

Relationship between diet and quality of life in patients with breast cancer receiving chemotherapy

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要旨：熊本大学病院で外来化学療法受療中の乳がん外来患者 38 名を対象に、食事と生活の質（QOL）の関連について、食物摂取頻度調査票および QOL 調査票を用いて調べた。また、副作用・食事・運動についてアンケート調査を行った。エネルギー、たんぱく質、脂質、炭水化物の摂取量は、それぞれ 1702 ± 472 kcal、60.3 ± 20.6 g、52.5 ± 18.6 g、243.2 ± 65.4 g (平均 ± SD) であった。QOL の平均スコアは 62.8 ± 16.0 ポイント (平均 ± SD、範囲：28 ~ 93 ポイント) であった。エネルギーおよび栄養素の摂取量と QOL スコアには正の相関が見られ、食品では野菜や果物、種実といった植物性食品、および魚や豆、海藻といった日本で伝統的に食べられてきた食品の摂取量と QOL スコアとの間に正の相関が見られた。これらの結果により、乳がん患者の QOL の維持・向上には「まごわやさしい」に示されるような日本の伝統的な食材の摂取が有効である可能性が示唆され、和食の良さに改めて注目する必要があると考える。

キーワード：乳がん、QOL、食事、和食、植物性食品

Summary

We investigated the relationship between diet and quality of life among outpatients with breast cancer receiving chemotherapy. We assessed dietary intake among 38 patients and quality of life at Kumamoto University Hospital, using food frequency and QOL questionnaires. Patient side effects and quality of life were queried using a self-report questionnaire. Energy, protein, fat, and carbohydrate intake were 1702 ± 472 kcal, 60.3 ± 20.6 g, 52.5 ± 18.6 g, and 243.2 ± 65.4 g (mean ± SD), respectively. The average quality of life score was 62.8 ± 16.0 points (range, 28-93 points). The intake of energy and nutrients were positively correlated to the QOL score. A positive correlation was found between the QOL score and the consumptions of plant food, such as vegetables, fruits, and seeds. In addition, a positive correlation was found between the QOL scores and the intake of traditionally consumed foods in Japan, such as fish, beans, and seaweed. These results suggest that the intake of traditionally consumed foods in Japan, such as those^{*4} indicated by the ‘magowa-yasashii’, may be effective in maintaining and improving the QOL of breast cancer patients. We need to refocus on the benefit of Japanese food.

Key words : breast cancer; quality of life, diet, Japanese food, plant food

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*⁴: beans, sesame, wakame, vegetable, fish, shiitake mushroom and potato

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Introduction

Cancer (malignant neoplasms) is the first cause of death of the Japanese from 1981, and 62% of men and 46% of women will get cancer in a lifetime¹⁾. Breast cancer is most common cancer in Japanese women, and the incidence will be 9%. Breast cancer is a relatively high survival rate than other cancers. Five years relative survival rate after diagnosis of breast cancer is 89.1%, which is higher than that of all cancer in women. Therefore, for patients with breast cancer, improvement of quality of life (QOL) and maintaining good prognosis could be useful in preventing recurrence of cancer and increasing survival rate.

The occurrence of cancer is closely related with the diet, and anticancer effect of food and nutrition have been investigated actively. American Cancer Society (ACS), World Cancer Research Fund (WCRF), and American Institute for Cancer Research (AICR) have announced cancer prevention dietary recommendations^{2) ~ 4)}. In Japan, National Cancer Center has announced cancer prevention methods for Japanese⁵⁾. On the other hand, effects of diet or dietary habits for cancer survivors have not been scientifically proven.

Recently, home-care cancer patients who receive outpatient treatment are increasing with advancement of medicine. In the past, cancer patients were hospitalized, and had resolved various problems with support from medical staffs in the hospital. However,

outpatients have to resolve them on their own. To maintain and improve QOL for home-care patients, their appropriate intake of food and nutrition is important.

In this study, we investigated dietary intake, nutritional status, QOL, and side effects in outpatients with breast cancer receiving chemotherapy. The purpose of this study is to make the relation between diet and QOL of breast cancer patients clear, and to find a dietary habit which works for improvement of their QOL.

Materials and Methods

1. Participants

Thirty-eight breast cancer patients, who were treated in the outpatient chemotherapy center, the Kumamoto University Hospital between March and October 2009, were examined.

2. Surveys

The intent of this study was explained to subjects, and informed consent was obtained from all study subjects. Questionnaires were handed out to patients and collected by mail after their self-complete at home.

(1) Dietary intake

Energy and major nutrient intakes were assessed using a validated food frequency questionnaire based on food groups (FFQg: Excel Eiyokun FFQg, version 2.0)⁶⁾⁷⁾. They were estimated from portion size and food frequency for a week.

(2) Blood biochemical analyses

Blood biochemical data was obtained from

the medical records of patients and the results were current at the time of the study.

(3) QOL assessment

To assess the QOL of subjects, QOL questionnaire was used, which was developed for cancer patients by a study group of the Ministry of health and welfare (current the Ministry of Health, Labour and Welfare)⁸⁾⁹⁾. It can assess QOL of cancer patients treated with anticancer drugs regardless of type of cancer and drug. QOL-ACD-B (B means breast) can evaluate the specific problem on QOL in breast cancer patients¹⁰⁾. QOL-ACD includes 22 questions, and QOL-ACD-B includes 18 questions. The points of answer for each question are 1, 2, 3, 4 and 5 in turn. QOL score is 100-point scale, and its higher score reflect a better level of QOL.

QOL score = (Total score / Number of questions - 1) * 25

(4) Side-effects and behavioral change

Symptoms of side effects and the correspondences to them were surveyed by using original questionnaire (Fig 1).

3. Statistical analysis

Statistical analysis was performed using Excel Statistics 2012. Correlation between the factors was analyzed by linear regression.

4. Ethical considerations

Privacy protection of this study was described to patients, and their consent was obtained in writing. It was explained to patients that participation in this study was based on the free will of the patient, and patients suffered no detriment in treatment if

they did not participate in this study. This study was got approval from ethical review committees of Kumamoto University (epidemiology No.57) and the Prefectural University of Kumamoto (No. 20-018).

Results

1. Characteristics of the patients

Table 1 shows patients included 38 women, with a mean age of 55.0 ± 10.2 . Average age at breast cancer diagnosis was 51.1 ± 9.8 . Average BMI (Body Mass Index: kg/m^2) of the patient was 22.6 ± 3.9 . Twenty-six patients were classified as normal weight, 10 patients as obese, and 2 patients as low weight. Average duration of treatment by chemotherapy was 54.5 ± 63.7 months. In addition, 25 patients underwent surgery.

Table 1. Characteristics of the patient (n=38)

	Mean \pm SD (range)
Age (years)	55.0 ± 10.2 (38-75)
Age at Diagnosis (years)	51.1 ± 9.8 (36 - 69)
Body mass index (kg/m^2)	22.6 ± 3.9 (16.6 - 33.7)
Therapy duration (months)	54.5 ± 63.7 (2 - 233)
Used drugs: Trastuzumab (17/38), Paclitaxel (12/38) Docetaxel (5/38), FEC100 (4/38), Vinorelbine (2/38), Tamoxifen (1/38) (Combination therapy)	

SD: Standard deviation.

2. Dietary intake

As shown in Table 2, energy, protein, fat, and carbohydrate intake were 1702 ± 472 kcal, 60.3 ± 20.6 g, 52.5 ± 18.6 g, and 243.2 ± 65.4 g (mean \pm SD), respectively. In terms of energy producing nutrient, the energy ratio of

■下記の質問について、当てはまるものに○をつけて下さい。

1. 化学療法による副作用の症状はありましたか。【複数回答可】

味覚が変わった	嗅覚が変わった	口腔内の症状（のどが渇く、口の中が乾燥するなど）		
食欲が落ちた	体重が減った	倦怠感（体のだるさ）		
胃のむかつき、吐き気	嘔吐	便秘	下痢	
その他〔 〕				

2. 1. の質問で選んだ副作用にどのように対処しましたか。【複数回答可】

家族に相談	他の患者さんに相談	医師や看護師に相談	栄養士に相談
食事内容を工夫した	薬を処方してもらった	休養した	とくに何もしなかった
その他〔 〕			

3. 病気の診断を受ける前と後で、変わったことはありますか。【複数回答可】

食事に気を遣うようになった→質問4.へ	健康食品（サプリメントを含む）を利用している→質問5.へ
運動（散歩など軽い運動を含む）を始めた→質問6.へ	
睡眠・休養を十分にとっている	アルコールやタバコをやめた（または控えるようになった）
その他〔 〕	

4. 3. の質問で「食事に気を遣うようになった」を選んだ方は、どのような点に気を付けていますか。【複数回答可】

栄養のバランス	1日3食規則正しく食べる	間食（甘い物など）を控える
塩分を控える	野菜を多く食べる	果物を多く食べる
体力をつけるために食事量を増やしている	体重管理のために食事量を減らしている	
その他〔 〕		

5. 3. の質問で「健康食品（サプリメントを含む）を利用している」を選んだ方は、どのような種類の健康食品またはサプリメントを利用していますか。【複数回答可】

アガリスク	プロポリス	AHCC	サメ軟骨	メシマコブ
フコイダン	マルチビタミン	ビタミンA	ビタミンB群	ビタミンC
ビタミンD	ビタミンE	β-カロテン	食物繊維	キチン・キトサン
コラーゲン	セサミノール	青汁	その他〔 〕	

6. 3. の質問で「運動（散歩など軽い運動を含む）を始めた」を選んだ方は、(1) 運動の種類、(2) 1日に運動する時間、(3) 運動の頻度を教えてください。

(1) 運動の種類 【複数回答可】

散歩・ウォーキング	ジョギング	サイクリング	プール（歩く）	プール（泳ぐ）
筋力トレーニング	体操	ヨガ	ダンス	エアロビクス
バレーボール	テニス	山登り	その他〔 〕	

(2) 1日に運動する時間 【1つだけ選ぶ】

10分未満	10分～20分未満	20分～30分未満	30分～1時間未満	1時間～2時間未満
2時間以上				

(3) 運動の頻度 【1つだけ選ぶ】

毎日	週6～4回	週3～1回	月2～3回	月1回	その他〔 〕
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御協力ありがとうございました。

Figure 1. Original questionnaire on side-effects and behavioral change.

protein, fat, and carbohydrate were 14.1 ± 2.2 %, 27.6 ± 4.8 %, 58.4 ± 6.1 %, respectively. Intake of calcium, iron, zinc, vitamin A, vitamin B-1, vitamin B-2, vitamin C, and dietary fiber were 570 ± 216 mg, 7.5 ± 2.6 mg, 7.3 ± 2.4 mg, 559 ± 203 μ g RAE, 0.83 ± 0.29 mg, 0.97 ± 0.30 mg, 117 ± 54 mg, and 14.3 ± 5.4 g, respectively. Intakes of each food group were also shown in Table 2.

3. Blood biochemical data

Table 3 shows that the number of white and red blood cell, hemoglobin concentration, hematocrit, concentration of total protein and albumin, CRP were $4.6 \pm 1.6 \times 10^3$ / μ L, $3.8 \pm 0.5 \times 10^6$ / μ L, 11.8 ± 1.3 g / dL, 35.7 ± 3.7 %, 6.6 ± 0.6 g / dL, 4.0 ± 0.5 g / dL, 0.66 ± 1.40 mg / dL, respectively. According to the CRP values, some patients were in an inflammatory state.

4. Assessment of QOL

QOL score was distributed from 28 to 93 points, and the average was 62.8 ± 16.0 points. An approximately 80% of people ranged from 40 to 79 points. When examining the relationship between QOL score and nutritional intakes, significant positive correlations were observed between them (Fig 2). In terms of energy producing nutrient, positive correlations between the energy ratio of protein and QOL score were observed significantly. In terms of food groups, potatoes, green and yellow vegetables, light-colored vegetables, seaweed, beans, seafood, milk and dairy products, fruits, nuts, and seeds were significantly correlated with QOL score

(Fig 3). There were no significant relation between QOL score and food group intake such as grain, meat, egg, confectionery, beverages, fats and oils, seasonings and spices. The number of white and red blood cell, plasma total protein and albumin concentration were significantly correlated with QOL score (Fig 4).

5. Side effects and behavioral change

Thirty-four people had side effects of chemotherapy, and 31 people had more than one side effect. The number of side effects per patient was negatively correlated with QOL score and dietary intake (Table 4). Symptoms of side effects included fatigue (n=27), anorexia (n=22), taste change (n=21), constipation (n=20). Among these side effects, factors which influence QOL, and dietary intake were “anorexia” and “taste change”. Correspondences to side effects included medical consultation (n=24), medicine (n=23), adequate rest (n=18), dietary change (n=14). Behavioral changes after breast cancer diagnosis included adequate sleep and rest (n=26), dietary change (n=25), use of health foods (n=15), start to exercise (n=13), abstention from alcohol and smoking (n=6). Dietary change included eating more vegetables (n=21), consideration of nutritional balance (n=17), eating more fruits (n=15), low-salt diet (n=12), reducing snacks (n=10), eating regular meals (n=9), reducing calorie intake (n=3), increasing calorie intake (n=1).

Table 2. Dietary intake (n=38)

Energy and nutrients (Mean ± SD, range)		Each food group (Mean ± SD, range)	
Energy (kcal/day)	1702 ± 472 (758 - 2908)	Grain (g/day)	344.9 ± 109.8 (36.4 - 610.7)
Protein (g/day)	60.3 ± 20.6 (22.8 - 115.5)	Potatoes (g/day)	50.3 ± 41.8 (7.1 - 228.6)
(E%)	14.1 ± 2.2 (8.9 - 19.9)	Green and yellow	
Fat (g/day)	52.5 ± 18.6 (23.6 - 96.2)	vegetables (g/day)	88.3 ± 44.3 (10.7 - 225.0)
(E%)	27.6 ± 4.8 (17.0 - 42.3)	Light-colored	
Carbohydrate (g/day)	243.2 ± 65.4 (98.8 - 444.5)	vegetables (g/day)	140.0 ± 77.0 (23.6 - 320.7)
(E%)	58.4 ± 6.1 (44.0 - 70.7)	Seaweed (g/day)	5.8 ± 5.3 (0.7 - 30.0)
Calcium (mg/day)	570 ± 216 (252 - 1099)	Beans (g/day)	82.0 ± 62.5 (10.0 - 315.0)
Iron (mg/day)	7.5 ± 2.6 (3.6 - 14.2)	Seafood (g/day)	63.3 ± 39.6 (0.0 - 174.3)
Zinc (mg/day)	7.3 ± 2.4 (2.7 - 13.0)	Meat (g/day)	49.2 ± 38.0 (0.0 - 160.0)
Vitamin A (µgRAE/day)	559 ± 203 (212 - 1168)	Egg (g/day)	24.6 ± 13.4 (0.0 - 50.0)
Vitamin B ₁ (mg/day)	0.83 ± 0.29 (0.34 - 1.60)	Milk and dairy	
Vitamin B ₂ (mg/day)	0.97 ± 0.30 (0.50 - 1.62)	products (g/day)	124.8 ± 93.0 (0.0 - 333.6)
Vitamin C (mg/day)	117 ± 54 (47 - 297)	Fruits (g/day)	154.8 ± 103.9 (21.4 - 450.0)
Dietary fiber (g/day)	14.3 ± 5.4 (6.0 - 30.9)	Confectionery (g/day)	67.4 ± 45.6 (13.9 - 226.4)
		Beverages (g/day)	36.6 ± 61.3 (0.0 - 250.0)
		Nuts and seeds (g/day)	3.5 ± 3.8 (0.1 - 15.3)
		Fats and oils(g/day)	10.0 ± 4.9 (1.4 - 21.1)
		Seasonings and	
		spices (g/day)	26.5 ± 13.4 (6.5 - 77.2)

SD: Standard deviation.

Table 3. Blood biochemical data (n=38)

	Mean ± SD (range)
White blood cell count ($\times 10^3/\mu\text{L}$)	4.6 ± 1.6 (1.7 - 8.4)
Red blood cell count ($\times 10^6/\mu\text{L}$)	3.8 ± 0.5 (2.6 - 5.1)
Hemoglobin (g/dL)	11.8 ± 1.3 (8.3 - 14.6)
Hematocrit (%)	35.7 ± 3.7 (26.7 - 44.1)
Total protein (g/dL)†	6.6 ± 0.6 (5.6 - 7.8)
Albumin (g/dL)†	4.0 ± 0.5 (3.1 - 4.8)
CRP (mg/dL) ‡	0.66 ± 1.40 (0.05 - 6.47)

SD: Standard deviation. †(n=29) ‡ (n=26)

Table 4. Correlation with number of side effects

	Number of side effects	
	R ²	p - value
QOL score	0.102	0.0512
Energy (kcal/day)	0.104	0.0487
Protein (g/day)	0.112	0.0396
Fat (g/day)	0.079	0.0880
Carbohydrate	0.079	0.0880
(g/day)		

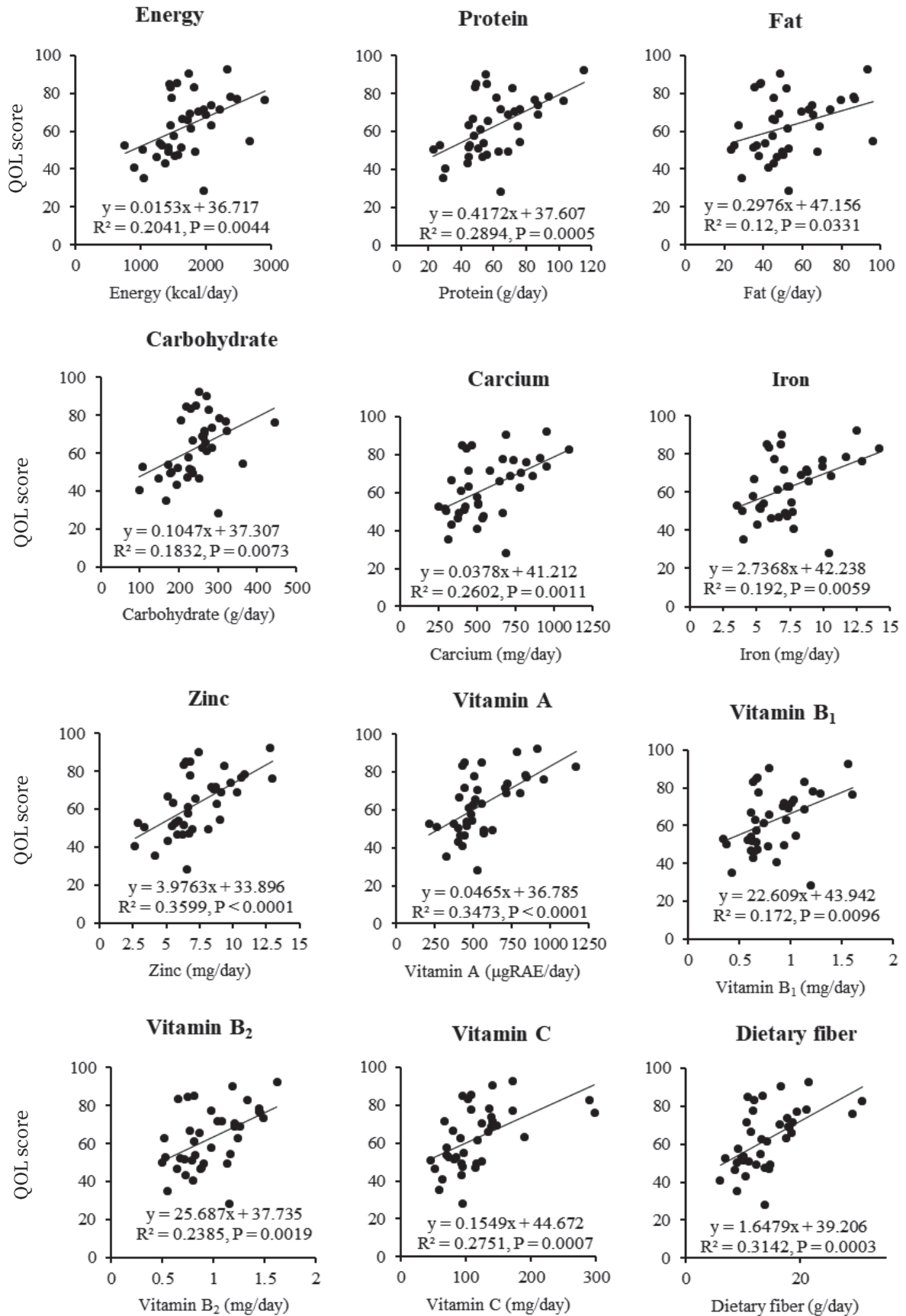


Figure 2. Correlation between QOL score and nutritional intake.

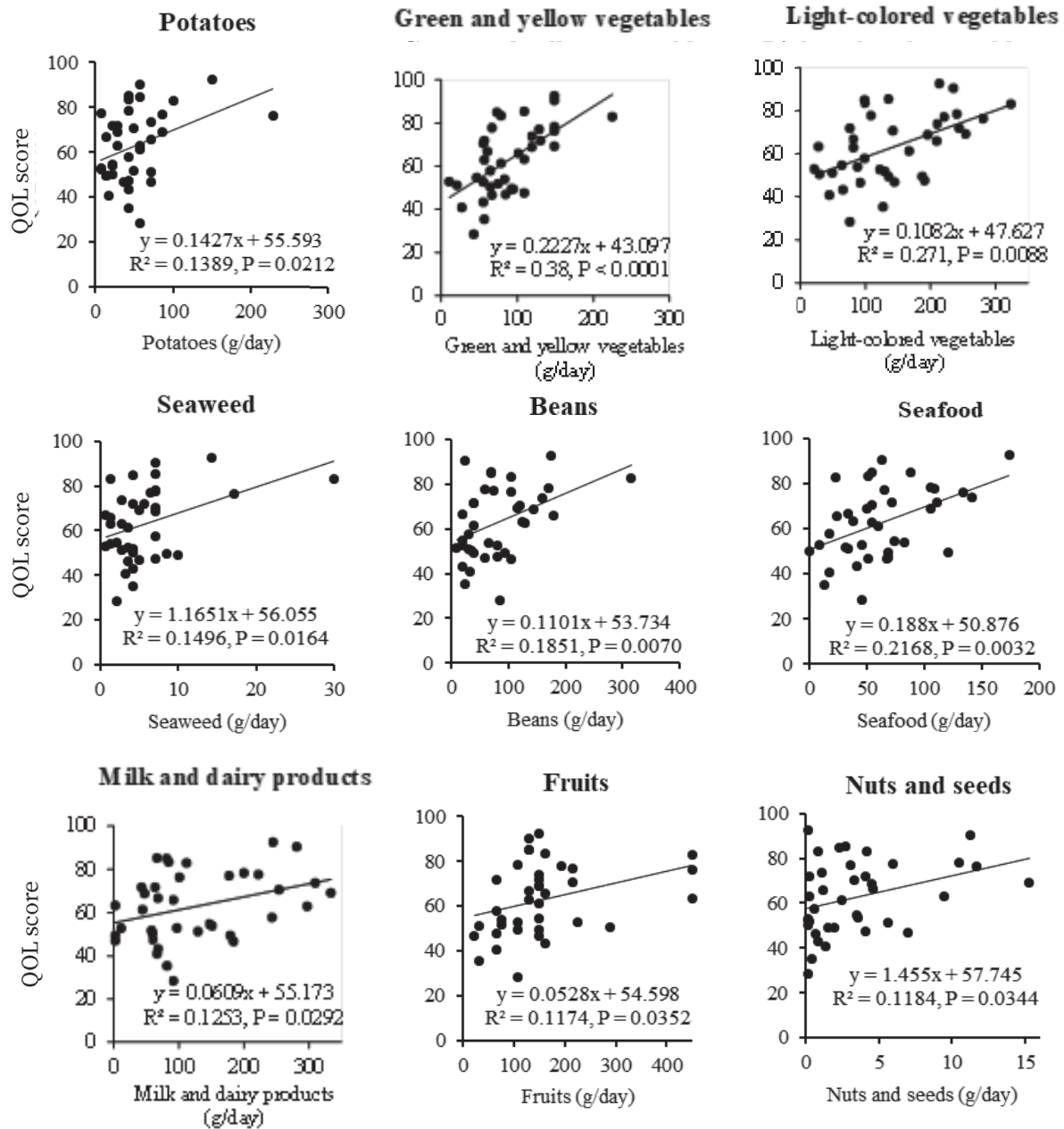


Figure 3. Correlation between QOL score and intake from each food groups.

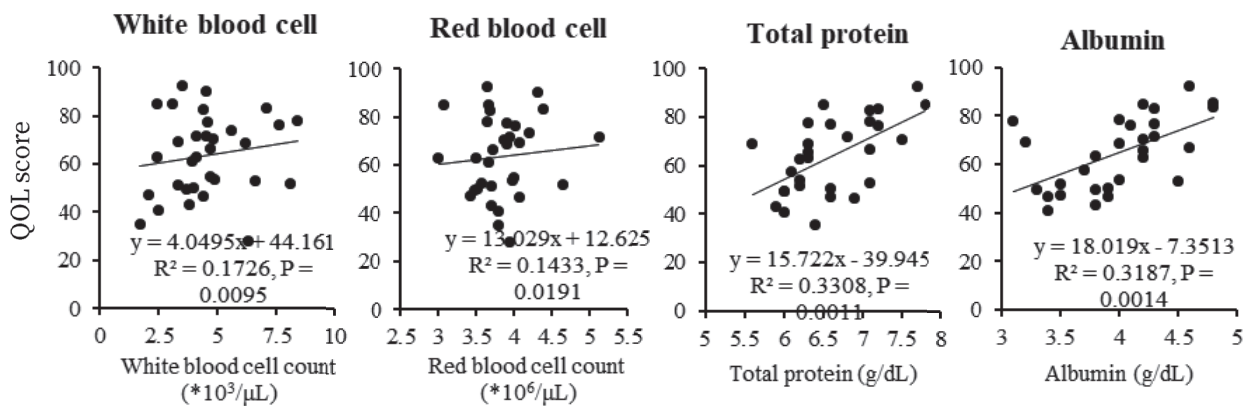


Figure 4. Correlation between QOL score and blood biochemical data.

Discussion

When the subjects were assessed by BMI, the subjects with normal body weight were about 70%. Two peoples were low body weight, and 10 peoples were obesity. It was previously proposed that obesity was a risk factor for breast cancer¹¹⁾¹²⁾. In the results of the meta-analysis, the risk of breast cancer was higher in obese women than that in normal weight women in the postmenopausal (hazard ratio 1.2-1.4), but lower in the premenopausal¹¹⁾. Japanese study also suggested that higher BMI was significantly associated with increased relative risk of breast cancer among premenopausal and postmenopausal women¹²⁾. Concerning with body weight management of breast cancer patients, control to the healthy weight was recommended by American Cancer Society and World Cancer Research Fund, and American Institute for Cancer Research²⁾⁴⁾¹³⁾¹⁴⁾.

Exercise is important to weight management. According to research on the efficacy of exercise for breast cancer patients, it was reported that exercise significantly reduced mortality¹⁵⁾¹⁶⁾. In this study, 13 patients started exercise after diagnosis of breast cancer. Exercise has generally a beneficial effect on health and QOL¹⁷⁾¹⁸⁾ and is recommended to incorporate into cancer treatment¹⁹⁾.

Use of cancer chemotherapeutic agents increases the metabolic rate and energy consumption²⁰⁾. Energy consumption in cancer patients receiving chemotherapy has

been reported to increase by 10% compared to healthy subjects²¹⁾. Therefore, energy consumption of cancer patients is said to be one-and-a-half to two times as much as the basal metabolic rate²²⁾. In the present study, an approximately 50% of the subjects consumed 80 to 120% energy of the dietary reference intakes²³⁾, and 29% of the subjects consumed less than 80% of the dietary reference intakes. 13% of the subjects consumed more than 120% of the dietary reference intakes. In terms of blood biochemical data, hemoglobin and total protein and albumin, which reflect the nutritional status, were low in about 40% of the subjects. Poor intake of energy and nutrients were considered to cause malnutrition of the subjects, but there was no correlation between energy and nutrients intake and blood biochemical data. Breast cancer patients are less damage to the gastrointestinal function compared to other cancer patients. In addition, reduction in dietary intake caused by side effect of anti-cancer drugs is temporary. Therefore, it seems that risk of malnutrition in breast cancer patients is relatively low. Breast cancer patients, particular obese patients, need to be careful to excess than lack of energy and nutrients intake.

Intake of minerals and vitamins was totally lower than dietary reference intakes. In food groups, intake of vegetables and fruits and milks, which become the main source of minerals and vitamins, were low. Recommended daily intake of vegetables is 350 g, and recommended daily intake of fruits is 200g in Japan²⁴⁾. According to national

health and nutrition examination survey in Japan (2013), intake of vegetables and fruits has not reached the target level in 70-80% of Japanese people²⁵⁾. In the present study, 80-90% patients have not taken recommended intake of vegetables and fruits. It was reported that increased intake of vegetables and fruits was a possible beneficial effect on relapse and survival in breast cancer patients¹³⁾¹⁴⁾, and adequate intake is desirable.

In terms of energy producing nutrient, 70-80% patients have eaten adequate range in the energy ratio of protein, fat, and carbohydrate. Different results about the effects of low-fat diet on breast cancer were reported²⁶⁾²⁷⁾. Chlebowski et al. showed that low-fat diet was effective on prevention of relapse in breast cancer patients²⁶⁾. On the other hand, Pierce et al. showed that low-fat diet was no effect²⁷⁾. Therefore, low-fat diet is not proven to be beneficial in breast cancer patients. However, Chlebowski et al. showed that the energy ratio of fat under 15% led to successful weight loss of obese patients²⁶⁾. It is considered that to maintain a healthy weight by low-fat diet is a possible beneficial effect on relapse and survival in breast cancer patients.

In terms of the relationship between QOL and intake from each food groups, intake of plant food, such as vegetables and fruits and seeds, was concerned with improvement of QOL. This result was like Guidelines (2012) of American Cancer Society²⁾²⁸⁾. In addition, traditionally consumed foods in Japan, such as fish, beans and seaweed, were concerned with improvement of QOL. It is important to revalue the benefit of Japanese food.

Patients with side effect symptoms accounted 89.5%. In previous study, the side effects incidence of patients receiving chemotherapy has been reported to be 62 to 100%²⁹⁾³⁰⁾. In this study, it was shown that breast cancer patients receiving chemotherapy had a high rate of side effect and reported multiple symptoms in many cases. Further, it was shown that many symptoms reduce QOL and dietary intake of patients. Side effect symptoms which mostly concerned with decrease of QOL, and dietary intake were “change in taste” and “loss of appetite”. Fukuda et al. indicated that side effect symptoms which concerned with decrease of dietary intake and enjoyment of eating were “loss of appetite” and “nausea” and “change in taste”³⁰⁾, the same factor were extracted in the present study.

In conclusion, this study made it clear that there was a correlation between diet and QOL of the breast cancer patient receiving chemotherapy. In particular, it was suggested that the intake of plant food and traditionally consumed foods in Japan may be involved in the maintenance and improvement of QOL of breast cancer patients. We need to refocus on the benefit of Japanese food.

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Author disclosures

The authors declare no conflicts of interest.

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