ISSN 2434-2688

Asian Journal of Dietetics

Vol.1 No.3, 2019

AJD
ASIAN JOURNAL OF DIETETICS

Official journal of the Asian Federation of Dietetic Associations (AFDA)

ISSN2434-2688

Asian Journal of Dietetics

Vol.1 No.3 2019

Contents

Originals

ORIGINAL

Dysphagia Prevalence among Elderly in Some Vietnamese Hospitals

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(received May 6, 2019)

ABSTRACT *Background/objective.* The Vietnamese elderly population has increased rapidly on an annual basis and dysphagia has become a common issue. However, in hospitals, dysphagia screening has not been a concern; the automatic solution for cases of choking/aspiration is still a prescription for tube feeding. In developed countries, oral intake is a priority alternative for dysphagia and has positive consequences. For suitable dysphagia dietary treatment, early, quick and effective screening for dysphagia plays an important role. Therefore, in this study, the aim was to determine the prevalence of dysphagia in the elderly in some Vietnamese hospitals. *Method*. The study was designed as a cross-sectional study and was conducted in three large hospitals in Vietnam. The subjects consisted of 1007 elderly inpatients aged 65 and older. They completed dysphagia screening tests that included the repetitive saliva swallowing test (RSST), the water swallowing test (WST) and Eating assessment tool-10 (EAT-10) questionnaires. The investigators were dietitians who were trained to collect data. *Results.* The rate of dysphagia was quite high 16.5% (166) among elderly inpatients according to the RSST and WST; and 24.6% (248) according to Eat-10 questionnaires. Specifically, according to clinical test, the rate of dysphagia was found to be higher in neurologic disorder group 40% (45/113), the esophageal disorders group 51% (32/63) and the respiratory & latrogenic disorder group 29% (19/65). Almost all subjects who could not sit while they were being examined belonged to the dysphagia group. *Conclusion.* Through a combination of simple screening tests, this study indicated that the rate of dysphagia in elderly inpatients was quite high. Therefore, early dysphagia detection is necessary to administer priority dietary treatment by oral intake instead of tube feeding.
Key Words: dysphagia, hospital, elderly, prevalence, Vietnamese

INTRODUCTION

Older adults are the fastest growing segment of the population in Vietnam. The number of Vietnamese aged 65 and older is projected to increase from 7.8% in 2015 to 17.8% in 2050 (1). Disease risk increases with advancing age. Dysphagia (swallowing difficulty) is a growing health concern issue in our aging population. 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, cancers of the head/neck and esophagus, and metabolic deficits are broad categories of diseases that might contribute to dysphagia. A systematic review indicated that dysphagia affected 8.1-80 % of stroke patients and 11-81 % of Parkinson's disease patients (2). Dysphagia may contribute to decreased food and liquid intake and may reflect altered level of consciousness, physical weakness, or lack of coordination in the swallowing mechanism (3). Therefore, prevention and early detection of dysphagia are important in improving health in the elderly.

There are many tools for screening dysphagia depending on conditions and resources. Some previous research on Vietnamese acute stroke patients showed that the rate of dysphagia is quite high, around 33-81% (4–6). Almost these studies were carried out on neurological disorder patients by rehabilitation specialists and sample sizes were limited by the dysphagia screening tools that were used, which require specialized techniques, take time, and can be costly. Under conditions in Vietnam, almost all hospitals have lacked speech therapy specialists and modern equipment such as video fluoroscopy (VF) and video endoscopy (VE) (7). Screening for dysphagia has not been a major concern; even if some hospitals have techniques for screening/assessing dysphagia, the automatic solution for cases of choking /aspiration is still a prescription for tube feeding. Dysphagia is related directly to nutritional status and quality of life. In developed countries, oral intake is a priority alternative for dysphagia and has positive consequences (8, 9).

Therefore, in order to improve Vietnamese dysphagia nutrition management, dietitians also

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should have basic knowledge about how to actively detect dysphagia patients, to prepare food for dysphagia and to apply techniques to feed dysphagia patients by oral intake, in case the dietitians lack support from rehabilitation specialists.

In addition, at present Vietnam is lacking data related to dysphagia rates among general elderly inpatients. Therefore, a simple screening tool would be useful in determining the rate of dysphagia and more importantly can be used by staff members such as dietitians who are not speech or language pathologists to identify dysphagia and aspiration risk in elderly patients or other subjects who may have a high risk of dysphagia. In this study, we used the repetitive the saliva swallowing test (RSST), the water swallowing test (WST) and the Eating assessment tool-10 (Eat-10) as initial screening dysphagia tools. These tools are simple, quick, low-cost procedures and in particular have a high sensitivity and specificity compared to modern equipment (7, 10–12). By combining clinical tests at a specific time and questionnaires administered over a span of time, we hoped to detect all subjects who have a risk of dysphagia to determine the proportion of dysphagia in elderly inpatients in some Vietnamese hospitals.

METHODS

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 received permission from Hanoi Medical University's ethical committee, number 1318. The study population consisted of elderly 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 1000 subjects who met the inclusion criteria: (a) hospitalized elderly in the three above hospitals, (b) age 65 or over. The exclusion criteria included: (a) refusal to participate in this study, (b) mute, deaf or psychosis and (c) suffering from ventilator, coma, dementia, trauma or injury. All potential subjects completed questionnaires and were screened using swallowing tests.

Data collection

All the questionnaires were filled out by investigators. The investigators were dietitians who were trained to collect 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

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

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 swallow 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 WST would be administered (10).

Water swallowing test (WST)

The position while drinking water needed to be evaluated: sitting or not sitting (from 30 degrees to 60 degrees). 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 dysphagia. If there was no choking or voice change but patients needed to swallow more than once or spent more than 5 seconds swallowing, subjects were suspected to have dysphagia. Subjects who swallowed 1 time within 5 seconds without abnormal symptoms were normal (10). In this study, no dysphagia group would be included both suspected dysphagia and normal status.

Beside the clinical tests, the following questionnaire was also used to screen dysphagia.

Eating assessment tool (Eat-10) questionnaire

Eat-10, a self-reported validated questionnaire that assesses perception of swallowing difficulty was used to evaluate dysphagia risk. The Eat-10 questionnaire was translated from English into Vietnamese. There are 10 simple questions with a total score of 40 points and the cut-off point is 3. If total score $\geq$ 3 points, it means the patient may have problems swallowing efficiently and safely (13).

RESULTS

This selection process resulted in a total of 1007 elderly inpatients (420 males and 587 females, mean age 75.5 years). Dysphagia was observed in 62 males (6.2%), 104 females (10.3%) and a combination of 166 males and females (16.5%) out of 1007 elderly inpatients. The no dysphagia group was about 83.5% of the total.

Figure 1 shows that with regard to age, the highest prevalence of dysphagia was seen in 83-91 year-old males (25%) and in 92-100 year-old females (40%), and the lowest prevalence dysphagia was observed in 65-73 year-olds, both males and females, with the same rate of 12%.

According to disease analysis, by clinical test, the patients with neurologic disorders (stroke, Parkinson's, etc.), esophageal disorders (dysfunction esophageal, gastroesophageal reflex, etc.) and respiratory & latrogenic disorders (tracheal surgery, artificial airway, etc.) had high dysphagia incidence (40%, 45/113), (51%, 32/63) and (29%, 19/65), respectively. By the Eat-10 questionnaires, neurologic disorders, esophagieal disorders and respiratory & latrogenic disorder also had high dysphagia incidence at 50%, 75%, 46%, respectively.

Figure 2 shows the distribution of Eat-10 scores. There were 248 subjects (24.6%) who had an Eat-10 score $\geq$3, which means that they have problems swallowing.

Figure 3 indicates the dysphagia status by clinical test and Eat-10 score. The dysphagia patients screened by clinical test (94%) almost all had an Eat-10 score $\geq$3 points and no dysphagia patients (89%) had Eat-10 score<3 points.

Figure 4 shows the sitting position to screen dysphagia and dysphagia status of elderly inpatients. The rate of not sitting in the dysphagia group (33%, 54/166) was higher than in the no dysphagia group (3%, 29/841).

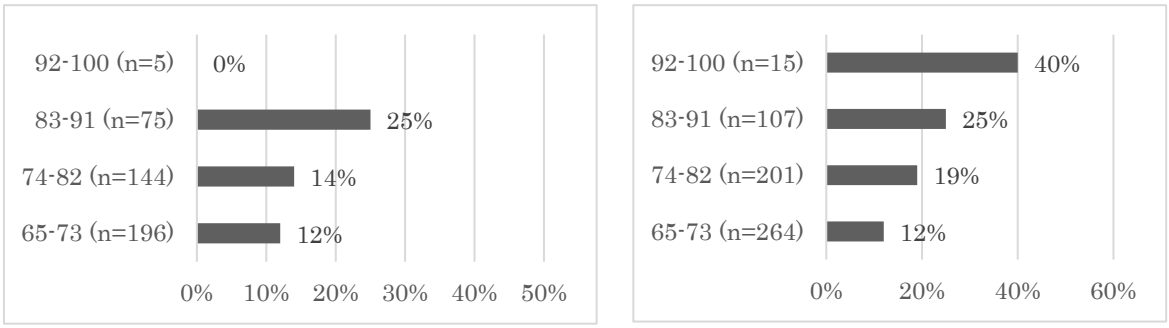

Figure 1. Prevalence of dysphagia by age in males (left) and females (right)

Table 1: Dysphagia status by clinical test (RSST & WST) and Eat-10 questionnaires in elderly inpatients according to function analysis.

Dysphagia status		Neurologic disorders (n=113)	Esophageal disorders (n=63)	Respiratory & latrogenic disorder (n=65)	Other (n=766)
Clinical test	Dysphagia	45 (40%)	32 (51%)	19 (29%)	70(9%)
Eat-10	≥3 score	57(50%)	47 (75%)	30 (46%)	114 (15%)

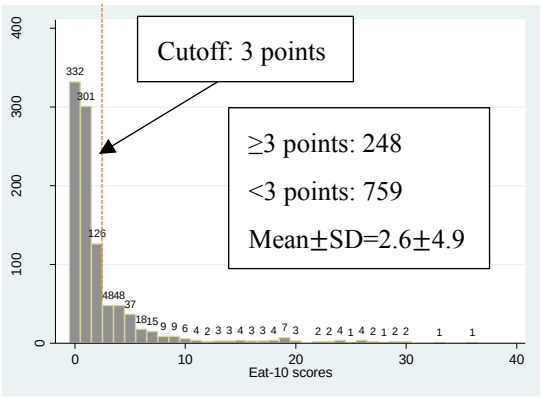

Figure 2: Distribution of Eat-10 scores

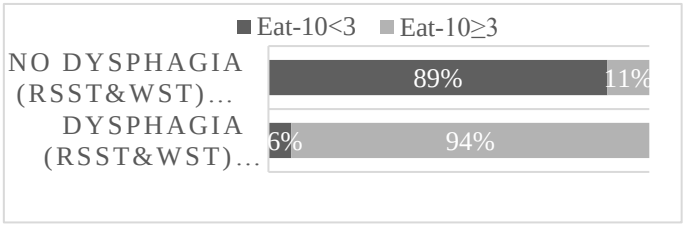

Figure 3: Dysphagia status by clinical test (RSST&WST) and Eat-10 score.

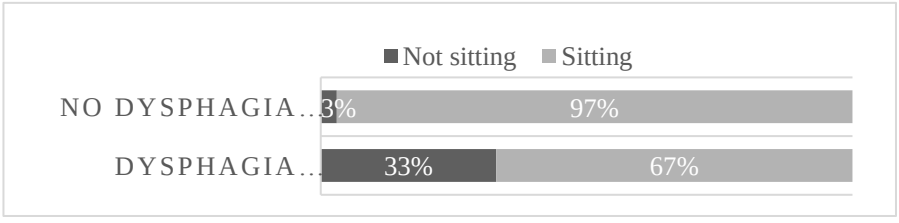

Figure 4: Sitting position to screen dysphagia and dysphagia status of elderly inpatient

DISCUSSION

Dysphagia is a common issue in elderly populations. World-wide, there are several swallowing tests to screen for dysphagia. In hospitals, VF and VE are used widely to assess dysphagia (7). However, they are expensive and require specialized techniques so simple swallow screening tests should be implemented first to detect abnormal cases before using complicated equipment. In Vietnam, dysphagia screening has not been a major concern. Even simple screening tests have not been implemented as standard procedure for all patients at risk of dysphagia such as the elderly, stroke victims, Parkinson's disease, dementia patients, etc.

There have been studies about simple tests such as RSST, WST and Eat-10 questionnaires that were used to screen for dysphagia. RSST and WST were indicated as a useful simple task-screening tool to detect dysphagia and they have high sensitivity, specifically as a predictor of aspiration ($p<0.05$) compared with VF (7, 11). And the Eat-10 questionnaire also was a reliable dysphagia screening tool (10). Thus, in this study, we used the simple tests to screen for dysphagia on more than one thousand elderly patients. Based on these results, we observed that the results of the Eat-10 questionnaires have a rate of dysphagia higher than the clinical tests because the questionnaires would ask about a range of time, but dysphagia symptoms may not be present when the clinical tests are conducted.

We found that the prevalence of dysphagia was 16.5% (166/1007) by RSST and WST and 24.6% by the Eat-10 questionnaire. These results were similar to those reported by Okamoto et al (15.1%) by using WST and Kawashima et al (13.8%) from questionnaires on community-dwelling individuals aged 65 and older in one prefecture in Japan (14, 15). This is also similar to a dysphagia survey in general hospitals by the Japanese National Institute of Longevity Research (13.6%) (16) and research in the US (about 15%) (12). Based on these results, we realized that the rate of dysphagia in elderly Vietnamese inpatients was quite high and similar to countries which have good dysphagia management systems with screening, dysphagia assessment and texture-modified food for oral intake by dysphagia patients. Through early detection of dysphagia and dysphagia dietary treatment, dysphagia status and quality of life can be significantly improved (8, 9). Therefore, screening for dysphagia is necessary and needs to be implemented widely in Vietnam not only in hospitals but also in the community; the choice of a suitable screening method further depends on the conditions in each country and area.

The rates of dysphagia related to neurologic disorders, esophageal disorders and respiratory & latrogenic disorders were quite high according to the clinical tests and the Eat-10 questionnaires. These results are similar to a systematic review which showed that 8.1–80 % of stroke patients and 11–81 % of Parkinson's disease patients have dysphagia (2). This systematic review had large range rate may be because of the difference method to screening dysphagia and epidemiology. These are patient groups with a high risk of dysphagia. Therefore, it is necessary to screen for dysphagia as soon as possible in these patients.

In Vietnam, dietitians are formally trained and the number of dietitians is gradually increasing. Therefore, by using the simple swallowing screening tools, the dietitian can actively screen patients for dysphagia and also administer food for dysphagia. In addition, dietitians determine diets for patients so it is more convenient for dietitians to detect dysphagia patients through their eating behavior. These were the reasons why in this study we selected dietitians to be investigators and they performed well.

Dysphagia is usually a concern in the elderly. In this study, we also observed that the higher the age, the higher the risk of dysphagia. The elderlies are likely to suffer from sarcopenia, stroke, dementia and many diseases which are closely related to dysphagia. In addition, the ability of the elderly to recover is less than that of younger people because of reduced organ function, so the risk of dysphagia is higher (12).

By comparing the two methods (clinical tests and Eat-10 questionnaires, Fig 3), we observed that almost dysphagia patients (94%) according to the clinical tests had Eat-10 score ≥ 3 points. Therefore, the appropriate cut-off point is 3, as indicated by the questionnaire instructions.

With regard to the sitting position when the clinical tests (RSST, WST) were administered, only 8% (83/1007) could not sit while they were being checked. These patients would lie on a bed tilted 30 – 60 degrees with head lying on a pillow tilted 30 degrees to administer the test. About 65% (54/83) of bedridden patients suffered from dysphagia. It is understandable that almost patients who cannot sit to swallow are in the dysphagia group because dysphagia usually occurs in patients who are suffering from a neurological disorder such as paralysis from stroke. Therefore, with bedridden patients, dysphagia detection needs to be a concern.

Limitations of this study included limited resources, so we have been unable to undertake a study to validate the Vietnamese Eat-10 questionnaire; we merely translated the English version into Vietnamese and did a pilot study to complete the questionnaire. In any case, the content of the questionnaire is not difficult, with items such as "Swallowing liquids takes extra effort", "Swallowing solids takes extra effort" etc., with levels from (0) "no problem" to (4) "severe problem", so we felt that the possibility of translation bias would be small.

In conclusion, through a combination of simple screening tests, this study indicated the rate of dysphagia in elderly inpatients was quite high. Therefore, early dysphagia detection is necessary to administer dietary treatment by oral intake instead of tube feeding.

ACKNOWLEDGEMENTS

This research was supported by Jumonji University, Japan and US-Japan Medical Science Programs. The authors would like to thank all the participants for their cooperation and Hanoi Medical University Hospital, Dong Da General Hospital, National Geriatric Hospital and the dietitians who provide assistance in the collection of data in Vietnam. Finally, we also would like to thank Andrew Durkin, Prof. Emeritus of Indiana University, for editing our English.

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ORIGINAL

Acceptability Evaluation by Vietnamese about Non-toxic Cultured Pufferfish in Comparison with Grouper and Mackerel

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(Recived June 4,2019)

ABSTRACT *Background and purpose.* World-wide there are few countries in which pufferfish (fugu) is eaten as in Japan. In Vietnam, pufferfish has been banned since it's toxic ocurred due to lack of knowledge about distinguish non-toxic species. Consequently, there is a huge amount of pufferfish inhabiting in Vietnamese water, but whenever accidentally catching it, we have to throw or use as fertilizer. To develop culinary culture of non-toxic pufferfish in Vietnam, it is very important and essential to recognize safe species and culture them in good condition, then apply proper method to process that become safety foods. In order to initial setting up for such purpose, we carried out a sensory study in Vietnamese to test whether they can accept foods made from fugu by method of Japanese. *Methods.* We compared the sensory reaction to Japanese cultured *Takifugu rubripes* and fish from Vietnamese waters: grouper and mackerel. The 107 panelists were Vietnamese volunteers working in the field of nutrition, employees of marine companies, or government officials who could influence the relevant laws. Each panelist tried 10 dishes which were prepared by chefs holding a Japanese fugu license. After eating, they were asked to fill out the sensory questionnaire, used a five-point scoring method, with 5 as the highest score, and reaction rating questionnaire. *Results.* The average score for the various puffer dishes was 4.40 in the good rank flavor was rated best. For questions such as "would you like to eat more Fugu, do you want to introduce it to others, do you want fugu to become a new food culture?", Over 90% of the panels answered "Yes". *Conclusion.* Fugu's acceptable flavor was confirmed for Vietnamese when it was prepared properly by fugu-licensed Japanese chefs.
Key words: pufferfish, fugu-licensed, sensory test, food culture, takifugu rubripes, Vietnam, Japan

INTRODUCTION

Worldwide, only Japan is well known for a special pufferfish (fugu) food culture. Japanese Ministry of Health and Welfare enacted a guideline of edible species, in that only 22 species of fugu are allowed, and only the people who has fugu license can cook (1–3). Marine fugu are believed to accumulate *tetrodotoxin* (TTX) but non-toxic fugu can be produced if they are raised with TTX-free diets in net cages at sea or aquaria on land, where the invasion of TTX-bearing organisms is completely shut off (4). By cultured fugu, some studies showed that it was delicious and rich in nutrients (5,6). Fugu is high class fish and expensive in Japan and now Japanese are trying to import fugu from the other countries such as China or Korea.

There are more than 350 species of fugu (7), and according to a report by the Research Institute for Marine Fisheries, Vietnam has about 60 species, resources are over 37,000 tons (8, 9). There are hundreds of food poisoning related to toxic fugu per years (10) so that the Ministry of Fisheries (now the Ministry of Agriculture and Rural Development) has implemented a ban on fugu since 2003 (11). In order to lift the law which prohibits the harvesting and using Vietnamese fugu, it is necessary to carry out a toxicity test and clarify the type and parts of fugu which can be eaten. Even if a toxicity test, which is difficult, is carried out, the effort would be pointless unless fugu is accepted as a part of food culture by Vietnamese people. Therefore, first of all, in this research, a sensory tests were carried out with various dishes of Japan cultured tiger fugu (*takifugu rubripes*) that was confirmed to be safe and got permission of Vietnam government.

METHODS

Study design: We evaluated Japanese fugu dishes and Vietnamese luxury fish dishes of mackerel and grouper, by using a sensory test two times in June and December of 2017. The first study was conducted at the Vietnam National Institute of Nutrition in Hanoi and the second study at a hotel in Da Nang city. After trying each dish, the panel were asked to score their reaction on the response sheets. We used 5 point scale (extremely good:5, good:4, neither good or bad:3, bad:2, extremely bad:1) to evaluate the flavor of each dish at 3 items: overall taste, aroma and texture. The panel were free to eat all dishes randomly and in unrestricted quantities. After that, panelists were asked to fill in the questionnaire of sensory test (Table 1).

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Ethical committee and customs clearance permission of Japanese fugu: Currently the use of puffer fish is banned in Vietnam so that the safety has not been guaranteed. Therefore, we can not use Vietnamese puffer fish in this study. To conducting research in addition to ethical permission, it was often necessary to get approval from the Vietnamese Ministry of Health. Japanese cultured puffer fish is a high-class fish, which was tested safety in Japan and passed the customs clearance, so it was allowed to bring into Vietnam.

Materials Preparation: Cultured *Takifugu rubripes* for the study were purchased at an aquaculture company in Japan and viscera were removed and then the fish was kept in a freezer under −20°C. The Fugu was delivered from Miyazaki, Japan to Hanoi and Da Nang, Vietnam by air. We used cold gel and dry ice to keep the fish under −20°C during shipping. In Vietnam, the fugu was kept in a freezer under −20°C. One day prior to the experiment, both mackerel and grouper were purchased at a market in Vietnam, viscera were removed and the fish were kept in refrigerators under 4°C. The frozen fugu was moved to a refrigerator and defrosted at about 4°C in more than 10 hours. Other materials were chosen and prepared under the control of Japanese fugu cooking license holders (Picture1). We used the same recipe for fugu, mackerel and grouper in the hotpot dish and Japanese style fried dish to make the comparison among them.

Prior to the main study, in a pilot study (n=10), various Japanese Fugu recipes (2) were evaluated. Based on that pilot, the menu items for the main study were determined: Japanese style fried dish, hot pot, sashimi (dishes with raw fish), hirezake (Japanese sake with grilled Fugu fin in it), nikogori (a kind of jelly made from fugu skin), skin mix (boiled fugu skin was sliced and mixed with chili, miso, and vinegar), tataki (fish grilled on the outside and kept raw inside), and shirako tofu (a kind of mousse made with fugu milt) (Picture 2). Total the amount of fugu for 1 serving set of sensory test with 8 fugu dishes was 400g (50g per dish × 8 dishes = 400g) so at least 42.8 kg needed to be cooked. In case something happen we brought about 90kg of frozen Japanese fugu to Vietnam. By same way, we calculate the amount of grouper and mackerel which were used for taste test. All the dishes were made as close as the time of the test at lunch time that why most of work had to be done since previous night.

Panel selection: To evaluate Vietnamese acceptance of Fugu dishes and to lift the law banning fugu in Vietnam in future, all 107 panelists were Vietnamese who may have influence on the law concerning fugu. In addition, they had experience with the sensory evaluation of food, especially fish, particularly the staff of National Institute of Nutrition, the Research Institute for Marine Fisheries and the government officials. They were adults, in good health, had no allergies to any materials used in this test, were not anomic, were not ageusic, had normal colour vison and able to detect anomalies in the appearance of fish and fish food in a consistent manner, and were able to rely on sensory perceptions and to report them appropriately. The panel were asked to avoid eating or drinking too much the day before the experiment, to get enough sleep, and to eat their usual breakfast on the day of the experiment. Informed consent was obtained from participants. We requested participants to report any adverse reactions during and after eating the food items.

Statistical Analysis: Data were statistically analyzed by Student *t*-test, and Tukey test, $p < 0.05$ was significant different.

Picture 1. Fugu preparation by Japanese fugu cooking license holders

Picture 2-1. Fugu sashimi

Picture 2-2. Fugu tataki

Picture 2-3. Japanese style fried fugu

Picture 2-4. Left: Nikogori; middle: Skin mix; right: Shirako tofu

Picture 2. Fugu dishes for Sensory test

Date Place
Age Sex: 1 Male 2 Female

1. Evaluate the items below to the gradual increase of the following characteristics on a scale from 1 to 5 and please check (✓) in the box

No	Dish		Item	5	4	3	2	1
1	Fugu sashimi		Overall taste					
			Texture					
			Aroma					
2	Hirezake		Overall taste					
			Aroma					
3	Hot pot	Fugu	Overall taste					
			Texture					
			Aroma					
		Mackerel	Overall taste					
			Texture					
			Aroma					
		Grouper	Overall taste					
			Texture					
			Aroma					
4	Japanese style fried	Fugu	Overall taste					
			Texture					
			Aroma					
		Mackerel	Overall taste					
			Texture					
			Aroma					
		Grouper	Overall taste					
			Texture					
			Aroma					
5	Nikogori		Overall taste					
			Texture					
			Aroma					
6	Skin mix		Overall taste					
			Texture					
			Aroma					
7	Tataki		Overall taste					
			Texture					
			Aroma					
8	Shirako tofu		Overall taste					
			Texture					
			Aroma					

2. Questionnaire on acceptance of Fugu dishes
Please circle the number of the answer that matches your opinion

2.1 Would you want to eat the fugu dishes again?
1. Yes 2. No 3. No each other

2.2 If we do other sensory investigations, would you be willing to participate in other taste tests?
1. Yes 2. No 3. No each other

2.3 Would you recommend Fugu dishes to your friends?
1. Yes 2. No 3. No each other

2.4 Would you introduce Fugu dishes to your family?
1. Yes 2. No 3. No each other

2.5 Do you think Fugu dishes can become a new food in Vietnam?
1. Yes 2. No 3. No each other

2.6 Do you like fish dishes?
1. Yes 2. No 3. No each other

2.7 Do you like Grouper dishes?
1. Yes 2. No 3. No each other

2.8 Do you like Mackerel dishes?
1. Yes 2. No 3. No each other

Table 1. Questionnaire of sensory test

RESULTS

The sensory evaluation panelists (age 28 - 38) consisted of 61 males and 46 females, more than 80% of panel liked the fish dishes, mackerel or grouper dishes (Table 2)

Table 2. Characteristics of Panelists

	Panelists	
	n	%
Like fish dishes	98	92
Like mackerel dishes	93	87
Like grouper dishes	103	96

Figure 1 showed the results of Japanese style fried dish, the overall taste of these three fish showed significant difference ($p<0.05$). When compared to grouper, the texture of fugu was the same, aroma was little lower but still in the good rank flavor was rated best; the overall taste of both was very good and even in the hotpot dish the score for fugu was higher in overall taste.

Figure 2 shows the hot pot dish, overall taste of these three fish was significantly different ($p<0.05$) and fugu got the highest score; texture of fugu compared to grouper or mackerel had a significant difference. In comparison with mackerel, fugu was

more delicious, with no fish smell as with mackerel in the hotpot dish, and texture was the same in the fried dish and better in the hotpot dish. In flavor, fugu was not only good but also better than these 2 luxury fish.

Table 3 showed the sensory evaluation of the 8 fugu dishes, in average point, the overall taste was higher than 4.42, the texture was higher than 3.84, the aroma was higher than 4.49. All of the points were at the good rank. The overall taste of sashimi was 4.82 - the highest score.

Figure 3 showed how the panelists accept fugu dishes; more than 92% of the panel wanted to eat them again and would recommend them to other people, 89% panel thought that fugu could become a new food in Vietnam.

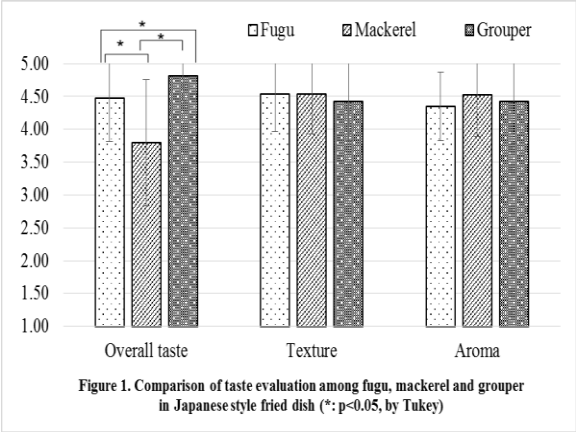

Figure 1. Comparison of taste evaluation among fugu, mackerel and grouper in Japanese style fried dish (*: p<0.05, by Tukey)

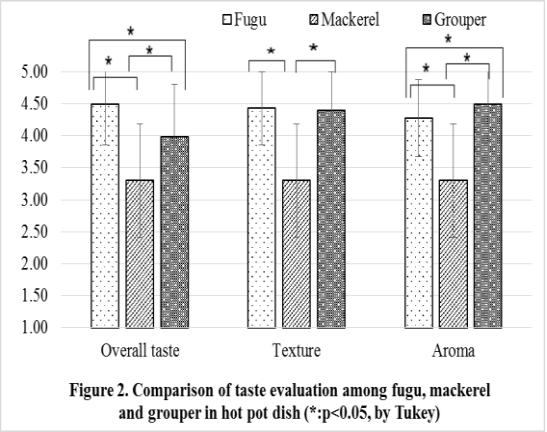

Figure 2. Comparison of taste evaluation among fugu, mackerel and grouper in hot pot dish (*:p<0.05, by Tukey)

Table 3. Average score of sensory evaluation of 8 fugu dishes

	Fugu sashimi	Hirezake	Fugu hot pot	Fugu fried	Skin mix	Nikogori	Shirako tofu	Tataki
Overall taste	4.82±0.39	4.42±0.69	4.50±0.64	4.48±0.66	4.56±0.62	4.56±0.62	4.41±0.71	4.59±0.50
Texture	4.46±0.54		4.50±0.57	3.84±0.96	4.48±0.54	4.48±0.54	4.44±0.57	4.48±0.57
Aroma	4.49±0.54	4.49±0.67	4.28±0.60	4.82±0.39	4.64±0.48	4.64±0.48	4.56±0.57	4.53±0.54

Values are mean ±SD

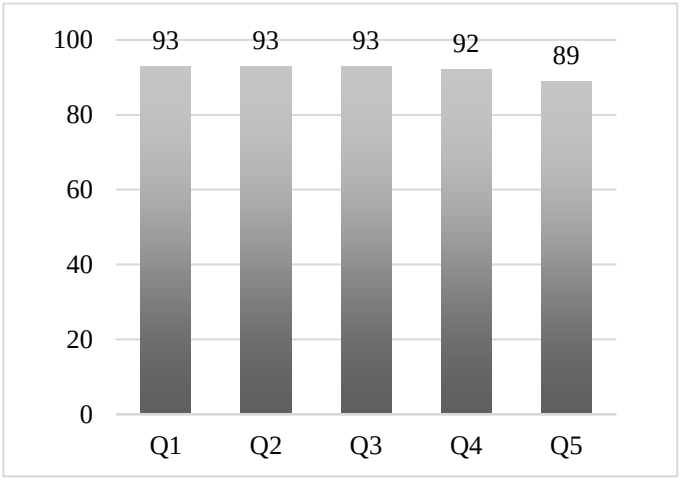

Figure 3. Percent of panelist answered "Yes" about questions on acceptance of Fugu dishes (%)

DISCUSSION

In Vietnam, the Government strictly prohibits processing, trading, and using of pufferfish; therefore, nobody knows the flavor of fugu dishes. However, with this sensory test, more than 90% of the panelists scored fugu dishes as high or best flavor, 80% said they would like to eat fugu again and hoped it would become a new food culture in Vietnam.

Eating and cooking Vietnamese fugu is illegal in Vietnam; therefore, when conducting this research we used Japanese fugu which was confirmed as safe in Japan. Every time when we did study we needed the permission of Vietnam government; all cooking period was under the control of National Research Institutes.

On the other hand, only Japan has a law for fugu culture as well as a fugu chef license system, that why this study followed Japanese cooking methods and all dishes were cooked by professional fugu chefs.

Grouper and mackerel are two of the most esteemed fish in Vietnam, considered to be excellent in overall taste, aroma, and texture. Three fish are white meat fish, the texture of these are considered as similar. Vietnamese usually use the muscle of fish to cook some dishes, such as: hot pot, fried; to compare among 3 kind of fishes we chose these 2 dishes only.

In this study, we invited 107 adults from Hanoi and Da Nang, the number of the panelists were sufficient for this study. According to "Sensory evaluation – guide of food practice", at ranking test the minimum size of panel participating in the test was 12 (12). According to the guideline number JIS Z 9080:2004 of Japan Industrial Standards Committee about sensory evaluation, in ranking test them minimum sample size are 7 if they are professional, 20 if they have experiences, 30 if they have no experience (13). Moreover as similar previous studies about sensory of sushi or food from liver of Japanese cultured fugu (14, 15) in this study we tried to collect more than 50 panel per test.

There are many method to evaluate sensory, for example hedonic scaling - 9 point scale, magnitude estimation, category-ratio scales (16) and 5 point scale. Each method has its own feature. We used the 5 point scale which suitable with the untrained panel and situation of this study as shown in similar studies (5, 6, 17).

In Vietnamese food culture state, most traditional dishes are cooked well. Recently, food safety is a major problem in Vietnam; every year there are 250-500 cases of food poisoning: 7,000-10,000 victims and 100-200 deaths, 33-49% from microorganisms (18–20). Vietnamese do not eat raw food much, especially raw fish. Fish intake in Vietnam in 2010 was only 59g (15.8% of protein intake) (21) lower than in Japan: 73g (20.7% of protein intake) (22). Fish in Vietnam is a luxury item and many times more expensive than meat or eggs. This may be the reason for low fish intake. In this study, the Japanese fugu dishes were very highly evaluated and appreciated by Vietnamese panel. Furthermore fugu has no small bones, usually has no fishy smell, is delicious and is easy for even the elderly or children to consume.

In particular, sashimi got the highest evaluation even though Vietnamese are not familiar with raw fish; in future we hope that fugu will become a part of Vietnamese food culture, and by Japanese experien - ces and cooking methods, Vietnamese can develop the new fish food culture.

The study results also helped the government and National Research Institutes acknowledge that "it was possible to make delicious and safe Vietnamese fugu food, moreover it could become a popular food culture in Vietnam". As a result, the National Research Institutes will send the government proposals for promptly legalizing safe fugu and propagating Japanese fugu culture in Vietnam.

Previous study showed that Fugu consume *tetrodotoxin* (Ttxs) holdings organisms finally become toxic fish. If fugu are prevented from Ttxs holdings organisms, fugu will be nontoxic (≦10MU) (1, 3, 23). Japan have developed technique to cultivate nontoxic Fugu (5, 6) and strictly manage - ment fugu food safety system. These should be established in Vietnam in parallel with fugu new food culture.

In the future, we will analyze toxic in tissue and clarify the types of puffer in Vietnam can be used as food. From those results, safe species of fugu could be chosen to expand the new food culture in Vietnam. We hope these will not only be a new food but will also play a part in "international humanity and cultural understanding", "economic development", "the knowledge society, "technology knowledge" and "practicing globalization".

ACKNOWLEGEMENTS

The author would like to thank all panelists participated in the study, and deeply thanks to Professor Andrew Durkin of Indiana University for his help in editing the English.

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ORIGINAL

Medical History of Infancy, Weaning Foods and Nutrient Intake of Indian Type 1 Diabetic Children aged 2 to 18 years

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(received June 1, 2019)

ABSTRACT *Background and purpose:* Worldwide prevalence of Type 1 Diabetes in children has been increasing. Various environmental factors have been identified as triggering agents in the development of Type 1 Diabetes. The current study assesses the medical history, weaning practices during infancy and present nutrient intake of type-1-diabetic children. *Method*: A cross section study was conducted on 126 children (63 Type-1-diabetic-mellitus) aged 2-18 years. Anthropometry, symptoms at diagnosis, insulin prescribed, medical history during infancy, food intake during weaning and present food intake of children was assessed using pretested standardized tool and techniques. *Results*: More diabetic children were classified as being underweight as compared to non-diabetic children. Common symptoms observed in diabetic children at time of diagnosis were polyuria, unexplained weight loss, tiredness, nocturia and excessive hunger. Significantly higher percentage of diabetic children had received antibiotics and had suffered from jaundice, mumps and hand-mouth disease during infancy ($p<0.05$). Significantly higher percentage of non-diabetic children were given cereals, pulses and fruits during weaning foods ($p<0.05$). Percentage recommended intake in boys (girls) for energy was 59.1±2.8% (57.3±2.5%) and for protein was 84.8±3.4% (79.5±3.4%). In both boys and girls aged 10 to 12 years and more than 13 years, diabetics had significantly higher nutrient intake as compared to non-diabetics. *Conclusion*: The present study highlights the correlation of increased morbidity and weaning practices during infancy with the precipitation of Type 1 Diabetes in later age. A compromised nutrient adequacy was also observed in the present intake in both Type 1 diabetic and non-diabetic children.

Keywords: Type 1 diabetes, nutritional status, weaning, infections during infancy, diet, medical history.

INTRODUCTION

Type 1 Diabetes is a lifelong heterogeneous metabolic disorder, caused by immune-mediated destruction of β cells of the pancreas leading to insulin deficiency in genetically susceptible individuals. Type 1 diabetes is the most common chronic endocrine disorder in childhood (1). Worldwide prevalence of Type 1 Diabetes in children has been increasing and it represents a rising global health burden (2). In the last few decades, there has been an overall increment in the incidence of Type 1 diabetes by 3-5% per year and an estimated 65,000 new cases are reported in children <15 years per year (2,3). As of 2014, an estimated 387 million people had diabetes of which Type 1 Diabetes accounts for 5-10% (4). Type 1 Diabetes contributes to ≥85 % of all diabetes cases in youth <20years of age worldwide. Onset of occurrence peaks between 10-14 years of age and declines after puberty, appearing to stabilize in adulthood (15-29 years) (4).

Given to the rapid rise in the last two decades it may be said that genetic susceptibility may not be the sole contributing factor, but it may be caused largely due to changes in lifestyle and diet. The underlying autoimmunity in genetically susceptible individuals is triggered by environmental factors. This indicates significance of interactions between environmental factors and genetic factors in the multi-factorial etiological components of Type 1 diabetes. Only 10% -15 % newly diagnosed cases report a positive family history (2,5-6).

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Environmental factors potentiate and triggers of β cell destruction either by directly affecting β cells or by aggravating abnormal immune responses to proteins normally expressed in the cells (7). This destruction ultimately leads to absolute insulin deficiency. Environmental factors involved in the destruction include nutritional factors, exposure to Vitamin D, viral infections, gut microflora, socio-economic condition, exposure to antibiotics, pollutants, perinatal and fetal influences and psychosocial stress. The factors may act directly on the pancreas, or provoke abnormal immune responses to proteins normally expressed in the cells (4-10).

Amongst nutritional factors, an early exposure to cow's milk or formula milk and a short breastfeeding period has been associated with increased risk of Type 1 Diabetes in ecological and analytical epidemiological studies. Besides this, nutritional inadequacy also leads to compromised immunity giving rise to opportunistic infections and thus resulting in an immune mediated destruction of β cell (8).

Viruses such as enteroviruses, mumps, rubella, cytomegalovirus, rotavirus have long been implicated in the pathogenesis of Type 1 diabetes. These viruses may either trigger an autoimmune reaction gradually causing destruction of β cell mass or may have a direct cytolytic effect (7,8).

The emerging global epidemic of Type 1 diabetes makes it crucial to identify relevant triggering factors and generate optimum awareness programs to prevent it from rising further. Thus, the aim of this study was to assess the medical history, weaning practices during infancy and present nutrient intake of type-1-diabetic children.

METHODS

A cross sectional study was conducted on 126 children [63 Type 1 diabetic (28 boys, 35 girls), 63 non-diabetics (26 boys, 37 girls)] aged 2- 18 years. Diabetic children were recruited from a pediatric endocrinologists clinic where as non-diabetic children were recruited from community. A written consent was obtained from parents of all children. Ethics approval was obtained from institutional ethic committee.

Anthropometry:

Weight of children was measured using an electronic weighing scale. Height was measured by a wall mounted non-stretchable tape. Body mass index (BMI) was calculated by dividing weight in kg by height in squared meter. Weight, height and BMI for ae Z-scores were calculated in comparison to Indian reference curves (11).

Diabetes related data:

A pre-structured questionnaire was used to identify the symptoms that noticed at time of diagnosis in children. Questions regarding the type of insulin were also inquired.

Details regarding birth:

The type of delivery for the child, details regarding gestation period, health issues at birth and use of antibiotics at birth were inquired using a pre-structured questionnaire.

Breastfeeding and weaning:

The pre-structured questionnaire was also used to inquire details regarding exclusive breastfeeding and foods used during weaning for children.

Nutrient intake:

Dietary intake was assessed by 24-hour recall on three random days of a week (2 weekdays and 1 holiday). Each parent was asked about intake of food and beverage items by their child at each breakfast, lunch, dinner and mid-meals, using standard household measured (cups, spoons and chapati cut-outs) through face to face interview. The type of food consumed, recipe of each food item and amount consumed at each meal were recorded. Daily nutrient intake was calculated by applying the nutritive value tables of the National Institute of Nutrition (NIN), India (12) with help of Dietcal software (AIIMS, Delhi, India). Intake of energy, proteins, carbohydrates and fats were calculated. Percentage recommended dietary allowance was calculated for energy and proteins using age and gender specific Indian reference (Table 1) (13).

Statistical methods:

Analyses were performed using SPSS software for Windows (version 16.0, 2007, SPSS Inc, Chicago, IL). Data are presented as Mean ± SE or frequency (percentage). Independent Sample T test was used to analyse difference in parameters between diabetics and non-diabetics. The frequency distributions were tabulated for various parameters by prevalence of Type 1 diabetes and were compared using cross tabulations and chi-square test. $p<0.05$ was considered to be statistically significant.

Table 1. Indian Recommended Dietary Allowance for Energy and Proteins (ICMR 2010)

	RDA Energy (kcal/day)		RDA Protein (g/day)	
	Boy	Girl	Boy	Girl
2-3 years	1060	1060	16.7	16.7
4 to 6 years	1350	1350	20.1	20.1
7 to 9 years	1670	1670	29.5	29.5
10 – 12 years	2190	39.9	2010	40.4
13-15 years	2750	54.3	2330	51.9
16 – 17 years	3020	61.5	2440	55.5

RESULTS

Data on 126 [63 Type 1 diabetic (28 boys, 35 girls), 63 non-diabetics (26 boys, 37 girls)] aged 2- 18 years is presented in the current study.

Age and Anthropometry:

The mean age of boys (girls) was 10.8±0.5 years (10.8±0.5 years), height was 134±4.5 cm (136.2±1.5 cm), weight was 34.3±2.2 kg (35.1±1.6 kg), BMI was 18±0.6 kg/m2 (18±0.5 kg/m2), height for age Z-score was -0.6±0.2 (-0.5±0.2), weight for age Z-score was -0.7±0.3 (-0.5±0.4) and BMI for age Z-score was -0.1±0.3 (0.2±0.3).

Table 2 presents anthropometric characteristics of diabetics and non-diabetic children separately for boys and girls. There was no significant difference in the age of diabetic and non-diabetic boys and girls ($p>0.05$) (Table 2). Diabetic girls had significantly lesser weight and height for age Z-score as compared to non-diabetic girls ($p<0.05$) (Table 2). There was no significant difference in the anthropometric characteristics of diabetic boys and non-diabetic boys ($p>0.05$) (Table 2).

In comparison to reference Indian standards, 10 children were stunted (height for age Z-score < -2). For age for weight Z-score, 16 children were undernourished (weight for age Z-score <-2), 5 children were overweight (weight for age Z-score between 2 to 3) and 1 child was obese (weight for age Z-score < -3). For BMI for age Z-score, 7 children were undernourished (BMI for age Z-score < -2), 5 children were overweight (BMI for age Z-score between 2 to 3) and 1 child was obese (BMI for age Z-score < -3). Figure 1 gives children in various Z-score categories when classified as diabetics and non-diabetics. As seen in Figure 1, more diabetic children were underweight for when classified according to BMI for Z score whereas more non-diabetic children were underweight when classified according to weight for Z-score (Figure 1).

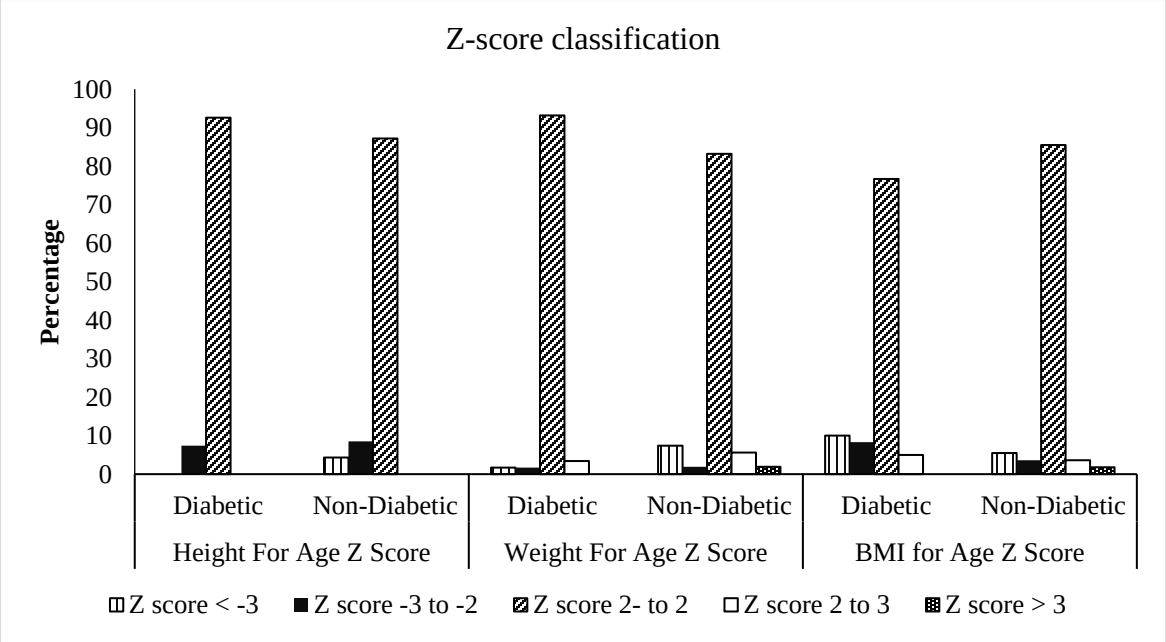
Symptoms noticed at time of diagnosis

Parents of the 63 type 1 diabetic children were asked about symptoms that they observed in their child at time of diagnosis (Figure 2). As seen in Figure 2, most common symptoms observed in diabetic children at time of diagnosis in the current study were polyuria, unexplained weight loss, tiredness, nocturia and excessive hunger. Smaller number of children reported symptoms of urinary tract infection, fever and diabetic ketoacidosis (Figure 2).

Table 2. Age And Anthropometric characteristics of Diabetic and Non-Diabetic Boys and Girls

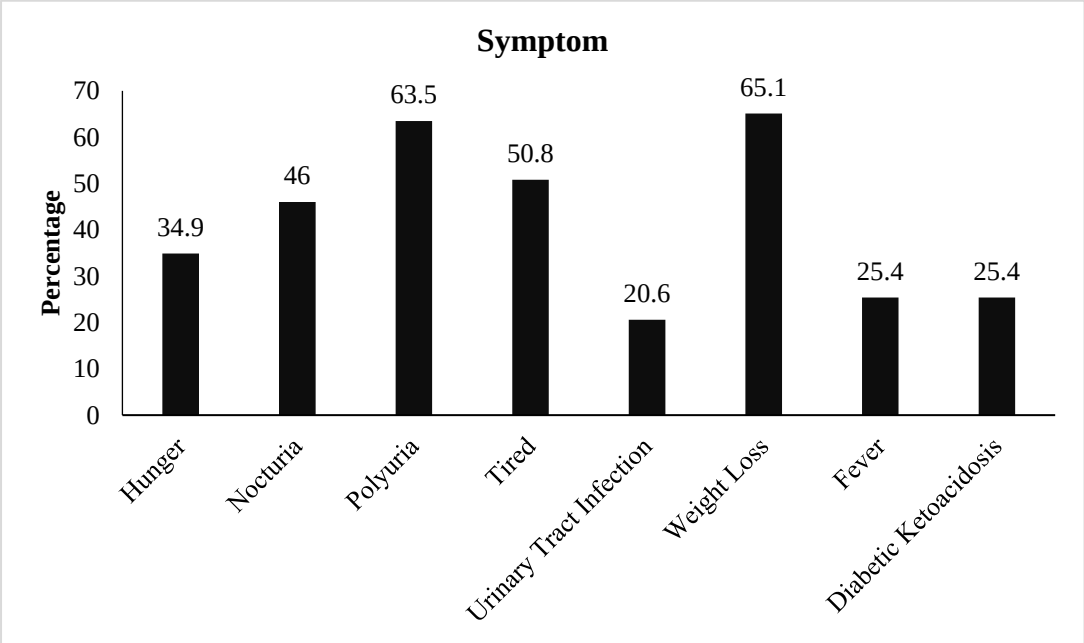
	Boys			Girls		
	Diabetic (n=28)	Non-diabetic (n=26)	P value	Diabetic (n=35)	Non-diabetic (n=37)	P value
Age (years)	11.2±0.7	10.3±0.8	0.425	10.3±0.6	11.3±0.8	0.334
Height (cm)	139.5±5.2	128.6±7.1	0.221	131.5±3.4	140.8±3.5	0.059
Weight (kg)	36.7±2.8	31.8±3.5	0.274	31.3±2.0	39.0±2.3	0.014
BMI (kg/m^2)	18.0±0.7	18.0±0.9	0.980	17.6±0.6	18.3±0.7	0.428
Height for age Z-score	-0.3 ±00	-0.9 ±0.3	0.067	-0.9±0.2	0.1±0.4	0.012
Weight for age Z-score	-0.5±0.3	-0.9±0.4	0.485	-1.0±0.3	0.1±0.6	0.094
BMI for age Z-score	0.1±0.4	-0.2±0.4	0.528	-0.1±0.2	0.6±0.6	0.349

Data presented as Mean±SE



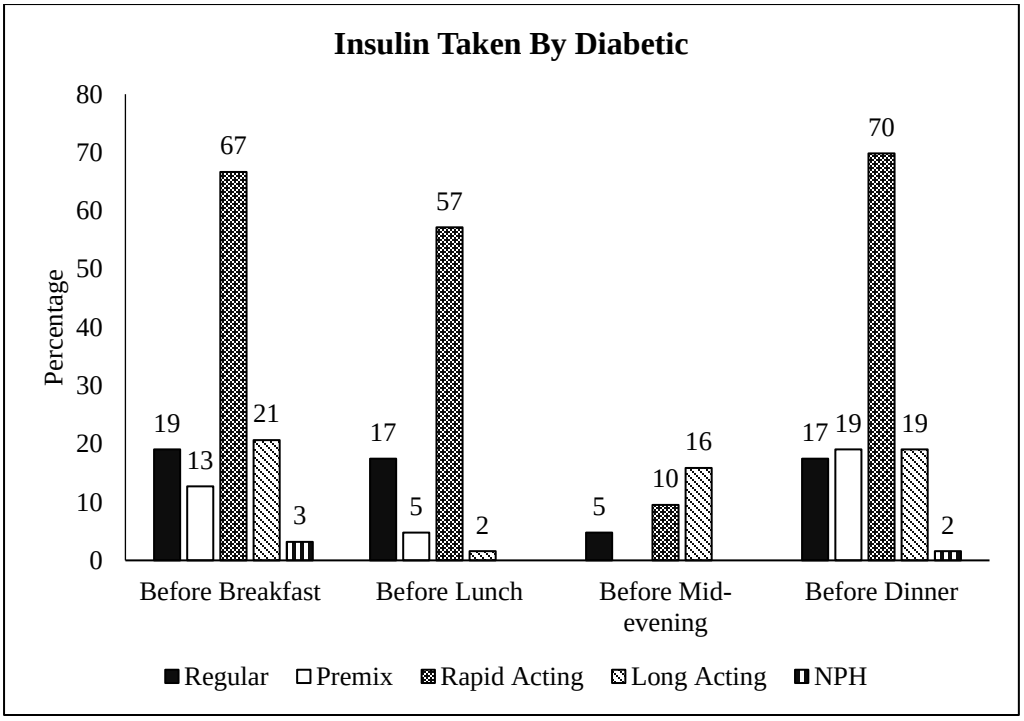
Data presented as percentage

Figure 1. Z-score categories of Diabetic and Non-Diabetic Children



Data presented as percentage

Figure 2. Symptoms observed by Diabetics at the time of diagnosis



Data presented in percentage

Figure 3. Insulin taken by type 1 diabetic children

Insulin taken by Type 1 Diabetic Children:

Figure 3 gives the type of insulin taken by children in the current study. As seen in Figure 3, the most common insulin taken by children in current study was rapid acting insulin at breakfast, lunch and dinner followed by long acting insulin. A small percentage of children were prescribed regular insulin, premix and NPH (Figure 3).

Type of delivery, medical history and Antibiotic usage in children:

Of the 126 children, 63 (50%) were born of normal delivery, 59 (46.8%) were born of C-section and 4 (3.2%) were born of other types of delivery. Twelve (9.5%) children were born pre-term, 14 (11.1%) children had allergies, 57 (45.2%) were given antibiotic from birth and 64 (50.8%) were given antibiotics from 1st – 3rd year of life. For medical history, 14 (11.1%) had suffered from jaundice, 18 (14.8%) had suffered from Mumps, 4 (3.2%) had suffered from hand and mouth disease, 2 (1.6%) had suffered from measles, 29 (23%) had suffered from febrile illness and 32 (25.4%) had suffered from other diseases. 27 (21.4%) children had never suffered from any illness.

Table 3 gives information regarding type of delivery, medical history and antibiotic usage in diabetic and non-diabetic children. Significantly higher percentage of diabetic children had received antibiotic at birth and during 1st – 3rd year of life as compared to non-diabetic children ($p<0.05$) (Table 3). There was a significant association of medical history between diabetic and non-diabetic children with higher percentage of diabetic children having suffered from jaundice, mumps and hand-mouth disease as compared to non-diabetic children ($p<0.05$) (Table 3). No significant association was seen between pre-term birth or allergy with the Type 1 Diabetes ($p>0.05$) (Table 3)

Foods consumed during infancy:

Of the 126 children, 123 (97.6%) were breastfed, 61 (48.4%) were given water along with breastfeeding. For weaning foods, 114 (90.5%) were given cereals, pulses; 106 (84.1%) were given fruits, 94 (74.6%) were given milk and 47 (37.3%) were given commercial supplement. Table 4 gives the foods given to baby during infancy. As seen in Table 4, significantly higher percentage of children without diabetes were given cereals, pulses and fruits during weaning foods as compared to diabetic children ($p<0.05$). There was no significant difference in the percentage of children with or without diabetes who were breastfed, given water with breastfeeding, given milk during weaning and given commercial supplement ($p>0.05$) (Table 4).

Nutrient intake in children:

The nutrient intake in children was calculated and percentage recommended dietary intake was assessed in comparison to Indian recommended values. The mean intake in boys (girls) for energy was 1158±78 kcal/day (1091±45 kcal/day), protein was 31.1±1.6 g/day (29.5±1.4

g/day), fat was 49.0±1.7 g/day (47.8±2.0 g/day) and carbohydrate was 137.4±9.0 g/day (128.3±7.7 g/day). Percentage recommended intake in boys (girls) for energy was 59.1±2.8% (57.3±2.5%) and for protein was 84.8±3.4% (79.5±3.4%).

Table 5a and 5b gives nutrient intake and percentage recommended intake in diabetic and non-diabetic boys and girls respectively. There was no significant difference in nutrient intake of diabetic and non-diabetic boys and girls age less than 6 years and 7 to 9 years ($p>0.05$) (Table 5a and 5b). In boys aged 10 to 12 years, protein, fat and percentage recommended protein intake was significantly higher in diabetics as compared to non-diabetics ($p<0.05$) (Table 5a). In boys aged more than 13 years, protein, carbohydrate and percentage recommended protein intake was significantly higher in diabetics as compared to non-diabetics ($p<0.05$) (Table 5a). In girls aged 10 to 12 years, energy and carbohydrate intake was significantly higher in diabetics as compared to non-diabetics ($p<0.05$) (Table 5b). In girls aged more than 13 years, energy, protein, carbohydrates and percentage recommended energy and protein was significantly higher in diabetics as compared to non-diabetics $p<0.05$) (Table 5b).

Table 3. Type of Delivery, Medical History and Antibiotic Usage in Diabetic and Non-Diabetic Children

	Diabetics (n=63)	Non-diabetic (n=63)	Chi square value	P value
Type of delivery				
Normal delivery	27 (42.9)	36 (57.1)		
C-section delivery	34 (54)	25 (39.7)	2.659	0.26
Other type	2 (3.2)	2 (3.2)		
Medical history at birth				
Preterm birth	5 (7.9)	7 (11.1)	0.368	0.544
Allergy	4 (6.3)	10 (15.9)	2.893	0.089
Antibiotics from birth	39 (61.9)	18 (28.6)	14.10	0.001
Antibiotics 1st - 3rd year of life	38 (60.3)	26 (41.3)	4.573	0.032
Medical history during infancy				
Jaundice	9 (14.3)	5 (7.9)		
Mumps	15 (23.8)	3 (4.8)		
Hand and mouth disease	3 (4.8)	1 (1.6)		
Measles	1 (1.6)	1 (1.6)	16.60	0.011
Febrile illness	13 (20.6)	16 (25.4)		
Any other	9 (14.3)	23 (36.5)		
No disease	13 (20.6)	16 (22.2)		

Data presented as frequency (%)

Table 4. Food consumed by Diabetic and Non-Diabetic Children during Infancy

	Diabetics (n=63)	Non-diabetic (n=63)	Chi square value	P value
Breastfed	61 (96.8)	62 (98.4)	0.341	0.559
Water given along with breastfeeding	31 (49.2)	30 (47.6)	0.032	0.859
Cereals given during weaning	52 (82.5)	62 (98.4)	9.211	0.002
Pulses given during weaning	53 (84.1)	61 (96.8)	5.895	0.015
Fruits given during weaning	45 (71.4)	61 (96.8)	15.20	0.001
Milk given during weaning	45 (71.4)	49 (77.8)	0.670	0.413
Commercial supplement given during weaning	22 (34.9)	25 (39.7)	0.305	0.581

Data presented by frequency (percentage)

Table 5a. Nutrient intake in boys with or without Type 1 Diabetes

	Up to 6 years		**7 to 9 years**		**10 to 12 years**		**More than 13 years**	
	Diabetic	Non - diabetic	Diabetic	Non - diabetic	Diabetic	Non – diabetic	Diabetic	Non – diabetic
Energy (kcal/day)	903± 180	994± 129	1272± 132	1099± 155	1314± 99	1028± 139	1363± 121	1110± 79
Protein (g/day)	21.2± 2.2	20.2± 2.7	25.4± 2.5	26.2± 3.4	43.8± 2.6	24.3± 1.6*	45.3± 3.4	30± 2.6*
Fat (g/day)	48.8± 5.7	46.5± 5.6	44.8± 7.9	45.4± 3.9	55.8± 2.6	44.3± 3.4*	49.5± 3.5	54.3± 6.4
Carbohydrates (g/day)	95.0± 46.1	123.6± 20.3	191.8± 19.6	144.2± 35.6	144.4± 18.5	121.1± 23.5	159.4± 17.7	104.2± 12.5*
RDA Energy (%)	66.9± 13.4	81.1± 12.0	75.3± 7.8	61.9± 6.9	59.7± 3.6	51.6± 7.0	49.5± 4.1	40.7± 3.0
RDA Protein (%)	105.3± 11	107± 11.6	86± 8.3	82.9± 5.7	104.8± 8.2	67.2± 6.2*	80.3± 6.4	55.9± 5.0*

**p<0.05 for comparison between diabetic and non-diabetics. Data presented as Mean±SE*

Table 5b. Nutrient Intake in Girls with or without Type 1 Diabetes

	Up to 6 years		**7 to 9 years**		**10 to 12 years**		**More than 13 years**	
	Diabetic	Non - diabetic	Diabetic	Non - diabetic	Diabetic	Non – diabetic	Diabetic	Non – diabetic
Energy (kcal/day)	971± 94	892± 92	1050± 142	930± 32	1467± 113	1071± 139*	1329± 126	931± 76*
Protein (g/day)	19.5± 1.5	17.3± 17	26.5± 1.5	25.0± 1.8	43.9± 3.2	35.3± 3.8	39.1± 2.9	25.4± 2.5*
Fat (g/day)	35.6± 3.1	47.4± 4.9	47.0± 4.3	40.6± 0.9	50.8± 5.4	50.7± 7.3	55.9± 8.0	46.5± 4.0
Carbohydrates (g/day)	141.6± 22	99.1± 19.8	130.3± 33.3	116.1± 4.3	199.8± 17.5	108.6± 16.4*	159.3± 11.7	87.8± 9.4*
RDA Energy (%)	72.1± 8.4	66.4± 7.4	62.1± 8.4	55.0± 1.9	69.4± 5.5	52.4± 6.7	56.8± 5.5	39.5± 3.4*
RDA Protein (%)	92.6± 10.4	80.2± 7.6	89.9± 5.2	84.8± 6.0	106.7± 9.1	90.4± 8.9	74.9± 5.7	49.6± 5.4*

**p<0.05 for comparison between diabetic and non-diabetics. Data presented as Mean±SE*

DISCUSSION

In the current study we have studied the growth, medical history at birth, weaning practices and nutrient intake of children suffering from Type 1 diabetes and compared them with non-diabetic children. Higher percentage of diabetic children had history of viral and bacterial infections as compared to non-diabetic children. Nutrient intake also differed between the 2 groups.

Growth impairment is a well-known complication of Type 1 diabetes. In the ICMR registry data 16% of Type 1 Diabetics had shown growth retardation (14). Factors affecting growth in Type 1 diabetic children include include gender, genetic endowment, puberty, metabolic control and status of growth hormone, Insulin like Growth Factor (IGF) and Insulin like Growth Factor Binding Proteins (IGFBP). The main cause of poor height and weight gain is under-insulinization leading to low circulating levels of IGF-1 and IGFBP-3 and high circulating levels of IGFBP-1. Poor glycemic control ultimately leads to delayed puberty, poor bone health and other health problems (15-16).

In a case controlled cohort study in children with an early diagnosis of Type 1 diabetes (<3 months), HbA1C was related to growth alteration during the first year of follow-up irrespective of other factors (17). In another study, children with Type 1 diabetes from 1 to 18 years of age, 30.9% were stunted, 17.7% were moderately stunted and 13.2% were severely stunted and was not associated with glycemic control (16). Even study conducted in Indian children suffering from Type 1 diabetes, it was observed that the mean height for age Z score and weight for age Z score were lower in children with diabetes as compared to controls (18). In our study, diabetic girls were significantly shorter as compared to non-diabetic.

The classic symptoms of diabetes are polydipsia, polyuria, polyphagia and weight loss. Levy-Marchal et al (2001) observed polyuria, weight loss and fatigue as the most commonly observed symptoms (19). Other typical symptoms for children at diagnosis include metabolic deterioration to diabetic ketoacidosis, presented with nausea, vomiting and lethargy (20). Similar symptoms were observed in children in our study at the time of diagnosis.

Maternal and pregnancy factors such as age, parity, gestational age (21). Higher percentage of diabetic children in the current study were born via caesarean as compared to non-diabetic children. Caesarean delivery has been associated with the development of type 1 diabetes in the offspring. Caesarean delivery may increase the risk of Type 1 diabetes due to differences in gut micro biotic compositions as compared to vaginal delivery (22-23).

Studies in mice have shown that early use of antibiotics in life leads to changes in gut microbiota that cause an increase the risk of developing Type 1 diabetes (24-25). This is also supported by literature that indicates a difference in microbial composition of children with and without Type 1 Diabetes (26). In the current study also, significantly higher percentage of children suffering from Type 1 diabetes had received antibiotics at birth as compared to non-diabetic children.

Several viruses such as enterovirus, rubella, mumps, rotavirus and cytomegalovirus have been associated with Type 1 diabetes (7-8, 27-29). Various mechanisms have been linked to the development of Type 1 Diabetes which depends on the type of virus (27,29). These involve non-immune mediated cytolytic infection leading to β-cell lysis or an immune mediated reaction. Mump, measles and rubella has been associated with type 1 diabetes as it was noted that children with mumps appear to have islet cell antibodies (27,30). Similarly, viral and bacterial infections were higher in diabetic children in our study. Neonatal jaundice has been associated with a small increase in the risk of Type 1 Diabetes. Phototherapy used for its treatment further increases the risk of developing type 1 diabetes. (30-32). We found similar results. We also observed no significant association was found between allergy and type 1 diabetes and is in line with results reported by Karavanaki et al (33).

Early nutrition is clearly the first environmental exposure to which infants are exposed. Dietary factors are critical factors that predispose or protect against Type 1 diabetes (34). Early exposure to cow's milk, cereals, fruits, berries, root vegetables and hydrolysed milk formula during weaning increase the risk of development of type 1 diabetes. (34-35). Similarly, in our study, higher percentage of diabetic children consumed cereals and fruits during weaning.

Children with Type 1 Diabetes have been reported to consume a diet that lacks in micronutrients. Their diets are nutritionally inadequate compared to children without Type 1 Diabetes. Previous studies on dietary assessment indicate that children with type 1 diabetes consume higher calories, carbohydrates, refined sugars, saturated fat and protein as compared to their counterparts and is in line with results observed in the current study. This indicates a lack of healthy eating approaches and a need to implement behaviour modification programs that promote wholesome nutrition in children with Type 1 Diabetes. (36-38).

In conclusion, the present study highlights the correlation of increased morbidity and weaning practices during infancy with the precipitation of Type 1 Diabetes in later age. A compromised nutrient adequacy was also observed in the present intake in both Type 1 diabetic and non-diabetic children. There is a felt need to strengthen awareness programs for parents towards exclusive breast feeding, correct weaning practices to prevent early childhood illness and predisposition to Type 1 diabetes.

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ACKNOWLEDGEMENT

We thank the participating children and parents for being a part of the study. We also thank all the pediatric endocrinologists who helped us with recruiting patients.

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ORIGINAL

Food Wastage in Hospital among Cancer Inpatients and its Relation with Nutrition Impact Symptoms

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(received July 3, 2019)

ABSTRACT The objective of the study is to determine the prevalence of food wastage among cancer patient in NCI, Putrajaya. The association between the nutrition impact symptoms resulted from cancer and side effects of cancer treatments with the rate of food wastage was also investigated. This cross sectional study has been conducted from May to June 2015 involving oncology wards in which samples were randomly selected. Weighing method and visual estimation were used to measure weight of leftovers or food waste. Based on observational and weighing method, as high as 59.3% and 41.9% respectively of foods served during lunchtime to the NCI's patient were discarded or wasted which equalled to RM25,259.44 and RM17,847.73 respectively from total expenditure. Based on weighing method, the most food groups being wasted by patient are vegetables, protein main dish, and soft CHO. From visual estimation method, the most wasted food group is main protein group, followed by vegetables group, carbohydrate group, side protein group and the dessert group. Between these two methods, similar food group were reported as being highly wasted. There are also a significant association between nausea, vomiting, loss of appetite and swallowing difficulties with the rate of food wastage. These nutrition impaired symptoms experienced by patients were important to be addressed appropriately to improve their diet intake and indirectly reduces food wastage in hospital..

Keywords: Nutrition, cancer treatments, food wastage, Malaysia.

INTRODUCTION

Food waste or food loss is food that is discarded or lost or uneaten (1). The causes of food waste or loss are numerous, and occur at the stages of production, processing, retailing and consumption (2).

In 2013, half of all food is wasted worldwide, according to the British Institution of Mechanical Engineers (IME) (3). Loss and wastage occurs at all stages of the food supply chain or value chain. In low-income countries, most loss occurs during production, while in developed countries much food – about 100 kilograms per person per year is wasted at the consumption stage (4). The statistic shows that in developing and industrialized countries had dissipated almost the same amount of food which is 630 and 670 million tonnes respectively where fruit, vegetables, root and tubers has the highest rate of food wastage of any food[5]. Global quantitative food losses and waste per year are roughly 30% for cereals, 40-50% for root crops, fruits and vegetables, 20% for oil seeds, meat and dairy plus 35% for fish (5).

High food wastage always being linked to reduced energy and protein intakes and has impact towards malnutrition related complications (6) and indirectly towards the prevalence of malnutrition in hospitalized patients. Malnutrition has been identified as one of related cause in death of cancer patient and many studies find from 25-40% of acute hospital patients are malnourished (7). Standard guidelines and protocol had been developed and practiced by dietitian, and provision of meals has become an essential parts of patient's treatment (8) but somehow the incidence of malnutrition in hospitalized patients especially in cancer patient still occur. In NCI, Putrajaya, a pilot study had been done in June to July 2014, with n=41, where from observation, the rate of food discarded by patient is 19.54% even though the score of Patient Satisfactory Survey is more than 80%. BAPEN 2012 also shows that worrying amount of food waste linked to hospital settings is approximately 40-45 %, coupled with a considerable level of malnutrition among patients which is approximately 20-40% in Denmark.

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In a study done in University hospital with 1200 sample aiming to investigate the cause of continuing weight lost in hospitalized patients, the study conclude that energy and protein intake in patients were low and did not met their recommended intake despite the value of 2000 kcal diet provided by hospital that should met patient's requirement (6). The study reveals that high rates of food wastage more than 40% is a proven evidence of low intake of diet provided among patient resulting in energy and protein received by patient is less than 80% of energy and protein recommended (6). More than enough food is produced or available in hospitals but still for some reason not all patients eat adequately, resulting in malnutrition and food waste (9). Clinical issues involving NIS like poor appetite due to illness or medication, changes in sense of taste or smell, swallowing difficulties, pain, textured modified diet and others issues such as long length of hospital stay had been listed as reasons for food wastage in hospitals (10) and all these condition always occur in cancer patients due to cancer itself or the treatment which can impaired towards patient's nutritional status (11). Therefore, simply planning and providing adequate food is ineffective if it is not eaten by patients regardless of whatever factors that contributed to the lower oral intake. In addition to the nutritional implication of the waste, there are financial concerns as well.

The main objective of this study is to determine the percentage of food wastage in (National Cancer Institute (NCI), Putrajaya and to find if there is significant association between nutritional impaired symptoms or side effects such as nausea, vomiting, diarrhea, stomach discomfort and others with incidence of food wastage in hospitalized cancer patients.

MATERIALS AND METHODS

This cross sectional study has been conducted from Mei to June 2015, during lunch time involving 337 samples from 4 different wards (7A, 7B, 8A and 8D). Sample is randomly selected within these 4 wards and the selected food tray for the selected sample is taken and labelled for data collection.

The food service system in NCI is a centralized plated system with 8 days menu cycle and patient's BOR is 40% from 252 beds. In this study, food wastage has been defined as volume or percentage of the served food that is discarded. There are two measurement methods that have been used: weighing and visual estimation.

Weighing methods had been used to measure weight of leftovers or food waste by each food components or items on each individual tray. Prior to that, few samples of selected tray were weighed before it being served to the patients. The average measurement is used as the baseline weight to be compared with wastage weight.

Second method is a visual estimation. It is used by measuring proportion of leftovers food using semi quantitative 5-point scale (all, ¾, ½, ¼, none) (12). The samples were taken at random date and being recorded using a set of form designed specifically for this study and the data collected by Assistant Catering Officers and Assistant Clerk as scheduled.

All data will be analysed using Microsoft Excel 2010 and the IBM SPSS Statistic 22.0, IBM Corp. Released 2010. IBM Statistic for windows, version 22.0 (Armonk, NY: IBM Corp). Descriptive statistic including range, means, median, standard deviation, interquartile range and frequency were used to present patient's demographic data, Class of diet and occurrence of NIS, food wastage, One- way Anova test were done to determine if the food wastage were affected with the difference of diet class and Independent T-test were done to present any significant correlation between NIS factors with the rate of food wastage.

RESULTS

Socio-demographic of the study samples are described in Table 1. A total of 337 cancer patients were included: 184 males (54.6%) and 153 females (45.4%). The mean age is 53±13 and 172 samples were from patients in Class 3 (51%), 32.3% and 16.6% from Class 2 and Class 1 respectively. The majority of the samples came from Malay patients (200, 59.3%), Chinese (107, 31.8%) and India (24, 7.1%) respectively and the rest were from other ethnic such as Sarawak Bumiputera.

As shown in Figure 1, all samples for this study were collected representing 8 cycle menu from Menu Day 1 to Menu Day 8 for therapeutic diet. There is no normal diet involve since in NCI, the high calorie high protein diet (therapeutic menu) were set as default diet for all patient admitted to NCI. This therapeutic diet were divided basically to several different types of menu including, spicy, non-spicy, western, vegetarian, soft diet, mixed porridge, minced diet and blended diet. Every type of menu consists of carbohydrate source food, protein source food, vegetables, fruits and water.

From observational method (semi quantitative 5-point scale), overall, the data shows that 59.3% of meal served at lunch time to NCI patients has been discarded. Only 30% of patients finished their lunch meal and another 10.7% had discarded ¼ of their meal. Wastage foods were divided into 5 main categories which were carbohydrate group, main protein group, side protein group, vegetables and desserts. As illustrated in Figure 3, the most wasted dish was main protein group (Dish), followed by vegetables group, carbohydrate group (Rice/ ala carte), side protein group (soup/ side dish) and lastly the dessert group.

For second method which was weighing method, the food item were categorised to 10 food groups. There were normal CHO, Soft CHO, Main Protein, Side Dish Protein, Vegetables, Drinks, Ala-Carte, Fruits, Desserts and Soup. Results showed that the total weight of food wastage was 118.69kg (41.9%) from the total meal weight provided to patients. Overall mean of food waste was 488.11± 256.61 gram. Mean of food wastage data according to the food groups was illustrated in Table 2.

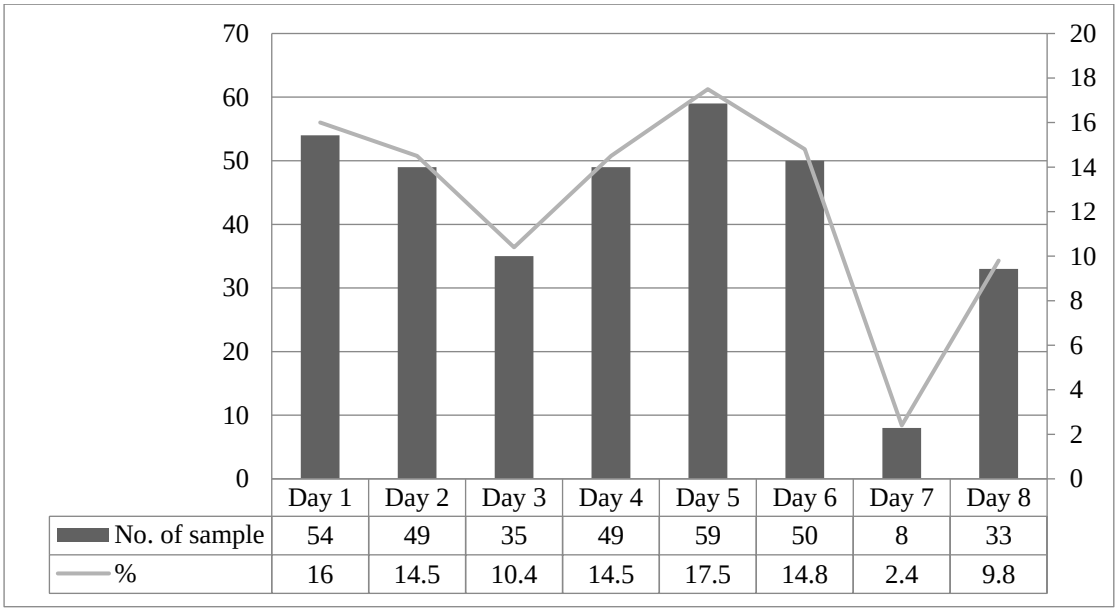
The 3 tops list of the most food groups being wasted by patient were vegetables (57.9%), protein main dish (55.7%), and soft CHO (51.6%). The independent *t*-test was done to

find if NIS occurs in cancer patients could affect the amount of food wastage. Below was the results produced from collected data as shown in Table 3.

Nausea, vomiting, loss of appetite (LOA) and swallowing difficulties had significant influence in food wastage. Other symptoms such as abdominal discomfort, vision disorders, chewing difficulties, diarrhoea and sleep disorders were insignificant effects on food wastage among cancer patients.

Table 1. Socio-demographic Characteristic

Characteristic		**Frequencies**	**%**
Gender	Male	184	(54.6)
	Female	153	(45.4)
Ethnic	Malay	200	(59.3)
	Chinese	107	(31.8)
	Indian	24	(7.1)
	Others	6	(1.8)
Education Level	No formal education	31	(9.2)
	Primary	79	(23.4)
	Secondary	176	(52.2)
	Universities/ College	50	(14.8)
Ward Class	Class 1	56	(16.6)
	Class 2	109	(32.3)
	Class 3	172	(51.0)
Group Age (Years)	13-21	9	(2.7)
	22-40	51	(15.1)
	41-59	162	(48.1)
	60>	115	(34.1)



	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
No. of sample	54	49	35	49	59	50	8	33
%	16	14.5	10.4	14.5	17.5	14.8	2.4	9.8

Figure 1. Total samples taken according to the 8 Days Menu Cycle and percentage.

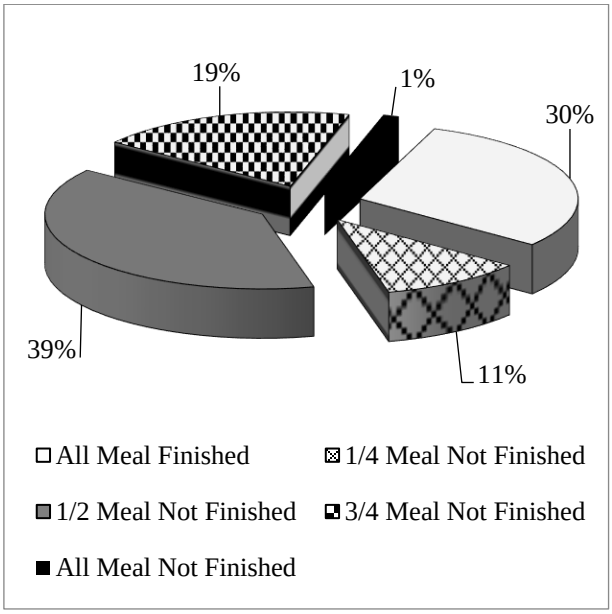


Figure 2. Distribution of food wastage by semi quantitative 5 point scale method

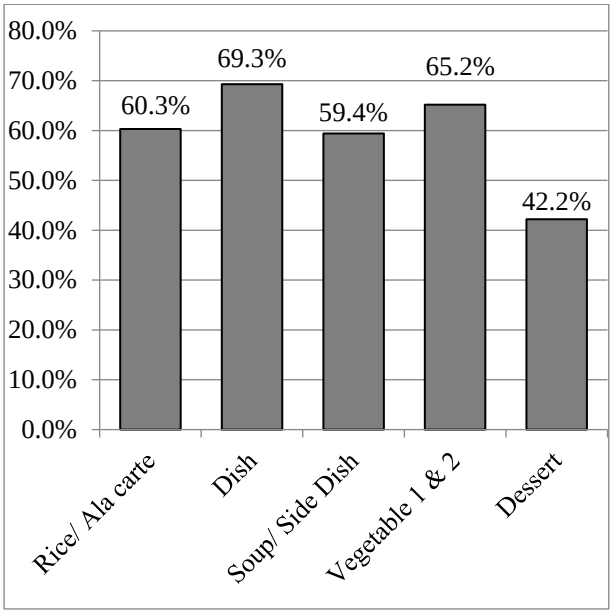


Figure 3. Distribution of most wasted dish

Table 2. Food Wastage by Food Groups

		Estimated Nutritional Value of Total Wastage	
Characteristic	**Mean (SD)**	**Energy (kcal)**	**Protein (Gram)**
Normal CHO	89.09 (81.03)	10.49 – 221.16	0.19 – 4.08
Soft CHO	180.16 (134.12)	18.03 – 123.06	0.33 – 2.27
Main protein	67.83 (53.18)	21.98 – 181.52	2.70 – 22.29
Side dish protein	26.07 (23.68)	3.59 – 74.63	0.44 – 9.16
Vegetables	60.75 (50.79)	2.88 – 32.30	0.21 – 2.32
Fruits	53.40 (69.08)	4.39 – 34.29	0.09 – 0.73
Drinks	36.53 (77.4)	NA- Plain water was provided during lunch time	
Dessert	38.13 (43.65)	10.71 – 158.65	0.10 – 1.55
Soup	141.34 (112.86)	34.46 – 307.58	1.22 – 10.85
Ala carte	86.14 (82.83)	5.73 – 292.32	0.15 – 7.60

** Estimation of nutrient value are calculated based on Atlas of Food Exchange & Portion Sizes; CHO=Carbohydrate*

Table 3. NIS influencing food wastage among cancer patients

Symptom		n	Mean (SD)	*t* statistic	*P* value[a]
Nausea	Yes	64	410.58 (283.54)	2.001	0.046*
	No	273	338.52 (253.44)		
Vomiting	Yes	52	468.63 (269.71)	3.57	<0.001**
	No	285	330.96 (253.58)		
Abdominal Discomfort	Yes	56	374.59 (247.22)	0.70	0.48
	No	281	347.74 (263.29)		
Loss of appetite	Yes	93	413.44 (278.75)	2.69	0.008**
	No	244	328.86 (249.89)		
Vision Disorder	Yes	46	328.5 (291.66)	-0.66	0.51
	No	291	355.95 (255.6)		
Chewing Difficulties	Yes	42	319.21 (250.34)	-0.88	0.38
	No	295	356.90 (262.01)		
Swallowing Difficulties	Yes	30	458.17 (294.71)	2.35	0.019**
	No	307	341.85 (255.12)		
Diarrhoea	Yes	23	383.22 (318.16)	0.59	0.56
	No	314	349.93 (256.26)		
Sleep Disorders	Yes	77	376.30 (271.69)	0.92	0.36
	No	260	345.07 (257.22)		

[a]*Independent t-test; *significant at 0.05; **significant at 0.01*

DISCUSSION

This study showed that based on observational and weighing method, as high as 59.3% and 41.9% respectively of foods served during lunchtime to the NCI's patient were discarded or wasted which equalled to RM25,259.44 and RM17,847.73 respectively from total expenditure. All patients in NCI, Putrajaya were given standardised therapeutic diet of High Calorie High Protein diet to meet the increased needs of nutrition in cancer patients. The standard calorie and protein provided for High Calorie High Protein Diet was 2000 kcal, 85gram protein. From this study, it showed that estimated loss of energy and protein value that can be provided towards cancer patients from discarded food were between 401.24 kcal until 589.07 kcal (20.1 – 29.5%) and 17.4 gram until 39.9 gram (20.5 – 46.9%) of protein from the standard requirement.

The top 3 most wasted food groups from observational method (semi quantitative 5-point scale) were protein group (Lauk), vegetables group and carbohydrate group (Nasi/ala carte) whereas based on weighing method, vegetables (57.9%), Protein Main Dish (55.7%), and Soft CHO (51.6%) were among the top food wasted. Between these two methods, similar food group were reported as being highly wasted.

There was also significant association between nausea, vomiting, loss of appetite and swallowing difficulties with the rate of food wastage. These nutrition impaired symptoms experienced by patients were important to be addressed appropriately to improve their diet intake and indirectly reduces food wastage in hospital. Food presentation could be improved further to enhance patients' appetite and encourage patient to eat more. Diet texture modification is also important to assist patients with swallowing difficulties.

In NCI, all inpatients will be provided with a menu card daily. Different menu will be provided for duration of 8 days. Patients have the right to choose their own preferred menu. However, dietitian in charge will provide suggestion to change the menu to cater the need of patients. For example, patients with swallowing difficulty may be prescribed with soft diet, liquid diet or blenderised diet. These adjustments helped to improve patients' food intake and subsequently reduce food wastage.

Limitation of this study was whether the total food wastage actually as stipulated. This was because there was no way to tell that the meal provided were actually consumed by the patient or not. Thus, the actual rate of wastage could be much higher than the results attained since there were possibilities that patient's meal actually being consumed by patient's next of kin or caregiver instead of patient himself.

In the near future, if similar study to be conducted, a simple interview should be done on all patients involved to obtain a more accurate information regarding actual diet intake.

CONCLUSION

Food wastage issue among hospitalized patients is a worldwide problem that needs to be addressed appropriately. Insufficient calorie intake directly affects nutritional status of patients and will result in malnutrition especially if the patients stay longer in ward. Apart from implication towards patient's nutritional status, food wastage also affects the hospital financially. A large sum of money equivalent to the wasted foods can be used for other aspect of patient's care. Thus, effective measures need to be taken to reduce total wastage. Besides nutrition impact symptoms being part of the reason patients not finishing meals provided, further study need to be done to identify causes of specific food groups being wasted.

ACKNOWLEDGEMENT

We would like to thank the Director General of Health Malaysia for his permission to publish this article.

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