

ORIGINAL**Texture-Modified Diets Need to be Improved in Vietnamese Hospitals**Thao Phuong Tran MSc¹, Linh Thuy Nguyen MD PhD², Keiko Hirose RD MSc^{1,3}, and Shigeru Yamamoto RD PhD¹¹Jumonji University, Niiza City, Saitama 352-8510, Japan, ²Hanoi Medical University and Hanoi Medical University Hospital, Hanoi, Vietnam, ³Nerima Hikarigaoka Hospital, Nerima City, Tokyo 179-0072, Japan

Abstract : Purpose : The aim of this study is to compare the nutritional status of older adult inpatients consuming Texture-Modified Diets (TMD) to older adult inpatients consuming a regular diet. **Methods :** The study was designed as cross-sectional and was conducted in three large hospitals in northern Vietnam. The data for 344 older adult inpatients were collected in 2021 by dietitians. **Results :** The result showed 104 subjects were prescribed TMD. The textures of hospital diets have still not been adequately developed. In particular, the hospitals had not yet developed pureed meals. All older adult inpatients (74.7 ± 6.8 years old, 52.9% female) had 28.8% malnutrition by the GLIM criteria. The TMD group had a malnutrition prevalence two times higher than the regular diet group. Total energy intake from hospital meal and outside snacks in the regular diet group was higher than in the TMD group, about 150 kcal. Although energy provided from the hospital diet in both groups was similar, hospital meal wastage in the TMD group was higher than in the regular diet group. **Conclusion :** The older adult inpatients on TMD may have a nutritional status worse than those consuming a regular diet. Hospital diets need to be improved in texture and quality. *J. Med. Invest.* 69:230-236, August, 2022

Keywords : older adult inpatients, IDDSI, GLIM, Vietnam**INTRODUCTION**

Vietnamese older adults are rapidly increasing. The percentage of Vietnamese aged 65 and older is projected to grow from 7.9% in 2020 to 16.3% of the population in 2040 (1). A previous study on about one thousand older adult inpatients showed the rate of malnutrition and risk of malnutrition in older adult inpatients were 17% and 54% by the Mini Nutritional Assessment-Short Form (MNA-SF), respectively (2). The Global Leadership Initiative on Malnutrition (GLIM) presented malnutrition diagnostic criteria for standardizing clinical practice based on the recommendations of global clinical nutrition societies. Currently, many countries are using this tool to assess malnutrition. It is important to take steps toward accurately assessing the ratio of malnourished Vietnamese older adult inpatients with the GLIM tool.

One of the factors leading to malnutrition in older adults is difficulty in chewing and swallowing. A previous article showed that the dysphagia prevalence was 16.5% in older adult inpatients by the Repetitive saliva swallowing test (RSST) and Water swallowing test (WST). The ratio of elderly with reduced oral function was about 6% (3). Dysphagia is becoming a problem among older adult inpatients in Vietnam.

In patients suffering from problems with chewing and swallowing, a regular diet is unsuitable. In early 2019, the International Dysphagia Diet Standardization Initiative (IDDSI) concept was published (4). One of the most common ways of managing dysphagia is the provision of a texture-modified diet (TMD) (chopped, minced, pureed) and thickened liquids. The traditional Vietnamese soft diet is rice porridge which is cooked

with finely chopped meat and diced vegetables. In addition, the liquidized diet is mixed with various ingredients such as rice, egg, meat, oil, vegetables, etc. In the past few years, the role of thickening agents for dysphagia patients has been expanded by dietitians. However, technical capability, thickening agent availability, and availability of speech therapy specialists can lead to differences in the applicability of the thickening agents to the diet of swallowing disorder patients in each hospital.

Many factors such as aging, diseases, and medicines may lead to reduced energy intake in older adult inpatients. Therefore, the quality of the hospital diet is very important because it will directly affect the food intake of patients. While studies have focused on both the aesthetics and safety of the food, there has been a lack of standardization in the evaluation of meal satisfaction of TMD (5). In some Vietnamese hospitals, clinical diets are served and TMD has gradually improved. Because of a lack of systemic support for nutrition practice, dietary intakes of patients are not followed, and evaluation of hospital meals is also not implemented officially. It is necessary to conduct a survey to evaluate the present nutritional practice situation in order to provide direction for improving Vietnamese hospital diets in the future.

Therefore, the aim of this study is to compare the nutritional status of older adult inpatients consuming TMD to older adult inpatients consuming a regular diet.

MATERIALS AND METHODS**Setting and Sample.**

The study was designed as a cross-sectional study and was conducted in 2021. This research was conducted in accordance with the Declaration of Helsinki and approved by the Hanoi Medical University's ethical committee, number 512/GCN-HDDNCYSH-DHYHN. The study population consisted of older adult inpatients being treated in three large general hospitals in northern Vietnam.

Received for publication January 19, 2022 ; accepted April 30, 2022.

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Subjects were recruited for the study from all newly admitted patients, i.e., patients in the first 48-72 hours after admission, by random selection (using a random number table) from admission registers.

The sample size was 344 subjects who met the inclusion criteria : (a) hospitalized older adults aged 65 or over, (b) consuming hospital diets with no need to control nutrients because of disease. The exclusion criteria included : (a) refusal to participate in this study, (b) lack of ability to answer questionnaires. All subjects received written information explaining the purpose of the research and signed consents were obtained in accordance with ethical requirements.

Data collection.

All the questionnaires were filled out by investigators. The investigators were dietitians who are responsible staff members in the nutritional department of each hospital. Researchers carried out training for investigators about research data collection. Before implementing the actual study, we conducted a pilot study on 20 patients to revise the instruments and adapt the model for each hospital.

Below is the information that we obtained.

Demographic data

Data such as age, gender, diagnosed disease, number of medicines, length of hospital stay, discharge situation were collected from medical records.

Nutrition parameters

Anthropometric measurement. If patients could stand, weight and height were measured with a Tanita scale BC-760-WH (Tanita, Tokyo, Japan) and Seca Germany. Weight was collected in the morning before eating and after toilet. Patients removed their shoes and wore only hospital clothes. Body mass index (BMI) was calculated using base weight and height. If patients could not stand, we used the circumference of the leg as an indicator to screen nutrition by MNA-SF (6).

Mini nutritional assessment – short form (MNA-SF). Various scales have been used to perform a quick initial nutritional assessment. The MNA-SF is used globally. Although it does not require special equipment, it has high sensitivity and specificity for assessing malnutrition risk in older adults in multiple settings, including hospitals. MNA-SF consists of six sections : appetite or eating problems, recent weight loss, mobility impairment, acute illness/stress, dementia or depression, and BMI. It contains a total of 14 points ; a score of 12–14 is within the normal range, 8–11 indicates risk of malnutrition, and ≤7 indicates malnutrition. All assessments were performed per the MNA-SF user guide.

The Global Leadership Initiative on Malnutrition (GLIM). Malnutrition was assessed using the criteria of the GLIM

definition, which is based on phenotypic criteria including change in body weight, low BMI, and reduced muscle mass, as well as etiologic criteria including reduced food intake or assimilation, and disease burden. The GLIM definition includes 2 steps. First, a validated nutritional risk screening tool is used to identify individuals at risk of malnutrition ; in this study we used the MNA-SF. Second, for people at risk of malnutrition, malnutrition is defined by the detection of at least 1 phenotypic and 1 etiologic criterion (7).

Dietary survey. The hospital diet had been supplied by 7-day cyclic menus. Normal hospital diets were constructed to meet at least the Vietnamese Recommendation Dietary Allowance (RDA) for low activity level. Based on height of the individual, ideal body weight (IBW) was calculated. An individual diet was calculated based on 30-35 kcal/kg IBW for energy, 1-1.2g/kg IBW for protein. Dietary intake of patients was conducted by the 24-hour dietary record. Patients recorded all food intake including the rate of staple food, main dish and side dish intake from hospital meals and the number of outside snacks in one day at admission. Based on the Vietnamese Food Composition Table 2017, diets of patients were calculated by dietitians.

Classifications of meal forms. At present, the development of hospital foods in Vietnam hasn't followed any standard. In this study, textures of food which were used in the three hospitals were classified according IDDSI testing methods (4). Textures of food in IDDSI were classified into 5 levels, including regular/easy to chew level 7 (RG7), soft & bite-sized level 6 (SB6), minced & moist level 5 (MM5), pureed level 4 (PU4) and liquidized level 3 (LQ3). In detail, SB6 : soft and moist with no separation of liquid, chewing is required, can be mashed or broken down with pressure from a spoon or fork, bite-sized pieces (15 mm) ; MM5 : soft and moist with no separation of liquid, holds its shape on the plate, small lumps (4 mm) easily squashed with tongue ; PU4 : no separation of liquid from solid, holds its shape on a plate, spoon or fork, no visible lumps and not sticky ; LQ3 : can't be piped, layered or molded on a plate, smooth texture with no "bits", can't be eaten by fork, no oral processing/chewing required-can be swallowed directly (8). In this study, TMD includes SB6, MM5, PU4 and LQ3. The meal forms were classified according to IDDSI by dietitians in each hospital.

Hospital meal evaluation. Patients evaluated hospital diets including staple foods, main dishes and side dishes based on factors such as hardness, amount, taste and size. In addition, temperature, appearance and overall satisfaction level with hospital meals were also evaluated. The satisfaction survey design used hedonic scales (1-5) to assist with ease of completion and is explained in detail in table A. Medical staff may affect the responses of meal evaluation, so researchers instructed subjects to answer the question sheet by themselves.

Eating assistance levels were recorded with 3 levels : independent, partially assisted and fully assisted. The independent level

Table A. Rank of hospital meal evaluation

Score	1	2	3	4	5
Hardness	Very hard	Hard	Normal	Soft	Very soft
Amount	Very little	Little	Normal	Much	Very much
Taste	Very poor	Poor	Normal	Good	Very good
Size	Very small	Small	Normal	Big	Very big
Temperature	Very cold	Cold	Normal	Hot	Very hot
Appearance	Very bad	Bad	Normal	Good	Very good
Overall liking	Very bad	Bad	Normal	Good	Very good

meant that patients were able to eat without any assistance. The partially assisted level meant that patients received partial support from medical staff such as holding a patient's hand to help them guide food to their mouth. The fully assisted level meant that the medical staff fed the patient with complete support.

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 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 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).

Eating assessment tool questionnaire (EAT-10). EAT-10, a self-reported validated questionnaire that assesses perception of swallowing difficulty was used to evaluate dysphagia risk. There are 10 simple questions with a total score of 40 points and the cut-off point is 3. If total score ≥ 3 points, it means the patient may have problems swallowing efficiently and safely (10).

The Simplified Nutritional Appetite Questionnaire (SNAQ)

The SNAQ was developed as a self-assessment screening tool with four questionnaires including appetite, how full after eating, food tastes and number of meals per day. SNAQ score < 15 indicates significant risk of at least 5% weight loss within six months (11).

The Oral Health Assessment Tool (OHAT)

The OHAT is a non-dental healthcare professionals tool with an eight category screening tool that includes the lips, tongue, gums and tissue, natural teeth, dentures, oral cleanliness and dental pain to assess oral health, including those with dementia (12).

Statistical analysis

All statistical analyses were performed using the Stata version 12.0 software. Categorical variables were expressed as the number of patients (percentage), and quantitative variables, including parametric and non-parametric values evaluated by the histogram, were expressed as mean \pm standard deviation (SD) such as age, BMI, or median (interquartile range) (IQR) such as nutrients from snack intake. Comparisons between groups were made using the Chi-square test for categorical variables and Student's *t*-test or Mann-Whitney *U*-test for quantitative variables. *P*-values of less than 0.05 were considered statistically significant for all the analyses.

RESULTS

Table 1 shows the characteristic of subjects. There were 344 older adults inpatients from three large hospitals in northern Vietnam recruited in this research. About 30% subjects ate TMD (21% SB6 diet, 8% MM5 diet and 1% LQ3 diet). Mean age of older adult inpatients was 74.7 years old and female ratio was 52.9%. The BMI was 21.1 ± 3.0 kg/m². BMI of the RG7 group (21.4 ± 3.0 kg/m²) was higher than the TMD group (20.6 ± 2.9 kg/m²). Results of nutrition assessment by GLIM

showed that there were 28.8% with malnutrition. The rate of malnutrition in the TMD group (44.2%) was two times higher than the RG7 group (22.1%). The prevalence of subjects who could eat independently in the RG7 group (96.3%) was higher than the TMD group (72.1%). More than 70% of subjects consumed outside snacks. There was no difference in the snack consumption rate in either group but ONS consumption and parenteral nutrition in the RG7 group were higher than in the TMD group. Dysphagia prevalence was 14.8% by RSST, WST and 20.1% by EAT-10. Dysphagia rate in the TMD group by both clinical tests (RSST, WST) and EAT-10 were also higher than in the RG7 group. According to OHAT scores, about 75% subjects had healthy oral status. The RG7 group's healthy oral status (about 81%) was higher than the TMD group (about 61%). With appetite evaluation by SNAQ scores, the TMD group had a score lower than the RG7 group. The number of medications of the TMD group (4.9 ± 2.4) was higher than the RG7 group (4.3 ± 2.6). The length of hospital stay of the TMD group (9.8 ± 4.3) was greater than for the RG7 group (8.1 ± 3.9).

Table 2 indicates the nutrition intake of older adult inpatients. From the hospital diet, they consumed 1308 ± 238 kcal, 58 ± 10 g protein, 32 ± 10 g lipid, 196 ± 42 g carbohydrate and 8 ± 3 g fiber. Energy and nutrients intake of the RG7 group were higher than the TMD diet with $p < 0.05$. With snack intake, energy, protein, lipid, carbohydrate and fiber intake were 127 (0-249) kcal, 4 (0-6) g, 3 (0-6) g, 20 (0-37) g and 0 (0-1) g, respectively. There were no differences in energy, carbohydrate and fiber intake from snacks between the two groups but protein and lipid intake showed differences. In total daily nutrient intake, energy, protein, lipid, carbohydrate and fiber intake were 1444 ± 229 kcal, 62 ± 10 g, 36 ± 9 g, 218 ± 43 g and 9 ± 3 g, respectively. We observed differences between the RG7 and TMD groups in energy and nutrients intake with $p < 0.05$.

Table 3 indicates the energy and protein requirements, hospital meal wastage and RDA comparison. Energy and protein requirements in both groups were similar. But hospital meal wastage in the TMD group was higher than the RG7 group with $p < 0.05$. The deficiency prevalence compared with RDA was quite high. The rate of subjects who consumed less than 75% RDA of energy and protein were 31% and 8%, respectively. In general, the rate of less than 75% RDA consumption in the TMD group was higher than RG7 group.

Table 4 shows the evaluation of hospital meals. With staple food and side dishes, the two groups were equally satisfied with the hospital meals. Concerning the main dish, hardness and size indicators, there were difference in satisfaction between the two groups. The TMD group found the food harder and in larger pieces than they preferred. In general, the temperature of hospital meals was still colder than patients expected. The appearance of dishes for the TMD group was also not evaluated highly; it was lower than the RG7 group with $p < 0.05$. With overall liking, the median scores were normal rank but IQR was between normal and low satisfaction and the TMD group's satisfaction level was lower than the RG7 group's with $p < 0.05$.

DISCUSSION

This study reports on the characteristics of 344 older adult inpatients in three large Vietnamese hospitals with regard to their nutritional status and characterizes TMD prevalence and hospital meal evaluation by older adult inpatients who received treatment diets in these hospitals. About 30% of the subjects consumed TMD. In the RG7 group, results of dysphagia (RSST, WST, EAT-10) and oral health (OHAT) screening showed that about 4-7% of subjects had a risk of dysphagia and about 20%

of subjects had abnormalities in oral care. Therefore, problems with incorrect ordering of food texture for patients when they are admitted may exist in Vietnamese hospitals. Currently, TMD is commonly used for patients who suffer from difficulty in chewing and swallowing. Without a dysphagia and oral care screening system and medical teamwork, it is difficult to provide suitable food textures for patients.

Malnutrition is a widespread problem for older adult inpatients and is a matter of concern in hospitals where clinical conditions such as dysphagia, or conditions that affect eating and drinking, can exacerbate an already poor oral intake. This study showed the proportion of malnutrition identified by nutritional diagnosis using GLIM was nearly one-third of subjects (about 29%). This malnutrition rate is quite similar to a study in Japan

(33% by GLIM) (13). The TMD group's malnutrition ratio was two times higher than the RG7 group's.

Hospital diet is a part of treatment. Diet quality is one of the biggest challenges for clinical management (14, 15). Inadequate dietary intake may be contributing to the high prevalence of malnutrition (16), although the energy and protein requirements of the RG7 and TMD groups were not significantly different. However, we observed that hospital meals and total daily consumption of energy and nutrients in the TMD group were lower than in the RG7 group. A study which was published in 2005 indicated that energy and protein intake can be significantly lower for patients prescribed TMD as compared with the regular hospital diet (17). In addition, hospital meal wastage for the TMD group was higher than for the RG7 group. And the deficiency

Table 1. Characteristics of subjects (n = 344)

Variable	Overall (n = 344)	RG7 (n = 240)	TMD (n = 104)	p-value
Age, years (mean ± SD)	74.7 ± 6.8	74.5 ± 6.9	75.1 ± 6.6	0.39 [†]
Female, n (%)	182 (52.9)	125 (52.1)	57 (54.8)	0.64 [#]
Aetiologies known to be associated with dysphagia				
Alzheimer's disease, n (%)	2 (0.6)	1 (0.4)	1 (0.9)	
Non-Alzheimer's dementia, n (%)	1 (0.3)	1 (0.4)	0 (0.0)	
Stroke, n (%)	46 (13.4)	21 (8.8)	25 (24.0)	
Parkinson's disease, n (%)	0 (0.0)	0 (0.0)	0 (0.0)	
BMI (kg/m ²) (mean ± SD)	21.1 ± 3.0	21.4 ± 3.0	20.6 ± 2.9	<0.05 [†]
MNA-SF score (mean ± SD)	9.8 ± 2.6	10.3 ± 2.4	8.9 ± 2.8	<0.05 [†]
0-7 : Malnutrition, n (%)	52 (15.1)	22 (9.2)	30 (28.8)	
8-11 : Risk of malnutrition, n (%)	173 (50.3)	120 (50.0)	53 (51.0)	<0.05 [#]
12-14 : Normal nutrition status, n (%)	119 (34.6)	98 (40.8)	21 (20.2)	
Malnutrition (GLIM), n (%)	99 (28.8)	53 (22.1)	46 (44.2)	<0.05 [#]
Mealtime independence				
Independent, n (%)	306 (89.0)	231 (96.3)	75 (72.1)	
Partial assistance, n (%)	30 (8.7)	8 (3.3)	22 (21.2)	<0.05 [#]
Total dependence, n (%)	8 (2.3)	1 (0.4)	7 (6.7)	
Snack consumption, n (%)	256 (74.4)	171 (71.3)	85 (81.7)	0.07 [#]
Oral Nutritional Supplements (ONS) consumption, n (%)	63 (18.3)	29 (12.1)	34 (32.7)	<0.05 [#]
Parenteral nutrition, n (%)	6 (1.7)	1 (0.4)	5 (4.8)	<0.05 [#]
Dysphagia (RSST, WST), n (%)	51 (14.8)	11 (4.6)	40 (38.4)	<0.05 [#]
EAT-10 score ≥3 : dysphagia, n (%)	69 (20.1)	17 (7.1)	52 (50.0)	<0.05 [#]
OHAT score (mean ± SD)	2.4 ± 2.2	2.1 ± 1.8	3.0 ± 2.7	<0.05 [†]
0-3 : healthy, n (%)	257 (74.7)	194 (80.8)	63 (60.6)	
4-8 : changes, n (%)	83 (24.1)	45 (18.8)	38 (36.5)	<0.05 [#]
9-16 : unhealthy, n (%)	4 (1.2)	1 (0.4)	3 (2.9)	
SNAQ score (mean ± SD)	14.0 ± 2.1	14.2 ± 2.0	13.5 ± 2.0	<0.05 [†]
≤14 scores : risk of reducing weight, n (%)	212 (61.6)	131 (54.6)	81 (77.9)	<0.05 [#]
Medicine number (mean ± SD)	4.4 ± 2.5	4.3 ± 2.6	4.9 ± 2.4	<0.05 [†]
Length of hospital stay, days (mean ± SD)	8.6 ± 4.1	8.1 ± 3.9	9.8 ± 4.3	<0.05 [†]
Discharge situation				
Home, n (%)	322 (93.6)	232 (96.7)	90 (86.5)	
Transfer to other care facilities, n (%)	22 (6.4)	8 (3.3)	14 (13.5)	
Death, n (%)	0 (0.0)	0 (0.0)	0 (0.0)	
Other, n (%)	0 (0.0)	0 (0.0)	0 (0.0)	

[†]Unpaired Student's *t*-test and [#]Chi-square test were used to compare RG7 and TMD groups.

Table 2. Nutrition intake of older adult inpatients (n = 344)

Nutrients	Type of diet	Hospital diet intake (Mean \pm SD)	P-value [†]	Snack outside intake (Median (IQR))	P-value [‡]	Total daily nutrient intake (Mean \pm SD)	P-value [†]
Energy (kcal)	Total	1308 \pm 238	<0.05	127 (0-249)	0.28	1444 \pm 229	<0.05
	RG7	1358 \pm 240		112 (0-256)		1490 \pm 225	
	TMD	1194 \pm 188		144 (37-217)		1340 \pm 204	
Protein (g)	Total	58 \pm 10	<0.05	4 (0-6)	<0.05	62 \pm 10	<0.05
	RG7	62 \pm 9		3 (0-6)		65 \pm 9	
	TMD	50 \pm 8		5 (2-8)		55 \pm 8	
Lipid (g)	Total	32 \pm 10	<0.05	3 (0-6)	<0.05	36 \pm 9	<0.05
	RG7	35 \pm 10		1 (0-6)		38 \pm 9	
	TMD	28 \pm 8		5 (0-7)		32 \pm 9	
Carbohydrate (g)	Total	196 \pm 42	<0.05	20 (0-37)	0.93	218 \pm 43	<0.05
	RG7	200 \pm 43		16 (0-42)		222 \pm 44	
	TMD	187 \pm 35		23 (6-31)		208 \pm 39	
Fiber (g)	Total	8 \pm 3	<0.05	0 (0-1)	0.79	9 \pm 3	<0.05
	RG7	9 \pm 3		0 (0-1)		10 \pm 3	
	TMD	7 \pm 3		0 (0-2)		8 \pm 3	

[†]Unpaired Student's *t*-test, [‡]Mann-Whitney *U*-test

Table 3. Energy and protein requirements, hospital meal wastage and RDA comparison (n = 344)

Nutrients	Type of diet	Requirement (Mean \pm SD)	P-value [†]	Hospital meal wastage (Median (IQR))	P-value [‡]	<100%RDA (%)	<75%RDA (%)
Energy (kcal)	Total	1736 \pm 144	0.09	402 (227-610)	<0.05	87	31
	RG7	1744 \pm 156		372 (181-552)		85	26
	TMD	1719 \pm 110		495 (356-726)		92	42
Protein (g)	Total	67 \pm 4	0.15	5 (0-15)	<0.05	53	8
	RG7	67 \pm 4		2 (0-8)		39	4
	TMD	66 \pm 4		16 (10-23)		85	18

[†]Unpaired Student's *t*-test, [‡]Mann-Whitney *U*-test

Table 4. Evaluation of hospital meals

Indicators	Overall (n = 344) (Median (IQR))	RG7 (n = 240) (Median (IQR))	TMD (n = 104) (Median (IQR))	P-value	
Stable food	Hardness	3 (3-3)	3 (3-3)	3 (3-3)	0.06
	Amount	3 (3-4)	3 (3-4)	3 (3-4)	0.83
	Taste	3 (3-3)	3 (3-3)	3 (3-3)	0.51
Main dish	Hardness	3 (3-3)	3 (3-3)	3 (2-3)	<0.05
	Amount	3 (3-3)	3 (3-3)	3 (3-3)	0.07
	Taste	3 (3-3)	3 (3-3)	3 (2-3)	0.06
	Size	3 (3-3)	3 (3-3)	3 (3-4)	<0.05
Side dish	Hardness	3 (3-3)	3 (3-3)	3 (3-3)	0.47
	Amount	3 (3-3)	3 (3-4)	3 (3-3)	0.09
	Taste	3 (2-3)	3 (2-3)	3 (3-3)	0.98
	Size	3 (3-3)	3 (3-3)	3 (3-3)	0.09
Temperature	2 (2-3)	2 (2-3)	2 (2-3)	0.58	
Appearance	3 (2-3)	3 (2-3)	2 (2-3)	<0.05	
Overall liking	3 (2-3)	3 (2-3)	3 (2-3)	<0.05	

Mann-Whitney *U*-test were used to compare RG7 and TMD groups.

rate compared with RDA in the TMD group was higher than in the RG7 group. Farrer *et al.* surveyed the reasons for food wastage. Clinical reasons associated with swallowing or disease were reported as the most common reason for food wastage (18). In addition, the results of the hospital meal satisfaction survey also showed that the TMD group had a lower evaluation than the RG7 group and in general hospital meal evaluations were not high. A study of 95 Korean patients receiving TMD indicated a significant relationship between the percentage of plate waste and the overall satisfaction level of patients receiving TMD (19). Furthermore, in this study, the TMD group also had lower appetite than the RG7 group. A Japanese study using logistic regression analysis showed that the consumption of TMD is associated with poor appetite. The reason for poor appetite in these subjects may be dysphagia or low quality of TMD. TMD may lead to poor appetite because of changes in appearance, texture, and taste, which are thought to have negative psychological effects (20). Therefore, it is necessary to have strategies to improve quality and reduce the food waste of TMD, which will lead to a better nutritional status and clinical outcomes among patients.

In addition, although the snack consumption rate in both groups was the same, the TMD group preferred to use ONS at snack time to supply more energy and protein and especially because they are easy to swallow. It is also understandable that the results showed that the protein and lipid from the snack intake of the TMD group were higher than for the RG7 group. Snacks of the RG7 group may come from sweet foods, for example fruit or cake, which are popular with Vietnamese, so we could not find any difference in carbohydrate intake, fiber and energy in snacks between the two groups. Previous reviews suggest older adults consume more energy with small and nutrient-dense ONS (21). However, more studies are required to conclude whether providing ONS contributes to a higher nutrition intake with TMD patients (22).

Although dietary intake is a good reflection of patient acceptance of meals, food quality, feeding assistance, and mealtime environment also contribute to nutritional intake (14). Other medical staff members should understand rates of malnutrition, low energy and nutrient intake and feeding care support for older adult patients in cooperation with dietitians in the treatment process. The development of TMD is different in different hospitals in Vietnam. The number of dietitians in hospitals and knowledge about the texture of food are still limited. Basically, hospitals in this investigation were able to supply a regular diet, a soft & bite-sized (not all hospitals), a minced & moist diet and a liquidized diet. Because the cost of meals is not covered by insurance and the cost of meals needs to be reduced to match people's incomes, expensive cooking equipment, for example steam convectors, slicing machines, high wattage mixers and hot and cold serving carts, are rarely used in Vietnamese hospitals. This may lead to difficulty in preparing some types of TMD, which need to be soft, smooth and higher energy density. In addition, temperature directly affects the taste acceptability and safety of food (23). Given the lack of hot and cold serving carts, other ways such as warm containers (warmed tableware, warm boxes) should be considered to supply warm hospital meals for patients. In addition, dietitians should cooperate closely with chefs to apply updated knowledge about cooking science in order to improve TMD based on present resources in Vietnamese hospitals.

In this study, the vitamin and mineral content of meals was not analyzed. But the low intakes of energy and nutrients suggest that vitamin and mineral requirements were unlikely to be met. The thickening fluids were also not investigated. This is a cross-sectional study so we could not conclude that TMD led to malnutrition in older adult Vietnamese inpatients. Subjects in the TMD group may suffer from dysphagia, poor appetite

and/or the other problems. And a previous study also showed that dysphagia and malnutrition have a strong relationship in Vietnamese older adult inpatients (24). In this study, based on the results of the energy intake and hospital meal evaluation, we think that the TMD group may have poorer nutritional status than the RD7 group.

In conclusion, the older adult inpatients on TMD may have a nutritional status worse than those consuming a regular diet. Patients on TMD should receive nutritional support by a dietitian. Hospital diets need to be improved in texture and quality.

DISCLOSURE OF STATE OF COI

No conflicts of interest to be declared.

ACKNOWLEDGEMENTS

This research was supported by Jumonji University. The corresponding author especially thanks the Otsuka Toshimi Scholarship Foundation for support to study in a PhD program in Japan. The authors would like to thank all the participants for their cooperation 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.

REFERENCES

1. Vietnam : aging population forecast 2015-2040 Statista Available at : <https://www.statista.com/statistics/713671/vietnam-forecast-aging-population/>.
2. Tran TP, Nguyen LT, Kayashita J, Shimura F, Yamamoto S : Nutritional Status and Feeding Practice among Dysphagic Older Adult Inpatients in Vietnam. *J Nutr Sci Vitaminol* 66 : 224-228, 2020
3. Tran TP, Nguyen LT, Hirose K, Shimura F, Yamamoto S : Oral Function, Handgrip Strength and Aspiration Pneumonia in Dysphagic Older Adult Inpatients in Vietnam. *Asian J Diet* 4 : 71-74, 2020
4. International Dysphagia Diet Standardisation Initiative. Complete IDDSI framework detailed definitions [Internet]. 2019. https://iddsi.org/IDDSI/media/images/Complete_IDDSI_Framework_Final_31July2019.pdf.
5. Wu XS, Miles A, Braakhuis AJ : Texture-Modified Diets, Nutritional Status and Mealtime Satisfaction : A Systematic Review. *Healthcare* 9 : 624, 2021
6. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, Thomas DR, Anthony P, Charlton KE, Maggio M, Tsai AC, Grathwohl D, Vellas B, Sieber CC, MNA-International Group : Validation of the Mini Nutritional Assessment short-form (MNA-SF) : a practical tool for identification of nutritional status. *J Nutr Health Aging* 13 : 782-788, 2009
7. Cederholm T, Jensen GL, Correia MITD, Gonzalez MC, Fukushima R, Higashiguchi T, Baptista G, Barazzoni R, Blaauw R, Coats AJS, Crivelli AN, Evans DC, Gramlich L, Fuchs-Tarlovsky V, Keller H, Llido L, Malone A, Mogensen KM, Morley JE, Muscaritoli M, Nyulasi I, Pirlich M, Pisprasert V, Schueren MAE, Siltharm S, Singer P, Tappenden K, Velasco N, Waitzberg D, Yamwong P, Yu J, Van Gossum A, Compher C, GLIM Core Leadership Committee, GLIM Working Group : GLIM criteria for the diagnosis of malnutrition – A consensus report from the

- global clinical nutrition community. *J. Cachexia Sarcopenia Muscle* 10 : 207-217, 2019
8. Cichero JAY, Lam P, Steele CM, Hanson B, Chen J, Dantas RO, Duivesteyn J, Kayashita J, Lecko C, Murray J, Pillay M, Riquelme L, Stanschus S : Development of International Terminology and Definitions for Texture-Modified Foods and Thickened Fluids Used in Dysphagia Management : The IDDSI Framework. *Dysphagia* 32 : 293-314, 2017
 9. Horiguchi S, Suzuki Y : Screening Tests in Evaluating Swallowing Function. *JMAJ* 54 : 31-34, 2011
 10. Belafsky PC, Mouadeb DA, Rees CJ, Pryor JC, Postma GN, Allen J, Leonard RJ : Validity and reliability of the Eating Assessment Tool (EAT-10). *Ann Otol Rhinol Laryngol* 117 : 919-924, 2008
 11. Lau S, Pek K, Chew J, Lim JP, Ismail NH, Ding YY, Cesari M, Lim WS : The Simplified Nutritional Appetite Questionnaire (SNAQ) as a Screening Tool for Risk of Malnutrition : Optimal Cutoff, Factor Structure, and Validation in Healthy Community-Dwelling Older Adults. *Nutrients* 12 : 2885, 2020
 12. Everaars B, Weening-Verbree LF, Jerković-Ćosić K, Schoonmade L, Bleijenberg N, de Wit NJ, van der Heijden GJMG : Measurement properties of oral health assessments for non-dental healthcare professionals in older people : a systematic review. *BMC Geriatrics* 20 : 4, 2020
 13. Matsumoto Y, Iwai K, Namikawa N, Matsuda S, Wakano C, Heya H, Yamanaka M : The relationship between existing nutritional indicators and Global Leadership Initiative on Malnutrition (GLIM) criteria : A one-institution cross-sectional analysis. *Clinical Nutrition* 39 : 3099-3104, 2020
 14. Engh MCN and Speyer R : Management of Dysphagia in Nursing Homes : A National Survey. *Dysphagia* 37 : 266-276, 2021
 15. Ballesteros-Pomar MD, Cherubini A, Keller H, Lam P, Rolland Y, Simmons SF : Texture-Modified Diet for Improving the Management of Oropharyngeal Dysphagia in Nursing Home Residents : An Expert Review. *J Nutr Health Aging* 24 : 576-581, 2020
 16. Bannerman E, McDermott K : Dietary and Fluid Intakes of Older Adults in Care Homes Requiring a Texture Modified Diet : The Role of Snacks. *Journal of the American Medical Directors Association* 12 : 234-239, 2011
 17. Wright L, Cotter D, Hickson M, Frost G : Comparison of energy and protein intakes of older people consuming a texture modified diet with a normal hospital diet. *J Hum Nutr Diet* 18 : 213-219, 2005
 18. Farrer O, Olsen C, Mousley K, Teo E : Does presentation of smooth pureed meals improve patients consumption in an acute care setting : A pilot study. *Nutrition & Dietetics* 73 : 405-409, 2016
 19. Razalli NH, Cheah CF, Mohammad NMA, Manaf ZA : Plate waste study among hospitalised patients receiving texture-modified diet. *Nutr Res Pract* 15 : 655-671, 2021
 20. Shimizu A, Fujishima I, Maeda K, Murotani K, Kayashita J, Ohno T, Nomoto A, Ueshima J, Ishida Y, Inoue T, Mori N : Texture-Modified Diets are Associated with Poor Appetite in Older Adults who are Admitted to a Post-Acute Rehabilitation Hospital. *Journal of the American Medical Directors Association* 22 : 1960-1965, 2021
 21. Nieuwenhuizen WF, Weenen H, Rigby P, Hetherington MM : Older adults and patients in need of nutritional support : review of current treatment options and factors influencing nutritional intake. *Clin Nutr* 29 : 160-169, 2010
 22. Wu XS, Miles A, Braakhuis A : Nutritional Intake and Meal Composition of Patients Consuming Texture Modified Diets and Thickened Fluids : A Systematic Review and Meta-Analysis. *Healthcare* 8 : 579, 2020
 23. Talavera K, Ninomiya Y, Winkel C, Voets T, Nilius B : Influence of temperature on taste perception. *Cell Mol Life Sci* 64 : 377-381, 2007
 24. Tran TP, Nguyen LT, Hirose K, Nguyen TH, Le HT, Shimura F, Yamamoto S : Malnutrition is associated with dysphagia in Vietnamese older adult inpatients. *Asia Pac J Clin Nutr* 30 : 588-594, 2021