Original Article

Evaluating the mental health benefits of farm volunteer tourism:
A case study of rice harvesting in Chiba, Japan

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Abstract
Mental health encompasses emotional, psychological, and social well-being that impacts how we think, feel, and act. Rural tourism is often considered a stress-relieving leisure activity, but insufficient scientific evidence supports this claim. Thus, a multidisciplinary research team investigated the psychological effects of participating in a rice harvest operation in Japan. The 19 effective participants, primarily IT company employees, along with their families and friends from the Metropolitan area, volunteered to assist in the farm operation. The researchers employed various tools, including the ordered logit model, POMS 2, SD method, and "Jikaku-sho shirabe," to administer questionnaires that assessed psychological effects. The findings indicated a significant positive correlation between job satisfaction and life satisfaction, while a significant negative correlation between life satisfaction and job stress. Further, the statistical analysis revealed that participants in the high-anxiety group reported lower life satisfaction and higher job stress than those in the low-anxiety group. The study provides evidence that the rice harvest experience reduced mental stress and improved psychological well-being, particularly in the high-anxiety group, indicating a differential effect based on individual anxiety levels. Consequently, volunteer tourism initiatives focused on rice related operations could be actively promoted, offering mutual benefits to both rural and urban communities.

Keywords
stress relieving effect, psychological well-being, anxiety, individual differences, volunteer tourism

1. Introduction

Rural tourism, including agritourism, attracts urban residents experiencing stressful lives, offering them opportunities for physical and mental relaxation [Ohe et al., 2017]. In this paper, rural tourism is defined narrowly as tourism activities primarily conducted by farmers and includes non-farm operators who provide lodging services connected to farm experiences in rural areas [Ohe, 2020]. Despite the increasing number of studies on rural tourism, the relaxation effects have great impacts on the tourists' overall wellness but have not yet been fully explored. While Yamada [2008] investigated the educational benefits of farm experiences, the psychological effects remain under-researched, although it has significant importance for mental health and well-being for the participants.

Existing research has explored the psychological and physiological benefits of outdoor activities. For example, Song et al. [2017] evaluated the effects of viewing forest landscapes on middle-aged hypertensive men, while Song et al. [2022] studied the effects of forest walking on young women, confirming the positive impact of forest therapy. Similarly, Ohe et al. [2017] demonstrated the psychological and physiological benefits of forest therapy tourism on urban workers, providing some of the earliest empirical evidence. Beyond forest therapy, other plant-related therapies have also been studied. Song et al. [2022] for park therapy, Igarashi [2015] for orchard therapy, and Park et al. [2016] for horticultural therapy are to name a few. Lu et al. [2023] identified 31 studies dealing with horticultural therapy on the subject. However, the effects of outdoor experiences on mental health and social well-being are still missing in the literature.

Previous scholars have utilized outdoor environments and generated valuable scientific evidence. However, to our knowledge, no experiments have been conducted to explore the psychological and physiological effects of farm activities in rural environments. Further accumulation of such evidence is necessary to better understand the value of rural tourism, particularly farm-related experiences. While it is anticipated that these relaxation effects may vary among individuals, a standardized empirical measurement has yet to be established.

To address this gap, based on empirical data collection, a statistical analysis was performed separately for the high-anxiety and low-anxiety groups in the State-Trait Anxiety Inventory (STAI) questionnaire. For this purpose, a multidisciplinary research team undertook this study, including agricultural and tourism economists specializing in rural tourism and nature therapy, and scientists with expertise in the therapeutic effects of rural environments. This paper specifically examines the psychological effects of rice harvesting activities in southern Chiba, a rural area on the southern peninsula of the Tokyo metropolitan region. The rice harvest program is part of a series of farm support volunteer tourism activities conducted in collaboration with local farmers, with participants mainly consisting of IT workers from Tokyo. We focused on IT workers in this research concerning higher level of mental stress

and the inherently stressful nature of their work [Weiss, 1983; Lallo et al., 2022; Takahashi et al., 2024]. Chiba Nature School (CNS), a non-profit organization, acts as an intermediary, providing accommodation in a renovated rustic farmhouse taken over by CNS. Rice, though facing declining consumption due to changing dietary preferences, remains a staple food and one of the most common farm products in Japan. Rice planting and harvesting are among the most popular farm experiences in the country. Thus, it is reasonable to focus on rice farming.

To fill the proposed gap, we conducted a survey in two stages: (1) the onsite and follow-up surveys conducted over 18 days after the rice harvest experience, and (2) the participants' attributes, and examined the relationships between life satisfaction, job satisfaction, and job stress. We present the statistical results of the multidisciplinary study, focusing on the psychological and mental stress-relieving effects of the rice harvest experience on participants, segmented by trait anxiety levels. Finally, we discuss the implications of these findings for developing evidence-based rural and volunteer farm tourism.

2. Literature review

Since this paper focuses on farm experiences and their stress-relieving effects, we review the literature on gardening and horticultural therapy. First, gardening, a common green environmental activity for urban residents, has been widely studied for potential health benefits.

Siah et al. [2023] reviewed restorative green environments in Singapore with a meta-analysis and emphasized the need for collaboration with mental health experts. Ainamani et al. [2022] reviewed gardening studies in low- and middle-income countries and highlighted the importance of promoting gardening's preventive health effects. In Europe, studies on gardening's health benefits are categorized into individual-based and community-based gardens. For individual-based gardening, Hassan et al. [2018] examined the physiological and psychological effects of gardening on 40 elderly populations in China, concluding that gardening can enhance relaxation. de Bell et al. [2020] analyzed the secondary data from a national survey in England to evaluate differences between those doing gardening and those not, finding a positive relationship between time spent gardening and well-being. However, participation in the harvesting activities and their effects on life, job satisfaction, and stress removal are still missing.

In recent years, studies on "garden therapy" have emerged. In terms of group-based or community gardening, Briggs et al. [2023] investigated the impact of group-based gardening on individuals with mental health issues through a meta-analysis of 24 studies, showing that it can alleviate symptoms of depression. Holloway et al. [2023] re-viewed 24 school gardening programs and concluded that such activities improve the health and well-being of school-aged children. Ambrose et al. [2023] found a positive relationship between community gardening and happiness using regression analysis on 119 households and 55 community gardeners in the US. Similarly, Daiz et al. [2022] confirmed the benefits of gardening by comparing 400 gardeners with non-gardeners in Central Philippines. Wästberg et al. [2019] explored garden therapy for six clients with common mental disorders in Sweden and found that it helped participants meet various needs through twice-narrative interviews and interpretation. Turovtseva et al. [2022] designed active garden therapy spaces as a case study in Ukraine for the elderly and disabled, recommending further development of garden therapy programs. Ward et al. [2022] conducted a case study of community gardens in Australia, revealing positive changes in participants' physical activity and psychological well-being. Odeh et al. [2022] compared art and gardening activities in 32 healthy women in the U.S.A., finding similar therapeutic benefits from both activities. Zutter and Stoltz [2023] in Canada and Elizalde and Lambertucci [2022] in Argentina found supportive results even in the COVID-19 lockdowns. To summarize, although agritourism-based therapy could impact more people through offering more therapeutic services, this kind of study has been scarce in the literature.

In Korea, agro-healing programs have been the focus of several studies [Jeong et al., 2020; Kim et al., 2021; Kim et al., 2022]. Agro-healing programs take advantage of the healing effects accrued to those involved in agriculture. Jeong et al. [2020] reviewed 83 agro-healing studies and research trends from 2010 to 2018, recommending a focus on socially disadvantaged groups. Kim et al. [2021] evaluated the service quality of agro-healing programs from an online survey on owners of agro-healing facilities and suggested improvements with an importance-performance analysis. Kim et al. [2022] assessed 183 samples collected from an online survey on 20s and 30s generations regarding stress awareness and demand for agro-healing programs with the Semantic Differential (SD) method, highlighting the need for a well-organized system. In summary, previous studies have not focused on a specific crop, leaving a gap that the authors aim to address.

Now, turning to horticultural therapy, which has been studied for its therapeutic benefits as well. Scott et al. [2022] reviewed the effects of horticultural activities on 178 community residents with dementia, finding positive impacts on mental and physical well-being. Heród et al. [2022] conducted a similar review on clients aged 60 and older, confirming horticulture's therapeutic effects. Gonzalez et al. [2011] studied the effects of therapeutic horticulture in 38 adults diagnosed with clinical depression in Norway, statistically showing significant improvements in mental health variables. Kim and Park [2023] examined horticultural therapy in Korea from a survey on 32 adults with Semantic Differential (SD) method, showing positive effects on depression in middle-aged women and improvements in psychophysiological aspects in adults, respectively. Kotozaki [2020] reported that horticultural activities improved mental health and cognitive function from the group t-test on 15 healthy postpartum women in Japan.

Studies on care farms, which offer agricare services, have also gained attention since the early 2010s. Bruin et al. [2013]

compared care farm programs for people with dementia, addiction, and autism in the Netherlands, noting that effects differed across these groups. Schreuder et al. [2014] found that care farms contributed to personal development in youngsters with the interpretative phenomenological analysis. In the UK, Leck et al. [2015] found positive relationships between time spent at Care Farms and well-being from 213 service users of 13 Care Farms, while Hemingway et al. [2016] emphasized the supportive environment these farms offer with the data collected from 15 Care Farm staff. Lee et al. [2019] examined farms providing agro-healing service in Korea and urged improvements in the professional skills of care farm operators. Deegan et al. [2023] explored social farming as a mental health intervention in Ireland through a case study. Ura et al. [2021] examined rice farming green care for 15 people with dementia in Japan with a non-parametric test, presenting promising evidence.

From a broader perspective, Berger and Tiry [2012] introduced the concept of nature therapy in Israel for people with psychiatric difficulties from a case study, emphasizing its potential for creative, non-verbal therapy. Haluza et al. [2014] performed a narrative review on 17 studies on the physiological effects of outdoor nature from a public health perspective, calling for interdisciplinary approaches. Coventry et al. [2021] examined nature-based outdoor activities through a meta-analysis of 50 papers, finding significant improvements in mental health outcomes. In summary, despite growing interest in the therapeutic benefits of agriculture and horticulture, individual differences in the psychological effects of farm experiences remain underexplored. This gap is critical for establishing evidence-based rural tourism and agritourism, as well as for effectively marketing these activities. Our study aims to fill this research gap by examining rice farming volunteer activities, a topic that has not been previously explored.

3. Materials and methods

3.1 Location and data collection process

The study took place in a paddy field located in southern Chiba, approximately 100 kilometres southwest of Tokyo, with relatively good access.

The field is a few minutes from a renovated traditional farmhouse owned by the Chiba Nature School (CNS). CNS, originally established as a nature school offering outdoor experiences for children, has been actively involved in building networks among rural tourism operators in collaboration with the Chiba Prefectural Government [Ohe, 2020: 255-265]. One of the authors has established an excellent rapport with CNS. The paddy field used in this study was made available by the local community to foster collaboration between local farmers, CNS, and volunteers. Before the survey, the authors conducted interviews in August 2019 with the leader of the volunteer group and representatives from CNS to develop an appropriate onsite questionnaire for the study.

Table 1: Timeline of rice harvest event and onsite survey

Time	Agenda
9:30	Meeting at the road station "Furari"
10:00-12:00	Rice-harvest operation
12:00-13:00	Complete questionnaire surveys
13:00-14:00	Lunch
15:00	End of event

Note: The rice harvest event and survey took place on August 19, 2019.

Tables 1 and 2 outline the timeline of the onsite questionnaire survey and the subsequent follow-up surveys, respectively.

The survey questionnaire collected demographic and professional information from the respondents, including occupation, age, gender, job stress levels, job satisfaction, and life satisfaction. To further explore the psychological effects of the rice harvest experience, standardized questionnaires, including a modified Semantic Differential (SD) method, the Profile of Mood States (POMS), and the STAI, were employed. Ethical approval for the onsite survey was obtained from the Research Ethics Committee of the Graduate School of Horticulture, Chiba University, Japan (approval number 19-03).

The onsite survey was conducted on August 25, 2019, the day of the rice harvest. The primary objective was to assess the harvest's immediate psychological effects and investigate how long these effects persisted post-event. Respondents were asked to complete printed follow-up survey sheets at intervals of one day, three days, five days, seven days, and up to 18 days

Table 2: Time schedule of a series of questionnaire surveys

Days after the rice harvest event	Place of survey	Conducted Surveys				
		SD method	POMS2	*Jikaku-sho shirabe* *	Work/life satisfaction	Attributes
On the day	Onsite	×	×	×	×	×
One day	Office	×	×	×	–	–
Three days	Office	×	×	×	–	–
Five days	Office	×	×	×	–	–
Seven days	Home	×	×	×	–	–
Eighteen days	Office	×	×	×	–	–

Notes: 1. "×" indicates the survey was conducted, while "–" indicates it was not conducted. 2. * *Jikaku-sho shirabe* refers to the questionnaire used for recording feelings of fatigue.

after the rice harvest. The control period was set at 18 days, representing the baseline state where the psychological effects of rice harvest participation had fully dissipated. Upon completion of the survey, the researchers requested that the respondents return the completed questionnaires via postal mail.

Before the survey began, we obtained written consent from all 29 participants and distributed the questionnaires to them. Of the 29 participants, 22 completed all surveys, providing a full-response sample size for evaluating life satisfaction. However, only 19 participants were included in the analysis for the high anxiety estimation model, except for changes in the "*Jikaku-sho shirabe*" measure. Readers may raise questions about the small sample size used in this study. As we mentioned in the literature review, most pilot studies utilize relatively small sample sizes. In the field of forest therapy research, a meta-review by Chae et al. [2021] reported that over 53.8 % of studies included fewer than 20 participants. For instance, Li [2010] conducted a study on forest bathing and immune function with 12 participants. Similarly, Morison et al. [2024] explored the effects of nature therapy on the well-being of internal medicine residents with a sample of 15 participants, while Bielinis et al. [2021] examined the psychological outcomes of snow-covered forest therapy with 22 participants. Therefore, our study is also a pilot study on the rice harvesting volunteers and does not have an exceptionally small sample size.

3.2 Details in assessment methods of the psychological effects

To assess the psychological effects of the rice harvest, the study utilized three key psychological indicators: the POMS 2 short version, the modified Semantic Differential (SD) method, and the *Jikaku-sho shirabe* questionnaire (used to measure subjective symptoms of fatigue). Both POMS and the SD method have been widely employed in previous research (for POMS 2, see Heuchert and McNair [2012]; Lin et al. [2014]; and for POMS 2 and SD method applications, see Lee et al. [2014]; Song et al. [2015; 2019]. The *Jikaku-sho shirabe* was initially developed in 1970 to assess fatigue levels among Japanese workers and was updated in 2002 [Itani, 2002]. It has been applied in physical education [Kobayashi et al., 2001; Kobayashi and Demura, 2002] and labor science [Nagata and Ikezaki, 2024].

First, the POMS 2 short version evaluated participants' mood states using 35 items across five negative mood subscales—Anger-Hostility (A-H), Confusion-Bewilderment (C-B), Depression-Dejection (D-D), Fatigue-Inertia (F-I), and Tension-Anxiety (T-A)—and two positive mood subscales, Vigor-Activity (V-A) and Friendliness (F) [Heuchert and McNair, 2012; Lin et al., 2014]. The POMS questionnaire is widely used globally, with the reliability and validity of the Japanese version confirmed [Heuchert and McNair, 2015]. To reduce the burden on participants, the shortened 35-item adult version was used, with responses rated on a 5-point Likert scale ranging from "Not at all (0)" to "Very often (4)" [Heuchert and McNair, 2015]. Additionally, the total mood disturbance (TMD) score was calculated using the following formula: ([A-H] + [C-B] + [D-D] + [F-I] + [T-A] – [V-A]) [Heuchert and McNair, 2012; 2015; Lin et al., 2014]. Lower TMD scores indicate a more positive state of mood.

Second, the modified SD method used three opposing adjective pairs—"comfortable-uncomfortable," "relaxed-awakening," and "natural-artificial"—to assess participants' impressions of the rice harvest subjectively. Responses were measured on a 13-point scale, ranging from 'very comfortable/relaxed/natural (+6)' to 'very uncomfortable/awakening/artificial (–6)' [Osgood et al., 1957].

Third, the *Jikaku-sho shirabe* questionnaire [Itani, 2002; Working Group for Occupational Fatigue, 2023] assessed participants' fatigue levels. Developed by the Research Group of Occupational Fatigue, part of the Japan Society for Occupational Health, this tool has been widely used in studies on Japanese workers [Sasaki and Matsumoto, 2005; Kubo et al., 2011]. It consists of 25 items divided into five factors: drowsiness, instability, uneasiness, local pain or dullness, and eye strain. Responses were rated on a 5-point scale ranging from "disagree completely (1)" to "strongly agree (5)."

To classify respondents into two groups and examine differences in anxiety levels, the STAI was used to assess participants' trait anxiety [Spielberger et al., 1970]. The Japanese version (STAI-JYZ), modified to reflect cultural factors and validated for reliability, was used in this study [Hidano et al., 2000; Iwata and Higuchi, 2020]. This inventory consists of 20 questions rated on a 4-point scale, from "almost never (1)" to "almost always (4)," with higher scores indicating higher levels of pre-existing anxiety. To account for gender differences, the scores were converted into standardized scores and divided into five levels of trait anxiety [Hidano et al., 2000]. Participants with a standard score of 45 or higher (Levels 3, 4, and 5) were categorized into the high-anxiety group, while those with a score of 44 or lower (Levels 1 and 2) were placed in the low-anxiety group. This classification was used for statistical tests to examine differences between the two groups.

This study hypothesizes that the rice harvest experience will generate greater psychological benefits for the high-anxiety group compared to the low-anxiety group. This hypothesis will be tested in the following sections of the study.

3.3 Outline of the survey results

Table 3 provides an overview of the participants' attributes. In terms of attendance, nearly 60 % of respondents came with their family (59.1 %), followed by those who came alone (13.6 %) and those who came with friends (13.6 %). The majority of respondents were male (72.7 %) and married (81.8 %). The average age was 38.8 years, with the youngest being 23 and the oldest 46, indicating that most participants were in their 30s and early 40s. With respect to the educational background of the respondents, more than two-thirds (68.2 %) were college graduates, followed by 18.2 % with graduate-level education.

Table 3: Attributes and respondents

Coming with whom			Occupation		
Item	% (sample size)		Item	% (sample size)	
Family	59.1	(13)	Company executive	40.9	(9)
Alone	18.2	(4)	Company administrative	27.3	(6)
Friends	13.6	(3)	Company employee	22.7	(5)
Family and friends	9.1	(2)	Layer	9.1	(2)
Total	100.0	(22)	Total	100.0	(22)
Gender			Overnight stay before the event		
Item	% (sample size)		Item	% (sample size)	
Male	72.7	(16)	No	54.6	(12)
Female	27.3	(6)	Yes	45.5	(10)
Total	100.0	(22)	Total	100.1	(22)
Age			Going to a hot spring afterwards		
Item	% (sample size)		Item	% (sample size)	
20s	4.5	(1)	No	54.5	(12)
Early 30s (30-34)	9.1	(2)	Yes	31.8	(12)
Late 30s (35-39)	40.9	(9)	Not decided	13.6	(3)
Early 40s (40-44)	31.9	(7)	Total	100.0	(22)
Late 40s (45-49)	13.6	(3)			
Total	100.0	(22)			
Academic background			No. time participating in the rice harvest		
Item	% (sample size)		Item	% (sample size)	
University	68.1	(15)	1	50.0	(11)
Graduate school	18.2	(4)	2	31.8	(7)
Hight school	9.1	(2)	3-4	9.1	(2)
Junior college/vocational school	4.6	(1)	5 times or more	9.1	(2)
Total	100.0	(22)	Total	100.0	(22)

This indicates that the participants were generally well-educated. As for occupation, 40 % of the participants were company board members, and more than 90 % of the respondents worked in private companies. The remainder included legal professionals (9.1 %). This suggests that the participants hold managerial or professional positions more often than is typical for such events. Regarding their stay, more than half (54.5 %) arrived the day before the event, and more than half (54.5 %) did not plan to visit a hot spring after the rice harvest. Half of the participants (50 %) attended the rice harvest for the first time, while nearly a third (31.8 %) attended for the second time. This shows that the participants were relatively inexperienced in rice harvesting.

Next, commuting time, job stress, job satisfaction, and life satisfaction were analyzed (Table 4). The most common daily commute time was one and a half hours (45.5 %), followed by one hour (31.8 %). Commuting times of over two hours were reported by 18.2 % of the respondents.

Regarding job stress, participants rated their stress levels on a 7-point Likert scale, with an average score of 5.3. Notably, 40.9 % of respondents rated their job stress at level 6, indicating relatively high stress levels. Job satisfaction was also measured on a 7-point scale, with an average score of 4.55, suggesting that the respondents were somewhat satisfied with their jobs. Life satisfaction followed a similar pattern, with an average score of 5.05, indicating mild satisfaction with life. Descriptive statistics for all variables are shown in Table 5.

3.4 Job and life satisfaction

Using the survey data, the researchers analyzed the relationship between life satisfaction, job stress, job satisfaction, anxiety levels, and other attributes using ordered logit models. Two models were estimated: one for life satisfaction and one for high/low anxiety.

Table 6 presents the results of the life satisfaction model. Although the results of pseudo R^2 are not high, which is not uncommon in the case of models using qualitative variables [Lei and Ohe, 2018; Mitsuyama and Ohe, 2019; Kojima and Ohe, 2025]. The models do not aim at forecasting, but at seeing the statistical significance of variables. Thus, what matters most is the significance levels of estimated parameters.

The results show that life satisfaction (measured on a 7-point scale) is significantly influenced by job satisfaction (also measured on a 7-point scale) and anxiety level (with high anxiety

Table 4: Job and life satisfaction

Commuting time		
Item	% (sample size)	
Within 1.5 hours	45.5	(10)
Within 1 hour	31.8	(7)
Within 2 hours	18.2	(4)
Within 30 minutes	4.5	(1)
Total	100.0	(22)

Job satisfaction		
Item	% (sample size)	
Very satisfied 7	9.1	(2)
6	18.2	(4)
5	31.8	(7)
4	18.2	(4)
3	9.1	(2)
2	9.1	(2)
Very dissatisfied 1	4.5	(1)
Total	100.0	(22)

Job stress		
Item	% (sample size)	
Very much 7	13.6	(3)
6	40.9	(9)
5	22.7	(5)
4	9.1	(2)
3	13.6	(3)
2	0	(0)
Very little 1	0	(0)
Total	99.9	(22)

Life satisfaction		
Item	% (sample size)	
Very satisfied 7	9.1	(2)
6	40.9	(9)
5	18.2	(4)
4	18.2	(4)
3	9.1	(2)
2	0	(0)
Very dissatisfied 1	4.5	(1)
Total	100.0	(22)

Table 5: Descriptive statistics of variables

Variable	Mean	Sample size	Std. Dev.	Min.	Max.
Coming with whom (4 types)	2.5909	22	0.9081	1	4
Overnight stay before the event (yes = 1, no = 0)	0.4545	22	0.5096	0	1
Plan to go to a hot spring (3 types)	0.5909	22	0.7341	0	2
No. rice harvest experiences before	1.9091	22	1.2690	1	5
Job type (6 types)	2.1818	22	1.4683	1	6
Commuting hour	1.7727	22	0.8125	0	3
Job satisfaction level (7-stage scale)	4.5455	22	1.5954	1	7
Job stress level (5-stage scale)	5.3182	22	1.2492	3	7
Life satisfaction level (7-stage scale)	5.0455	22	1.4631	1	7
Sex: Male (yes = 1, no = 0)	0.7273	22	0.4558	0	1
Age	38.8181	22	5.0863	23	46
Marital status (yes = 1, no = 0)	0.8182	22	0.3948	0	1
Academic background (4-stage scale)	3.9545	22	0.7854	2	5

Table 6: Life satisfaction and job stress (ordered logit model)

Model	Model 1		Model 2		Model 3	
Item	Parameter	Z-value	Parameter	Z-value	Parameter	Z-value
Explained variable	Life satisfaction (6 levels)				High Anxiety (yes = 1, no = 0)	
Job satisfaction (7 levels)	0.6696 **	2.01	0.8893 **	2.53	–	–
Job stress level (5 levels)	–0.8826 **	–2.10	–	–	2.0410**	1.97
Management position (yes = 1, no = 0)	–	–	–1.5587 *	–1.73	–	–
Sample size	22	22	19			
LR Chi2	13.13 ***	11.17 ***	9.24 ***			
Pseudo R^2	0.1910	0.1626	0.3627			

coded as 1 and low anxiety as 0). As expected, job satisfaction positively influenced life satisfaction, while higher anxiety negatively impacted life satisfaction. Therefore, participants with higher job satisfaction and lower anxiety reported higher life satisfaction.

The results for the anxiety group show that job stress (measured on a 7-point scale) had a significant positive relationship with anxiety levels. Thus, higher job stress was associated with higher anxiety. However, other variables, such as age, sex, commuting time, managerial position, previous participation in the rice harvest, and type of participation (alone, with friends, or with family), did not yield statistically significant results. These results suggest that the context of daily life is a more significant determinant than the types of event participation. These results also suggest that daily involvement in farm activity can be more effective for those IT workers.

In summary, the participants were predominantly male, well-educated, and held managerial positions. They were mostly married and attended the event with their families. Despite experiencing job stress, they reported mild satisfaction with both their jobs and lives. This makes them suitable subjects for the detailed empirical evaluation of the psychological effects of the rice harvest, which will be explored in the following sections.

3.5 Psychological effects

SPSS 28.0 (IBM Corp., USA) was used for statistical analysis. The value of $p < 0.05$ was considered statistically significant. To examine the psychological effects of the rice harvest, data from the POMS 2 short version, modified SD method, and *Jikaku-sho shirabe* questionnaire were evaluated using the Wilcoxon signed-rank test. Measurements were taken on the day of the harvest, as well as 1, 3, 5, and 7 days later, with the results after 18 days used as a control. To correct for Family-Wise Error in multiple comparisons, the Holm correction [Victor et al., 2010] was applied.

In addition, a mixed-design two-factor analysis of variance

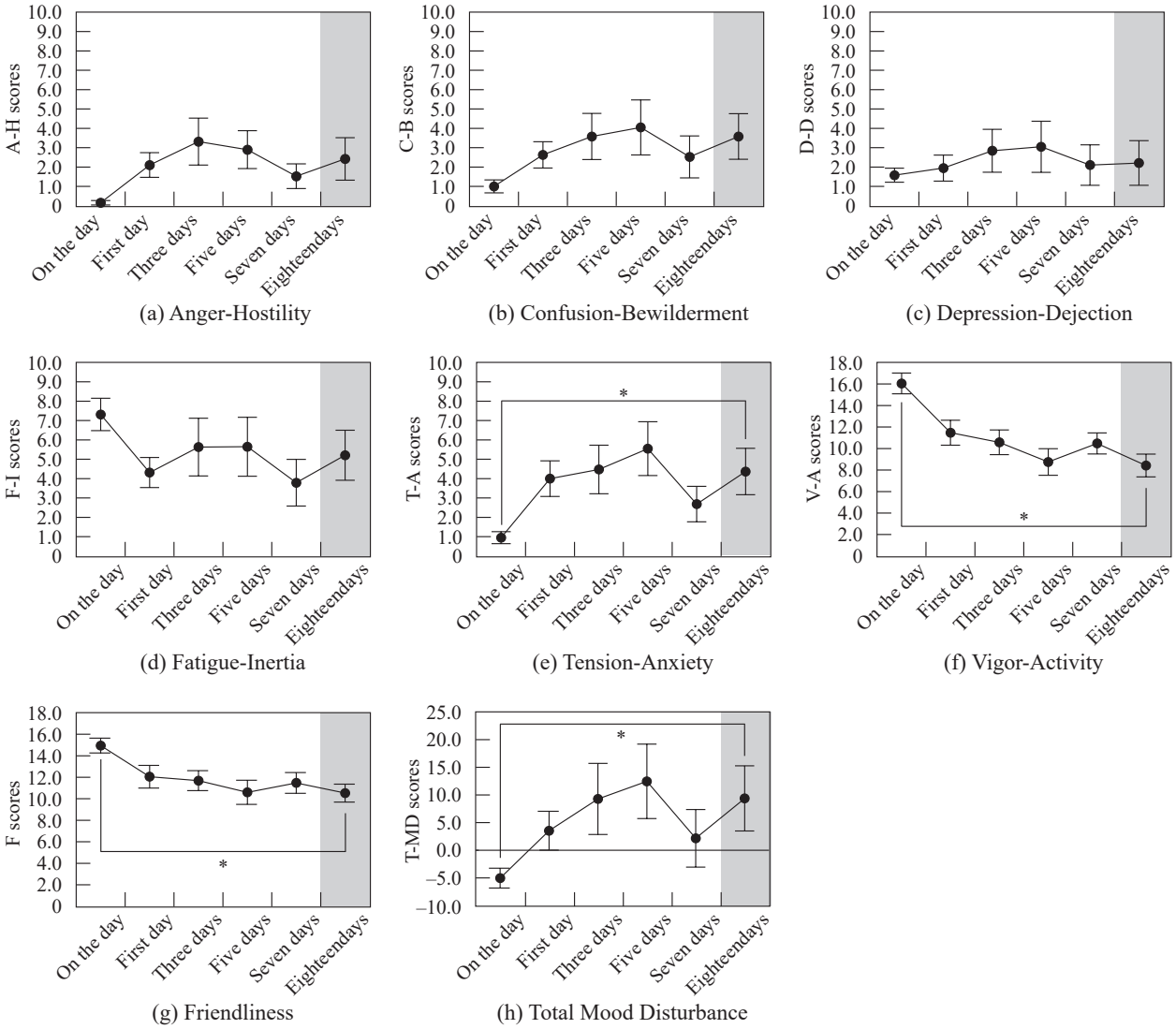

Figure 1: Changes in POMS 2 short version due to rice harvest

Notes: $N = 19$, mean ± standard error, * $p < 0.05$, Wilcoxon signed rank test, Holm correction.

(ANOVA) was conducted to investigate differences in participants' trait anxiety and time course. The independent variables were trait anxiety levels (high-anxiety vs. low-anxiety groups) and time course (day of the harvest vs. 18 days later). The dependent variable was the participants' subjective assessment scores.

4. Results

4.1 Psychological effects of the rice harvest

The psychological effects of the rice harvest are illustrated in Figures 1, 2, and 3 for the POMS 2 short version, the modified SD method, and the *Jikaku-sho shirabe*, respectively, using results 18 days after the experience as a control.

4.1.1 POMS 2 short version

The results, depicted in Figure 1, show the effects of the rice harvest on various psychological scales. The vertical axis represents the score for each item, while the horizontal axis shows the days following the harvest. The rice harvest experience led to a significant reduction in the "Tension-Anxiety" scale score and a significant increase in the "Vigor-Activity" and "Friendliness" scale scores compared to the control. Additionally, the "Total Mood Disturbance" scale score decreased significantly. However, no significant differences were observed between controls and the 1, 3, 5, and 7-day intervals for other scales like "Anger-Hostility, "Confusion-Bewilderment," "Depression-Dejection," and "Fatigue-Inertia."

In summary, the rice harvest experience reduced mental stress by decreasing "Tension-Anxiety" and improving positive feelings such as "Vigour-Activity" and "Friendliness."

4.1.2 Modified SD method

As shown in Figure 2, participants perceived the rice harvest experience as significantly more comfortable and relaxing than the control. However, these effects did not last, as no significant differences were observed between the controls and the scores 1, 3, 5, and 7 days after the harvest.

4.1.3 Jikaku-sho shirabe

The results from the *Jikaku-sho shirabe* (Figure 3) indicated no significant differences in either the total score or individual items compared to the control. Thus, the rice harvest experience did not have an effect on self-reported symptoms of fatigue.

4.2 Effects of participants' trait anxiety and time course (two-way ANOVA)

4.2.1 POMS 2 short version

In the POMS 2 short version, a simple main effect test was conducted because interactions were found in the "Anger-Hostility," "Confusion-Bewilderment," "Depression-Dejection," "Fatigue-Inertia," "Tension-Anxiety," and "Total Mood Disturbance" scale scores. In the "Vigor-Activity" and "Friendliness" scale scores, only the main effect of the time course was

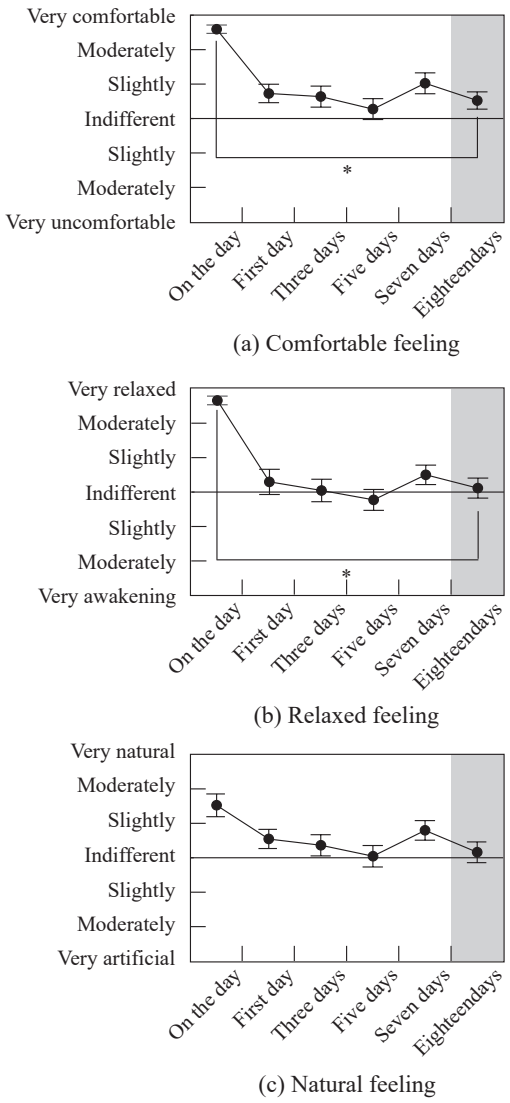

Figure 2: Changes in the modified SD method due to rice harvest

Notes: $N = 22$, mean ± standard error, * $p < 0.05$, Wilcoxon signed rank test, Holm correction.

significant, and the interaction was not significant.

"Anger-Hostility" (Figure 4): Significant main effects of trait anxiety (F (1, 17) = 8.90, p = 0.008), time course (F (1, 17) = 5.28, p = 0.034), and their interaction (F (1, 17) = 7.01, p = 0.017) were found. A simple main effect test revealed that the high-anxiety group had significantly lower "Anger- Hostility" scores on the day of the rice harvest compared to 18 days later (F (1, 17) = 12.55, p = 0.003). The "Anger-Hostility" scale scores of the high-anxiety group were significantly higher than those of the low-anxiety groups 18 days later (F (1, 17) = 6.18, p = 0.024). This suggests that the rice harvest experience contributed to a reduction in anger-hostility emotions, particularly for participants with high anxiety.

"Confusion-Bewilderment" (Figure 5): Significant main effects of trait anxiety (F (1, 17) = 13.16, p = 0.002), time course (F (1, 17) = 9.31, p = 0.007), and their interaction (F (1, 17) = 5.89, p = 0.027) were also found. A simple main effect test showed

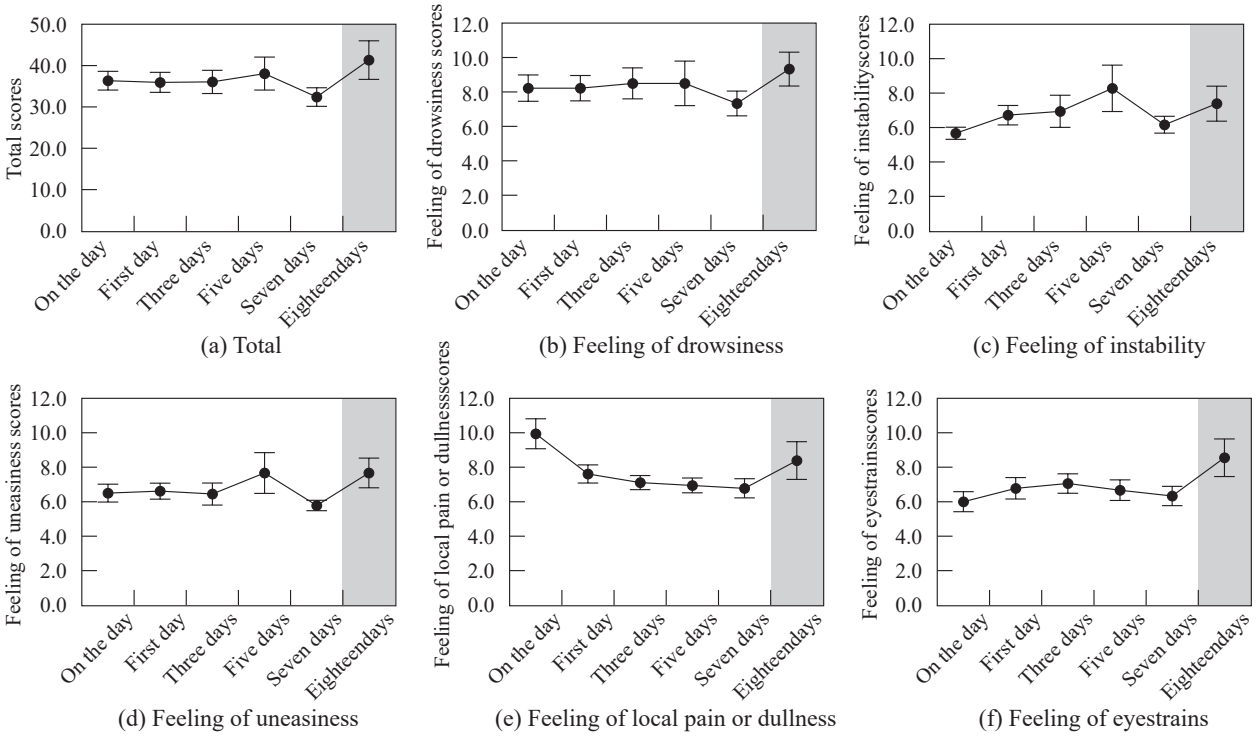

Figure 3: Changes in "*Jikaku-sho shirabe*" due to rice harvest

Notes: $N = 18$, mean ± standard error, Wilcoxon signed rank test, Holm correction.

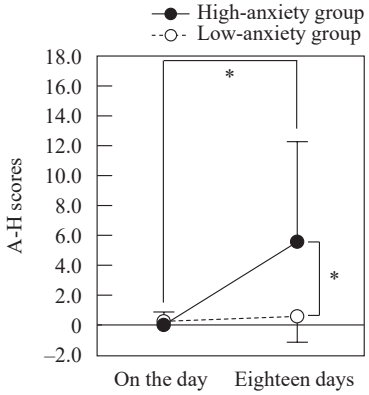

Figure 4: Changes in the POMS 2 short version of the "anger-hostility (A-H)" scale score by trait anxiety due to rice harvest

Notes: High-anxiety group $N = 7$, low-anxiety group $N = 12$, mean ± standard deviation, * $p < 0.05$, two-way ANOVA.

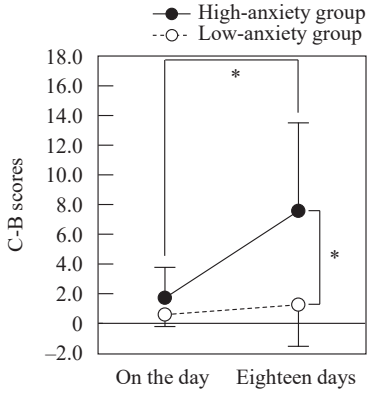

Figure 5: Changes in the POMS 2 short version of the "confusion-bewilderment (C-B)"scale score by trait anxiety due to rice harvest

Notes: High-anxiety group $N = 7$, low-anxiety group $N = 12$, mean ± standard deviation, * $p < 0.05$, two-way ANOVA.

that in the high-anxiety group, the "Confusion-Bewilderment" scale score was significantly lower on the day of rice harvest than 18 days later (F (1, 17) = 11.88, $p = 0.003$). The "Confusion-Bewilderment" scale scores of the high-anxiety group were significantly higher than those of the low-anxiety group 18 days later (F (1, 17) = 10.08, $p = 0.006$). These findings highlight the potential of rice harvest experiences to reduce confusion and bewilderment, especially for high-anxiety individuals.

"Depression-Dejection" (Figure 6): Significant main effects of trait anxiety (F (1, 17) = 5.09, $p = 0.038$) and an interaction effect (F (1, 17) = 4.12, $p = 0.058$) were found. No significant time course effect was observed. A simple main effect test showed that at 18 days, the "Depression–Dejection" scale score of the high-anxiety group was significantly higher than that of the low-anxiety group (F (1, 17) = 5.12, $p = 0.037$). For both the high and low anxiety groups, there was no significant difference between the scores on the day of rice harvesting and 18 days later.

"Tension-Anxiety" (Figure 7): Significant main effects of trait anxiety (F (1, 17) = 7.54, $p = 0.014$), time course (F (1, 17) = 23.69, $p < 0.001$), and their interaction (F (1, 17) = 14.69, p = 0.001) were found. A simple main effect test showed that in the high-anxiety group, the "Tension-Anxiety" scale score was significantly higher on the day of rice harvest than 18 days later (F

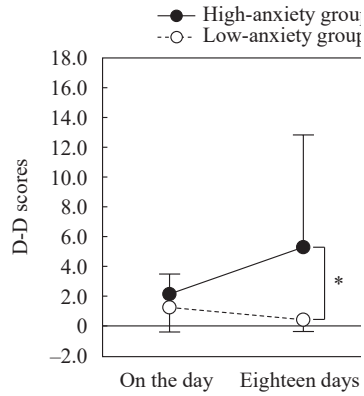

Figure 6: Change in the POMS 2 short version of the "depression-dejection (D-D)" scale score by trait anxiety due to rice harvest

Notes: High-anxiety group $N = 7$, low-anxiety group $N = 12$, mean ± standard deviation, * $p < 0.05$, two-way ANOVA.

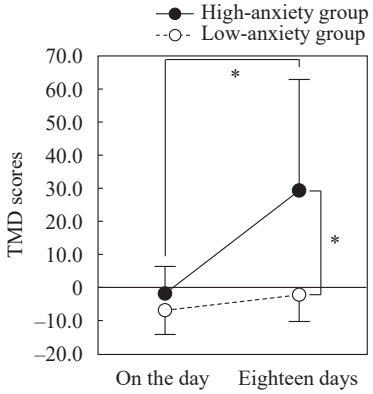

Figure 8: Changes in the POMS 2 short version of the "total mood disturbance (TMD)" scale score by trait anxiety due to rice harvest

Notes: High-anxiety group $N = 7$, low-anxiety group $N = 12$, mean ± standard deviation, * $p < 0.05$, two-way ANOVA.

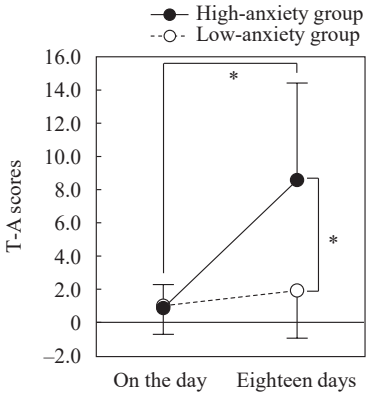

Figure 7: Changes in the POMS 2 short version of the "tension-anxiety (T-A)" scale score by trait anxiety due to rice harvest

Notes: High-anxiety group $N = 7$, low-anxiety group $N = 12$, mean ± standard deviation, * $p < 0.05$, two-way ANOVA.

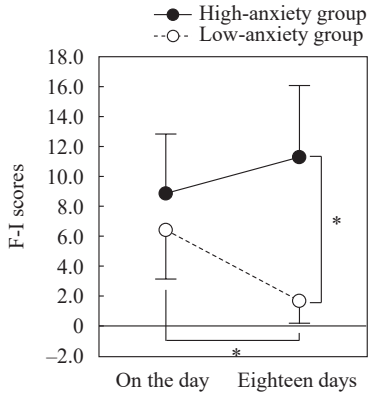

Figure 9: Changes in the POMS 2 short version of the "fatigue-inertia (F-I)" scale score by trait anxiety due to rice harvest

Notes: High-anxiety group $N = 7$, low-anxiety group $N = 12$, mean ± standard deviation, * $p < 0.05$, two-way ANOVA.

(1, 17) = 29.96, $p < 0.001$). In addition, the "Tension-Anxiety" scale scores of the high-anxiety group were significantly higher than those of the low-anxiety group 18 days (F (1, 17) = 11.22, $p = 0.004$). This supports the hypothesis that rice harvest experiences can reduce tension and anxiety.

"Total Mood Disturbance" (Figure 8): Significant main effects of trait anxiety (F (1, 17) = 10.52, $p = 0.005$), time course (F (1, 17) = 13.08, $p = 0.002$), and their interaction (F (1, 17) = 7.15, $p = 0.016$) were observed. A simple main effect test showed that in the high-anxiety group, the "Total Mood Disturbance" score was significantly lower on the day of rice harvest than 18 days later (F (1, 17) = 15.67, $p = 0.001$). At 18 days, the "Total Mood Disturbance" score of the high-anxiety group was significantly higher than that of the low-anxiety group (F (1, 17) = 10.00, $p = 0.006$). The results are also consistent with our hypothesis and demonstrate the positive psychological effect of the rice harvest experience.

"Fatigue-Inertia" (Figure 9): The "Fatigue-Inertia" scale exhibited a different change than the other scale scores. Significant main effects of trait anxiety (F (1, 17) = 48.85, $p < 0.001$) and an interaction (F (1, 17) = 7.34, $p = 0.015$) were found. However, no significant effect of time course was observed. A simple main effect test showed that in the low-anxiety group, the "Fatigue-Inertia" scale score was significantly higher on the day of rice harvest than 18 days later (F (1, 17) = 8.72, $p = 0.009$). At 18 days, the "Fatigue-Inertia" scale score of the high-anxiety group was significantly higher than that of the low-anxiety group (F (1, 17) = 42.90, $p < 0.001$).

5. Discussion

The discussion of this paper highlights the significant psychological effects of rice harvest experiences on participants, particularly when considering trait anxiety. Here are the key points summarized:

5.1 Positive psychological effects

POMS 2 Short Version Results: The experience of rice harvesting led to significant improvements in mental well-being. Specifically, scores for "Tension-Anxiety" and "Total Mood Disturbance" decreased, while "Vigor-Activity" and "Friendli-

ness" increased.

Modified SD Method: Participants reported increased feelings of comfort and relaxation on the day of the harvest compared to 18 days later. This is consistent with findings from nature-based activities like forest walks, though it's a novel finding for farm experiences.

5.2 Trait anxiety and its impacts

The high-anxiety group demonstrated greater psychological benefits from the rice harvest experience than the low-anxiety group. Specifically, negative emotions like "Anger-Hostility" and "Depression-Dejection" were significantly reduced, supporting the hypothesis that farm experiences may be particularly effective for individuals with higher anxiety.

These findings align with research in nature-based therapies (such as forest walks) but are pioneering in farm experiences like rice harvesting.

5.3 Implications for rural tourism

The results suggest that rural tourism, particularly farm volunteer experiences, can target individuals with high anxiety, such as urban workers in high-stress professions like IT. By offering empirically supported benefits, rural tourism can be marketed more effectively to these groups.

This research can contribute to developing evidence-based rural tourism by emphasizing the positive externalities and mental health benefits of agricultural activities. Ultimately, it contributes to the healthy and sustainable urban life of those participating in these tourism activities in rural areas.

5.4 Novel findings

The study is one of the first to focus on the individual differences in psychological responses to agricultural experiences based on anxiety levels, providing empirical evidence for tailoring rural tourism offerings to specific psychological needs.

Overall, the results suggest that rice harvest experiences have measurable psychological benefits, particularly for individuals with high anxiety, and that these findings can be applied to enhance the appeal and effectiveness of rural tourism programs.

6. Conclusions

In this paper, we have clarified the effects of the relaxation brought by agricultural experiences in a stress-prone society, which is expected to intensify further. This content aligns with Sustainable Development Goal 3: Good Health and Well-being for a sustainable community and healthier people. Thus, the conclusion of the paper emphasizes the significant findings regarding the psychological benefits of rice harvest experiences, particularly for individuals with high anxiety. Participating in rural tourism ultimately helps to release stress and contributes to the sustainable mental health of urban people. Here's a summary of the key takeaways:

6.1 Psychological benefits

The study provides empirical evidence that participating in farm experiences, specifically rice harvesting, relieves mental stress and promotes feelings of comfort and relaxation, especially for individuals with high anxiety.

This is the first study to highlight the individual differences in psychological effects between high- and low-anxiety participants during agricultural activities.

6.2 Targeting high-anxiety groups

The study participants, largely IT workers, represent a group prone to high stress due to the fast pace of technological development. The contrast between their typical work environment and the manual, relaxing nature of farm work is significant, making farm experiences valuable for balancing work and life.

The findings suggest that rural tourism, especially farm volunteer experiences, can serve as a preventative measure for mental health issues in high-stress professions, such as those in the IT sector.

6.3 Implications for rural tourism

This mental health benefit can be reinforced through repeat visits, which would be valuable for marketing efforts aimed at encouraging regular or repeat visits.

Farm volunteer tourism can be marketed as an attractive option for mental health maintenance, particularly for urban professionals facing high stress. This mental health function distinguishes rural tourism from other types of tourism.

The study emphasizes the importance of evidence-based rural tourism, encouraging further research to explore the mental health benefits of different agricultural experiences.

6.4 Future research

The paper suggests that more scientific evidence should be accumulated across various agricultural contexts and circumstances to further understand the mental health benefits of rural tourism and to enhance its appeal through targeted marketing.

In conclusion, this study contributes to the growing body of evidence supporting the mental health benefits of farm volunteer tourism, particularly for high-anxiety individuals. The findings have practical implications for rural tourism marketing and suggest future research directions to strengthen the scientific basis for promoting these experiences. Finally, the duration of psychological effects should be examined in more detail and further research is required on other crops with different seasonality in different regions.

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