Association Between Planetary Health Diet with Regular Consumption of Breakfast and a Well-Balanced Diet: A Cross-sectional Analysis in Japanese Male Undergraduates

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Article

Association between Planetary Health Diet with Regular Consumption of Breakfast and a Well-Balanced Diet: A Cross-Sectional Analysis in Japanese Male Undergraduates

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Abstract: Few young Japanese adults regularly consume a well-balanced diet composed of staples, course dishes, and sides. We hypothesised that adopting the recommended planetary health diet with regular breakfast consumption would promote well-balanced diets among young Japanese male undergraduates. This study aimed to examine the structural association between a planetary health diet with regular breakfast consumption and well-balanced diet intake. Participants were 142 male undergraduates who completed a 2022 online questionnaire via Google Forms in a cross-sectional study at a public university in Hyogo Prefecture. A planetary health diet comprises the consumption of the recommended eight items. A covariance structure analysis was performed in a hypothetical model with factors (regular breakfast consumption and eight items) potentially associated with the intake of a well-balanced diet at least twice daily. Acceptable goodness-of-fit was obtained by excluding chicken dishes and nuts from the eight recommended items of the planetary health diet. Frequent consumption of the remaining six recommended items (fish, eggs, soybeans/soybean products, dairy foods, vegetables, and fruits) was significantly positively correlated with regular breakfast consumption and a significant positive path to a well-balanced diet. Among male university students, regular breakfast consumption and a planetary health diet may lead to a well-balanced diet.

Keywords: Japanese male undergraduates; planetary health diet; eating breakfast; healthy diets; dietary quality; health behaviour

1. Introduction

The food-based dietary guidelines issued in 2000 (partly revised in 2016) for the Japanese population [1] recommend well-balanced meals comprising staples (cereal grains), main courses (proteins), and sides (vegetables). Furthermore, the "Japanese Food Guide Spinning Top" was formulated in 2005. Mortality risk from cardiovascular [2,3] and cerebrovascular [3] diseases decreased in individuals who adhered to the sex- and age-recommended daily amounts of various food groups, as indicated in the 2005 Japanese Food Guide Spinning Top [4]. The Japanese government has set a goal to ensure that the proportion of Japanese individuals who consume meals comprising staple foods, main courses, and side dishes at least twice daily increases to at least 50% of the population by 2025. However, in 2020, the actual figures remained extremely low at 36.4% [5]. The Hyogo Nutrition and Diet Survey conducted in 2021 showed that, among respondents aged ≥20 years, compared to males and females aged 60–69 years (38.9% and 47.3%, respectively), the proportion of those who consumed meals that comprised staples, main courses, and side dishes at least twice a day on "6 or 7 days per week" was the lowest among males and females aged 20–29

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years (26.5% and 25.8%, respectively), followed by males and females aged 30–39 years (27.4% and 32.7%, respectively); the proportion was the lowest among the younger generation [6].

Besides the problem of not consuming well-balanced diets, younger adults have another problem: skipping breakfast. Daily breakfast consumption is recommended by health and nutrition professionals and governments worldwide [7]. Breakfast consumption is associated with better dietary quality [8,9] and helps prevent stroke in Japan [10]. However, a global decline in breakfast consumption has been noted in many countries [11]. Similarly, Japan is not exempt from this behaviour; according to the 2017 National Health and Nutrition Survey [12], the percentage of individuals who skipped breakfast was the highest in males and females aged 20–29 years (30.6% and 23.6%, respectively). The Hyogo Nutrition and Diet Survey conducted in 2021 [6] showed that, among the respondents aged ≥20 years, the proportion of those who ate breakfast "6 or 7 days per week" was the lowest among males, compared to females, aged 20–29 years (47.0% vs. 64.9%). Therefore, skipping breakfast is a common dietary issue among younger adults, along with the infrequent consumption of diets that contain staples, main courses, and side dishes. Low health awareness might be a key factor mediating the above-mentioned problems in younger adults [13], especially among males [14].

The United Nations' Sustainable Development Goals (SDG) [15] necessitate a transition to sustainable food systems, which involves major improvements in food-production practices, a substantial shift toward mostly plant-based diets, and marked reductions in food loss and waste [16], to reduce environmental impacts and achieve a better food future. The EAT-Lancet Commission confirmed the need for a shift toward the Planetary Health Diet [17]; accordingly, the Sustainable Healthy Diets Guiding Principles [18] were published by the WHO in 2019. Moreover, food-based dietary guidelines implemented with the assistance of the Food and Agriculture Organization of the United Nations (FAO) incorporate the need for sustainability. Thus, a planetary health diet is recommended to achieve the SDGs worldwide. A recent survey in Japan [19] showed an SDG awareness rate of 86.0%, which had increased by more than 30% and approximately six times from that in the fourth and first surveys conducted in January 2021 and February 2018, respectively. When stratified by sex and age, SDG awareness was higher among teenage males (94.6%) and those in their 30s (91.8%). Therefore, relatively young adults are expected to be slightly more interested in planetary environment-related issues rather than health-related issues. As breakfast consumption has been associated with better dietary quality (8,9), we hypothesised that combined adherence to the recommended planetary health diet and regular breakfast consumption might promote the adoption of a well-balanced diet among young Japanese males. This theory indicates the need to examine the associations of planetary health diet consumption with regular breakfast consumption and the intake of a well-balanced diet to promote a healthy diet among young adults.

In this study, we aimed to comprehensively determine the associations between regular breakfast consumption and adherence to planetary health and well-balanced diets among Japanese male university students. The planetary health diet encompasses foods recommended to achieve the SDGs, and this research assessed the impact of the planetary health diet and eating breakfast on well-balanced diets in this demographic. Recommending the planetary health diet [17,18] should aid in promoting a healthy diet and ameliorating prevalent issues [6,12], such as poorly balanced diets and irregular breakfast habits among young adults.

2. Materials and Methods

2.1. Study Design and Participants

The study was conducted at a public university in Hyogo Prefecture, Japan. The target group consisted of 1624 engineering students aged 18–24 years (1397 male and 227 female). We asked the university students to complete a questionnaire survey through the notice board of the university portal site and flyers with a QR code for Google Forms. The response period was from November 7 to December 10, 2022. Posters with QR codes were also displayed at conspicuous locations across the university. In total, 222 students completed the questionnaire. Among them, female students (n = 37)

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and those who had missing values were excluded, leaving 142 eligible male students (age: 20.0 ± 1.3 years, who were selected (80.6% valid response rate) for the analysis.

This study was conducted in accordance with the tenets of the Declaration of Helsinki, and all procedures involving study participants were approved by the Ethics Committee of the University of Hyogo. After informed consent was provided to all participants prior to their participation in the original study, those who responded to the survey were considered to have consented to participate in the study.

2.2. Measures

The questionnaire for this study included items pertaining to the respondents' characteristics, including age, breakfast regularity (eating breakfast regularly: ≥4 days/week or not eating breakfast regularly: ≤3 days/week or less), living arrangement (living alone or with family), regular exercise (exercise for ≥30 min) (3 times per week for ≥1 year/2 times per week for ≥1 year/2 times per week and <1 year continuously/Once per week/Little or no exercise/No exercise at all), importance of breakfast for healthy living (Very important /Somewhat important/Not very important/Not important at all), and self-assessment of diet (What do you think of your current dietary habits?) (Very good/Good/A few problems/Many problems), frequency of eating well-balanced diet at least twice daily per week (6 or 7 days/4 or 5 days/2 or 3 days/≤1 day/Not at all), frequency of eating meals with family or friends per week (6 or 7 days/4 or 5 days/2 or 3 days/≤1 day/Not at all), planetary health diet initiatives (Working already (>6 months)/Working already (<6 months)/Intend to start soon (within 1 month)/Intend to start soon (within 6 months)/Interested, but not working/Not interested), and self-reported height and body weight. Body mass index (BMI) was calculated as body weight (kg)/height $(m)^2$. Well-balanced diets were defined as the regular consumption of meals composed of staples, main courses, and side dishes at least twice daily.

Food constituting the planetary health diet was defined based on a previous study [17], that is, consumption of two "abstain" items (beef and pork dishes) and eight "recommended" items (chicken dishes, fish dishes, egg dishes, soybeans/soybean products, nuts, dairy foods, vegetable-based dishes, and fruit). The students were asked to choose only one option for the frequency of each item and assigned scores as follows: 7 = at least twice daily, 6 = once daily, 5 = 5 or 6 times/week, 4 = 3 or 4 times/week, 3 = 1 or 2 times/week, 2 = 1–3 times/month, and 1 = Not at all for each item.

2.3. Data Analysis

The mean values for age by breakfast regularity (eating breakfast regularly: ≥4 days/week or not eating breakfast regularly: ≤3 days/week or less) were compared using a Student's *t*-test, and proportions (BMI, living arrangement) by breakfast regularity were compared using the chi-square test. The variables of regular exercise, importance of breakfast for healthy living, self-assessment of diet, frequency of well-balanced diets, frequency of eating meals with family or friends, planetary health diet initiatives, and each consumption item of planetary health diets were analysed on an interval scale. Welch's *t*-test was used to compare the above-specified items by breakfast regularity.

We developed an initial hypothetical model (Figure 1) using factors potentially associated with the intake of a well-balanced diet at least twice daily, including regular breakfast consumption and the eight variables recommended for planetary health diet consumption. We performed a covariance structure analysis to validate the hypothetical model. Based on the path direction, standardised estimates, coefficient of determination, and fit indices, such as the goodness-of-fit index (GFI), adjusted GFI (AGFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and Akaike's information criterion (AIC), we repeatedly modified the model (for example, by deleting non-significant paths) until the best possible fit was achieved. We determined that the goodness of fit of the model was better when the GFI, AGFI, and CFI indices were ≥0.9, RMSEA was ≤0.05, and AIC was lower than those of the other models. The sample size was calculated using RMSEA for the null hypothesis: $\varepsilon 0 \leq 0.1$, and RMSEA for the alternative hypothesis: $\varepsilon 1 = 0.01$, with the power of the not close fit test = 0.8, model degrees of freedom = 19, a significance level of 5%. With 19 model degrees of freedom, the minimum sample size calculated was 117 [20]. Statistical

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significance was set at $p < 0.05$. Statistical analyses were performed using SPSS version 26 (IBM Japan, Ltd., Tokyo, 2019).

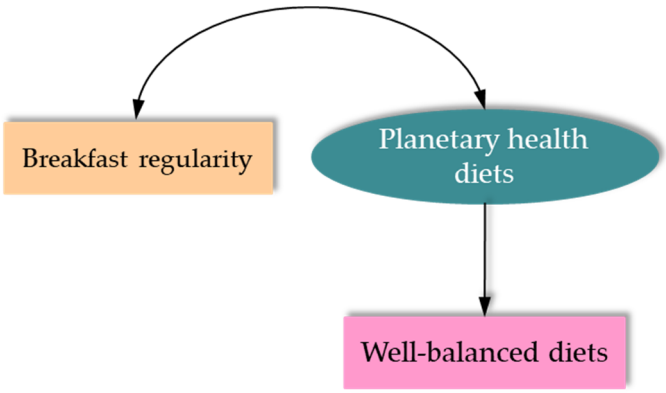

Figure 1. Initial hypothetical model associating well-balanced diets with the consumption of items from the planetary health diet (the eight items recommended) and breakfast regularity.

The bidirectional arc arrow shows an association, and the straight arrows indicate significant paths.

3. Results

Table 1 shows the characteristics of the participants and the results of comparisons by breakfast regularity. Among participants who consumed breakfast regularly, those living with family accounted for the highest percentage (78.2%). In contrast, among participants who did not eat breakfast regularly, 56.1% lived alone, with a significant intergroup difference ($p < 0.001$). A significantly higher percentage of those with and without regular breakfast consumption (74.3% and 39.0%, respectively) indicated that breakfast was crucial for healthy living ($p < 0.001$). In terms of self-assessment of diet for the question "What do you think of your current dietary habits?" Of the participants with and without regular breakfast consumption, 47.5% and 53.7% reported good and few problems, respectively, with a significant intergroup difference ($p < 0.001$). Comparisons of breakfast regularity showed no intergroup difference in the frequency of working on a planetary health diet; however, there was a significant intergroup difference ($p < 0.001$) in the frequency of eating a balanced diet comprising staples, main courses, and side dishes at least twice per day for 6 or 7 days/week, which was the highest and lowest among participants with and without regular breakfast consumption (35.6% and 2.4%, respectively).

Table 1. Overall characteristics of the participants and intergroup comparison stratified by breakfast regularity (n=142).

Characteristics	Total	Eating breakfast regularly[1]	Not eating breakfast regularly[1]	p
n	142 (100)	101 (71.1)	41 (28.9)	
Age[2]	20.0±1.33	19.9±1.35	20.4±1.22	0.053
BMI[3], kg/m^2				

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<18.5	21 (14.8)	11 (10.9)	10 (24.4)	0.085
≥18.5 and <25	113 (79.6)	83 (82.2)	30 (73.2)	
≥25	8 (5.6)	7 (6.9)	1 (2.4)	
Living arrangement[3]				
Living alone	45 (31.7)	22 (21.8)	23 (56.1)	<0.001
Living with family	97 (68.3)	79 (78.2)	18 (43.9)	
Regular exercise (exercise for ≥30 min)[4]				
3 times/week for ≥1 year	28 (19.7)	21 (20.8)	7 (17.1)	0.30
2 times/week for ≥1 year	19 (13.4)	14 (13.9)	5 (12.2)	
2 times/week, <1 year continuously	22 (15.5)	16 (15.8)	6 (14.6)	
Once per week	26 (18.3)	20 (19.8)	6 (14.6)	
Little or no exercise	40 (28.2)	26 (25.7)	14 (34.1)	
No exercise at all	7 (4.9)	4 (4.0)	3 (7.3)	
Importance of breakfast for healthy living[4]				
Very important	91 (64.1)	75 (74.3)	16 (39.0)	<0.001
Somewhat important	38 (26.8)	23 (22.8)	15 (36.6)	
Not very important	11 (7.7)	3 (0.0)	8 (19.5)	

 doi:10.20944/preprints202403.0040.v1

Not important at all	2 (1.4)	0 (0.0)	2 (4.9)	
Self-assessment of diet[4]				
Very good	12 (8.5)	12 (11.9)	0 (0.0)	<0.001
Good	58 (40.8)	48 (47.5)	10 (24.4)	
A few problems	59 (41.5)	37 (36.6)	22 (53.7)	
Many problems	13 (9.2)	4 (4.0)	9 (22.0)	
Eating behaviours				
Well-balanced diet at least twice daily[4]				
6 or 7 days/week	37 (26.1)	36 (35.6)	1 (2.4)	<0.001
4 or 5 days/week	32 (22.5)	24 (23.8)	8 (19.5)	
2 or 3 days/week	44 (31.0)	28 (27.7)	16 (39.0)	
≤1 day/week	16 (11.3)	6 (5.9)	10 (24.4)	
Not at all	13 (9.2)	7 (6.9)	6 (14.6)	
Eating meals with family or friends[4]				
6 or 7 days/week	57 (40.1)	49 (48.5)	8 (19.5)	0.088
4 or 5 days/week	32 (22.5)	17 (16.8)	15 (36.6)	
2 or 3 days/week	22 (15.5)	15 (14.9)	7 (17.1)	

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≤1 day/week	18 (12.7)	10 (9.9)	8 (19.5)	
Not at all	13 (9.2)	10 (9.9)	3 (7.3)	
Planetary health diet initiatives[4]				
Working already (>6 months)	14 (9.9)	9 (8.9)	5 (12.2)	0.44
Working already (<6 months)	14 (9.9)	9 (8.9)	5 (12.2)	
Intend to start soon (within 1 month)	8 (15.5)	6 (5.9)	2 (4.9)	
Intend to start soon (within 6 months)	22 (15.5)	17 (16.8)	5 (12.2)	
Interested, but not working	53 (37.3)	36 (35.6)	17 (41.5)	
Not interested	31 (21.8)	24 (23.8)	7 (17.1)	

Data are expressed as mean ± SE or *n* (%). [1]Eating breakfast regularly: ≥4 days/week; not eating breakfast regularly: ≤3 days/week. [2]A Student's *t*-test was used. [3]Ratios were based on two independent sample chi-squared tests. [4]A Welch's *t*-test was used, as the data were analysed as interval scales (6 = 3 times 3 times/week for at least 1 year; working already (>6 months). 5 = 2 times/week for at least 1 year; 6 or 7 days/week; already working (<6 months). 4 = 2 times/week, <1 year continuously; very important; very good; 4 or 5 days/week; intend to start soon (within 1 month). 3 = once per week; somewhat important; good; 2 or 3 days/week; intend to start soon (within 6 months). 2 = little or no exercise; not very important; few problems; 1 day/week or less; interested but not working. 1 = no exercise at all, not important at all, many problems, not at all, not interested).

Table 2 shows the results of the comparisons of planetary health diets (abstain/recommended) based on breakfast regularity. In the analysis based on breakfast regularity, for the abstinence items of the planetary health diet, there was a significantly higher frequency of intake of pork dishes (p = 0.027) among participants with regular breakfast consumption compared to those without it; however, there was no significant intergroup difference in the frequency of intake of beef dishes. In the analysis based on breakfast regularity, for the eight recommended items of the planetary health diet, there were significant intergroup differences for all items except chicken (fish, p = 0.005; eggs, p = 0.006; soybeans/soybean products, p = 0.002; nuts, p = 0.008; dairy foods, p = 0.001; vegetables, p < 0.001; and fruits, p < 0.001).

Table 2. Comparison of planetary health diets (abstain/recommended) by breakfast regularity (*n*=142).

Characteristics	Total	Eating breakfast regularly	Not eating breakfast regularly	*p* [1]

 doi:10.20944/preprints202403.0040.v1

n	142 (100)	101 (71.1)	41 (28.9)	
Beef dishes[2]				
At least twice daily	1 (0.7)	1 (1.0)	0 (0.0)	0.36
Once daily	3 (2.1)	1 (1.0)	2 (4.9)	
5 or 6 times/week	7 (4.9)	6 (5.9)	1 (2.4)	
3 or 4 times/week	39 (27.5)	28 (27.7)	11 (26.8)	
1 or 2 times/week	53 (37.3)	43 (42.6)	10 (24.4)	
1–3 times/month	34 (23.9)	18 (17.8)	16 (39.0)	
Not at all	5 (3.5)	4 (4.0)	1 (2.4)	
Pork dishes[2]				
At least twice daily	1 (0.7)	1 (1.0)	0 (0.0)	0.027
Once daily	3 (2.1)	2 (2.0)	1 (2.4)	
5 or 6 times/week	6 (4.2)	4 (4.0)	2 (4.9)	
3 or 4 times/week	40 (28.2)	34 (33.7)	6 (14.6)	
1 or 2 times/week	76 (53.5)	53 (52.5)	23 (56.1)	
1–3 times/month	12 (8.5)	5 (5.0)	7 (17.1)	
Not at all	4 (2.8)	2 (2.0)	2 (4.9)	

 doi:10.20944/preprints202403.0040.v1

Chicken dishes[3]				
At least twice daily	4 (2.8)	3 (3.0)	1 (2.4)	0.61
Once daily	5 (3.5)	3 (3.0)	2 (4.9)	
5 or 6 times/week	14 (9.9)	10 (9.9)	4 (9.8)	
3 or 4 times/week	45 (31.7)	35 (34.7)	10 (24.4)	
1 or 2 times/week	59 (41.5)	40 (39.6)	19 (46.3)	
1–3 times/month	13 (9.2)	9 (8.9)	4 (9.8)	
Not at all	2 (1.4)	1 (1.0)	1 (2.4)	
Fish dishes[3]				
At least twice daily	1 (0.7)	1 (1.0)	0 (0.0)	0.005
Once daily	2 (1.4)	1 (1.0)	1 (2.4)	
5 or 6 times/week	2 (1.4)	2 (2.0)	0 (0.0)	
3 or 4 times/week	26 (18.3)	22 (21.8)	4 (9.8)	
1 or 2 times/week	72 (50.7)	54 (53.5)	18 (43.9)	
1–3 times/month	30 (21.1)	18 (17.8)	12 (29.3)	
Not at all	9 (6.3)	3 (3.0)	6 (14.6)	
Egg dishes[3]				

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At least twice daily	4 (2.8)	4 (4.0)	0 (0.0)	0.006
Once daily	22 (15.5)	20 (19.8)	2 (4.9)	
5 or 6 times/week	27 (19.0)	19 (18.8)	8 (19.5)	
3 or 4 times/week	43 (30.3)	30 (29.7)	13 (31.7)	
1 or 2 times/week	35 (24.6)	21 (20.8)	14 (34.1)	
1–3 times/month	10 (7.0)	6 (5.9)	4 (9.8)	
Not at all	1 (0.7)	1 (1.0)	0 (0.0)	
Soybeans/soybean products[3]				
At least twice daily	3 (2.1)	3 (3.0)	0 (0.0)	0.002
Once daily	13 (9.2)	12 (11.9)	1 (2.4)	
5 or 6 times/week	16 (11.3)	14 (13.9)	2 (4.9)	
3 or 4 times/week	36 (25.4)	25 (24.8)	11 (26.8)	
1 or 2 times/week	43 (30.3)	29 (28.7)	14 (34.1)	
1–3 times/month	25 (17.6)	16 (15.8)	9 (22.0)	
Not at all	6 (4.2)	2 (2.0)	4 (9.8)	
Nuts[3]				
At least twice daily	1 (0.7)	1 (1.0)	0 (0.0)	0.008

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Once daily	5 (3.5)	4 (4.0)	1 (2.4)	
5 or 6 times/week	2 (1.4)	2 (2.0)	0 (0.0)	
3 or 4 times/week	9 (6.3)	8 (7.9)	1 (2.4)	
1 or 2 times/week	20 (14.1)	18 (17.8)	2 (4.9)	
1–3 times/month	38 (26.8)	25 (24.8)	13 (31.7)	
Not at all	67 (47.2)	43 (42.6)	24 (58.5)	
Dairy foods[3]				
At least twice daily	9 (6.3)	7 (6.9)	2 (4.9)	0.001
Once daily	38 (26.8)	33 (32.7)	5 (12.2)	
5 or 6 times/week	14 (9.9)	10 (9.9)	4 (9.8)	
3 or 4 times/week	20 (14.1)	15 (14.9)	5 (12.2)	
1 or 2 times/week	32 (22.5)	21 (20.8)	11 (26.8)	
1–3 times/month	19 (13.4)	12 (11.9)	7 (17.1)	
Not at all	10 (7.0)	3 (3.0)	7 (17.1)	
Vegetable-based dishes[3]				
At least twice daily	14 (9.9)	14 (13.9)	0 (0.0)	<0.001
Once daily	28 (19.7)	24 (23.8)	4 (9.8)	

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5 or 6 times/week	20 (14.1)	15 (14.9)	5 (12.2)	
3 or 4 times/week	37 (26.1)	25 (24.8)	12 (29.3)	
1 or 2 times/week	33 (23.2)	19 (18.8)	14 (34.1)	
1–3 times/month	7 (4.9)	1 (1.0)	6 (14.6)	
Not at all	3 (2.1)	3 (3.0)	0 (0.0)	
Fruit[3]				
At least twice daily	2 (1.4)	2 (2.0)	0 (0.0)	<0.001
Once daily	18 (12.7)	16 (15.8)	2 (4.9)	
5 or 6 times/week	8 (5.6)	7 (6.9)	1 (2.4)	
3 or 4 times/week	19 (13.4)	16 (15.8)	3 (7.3)	
1 or 2 times/week	36 (25.4)	27 (26.7)	9 (22.0)	
1–3 times/month	43 (30.3)	26 (25.7)	17 (41.5)	
Not at all	16 (11.3)	7 (6.9)	9 (22.0)	

Data are expressed as *n* (%). [1]A Welch's t-test was used, as the data were analysed as interval scales (7 = at least twice daily; 6 = once daily; 5 = 5 or 6 times/week; 4 = 3 or 4 times/week; 3 = 1 or 2 times/week; 2 = 1–3 times/month; 1 = Not at all). [2]Planetary health diets: abstain: Abstain from these items with a planetary health diet. [3]Planetary health diets: Recommended items to be consumed with a planetary health diet.

In the initial hypothetical model (Figure 1), the results of the covariance structure analysis did not show acceptable goodness of fit ($\chi^2 = 69.419$, $df = 34$, GFI = 0.915, AGFI = 0.863, CFI = 0.873, RMSEA = 0.086, and AIC = 111.419). Therefore, by excluding chicken dishes and nuts from the eight recommended items of the planetary health diet, an acceptable goodness of fit was obtained ($\chi^2 = 24.586$, $df = 19$, GFI = 0.962, AGFI = 0.927, CFI = 0.975, RMSEA = 0.046, AIC = 58.586). Frequent consumption of the remaining six items of a planetary health diet, namely fish, eggs, soybeans/soybean products, dairy foods, vegetables, and fruits, had a significant positive correlation

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(0.50, $p < 0.001$) with breakfast regularity and a significant positive path (standardised estimate 0.56, $p < 0.001$) to transition to well-balanced diets (Figure 2).

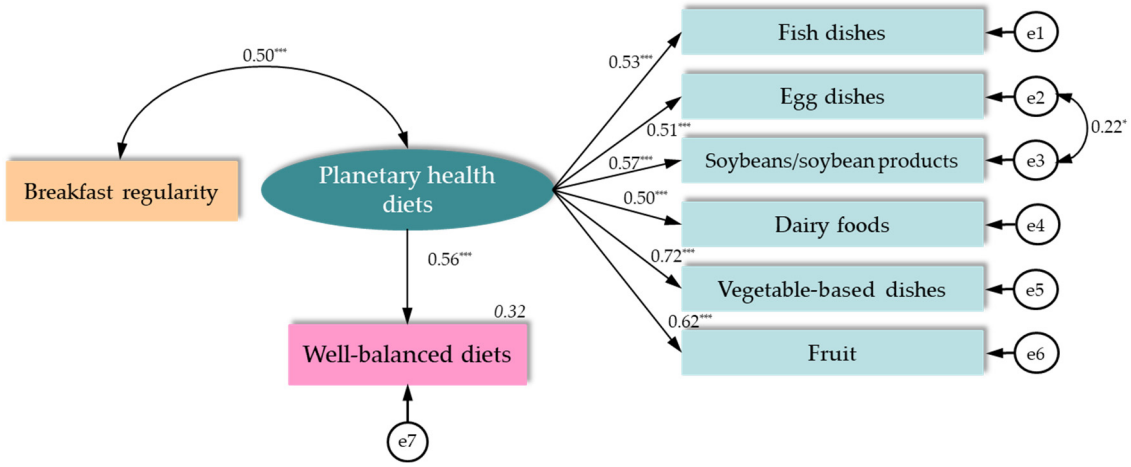

Figure 2. Association of breakfast regularity and well-balanced planetary health diet (frequent consumption of the six recommended items) among Japanese male undergraduates ($n = 142$).

The numbers in regular font in the path diagram are standardised estimates (next to the straight arrows) and correlation coefficients (above the bidirectional arc arrow). The numbers in italics are R^2 values (coefficients of determination). Statistical significance was set at * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$. The covariance structure analysis results suggested that the hypothetical model had acceptable goodness of fit ($\chi^2 = 24.586$, $df = 19$ ($p = 0.175$), GFI = 0.962, AGFI = 0.927, CFI = 0.975, RMSEA = 0.046, AIC = 58.586).

4. Discussion

In this study, we investigated whether recommending regular breakfast habits and a planetary health diet [17,18], including chicken, fish, eggs, soybeans/soybean products, nuts, dairy foods, vegetables, and fruits, might help ameliorate dietary issues [6,12] such as poorly balanced diets among young Japanese adults. Accordingly, a structural analysis of the covariance of the hypothesised model was performed using planetary health diet consumption, regular breakfast consumption, and well-balanced diet intake in young males.

After excluding chicken and nuts, the final hypothetical model of this study comprised six of the eight recommended items of the planetary health diet, namely, fish, eggs, soybeans/soybean products, dairy foods, vegetables, and fruits. The results of this study showed that, despite the higher frequency of intake of chicken dishes than that of beef or pork dishes, there was no significant intergroup difference in the frequency of intake of chicken dishes in the subgroup analysis stratified by breakfast regularity; therefore, intake of chicken dishes was excluded from the final model. The analysis also excluded the intake of nuts, potentially due to their infrequent consumption. Nuts are not commonly consumed in Japanese dietary habits.

Among the G20 countries, Japan has relatively low per-capita food-related greenhouse gas emissions [21,22]. Furthermore, adherence to a well-balanced diet, characterised by a combination of staple foods, main courses, and side dishes, as outlined in the 2000 Japanese food-based dietary guidelines, is currently recommended. The origin of Japanese cuisine is attributed to "*honzen ryori*" (*honzen* cuisine), which was used to entertain guests of the samurai families in the Muromachi period (AD 1336–1573), and its basic form is "*ichijyu sansai*" (one soup and three dishes: vinegared, simmered, and grilled) in addition to rice and savoury dishes [23–25]. Throughout its extensive history, Japanese food culture has permeated the existing dietary habits of the Japanese people, which includes eating "*okazu*" (the main course and side dishes) with rice – the staple food – as the main ingredient. Dairy products were not a part of the common people's diet until after World War II. The Ministry of Health and Welfare (now the Ministry of Health, Labour and Welfare) established a

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Ministerial Ordinance on Ingredient Standards for Dairy Products in 1951. This is possibly why the current daily intake of Japanese people remains at a low average of 110.7 g [26]. However, in this study, dairy foods were included among the six recommended items of the planetary health diet. The percentage of adults (age ≥20 years) who ate rice for breakfast daily (17.7% in the 2016 Hyogo Dietary Survey) [27] was lower than that 13 years ago (24.8% in 2003). In contrast, the highest percentage of breakfast content in the 2016 Hyogo Dietary Survey [27] comprised staple foods (91.9%), whereas dairy foods accounted for 47.6%, which was higher than the 37.5% and 36.7% contents of main and side dishes, respectively. This may be due to the intake of dairy foods, along with bread and non-rice cereals, as a staple for breakfast. Therefore, because they are regularly consumed at breakfast, dairy foods may have been retained as one of the six items in the planetary health diet.

For more than 20 years, the National Health and Nutrition Survey in Japan has indicated that the lower consumption of fish (50.8 g vs. 59.2 g), soybeans/soybean products (46.2 g vs. 63.4 g), vegetables (222.6 g vs. 268.6 g), and fruits (46.9 g vs. 70.6 g) per day among young adults than among middle-aged and older adults (age groups 20s vs. 50s, respectively) constitutes a problem [26]. In this study, dietary issues in young adults accounted for four of the six recommended items in the planetary health diet. Therefore, improving the intake of these items in combination with regular breakfast consumption may lead to a healthy and well-balanced diet.

The importance of breakfast has been reported in various countries, including higher dietary quality among American adults [9], Australian adults [28], and European adolescents [29] who consumed breakfast, and the contribution of breakfast to the overall dietary quality among Malaysian [30] and Indonesian [31] adults. The intake of foods associated with planetary health diets may vary slightly in each country. Nonetheless, the combination of the recommended planetary health diet and regular breakfast consumption may be an effective strategy to improve diet quality not only in Japan but also in other countries worldwide.

The strengths of the present study include the examination of dietary issues such as adherence to a balanced diet and skipping breakfast among young Japanese individuals, which may be ameliorated through an interventional approach that incorporates a focus on the planetary health diet to achieve the SDGs. Importantly, our study also serves to integrate the findings that foods that were identified as problematic through low consumption among young adults were nearly identical to the foods recommended in the planetary health diet.

The limitations of this study include the fact that the participants were male students enrolled in an engineering program at a university in Hyogo Prefecture. Therefore, they are not representative of the overall Japanese population aged 18–24 years. Further research involving female participants of different ages should be conducted to confirm these results. Moreover, because this was a cross-sectional study, we were unable to ascertain a causal relationship between regular breakfast consumption-related changes in adherence to the recommendations of the planetary health diet to protect the planet's environment and habituation to a well-balanced diet. An additional study of the effects of a well-balanced diet through interventional research that promotes regular breakfast consumption according to the recommendations of the planetary health diet for young adults will be helpful in this regard.

In summary, we examined the structural associations between planetary health diet consumption and regular breakfast and well-balanced diet intake in young males. In male university students, the association of regular breakfast consumption with adherence to the planetary health diet, which includes foods recommended to achieve the SDGs, may lead to the consumption of a well-balanced diet.

5. Conclusions

In this study, we suggested that recommending regular breakfast habits and a planetary health diet, which helps meet the SDGs set by the United Nations, might help ameliorate dietary issues such as poorly balanced diets among young Japanese adults.

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Informed Consent Statement: Written informed consent was obtained from all participants.

Data Availability Statement: The data in this study are available on request from the corresponding authors. The data are not publicly available due to confidentiality reasons.

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