lunches prepared by GSFP schools compared to private school meals in the Hohoe Municipality and found the nutritional value of the meals to be similar *(18)*. Meals of the GSFP schools compared to private schools had 420.6 vs 462.2 kcal of energy, 6.8 vs 6.8 g of protein, 23.8 vs 27.7 g of fat, 3.0 vs 2.8 mg of iron, 417.3 vs 280.8 µg retinol equivalent of vitamin A, 25.1 vs 16.5 mg of vitamin C, 1.3 vs 1.2 mg of zinc, and 62.6 vs 61.4 mg of calcium. Only the requirements for fat, vitamin A, C and iron were fully met.

Nutritional Status of Children: Anthropometric and Biochemical Indices

The Ghana School Feeding Programme is reported to have improved the nutritional status of children in implementing schools *(4,9,19)*. A longitudinal cluster randomized control trial by Gelli and Aurino (2019), involving 2869 children aged 5-15 years nationwide reported that the GSFP meals had no effect on the nutritional status (HAZ and BAZ) of children 5-15 years old in the program *(12)*. However, in sub-group analyses, the school feeding intervention was associated with increased HAZ in children aged 5-8 years (effect size 0.12SDs); increased BAZ in boys aged 5-8 years (effect size 0.19 SDs); and increased HAZ in girls (effect size 0.12SDs), especially girls aged 5-8 years living in the northern regions of Ghana (effect size: ~0.3 SDs). Also, the GSFP was found to be associated with increased HAZ in children aged 5-8 years from households living below the poverty line (effect size 0.22SDs) *(12)*.

In contrast, a cross-sectional study at Denkyembour in the Eastern Region of Ghana comparing the nutritional status of 359 children aged 5-12 years attending GSFP and those non-GSFP schools found a higher prevalence of overweight ((BAZ) 1.9% vs 0.0%) among pupils in GSFP compared to non-GSFP schools. The prevalence of thinness (WHZ) was two times higher (9.3%) among pupils in GSFP compared to non-GSFP schools (4.6%) (p=0.028). They also observed more stunting among pupils from non-GSFP schools (HAZ) 17.2% vs 16.2%; ($p = 0.284$)), but the difference was not statistically significant *(20)*. The authors suggested that the mixed outcome may be related to operational issues associated with the GSFP.

A study in the Hohoe Municipality of the Volta Region compared the nutritional status of 417 pupils in GSFP and non-GSFP schools and found no significant differences among the two groups as follows: underweight, 12.4% vs 16.8%; stunting, 13.3% vs 8.6%; thinness 1.8% vs 5.3%; and overweight 3.5% vs 5.6%, respectively *(21)*. However, the observed differences were not statistically significant. Furthermore, logistic regression revealed that being a GSFP beneficiary did not significantly reduce the odds of being underweight, stunted, thin or overweight. They also found that the odds of being underweight was significantly higher in pupils in lower primary aged 5 to 9 years (AOR; 3.0, 95% CI; 1.4-6.6, P=0.006), while children from rural areas were five times more likely to be stunted (AOR; 5.3, 95%CI; 1.3-21.6, P=0.021).

A cross-sectional study in the Atwima-Nwabiagya district of the Ashanti Region involving 234 pupils between the ages of 9 and 17 years, comprising of 114 pupils from three GSFP schools and 120 pupils from three schools without GSFP found a significant difference between the mean heights of the pupils in GSFP vs non-GSFP schools (147.4cm SD 8.9) and (144.6 SD 8.6) (P=0.016), but attributed it to the higher ages of children in the GSFP schools (15-17 years) (mean ages 13 vs 12 years) *(10)*. Comparing GSFP schools with non-GSFP schools, the study found 47.4% vs 56.6% of stunting, 48.2% vs 45.0% underweight, 4.4% vs 2.4% of thinness, 4.4% vs 5.0% overweight, and 0% vs 4.2% obese pupils. Although less stunting was observed among pupils in GSFP schools. Overall, they found no statistically significant difference in the nutritional status of children in the two groups and concluded that there was no association between having a school lunch and nutritional status.

In the cross-sectional survey of 383 school children in the Tolon-Kumbungu district comparing the nutritional status of children participating in the GSFP with those who did not, no significant differences in the prevalence of stunting (HAZ) (23·3 vs 28·9; P=0.09), underweight (WAZ) (16·3 vs 14·4; P=0.76) and thinness (11·9 vs 5·6; P=0.25) were found among the two groups of children *(11)*. The mean Hb was found to be 100 (SD16) g/l but levels were significantly higher in the school feeding group by 6g/l (P<0·001). The GSFP group had significantly lower soluble transferrin receptor (sTfR) levels (11.2 vs 124 mg/l; P=0.04). However, there was no significant difference in the prevalence of iron deficiency anaemia (62·7g/l vs 69·4 g/l; P=0.56).

In the La Nkwatanang-Madina District of the Greater Accra Region, malnutrition was prevalent in both GSFP and Private school feeding program schools *(14)*. Altogether, 48% were stunted (HAZ), 35% had low BMI-for-Age or were thin, and two thirds (67%) had one of these abnormal values. In addition, 1% were overweight (BAZ). Also, 28% of the pupils were found to be anaemic with low Hb levels. Comparison of the nutritional status of pupils in the GSFP (n=113) and the private school feeding programme (n=216) in the Hohoe Municipality by Agbozo et al. (2018) revealed that the nutritional status of the children in the two groups were similar. The prevalence of stunting was estimated at 8.9% vs 7.9%, underweight at 3.6% vs 5.7%, thinness at 1.8% vs 3.7% and overweight/obesity at 3.5% vs 4.2% *(18)*.

Education: Enrolment, attendance, retention and performance.

A mixed methods study comprising 21 schools in Bawku West and Upper East Regions showed that the GSFP resulted in over 100% increased enrolment over a 12-year period, from 4,013 in 2004/2005 to 10,589 in 2016/2017 *(22)*. However, the study also showed that the increase in enrolment began before the programme was introduced, though majority of parents and teachers attributed the increase to the programme. Another mixed methods study of a basic school in Nyoglo in the Savelugu-Nanton Municipality of the Northern region found an increase in school attendance from 22% before initiation of the GSFP to 65.4% after the programme was implemented *(23)*. In addition, school enrolment increased from 35.8% to 64.2% after programme initiation, while the school dropout rate reduced from 73.8% to 26.2% (X_2 =29.767, df=4, P=0.000), based on a records review.

Similarly, a study in the Asikuma-Odoben-Brakwa district of the Central region also demonstrated an increase in school enrolment with implementation of the GSFP and a decrease in non-GSFP schools *(24)*. The study also found significant association between the GSFP and improved academic performance of pupils in GSFP when compared with non-GSFP schools (Partial Eta Squared value 0.399, P=0.000), an association with attentiveness in class (Partial Eta Squared value 0.735, P=0.000) and an association with enrolment in school (Partial Eta Squared value 0.752, p=0.000), after a multivariate analysis. However, the association between school attendance and the GSFP was not statistically significant (Partial Eta Squared value 0.001, P=0.746). A comparative study between 10 primary schools with GSFP and 10 primary schools without GSFP in the Weweso circuit of Kumasi Metropolitan area in the Ashanti region found that school feeding had a significant impact on school enrolment, attendance and retention *(25)*. The study reported that a 100% increase in school feeding programme results, an increase in

enrolment by about 4 percentage points, an increase in attendance by 98% and an increase in retention by 99%.

A study of 5 schools in the Kwaebibirim District in the Eastern region reported that there had been a gradual increase in enrolment prior to the introduction of the GSFP from the capitation grant, awareness creation through education, provision of school uniforms, books, materials and infrastructure *(26)*. However, enrolment increased soon after the introduction of the GSFP in the schools, with the greatest increases occurring within the 2006/2007 to 2008/2009 academic years. The observed increases were varied, ranging from 3.1%, 10% and 52%, through to 66.2% increase in some schools. Thereafter, a general decrease of 9.2% was observed in the 2009/2010 academic year, followed by a small rise of about 2.2% in the subsequent year. A major incident associated with the observed decrease in enrolment was the establishment of an Islamic school in a predominantly Moslem community causing a movement of Moslem pupils to the Islamic school. The increase in enrolment generally favoured males. However, two schools reported the contrary with male to female increases in enrolment of 49% vs 89.6% and 0.5% vs 5%. The study also showed only modest improvements in school attendance by 1% - 15 % in the schools studied, while the dropout rate remained low at 4%. Only 26.3% of pupils relied solely on the GSFP for lunch.

A descriptive study at Asebu Kwamankese District in the Central Region found that the GSFP increased enrolment, attendance and retention in schools *(27)*. It also improved school performance in terms of pass mark, thinking ability, understanding, concentration and discipline, and had some effect on nutritional status, but no effect on Body mass index (BMI) and the heights of pupils *(27)*.

A study with a quasi-experimental design at Garu-Tampene community of the Upper East Region examined 360 pupils consisting of 180 pupils in GSFP schools and 180 pupils in non-GSFP schools and found a correlation between GSFP and performance in core subjects *(28,29)*. The performance of girls and boys in the GSFP schools was better compared to the non-GSFP schools and were as follows: English Language (63.3% and 63.6%) vs (55.9% and 55.2%), Mathematics (62.0% and 69.7%) vs (57.0% and 56.3%) and Integrated Science (68.4% and 66.6%) vs (59.1% and 56.1%), respectively. In addition, an increase in gross enrolment rate by about 24% was also observed in GSFP schools from 2008-2012, while a decrease in enrolment of 7% occurred in non-GSFP schools *(29)*. The increase was mostly in males in both settings.

A case study of three GSFP schools in the Ga East Municipality showed an increase in school attendance in all three schools between 2004/2005 academic year and 2006/2007 academic year from 68.4% to 94.3%; 83.9% to 92.5%; and 86.5% to 91.9% respectively *(30)*. Furthermore, an interview of stakeholders revealed, that while some students did not need or eat the school meals, others attended school without breakfast. Hence, the school meal was their first and main meal for the day.

A descriptive study of 4 schools in Talensi, Upper East region showed that prior to establishing the GSFP, the level of enrolment was 1,951 for the 2010/2011 academic year which increased by 10.9% to 2,164 in 2012/2013 academic year after it was established *(31)*. Retention rates also increased from 93.0% in the 2010/2011 academic year to 99.3% in the 2012/2013 academic year with corresponding dropout rates of 6.98% and 0.7% respectively. A qualitative study carried out concurrently suggests that the GSFP had contributed to these changes. A case study of the effect of the GSFP on school enrolment in the Tamale metropolis of the Northern Region reported that after its introduction in 2006/2007 academic year, enrolment rose steadily until the 2009/2010 academic year when it declined and increased again thereafter from 34.98 per ten thousand population in 2010/2011 academic year to 40 per ten thousand population in 2013/2014 academic year *(32)*.

DISCUSSION

Current evidence shows that school feeding programmes improve nutritional status, school enrolment and attendance in several settings globally *(1,4,11,33)*. The outcome of this review demonstrates mixed results on the effect of the GSFP on the nutritional status of Ghanaian school children. While a positive effect on nutritional status was demonstrated by an RCT, the effect did not cut across all ages or settings. Children aged 5-8 years, mostly girls living in poverty, had the most positive response *(12)*. A Cochrane review of school health programmes comprising 18 studies with nine from higher income countries and nine from low income countries showed an average weight gain of 0.39 kg over 19 months in children from low income countries who were fed at school compared to controls using RCT's alone. In other studies that were not RCTs, the gain was 0.71kg over an 11.3-month period *(4)*. Our findings are similar to the findings of another extensive review, which found that although school feeding programmes were effective in improving energy and micronutrient intakes, their effect on nutritional status was mixed and less conclusive *(33)*. While some of the GSFP schools demonstrated a positive effect on nutritional status, this was not consistent. Poor nutritional status was prevalent in both GSFP and non-GSFP schools *(20,21,10,11)*.

Interactions between Poverty and the Ghana School Feeding Programme

The observed height gain reported in this review by Gelli et al (2019), was more pronounced in children living in poverty (effect size 0.22) *(12)*. We also noted that overweight and obesity were generally uncommon in GSFP participating schools, except in the RCT and another study which showed that children living in poverty benefitted most from the GSFP *(10,12,21)*. An important observation that reflects the interaction between poverty and the GSFP is that some children on the GSFP received less food at home, and for others, the school meal served as their main meal for the day. Some studies also reported that a small proportion of the children shared some of their meal with siblings; *(11,12,30)*. These observations support the perceived notion that there are children who really need the school meals for reducing hunger, even if the gain in nutritional status is not as pronounced *(33)*. For this reason, effective targeting of the GSFP is necessary to cover all needy children. To this end, needy children can be better defined, identified and targeted, so that schools with needy pupils can be prioritized and solely funded by government, while others are funded by government with support from parents, communities or development partners as occurs in Kenya, Cote D'Ivoire and other countries *(9,34)*. In Cote D'Ivoire, communities contribute to the programme through food stamps, salaries of canteen managers, perishables, cooking fuel and agricultural supports *(9)*. A similar arrangement involving the creation of self-financing school feeding programmes with external support has been tried in cocoa growing areas in Ghana with promising results *(35)*. Thus, better engagement with the community is

critical to improving the impact of the GSFP on nutrition and education outcomes.

Nutrient Intake and Dietary Adequacy of School Meals

Menu compositions of GSFP meals generally vary across the country and change with the time of year *(36)*. Dietary adequacy of school meals was reported in some of the studies reviewed, but this did not necessarily translate into improved nutritional status among the children *(10,11,14)*. This observation suggests that there are other factors, other than the school diet, influencing nutrient intake and nutritional status. The best results, in terms of dietary adequacy, were from schools that used cowpeas, which reported improved iron, protein and thiamine intake; the addition of a multiple-micronutrient-fortified corn soya blend to the food served by the GSFP; and a private school feeding programme which provided larger portions at an additional cost *(10,11,15)*. Due to the difficulties with achieving dietary adequacy, particularly in the micronutrient composition of some school feeding programmes, suggestions have been made to introduce fortification programmes and to increase the diversity of foods provided *(13)*. In addition to this approach, careful meal planning to improve the micronutrient status of school children has been suggested, as well as the development of National Guidelines and Standards (NGS), which are currently in progress *(3,13,36)*. To this end, a school meal planner has been introduced in schools in 42 districts to facilitate the provision of locally sourced nutritious food to school children in Ghana *(37)* It is important that these guidelines address both underweight and overweight holistically since these conditions occur in both GSFP and non-GSFP, and in private schools *(3,10,20,21,36,38)*

Insufficient iron in the diet and anaemia is a major problem of school-aged children in Ghana *(11,13,14,39)*. A study in India showed that multiple micronutrient drinks were effective in improving iron deficiency, iron deficiency anaemia, vitamin C and vitamin B12 status in school children *(40)*. Such an intervention can also be applied to the school feeding programme in Ghana. Additionally, research in Ghana that has demonstrated that the use of Cowpea fortified with NaFe EDTA or in other forms was effective in reducing anaemia in school-aged children, can also be applied *(10,41)*. Increasing the dietary diversity of school meals can be a useful way of enhancing adequate nutrient intake and improving iron status *(18,42,43,44)*. Rations of a corn-soy blend porridge have also been used to improve reversal learning and catch-up growth in lean muscle mass of Malawian school children *(45)*. A low intake of calcium which was observed in some schools can be combated by introducing dairy foods such as milk. Since school meals provide only a third of nutrient requirements, parents need to be supported to provide adequate nourishment for their children and provided access to other social protection interventions to support this effort, where necessary.

Education

An increase in school enrolment and attendance in response to school meals has been reported globally *(1,4)*. The studies reviewed consistently reported an increase in enrolment of children in schools with a feeding programme *(22,23,24,25,26,27)*. Some schools also demonstrated an increase in attendance and retention or reductions in dropout rates *(23,25)*. In addition, better performance and punctuality were reported *(26,27,28,29,46)*. However, the lack of analytic studies and RCT's, as well as the presence of several confounding factors make it too simplistic to attribute these observations solely to the GSFP as some of the studies have done. Most of the studies were cross-sectional with a comparison group. Though these studies provide useful information, cross sectional studies do not determine causality. Nonetheless, the studies which explored further analysis still found statistically significant relationships between increased school enrolment and the GSFP *(22,25,27)*. This observation is similar to findings from Kristjansson et. al.'s RCT, which showed that children who were fed in school attended school at rate of about 4 to 6 days more frequently, made more gains on mathematical tasks and on some short-term cognitive tasks than controls *(4)*. The study concluded that school meals may have small physical and psychosocial benefits for disadvantaged school children which have been shown by some of these studies *(12)*.

There was limited data on the effect of the GSFP on female enrolment in schools. The studies which reported an effect on gender showed that, overall, males were favoured, unlike a study in Burkina Faso, which found an increase in the enrolment rate of girls by 3.2 percentage points *(47)*. Further studies with more rigorous designs are needed to demonstrate the effect of the GSFP on education-related gender outcomes.

CONCLUSION

The findings of this review are similar to that of a systematic review, which examined the nutrition and educational outcomes of the school feeding programme in Ghana *(48)*. The effect of the GSFP on nutrient intake and nutritional status showed mixed results. While some GSFP schools demonstrated a positive effect on the nutritional status of school children, others showed no difference. Insufficient funding and delayed payments to caterers seem to have negatively impacted the gains in nutrition as some studies reported that children on the GSFP received small portion sizes and lower quality of food as a result of inadequate funding *(7,10,15)*. It seems reasonable to conclude, that although the GSFP reduces hunger in some children and complements household food intake, especially for poor families, it might not be adequate to impact nutritional status for several reasons including funding and logistics.

This review found that studies on the impact of the GSFP on education consistently report increases in enrolment, attendance, retention and punctuality. However, without gains in nutritional outcomes, it is unlikely that the GSFP would improve cognition and academic performance of school children significantly, despite impressive documented effects on other indicators.

Resolution of the pervasive funding problem is needed to provide the necessary infrastructure and resources to improve programme implementation and yield better nutrition and education outcomes. Better management and monitoring of the programme, targeting of beneficiaries and exploration of alternate models of school feeding are needed. In addition, comprehensive approaches to addressing the nutritional needs of all school children, including inculcating positive values that influence nutrition-related behaviours *(48)* and promote healthy development of the minds and bodies of school children are recommended. Further studies which employ robust methodology as well as the collection of baseline and routine monitoring

data to inform program performance and evaluation are also needed.

STRENGTHS AND LIMITATIONS

This desk review differs from the systematic review by Awojobi, 2019 *(49)* as the studies included in this review were limited to articles from peer reviewed journals and therefore did not include student dissertations or theses. Additionally, our review included articles and papers on nutrient adequacy and intake and reported measurable outcomes; One (1) randomized controlled trial provided the highest level of evidence. Assessment of dietary intakes was performed using different tools and reference standards which may have affected comparisons across studies. Furthermore, since schools implementing the GSFP tend to be in deprived areas with higher risk of nutritional deficiency, it is possible that children in these schools are nutritionally deprived at baseline than the comparison groups in other schools. Longitudinal studies examining the progress of individual children and community characteristics would have provided useful objective information

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Original

Nutritive analysis of School Meals: An Investigation of a One-day Meal Provided in Feeding Schools of Bhutan

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ABSTRACT The School Feeding Program in Bhutan was initiated in 1974 with an objective of attracting school enrollment and retaining students in school. However, priorities have now shifted towards serving quality meals. In a quest to improve school feeding program, a nutrient analysis of one-day school menu was conducted. *Methods*: Twenty-four schools from the three different regions of the country were purposively sampled for data collection in three phases corresponding to the three school seasons. Food intake information was collected using weighted method. *Result*: Meals served in schools were inadequate in protein (27.2 grams compared to RDA of 29.5 grams for age group 6-9 years, 27.9 grams compared to RDA of 40.2 grams for age group 10-13 years and 29.6grams compared to RDA of 55.8 grams for age group 14-18 years respectively). The meals were high in fat (49.9 grams compared to RDA of 30 grams for age group 6-9 years, 54.2 grams compared to RDA of 35grams for age group 10-13 years and 59.9 grams compared to RDA of 42.5 grams for age group 14-18 years). The sodium availability in the meals was way higher than the recommendations of the World Health Organization across all age groups. The quality of food was homogenous across the phases and regions. *Conclusion*: The assessment indicates homogeneity of school meals across regions and seasons with limited diversity. Protein and energy available in the meals served were inadequate as compared to age appropriate Recommended Daily Allowances including some of the selected micro-nutrients.
Keywords: Food diversity, Micronutrient, School children, Bhutan.

INTRODUCTION

The School Feeding Program (SFP) in Bhutan was initiated in the 1974 with support from World Food Programme (WFP) (1). Back then, the primary objective of the feeding program was to increase school enrollment and retain them in school. After, over four decades into School Feeding Program, the priority has now shifted from school enrollment and retention to improving and maintaining the health and nutritional status of the school going population of the country (1). The National Nutrition Survey 2015 indicated that the nutrition situation in Bhutan remains precarious, with 21.2% of children under the age of five being stunted and nearly 40% anemic, mostly women and adolescent girls (2). In the last five years, sporadic outbreak of peripheral neuropathy has been reported amongst boarding school children across the country indicating the existence of micronutrients deficiencies, such as Thiamine (3). The Government considers School Feeding Program as a key program to bridge the nutritional gap, and is supported and implemented through the Ministry of Education (MoE) (4). There were 86,910 students in 2019 benefiting from the school feeding program. Of these, 41,734 students were boarders (receiving 3 meals); 25,940 were receiving two meals (breakfast and lunch) and 19,236 were receiving one meal (lunch) (5). The food served in feeding schools is based on dietary guideline set by the government. Nine non-perishable commodities (rice, lentils, chickpeas, processed cheese, vegetable oil, milk powder, sugar, tea leaves and salt) are provided by the government through the Food Cooperation of Bhutan (FCBL). Perishable commodities (such as leafy and green vegetables, animal source proteins and fruits) would be bought by the individual schools with the stipend money (Nu 400/child/month, exchange rate1SUD$ = 73.85 Ngultrum as of 10th March 2020) (6).

Although the Royal Government of Bhutan (RGoB) has been running the School Feeding Program for over 45 years, no formal assessments have been conducted to ascertain whether the current standard menu provides the beneficiaries with the recommended daily allowance (RDA) of both macro and micro nutrients. Therefore, the Ministry of Education with financial support from

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World Food Program (WFP) and in collaboration with Ministry of Health and Khesar Gaylpo University of Medical Sciences of Bhutan, conducted an analysis of nutrient content of the meals served in feeding schools of Bhutan. The general objective was to evaluate the nutrient content, and thereafter make appropriate recommendations to improve the overall nutrient t quality of the food in schools for the growth and development of school children.

METHODS

Study design and site

A cross-sectional nutritional assessment was conducted in 2017. Twenty-four schools with feeding program were purposively selected (eight schools from each region; Western, Central and Eastern) to represent feeding schools in the country. To present seasonality, data was collected during the three seasons (spring, summer and autumn) on a random day including all three meals, teas and snacks from the selected schools.

Data collection

Data was collected in three phases (1st phase from April-May; 2nd phase in September and 3rd phase from October-November of 2017) representing the different seasonal variations. Weighted method was used to estimate the average consumption of the food items served on a typical day. Among the various assessment methods, weighted method is considered as the only practical approach in societies where it is usual for all household members to eat from the same pot (7). Since the selected schools were residential schools, all three meals were provided by the schools, thus, each school was considered as a household. First the raw ingredients used for preparing dishes were individually weighed and recorded. Then, the ingredients were cleaned off their non-edible portion, weighed again and recorded. After cooking, the entire cooked dish was weighed and recorded. The approximate average portion size served to students of various age-groups was weighed in the following manner: Three students each from classes PP-III representing the 6-9 years, classes IV-VII representing 10-13 years, and classes VIII-XII representing 14-18 years old were randomly selected from each participating school. The randomly selected students collected food in three incidences (beginning, middle and towards the end) of food serving. The three servings were weighed, recorded and the average of the three readings was recorded as the standard portion for that age group.

Data analysis

Data from the weighted method was entered in Nutri-survey TM software to deduce the nutrient content of the food(s) item(s) based on the approximate serving size that each student presumably would receive. The deduced data was transferred to Microsoft excel for data management and SPSS version 22 for analysis. Descriptive statistics such as frequency, mean, median and percentage was used to quantify the nutrients and compared with the Recommended Dietary Allowance (RDA) of various age groups. Analysis of variance (ANOVA) was used to compare the difference in nutrient content of the food served in participating schools among various age groups, seasons and regions.

Ethical Clearance

This project was a programmatic assessment of quality of diet served in schools; therefore, all communication including permission to collect data was overseen by the Ministry of Education, Royal Government of Bhutan.

Table 1. Number of observations by weighted method

			Class		
			PP-3	4-7	8-12
		n (%)	n (%)	n (%)	n (%)
Regions	Western	58 (35.6)	21 (36.8)	24 (36.4)	13 (32.5)
	Central	45 (27.6)	12 (21.1)	21 (31.8)	12(30.0)
	Eastern	60 (36.8)	24 (42.1)	21 (31.8)	15 (37.5)
	Total	163 (100)	57 (100)	66 (100)	40 (100)
Food Type	Veg	153 (93.8)	54 (94.7)	61 (92.4)	38 (95.0)
	Non veg	10 (6.2)	3 (5.3)	5 (7.6)	2 (5.0)
	Total	163 (100)	57 (100)	66 (100)	40 (100)

*Significant an P-value < 0.0

Table 2. Age-wise mean nutrient availability from meals served in schools

Nutrients	Class PP - 3 (n= 57)				Class 4 - 7 (n=66)				Class 8 -12 (n=40)			
		Nutrient availability				Nutrient availability				Nutrient availability		
	RDA	Mean	SD	% RDA	RDA	Mean	SD	% RDA	RDA	Mean	SD	% RDA
Protein (gm)	29.5	27.2	10.4	92.2	40.2	27.9	10.2	69.4	55.8	29.6	12.9	53.0
Fat (gm)	30	49.9	15.7	166.3	35	54.2	17.7	154.9	42.5	59.9	19.1	140.9
Vitamin A(mcg)	600	445.8	192	74.3	600	480.4	248.1	80.1	600	546.1	276.9	91.0
Thiamine (mg)	0.8	0.7	0.6	87.5	1.1	0.7	0.5	63.6	1.3	0.7	0.5	53.8
Pyridoxine (mg)	1.6	1	0.6	62.5	1.6	1	0.5	62.5	2	1.1	0.5	55.0
Folate (mcg)	120	99.8	31.9	83.2	140	96.9	32.8	69.2	175	104.9	31.2	59.9
Cobalamin (mcg)	1	0.5	0.9	50.0	1	0.5	1	50.0	1	0.7	1.5	70.0
Niacin (mg)	13	8.2	4.7	63.1	14	8.8	6.6	62.9	15.3	8.3	4.3	54.2
Vitamin C (mg)	40	40.2	19.1	100.5	40	40.5	21.5	101.3	40	44.9	24.2	112.3
Calcium (mg)	600	271.3	113.6	45.2	800	277	109	34.6	800	314.4	108.2	39.3
Iron (mg)	16	7.8	4	48.8	24	7.9	3.3	32.9	28.3	8.3	3.3	29.3
Zinc (mg)	8	4.7	2.5	58.8	9	4.8	2.1	53.3	11.5	5.2	2.5	45.2
Sodium (mg)	2000	4669.6	2031.9	233.5	2000	4995.7	1918.8	249.8	2000	5007.5	1598.4	250.4

Table 3. Region-wise nutrient availability from meals served in schools

Nutrients	Region	N	Mean	Std. Deviation	Median	ANOVA p-value
Energy (kcal)	Western	58	1132.4	289.98	1085	
	Central	45	1262.3	288.75	1200.8	
	Eastern	60	1590.81	482.93	1386.95	.000*
Protein (gm.)	Western	58	25.15	11.71	22.2	
	Central	45	26.37	9.73	24.6	
	Eastern	60	32.13	9.86	29.8	.001*
Fat (gm.)	Western	58	49.92	18.51	45.6	
	Central	45	59.3	20.7	52.4	
	Eastern	60	54.27	13.2	51.95	.028*
Vitamin A (mcg)	Western	58	489.78	286.06	423.95	
	Central	45	513.27	300.48	395.1	
	Eastern	60	457.57	98.6	448.65	0.49
Thiamine (mg)	Western	58	0.48	0.13	0.5	
	Central	45	0.65	0.15	0.6	
	Eastern	60	0.94	0.8	0.5	.000*
Pyrodoxine (mg)	Western	58	0.83	0.31	0.8	
	Central	45	0.98	0.26	1	
	Eastern	60	1.26	0.72	0.85	.000*
Folate (mcg)	Western	58	106.78	27.81	101.05	
	Central	45	80.18	26.25	75.5	
	Eastern	60	108	33.87	96.25	.000*
Cobalamin (mcg)	Western	58	0.46	1.2	0	
	Central	45	0.58	0.99	0.1	
	Eastern	60	0.61	1.02	0.1	0.716
Niacine (mg)	Western	58	7.25	6.53	5.7	
	Central	45	8.16	2.5	7.5	
	Eastern	60	9.76	5.77	7.25	.041*
Calcium (mg)	Western	58	249.82	115.5	225.85	
	Central	45	301.81	118.71	257.9	
	Eastern	60	304.21	93.33	283.85	.013*
Iron (mg)	Western	58	6.31	1.91	6.05	
	Central	45	8.5	1.98	8.4	
	Eastern	60	9.13	4.8	7.1	.000*
Zinc (mg)	Western	58	3.89	1.74	3.5	
	Central	45	4.82	1.26	4.8	
	Eastern	60	5.84	2.96	4.3	.000*

RESULTS

During the entire data collection process a total of 163 direct observations were made for weighted methods across 24 schools in three phases. Data was collected on a random day of each of the three seasons. Schools were found to serve non-vegetarian meals (meats such as pork, beef or chicken) only during 10 observations (6.2%). More of non-vegetarian meals were served towards the end of school season corresponding to the second and last phase of data collection (Table 1). Mean age-wise nutrient availability from one-day menu estimated using weighted method is presented in Table 2. The menu was found to be deficient in protein as compared to the RDA for all the three age-groups. Higher classes had higher gaps in protein as indicated by a higher standard deviation. However fat intake exceeded by more than 10% of the RDA in all age groups. The mean availability of most of the micronutrients was inadequate as compared to age appropriate RDA except for vitamin C. Among them calcium, iron and zinc were deficient by almost 50% from the menu in all the age group. However, mean sodium intake exceeded the RDA by over 50%. Region-wise nutrient availability from meals served in school is presented in table 3. ANNOVA test detected significant difference in the mean intake of all the macronutrients and energy between the regions. The menu from the eastern region provided significantly higher levels of energy and protein and almost all the other micronutrients such as thiamine, pyridoxine, iron, zinc, cobalamin, and niacin. There was no statistical difference in phase-wise (seasonality) analysis of nutrient intake (data not presented) were poor in animal source protein, it also hints towards deficiency of iron, vitamin A, zinc and other micro nutrients, as animal source foods are considered the best source of protein, iron and zinc (12).

DISCUSSION

The assessment found that the school meals were deficit in protein and most of the micronutrients. Meals were homogeneous across the regions and seasons but with limited diversity and minimal animal source foods with non-vegetarian meals being served only 10 times (6.2%) out of 163 observations. The World Health organization recommends less than 2000 milligrams of sodium per day (8). However, the assessment also found that the mean sodium availability from the meals served was more than 4500 milligrams in the lowest age groups with higher availability in higher age groups. High sodium intake in the Bhutanese population was reported by the WHO step survey of Bhutan 2015 (9).

School meals have been under scrutiny in the region where some similar findings have been reported. In a narrative of a study from Allahabad district of India, they reportedly mentioned that the mean nutrient intake for energy, protein, iron and calcium were lower than RDA but fat intake was higher in all age groups (10).

A Chinese study reported that the calories from fat exceeded the RDA by almost 30% (11) which is consistent with the present finding in Bhutanese schools where fat availability in the meals exceeded almost by 50% as compared to the RDA. The study also reported that vitamin B2 and calcium were inadequate, whereas, vitamin C, vitamin B1, iron and zinc were adequate. In Bhutanese schools except for vitamin C (40.2 mg, 40.5 mg and 44.9 mg for age group 6-9 years, 10-13 years and 14-18 years respectively), all other micronutrient was far lower than the RDA. This could be because for the Chinese student's, livestock and poultry were served more than twice the required amount. In contrast, of the 163 observation only 10 incidences recorded non-vegetarian (meat, chicken or pork) side dish during the study period of boarding schools in Bhutan. Since the meals served in schools

The Royal Government of Bhutan (RGOB) having realized the role of school feeding program has now shifted the focus of school feeding program from retaining in school to providing diverse and nutritionally wholesome meals. A System Approach to Better Education Result (SABER) assessment conducted by the MOE in 2014 recommended establishing a clear policy for the school feeding program (13). The Bhutan Education Blueprint (2014 - 2024) has given priority to school feeding program and recommended for a strong school feeding policy (1). The School Health and Nutrition Division (SHND) under Ministry of Education is responsible for school feeding program in providing quality meals and have been collaborating with other agencies / ministries such as the ministry of Agriculture and Forestry, Finance, Gross National Happiness Commission and the World Food Program (4).

As an immediate measure to improve the quality of the meals in feeding schools, the MoE with technical and financial assistant from WFP started providing fortified rice towards the end of 2017(5). The rice is fortified with six vitamins (vitamin A, Thiamine, folic acid, vitamin B3, B6 and B12) and two minerals (iron and zinc) by blending with the fortified rice kernels (14). During the time of the data collection for this study, the supply of fortified rice had not reached schools and therefore the finding of this study is timely and informative and the fortification of rice with vitamins and minerals are very timely for the given situation.

LIMITATIONS

The project was a programmatic review on nutrient adequacy of meals served in feeding schools. The nutrients were analyzed from standard portion size served and not based on actual consumption by the students.

CONCLUSION AND RECOMMENDATION

The assessment indicates the homogeneity of school meals across regions and seasons. The average protein availability from the meals served was similar for different age-groups, (27.2 grams, 27.9 grams and 29.6 grams for age group 6-9 years, 10-13 years and 14-18 years respectively) which might not be sufficient to meet the requirements of the higher age-groups. Most of the micro-nutrients were deficient which was even more pronounced in the higher age-groups. This is probably because of the limited variety of school meals as indicated from infrequent provision of meats and fruits. The assessment recommends to implement initiatives that will improve the availability of micronutrients such as food fortification, integration of school agriculture programs with school feeding and linkages with local farmers, strengthen monitoring and supportive supervision and promote local creativity and involvement of students in the menu planning and decision making process.

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Original

Fiber-focused Nutrition Counseling Through Nutrition Software Improved HbA1c of Vietnamese Type 2 Diabetes Mellitus Patients

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ABSTRACT ***Background and purpose:*** Type 2 diabetes mellitus **(**T2DM**)**, which is an individual health challenge requiring ongoing management, has been rapidly increasing**.** The major factor affecting the rate of Vietnamese T2DM is reported by some studies as low fiber intake**.** In this situation, dietitian need to help T2DM patients to change their dietary habits, in order to control their blood glucose**.** However, in Vietnam, the number of dietitians is very limited**.** Calorie Smile Vietnam version (CSV) is a nutrition support software which can be a solution for dietitians, who can monitor and advise many people at the same time and also work at from any time and place**.** Such a tool will be extremely useful in Vietnam**.** Therefore, we wanted to determine the effect of fiber-focused nutrition counseling thourgh the nutrition software on improving HbA1c of Vietnamese T2DM patients. ***Method*****:** Sixty outpatients with T2DM were recruited at a hospital for a 3-month randomized controlled trial study. We formed 30 pairs matched by HbA1c, sex, age, BMI, and years of diabetes, and divided them randomly into an Intervention and a Control group. Both groups were instructed to use the CSV software. All the nutrition surveys and nutrition counseling were carried out using CSV. The Control group had a 3-consecutive-day nutrition survey at baseline and final and received 1-time nutrition counseling at baseline. The Intervention group had 3-consecutive-day nutrition survey and counseling 5 times. The counseling was focused on increasing fiber intake from vegetables and fruits. The target was 2 bowls of vegetables/meal; the appropriate amount of fruit/day. In addition, subjects were also counseled about food choices. At baseline and final, anthropometric measurements and blood withdrawal were conducted. ***Result:*** After 3 months, the intervention group had increased fiber intake (from 6.4 ± 2.5 to 8.3 ± 3.0 g/day, $p<0.0001$), while the control group had no change. As a result, HbA1c was significantly improved in the Intervention group (from 8.16 ± 0.75% to 7.79 ± 0.85%, $p<0.05$) compared with the Control group (from 8.05 ± 0.77% to 8.39 ± 1.33%). There was a negative correlation between change in fiber intake and change in HbA1c. ***Conclusion:*** Real time nutrition counseling for T2DM patients using the CSV software was effective for improving fiber intake and HbA1c.

Keywords: Nutrition Software, education, dietary fiber, - \Type 2 DM, Vietnam

BACKGROUND

Diabetes mellitus is a chronic metabolic disease characterized by elevated levels of blood glucose thatoccur either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces (1). Diabetes of all types can lead to complications in many parts of the body and can increase the overall risk of dying prematurely. According to the World Health Organization (WHO), globally, in 2014 there were about 422 million people with diabetes; in 2016, an estimated 1.6 million deaths were directly caused by diabetes and another 2.2 million deaths were attributable to high blood glucose in 2012 10 years. In 2002, the proportion was 2.7%, but by 2012, it was up to 5.4% (2). In 2015, it was estimated that 5.6% of people had diabetes and about 53,458 deaths were attributed to diabetes (3). The diabetes-related expenditures in Viet Nam are on average 163 USD per patient per year, more than the average monthly salary of 150 USD in Viet Nam (4).

Nowadays, in a period of economic development and transformation of nutrition and food security, the traditional diet of Vietnamese, which was high-carbohydrate, low-fat and high-fiber, has been changed to a high-carbohydrate, high-fat, and low-fiber diet. This is a major factor affecting the rate of type 2 diabetes mellitus (T2DM) in Vietnam. If T2DM patients do not have a proper diet, they cannot control their blood glucose, so they may suffer from serious complications whereby the economic burden also becomes extremely high. Dietary management for diabetic patients has been

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shown to improve blood glucose control and reduce the risk of complications. Despite that, there are various barriers for patients to obtaining the proper dietary management. These include lack of dietitians, lack of time for dietitians to provide patients with continuing education and sometimes lack of patients′ access to dietitians because patients do not have the time or money to come to the hospital.

In this situation, a solution to support patients in dietary management is very necessary. There is a need for a tool that can overcome the barriers. Systems and software to support nutritional counseling become imperative but in Vietnam, they are not available. Thus, a Japanese computer company and some Vietnamese nutrition experts have developed nutrition software for Vietnamese, called Calorie Smile Vietnam version (CSV) (5). Such a tool will be extremely useful in Vietnam where the number of dietitians is very limited. However, there has been no study to prove its effectiveness with Vietnamese people. Therefore, we wanted to determine the effect of nutrition counseling through CSV software on improving HbA1c in T2DM patients.

METHODS

Design of Calorie Smile Vietnam version (CSV)

CSV is a nutrition software which has installed in it Vietnamese language (5), and has been integrated with the Vietnam food composition table (6), the nutrition value of 500 common dishes from the Hanoi area (7) and the nutrition value of common street food from the Ho Chi Minh city (8). This software offers dietitians a new way to conveniently exchange information with their patients.

CSV is designed to connect dietitians and patients through the internet, from anywhere and at any time. So, the dietitians can adjust the time and place of work and the patients can get nutrition advice without going to the hospital.

CSV includes 6 functions:

1. Questionnaire: The dietitian can create a detailed questionnaire about patients′ everyday dietary habits and ask the patients to complete it. The patients can use their smartphones to fill in the questionnaire and return it to the dietitian. Based on this data, the dietitian drafts an action plan to monitor the patients′ daily progress.
2. Data transferring: Patient data such as meal photos, biochemical indices, anthropometric indicators, and physical activity indicators submitted by the patient to the software will be transferred to the account of the dietitian as well as being shown on the patient's page.
3. Daily progress: The patient′s daily progress can be traced at a glance. Patient data are shown in tables and charts, making it easy for the dietitian to check.
4. Meal analysis: Based on the patient′s meal photos, the dietitian can make a detailed nutritional analysis and send back to the patient. CSV is integrated with data about common dishes in Vietnam, so the meal can be analyzed quickly. In addition, if the patient's dishes are different from the available dishes, change can be made to meal ingredients and portions.
5. Nutritional advice: After analyzing, the dietitian sends the patients nutritional advice to boost their motivation. Patients can also reply to the dietitian, so that the communication is carried out smoothly.
6. Group counseling: A team of dietitians can work together to advise one user. This function is very convenient for learning and sharing experiences among dietitians, as well as transferring information on patients in the same group.

Study design:

This was a 3-month randomized controlled trial performed between October 2018 and April 2019 at Vietnam-Cuba Friendship Hospital. T2DM patients who had HbA1c>7%, were using oral drugs for management of T2DM, had no severe complications, had no intervention by dietetics professionals for T2DM, were using smart-phones and were able to access the internet and weren′t pregnant at the time of recruitment for the study. After screening data at the hospital, and through phone contact and meeting in person, 60 subjects who agreed to participate in this study were enrolled. Sixty patients who were pair matched by HbA1c, age group, years with T2DM, BMI, and gender then were randomly divided into 2 groups, 30 in the Control Group and 30 in the Intervention Group. During the intervention, drug dosage was not changed in either the Control or the Intervention Group.

Study methods:

Subjects visited us twice, at baseline and final. At baseline, all the subjects received CSV software instruction.

Nutrition survey:

A 3-consecutive-day nutrition survey by the photographic method was conduct at week 1 and week 12 through CSV software for all subjects. For the intervention group, subjects would have 4 more sessions of nutrition survey in weeks 3, 6, 10, and 12. Energy and nutrient intakes were calculated.

* Patients were instructed to take photos of food:
  - Patients were asked what type of bowls, plates that they use.
  - At meals, patients took photos of all the food with the proper amounts that they intended to eat in separate bowls/plates and took pictures from 2 angles: straight and tilted.
  - After the meal, patients would take pictures of the food left over.

Dietary counselling:

All the counselling was given through CSV software by 5 Bachelors of Nutrition who had graduated from Hanoi Medical University. Subjects in the intervention group had counseling 5 times, after the nutrition survey in week 1, and in weeks 3, 6, 10, and 12. Subjects in the control group continued their treatment regimen and did not receive any counselling from this study during the intervention period.

Counselling method:

The counseling was focused on increasing fiber intake and food choices.

We instructed patients to gradually increase vegetables, using certain measuring tools such as rice bowls to measure the amount of vegetables at each meal and we set goals for patients at each consultation. For example, for the first consultation, we set a goal of 2/3

of a bowl of vegetables/meal, at the second consultation we would check and raise the target to 1 bowl of vegetables/meal, the 3rd consultation targeted 1.5 bowls of vegetables/meal, the 4th consultation targeted 2 bowls of vegetables/ meal and then subjects maintained this amount. We also advised them to choose seasonal vegetables and to combine various kinds of vegetable in one meal. We checked their progress through photos of the food they ate and constantly monitored, motivated, and reminded them to try to achieve their goals.

Besides vegetables, we encouraged patients to eat more fruits, gave them a list of fruits they should eat and fruits they should avoid or eat only occasionally if they craved them and we also showed them the amount they could eat each time. For example, Guava is a low-sugar, high-fiber fruit so we recommended that they could eat 1/2-1 guava/day.

Blood test

Intravenous fasting blood samples were taken in the morning at baseline and final. HbA1c was analyzed.

Anthropometric measurement

Weight, height, and body fat percentage were measured twice, at the baseline and final and the average value was calculated for each individual. Body weight and height were measured in light clothing and without shoes. Body mass index (BMI) was computed as the ratio of weight (kg) per height squared (m^2). Body weight and percent body fat were measured by a digital weight scale (OMRON HBF-354IT) with accuracy to 0.1kg and 0.1%. Body height were measured by a portable stadiometer (Seca 213) with accuracy to 0.01cm.

Statistical analysis

Quantitative variables were checked for normal distribution and compared by the paired and unpaired Student *t*-test. P-values of less than 0.05 were considered statistically significant for all the analyses. The above statistical procedures were performed using Microsoft Excel 2013.

RESULTS

Baseline characteristics of the 60 subjects are shown in Table 1. Characteristics were similar between the 2 groups. The overall study population was predominantly female (66%), average age was 59.2 years (SD = 9.4), and average HbAc1 8.0% (SD = 0.7). After 3 months, there were 2 dropout patients in the Intervention Group.

Table 2 shows the change in HbA1c from baseline to final by study group. HbA1c values declined significantly in the Intervention Group ($p<0.05$), while in the Control Group, it increased but not significantly.

Table 1: Baseline characteristics of the subjects

	Intervention Group (n=30)	**Control Group (n=30)**
HbA1c (%)	8.17±0.73	8.05±0.77
Age (years)	57.8±9.0	60.6±8.2
Year with diabetes	6.0±4.3	6.5±5.9
Sex		
Female	20	20
Male	10	10
Body mass index (kg/m^2)		
<18.5	0	0
18.5-24.9	20	20
≥25	10	10
P values obtained from unpaired *t*-test between intervention and control groups		

Table 2: Comparison of biochemical parameters at baseline and final of Intervention and Control Group

	Intervention Group (n=28)		**Control Group (n=30)**	
	Baseline	Final	Baseline	Final
HbA1c (%)	8.16±0.75	7.79±0.85*	8.05±0.77	8.39±1.33
*Significantly different from baseline to final within the group by paired *t*-test; $p<0.05$				

Table 3 shows the comparison of vegetable and fruit intake at baseline and final of Intervention and Control Groups. With the Intervention Group, the intake increased significantly. Energy and nutrient intakes of both groups at baseline and final data within the group did not differ except for fiber (Table 4). As a result, after 3 months, there were no changes in the physical characteristics of both groups (Table 5). Relationship between changes in fiber intake and change in HbA1C is shown in figure 1. HbA1C decreased as fiber intake increased.

Table 3: Comparison of vegetable and fruit intake at baseline and final of Intervention and Control Group

	Intervention Group (n=28)		**Control Group (n=30)**	
	Baseline	Final	Baseline	Final
Vegetable and fruit intake (g)	234.4±129.9	326.2±173.2*	160.9±118.2	187.4±132.4

*Significantly different from baseline to final within the group by paired *t*-test; p<0.05

Table 4: Energy and nutrient intakes at baseline and final of Intervention and Control Group

	Intervention Group (n=28)		**Control Group (n=30)**	
	Baseline	Final	Baseline	Final
Energy (kcal/day)	1399±294	1377±234	1398±315	1378±296
Protein (%E)	19.1±4.4	18.0±3.2	17.6±2.6	16.9±2.6
Protein (g/day)	66.4±18.3	62.6±16.9	61.5±15.7	58.9±17.1
Fat (%E)	26.3±6.2	24.9±3.1	24.7±4.3	25.5±3.8
Fat (g/day)	41.3±13.1	38.1±8.7	38.4±11.0	39.1±10.6
Carbohydrate(%E)	54.7±8.2	57.1±4.4	57.7±5.5	57.6±4.9
Carbohydrate (g/day)	190.4±47.5	195.7±32.7	201.5±50.6	197.6±45.2
Fiber (g/day)	6.4±2.5	8.3±3.0***	5.5±1.8	5.9±2.1

*** Significantly different from baseline to final within the group by paired *t*-test (p<0.0001)

Table 5: Comparison of physical characteristics at baseline and final of Intervention and Control Group

	Intervention Group (n=28)		**Control Group (n=30)**	
	Baseline	Final	Baseline	Final
Weight (kg)	61.2 ± 10.4	60.9 ± 10.4	60.6 ± 8.2	60.5 ± 8.12
BMI (kg/m2)	24.4 ± 3.6	24.4 ± 3.6	24.5 ± 2.6	24.5 ± 2.7
Body fat (%)	31.8 ± 4.8	31.4 ± 4.9	31.2 ± 4.7	30.6 ± 4.9
P values obtained from paired t-test between baseline and final within the group				

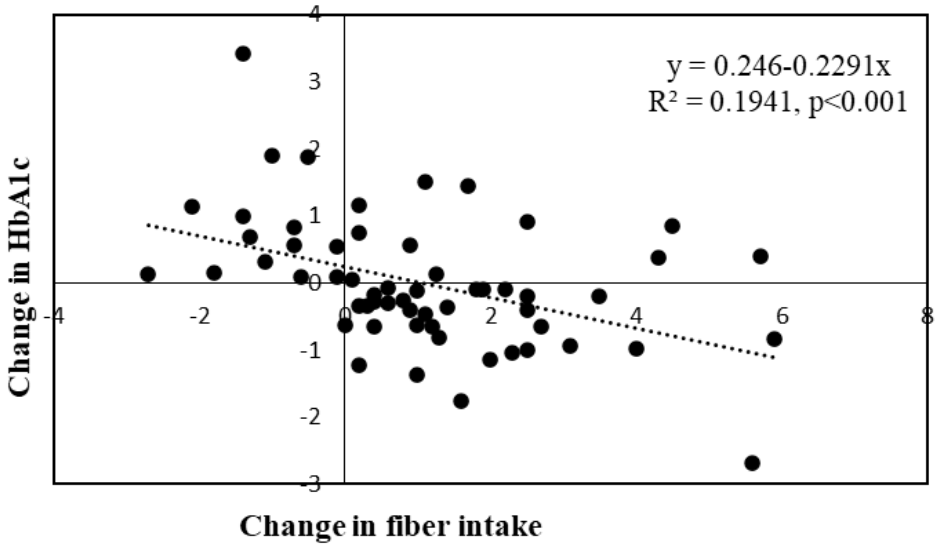

Figure 1: Relationship between change in fiber intake and change in HbA1c

Table 6 presents the comparison of nutrition education received by the 2 groups in 3 months. At baseline, all patients said that they had consulted with their general practitioner and referred to the internet about diet for diabetics, but they had only very basic knowledge. They had followed it for a short time, but no one pushed them, so they quickly returned to their old habits and ate what they liked. Subjects expected to get counseling from dietitians and to be monitored on diet and to receive timely advice. In the 3 months of the study, the control group received nutrition education only 3 times with very basic information from a general doctor at the hospital without analysis of their diet, while the intervention group were able to receive intensive nutrition education suited to their diet 5 times and received it at home.

Table 6: Comparison of nutrition education received by the 2 groups in 3 months.

	Intervention group	**Control group**
Number of nutrition counseling/3 month	5 times	3 times
Counselor	Dietitian	General doctor
Place	At home	At hospital
Time	At week 1,3,6,12 of the study	When coming to hospital to for re-examination and to receive drug
Content	Detailed advice according to the analyzed diet information Diet goal: - Fiber: 10g/1000Kcal, Vegetable and fruit: 400-500g/day - Energy: 30-35 kcal/ kg of ideal body weight/ day - Carbohydrate: 55-65% of total energy, coordination between low glycemic load foods and high glycemic load foods. - Protein: 1 -1.25g/kg of ideal body weight/day - Fat: 20-25% of total energy	Only received advice: ″Your blood glucose is too high; you should reduce the energy and carbohydrate intake; increase the vegetable intake″ without analyzing their diet.

DISCUSSION

This study found that nutrition counseling through nutrition software was effective in lowering HbA1c, and improving dietary pattern, especially fiber intake, in a community population of adults with diabetes over a 3-month period.

In order for patient to change their eating habits, it is essential to set individual specific goals at each consultation, and to provide feedback, follow-up, and motivation for the patient. If patients are motivated regularly and given timely advice, they will be able to adopt good lifestyle behaviors, and easily control their blood sugar well. In this study, these tasks were facilitated by the CSV software and patients did not have to go to the hospital, which saved them a lot of time. Both dietitians and patients can easily exchange data at any time of the day, wherever they may be. This is more efficient than making face-to-face appointments that can be missed due to busy schedules. Dietitians and patients can stay in constant contact to help patients reach their targets. Moreover, thanks to the analytical features available on CSV software, dietitians could analyze patients′ meal photos quickly; therefore, at the same time, they could analyze for more patients. After the 3 months of study, it was rewarding to note that patients in the intervention group referred to dietitians for diabetes nutrition counseling. Their behaviors were likewise improved, paralleling and likely influencing positive clinical outcomes. In addition, there were only 2 dropout patients, indicating that CSV is easy to use, convenient and had supported patients particularly well.

After the intervention, the HbA1c of the intervention group decreased by 0.38% ($p < 0.05$) while the control group increased by 0.34% ($p > 0.05$). During the 3 months, no patient had changed medication, indicating regular monitoring and nutrition counseling were effective. In order to reduce HbA1c, it is very important to properly evaluate the current diet and to develop an appropriate nutrition plan for patients. After the first nutrition survey, we found that most subjects in the study were consuming a moderate energy level of 1300-1400 kcal with a reasonable ratio of protein: lipid: carbohydrate, but the food choices and distribution of meals were not yet appropriate. In particular, the amount of fiber consumed was very low. The low fiber consumption may explain why the subjects′ BMI was not high (about 24.4-24.5 kg/m2) even though T2DM patients worldwide are usually obese. Therefore, if we continue to require patients who have already reduced energy intake to reduce energy intake more, it may not be effective and may often lead to low compliance. Instead, counseling on how to change the pattern of eating, food choices and recommendations to eat more fiber can bring greater compliance for participants. With this counselling method, after the study, in the

intervention group, vegetable consumption increased from 234 to 326 g/day and fiber consumption increased statistically, from 6.4 ± 2.5 to 8.3 ± 3.0g/day, while the control group did not change. Moreover, the variety of vegetables also increased. At baseline, almost all intervention patients ate just one kind of vegetable at many meals. This may have made them lose their appetite and they did not want to eat more vegetables. We tried to tell them to choose seasonal vegetables and combine various kinds of vegetable in 1 meal so the dishes will become more delicious and eye-catching. We also encouraged patients to change the kind of vegetable frequently, so they did not get bored. Hence, from 1 kind of vegetable/meal at baseline, they could change to 2-3 kinds of vegetables/meal at the end of the study.

Fiber is important for everyone and especially for people with diabetes. Dietary fiber can increase the viscosity of diets and cause a delay in digestion and the absorption of sugar into the bloodstream. The positive effects of fiber or vegetables on blood glucose control have been shown by many studies. The last two studies on diabetics in Vietnam have shown similar results (9,10). A study of Okara in which the intervention group consumed about 6 g of fiber from Okara per day for 2 weeks showed that when dietary fiber intake increased from 6.9 to 12.6 g ($p<0.01$), fasting blood glucose and fructosamine dropped from 6.3 to 5.4 mmol/L ($p<0.05$) and from 319 to 301 μmol/L ($p<0.05$), respectively. Another study showed that when vegetable intakes increased from 200-300g to 300g and 450g in the control and intervention group, respectively, the fructosamine concentration in the intervention group decreased significantly ($P<0.05$) but not in the control group ($P>0.05$). Other studies in various countries used a variety of grams of fiber per day in their interventions, comprising a large range, from as little as an additional 4 g/d to as much as 40 g/d; the mean increase in fiber was approximately 18 g/d to achieve an overall reduction in HbA1c by fiber of 0.26% (95% CI, 0.02–0.51) more than the reduction from a placebo (11). However, in this study, only a small quantity of fiber increase (2g) was effective in controlling blood glucose. It may be due to the fact that the recent intake of Vietnamese is very low, only 6g/day, so an increase of 2 grams means a 1/3 increase over recent intake.

Although we observed positive results for the application of CSV in supporting nutrition counseling in our current research, several obstacles need to be overcome before this software can be implemented. At typical Vietnamese meals, all dishes except individual bowls of rice are communal, so it is necessary to establish common measurement methods to be able to calculate the patient's diet accurately. Besides, Vietnamese people are not familiar with taking photos of meals as well as posting photos and receiving advice through the software. In this study, we had to contact patients regularly to remind them but in reality, with the workload of doctors and nutritionists, they would not be able to do so. This limitation can be overcome by developing an automated reminder system based on the patient's data.

This study had 3 months of intervention; but with T2DM patients, to improve glycemic control, maintaining long-term control is required. Therefore, further study should have a longer time for intervention and follow-up.

CONCLUSION

In summary, by using nutrition counseling through nutrition software for 3 months, fiber intake was increased about 2g/day, were effective in decreasing HbA1c of Vietnamese T2DM patients.

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ORIGINAL

Oral Function, Handgrip Strength and Aspiration Pneumonia in Dysphagic Older Adult Inpatients in Vietnam

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ABSTRACT *Background/objective.* The Vietnamese older adult population has increased rapidly on an annual basis and dysphagia has become a common issue. Dysphagia and factors related to dysphagia will effect treatment in general and dietary treatment in particular. This study aimed to find out the relationship between dysphagia and oral function, handgrip strength and pneumonia in older adult inpatients in Vietnam. *Method.* The study was designed as a cross sectional study and was conducted from August 2018 to January 2019. There were more than one thousand older adult patients who met the inclusion criteria. The data about dysphagia status, oral function, muscle strength and pneumonia were collected by dietitians. *Results.* The proportions of older adult inpatients with the ability to open the mouth more than three fingers, move the tongue forward, move the tongue to the left and right, push the buccal mucosa with the tongue, inflate both cheeks and with no atrophy of the tongue and no tongue-surface dryness in the non-dysphagia group were more than dysphagia group ($p<0.001$). No difference was observed between those with and without dentures in the two groups. The dysphagic older adult inpatients had lower muscle strength than the non-dysphagics in both genders ($p<0.001$). There were 13.5% older adult inpatients who suffered from pneumonia. The pneumonia rate (39.2%) in the dysphagia group was higher than in the non-dysphagia group (8.4%). *Conclusion.* Dysphagia has a positive relationship with poor oral function, low handgrip strength and a high rate of pneumonia. Dietitians need to have an overview of dysphagia patients in order to supply a suitable texture-modified diet.

Key Words: elderly, patients, hospital, dysphagia, oral function, pneumonia, muscle strength

INTRODUCTION

Population aging is now a worldwide unavoidable trend. Dysphagia has become a common issue in older adult populations (1). Swallowing is a complex neuromuscular activity that consists of oral, pharyngeal, and esophageal phases, and involves the coordinated function of many muscles. Thus, many adverse health conditions can influence swallowing function. Neurological diseases, head/neck and esophageal cancer, and metabolic deficits are broad categories of diseases that might contribute to dysphagia.

The number of Vietnamese aged 65 and older is projected to increase rapidly from 7.8% in 2015 to 17.8% in 2050 (2). In previously published data, more than one thousand older adult inpatients in three large Vietnamese hospitals were screened for dysphagia through the use of quick and simple tools. The results showed that the rate of dysphagia was quite high, about 16.5% (3). This result is similar to other studies in Japanese and US older adult populations (4, 5). Therefore, dysphagia also is a main issue in older adult inpatients in Vietnam.

In clinical practice, dysphagia patients who suffer from neurological conditions such as stroke disease, Parkinson's disease may have limited oral function because of their neurological disorder. These abnormal oral functions, such as open mouth, tongue motion, inflated cheeks, dentures, atrophy of the tongue papilla and drying of the tongue surface may affect dysphagia status. These are simple tests but based on the dysfunction of each part of the oral cavity, the dietitian can decide which kind of texture-modified diet is suitable for each patient.

Muscle weakness may reflect a global effect of aging. The tongue is a key component in safe swallowing. Poor performance of the tongue leads to high risk of aspiration. There was a significant positive association between posterior tongue strength and handgrip strength (6). Checking handgrip strength may be supply information which reflects tongue strength and muscle of the body. On the basis of these data, a dietitian can design suitable menus for patients.

Dysphagia patients who aspirate are at an increased risk of acquiring pneumonia. A recent large-scale cross-sectional study of Japanese older adults showed that the risk factors for aspiration pneumonia were sputum suctioning, dysphagia, dehydration, and dementia; pneumonia is the third leading cause of death in this country (7, 8). Pneumonia is a serious consequence of dysphagia and a major cause of morbidity and mortality in the older adult; therefore, improving understanding of the prevalence of dysphagia in people with pneumonia is also important to highlight the necessary for better management of dysphagia to prevent development of this serious condition.

In this study, dietitians would directly collect the oral function indicators and muscle strength and pneumonia status of subjects. We thought that by understanding oral function, muscle strength, and pneumonia status, the dietitian can provide dysphagia patients suitable food choices. The aim of this study was to find the relationship between dysphagia and oral function, muscle strength and pneumonia status in dysphagic older adult inpatients in Vietnamese hospitals.

METHOD

Settings and Sample

The study was designed as a cross-sectional study and was conducted for 6 months, from August 2018 through January 2019. This research was conducted in accordance with Declaration of Helsinki and approved by the Hanoi Medical University's ethical committee, number 1318. The study population consisted of older adult inpatients being treated in three large general hospitals in Vietnam: Hanoi Medical University Hospital (500 beds), Dong Da General Hospital (800 beds) and National Geriatric Hospital (500 beds).

Subjects were recruited for the study from all newly admitted patients, i.e., patients in the first 48 hours after admission, by random selection (using a random number table) from admission registers.

The sample size was about one thousand subjects who met the inclusion criteria: (1) hospitalized older adults in the above three hospitals, (2) age 65 or over. The exclusion criteria included: (1) refusal to participate in this study, (2) mute, deaf or psychotic and (3) suffering from ventilator, coma, trauma or injury. All potential subjects completed questionnaires and were screened using swallowing tests.

Data collection

All the questionnaires were carried out by investigators. The investigators were dietitians who were trained to collect the study data. Before carrying out the actual study, we conducted a pilot study on 50 patients to revise the instruments.

Below is the information that we obtained.

Demographic data

Data such as age, gender, diagnosed diseases were collected from medical records.

Dysphagia screening

Repetitive saliva swallowing test (RSST)

Patients were asked to swallow their own saliva as many times as possible in 30 seconds; the examiner determined the absence of laryngeal elevation during swallowing by observing and/or feeling laryngeal movement. If a patient was unable to perform three consecutive swallows with two retests, he/she suffered from dysphagia. If a patient was able to swallow 3 times or more, then the Water Swallowing Test would be administered (9).

Water Swallowing Test (WST)

The examiner would offer 3ml water for the subject to drink; if patients choked or their voice changed, patients suffered from dysphagia. If there was no choking or voice change, subjects continued to drink 30 ml water. Subjects who had choking or voice change were dysphagic. If there was no choking or voice change, patients were normal (9).

Oral functional test

In order to check oral function, a tongue depressor was used. Some indicators such as opening degree, tongue motion, inflating cheeks, dentures, atrophy of the tongue papilla and lingual surface drying were collected.

Muscle strength

Muscle strength was assessed using hand grip strength. A hand dynamometer (MP-HDM03-BK, China) was used. The mean of three measurements from each hand was recorded. In cases of parenteral nutrition or paralysis, a mean of three measurements was used from the dominant hand. Missing data could be accepted.

Pneumonia

Information was collected from the medical record.

Statistical analysis

P-values of less than 0.05 were considered statistically significant for all the analyses is the plural. The above statistical procedures were performed using Stata version 12.0.

RESULTS

Table 1 shows the characteristics of 1007 older adult inpatients (420 males and 587 females, mean age 75.5±7.3 years). Dysphagia occurs more in older patients with no difference between genders. There were 24% of subjects who suffered from neurologic disorders or esophageal disorders or respiratory & latrogenic disorders.

Table 2 shows the comparison about oral function between dysphagia group and non-dysphagia group. The proportions of older adult inpatients with the ability to open the mouth more than three fingers, move the tongue forward, move the tongue to the left and right, push the buccal mucosa with the tongue, inflate both cheeks in non-dysphagia group were higher in the non-dysphagia group than in the dysphagia group and have a significant difference with $p<0.001$. There was no observed difference in having or not having dentures between the two groups. The dysphagia group had rates of tongue atrophy and tongue surface dryness higher than the non-dysphagia group and the difference was statistically significant with $p<0.001$.

Table 3 indicated the comparison about muscle strength between dysphagia group and non-dysphagia group. The dysphagia older adult inpatients had lower muscle strength than non-dysphagia patients in both genders with a significant difference of $p<0.001$.

Table 4 show the comparison about aspiration pneumonia between dysphagia group and non-dysphagia group. There were 13.5% older adult inpatients who suffered from pneumonia. The pneumonia rate (39.2%) in the dysphagia group was higher than in the non-dysphagia group (8.4%). It had a significant difference of $p<0.0001$.

Table 1. Characteristics of subjects enrolled in this study (n=1007)

Characteristics	Overall (n=1007)	Dysphagia (n=166)	Non-dysphagia (n=841)	P-value
Age, years	75.5±7.3	78.0±7.7	75.0±7.1	<0.05#
Female, n (%)	587 (58.3)	104 (62.7)	483 (57.4)	0.21*
Male, n (%)	420 (41.7)	62 (37.3)	358 (42.6)	
Disease groups				
• Neurologic disorders, n (%)	113 (11.2)	45 (27.1)	68 (8.0)	
• Esophageal disorders, n (%)	63 (6.3)	32 (19.3)	31 (3.7)	
• Respiratory & latrogenic disorders, n (%)	65 (6.5)	19 (11.4)	46 (5.5)	
• Other, n (%)	766 (76)	70 (42.2)	696 (82.8)	

Data presented as mean ± standard deviation or n (%)
*Chi-square test # Student t-test

Table 2: The comparison about oral function between dysphagia group and non-dysphagia group

Oral function indicators		Overall (n=1007)	Dysphagia (n=166)	Non-dysphagia (n=841)	P-value
Mouth opening degree	Higher three fingers	943 (93.6%)	133 (80.1%)	810 (96.3%)	P<0.001
	Lower three finger	64 (6.4%)	33 (19.9%)	31 (3.7%)	
Move your tongue forward	Can	981 (97.4%)	149 (89.8%)	832 (98.9%)	P<0.001
	Can not	26 (2.6%)	17 (10.2%)	9 (1.1%)	
Move your tongue left and right	Can	946 (93.9%)	130 (78.3%)	816 (97.0%)	P<0.001
	Can not	61 (6.1%)	36 (21.7%)	25 (3.0%)	
Push the buccal mucosa with your tongue	Can	941 (93.4%)	127 (76.5%)	814 (96.8%)	P<0.001
	Can not	66 (6.6%)	39 (23.5%)	27 (3.2%)	
Inflating both cheeks	Can	941 (93.4%)	124 (74.7%)	817 (97.1%)	P<0.001
	Can not	66 (6.6%)	42 (25.3%)	24 (2.8%)	
Dentures	Yes	302 (30.0%)	48 (28.9%)	254 (30.2%)	P<0.5
	No	705 (70.0%)	118 (71.1%)	587 (69.8%)	
Atrophy of the tongue papilla	Yes	83 (8.2%)	32 (19.3%)	51 (6.0%)	P<0.001
	No	924 (91.8%)	134 (80.7)	790 (94.0%)	
Tongue surface drying	Little saliva	112 (11.1%)	48 (28.9%)	64 (7.6%)	P<0.001
	Enough saliva	895 (88.9%)	118 (71.1%)	777 (92.4%)	

Fisher's exact test

Table 3: The comparison about muscle strength between dysphagia group and non-dysphagia group

Muscle strength (kg)	Overall	Dysphagia	Non-dysphagia	P-value
Male	(n=384) 18.6±8.0	(n=53) 12.6±7.4	(n=331) 19.6±7.7	
Female	(n=532) 11.2±5.0	(n=87) 9.0±4.7	(n=445) 11.6±4.9	
All	(n=916) 14.3±7.4	(n=140) 10.3±6.1	(n=776) 15.0±7.4	P<0.001

Mann-Whitney U test

Table 4: The comparison about aspiration pneumonia between dysphagia group and non-dysphagia group

Pneumonia status	Overall (n=1007)	Dysphagia (n=166)	Non-dysphagia (n=841)	P-value
Yes	13.5% (136)	39.2% (56)	8.4% (71)	P<0.0001
No	86.5% (871)	60.8% (101)	91.6% (770)	

Fisher's exact test

DISCUSSION

The aging population in Vietnam is increasing rapidly and dysphagia is becoming an issue of concern related directly to quality of life and mortality of older adults. Oral function indexes also provide results regarding dysphagia. Limited mouth opening, tongue movement are related strongly to dysphagia. Based on these examinations, dietitians were able to adjust the texture of food and the liquid feeding position of dysphagia patients. For example, dysphagia patients cannot open the mouth easily to chew so pureed food will be the priority of choice. In cases of paralysis on one side where the patient cannot sit to eat, the patient's position can be adjusted so that he/she lies on the healthy side and can turn the head to the paralyzed side; then food can be given on the healthy side of the mouth.

A decline in isometric tongue strength with aging has been previously reported (10). There was a significant positive association between posterior tongue strength and handgrip strength (6). It is suggested that lower isometric tongue strength might represent diminished functional reserve, which may increase risk for dysphagia and cause dysphagia omit (11). In this study we found handgrip strength of the dysphagia group was lower than in the non-dysphagia. Malnutrition also leads to reduced muscle (sarcopenia disease) which has a high risk of dysphagia. Hand grip

strength uses simple equipment to detect low muscle strength and its relation to dysphagia. A diet should have not only suitable texture but also sufficient energy and protein should be considered with dysphagia patients with low muscle strength.

Pneumonia was found at a higher rate in the dysphagia group. Aspiration leading to pneumonia is common in dysphagia patients. Besides pneumonia status, the body temperature also needs to be considered in determining inflammation status. Energy and water requirements will need to be increased to speed recovery and reduce risk of mortality. Aspiration pneumonia usually occurs in dysphagia patients in general and in dysphagia patients with Gastroesophageal reflux disease (GERD) in particular. Dysphagia patients with tube feeding usually have GERD and consideration of a nutrition liquid with high viscosity such as a semi-solid can be effective in reducing symptoms of GERD (12).

Therefore, oral function, muscle strength and pneumonia have a strong relationship with dysphagia status. From these observations, the dietitian can make suitable adjustments to diet from texture to nutrients to improve the nutrition status of patients.

In conclusion, dysphagia has a positive relationship with poor oral function, low handgrip strength and a high rate of pneumonia. Dietitians need to have an overview of dysphagia patients in order to supply a suitable texture-modified diet.

DISCLOSURE OF STATE OF COI

No conflicts of interest to be declared.

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Research Note

Nutrition Support Following Enhanced Recovery After Surgery Protocol for Malnourished Cancer Elderly Patient

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ABSTRACT Short-term nutritional optimization before surgery and Enhanced Recovery After Surgery (ERAS) protocol aimed to achieve early recovery after surgery by maintaining preoperative organ function and reducing the profound surgical stress response. *Case presentation***:** A 83-years-old female patient with Rectal Adenocarcinoma with Locoregional Infiltration of Uterus was started intensive nutritional intervention fortnight pre-operation. The patient was cachexia with 33 kg; loss of 2 kg within 1 month; PG-SGA score 13 (severe malnourished); She experienced very poor oral intake for the past 1 month. Total intake was 770 kcal and 33 g/day protein. Oral nutritional support (extra 500kcal) was given. The phone call and home-visit were conducted to ensure compliance of the nutritional intervention. Upon admission, the patient gained 0.9 kg; increased intake 1542 kcal/day with 76g/day protein. ERAS protocol with preoperative carbohydrate loading and postoperative early oral feeding was implemented. Length of hospital stay was 6 days 16 hours, clear fluid toleration was 20 hours, solid food toleration was 5 days and gastrointestinal function (flatus and bowel open) was 3.5 days. *Discussion*: Advanced age is a proven risk factor for postoperative complications. Intensive nutrition support, which involved phone call and home-visit, was proven to facilitate compliance towards nutrition counselling. Integrating nutritional support following perioperative ERAS protocol showed combination outcomes where increased nutrition intervention compliance and shorten length of hospital stay without compromise complications for the malnourished elderly patients. *Conclusion***:** Nutrition support following the ERAS protocol was beneficial for malnourished cancer elderly patients.

Keywords: Nutrition support, ERAS, malnourished, elderly.

INTRODUCTION

Cancers are one of the leading causes of morbidity and mortality worldwide. There is frequent development of malnutrition and metabolic derangement among cancer patients due to increase nutrients requirements and reduced oral intake. Treatment of cancers includes surgeries, radiotherapies, and pharmacological therapies. Surgery leads to inflammation and metabolic stress response. Surgical stress and trauma will induce further catabolism of nutrient storage in the body (glycogen, fat, and protein) among cancer patients (1,2). Pre-operative prehabilitation was recommended to optimize nutritional status patients before elective operation (1).

Nutrition intervention is the key element in preoperative management phase (3). Nutritional counseling and provision of oral nutrition supplement preoperative has been shown to significantly increase energy and protein intake (4). As per the recommendation in Enhanced Recovery After Surgery (ERAS) and European Society for Parenteral and Enteral Nutrition (ESPEN) 2017, shortening the preoperative fasting via carbohydrate (CHO) loading and postoperative early initiation of oral feeding, early mobilisation, minimal invasive surgery, and multimodal pain management with minimal opioid usage improved postoperative outcomes and without increased postoperative readmission rate (1,5). The purpose of this case report is to share our clinical experience with the practice of nutrition support following with ERAS protocol for malnourished surgical cancer elderly patients.

Case presentation

An 82-years-old female patient was diagnosed with rectal adenocarcinoma with local infiltration to the right side of the uterus, elective admitted for colon resection low anterior resection with Total Abdominal Hysterectomy with Bilateral Salpingo-Oophorectomy operation fortnight. The patient first presented to a multidiscipline clinic, with low Body Mass Index (BMI) 14.7 kg/m^2, cachexia looking, and lost weight 7 kg within one month. Nutritional assessment using PG-SGA, found that patient was moderately malnourished with PG-SGA score 14, and albumin level was 30 g/L. Patient-reported

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significantly reduced appetite and poor oral intake for the past 1 month with an estimated oral intake of 450 kcal and 15 g/day protein. Nutritional diagnosis for her was unintentional weight loss related to inadequate oral intake as evidenced by poor oral intake and weight loss. Intensive nutrition intervention pre-operative which included individualized nutritional counseling (where individual energy and protein intake were calculated based on Medical Nutrition Therapy protocol for cancer patients) (6), oral supplementation support, and home-visit follow-up was started two weeks before the operation to optimise nutritional status before admission. After elective operation admission, protocol (ERAS) with carbohydrate loading and early oral feeding post-operation was implemented as well. Specific drink with carbohydrate plus whey protein was served as carbohydrate loading drink. As one of the elements in ERAS (preoperative carbohydrate loading), the patient was loaded with 100 g carbohydrate and 18 g of whey protein as evening drink and 50 g carbohydrate and 9 g whey protein 3 hours pre-operation. Postoperative early oral feeding (allowed clear oral nutrition supplement 6 hours after operation) was implemented for this patient. After tolerated with 750 ml clear oral nutrition supplement on the post-operation day 1, the patient started a solid diet on post-operation day 2; tolerated well with solid food on post-operation day 5 and allowed discharged on post-operation day 6. Anthropometry was measured by using calibrated body composition analyzer, TANITA model SC 330. As a summary, length of hospital stays was 6 days 16 hours, clear fluid toleration was 0.8 day, solid food toleration was 5 days and gastrointestinal function (flatus & bowel open) was 3.5 days. There were no incidents regarding postoperative ileus, wound breakdown, infection, or pneumonia recorded for this patient. Intensive nutritional intervention (counseling and oral nutrition supplement prescription) was given to the patient throughout the hospitalization and after discharge. The patient reported good improvement in appetite and more cheerful. She gained weight and muscle mass and achieved adequate oral intake with oral nutrition supplement upon 1-month follow up.

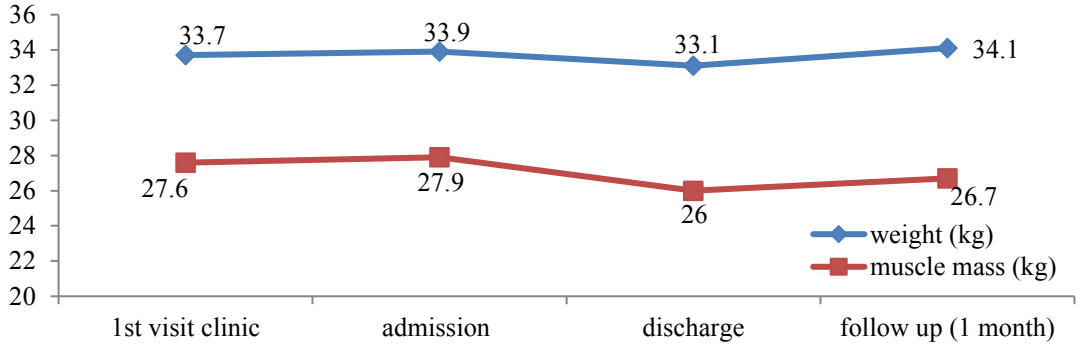

Figure 1. Perioperative Anthropometric Changes

Table 1. Daily total energy and protein intake

	1st visit clinic	Admission	Discharge	Follow up (1 month)
Daily total energy intake (kcal/day)	770	1542	830	1492
Daily total protein intake (g/day)	33	76	42	62.4

DISCUSSION

In this study, we able to demonstrate that intensive nutrition intervention can maintain patient weight preoperatively, as shown in figure 1. It is important to ensure weight loss among cancer patients not reduce further preoperatively because weight loss will influence survival during recovery. For instance, Isenring et al. (2004) found that intensive nutrition intervention with regular follow-up helped attenuate weight loss in the intervention group compared to those subjects in usual care group (7). In the study, subjects in the intervention group, comprised of gastro intestine or head and neck patients, who have received early nutrition counseling, telephone reviews, and oral nutrition supplement showed more weight stable among subjects.

As shown in Table 1, the energy and protein intake of patient improve preoperatively from baseline. These results were similar in the study conducted by Macfie et al. (2000). The study shows that patients, who received oral nutrition supplement, significantly reported higher energy and protein intake compared to patients who are not received oral

nutrition supplement during preoperative outpatient phase (4). Other studies also documented that oral nutrition supplement has proven effective at increasing the nutritional intake of the patients (8). Stratton et al suggested that positive outcome seen in patients given with oral nutrition supplement was associated with the minimal effect that liquid supplements probably have on appetite and voluntary food intake (increasing total energy and protein intake) (8).

Our study supports the findings of many studies that conclude that oral nutrition supplement is able to increase total energy and protein intake. It is believed that adherence patients toward oral nutrition supplement regime and nutrition counseling play an important key in the positive outcome seen. It is suggested that adherence towards dietary advice and oral nutrition supplement prescription could be achieved if patient receives encouragement by a dietitian. As for this patient, we developed a monitoring system where a patient was followed up by the dietitian by phone call and a home visit. During phone and home visit follow-up, patients were educated on how to manage symptoms, provide encouraging words to maximize health, and most importantly ensure calorie and protein requirements achieve. These beliefs to be drivers for dietary manipulation as well (9,10).

Phone counseling is feasible and helpful in improving the outcome of the treatment, whereby the respondent rated counseling relationship and level of interpersonal influence similar to face to face counseling (9,10). The rapport developed during phone counseling also believes to facilitate on-going participation in the study (10). Besides, a comprehensive approach given during home visit which includes motivation and individual education especially for an elderly patient is proven effective in improving nutritional outcome (12).

Elective surgery has been shown to reduce in surgery stress, minimize catabolism, and support anabolism throughout surgical treatment and promote speedy recovery process if compare to emergency surgery. Traditionally, the patient was kept nil-by-mouth before surgery. A nasogastric tube was used to clear stomach content and withheld oral feeding until resolution of the postoperative ileus because the patient was believed that unable to tolerate early feeding. Once bowel function returned with bowel sound, the patient was allowed for clear fluid as standard post-operation drink and step up feeding/diet accordingly (3). However, researches have proven that ERAS whereby patient was allowed for solid food 6 hours and clear fluid 2 hours before surgery as well as early oral feeding on the first day of post-surgery length of hospital stays, length of bowel function return and length of solid food toleration significantly (3,13,14,15,16).

Advanced age is shown as the risk factor of postoperative complications. A study showed that elderly patients' postoperative morbidity rate and mortality rate were significantly higher if compared with younger patients (14). The elderly probably takes longer time to recover from anesthesia and their ileus rate after surgery is higher if compared with younger patient (15). Traditional perioperative care patient's length of hospital stays after elective colorectal surgery was reported around 10 to 15 days and was associated with a delayed return of bowel motility (16,17,18,19). This patient was recorded similar outcomes with previous study findings that a significant reduction of 2 days in length of hospital stays was achieved after implementing ERAS (8 days vs. 6 days; $p < 0.0001$) without increasing readmission rate in elderly patients who underwent elective colorectal surgery (21).

Good compliance with the ERAS protocols also resulted in faster peristalsis return and earlier bowel movement which was 2.5 days postoperatively on average, regardless of the age of patients. Patients hospitalized up to 10 to 15 days and with delayed bowel motility post-operatively under traditional care (19,20,22). Studies also proved that significantly shorten the length of hospital stays, and reduced the number of postoperative complications (17,18). Post-surgery complication rate, length of hospital stays and length of solid food toleration indicate successfulness of ERAS protocol implementation. There are no significant differences in length of stay post colorectal operation between younger and older age groups of patients; the mean of hospital stay was 5 days (18). Both younger and older groups of patients reported that able to tolerate early postoperative oral fluid and food intake (21).

This case report is supported by previous studies result whereby elderly patient benefited via ERAS protocol post-operatively. ERAS protocol did not show to be harmful in elderly surgical patients; instead, it has comparable positive outcomes as younger surgical patients (23,25).

CONCLUSION

Nutrition support following ESPEN which recommended preoperative early nutrition support and ERAS protocol was beneficial to this patient. Preoperative prehabilitation optimize the nutritional status of patients before elective operation while ERAS protocol boosts postoperative recovery, and shortened length of hospital stays, length of bowel function return, and length of solid food toleration without compromised postoperative complications or readmissions.

CONFLICT OF INTEREST

The authors declare no conflict of interest arising from the findings for the reported case and its management.

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Research Note

Validation of Calorie Smile Vietnam Software for Measuring Food Intake

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ABSTRACT *Background and purpose.* Achieving accuracy and precision in assessing diet is a challenge. Food weighing (FW) is the ″gold standard″ method for dietary estimation. However, this method is time-consuming, costly, and disruptive. Traditional methods such as 24h recall, diet record and food frequency questionnaires are mostly used today but these depend largely on the participants′ memory. A new Vietnamese version of a nutrition support software called ″Calorie Smile Vietnam″ (CSV) has been developed and has a food-measuring intake function. The purpose of this study was to test the validity of CSV software for measuring food intake compared with the weighed food method. *Method.* Actual intake of meals (study 1) and dishes (study 2) as estimated by the CSV method were compared with weighed food. Three dietitians independently estimated portion sizes of each food. *Result.* Estimation of food intake by CSV was highly correlated with FW. CSV showed small overestimates or underestimates (from 0.2% to 4%). Energy and nutrients calculated from CSV had no difference when compared with FW, except for lipid ($p<0.05$). Bland-Altman regression found the CSV yielded results comparable to FW. *Conclusion.* Calorie Smile software is a useful tool for measuring food intake with high accuracy and overcomes the disadvantages of conventional methods.
Keywords: Validation, Calorie Smile Vietnam software, measuring food intake

INTRODUCTION

The accuracy of evaluating nutritional components in dietary surveys is fundamental for assessing nutritional status and analyzing the relationship between diet and a population's health status **(**1**)**. The most accurate method for measuring food intake is the food weighing (FW) method: weighing food before and after eating (2). However, weighing each food item can introduce changes in eating habits, exerts a huge burden on individuals, is very difficult to use with a large sample of people and does not permit assessment of past intakes (3,4). In the context of public health nutrition, self-reporting methods (food records, 24-hour recall, and food frequency questionnaires) are commonly used to collect food intake data but these methods can encounter difficulties. Visual aids used to help subjects remember and describe the food amounts have been created (5). A number of studies have reported the benefits of using photographs to help subjects assess portion sizes (6–13). Food photographs depicting standardized portion sizes organized in an atlas are helpful in improving the accuracy of food quantification (14,15). Therefore, the image-based method is an innovative approach compared with the conventional ones. In addition, in order to measure food intake accurately, we need well-trained personnel such as dietitians.

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However, recently in Vietnam, the number of dietitians is very limited. Therefore, if we continue to follow the traditional food estimating methods, it will take considerable time. In this situation, a nutrition support software has been developed, called ″Calorie Smile Vietnam″ (CSV) (16). This software offers dietitians (or supporters) a new way to conveniently exchange information with their patients (or users) and was designed for both computer and smartphone use. The basic method is that users take photos of their food, send them to the dietitian′s computer, and then the dietitian evaluates their dietary pattern and gives proper advice to users. CSV software has been integrated with the Vietnam Food Composition Table 2007 (17), the nutrient value of 500 common dishes from the Hanoi area (18), and the nutrient value of common street foods from [the] Ho Chi Minh city area (19). When users′ meals are different or they eat items other than those in the data base, adjustments can be made according to the "Photo book to estimate the weight of food" (20), so the dietitians can analyze users′ meals easily and quickly.

There are many potential benefits to be gained by using CSV software in evaluating diet, but there has been no study to validate it. For this reason, we carried out this study with the purpose of testing the validity of CSV software for measuring food intake compared with weighed food.

METHODS

Study design and methods:

The study followed a cross-sectional study. *Study 1:* 50 test meals were prepared in university cafeterias and given to students at lunch. The meals included 5 dishes: starches, a meat dish, 2 vegetable dishes, and soup. *Study 2:* 78 test dishes were prepared in university cafeterias and given to students. The dishes varied from a complete dish like a main dish to a single food like a cup of milk or a bowl of rice or even one piece of fruit.

For both studies, the procedure was the same: Before and after serving, each component was weighed and a trained research staff took all of the photographs of the food to the same standard (study 1: whole meal photo, study 2: dish photo). The food was photographed using a smartphone mounted on a tripod with the lens 2 feet above and 2 feet away from the center of the meal plate with a camera angle of approximately 45°. A placemat with marked regions for placement of the food plates was fixed to the table supporting the camera tripod to ensure optimal visibility of the meal in the digital photographs. All the photos were sent to the CSV software platform for estimation.

Three dietitians involved in this study independently estimated portion size and then calculated the actual food intake using CSV software. The results as estimated by CSV were compared with weighed foods. The comparison focused on energy (kcal), protein (g), lipid (g), and carbohydrate (g).

Statistical Analysis:

Spearman's rank correlation coefficients were calculated to assess the association.

The differences in energy and nutrient intake between CSV and FW were tested using one sample *t*-test.

Agreement between the two methods was evaluated according to Bland−Altman analysis. Statistical analysis was done by SPSS 20.0. The significance level for statistical tests was set at 0.05 for all tests.

RESULTS

Study 1: 50 test meals

Table 1 shows the comparison of energy and nutrient intake between FW and CSV. There was no significant difference between the two dietary assessment methods for intakes of energy, carbohydrate and protein, although the mean difference in lipid/meal was statistically significant ($p<0.05$). The correlation between the two methods was relatively high, ranging from 0.73 (for energy) to 0.79 (for carbohydrate).

Figure 1 shows the differences in estimated energy and nutrients intake from meal between the CSV and FW methods against the FW method with the representation of confidence interval (CI) limits for mean. Most data points are within 95% CI with only one or two outliers.

Table 1: Comparison of estimated energy and nutrients intake from lunch between FW and CSV

Nutrients	Method	Mean intake ± SD	Mean difference ± SD	Difference (%)	Pearson correlation
Energy (kcal)	FW CSV	605.9±69.5 606.9±61.6	1.0±49.2	0.2	0.73**
Protein (g)	FW CSV	33.6±6.7 34.9±7.2	1.28±4.76	3.9	0.77**
Lipid (g)	FW CSV	22.5±4.7 23.4±4.6^{+}	0.97±3.3	4.0	0.74**
Carbohydrates (g)	FW CSV	65.7±11.8 63.7±10.6	-1.9±7.2	3.0	0.79**

\+ *t*-test, $p<0.05$
** $p<0.001$

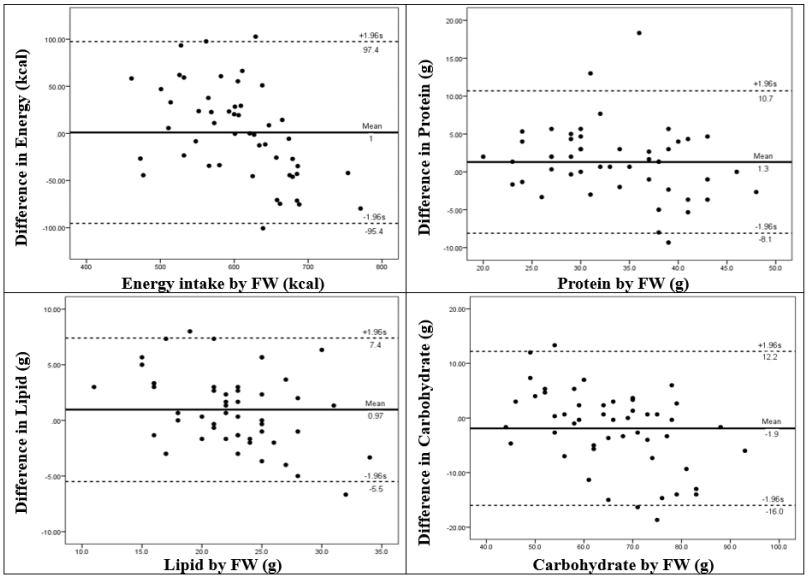

Figure 1: Plot of differences between CSV and FW methods against the FW method in estimating energy and nutrient intakes from meal

Study 2: 78 test dishes

Figure 2 presents the differences of estimated energy and nutrient intake from dishes between CSV and FW method against the FW method with the representation of confidence interval (CI) limits for mean. The 95% CI were relatively narrow and most data points are within the limits of agreement with only a few outliers. In addition, the scatter around the bias line tends to get larger as the intake estimated by FW increases.

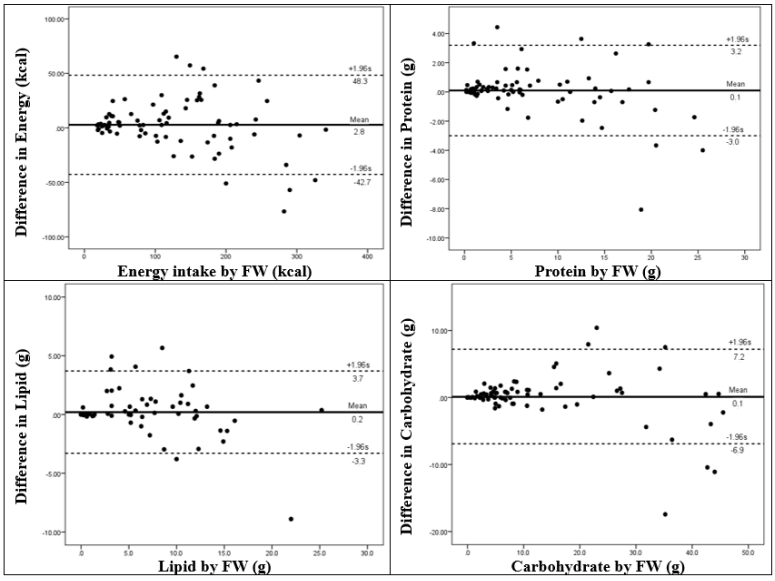

Figure 2: Plot of differences between CSV and FW methods against the FW method in estimating energy and nutrient intakes from dishes

DISCUSSION

The results of this study support the validity of the CSV for measuring food intake. Overall, CSV was highly correlated with foods that were carefully weighed and measured. There was no significant difference between the two dietary assessment methods for intakes of energy, carbohydrate and protein intakes, although the mean difference of lipid/meal was statistically significant. It could be understood that lipid is a component that creates difficulties in assessing diet via the CSV platform because CSV operates in visual items. Moreover, energy and the three nutrients estimated from CSV indicated a high level of association with FW with correlation coefficients ranging from 0.73 (energy) to 0.79 (carbohydrate), which also strongly supports the validity/accuracy of this method. The average differences between the two methods were also small, ranging from 0.2% (energy) to 4.0% (lipid) overestimated and 3% underestimated (carbohydrate). The percentage difference in energy was only 0.2% overestimated compared with the actual FW which was more accurate than the novel food frequency questionnaires with 11% underestimated (21) and the Remote Food Photography Method with an error range of −8.8% to 6.8% (22). Lipid is the component that has the highest percentage of difference comparing the CSV and FW methods but the difference is still small (4.0%). As previously mentioned, lipid was estimated mostly on the basis of experience, so needless to say these experiences vary from individual to individual. From the comparison with previous studies, CSV has provided positive results in terms of assessing diet with less than 5 % estimated food difference.

An acceptable level of agreement between CSV with FW was demonstrated by the Bland−Altman plots. According to figure 1 and 2, the two methods were found to be comparable in estimating energy and nutrient intakes for both meals and single dishes. The approach involves linearly regressing the difference depending on the average. Almost all of the points are in a band of plus or minus double the standard deviation of the straight equality of means. Bland−Altman analysis shows that most measures of energy and nutrients are scattered on either side of the mean differences and all along the line of equality (difference=0). Our data analyses of energy and nutrient intakes show that the Calorie Smile software method was able to adequately estimate the weights of food portions and gave results that are comparable to the actually consumed amounts (FW).

To sum up, from the results of the study, the appearance of CSV software is actually an innovation in the nutritional field which can be considered a useful method in assessing dietary intakes in a free-living environment as well as for clinical purposes, given its high level of accuracy.

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Letter to Editor

Milk in School Lunch and Nutritional Adequacy, Asian Journal of Dietetics 2019 – A Comment

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Dear Editor:

The study by Matsumoto et. al. (2019) reported that while calcium intake was higher among adolescent girls who had milk as part of their school lunch, intakes of niacin, vitamin B12, iron, copper and sodium were higher among students who did not have milk as part of their school lunch (1). They found no significant differences in total nutritional inadequacy and inadequacy for each nutrient among the two groups and concluded that habitual nutrient intake adequacy for Japanese junior high school female students was independent of milk provision in school lunch programs (1). This finding is disconcerting as dairy products such as milk have been recommended for preventing undernutrition and treating stunting in children (2). In addition, it has been reported that there may be a small but limited window of opportunity to minimise stunting in adolescence due to delayed skeletal growth (3). The "milk in school lunch" might therefore be beneficial to stunted adolescents who may have missed earlier opportunities for correction.

Stunting, which is a manifestation chronic malnutrition, is defined by a height-for-age z-score of more than 2 standard deviations below the World Health Organization (WHO) Child Growth Standards median (4). In 2016, an estimated 154.8 million (22.9%) children under 5 years of age globally were reported to be stunted. This included 87 million children in Asia, 59 million in Africa and 6 million in the Latin American and Caribbean regions (4). Global interest in stunting stems from its association with poor cognitive development, child mortality and poor adult health. Furthermore, studies have documented associations between childhood stunting and an increased risk of degenerative diseases such as diabetes, hypertension and coronary heart disease in later life (5). Consequently, the Global Nutrition Targets aim at a 40% reduction in the number of children under 5 years of age who are stunted by 2025, which is also a target of the Sustainable Development Goals (4).

Milk is considered as a standard reference protein, a panacea in malnourished states and is used in the preparation of F75 and F100 nutritional supplements for treating severe acute malnutrition or wasting (2). More recently, studies have explored its use for preventing and treating stunting because stunting has been associated with limited consumption of animal food sources including milk (6). The South East Asian Nutritional Survey, for instance, reported lower stunting and underweight among children who consumed dairy products on a daily basis compared with those who did not (7). One of the most successful food policies in the last century was the "Milk in Schools Scheme" for school children in post-war Britain and Japan (8,9). Thus, providing milk for school children may be one of the ways the world can alleviate the enormous burden of undernutrition and stunting, improve calcium and other nutrient intakes and obtain other benefits such as improvements in cognitive function (10).

In the article by Matsumoto et. al. (1), although the mean height of adolescents in the milk group was higher than the non-milk group, which is expected, the authors concluded that providing adolescent girls in school with milk may not always translate into nutrient sufficiency as it also depends on the diet consumed at home or complementing the milk. The observation may also be related to the skipping of breakfast among adolescents as recently reported in another study by Matsumoto et. al. (11). While further studies are needed to unravel these observations in other contexts, including resource-limited settings where the home diet is often inadequate, their findings suggest that in these school settings, milk provision should be considered complementary and attention should probably be focused on promoting milk consumption in early childhood or younger school-age children. The Food and Agriculture Organisation (FAO) promotes milk in schools through "school milk conferences" and a "world school milk day" (12). Such initiatives must be supported and strengthened by nutrition sensitive food and agricultural policies that promote milk production and consumption by children and adolescents, since providing milk in schools, though expensive, can provide long-term developmental and socioeconomic benefits to society.

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Letter to Editor

Dietary Reference Intake Level for Protein is not a Point but a Range.

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Dear Editor:

In the nutritional field, the recommendations which drop by official organizations have always been accepted as facts. However, there are many figures we do not know how scientists calculate them, resulting in a rigid application for varying situations. To be specific, We are talking about the Dietary Reference Intake (DRI).

- Table 1 indicates that DRI for protein differ for WHO, the US, Japan and Vietnam. They are (g/kg body weight) 0.75, 0.8, 0.9 and 1.13, respectively. There is a large differences and we have doubts about them. Is there some mystery here?

Table 1. DRI for Protein for adults in some countries

Country	DRI (g/kg BW/day)	DRI (g/day)	
		Male	Female
WHO	0.75		
USA	0.8	56	46
Japan	0.9	60 =	50
Vietnam	1.13	70	60

To use it freely, people have to understand how the DRI was obtained. The nitrogen balance method is considered to be the standard method for determining protein requirement. A Joint *WHO/FAO/UNU* Expert Consultation analysed the nitrogen balance data of 235 adults who were using good quality protein sources (Figure 1. Shows) (1).

Dietary Reference Intake (DRI) for Protein include several different systems for identifying protein levels that can be used in planning diets for healthy people and assessing their diets as listed below.

Estimated Average Requirement (EAR) of protein: this is expected to satisfy the protein need of 50% of the people in general population. *Recommended Dietary Allowance (RDA) of protein:* the daily dietary intake level of protein to meet the requirements of 97.5% of the general population. It is calculated based on the EAR. RDA= EAR+2SD.

Safe Upper Limit (UL) is the highest level that is likely to pose no risk of adverse health effects in almost all individuals in the general population and to meet everyone's needs but could result in harmful effects if exceeded (2)..

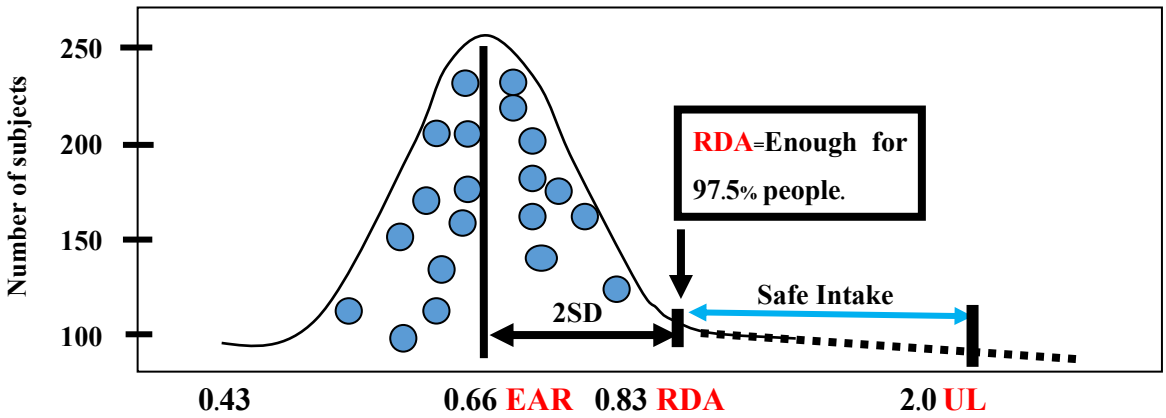

Figure 1: How to determine Dietary Reference Intake (DRI) for Protein (g/kg body weight)

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Figure 1 shows EAR as 0.66 g/kg per day and RDA as 0.83 g/kg per day. Although the UL has not been identified, it is stated that intakes of 2g/kg body weight are unlikely associated with any risk (1).

Although RDA is the enough level for 97.5% people from the nitrogen balance study, but we do not know the requirement from the points of immunity, stress and other factors. Furthermore, the actual intake level is usually higher than the RDA and changes day by day and person to person.

Considering such facts, scientists set DRI any figure between RDA and UL, which means that dietitians can think menus with protein intake level from RDA to UL freely.

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