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Journal office: **Asian Nutrition and Food Culture Research Center,**
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e-mail: aj-dietetics@jnl.calorie-smile.jp

FOREWORD

It is Time to Publish!
Editorial for the First Issue of Asian Journal of Dietetics

Chwang Leh-chii, DrPH, RD
Honorary President
Asian Federation of Dietetic Associations

It is with great pride and privilege that I write this editorial for the first issue of the Asian Journal of Dietetics (AJD), the official journal of the Asian Federation of Dietetic Associations (AFDA). Being founded in 1991, AFDA is a professional coalition of dietetic organizations in Asia. Its aim is to pursue the advancement of applied nutrition and dietetic practice in order to achieve better nutrition status for the population of Asia. Evidence resources are essential for evidence-based practice in all aspects of nutrition care. However, until the present, it has been difficult to find an academic international periodical in Asia which could provide various subjects of interests to dietitians, whose expertise includes, but is not limited to such areas as: preventive and clinical dietetics, dietary culture and behavior, institutional food service management, nutrition policy, education and epidemiology. There is an urgent need to build a platform for dietitians to document and publish their research findings. Furthermore, publication in international journals will not only access to more readers, and impact larger communities, but also increase research credibility and benefit professional development. At the July 2018 council meeting of AFDA held in Hong Kong, the establishment of a web publishing and peer-reviewed journal was approved and the Asian Journal of Dietetics began to take shape. The birth of this new journal would not have been possible without the dedication and enthusiasm of Editor-in-Chief, Shigeru Yamamoto, PhD, RD, from Japan. Special thanks also extend to the editorial board and expert reviewers from twelve member-organizations of AFDA. The editorial board welcomes you to share original research, research note and case reports, and to use this journal as a forum for the progress of dietetics. As the New Year unfolds and the Asian Journal of Dietetics goes online, we cordially hope that you will enjoy this publication and find it a useful medium for the dissemination of information and ideas.

We look forward to your support and feedback.

January, 2019
Chwang Leh-chii, DrPH, RD

E-mail: lcchwang@yahoo.com

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Contents

REVIEW

The Rise of Nutrition and Dietetics in Asia

Chwang Leh-chii *

Honorary President, The Asian Federation of Dietetic Associations,
President of Chinese Dietetic Society (Taiwan)

(Received November 30, 2018)

ABSTRACT This article overviews the history and development of nutrition and dietetics starting from the ancient civilizations in Asia. The progress of the nutrition research on nutrition deficiencies leading to the discovery of vitamins, and the extension of nutrition services evolving from healthcare facilities to communities are described. The emerging advancement in dietetic education and professionalism, and the establishment of the Asian Federation of Dietetic Associations (AFDA) aiming for improved nutrition status are summarized.
Keywords: Asian dietetic history, AFDA

The early beginnings of nutrition and dietetics in Asia

Ancient civilizations, among them, the Asian cultures of China and India, noticed and studied the importance and impact of food and diet on health and disease of their people.

Three thousand years ago, during the Zhou Dynasty in China, a diet doctor was a medical specialist as delineated in the royal protocol of the ancient book Zhouli. Preserved in a seventh-century text, entitled "Essential Prescription worth a Thousand Gold" is the following passage on diet therapy: “food is fundamental to health; unawareness of proper food intake is inadequate for survival; physicians find the disease origin and treat patients with food modification, then prescribe medicine; taking prudent diet, over-eating causes diseases” (1).

The traditional medical care system in India, Ayurvedic medicine, has also been practiced thousands of years. Ayurvedic physicians today continue to prescribe diets, in addition to herbal compounds, exercise regimens and lifestyle recommendations to improve the health of their patients (2).

The development of a nutrition research approach

During its early development, nutrition and dietetics were mainly based on empirical information. The research approach to these sciences evolved slowly over the years. The following are examples of how early research into nutrition and dietetics helped to improve the lives of people suffering from nutrient deficiency maladies which afflicted people worldwide. With the Age of Exploration to the new world during the fifteenth through the eighteenth centuries, nutrition deficiencies and the discovery of nutrients became the subjects of research and experimentation. The high morbidity and mortality among people during extended ocean crossings captured the interest of researchers. In 1747, the Scottish physician in British Navy, Dr. James Lind, performed the first clinical trials of test diets on the crew to study the nutritional requirements of seafarers who lacked the availability of fresh fruits and vegetables for extended periods of time (3). His discovery of the need for citrus fruit to prevent scurvy was a landmark achievement in the annals of maritime history.

Later, in 1884, Dr. Kanehiro Kakaki, a Japanese naval physician, using epidemiological research, hypothesized that beriberi was due to insufficient nutrition (4). His research results helped to drastically reduce the incidence of this deficiency by improved diet. Another example of early research in 1897 is provided by Dr. Christiaan Eijkman who a Dutch physician conducted investigation in Batavia, Indonesia, noticed that unpolished rice containing some substance fed to chickens helped to prevent beriberi. His work led to the discovery of vitamins (5).

The evolution of dietetics in the early twentieth century

As the twentieth century approached, nutrition concerns, formerly focusing mainly on military personnel, began to include children. The earliest school lunch program was a Buddhist activity in Yamagata Prefecture in northern Japan in 1889. This program eventually grew into a nationwide undertaking (6, 7).

In Japan, in 1914, Dr. Saiki Tadasu established the first nutrition institute. He is also credited with opening the first school to train dietitians in 1924 (8). In Korea, in 1929, Nutrition Science and Food Management was offered as a major of study in the Department of Home Economics at Ewha

*To whom correspondence should be addressed.
E-mail: lcchwang@yahoo.com

Women's Professional School (9, 10). Ten years later in 1939, at the University of the Philippines, the discipline of Foods and Nutrition was introduced as a bachelor degree major (11).

Today, dietitians play an essential role in service in health care facilities. This service can trace its origin to Turkey during the Crimean War, 1854-1856. In this war, Florence Nightingale, originally from Britain, found that poor diet, along with inadequate sanitation and lack of nursing care were detrimental to the wounded and the sick, she was the first to set up a diet kitchen in the military hospital (12, 13).

As the importance of dietetics grew, hospitals in Asia began to hire dietitians in early twentieth century. In 1921, Beijing Union Hospital being funded by Rockfeller Foundation opened in China and had an independent nutrition department, whose chief dietitians were from the United States (14).

Nutrition service now widely extends to the community. Dr. Cicely Williams, a Jamaican pediatrician who worked in Malaysia, began an outreach program in the 1930's and 1940's to campaign against the use of artificial milk substitutes for infant feeding. Her famous speech on "Milk and Murder" was a landmark event at the Singapore Rotary Club in 1939 (15). Her outspoken promotion of breastfeeding made an everlasting and global impact on nutrition related to infants and young children. Today, there are two non-government organizations formed in Penang working around the world to support and promote breastfeeding – the International Baby Food Action Network (IBFAN) and the World Alliance for Breastfeeding Action (WABA) (16).

The emerging progress of dietetics

The field of dietetics has been booming in Asia since the second half of the twentieth century. This is evidenced by the increasing demand for dietitians in the workforce along with the increased number of graduates in nutrition and dietetics from Asian universities. The issues of curriculum, practicum and qualification requirement have been addressed and imposed by educational institutions and regulatory bodies to safeguard the competency standards of dietitians.

One of the most significant events in the history of Asian dietetics was in early 1990s with the establishment of the Asian Federation of Dietetic Associations (AFDA). The first time that Asian dietetic leaders met was at the Asian Symposium on Rice and Nutrition by the invitation of the Taipei Dietitian Association in 1990. This symposium brought about the birth of the Asian Forum of Dietetic Professionals (AFDP) in 1991, in Kuala Lumpur. AFDP was later renamed as AFDA (17).

The AFDA has a three-fold mission: (1) to promote networking, (2) to organize and host the Asian Congress of Dietetics, and (3) to pursue the advancement of applied nutrition and dietetic practice to achieve better nutrition status for the Asian populations (17).

Since the first Asian Congress of Dietetics (ACD) in Jakarta in 1994, and the subsequent meetings held every four years, this Congress has become the major venue for the sharing of knowledge as well as research and practice among dietitians and nutritionists. Beginning with this new year 2019, AFDA will start to publish the web-based and peer-reviewed Asian Journal of Dietetics (AJD).

The AFDA now consists of 11 full members from Hong Kong Nutrition Association, Indian Dietetic Association, Indonesia Dietitians Association, Japan Dietetic Association, Korean Dietetic Association, Malaysian Dietitians' Association, Pakistan Nutrition and Dietetics Society, Nutritionist-Dietitians' Association of the Philippines, Singapore Nutrition and Dietetics Association, Thai Dietetic Association, Chinese Dietetic Society (Taiwan), and one affiliated member from Dietitians Association of Australia (17). AFDA dietitians serve more than 20 billion people, their responsibility is huge and tremendously important.

Looking to the future, AFDA will consolidate more inspiring ideas, search for excellence in the dietetic profession, and continue striving to achieve improved nutrition and health of the people in Asia.

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ORIGINAL

A Nutrition Survey and Food Patterns in Predominantly Middle-income Housewives in Jakarta

Indri Kartiko Sari[1]*, Dwi Oktaviana[2], Diah Mulyawati Utari[2]

[1] *International Nutrition, Jumonji University Niiza, Saitama Prefecture, Japan*
[2] *Department of Public Health Nutrition Studies, Faculty of Public Health, Universitas Indonesia. Depok, West Java, Indonesia*

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ABSTRACT *Background and purpose*. Lifestyle-related diseases have become the leading cause of death in Indonesia and are increasing along with overweight and obesity in all ages. Currently, about half of Jakarta women are obese. Little is known of their present dietary habits and food patterns, particularly among housewives. This study investigated energy and nutrient intakes compared with the current recommended dietary allowance, intakes of vegetable and table sugar, and frequently consumed foods. *Methods.* Seven communities in Jakarta were contacted and permission from 4 communities was obtained. Housewives were approached through each community health center. There were 196 housewives agreed to be subjects. Anthropometric measurements were conducted at the health centers. A nutrition survey by the 24 hour dietary recall method for 3 nonconsecutive days was conducted by visiting each subject's home. *Results.* Thirty-nine percent of the subjects had normal BMI, 21% were overweight, and 40% obesity. The daily nutrient intakes of energy, protein, carbohydrate, lipid, and fiber were 1962 kcal, 54g, 249g, 87g, and 10g, respectively. Energy intake was close to RDA of 1900kcal/day, lipid intake was on upper limit level, and fiber intake was only half of lower limit level. The vegetable intake was 96g/d, only 25% of recommendation. The table sugar intake was 29g/d, within recommendation of less than 10% energy. The top three frequently consumed foods were 29% fried animal protein, 17% fried tempeh, and 15% coconut milk rice. Commonly consumed sugary food and drinks were 19% cake and 19% added table sugar in tea or coffee. *Conclusion.* By the high prevalence of overweight and obesity whilst energy intake was close to energy RDA, it suggested that RDA is currently overestimated. The factors for lifestyle-related diseases were suggested by the housewives` overweight and obesity prevalence, high lipid intake and low fiber intake.
Keywords: nutrition intake, food patterns, vegetable intake, sugar intake, housewives

INTRODUCTION

In Indonesia, the tendency toward lifestyle-related diseases has been increasing year by year. According to basic health research conducted by the Ministry of Health, the three major causes of death in Indonesia are stroke, heart diseases, and diabetes mellitus (1-4). It was also found that the prevalence of obesity and overweight has been increasing for the last 10 years, basically in all age groups (1-3). In Indonesian adult population, male obesity increased from 13.9% to 19.7% and female obesity increased from 23.8% to 32.9% (3). The role of nutrition intake in lifestyle-related disease is important for determining the next steps in both prevention and cure. Excessive nutrient intakes can lead to development of lifestyle-related diseases.

Almost 20 years ago, a dietary intake and food pattern study in relation to heart disease was conducted in West Sumatra, investigating on the food culture of West Sumatra food culture, which Indonesians believe has the highest prevalence of coronary heart diseases because of its traditional fatty and oily foods with coconut milk, palm oil, and animal protein as the main ingredients (5). It concluded that intakes of animal foods, total protein, cholesterol, and total carbohydrate were coronary artery disease predictors (5). This study is a good example of Indonesian cuisine with no influence of western food, but it was limited to case of people suffering from coronary heart disease and included both men and women (5).

From the data of the national economic survey in Indonesia, which shows per capita consumption by households and was analyzed by the Ministry of Health (6), it was found that the average energy intake in Indonesia, especially in women age 19 – 55 years old, was 1607kcal/day (7). The total energy intake was about 77% energy of the 2000kcal Indonesian Recommended Dietary Allowance (RDA) (7,8). However, 40% of women, especially in Jakarta, were obese (3) and death caused by lifestyle-related diseases has been increasing (1-4).

Worldwide, most women stay at home or work as housewives. They tend to spend more time taking care of the family rather than their own health (9). Dietary

*To whom correspondence should be addressed:
indri.kartiko@yahoo.com

habits of the family begin with the housewives, but the housewives often care more about the family food consumption than their own (9). Economic development has an effect on the normal household. It may also change their lifestyle, which eventually changes their dietary habits as well.

Since little is known about the food patterns of Jakarta housewives and nutrition surveys on them, yet almost half of Jakarta women are obese, the purpose of the study was to find the current nutrition intake of housewives in Jakarta compared with the current Indonesian RDA, including vegetable and table sugar intakes, their current nutritional status, and food patterns. The nutrient intakes, food intakes, and nutritional status of the women investigated in this study are considered predictors for lifestyle related diseases.

METHODS

In Indonesia, there are community health centers available in every district and community. Two cities in Jakarta, of which has 65 districts, with about 1820 communities in total. Each community has one community health center. Every month, the health centers offer basic health examinations for residents from infants to elderly people. We contacted 7 communities, but only 4 communities agreed to accept us for the study. After that, we applied for permission from each district social welfare service. The social welfare service brought the application to the mayor`s office. After the mayor`s office granted permission, we could start the study at the community health centers.

Before the study, we trained the investigators, who hold Bachelor of Nutrition degree from the Universitas Indonesia. Next, we contacted 4 health centers and from each health center we obtained a list of housewives who regularly visit the health center. Then we invited them to come visit us at the health center. At the visit to the community health center, we took their anthropometric measurements and recorded the personal data and addresses of the housewives.

Estimation of nutrient intake. Nutrition surveys using the 3-day 24-hour recall method were implemented three times: 2 weekdays and 1 weekend day. All the nutrition surveys were conducted on one by one home visits to each subject. The nutrition survey were conducted by nutritionists who have at least one year experience in monitoring and supervising studies, especially community studies. Energy, protein, lipids, carbohydrate, fiber, vegetable, and sugar intake were obtained from each survey. The nutrition surveys were calculated using Indonesian food composition data (10) in Microsoft Excel Software 2013

Estimation of table sugar intake. the intake of table sugar was estimated using sugar composition table which was establish previously (11) The calculation of table sugar intake was performed using Microsoft Excel Software 2013.

Statistical Analysis. All procedures of data analysis were performed using Microsoft Excel Software 2013.

RESULTS

In total there were 196 subjects who participated in our study. The characteristics of the subjects included an average age of 51, weight of 60kg, height 152cm and BMI of 26.5kg/m^2 (Table 1). All subjects were housewives. Thirty-nine percent of subjects had normal BMI, 61% were overweight or obese, and no underweight subjects found in this study (Fig 1). The nutrient intakes and food intakes were presented as grams per day (g/d). The energy intake was 1962 kcal/d, protein intake was 54g/d, carbohydrate intake was 249g/d, and the total lipid intake was 87g/d, while fiber intake was 10g/d with vegetable intake of 96 g/d, and sugar intake from table sugar of 29g/d (Table 2)

Table 1. Characteristics of the subjects (n=196)

Variables	Average	±	SD
Age (years)	51	±	9
Weight (kg)	60	±	10
Height (cm)	152	±	6
BMI (kg/m^2)	26.5	±	4.2

Data are shown in mean ± SD

Table 2. Energy and nutrient intakes of the subjects and Indonesian RDA 2013[8] (n=196)

	Daily intake	RDA[8]	Daily intake/RDA(%)
Energy (kcal)	1962 ±342	1900	103.3%
Protein (g)	54 ±15	57	94.4%
Lipids (g)	87 ±24	53	163.4%
Carbohydrate (g)	249 ±52	285	87.2%
Fiber (g)	10 ±4	28	35.7%
Vegetable (g)	96 ±38	-	-
Sugar from table sugar only (g)	29 ±14	-	-

Data are shown in mean ± SD

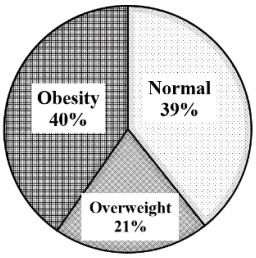

Fig 1. Prevalence of Normal, Overweight, and Obesity (n=196)

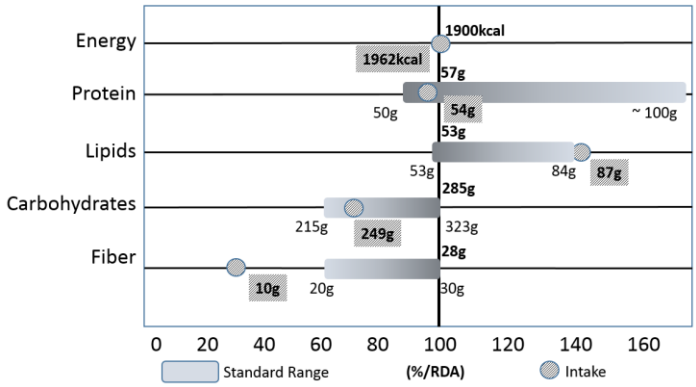

Fig 2 Comparison of energy and nutrient intakes with RDA

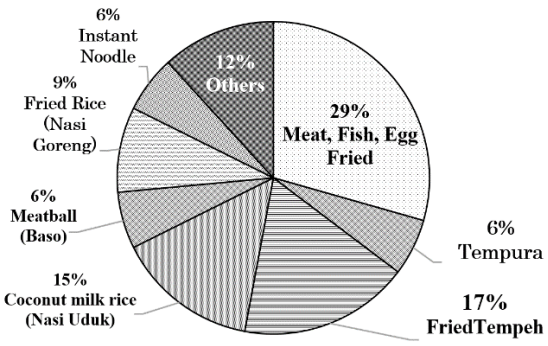

Fig 3. Food pattern frequencies

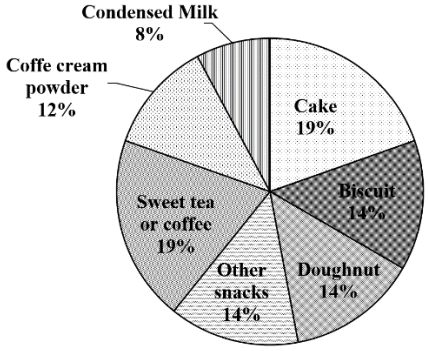

Fig 4. Sugary food and drink patterns

Energy and nutrient intakes were compared with Indonesian RDA (8) in Fig 2. The RDAs for nutrient intakes are shown in ranges (12). Protein intake was 54g (standard range 10 – 15% of energy, about 0.9–1.5g/kgBW/day, 50 – 81g/d), total lipid intake was 87g (standard range 25 – 35% of energy, 53 – 84g/d), carbohydrate intake was 249g (standard range 40 – 60% of energy, 215 – 323g/d), and fiber intake was 10g (standard 20g/d or more, 10 – 14g/1000kcal).

The food patterns of the housewives are shown in frequencies. The most frequent foods is 29% fried animal protein which includes meat, fish, and egg, 17% fried tempeh, 15% coconut milk rice, 9% fried rice, 6% of meatball, 6% tempura, 6% instant noodles, and others. There are almost no vegetable dishes among the foods most frequently consumed by the housewives.

Sugary food and drink patterns is shown at Fig 4. The most common sweet foods consumed is 19% cake, 14% biscuit, 14% doughnut, and 14% other snacks. For drinks, 19% drink tea and coffee with added table sugar, 12% coffee cream powder, and 8% condensed milk.

DISCUSSION

This study was conducted in 196 female subjects who were housewives in Jakarta to determine their obesity rates through BMI and dietary factors from intakes of energy, as well as to establish major nutrients including fiber and vegetable and table sugar. The Jakarta area was selected since the average overweight and obesity there was found to be high from the government basic health research (1-3).

Overall there were no underweight women found

in our study, while the normal, overweight, and obesity prevalence was 39%, 21%, and 40%, respectively. The results support the government report on basic health research, which showed the obesity prevalence in Jakarta women was 40% (3). In this study, the subject housewives were from average, middle class families. These results support the contention that the subjects in this study can be recognized as representative of women in Jakarta.

The results of energy and nutrient intakes from this study and the Recommended Dietary Allowance 2013 (RDA is called AKG 2013 in Indonesian) were compared (8). The results of energy intake in the housewives were close to the Indonesian RDA, which makes it difficult to explain the high prevalence of overweight and obesity. The Indonesian RDA was estimated using the model formulation of Dietary Reference Intake developed by the Institute of Medicine, United States (12,13)

The model calculation is called EER, Estimated Energy Requirement, an average dietary energy intake to predict energy required to maintain balance in a healthy adult defined by age, gender, weight, height, and physical activity level (PAL) in order to sustain weight in the range desired for good health (13). This model calculation was used with the Indonesian RDA 2013 with adjustment (12).

The Indonesia RDA of energy calculation was estimated using units for weight and height for normal median weight and height of Indonesians based on national basic health research (8,12). For physical activity value, it was estimated using "Light Activities" value, based on basic health research which shows that more than 90% of Indonesians' activity level was from very light to light activities (1-3,8.12) so the value for physical activities was estimated 1.12 for women above 19 years old (12,13) The model calculation of EER for women 19 years and older is indicated below:

EER = [354 – (6.91xAge in year)] + PA x [(9.36xWeight in kg) + (726xHeight in meter)]

(PA = 1.12)

In determining women's RDA for energy, for women age 50 – 64 years old, the Indonesian data for weight and height used were 55kg and 159cm (8,12). At the final regularity which was listed as Indonesian RDA, energy RDA for women age 50 – 64 years old is 1900kcal/day (8,12). In our study, it was found that the housewives with an average age of 51 had an energy intake of 1962kcal/day. It is similar to the current Indonesian RDA for 50 – 64 years old (8). In contrast, overweight and obesity rates were found to be high in our study. This may suggest that the current Indonesian RDA is overestimated.

A better situation has developed in Japan, as the female obesity rates have been decreasing for the last ten years (14). For Japanese Dietary Recommended Intake (DRI), the EER for Japanese is obtained by multiplying basal metabolic rate (BMR) and PAL (15,16). Representative values for BMR per kg of body weight were determined based on previous researches for Japanese people, called the reference value for BMR (15,16). The reference BMR is based on the reference BMR reported in 2005 DRI and BMR values that have been reported since 1980 (15-23). The PAL unit used for light activities is 1.5 based on PAL research in Japanese (15,16).

For Japanese women aged 50 – 69 years old with light activity the DRI for energy is 1650 kcal/d (15). The current average energy intake is 1706kcal/d and the average weight and height for women age 50 – 59 years old is 55kg and 156.6cm (14), meaning that this is a proper recommendation for controlling health problems, especially obesity. As comparison, when these these values for average weight and height for 50years old and light physical activity were inserted in the formulation used for Indonesian RDA, the result will be 1855kcal, about 205kcal higher than the current Japanese DRI for energy with light activities (12-14).

The Indonesia RDA is available only at one level, as it is formulated for light activity and is used for all age groups (8,12). However for most other countries, the RDA for energy is listed using 3 – 4 levels of activity (15,16, 23,24). In comparison with women 50 years old with light activities, Japanese energy DRI is 1650kcal/d, Singaporean is 1720kcal/d, and Malaysian energy RDA is 1660kcal/day (16,23,24). The current Indonesian RDA for energy is 200kcal higher compared with energy RDAs for these countries for light activities level (8,16,23,24). Further research and reviews need to be done in order to improve the current RDA of Indonesians, especially on deciding an equation which is properly applicable for Indonesian people.

The lipid intake of the housewives reached 36% of their total energy intake, which is 87g/d. It is at the upper limit of the standard range for lipid intake (12). About 25% of EER was determined as the RDA for lipids in the Indonesian RDA, which means that for women age 50 – 64 years the EER is 1900kcal/d and 25% of this is 53g/d for the lipid RDA (8,12). When the actual lipid intake and the RDA lipid intake are compared, there is 34g difference, which means that the housewives' lipid intake is 306kcal higher than the RDA lipid intake (8). An explanation for this lipid intake is suggested in the following discussion

From the subjects' frequent food intake, it was found in this study that almost all the frequent foods were fried foods. The most common food consumed by the housewives were 29% animal protein fried, such as meat, fish, and egg cooked by deep frying methods, the second was 17% fried tempeh, and the third was 15% coconut milk rice, known as Nasi Uduk. Frying is one of the common, easy methods to prolong food expiration, a tasty, attractive, and very simple cooking method (25). The fact that it is a simple cooking method may also be a factor in why the housewives consumed more fried foods.

In Indonesia, the most common oil used in frying is palm oil since the price is cheap and it is easy to find anywhere, but it contains 45 – 50% saturated fatty acids (SFA) in one serving (10,26). As for originally low calorie and low fat foods, they will become energy-dense foods with oil absorption from the frying process (27,28). Another common lipid source used in Indonesian cuisine is coconut milk, which contains 20% SFA of total calories in one serving (10,29). Coconut milk is used to make soup and creamy savory sauces in Indonesian cuisine. Since both ingredients are major parts of Indonesian cuisine, the SFA might make a significant contribution to total lipid intake in our study, which can lead to higher risk of cardiovascular diseases (30).

The housewives SFA intake is estimated from their frequent food intake, of which roughly 45% is fried foods. In 1962kcal of the housewives' energy intake, 883kcal comes from fried foods. Thus, about 36% of the energy contribution from fried foods comes from

lipids, 317kcal. Finally, approximately 50% of 317kcal is SFA from palm oil, which is about 159kcal, so the SFA intake of housewives is roughly 17.6g per day just from palm oil. This amount might become higher if it is combined with other lipid sources.

Although a SFA recommendation is currently unavailable in the Indonesian RDA, other countries like the USA have SFA intake recommendations which are less than 10% of energy per day, about 21g/d (31). This recommendation is based an American nutrition survey in 2010, which found that the SFA intake of the whole American population on average contributed 325calories or more than 16% of energy per day, about 36g/d (32). It was found that the SFA intake of 51 – 70 year old American females ranges between 10 – 12% of energy, which is about 22.5g/d from SFA intake alone (31).

Unlike American dietary guidelines, the recommendation for SFA the Japanese DRI is 4.5% - 7% of the total lipid intake. The lipid intake of Japanese women age 50 – 59 years old is 55g/d, means that intake of SFA is 4g/d at maximum, much lower than the SFA intake from our study (14,16). From these comparisons, American women have a higher SFA intake than Japanese women and Indonesian women‘s SFA intake is closer to that of American women. This excess lipid intake might be a factor in the very high death rate from heart disease in Indonesia (4)

When causes of death are compared among these countries, death caused by lifestyle-related diseases are currently higher in America and Indonesia than in Japan (1-4, 33,34) Trends in mortality caused by lifestyle-related diseases among the same age group is mostly caused by circulatory system disease in America and Indonesia. For Indonesian women, with the high prevalence of overweight and obesity and high lipid intake, close to the situation in American women, the tendency to hyperlipidemia and the risk of circulatory system diseases seem to be high, with heart disease becoming one of the leading causes of death in Indonesia.

From all these facts, the real problem is over-intake. If the housewives can develop better food habits of to reduce lipid intake, 300kcal excess can be eliminated from their total energy intake and they can eventually reach a proper energy intake to lower the risk of lifestyle-related diseases. Reducing fried foods or reducing the SFA might be good ways to improve health.

High lipid intake and low fiber intake have been linked with increases of cardiovascular disease risk (37). Fiber intake of housewives found the present study showed only 10g/d, half of lower limit level. The benefit of fiber to control cholesterol levels and to decrease the risk of coronary heart disease has been reviewed in many studies, which is found 14g/1000kcal can achieved that benefit (12,13,39). Fiber can be a good way to modify diet with the goal of improving lipid profiles and blood pressure to reduce cardiovascular risk (40). In other words, more fiber will have the effect of better coronary circulation and less risk of cardiovascular disease (41).

When the subjects` food pattern was observed, it became clear that the animal source dishes and high carbohydrate dishes were frequently included in their daily diet. Source of fiber like vegetable dishes and fruit were rather infrequently included. The Staple food for Indonesian is rice as in most Asian Pacific countries, but it doesn’t contain high fiber since the skin of the rice is removed during processing the husk. Fiber contained in raw Indica rice, the common rice consumed in Indonesia, is only 0.4g/100g (10,42). Raw shorter grain rice, commonly consumed in East Asian countries, contains 0.5gram fiber of 100g (42). Brown rice contains more fiber, about 3g/100g. However, for most Indonesians, brown rice is infrequently consumed since the flavor is not as delicious as regular white rice. In European countries and the US, people consume cereal which contains oats and a fiber content of 9.4g/100g or bread which contains wheat and has a fiber content of 10.8g/100g (42). These staple foods can be the source of fiber for these countries (31,32). So for Indonesians, the major source of fiber is vegetables and fruit. Indonesians currently rely on vegetables to include more fiber in their daily food habit. If Indonesians have a low vegetable intake, this will result in a low fiber intake.

The FAO/WHO recommendation is 400g/d for vegetable and fruit intake (43). However from our survey, the intake was only 96g/d for women, which is about 25% of the recommendation (8,43). In comparison, for Japanese women vegetable intake was 237g/d (14). This means that Indonesian women consume only 40% of the Japanese intake. Despite the fact that vegetable production in Indonesia is quite high, there are many factors that might contribute to the low vegetable intake, from current social habits regarding food to the economic distribution within the country. The cooking time needed to process vegetables might also be a factor, since the housewives choose simpler cooking methods like frying. Given current Indonesian women‘s food patterns, higher vegetable intake in women is highly recommended, especially to increase the fiber intake. Other strategies should be considered to include more fiber in Indonesian daily dishes such as recommending other sources of fiber aside from vegetables.

Other possible factors related to overweight and obesity were observed, including the sugar intake of the housewives. The frequencies of consumption of sugary food and beverages by the housewives were recorded. The most frequent sweet food consumed by the housewives was cake and a common sweet drink was coffee or tea with regular table sugar. The frequencies of sweet foods and drinks were low, indicating that the housewives do not regularly consume commercially available sweet food and beverages.

Sugary beverages are thought to be a problem in weight management since it is easy to ingest more in liquid form. However, it has been suggested that solid foods like cakes are more satiating than sugary beverages, which may also potentially increase the sugar consumption (44,45). In the case of the housewives` sugar intake, sugar intake coming from homemade sugary foods might provide a greater feeling of satiety than drinking sugary beverages, so cakes are more frequent compared with sugary beverages. Cakes are usually energy dense and its frequent excessive intake is associated with weight gain and excess adiposity (44). In future strategies of integrating healthier dietary habits, the housewives should be encouraged to replace sweet foods with healthier food choices that provide a greater feeling of satiety.

The total sugar intake from table sugar was 29 g/d. The housewives‘ sugar intake in this study can be

considered to be within the WHO recommendation, which is below 10% energy, 50g/d, with a preferable suggestion of less than 5% energy, 25g (7,12). There are many studies suggesting that intake of sugar from sugar-sweetened snacks and beverages may promote weight gain and eventually cause obesity (8,15,36). However, in this study we found that the sugar intake was normal and had no clear relation to the subjects' overweight and obesity prevalence. It is suggested that with intake over 90g/d it may be possible to predict overweight problems in the future (34). This may be the case, but it depends on the situation within the country itself. Despite the fact that the total sugar intake meets WHO recommendations, the awareness of varieties of sugar content and their effects on health should attract the attention of stakeholders and the society itself.

In conclusion, the current RDA is suspected to be an overestimation. Improvement is necessary, especially in the applicable equation to be used for Indonesian people. Lipid intake was found high especially from fried foods. Fiber intake was low, which may be caused by low vegetable intake. Sugar intake was considered normal. The housewives' current food habits carry lifestyle-related disease risks. Future study can be focused on the strategies to be employed in developing healthier food habits in women especially in housewives.

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ORIGINAL

Indonesian Tempeh from Soybeans Can Be Included in Japanese Main Dishes and Can Increase Fiber Intake

Sumiko Kamoshita[1]*, Indri Kartiko Sari[1], Diah Mulyawati Utari[2], Saiko Shikanai[3] and Shigeru Yamamoto[1]

[1]*International Nutrition, Graduate School of Human Life Sciences, Jumonji University, Saitama 352-8510, Japan*
[2]*Department of Public Health Nutrition Studies, Faculty of Public Health, Universitas Indonesia. Depok, West Java, Indonesia*
[3]*Department of Health and Science, Aomori University of Health and Welfare, Aomori 030-8505, Japan*
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ABSTRACT ***Background and purpose.*** Currently, major health problems, not only in Japan, include lifestyle-related diseases such as diabetes, dyslipidemia and myocardial infarction. Insufficient fiber intake is one of the main factors for these conditions. Although the Japanese Recommendation Dietary Intakes for fiber are 20g/d for men and 18g/d for women, according to a recent nation-wide nutrition survey intakes were about 15g and 14g, respectively. An increase in dietary fiber intake is usually expected from increased consumption of vegetables and grains but not from main dishes such as meat, fish, eggs, dairy products, or soybean protein products, because these contain little fiber. In this study, we focused on the use of tempeh (dietary fiber 10.2g/100g), Indonesian fermented soybeans, as a main dish. *Purpose*. An increase in dietary fiber intake through main dishes using tempeh. ***Method***. The subjects were female students, faculty and staff, security guards, and cleaners (totaling 60 people) at a university. Ten Japanese-style main dishes were prepared using the usual principal ingredients, such as eggs and meats, and ten dishes that replaced those ingredients with tempeh. The ten dishes were: rolled thick omelet, teriyaki, Chinese-style fried chicken, keema curry, piccata, hamburger steak, croquette, tofu in meat-and-chili sauce, sweet-and-sour pork, and stuffed pouches of deep-fried tofu. We offered each control dish (normal ingredients) and its parallel tempeh-based dish on the same plate for lunch. Overall taste, aroma, mouth feel and basic taste were evaluated by scores from 1 to 4 (4 very good; 3 good; 2 poor; 1 very poor). ***Results***. The average evaluations of the 10 control dishes and tempeh dishes were 3.7 and 3.5 points for overall taste, 3.7 and 3.4 points for aroma, 3.4 and 3.1 points for mouth feel and 3.7 and 3.4 points for basic taste, respectively. Evaluations of tempeh dishes were close to those of the control dishes. Especially for keema curry, hamburger steak, and stuffed pouches of deep-fried tofu, the tempeh dishes received high evaluations. In these three dishes, we used finely chopped tempeh, which suggests that the optimal use of tempeh was in a finely chopped form. The amount of dietary fiber increased by about 2g with tempeh dishes. ***Conclusion***. We found that tempeh can be used as a part of Japanese main dishes to increase dietary fiber by about 2g from each meal.
Keywords: Tempeh, fiber, main dish, Japanese.

INTRODUCTION

Lifestyle-related diseases, such as diabetes, dyslipidemia, and myocardial infarction, have been increasing, not only in Japan but also globally (1). One of the important dietary factors for this is insufficient fiber intake (2-3). However, it is usually difficult to meet sufficient amounts of fiber. According to the Dietary Reference Intakes (DRI) for Japanese (2015), the recommendation is 20g/d for men and 18g/d for women (4), while the actual intake of fiber reported by a recent Nationwide Dietary Survey was 14.5g/d for men and 13.9g/d for women in 2016 (5). This means that actual daily fiber intake is about 5g short. It is difficult to satisfy the recommended intake of dietary fiber from vegetables and staple foods. We need to look for new fiber sources. In this study, we examined ways to increase fiber intake from main dishes. For this purpose, we chose tempeh, which is rich in dietary fiber and can be used as a main dish. Fiber concentrations of tempeh are high. Fiber in 200kcal tempeh and in natto is 10.1g and 6.7g, respectively (6). Tempeh has been a traditional fermented soybean food in Indonesia for more than 500 years. It can easily be obtained at a low price (about 50 Yen (half a US dollar) per one serving size of 400g) and used in cooking in a great variety of ways.

*To whom correspondence should be addressed:
da16001@jumonji-u.ac.jp

METHODS

Development of tempeh dishe: The subjects were female students, faculty and staff, security guards, and

cleaners at universities where the researchers work. We explained the purpose of this research and those who agreed to participate signed the informed consent form (50 people in total). Prior to the main study, we conducted a pilot study to find the best cooking methods for 10 types of tempeh dishes. These dishes were familiar to Japanese and did not require special cooking skills. For some dishes, the ingredients were completely replaced with tempeh, while in others they were partially replaced. Details of the cooking methods for the 10 dishes are shown below.

Rolled thick omelet: We explored how much tempeh could be added to the egg solution. The tempeh was not finely chopped, but it was ground and mixed with raw beaten eggs. The trial tests started with 30% of the total solution but this resulted in a hard and dry texture. Trial production and tasting were repeated, gradually decreasing the proportion of tempeh. As a result, we found that an 80% egg and 20% tempeh mixture was the most delicious (Fig 1-1).

Teriyaki: Chicken was replaced with tempeh. When tempeh was coated with potato starch and fried, the texture became soft. This would be good for people with chewing difficulties. When tempeh was covered with wheat flour and fried, it was chewy and more delicious. In this study, wheat flour was used. A flavorful sweet sauce went well with the tempeh, so we fried the tempeh and simmered it with the sauce; this was the best tasting version and the one used in the study (Fig 1-2).

Fig 1-1. Rolled thick omelet lunch
right: with tempeh
left: only eggs (control)

Fig 1-2. Teriyaki lunch
right : tempeh
left : chicken (control)

Fig 1-3. Chinese-style fried chicken lunch
right : tempeh
left : chicken (control)

Fig 1-4. Keema curry lunch
right : with tempeh
left : ground beef and pork (control)

Fig 1-5. Piccata lunch
right : tempeh
left : chicken (control)

Fig 1-6. Hamburger steak lunch
right : with tempeh
left : ground beef and pork (control)

Fig 1-7. Croquette lunch
right : tempeh
left : ground beef and pork (control)

Fig 1-8. Tofu in meat-and-chili sauce lunch
right : with tempe
left : ground pork (control)

Fig 1-9. Sweet-and-sour pork lunch
right : tempeh
left : pork (control)

Fig 1-10. Stuffed pouches of deep-fried tofu lunch
right : with tempeh
left : ground chicken (control)

Fig 1. Ten lunches given to subjects

Chinese-style fried chicken: Chicken was replaced with tempeh. When tempeh was coated with potato starch and fried, it was smooth and easy to eat. The tempeh was delicious with reduced acid, especially when seasoned with soy sauce before cooking. This taste was best and was the version used in this study (Fig 1-3).

Keema curry: Mixed ground meat and tempeh in various proportions and found that 30% meat and 70% tempeh was most delicious (Fig 1-4).

Piccata: Chicken was replaced 100% with tempeh and seasoned with soy sauce. When egg and grated cheese were added, the taste was markedly improved (Fig 1-5).

Hamburger steak: Started with 70% ground meat and 30% tempeh. This tasted good, but it was difficult to form the hamburger patty. We tried to find the best combination for taste and shaping the burger and decided on 50% chopped meat and 50% tempeh (Fig 1-6).

Croquette: Used 100% tempeh without meat. The taste was good and cooking was not difficult. With soy sauce and sugar, the taste became much better (Fig 1-7).

Tofu in meat-and-chili sauce: At first we used 100% tempeh without meat. The taste was too bland without any fat. Therefore we increased the meat and found finally that 70% tempeh and 30% meat was best (Fig 1-8).

Sweet-and-sour pork: Pork was completely replaced with tempeh and the taste was as good as the original pork. However, the tempeh was easily broken up when we cooked it with vegetables; therefore, we cooked the tempeh and vegetables separately (Fig1-9).

Stuffed pouches of deep-fried tofu: At first we used 100% tempeh but this was too soft. We tried to find the best combination and found 50% ground meat and 50% tempeh was most delicious (Fig 1-10).

Sensory Evaluation

We evaluated the 10 traditional Japanese dishes made with the usual ingredients such as egg, meat, etc. and the same dishes with the main ingredient partially or fully replaced with tempeh. The control and tempeh dishes were placed on the same plate. We did not inform subjects which was the tempeh dish and which was the control dish.

The subjects were female students, faculty and staff, security guards, and cleaners at universities where the researchers work. We explained the purpose of this research and those who agreed to participate signed the informed consent form (50 people in total). Overall taste, aroma, mouth feel and basic taste were evaluated by scores from 1 to 4 (4 very good; 3 good; 2 poor; 1 very poor). Statistical analyses were conducted by paired Student *t*-test and Turkey using excel.

RESULTS

Table 1 shows the number of subjects and average age by gender. Total number of subjects was 60 (13 males and 47 females). The average age was about 39y (58y for males and 33y for females). Table 2 shows the comparison of scores of overall taste, aroma, mouth feel and basic taste between tempeh and control foods in 10 different menus. Among 10 dishes, 6 dishes were evaluated higher for the control than for the tempeh ($p<0.05$), however, the difference was not large. On average for the 10 dishes, the scores for tempeh and control were respectively 3.5 and 3.7 for overall taste, 3.4 and 3.7 for aroma, 3.1 and 3.4 for mouth feel and 3.4 and 3.7 for basic taste.

Fig 2 shows the comparison of 3 tempeh cooking methods (chopped, cut in blocks and ground). The order was consistent regardless of the 4 evaluation items, with chopped highest, block second, and ground third. Table 3 shows comparison of evaluations for the best 4 tempeh dishes by age. Age differences were not observe Fig 3 shows fiber in one serving of lunch. Average dietary fiber included in the control and tempeh dishes was 4.2 g and 6.3 g for lunch. Teriyaki lunch increased 3.4g. By using tempeh dish as the main dish, it is possible to increase the dietary fiber intake by 2.1g.

Table 1. Number of subject and average age by gender

	Number	Age (year) Mean±SD
Male	13	58 ± 10
Female	47	33 ± 18
Total	60	39 ± 19

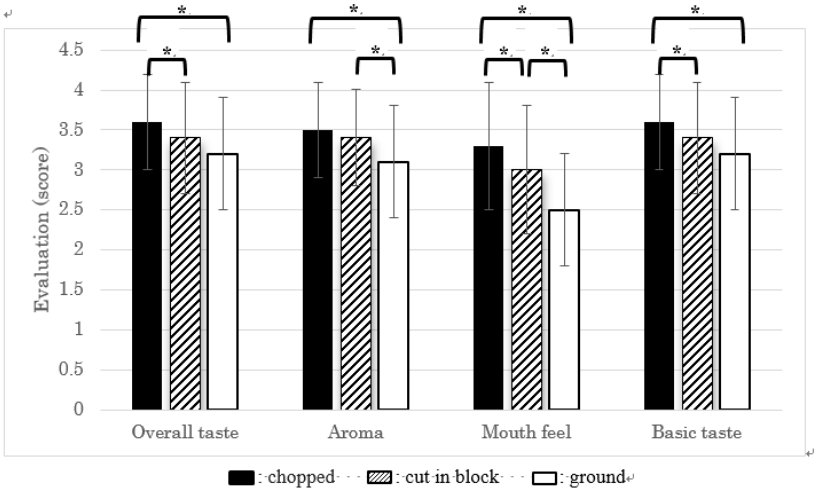
Table 2. Comparison of scores of overall taste, aroma, mouth feel and basic taste between tempeh and control foods in 10 different menus

	n		Overall taste		Aroma		Mouth feel		Basic taste	
Rolled thick omelet	46 (M:10,F:36)	Tempeh	3.2±0.7	*	3.1±0.7	*	2.5±0.7	*	3.2±0.7	*
		Control	3.6±0.6		3.6±0.5		3.5±0.6		3.6±0.5	
Teriyaki	50 (M:10,F:40)	Tempeh	3.3±0.7	*	3.3±0.7	*	2.7±0.8	*	3.4±0.8	*
		Control	3.8±0.5		3.7±0.4		3.4±0.6		3.8±0.5	
Chinese-style fried chicken	51 (M:12,F:39)	Tempeh	3.4±0.7	*	3.6±0.5	ns	3.1±0.8	*	3.3±0.7	*
		Control	3.7±0.5		3.7±0.4		3.5±0.7		3.7±0.6	
Keema curry	50 (M:14,F:36)	Tempeh	3.8±0.4	ns	3.6±0.5	ns	3.3±0.8	ns	3.7±0.5	ns
		Control	3.7±0.5		3.5±0.7		3.3±0.7		3.6±0.6	
Piccata	45 (M:12,F:33)	Tempeh	3.5±0.5	ns	3.4±0.6	ns	3.0±0.8	ns	3.4±0.6	ns
		Control	3.7±0.5		3.5±0.6		3.3±0.7		3.5±0.5	
Hamburger steak	45 (M:14,F:31)	Tempeh	3.5±0.6	ns	3.5±0.6	ns	3.3±0.7	ns	3.5±0.6	ns
		Control	3.7±0.4		3.7±0.5		3.3±0.6		3.7±0.5	
Croquette	50 (M:12,F:38)	Tempeh	3.5±0.7	*	3.5±0.6	ns	3.3±0.8	ns	3.5±0.7	*
		Control	3.9±0.4		3.6±0.6		3.4±0.7		3.8±0.5	
Tofu in meat-and-chili sauce	60 (M:13,F:47)	Tempeh	3.5±0.7	*	3.3±0.8	*	3.1±0.8	*	3.3±0.6	*
		Control	3.7±0.5		3.8±0.5		3.4±0.6		3.8±0.5	
Sweet-and-sour pork	51 (M:12,F:39)	Tempeh	3.2±0.7	*	3.4±0.6	*	3.0±0.9	ns	3.3±0.7	*
		Control	3.6±0.6		3.7±0.5		3.3±0.8		3.7±0.5	
Stuffed pouches	50 (M:12,F:38)	Tempeh	3.8±0.4	ns	3.6±0.5	ns	3.5±0.7	ns	3.8±0.4	ns
		Control	3.8±0.4		3.8±0.5		3.3±0.8		3.8±0.4	
Average	50 (M:12,F:38)	Tempeh	3.5±0.7	*	3.4±0.6	*	3.1±0.8	*	3.4±0.7	*
		Control	3.7±0.5		3.7±0.5		3.4±0.7		3.7±0.5	

Values are mean ± SD.

** Significant difference by paired Student t-test between Tempeh and Control groups in each dish at p <0.05.*

M and F stand for male and female, respectively.



** Significant difference by Turkey at p <0.05.*

Fig 2. Comparison of 3 cooking methods in tempeh score

Table 3. Comparison of evaluation for best 4 tempeh dishes by age

		20～30's		40～50's		60～70's	
		Control	Tempeh	Control	Tempeh	Control	Tempeh
Keema curry	Overall taste	3.9±0.3	3.9±0.3	3.6±0.5	3.7±0.5	3.3±0.8	3.6±0.5
	Aroma	3.5±0.7	3.7±0.5	3.4±0.7	3.2±0.4	3.5±0.8	3.5±0.5
	Mouth feel	3.4±0.7	3.3±0.9	3.1±0.8	3.0±0.7	3.1±0.7	3.6±0.5
	Basic taste	3.7±0.5	3.8±0.4	3.3±0.7	3.6±0.5	3.3±0.8	3.5±0.5
Stuffed pouches of deep-fried tofu	Overall taste	3.9±0.3	4.0±0.0	3.8±0.4	3.7±0.5	3.7±0.5	3.6±0.5
	Aroma	3.9±0.4	3.7±0.5	3.7±0.5	3.6±0.5	3.6±0.7	3.7±0.5
	Mouth feel	3.1±0.9	3.5±0.7	3.7±0.5	3.6±0.7	3.4±0.7	3.3±0.8
	Basic taste	3.9±0.3	4.0±0.2	3.7±0.5	3.8±0.5	3.7±0.5	3.6±0.5
Piccata	Overall taste	4.0±0.0	3.8±0.4*	3.4±0.5	3.2±0.7	3.3±0.5	3.3±0.5
	Aroma	3.8±0.5	3.6±0.6	3.4±0.5	3.2±0.7	3.1±0.7	3.3±0.6
	Mouth feel	3.5±0.7	3.2±0.9	3.1±0.8	2.7±0.7	3.1±0.8	2.9±0.8
	Basic taste	3.8±0.4	3.5±0.5	3.2±0.4	3.1±0.8	3.3±0.5	3.4±0.5
Hamburger steak	Overall taste	3.9±0.3	3.7±0.6	3.8±0.4	3.2±0.7	3.4±0.5	3.5±0.5
	Aroma	3.9±0.3	3.7±0.5	3.3±0.7	3.1±0.8	3.5±0.5	3.5±0.5
	Mouth feel	3.5±0.7	3.5±0.7	3.1±0.8	3.1±0.8	3.2±0.4	3.3±0.7
	Basic taste	4.0±0.0	3.7±0.6*	3.4±0.5	3.0±0.5	3.4±0.8	3.4±0.6

Values are mean ± SD

** Significant difference by paired Student t-test between Tempeh and Control groups in each dish at p <0.05*

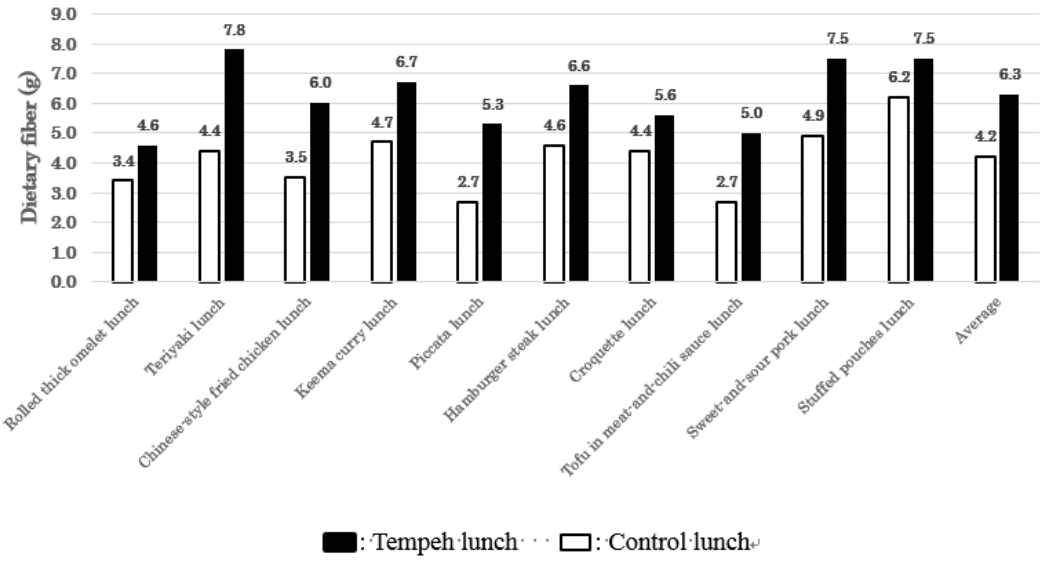


Fig 3. Dietary fiber in one serving lunches

DISCUSSION

With this study we found that tempeh can be used as a part of Japanese main dishes and can increase dietary fiber by about 2g from each meal.

The increase of fiber was quite significant. Although the Japanese Dietary Recommended Intakes (DRI) for fiber in 2015 is 20g/d for men and 18g/d for women (4), according to a recent nation-wide nutrition survey in 2016, the intakes were about 15g and 14g, respectively (5). An increase in dietary fiber intake is usually expected from increased consumption of vegetables and grains but not from main dishes such as meat, fish, eggs, dairy products, or soybean protein products, because these contain little fiber. If we increase the amount from white rice, we have to eat 400g of white rice (uncooked). On the other hand, if we use brown rice, only 80g is sufficient; however, many people dislike its hardness and smell, so it is not easy to increase fiber by this method. The Japanese recommendation for vegetables is 350g/d but at present average intake is about 280g, which contains about 8g fiber; this intake has been decreasing for the last 10 years (5), indicating that in order to supply 2g fiber from common Japanese vegetables, we would need about 70g additional vegetables, which is difficult. When we have difficulties in supplying fiber, tempeh is really a good main dish.

In Japan there is a traditional fermented soybean food "natto", but it uses a different type of microorganism from that used in tempeh. The microorganism for natto is a bacterium, “Bacillus subtilis var. natto”, whereas for tempeh it is a mold,

"Rizopus oligosporus". This is a filamentous fungus that belongs to the genus Rizopus. In Indonesia, it is a common mold which naturally occurs on the underside of banana and hibiscus leaves. In Japan, tempeh is manufactured with bacteriologically pure cultured Rizopus oligosporus (called tempeh fungus). Tempeh has a high dietary fiber content because the fungus cells themselves are fibrous. The main component of the mycelia is thought to be "chitin" (7-8). Chitin is an insoluble dietary fiber distributed in fungi, animals and plants. Tempeh can be a high-dietary fiber-containing food because there are many dietary fibers in the constituents of the mycelia. Since tempeh, unlike natto, has little smell or stickiness, it can be adapted to various dishes. It is soft and easy to chew for persons with chewing difficulties. From these facts, we believe that if we can use tempeh as the prime ingredient in Japanese main dishes, we can increase dietary fiber intake to the level meet the RDA.

Although tempeh is a new food for Japanese and can be a significant fiber source, it will be accepted only if people like the taste. Ten Japanese-style main dishes were prepared using the usual principal ingredients, such as eggs and meats, and ten dishes that replaced those ingredients with tempeh. The ten dishes were: rolled thick omelet, teriyaki, chinese-style fried chicken, keema curry, piccata, hamburger steak, croquette, tofu in meat-and-chili sauce, sweet-and-sour pork, and stuffed pouches of deep-fried tofu. We thought that the ordinary food dishes would have higher evaluations than the tempeh dishes, but surprisingly the tempeh dishes had quite high evaluations, with 4 out of 10 dishes evaluated as high as the ordinary dishes. Among the best 4 tempeh dishes, finely chopped tempeh was used in 3 dishes. These were keema curry, hamburger steak, and stuffed pouches of deep-fried tofu (Table 2).

The reason why the taste of finely chopped tempeh dishes is rated highly is that the taste of the soybeans themselves was not noticed when the tempeh was mixed with sufficient amounts of other ingredients. If we eat tempeh itself, not finely chopped, we sense the smell and taste of the soybeans. In the case of croquettes, which are fried, tempeh is less greasy than meat and may be easier to eat.

Tempeh piccata was evaluated one of the best 4, but the tempeh was left as it was and not chopped. The reason for this may be the browning of the grated cheese added to the seasoned egg mixture. Browning grated cheese in the egg mixture in a frying pan produces a fragrant aroma, which may reduce the awareness of the soybean smell of tempeh.

The limitations of this study, if there are any, are the number of male and female subjects and also the difference in the age groups. In this study, we evaluated 10 types of tempeh dishes that were tested by about 50 people. This total number is similar to the published papers using panel test (9-15). Although the number of male and female subjects and also the age structure were different, the results in Table 3 show similar scores for 20-30's, 40-50's and 60-70's except for minor differences, indicating that the results obtained in this study were not affected by such factors.

In conclusion, tempeh dishes will be easily accepted by Japanese with proper cooking. High fiber and also soybean protein can be expected to control blood glucose and lipids significantly. Further studies are expected.

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ORIGINAL

Relationship between Nutritional Status and Quality of Life in Gastrointestinal Cancer Patients on Chemotherapy

Linh Nguyen Thuy[1,2*], Nguyen Huu Tu[3], Phuong Duong Thi[1], Nhung Nguyen Thi[4], Huong Le Thi[1,2]

[1] *Department of Nutrition and Dietetics, Hanoi Medical University Hospital, Hanoi, Vietnam.*

[2] *Department of Nutrition and Food safety, Institute for Preventive Medicine and Public Health, Hanoi Medical University, Hanoi, Vietnam.*

[3] *Department of Anaesthesia and Critical Care, Hanoi Medical University, Hanoi, Vietnam*

[4] *Department of Pulmonology, Middle Berlin Hospital, DRK Berlin Hospitals, Berlin, Germany.*

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ABSTRACT ***Background and purpose.*** Malnutrition occurs frequently among cancer patients, especially those who having GI cancer and receiving chemotherapy. This condition obviously affects to patient's QoL. This study aimed to determine relationships between nutritional status and QoL in GI cancer patients receiving chemotherapy. ***Method.*** This cross-sectional study was conducted among 65 patients in HMUH from 2016 to 2018. BMI, PG-SGA, Albumin and the EORTC QLQ –C30 was used to assess. ***Results.*** The rate of underweight was higher in gastric cancer than colorectal cancer patients, 50.0% and 27.6% respectively ($p<0.05$). Malnourishment rate was significantly higher in gastric cancer patients with 97.2% in comparing with 62.1% colorectal cancer patients ($p<0.0001$). Among 65 patients, 23.1% patients had low Albumin (<35g/dL). Global score, emotional functioning score were lower and fatigue score was higher in malnourishment or underweight groups ($p<0.05$). Patients at risk of malnourishment had significantly lower score of physical functioning ($p=0.005$) and higher score of nausea and vomiting ($p=0.01$), pain ($p=0.0001$), appetite loss ($p=0.047$). Additionally, as PG-SGA score increased, fatigue, appetite loss and pain symptoms increased ($r=0.59$ 0.42 and 0.43 respectively) while global score decreased ($r=-0.45$) ($p<0.005$). The correlation of BMI with global score was positive ($r=0.42$, $p<0.005$), with fatigue and pain symptoms was negative ($r= -0.25$ and -0.27 respectively, $p<0.005$). ***Conclusion.*** The results showed that underweight patients or patients at risk of malnourishment had lower QoL than normal weight and well-nourished patients. Thus, nutritional interventions are essential to improve QoL of GI cancer patients receiving chemotherapy.

Keywords: nutritional status, quality of life, gastrointestinal cancer, chemotherapy

INTRODUCTION

Cancer incidence has been increased recently and was the second leading cause of death worldwide in 2015 (8.8 million deaths); while the third and fourth most common causes were colorectal and stomach cancer (774 000 and 754 000 deaths respectively) (1). In Vietnam, cancer is the second leading cause of death among non-communicable diseases (2).

Cancer affects to nutritional status and QoL negatively due to the disease itself as a result of metabolic alterations, symptoms, and also because of treatment therapy's side effects. Most common symptoms of GI cancer and chemotherapy are anxiety, abdominal pain, weight loss as well as digestive problems such as appetite loss, heartburn, nausea, vomiting, indigestion, constipation and diarrhea. GI cancer patients on treatment therapy reported various negative effects on their nutrition and QoL such as fatigue, body image disturbance, eating restriction, digestive problems and neuropathy symptoms; these symptoms can persist long time after treatment (3,4). It is known about relationship between nutrition and risk of complications, hospital stay, recurrence, tre-ment outcome and survival rate. Weight loss is

*To whom correspondence should be addressed. E-mail: linhngthuy@hmu.edu.vn

Abbreviations: GI = Gastrointestinal, HMUH = Hanoi Medical University Hospital, BMI= Body mass index, PG-SGA = The scored Patient-Generated Global Assessment, EORTC QLQ–C30=European Organization for Research and Treatment of Cancer Care Quality of Life Questionnaire

common in patients on chemotherapy; it depends on cancer type and stage, arranged from 20% to 58% and up to 72% in advanced gastric cancer (5,6,7). Weight loss and low dietary intake cause higher malnutrition rate in GI cancer patients on chemotherapy, which is reported from 37.9% to 74.3% (8,9). A study in geriatric GI system cancer patients indicated that the malnutrition rate increased from 34.6% to 46.4% significantly with p=0.001 after one course of chemotherapy (8). The serum albumin level was significantly decreased after chemotherapy treatment and patients with hypo-albuminemia developed more severe chemotherapy-induced toxicity symptoms. That was a finding in a study of X. Wang and college (10). Moreover, albumin was demonstrated as a marker of prognosis of treatment outcome and mortality, higher serum albumin associated with better survival in cancer patients (11).

Patients who at risk of malnutrition reported significantly lower QoL than well nourishment in domains of global health, functioning, and symptoms (12, 13). These patients had lower global health, worse psychosocial issues like physical, emotional, cognitive and role functioning which belong to human being and suffered from more unwanted physical symptoms like nausea, vomiting, pain, fatigue.

Thus, the demand of screening malnutrition and management nutritional status, QoL of GI cancer patients undergoing chemotherapy increased, in order to implement nutritional intervention and also improve QoL. However, as the best knowledge, it was limited research in Vietnam about nutritional status of these patients on chemotherapy. For this reason, we conducted this study to find out the malnutrition rate and the relationship between nutritional status and QoL in GI cancer patients on chemotherapy.

MATERIALS AND METHODS

A cross-sectional study was carried out on GI cancer patients who receiving chemotherapy in HMUH, Vietnam from January 2016 to January 2018. The study conducted 65 patients above 17 years old with diagnose of gastric or colorectal cancer, who were receiving chemotherapy. Excluding criteria: patients have other diseases related cardiology, kidney diseases, liver diseases...The patients were voluntary to be asked and involved to this study, and were explained clearly about the goals and the approach of this study and signed in the consents. General information include age, sex. Weight and height were measured directly at point time of interview. PG-SGA and EORTC QLQ C30 were completed with face to face interview or self-completed the questionnaire. By using medical record with agreement of hospital director board, age, type and stage of cancer, albumin were investigated. The research was approved by medical ethic committee of Hanoi Medical University in 2016

Nutritional status: Nutritional status was assessed by BMI, scored PG-SGA and Albumin simultaneously.

The BMI was calculated from weight and height and classified into 3 groups (underweight: BMI<18.5 kg/m^2, normal weight: 18.5 – 24.9 kg/m^2, overweight: $\geq$ 25 kg/m^2).

The scored PG-SGA, which is widely implemented and recommended in oncology clinical practice, was assessed. This scale includes patient-generated historical components, professional components, and classified into three groups (A: well nourished, B: moderately malnourished or suspected malnutrition, C: severely malnourished). Three groups of Albumin include: normal rank is 35-50g/L; malnutrition is <30g/L

Quality of life (EORTC QLQ-C30) Participants' QoL was evaluated by Vietnamese version 3.0 of EORTC QLQ-C30. The EORTC QLQ-C30 is a questionnaire developed to assess the QoL of cancer patients worldwide (14,15). The questionnaire consists of four domains (global health, five functional scales, eight symptom scales and financial difficulties) with totally 30 questions. A low score of global health and functional scale, high score of symptom scale and financial difficulties indicate low QoL. The Vietnamese version was validated elsewhere and showed high/moderated validity and reliability.

Statistical analysis: The data obtained from study was analysed by STATA 12.0 (StataCorp, College Station, Texas, USA). The relationship between nutritional status and QoL was assessed by t-test, Mann-Whitney test and Pearson's correlation. P-value <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Participants' characteristics: Patients over 60 years old were 35.4%. Thirty-seven patients (56.9%) were male and twenty eight patients (43.1%) were female. 36 patients (55.4%) had stomach cancer and 29 patients (44.6%) had colorectal cancer, including 31 patients (48.5%) in stage II or III and 33 patients (51.5%) in stage IV.

Nutritional status: According to BMI classi- ˆ fication of WHO, 40.0% patients were underweight, 58.5% had normal weight and only one patient (1.5%) was overweight. The prevalence of malnutrition in gastric cancer was non-significantly higher than colorectal cancer (p=0.076). This underweight prevalence is lower than the finding of a study in Bach Mai hospital in 2012 in colorectal cancer patients with 58.6% patients had BMI <18.5 kg/m^2 (16). However, the result of the present study is higher than the report in France of A. Nourissat et.al in 2008 with only 8.6% or the finding of Reza et al. in 2011 with 10.9% of patients were underweight (13,17). The differences may due to differences in population, cancer type and stage, nutrition practice. However, the BMI index is often used to making decision about nutrition management. So, nutrition improvement and intervention to increase BMI for the patients are necessary.

As the classification of the scored PG-SGA, 18.5% patients were allocated with PG-SGA A. 61.5% patients were allocated with PG-SGA B and 20.0% patients with PG-SGA C, giving total a malnutrition prevalence of 81.5% patients. Especially, there was 27.8% gastric cancer patients had severe malnourishment. This prevalence is higher than the report of Nunilon Veergara and college in 2011 with 40.21% malnourished patients in the research or 43.4% patients in the report of A. Nourissat et al. (17,18). However, the present study has similar finding with another study on gastric cancer patients receiving chemotherapy, which showed 59% of the patients were malnourished, and 27.8% of the patients revealed serious malnutrition (19). Another study of AZ. Zalina et al. on patients with GI cancer showed a high prevalence of malnutrition with 74.3%, whereas 48.6% were classified as severely malnourished (9). Our study indicated that patient with gastric cancer had significantly higher risk of malnutrition than

patients with colorectal cancer (97.2% and 62.1%, p=0.000 respectively). This finding is similar to the finding in research of Liyan Zhang et.al, that rectal cancer patients had a lower risk of malnutrition than the other GI cancer (20). In this study, there was no significant difference of malnutrition risk between gender, age and cancer stage. From these results, GI cancer patients undergoing chemotherapy, especially gastric cancer, were vulnerable to be malnourishment and needed intensive support to improve nutritional status.

Albumin was conducted in all participants in this study. Hypoalbuminemia or albumin serum level lower than 35g/L was 23.1% and no significant difference was found between stomach and colorectal cancer (p=0.72). This prevalence is lower than the result of the research on advanced non-small cell lung cancer (50%) (21). Although, the prevalence is higher than the result of SH. Seo et al. with 14.5% or A. Nourissat et.al with 4.6% of patients had hypo-albumineamia (13,17). Our finding pointed that an essential intervention in providing and improving nutrition practice, dietary intake and also supplement during treatment are needed.

Quality of life: The different parameters of QoL across the different nutritional status classifications (PG-SGA, BMI and Albumin) are depicted in table 1. As the result of this study, all parameter scores of global and functional scales were higher in patients with well nourishment (PG-SGA A) or normal weight in compared with malnourished and underweight. Among the functioning domains, cognitive functioning showed the highest score in all patients with PG-SGA A or B and C, underweight or normal weight. On the other hand, all parameter scores of physical scales and financial difficulties were higher in malnourished or underweight patients. The highest scores of malnourishments and underweights were financial difficulties and fatigue. Moreover, the results show significantly higher scores in domains of global health and emotional functioning among well-nourished or normal weight patients than malnourished or underweight patients ($p<0.05$). While fatigue among patients with PG-SGA A or BMI ≥ 18.5 kg/m^2 was lower than the others ($p<0.05$). There were significantly differences between malnourishment and well nourishment in physical functioning, nausea and vomiting, pain and appetite loss ($p<0.05$). The differences of other scales between well nourishment and malnourishment, underweight and normal weight had non-significant.

Table 1. Assessment of patients' quality of life score according to their nutritional status by PG-SGA, BMI and Albumin

Variable	PG-SGA			BMI			Albumin		
	Malnourished (B & C)	Well-nourished (A)	p	Underweight (< 18.5 kg/m^2)	Normal	p	Malnutrition (<35 g/l)	Normal (≥ 35 g/l)	p
Global score	47.5 ± 13.7	61.1 ± 13.5	0.003[b]	45.5 ± 14.0	52.99 ± 14.4	0.02[b]	52.8 ± 18.0	49.2 ± 13.5	0.54[b]
Physical functioning	67.9 ±115.1	80.6 ± 10.8	0.005[b]	66.7 ± 15.9	72.6 ± 14.3	0.23[b]	75.1 ± 12.5	68.8 ± 5.7	0.1[b]
Role functioning	55.3 ± 23.6	68.1 ± 22.98	0,1[b]	57.1 ± 23.65	58.1 ± 23.8	0.85[b]	56.7 ± 28.7	58.0 ± 22.1	0.8[b]
Cognitive functioning	94.6 ± 14.5	100 ± 0	0,13[b]	95.5 ± 14.6	95.7 ± 12.5	0.71[b]	96.7 ± 9.3	95.3 ± 14.3	0.94[b]
Emotional functioning	87.3 ± 17.7	97.2 ± 6.5	0.03[b]	84.9 ± 16.0	91.9 ± 16.7	0.02[b]	87.8 ± 12.5	89.5 ± 17.8	0.27[b]
Social functioning	65.1 ± 23.2	65.3 ± 20.7	0.95[b]	59.0 ± 21.7	69.2 ± 22.5	0.08[b]	73.3 ± 20.7	62.7 ± 22.7	0.12[b]
Fatigue	32.1 ± 20.6	5.6 ± 10.1	0.0001[a]	36.3 ± 24.3	21.1 ± 17.6	0.01[a]	25.9 ± 14.9	27.6 ± 23.5	0.8[a]
Nausea and vomiting	5.0 ± 15.2	0 ± 0	0.01[b]	7.1 ± 19.5	2.1 ± 7.8	0.3[b]	0 ± 0	5.3 ± 15.6	0.1[b]
Pain	24.0 ± 16.2	5.6 ± 8.2	0.0001[a]	25.0 ± 17.8	18.4 ± 14.7	0.05[a]	20.0 ± 15.7	21.3 ± 16.5	0.8[a]
Dyspnea	9.4 ± 20.0	0. ± 0	0.09[b]	11.5 ± 20.9	5.1 ± 16.3	0.09[b]	4.4 ± 11.7	8.7 ± 19.9	0.6[b]
Insomnia	22.01± 29.9	11.1 ± 21.7	0.25[b]	29.5 ± 34.4	13.7 ± 22.6	0.06[b]	26.7 ± 25.8	18.0 ± 29.5	0.12[b]
Appetite Loss	17.6 ± 25.8	2.78 ± 9.6	0.047[b]	17.9 ± 27.0	12.8 ± 22.4	0.4[b]	4.4 ± 11.7	18.0 ± 26.3	0.06[b]
Constipation	4.4 ± 14.7	2.8 ± 9.6	0.88[b]	5.1 ± 15.5	3.4 ± 12.8	0.6[b]	0 ± 0	5.3 ± 15.6	0.16[b]
Diarrhea	8.2 ± 18.4	2.8 ± 9/6	0.31[b]	7.7 ± 21.7	6.8 ± 12.6	0.66[b]	6.7 ± 13.8	7.3 ± 18.2	0.9[b]
Financial Difficulties	39.6 ± 29.3	27.8 ± 34.3	0.19[b]	42.3 ± 32.1	34.2 ± 29.1	0.31[b]	35.6 ± 29.5	38.0 ± 30.9	0.85[b]

[a]: ttest [b]: Mann-Whitney test

As the result of the study, a significant association of QoL with nutritional status was found. Patients, who had higher PG-SGA score or malnourishment, had significantly lower score in domains of global health status (r= -0.45), physical, role, cognitive functioning and higher score in domains of fatigue (r= 0.59), nausea and vomiting, pain (r= 0.43), dyspnea, appetite loss (r= 0.43), constipation and financial difficulties ($p<0.03$). Adversely, patients with higher BMI had higher global score (r= 0.42) and lower score of fatigue, insomnia and financial scale in compared

with underweight patients significantly ($p<0.05$).

The association between nutrition and QoL was proved in many studies. Out of the 26 publications reviewed, 24 found that better nutritional status was associated with improved QoL and all eight studies in GI cancer concluded that better nutritional status was positively associated with better QoL (22). Based on the present study, the result indicated the same relationship, that patients had better nutritional status (lower PG-SGA score, greater BMI), had better QoL, or conversely, patients with malnutrition had impaired QoL. Table 2 shows a significantly positive correlation between PG-SGA score with symptoms: fatigue, pain and appetite loss, dyspnoea, nausea and vomiting, constipation, and negative correlation with global health status, physical functioning, role functioning, cognitive functioning. Other studies showed a similar relationship between PG-SGA score and main scales of QoL (23, 24).

Otherwise, in the present study, the correlation between BMI index and global score was significantly positive, while a significant negative correlation was observed in symptom domains: fatigue and insomnia ($p<0.05$). A research conducted on breast cancer patients on chemotherapy indicated that greater BMI was associated with better emotional and cognitive functioning and less fatigue (25).

Both PG-SGA score and BMI were significant associated with financial difficulties. The finding was the same with the one of a study among Korean intestinal cancer patients, a higher perceived economic burden from cancer treatment affected negatively on QoL (26).

In our study, we found no significant in the correlation between Albumin and QoL. The research of Tian J, 2008 about Nutritional status and quality of life in gastrointestinal cancer showed that patients had high level of albumin had a significantly better quality of life (22).

Table 2: Correlation between the QoL scores and nutritional parameters

Variable		PG-SGA score	BMI (kg/m^2)	Albumin (g/l)
Global score	*(r)*	-0.45	0.42	0.001
	(p)	0.0002	0.0005	0.99
Physical functioning	*(r)*	-0.35	0.198	-0.06
	(p)	0.004	0.11	0.66
Role functioning	*(r)*	-0.32	0.03	0.13
	(p)	0.01	0.86	0.34
Emotional functioning	*(r)*	-0.001	-0.05	0.07
	(p)	0.99	0.7	0.6
Cognitive functioning	*(r)*	-0.28	0.05	0.08
	(p)	0.025	0.7	0.55
Social functioning	*(r)*	-0.13	0.167	-0.17
	(p)	0.31	0.18	0.2
Fatigue	*(r)*	0.59	-0.25	-0.05
	(p)	0.000	0.044	0.73
Nausea and vomiting	*(r)*	0.3	-0.16	0.17
	(p)	0.016	0.21	0.78
Pain	*(r)*	0.43	-0.095	-0.125
	(p)	0.0004	0.45	0.36
Dyspnea	*(r)*	0.34	-0.093	0.08
	(p)	0.006	0.46	0.55
Insomnia	*(r)*	0.23	-0.26	0.02
	(p)	0.06	0.035	0.88
Appetite Loss	*(r)*	0.43	0.09	0.075
	(p)	0.0004	0.46	0.58
Constipation	*(r)*	0.295	-0.15	0.18
	(p)	0.017	0.24	0.17
Diarrhea	*(r)*	0.07	-0.02	0.025
	(p)	0.57	0.86	0.85
Financial Difficulties	*(r)*	0.31	-0.27	0.14
	(p)	0.01	0.03	0.3

CONCLUSIONS

Our study confirmed that malnutrition impaired QoL in GI cancer patients on chemotherapy. Thus, nutritional assessment and intervention are fundamental before, during and after treatment in order to get better nutritional status, reduced malnutrition and through that to optimize QoL.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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