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Communication

Factors Affecting Nonmarket Fruit and Vegetable Receiving: Analyses of Two Cross-Sectional Surveys in Gunma, Japan

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Abstract: In this communication, we clarified the factors affecting the nonmarket fruit and vegetable (FV) receiving frequency. For Survey 1, we conducted a cross-sectional survey using a self-administered questionnaire for men aged 50−74 in city (A) in Gunma, Japan. Participants were asked questions regarding FV receiving frequency, FV gardening, social cohesion (4 to 20 points), and basic characteristics. For Survey 2, a similar survey was conducted for residents aged 20—74 in three areas in city (B) in Gunma, but we added more variables. For analysis, ordinal logistic regression models were used. In the survey 1, 243 participants were used for analysis. As a result, FV receiving frequency was positively associated with non-gardeners, and social cohesion. In Survey 2, 791 participants were used for analyses. For Survey 2, vegetable receiving frequency was positively associated with rural and suburban area, family structure, employment status, and non-farmers. The relationship between receiving frequency and social cohesion was similar to that found in Survey 1. In conclusion, in areas where FV cultivation flourished, it appears easy to obtain FV through the social networks of receiving, even for those who are not cultivating themselves.

Keywords: fruit and vegetable intake; fruit and vegetable receiving; locally-grown products; local food system; nonmarket food; social cohesion

1. Introduction

The distribution of nonmarket food (home produced food and foods received from neighbors and/or relatives) may have an impact on Japanese people's diets [1-5]. In the *Noto* Peninsula (a traditional Japanese rural setting called *Satoyama* [1]), there was greater diversity and a higher ratio of daily meal products produced at home compared to other areas of Japan [2], and the variety and quantity of nonmarket foods also differ depending on the areas within the *Noto* Peninsula [1]. Additionally, if people have more food sharing partners, greater diversity and quantities may be obtained from nonmarket food sources [1]. On *Hachijo* Island, nonmarket potatoes, vegetables and fish are widely available [3]. Also, nonmarket foods account for approximately 25% of the production price basis and about 17% on caloric basis within food consumption as a whole [3]. Approximately half of all food consumed was from nonmarket sources between the spring and autumn seasons [4]. In addition, a nationwide internet survey reported there were no significant differences in the ratio of access to nonmarket foods due to the agricultural area classification, and there was a significant relationship between land use types and obtaining amounts and varieties of nonmarket food [2, 5]. Nonmarket food distribution largely consists of locally harvested crops that are suited to the local climate and carry a relatively low environmental burden [6]. Nonmarket food is also important for survival in the event of a disaster [7]. All these aspects align with the following Sustainable Development Goal:

"2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen

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capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters and that progressively improve land and soil quality [8]."

Increased fruit and vegetable (FV) intake has reduced mortality as well as the risk of cardiovascular disease [9, 10]. From a health promotion perspective, therefore, it is important that distribution of nonmarket FV contributes to overall increases in FV intake. Among the several studies confirming the relationship between nonmarket FV distribution and FV intake, a positive relationship was widely observed between gardening or food cultivation and FV intake in Japan [11–17]. This relationship has been globally reported, and is generally positive and consistent [18-21]. It has also given us a deeper understanding of the characteristics and motivation of those engaged in FV gardening [14,21-23]. Additionally, there are several reports on the association between FV receiving and FV intake [11-13]. In Japanese rural areas, the higher the receiving vegetable intake, the higher the total vegetable intake [11]. There is an interaction between vegetable cultivation and vegetable receiving frequency, affecting vegetable intake [12]. Furthermore, there is a positive relationship exists between vegetable cultivation and vegetable intake, as well as a positive relationship between vegetable receiving and vegetable intake, even if they or their families do not grow vegetables themselves [13]. However, there were no empirical studies on factors affecting FV receiving frequency. If FV receiving is positively related to FV intake, understanding the underlying factors may lead to a better interpretation of these ecosystems, and it may contribute to future sustainable health and promoting associated food systems [24].

In this paper, we seek to clarify factors affecting FV receiving frequency. This study was a secondary analysis of the two cross-sectional data surveys [11,15,25]. As such, the selection of participants was not optimally designed for the present purpose. However, additional analyses may offer some useful findings for future studies.

2. Materials and Methods

2.1. Survey 1

2.1.1. Participants and methods

The participants were men aged 50–74 years, and living in three census tracts in a city in Gunma Prefecture, Japan. The primary purpose of this survey was to identify the health effects of community gardening and home gardening [15]. This city is located in the south of Gunma, covers 139.4 km^2, and has a population of approximately 210,000 residents. We used multiple frame sampling to refer to previous community gardening studies [26,27]. The first framework involved the participants of community gardens in the three census tracts. This area was a suburban setting with farmland within the residential areas. An explanatory document and a self-administered questionnaire were distributed directly by the staff of the community garden management organization (April 25, 2014). The second framework was for residents of the three census tracts. Each household was sent an explanatory document and a self-administered questionnaire by Delivery Area Designated Mail (Japan Post Co., Ltd.; April 25, 2015). This service allows mail to be delivered to all households in the designated area without knowing the participants' specific addresses. The explanatory document requested a response from men aged 50–74 years. Moreover, when there were two or more men aged 50–74 in the household, we asked that only one of them reply. To avoid duplication of answers between the two sample frameworks, the explanatory document clearly stated that those answering the community garden questionnaires were not required to cooperate. The survey was conducted anonymously, and consent was obtained if the questionnaire was completed.

By May 31, 2015, 253 completed questionnaires had been collected. Approximately 200 were distributed to the community gardeners with 25 replies. For the residents, 3,397 were delivered to the households in the three towns, with 228 responses. Of these, 10 with missing values were excluded, resulting in 243 for analysis. The response rate was not calculated because the correct number of participants could not be determined in any sample framework. The survey was approved by the

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Gunma University Ethical Review Board for Epidemiological Research (submission no. 26-58; February 04, 2015).

2.1.2. Survey instrument

To determine whether the men were receiving FV from people in their social network, participants were asked: "How often do you obtain fruits and vegetables from relatives or neighbors?" The answers ranged from 1 (never), to 4 (often).

To determine whether or not a participant performed FV cultivation or gardening, they were asked to provide an answer of "yes" or "no" to the question: "Do you grow fruits and vegetables?" In this survey, gardeners and farmers were combined into the "gardener" group, and those who answered no were classified as the "non-gardener" group.

Social cohesion was scaled using four items from neighborhood scales, as developed by Mujahid et al. [28], and which have since been adapted for Japanese populations [29]. Participants were asked to rate four statements on a scale from 1 (strongly disagree), to 5 (strongly agree). These were: "People around here are willing to help their neighbors"; "People in my neighborhood generally get along with one another"; "People in my neighborhood can be trusted"; and, "People in my neighborhood share the same values." We created a social cohesion index by adding the scores for these four items (Cronbach $\alpha = 0.851$).

Furthermore, the participants were asked to provide information on their basic characteristics such as age, educational background, and employment status.

2.2. Survey 2

2.2.1. Participants and methods

We used the same dataset as that described in previous articles, and the primary purposes of this survey were to estimate regional differences in vegetable intake and the impact of locally-grown vegetable acquisition upon vegetable intake [11,25]. The participants in this cross-sectional study were residents aged 20—74 years who were living in three areas of city (B) within Gunma, Japan. This city is located in the center of Gunma, covers 459.2 km^2, and has a population of approximately 370,000 residents. Within this city, we identified three geographic regions, each with a population of about 1,000 people aged 20 to 74 years, and which could be classified as rural, suburban, and urban, respectively [25]. Additionally, in the agricultural area classification system developed by the Japanese Ministry of Agriculture, Forestry and Fisheries, these areas are considered "mountainous agricultural area[s]," "flat agricultural area[s]," and "urbanized area[s]," respectively [5, 30]. Also the previous study indicated there were more vegetable growers (constituted by both farmers and gardeners) in the rural and the suburban areas than in the urban area [25].

We collected the survey data during September and October 2016 using a self- administered, anonymous questionnaire. We mailed the questionnaire to 2,260 households by Delivery Area Designated Mail (Japan Post Co., Ltd.; September 12, 2016). We mailed two sets of questionnaires to all households in the three areas. An explanatory letter and a stamped, self-addressed return envelope were enclosed with the questionnaire. The explanatory letter stated that: (1) two residents should reply if there were three or more residents aged 20 to 74 years in the household; and, (2) Ethical matters, such as arbitrariness and anonymity, would be handled securely. In addition, we numbered each questionnaire so that we could identify from which of the three geographic areas each response was received. A total of 873 residents from 586 households responded (representing a 25.9% household response rate), of whom 82 with missing values were excluded. Therefore, we used responses from 791 participants for the analyses. This survey was approved by the Gunma University Ethical Review Board for Medical Research Involving Human Subjects (submission no. 160074, approved on August 16, 2016).

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2.2.2. Survey instrument

The vegetable receiving frequency and social cohesion (Cronbach $\alpha = 0.892$) were measured with the same tool as Survey 1.

To understand the self-perceptions about vegetable growing, we asked participants, "Do you or members of your household grow vegetables?" Participants who answered yes were further asked whether they grew the vegetables as farmers, home gardeners, community gardeners, or other gardeners. From these responses, we classified those who answered farmer as "farmer," and those who answered home gardener, community gardener, or other gardener as "gardener," and those who answered no as "non-grower."

Other than that, we assessed subjective difficulty in food-store access by using a single item from a previous study, which asked the participants about their subjective difficulty with food-store access in one of four categories: "very difficult"; "difficult"; "easy"; and, "very easy." [31]. We assessed the respondents' economic circumstances by using a single item that asked them to indicate their economic situation in five categories: "very poor"; "poor"; "fair"; "good"; and "very good'. This item was confirmed as having a positive relationship with household income in a previous study [32]. We assessed health attitudes using a single item: "Are you usually health-conscious?" Participants answered in one of four categories: "not at all"; "little"; "occasionally"; and, "often, or all the time." Subjective difficulty with food-store access (difficult and easy) and health attitude (low, or not at all/little) and high (occasionally/often/all the time) were divided into two categories, and economic circumstances were divided into three categories because there was an intermediate choice (poor, fair, and good). In addition, the participants were asked about their basic characteristics, such as sex, age, family structure, educational background, and employment status.

2.3. Analyses

Firstly, we described participants' characteristics according to FV receiving frequencies obtained from Survey 1, and analyzed the different responses according to FV receiving frequency using a one-way ANOVA test for social cohesion, and chi-square tests for all the other variables. Following this, we identified the factors related to the FV receiving frequencies of Survey 1 using an ordinal logistic regression model. The FV receiving frequency was used as a dependent variable. All other variables were used as independent variables, and we computed a partial regression coefficient (β) and a 95% confidence interval (95%CI).

We conducted a similar analysis for Survey 2. In the ordinal regression model, vegetable receiving frequency was used as the dependent variable, and all other variables were used as independent variables. In addition, we attempted a similar analysis for only non-gardeners using the data obtained from Survey 2. This is because previous research has suggested the relationship between vegetable receiving frequency and vegetable intake is particularly strong among non-gardeners [11,12].

A two-tailed p-value less than 0.05 was considered statistically significant. All analyses were performed using the statistical software package IBM SPSS Statistics, Version 23.

3. Results

3.1. Survey 1

We described characteristics of Survey 1 participants in Table 1. FV gardening status (p=0.002) and social cohesion (p=0.003) were significantly related with FV receiving frequency.

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Table 1. Participants' characteristics according to FV receiving frequency (Survey 1).

			FV Receiving Frequency								
	Total		Never		Rarely		Sometimes		Often		
	N	%	n	%	n	%	n	%	n	%	p-value*
N	243	100.0	16	6.6	30	12.3	133	54.7	64	26.3	
Age											
<60	53	21.8	5	31.3	4	13.3	33	24.8	11	17.2	0.307
≥60	190	78.2	11	68.7	26	86.7	100	75.2	53	82.8	
Educational background											
≤High school	148	60.9	9	56.2	17	56.7	80	60.2	42	65.6	0.801
>High school	95	39.1	7	43.8	13	43.3	53	39.8	22	34.4	
Employment status											
Unemployed/retired	110	45.3	7	43.8	16	53.3	58	43.6	29	45.3	0.813
Employed	133	54.7	9	56.2	14	46.7	75	56.4	35	54.7	
FV gardening											
Non-gardener	131	53.9	14	87.5	10	33.3	67	50.4	40	62.5	0.002
Gardener	112	46.1	2	12.5	20	66.7	66	49.6	24	37.5	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Social cohesion (4 to 20)**	13.5	2.6	11.4	2.8	13.1	2.3	13.5	2.3	14.2	2.8	0.003

*one-way ANOVA for social cohesion, and chi-square test for all the other valuables.

FV: fruit and vegetable. SD: standard deviation

An examination of factors related to FV receiving frequency from Survey 1 (Table 2) indicated significant relationships with non-gardeners (β=0.617, p=0.027) and social cohesion (β=0.198, p<0.001).

Table 2. Relationship with FV receiving frequency (Survey 1).

	β (95%CI)	p-value
Age: ≥60 (Ref: <60)	0.309 (−0.374–0.992)	0.375
Education: >high school (Ref. ≤high school)	−0.515 (−1.055–0.026)	0.062
Employed (Ref. unemployed or retired)	0.225 (−0.335–0.785)	0.431
Non-gardener (Ref. FV gardener)	0.617 (0.071–1.163)	0.027
Social Cohesion (4 to 20)	0.198 (0.097–0.299)	<0.001

Ordinal logistic regression models; N=243; likelihood-ratio test: p<0.001;

Dependent variable: FV receiving frequency (Never=1 to Often=4)

FV: fruit and vegetable. β: partial regression coefficient. 95%CI: 95% confidence interval

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3.2. Survey 2

We described the characteristics of Survey 2 participants in Table 3. There were significant differences in area (p<0.001), age (p<0.001), family structure (p<0.001), educational background (p=0.008), and social cohesion (p=0.003), when compared to vegetable receiving frequency. We described non-gardeners' characteristics in Table 4. The similar trends with area (p<0.001), family structure (p<0.001), and social cohesion (p=0.003) were shown. In addition, significant differences in sex (p=0.016) and employment status (p=0.013) were shown. However, age (p=0.142) and educational background (p=0.250) had no significant difference when compared according to vegetable receiving frequency.

Table 3. Participants' characteristics according to vegetable receiving frequency (Survey 2).

	Total		Vegetable Receiving Frequency								
			Never		Rarely		Sometimes		Often		
	N	%	n	%	n	%	n	%	n	%	p-value*
N	791	100.0	165	20.9	225	28.4	261	33.0	140	17.7	
Area											
Rural	260	32.9	32	19.4	71	31.6	94	36.0	63	45.0	<0.001
Suburban	263	33.2	52	31.5	81	36.0	92	35.2	38	27.1	
Urban	268	33.9	81	49.1	73	32.4	75	28.7	39	27.9	
Sex											
Women	435	55.0	81	49.1	126	56.0	144	55.2	84	60.0	0.280
Men	356	45.0	84	50.9	99	44.0	117	44.8	56	40.0	
Age										0.0	
<60	473	59.8	100	60.6	120	53.3	147	56.3	106	75.7	<0.001
≥60	318	40.2	65	39.4	105	46.7	114	43.7	34	24.3	
Family structure											
Living alone	99	12.5	39	23.6	25	11.1	23	8.8	12	8.6	<0.001
Living 2 or more members	692	87.5	126	76.4	200	88.9	238	91.2	128	91.4	
Educational background											
≤High school	353	44.6	68	41.2	107	47.6	131	50.2	47	33.6	0.008
>High school	438	55.4	97	58.8	118	52.4	130	49.8	93	66.4	
Employment status											
unemployed/retired	258	32.6	62	37.6	84	37.3	88	33.7	24	17.1	0.271
Employed	533	67.4	103	62.4	141	62.7	173	66.3	116	82.9	
Economic circumstances											
Poor	178	22.5	43	26.1	36	16.0	67	25.7	32	22.9	0.093
Fair	280	35.4	52	31.5	82	36.4	98	37.5	48	34.3	
Good	333	42.1	70	42.4	107	47.6	96	36.8	60	42.9	

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Health Attitude											
Low	235	29.7	50	30.3	61	27.1	71	27.2	53	37.9	0.112
High	556	70.3	115	69.7	164	72.9	190	72.8	87	62.1	
Subjective difficulty in food-store access											
Difficult	219	27.7	43	26.1	57	25.3	71	27.2	48	34.3	0.271
Easy	572	72.3	122	73.9	168	74.7	190	72.8	92	65.7	
Vegetable growing											
Non-grower	394	49.8	96	58.2	110	48.9	121	46.4	67	47.9	0.057
Gardener	290	36.7	47	28.5	77	34.2	111	42.5	55	39.3	
Farmer	107	13.5	22	13.3	38	16.9	29	11.1	18	12.9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Social cohesion (4 to 20)**	13.2	3.0	12.4	3.1	13.1	2.9	13.3	3.0	14.3	2.9	<0.001

*one-way ANOVA for social cohesion, and chi-square test for all the other valuables.

SD: standard deviation

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Table 4. Participants' characteristics according to vegetable receiving frequency among non-gardeners (Survey 2).

	Total		Vegetable Receiving Frequency								
			Never		Rarely		Sometimes		Often		
	N	%	n	%	n	%	n	%	n	%	p-value*
	394	100	96	24.4	110	27.9	121	30.7	67	17.0	
Area											
Rural	63	16.0	16	14.2	34	30.1	45	39.8	18	15.9	<0.001
Suburban	113	28.7	8	12.7	12	19.0	18	28.6	25	39.7	
Urban	218	55.3	72	33.0	64	29.4	58	26.6	24	11.0	
Sex											
Women	215	54.6	43	20.0	69	32.1	60	27.9	43	20.0	0.016
Men	179	45.4	53	29.6	41	22.9	61	34.1	24	13.4	
Age											
<60	298	75.6	79	26.5	78	26.2	87	29.2	54	18.1	0.142
≥60	96	24.4	17	17.7	32	33.3	34	35.4	13	13.5	
Family structure											
Living alone	68	17.3	32	47.1	15	22.1	15	22.1	6	8.8	<0.001
Living with 2 or more members	326	82.7	64	19.6	95	29.1	106	32.5	61	18.7	
Educational background											
≤High school	126	32.0	23	18.3	36	28.6	44	34.9	23	18.3	0.250
>High school	268	68.0	73	27.2	74	27.6	77	28.7	44	16.4	
Employment status											
unemployed/retired	102	25.9	20	19.6	39	38.2	33	32.4	10	9.8	0.013
Employed	292	74.1	76	26.0	71	24.3	88	30.1	57	19.5	
Economic circumstances											
Poor	91	23.1	25	27.5	20	22.0	31	34.1	15	16.5	0.291
Fair	140	35.5	27	19.3	38	27.1	48	34.3	27	19.3	
Good	163	41.4	44	27.0	52	31.9	42	25.8	25	15.3	
health attitude											
Low	129	32.7	31	24.0	32	24.8	40	31.0	26	20.2	0.615
High	265	67.3	65	24.5	78	29.4	81	30.6	41	15.5	
Subjective difficulty in food-store access											
Difficult	108	27.4	27	25.0	32	29.6	27	25.0	22	20.4	0.432
Easy	286	72.6	69	24.1	78	27.3	94	32.9	45	15.7	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Social cohesion (4 to 20)	12.6	3.1	11.7	3.0	12.5	2.9	12.4	3.1	14.2	3.0	<0.001

*one-way ANOVA for social cohesion, and chi-square test for other valuables. SD: standard deviation

An examination of factors related to FV receiving frequency of Survey 2 (Table 5) indicated significant relationships with area (suburban: β=0.437, p=0.014, rural: β=1.142, p<0.001), living with

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two or more household members (β=0.831, p<0.001), employed (β=0.405, p=0.011), vegetable growing (gardener: β=0.688, p=0.001, non-grower: β=0.699, p=0.002), and social cohesion (β=0.104, p<0.001). Among non-grower, significant relationships were also shown with area (suburban: β=0.599, p=0.009, rural: β=1.583, p<0.001), living with two or more household members (β=0.958, p<0.001), and social cohesion (β=0.140, p<0.001), but with employment status was not significant (β=0.303, p=0.203).

Table 5. Relationship with vegetable receiving frequency (Survey 2).

	whole participants*		among non-grower**	
	β (95%CI)	p-value	β (95%CI)	p-value
Area (Ref: urban)				
suburban	0.437 (0.090–0.783)	0.014	0.599 (0.150–1.048)	0.009
rural	1.142 (0.742–1.542)	<0.001	1.583 (0.993–2.172)	<0.001
Sex: men (ref: women)	−0.254 (−0.522–0.013)	0.062	−0.244 (−0.639–0.152)	0.227
Age: ≥60 (Ref: <60)	−0.329 (−0.660–0.001)	0.051	−0.262 (−0.768–0.244)	0.311
Living 2 or more members (Ref: living alone)	0.831 (0.424–1.238)	<0.001	0.958 (0.436–1.479)	<0.001
Education: >high school (Ref: ≤High school)	0.206 (−0.088–0.500)	0.169	−0.286 (−0.722–0.150)	0.199
Employed (Ref: unemployed/retired)	0.405 (0.091–0.719)	0.011	0.303 (−0.164–0.769)	0.203
Economic circumstances (Ref: poor)				
Fair	−0.004 (−0.356–0.349)	0.984	0.163 (−0.347–0.673)	0.532
Good	0.003 (−0.348–0.355)	0.985	0.425 (−0.083–0.932)	0.101
Health Attitude: high (Ref: low)	−0.019 (−0.315–0.277)	0.900	−0.171 (−0.586–0.244)	0.420
Food-store Access: easy (Ref: difficult)	−0.167 (−0.470–0.135)	0.279	−0.024 (−0.449–0.401)	0.910
Vegetable Growing (Ref. farmer)				
Gardener	0.688 (0.059–1.107)	0.001		
Non-grower	0.699 (0.270–1.147)	0.002		
Social Cohesion (4 to 20)	0.104 (0.251–0.149)	<0.001	0.140 (0.077–0.203)	<0.001

Ordinal logistic regression models; *N=791, **n=396; likelihood-ratio test: both of models were p<0.001.

Dependent valuable: vegetable receiving frequency (Never=1 to Often=4).

FV: fruit and vegetable. β: partial regression coefficient. 95%CI: 95% confidence interval.

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4. Discussion

In this study, we clarified the factors affecting FV receiving frequency. In previous studies, the characteristics and motivation of those who are engaged in FV gardening [14,21-23] have been reported. Furthermore, in the context of obtaining locally-grown produce, the motivation and characteristics were reported by including using farmers' markets [33-36]. However, we have not managed to uncover other studies which reveal factors related to FV receiving. FV gardening and purchasing at farmers' markets are active behaviors; on the other hand, receiving is rather passive behavior. Therefore, we reasonably inferred that these factors are very different. Hence, identifying the factors related to FV receiving in this study had important implications. Specifically, we were able to generate data that, when analyzed, will be of great use in developing a scheme to increase accessibility among those who do not have an active FV intake. In turn, this could lead to an increased FV intake, and may contribute to overall health promotion of those involved. Additionally, it has low environmental impact [6], and can be said to constitute a form of emergency resilience [7]. Thus, interpreting this result contributes to achieving sustainable development goals [8]. The details of factors related to FV receiving was discussed below.

The vegetable receiving frequency in the rural and the suburban areas was higher than in the urban area. Previous studies reported no significant difference in the ratio of access to nonmarket food due to the agricultural area classification [2,5]. However, there were significant relationships between land use types and the amounts and variety of nonmarket foods individuals consumed [5]. In the initial analysis of Survey 2, many people were growing vegetables in rural and suburban areas compared to urban areas [25]. Therefore, it is assumed that the differences in the vegetable receiving frequency according to area in Survey 2 reflected the land use types, not the agricultural area classification. Specifically, the more areas used for vegetable farmland, the higher the vegetable receiving rates from neighbors.

In addition, the relationship between social cohesion, family structure, working status, and FV or vegetable receiving frequency was confirmed. Common to these backgrounds, there may be broad social networks which are effective in this context [1]. Those who recognize social cohesion as high are likely to help each other. Also, the social network may spread in terms of significance in proportion to the number of families. Moreover, people who are employed have a network with workplace colleagues. It is in keeping with commonsense interpretations that the FV receiving frequency increases if people who cultivate FV are in close proximity and have a broad social network.

Moreover, the FV receiving frequency of non-gardeners was high in Survey 1; in Survey 2, gardeners and non-growers were more likely to receive vegetables than farmers. In addition, when analyzed with non-growers alone, β of area, family structure, and social cohesion were greater than when analyzed as a whole. It is already well known that FV growing increases FV intake among growers and their family members [11-21]. Besides this, the results suggest that FV growing increases FV intake, not only among those growing FV (or their family members), but also their neighbors. In fact, the initial analysis of Survey 2 confirms that vegetable growers give harvested vegetables to others at a rate of 15.3% among farmers and 17.3% among gardeners [11]. In general, the amount of vegetables provided by farmers have a greater impact than that provided by gardeners since farmers' cultivation scales are far greater than those of gardeners.

Accordingly, we believe that FV are frequently given from farmers to non-farmer neighbors in areas where FV cultivation is high, and one of the factors promoting this may be social networks. Currently, in rural areas of Japan, it seems that FV cultivation is flourishing and social cohesion is high in many cases. As a result, increased FV intake among those who do not grow FV seems to be maintained through nonmarket food distribution. However, farmers are now on a downward trend, and abandonment of cultivation areas is also increasing in Japan [37,38]. Along with that, the rural population in Japan has been decreasing, and social networks may also be decreasing according to decreasing numbers of local residents [39]. We wonder if this is OK? We should aim to rebuild this desirable Japanese set of (rural) conditions which is being slowly lost.

Limitations

This was self-report data and has a probability of recall bias i.e., respondents may overestimate or underestimate their specific condition. Generalization is difficult because it covers only the residents of two Japanese cities. Of course, it may be significantly different in areas where vegetable cultivation is small, in Japan as well as in other countries (because of differences in cultural contexts). Moreover, there was the possibility of sampling bias and response bias since it was performed by convenient sampling, and the number of responses was not large. In the future, research designed to clarify this connection will be necessary. Finally, this was a cross-sectional study, and further longitudinal studies are required to clarify the underlying causal relationships.

5. Conclusions

In this communication, the factors affecting the FV receiving frequency (such as rural or suburban area, living multiple members, non-gardeners or non-farmers, and social cohesion) were clarified. Accordingly, it was suggested that FV are frequently given from farmers to non-farmer neighbors in areas where FV cultivation is high, and one of the factors promoting this may be social networks. We believe that these are sustainable food systems that promote the health of local residents, generate fewer environmental burdens, and serve as a form of resilience, particularly in emergency scenarios. Furthermore, in order to maintain this food system, specific strategies are needed to maintain land cultivation and social networks in rural areas of Japan.

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