

*Full Length Research Paper*

# **Comparisons of game usage time and game usage-related factors in Japanese women before pregnancy and during early pregnancy**

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**Considering the increase in game usage among young people, many women may use games before pregnancy. However, it has not been shown whether game usage time changes in women after they become pregnant. This study was carried out to compare game usage time and game usage-related factors in Japanese women before pregnancy and during early pregnancy. We recruited pregnant women during the first trimester. We conducted a web questionnaire survey in 351 pregnant women. The time spent playing games was significantly shorter during the early gestation period than before pregnancy, and 35.7% of the women who played games before pregnancy did not play games in the early gestation period. We divided women who played games before pregnancy into two groups: one group of women who played games both before and in the early gestation period (n=133) and one group of women who played games before pregnancy but did not play games in the early gestation period (n=74). The proportion of women who smoked before pregnancy and the proportion of women who thought they might have game addiction were significantly higher in women who played games both before and in the early gestation period. The proportion of partners who played games was also significantly higher for women who play games both before and in the early gestation period. We found that many women stopped playing games or reduced their game usage time after becoming pregnant. Careful observation may be required for women who continue to play games during pregnancy.**

**Key words:** Pregnant women, game usage, before pregnancy, early pregnancy.

## **INTRODUCTION**

It is known that pregnancy is a trigger for women to take action to improve their lifestyle habits for the health of both the mother and the fetus. As one example, many women who become pregnant quit smoking or reduce the number of cigarettes they smoke because of the harmful

effects of smoking during pregnancy. Pickett et al. (2003) reported that women in the US with a smoking habit stopped smoking or reduced the number of cigarettes they smoked when they become pregnant. It has also been reported that women in Japan with a smoking habit

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tried to quit smoking when they become pregnant (Ueda et al., 2020) and that the proportion of women in Japan with a smoking habit after becoming pregnant was lower than that before pregnancy (Yasuda et al., 2013). Ethen et al. (2009) reported that many women in the US with an alcohol drinking habit stopped drinking after they became pregnant, and it was reported that 76.9% of Japanese women who had a history of alcohol drinking stopped drinking after they became pregnant (Yamamoto et al., 2008). It has also been reported that women's eating habits changed after pregnancy. A study conducted in Japan showed an increase in the frequency of eating three times a day, improvement in meal regularity, and a decrease in the frequency of eating out for women after becoming pregnant (Souma, 2011). On the other hand, in a study conducted in Finland, it was shown that sleep duration was longer in the first trimester of pregnancy than that before pregnancy but that the quality of sleep in the first trimester was lower than that before pregnancy (Hedman et al., 2002). In a cross-sectional survey conducted in Japan, it was shown that sleep duration was longer and sleep duration in the daytime increased in the third trimester of pregnancy compared to those before pregnancy but that the proportion of women with insomnia increased in the third trimester of pregnancy (Souma, 2011).

In recent years, gaming disorder (GD) has become a social problem due to the increase in game usage among young people. A recent systematic review showed that the prevalence of GD in the young generation was 3.05% (Stevens et al., 2021). Considering the increase in game usage, many women may use games before pregnancy. During pregnancy, women are known to change to healthier behaviors, but some lifestyle habits remain the same. These lifestyle habits can have a positive or negative impact on women's lives. One such habit is game use, which has become more common in recent years. Padilla-Walker et al. (2010) reported that video game use in adulthood was associated with negative outcomes, alcohol drinking, drug use, and lower quality of relationships with friends and parents. Weaver et al. (2009) showed in a survey of adult men and women that game users had higher BMI than that of non-users. Although game use as a habit may have an impact on pregnant women, it is not clear whether women stop or continue to use games after they become pregnant. It has also not been shown whether game usage time changes or not.

This study was carried out to compare game usage time and game usage-related factors in Japanese women before pregnancy and during early pregnancy.

## SUBJECTS AND METHODS

The survey was conducted at a birth center in Japan in which the number of births is approximately 700 per year. The researchers explained the aims of the study and methods to be used in the

study to 616 pregnant women who visited the birth center for a medical check in their first trimester. For 568 pregnant women who agreed to participate in the study, we distributed QR codes for the online survey and conducted the survey by using Survey Monkey, which is an online questionnaire creation and operation tool. Data were obtained for women in their first trimester of pregnancy between April 2021 and March 2022. The necessary sample size was determined to be 172 by using effect size (0.3), a coefficient (0.05), power (0.95), and degree of freedom (2).

Women in their first trimester of pregnancy who underwent prenatal checkups and consented to participate in the study were recruited. We excluded women who were younger than 20 years of age, women who did not have a spouse (or partner), and women who had a plan for delivery at another birth center during pregnancy. We also excluded women who needed antenatal care in a tertiary care facility such as women with multiple pregnancies, women who were previously treated for severe hypertension, diabetes, schizophrenia, or severe depression prior to pregnancy, and women who were receiving treatment for those diseases. Pregnant women who had difficulty completing the questionnaire due to mental or physical problems were also excluded.

The questionnaire consisted of five parts with questions on background characteristics, game usage, daily life behavior and thoughts about game usage in the early gestation period, daily life behavior before pregnancy, and Internet Gaming Disorder Scale (IGDS). The first part regarding background characteristics included questions on gestational weeks, employment, smoking habit, alcohol drinking habit, age of the partner, and the partner's game usage in the past month. The second part regarding game usage included questions about experience in offline game use (not connected to the Internet), age when starting to use offline games, experience with online game use (connected to the Internet), age when starting to use online games, game usage before pregnancy, time spent playing games per day before pregnancy, game usage in the past month, time spent playing games per day in the past month, and the reason for not playing games in the early gestation period for women who played games before pregnancy. The third part of the questionnaire regarding daily life behavior in the past month included questions on sleeping hours per day, regularity in wake-up time and bedtime, whether there were days when good sleep was not possible due to game usage, whether there were days when meals were not cooked due to game usage, whether there were days without regular meals (3 meals/day) due to game usage, frequency of eating ready-to-eat meals (e.g., instant food, precooked food and fast food), presence of friends or acquaintances (other than family members) for whom consultation by face-to-face communication is possible, whether there is a feeling that it is difficult to achieve personal relationships by face-to-face communication, whether there is a feeling that game usage has had a negative effect on a child's or children's development, whether there is a feeling that game usage is addictive, whether there is a feeling of ever having game addiction, and whether there is a feeling of not having sufficient time for playing games because of pregnancy or because of child-rearing. The fourth part of the questionnaire regarding daily life behavior before pregnancy included questions on sleeping hours per day, regularity in wake-up time and bedtime, and frequency of eating ready-to-eat meals (e.g., instant food, precooked food and fast food). The fifth part of the questionnaire included questions on IGDS. IGDS is a dichotomous 9-item IGD scale (Lemmens et al., 2015). The answer is yes (1 point) or no (0 points), and the cutoff value is 5 points. The Japanese version of IGDS was translated by Sumi (Sumi et al., 2018).

## Ethical consideration

This study was approved by the Ethics Committee of Tokushima

University Hospital (Approval No. 3945). We recruited subjects according to inclusion and exclusion criteria and provided them with a study brochure describing the study. We obtained consent from each subject to obtain information such as information on age and reproductive history from medical records. Subjects were informed that they were deemed to have consented to participate in the study by completing an online questionnaire and checking a box. Consent to participate from each subject was based on the explanation that participation in the study was voluntary, that refusal to participate was not harmful, and that the data obtained would not be used for any other purpose than this study. An anonymous web survey was conducted.

### Statistical analyses

Background characteristics of the subjects were analyzed by descriptive statistics. Comparisons of game usage time and sleeping hours for women before pregnancy and during the early gestation period were performed by the Wilcoxon signed-rank test. The correlation between game usage time before pregnancy and that in the early gestation period among women who had used games before pregnancy was assessed by Spearman's rank correlation coefficient. In order to compare game usage time and various factors related to game usage before pregnancy and in the early gestation period, the women were divided into two groups (Groups 1 and 2) according to game usage before pregnancy and in the early gestation period.

Comparisons of age, age of the partner, sleeping hours, game usage time before pregnancy, ages when starting offline games and online games, and IGDS score in the two groups were performed by the Mann-Whitney U test. The Chi-square test was used for comparisons between the two groups in parity, employment, experience in online game usage, partner's game usage, smoking habit, alcohol drinking habit before pregnancy, regularity of wake-up time and bedtime, frequency of eating ready-to-eat meals, presence of friends and acquaintances other than family members for whom face-to-face consultation is possible, achieving personal relationships by face-to-face communication, and thoughts on games (whether there is a feeling that game usage has a negative effect on a child's or children's development, a feeling that game usage is addictive, a feeling of having game addiction, and a feeling of not having sufficient time for playing games because of pregnancy or because of child-rearing). Fisher's exact test was used for comparisons between the two groups in experience in offline game use, days when good sleep was not possible due to game use in the early gestation period, days when meals were not cooked due to game use in the early gestation period, and days without regular meals due to game use in the early gestation period. A *p* value less than 0.05 was considered to be statistically significant. All statistical analyses were conducted using SPSS statistics ver.28.0 (IBM Corp).

## RESULTS

### Background characteristics

Of the 568 pregnant women who agreed to participate in the study, 361 women responded to the questionnaire in the early gestational period (recovery rate: 63.6%). We excluded 10 questionnaires with incomplete answers, and data for 351 participants were used for analysis (effective response rate: 61.8%). The background characteristics of the subjects are shown in Table 1. The mean ( $\pm$  standard deviation: SD) sleeping hours per day

in the early gestation period ( $7.4 \pm 1.4$  h) was significantly longer than that before pregnancy ( $6.9 \pm 1.0$  h) ( $p < 0.001$ ).

### Comparison of game usage before pregnancy and that during early pregnancy

The number of women who played games before pregnancy and the number of women who played games during early pregnancy are shown in Table 2. The number (proportion) of women who played games before pregnancy was 207 (59.0%) and the number (proportion) of women who did not play games before pregnancy was 144 (41.0%). Of the 144 women who did not play games before pregnancy, 6 women (4.2%) played games in the early gestation period and 138 women (95.8%) did not play games in the early gestation period.

For the 207 women who played games before pregnancy, the mean time ( $\pm$  SD) spent playing games per day before pregnancy was  $80.5 \pm 80.4$  min (range: 0-720 min) and the mean time ( $\pm$  SD) spent playing games per day in the early gestation period was  $50.1 \pm 65.8$  min (range: 0-300 min). There was a positive correlation between the mean time spent playing games before pregnancy and that in the early gestation period ( $r = 0.519$ ,  $p < 0.001$ ). In those 207 women, 133 women (64.3%) played games in the early gestation period, and the mean time ( $\pm$  SD) spent playing games per day was  $78.0 \pm 67.5$  min (range: 10 to 300 min). For those 133 women, the mean time spent playing games per day in the early gestation period ( $78.0 \pm 67.5$  min) was significantly shorter than that before pregnancy ( $93.5 \pm 86.2$  min) ( $p < 0.001$ ). Of the 207 women who played games before pregnancy, 74 women (35.7%) did not play games in the early gestation period. The reasons why they stopped playing games are shown in Table 3.

### Internet gaming disorder scale (IGDS) in the early gestation period

In the 351 pregnant women in the early gestation period, one woman (0.3%) had 4 points for the IGDS, three women (0.9%) had 3 points, 8 women (2.3%) had 2 points, 28 women (8.0%) had 1 point and 311 women (88.6%) had 0 points. There were no women with an IGDS score of more than 5 points. A score of more than 5 points indicates a high level of dependence on Internet games.

### Comparison of various factors for women who played games both before pregnancy and in the early gestation period and women who played games before pregnancy but not in the early gestation period

To compare women who continued to play games after

**Table 1.** Background characteristics of the pregnant women (N=351).

<b>Variable</b>	<b>Mean</b>	<b>SD</b>
Age (years)	31.8	4.6
Gestational weeks	10.7	2.2
Age of partner (years)	33.7	5.9
Sleeping hours before pregnancy (hours/day)	6.9	1.0
Sleeping hours in the early gestation period (hours/day)	7.4	1.4
Age when starting offline games (years)	9.2	4.0
Age when starting online games (years)	19.1	5.8
<b>Parity</b>	<b>n</b>	<b>%</b>
Primiparous	178	50.7
Multiparous	173	49.3
<b>Employed (in the early gestation period)</b>		
Yes	279	79.5
No	72	20.5
<b>Game use (before pregnancy)</b>		
Yes	207	59.0
No	144	41.0
<b>Game use (in the early gestation period)</b>		
Yes	139	39.6
No	212	60.4
<b>Experience in offline game use (in life so far)</b>		
Yes	297	84.6
No	54	15.4
<b>Experience in online game use (in life so far)</b>		
Yes	243	69.2
No	108	30.8
<b>Partner's game use (in the early gestation period)</b>		
Yes	249	70.9
No	102	29.1

Information on background characteristics of the pregnant women was obtained in their early gestation period. SD: Standard deviation.

Source: Author's 2023

**Table 2.** Game usage of the pregnant women before pregnancy and in the early gestation period (N=351).

<b>Variable</b>	<b>n</b>	<b>%</b>
<b>Women who answered that they played games before pregnancy</b>	207	59.0
and played games in the early gestation period	133	
but did not play games in the early gestation period	74	
<b>Women who answered that they did not play games before pregnancy</b>	144	41.0
but played games in the early gestation period	6	
and did not play games in the early gestation period	138	

Information on game usage of the pregnant women was obtained in their early gestation period. We defined 133 women who played games in the early gestation period as Group 1 and 74 women who did not play games in the early gestation period as Group 2.

Source: Author's 2023

**Table 3.** Reasons why women who played games before pregnancy did not play games in the early gestation period (n=74).

Variable	n	%
I'm pregnant	23	31.1
I actually did not like playing games	23	31.1
I felt physiological changes due to pregnancy (hyperemesis gravidarum, feeling tired or drunk when playing games, wanting to sleep more than playing games)	13	17.6
I lost interest in games	10	13.5
I don't have time to play games	5	6.8

Source: Author's 2023

pregnancy and women who played games only before pregnancy, we divided the 207 women who answered that they played games before pregnancy into two groups: one group of women who played games both before and in the early gestation period (Group 1, n=133) and one group of women who played games before pregnancy but did not play games in the early gestation period (Group 2, n=74). We compared background characteristics and game usage time in Groups 1 and 2, and the results of comparisons between the two groups are shown in Table 4.

Comparisons between the two groups in daily life behavior before pregnancy and daily life behavior and thoughts about game usage in the early gestation period are shown in Table 5. The proportion of women who smoked before pregnancy was significantly higher in Group 1 than in Group 2 (p=0.019) and the proportion of women who thought they might have game addiction was also significantly higher in Group 1 than in Group 2 (p=0.033).

The scores for the IGDS for women in Group 1 were 4 points in one woman (0.8%), 3 points in two women (1.5%), 2 points in 5 women (3.8%), 1 point in 17 women (12.8%), and 0 points in 108 women (81.2%). In Group 2, none (0.0%) had 4 points, one woman (1.4%) had 3 points, 3 women (4.1%) had 2 points, 6 women (8.1%) had 1 point,

and 64 women (86.5%) had 0 points. There was no significant difference between the IGDS scores in the two groups (p=0.348).

### DISCUSSION

In the present study, we found that many women stopped playing games or reduced their game usage times after becoming pregnant. A relatively large proportion (64.3%) of the women who played games before pregnancy continued to play games in the early gestation period, though the time spent playing games was shorter in the early gestation period than before pregnancy.

The reason for the decrease in the time spent playing games after pregnancy is thought to be physiological changes associated with pregnancy. Women in their early gestation period may experience deterioration in their physical condition due to emesis and an increase in sleeping time related to an increase in the level of progesterone, which may lead to a shorter game usage time. Healthier behavior as a psychological change associated with pregnancy may also be involved in the shorter game usage time. It is well known that many pregnant women quit smoking (Pickett et al., 2003; Ueda et al., 2020) and alcohol drinking (Yamamoto et al., 2008; Ethen et al.,

2009) for the health of the mother and the fetus. We showed that the proportion of women who smoked before pregnancy was higher in women who continued playing games after pregnancy. It is possible that women who continued playing games after pregnancy have lower health interests than do women who stopped playing games after pregnancy. On the other hand, there were no differences in alcohol drinking habits according to game use. Changes in lifestyle behavior during pregnancy include changes in meals, sleep and exercise. Souma et al. (2011) reported that many pregnant women changed their meal times to three times a day by decreasing the frequency of skipping breakfast, tended to eat more green and yellow vegetables, seafood, soybean products, dairy products and foods containing iron, and reduced the frequency of eating out. They also reported that pregnant women tended to secure sleeping hours in the daytime and perform exercise. The time spent playing games during pregnancy might have decreased because the pregnant women gave priority to using their time for eating and sleeping. In this study, 35.7% of the women played games before pregnancy but stopped playing games in the early gestation period. One of the main reasons why the women stopped playing games is thought to be their experience of physiological

**Table 4.** Comparisons of background characteristics and game usage time between the two groups (n=207).

Variable	Group 1 <sup>d</sup>		Group 2 <sup>e</sup>		p value
	Mean	SD	Mean	SD	
Age (years) <sup>c</sup>	31.4	4.5	31.8	4.4	0.496
Age of partner (years) <sup>c</sup>	33.6	6.1	32.6	5.4	0.238
Sleeping hours before pregnancy (h/day) <sup>c</sup>	6.9	1.0	6.9	0.8	0.484
Sleeping hours in the early gestation period (h/day) <sup>c</sup>	7.4	1.4	7.2	1.5	0.881
Game usage time before pregnancy (min/day) <sup>c</sup>	93.5	86.2	57.3	62.9	< 0.001
Age when starting offline games (years) <sup>c</sup>	9.4	3.5	9.4	5.5	0.170
Age when starting online games (years) <sup>c</sup>	19.0	6.0	19.4	6.0	0.479
<b>Parity<sup>b</sup></b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	
Primiparous	74	55.6	38	51.4	0.553
Multiparous	59	44.4	36	48.6	
<b>Employed<sup>b</sup></b>					
Yes	103	77.4	64	86.5	0.079
No	30	22.6	10	13.5	
<b>Experience in offline game use<sup>a</sup></b>					
Yes	127	95.5	70	94.6	0.747
No	6	4.5	4	5.4	
<b>Experience in online game use<sup>b</sup></b>					
Yes	121	91.0	60	81.1	0.039
No	12	9.0	14	18.9	
<b>Partner's game usage in the early gestation period<sup>b</sup></b>					
Yes	116	87.2	49	66.2	
No	17	12.8	25	33.8	< 0.001

SD: Standard deviation. <sup>a</sup>Statistical analysis was performed by Fisher's exact test. <sup>b</sup>Statistical analysis was performed by the chi-square test. <sup>c</sup>Statistical analysis was performed by the Mann-Whitney U test. <sup>d</sup>Group 1: 133 women who used games before and during the early period of gestation. <sup>e</sup>Group 2: 74 women who used games before pregnancy but did not use games during the early period of gestation. Source: Author's 2023

changes such as emesis. After becoming pregnant, they felt changes in their bodies and they thought about their own health and the health of the fetus. The decision to have healthier behavior due to these changes may have resulted in a decrease in their interest in playing games.

We showed that the time spent playing games before pregnancy in women who continued to play games after pregnancy was significantly longer than that in women who stopped playing games after pregnancy. A systematic review of 58 empirical studies showed that the proportion of young people with problematic game use was about 8-12% and that 2-5% of children, teenagers and students had game usage addiction, suggesting that game usage addiction may occur in individuals with excessive game usage (Kuss et al., 2012). Pregnant women who have used games for a long time do not necessarily have game usage addiction. However, it is necessary to pay attention to excessive game usage

since a number of women who continue to play games after becoming pregnant might have given priority to playing games in their daily activities before pregnancy. This study showed that online games were used more frequently by women who continued playing games after pregnancy than by women who stopped playing games after pregnancy. There has been no study in which game usage proportion and game usage time were compared between online games and offline games among women in their 20 and 30s. However, Kuss et al. (2012) reported that online games were created to reinforce playing and were more addictive than offline games. Therefore, it is necessary for pregnant women who have used online games to check whether their game usage is excessive or not.

There were no pregnant women in this study whose IGDS score was 5 or higher. However, women who continued to play games after pregnancy were more

**Table 5.** Comparisons of daily life behavior before pregnancy and daily life behavior and thoughts about game usage in the early gestation period between the two groups (n=207).

Variable	Group 1 <sup>d</sup>		Group 2 <sup>e</sup>		p value
	n	%	n	%	
<b>Before pregnancy</b>					
<b>Smoking habit<sup>b</sup></b>					
No	96	72.2	64	86.5	0.019
Yes	37	27.8	10	13.5	
<b>Alcohol drinking (before pregnancy)<sup>b</sup></b>					
No	91	68.4	56	75.7	0.270
Yes	42	31.6	18	24.3	
<b>Regularity of wake-up time and bedtime<sup>b</sup></b>					
Yes	100	75.2	58	78.4	0.605
No	33	24.8	16	21.6	
<b>Frequency of eating ready-to-eat meals (e.g., instant food, precooked food and fast food)<sup>b</sup></b>					
≥3 days/week	37	27.8	13	17.6	0.099
≤2 days/ week	96	72.2	61	82.4	
<b>Early gestation period</b>					
<b>Regularity of wake-up time and bedtime<sup>b</sup></b>					
Yes	101	75.9	60	81.1	0.394
No	32	24.1	14	18.9	
<b>Presence of days on which you could not sleep due to game use<sup>a</sup></b>					
Yes	8	6.0	0	0.0	0.053
No	125	94.0	74	100.0	
<b>Presence of days on which you could not cook your own meal due to game use<sup>a</sup></b>					
Yes	5	3.8	0	0.0	0.163
No	128	96.2	74	100.0	
<b>Presence of days on which you could not eat regularly (3 meals/day) due to game use<sup>a</sup></b>					
Yes	5	3.8	0	0.0	0.163
No	128	96.2	74	100.0	
<b>Frequency of eating ready-to-eat meals (e.g., instant food, precooked food and fast food)<sup>b</sup></b>					
≥3 days/week	50	37.6	29	39.2	0.821

Table 5. Cont'd

≤2 days/ week	83	62.4	45	60.8	
<b><i>Presence of friends and acquaintances (other than family members) with whom I can consult face-to-face<sup>b</sup></i></b>					
No	14	10.5	13	17.6	0.149
Yes	119	89.5	61	82.4	
<b><i>Achievement of personal relationships by face-to-face communication<sup>b</sup></i></b>					
Difficult	40	30.1	31	41.9	0.086
Not difficult	93	69.9	43	58.1	
<b><i>I think that game usage by mothers produces a negative environment for child/children's development<sup>b</sup></i></b>					
Yes	81	60.9	48	64.9	0.573
No	52	39.1	26	35.1	
<b><i>I think that game usage is addictive<sup>b</sup></i></b>					
Yes	115	86.5	67	90.5	0.389
No	18	13.5	7	9.5	
<b><i>I think that I may have a game addiction<sup>b</sup></i></b>					
Yes	28	21.1	7	9.5	0.033
No	105	78.9	67	90.5	
<b><i>I think that I could not use gaming sufficiently due to pregnancy and child-rearing<sup>b</sup></i></b>					
Yes	15	11.3	8	10.8	0.918
No	118	88.7	66	89.2	

<sup>a</sup>Statistical analysis was performed by Fisher's exact test. <sup>b</sup>Statistical analysis was performed by the chi-square test. <sup>c</sup>Group 1: 133 women who used games before and during the early period of gestation. <sup>d</sup>Group 2: 74 women who used games before pregnancy but did not use games during the early period of gestation.  
Source: Author's 2023

likely than women who stopped playing games after pregnancy to feel that they might be game addicts. The IGDS is a scale for objective assessment of game addiction (Lemmens et al., 2015), but the scale cannot be used for assessing a feeling of anxiety that one may be addicted to gaming. Thus, it may be necessary to check whether women who continue to use games after

pregnancy have anxiety about game addiction even if they are assessed to be negative by using IGDS screening. Healthcare workers may need to identify pregnant women who have anxiety about game addiction and consider individual psychological care.

In a study of 4,028 adolescents in the US, it was shown that regular smoking, drug use and

violence were risk behaviors associated with problematic game usage (Desai et al., 2010). However, there has been no study on the relationship between game usage and history of smoking habit in pregnant women. Since smoking during pregnancy has adverse effects on both the mother and the fetus, quitting smoking during pregnancy is recommended (World Health



Organization, 2020). It has been reported that many women quit smoking when they became pregnant (Pickett et al., 2003; Ueda et al., 2020). In the present study, we showed that a history of smoking was more frequent in women who continued to use games after pregnancy than in women who stopped using games after pregnancy. Therefore, it is necessary for healthcare workers to confirm a history of smoking before pregnancy in pregnant women and check whether game usage is excessive or not during pregnancy in women with a smoking habit.

Interestingly, we showed that the proportion of partners who played games was significantly higher for women who continued to play games after pregnancy than for women who stopped playing games after pregnancy. There has been no study on the association of the status of game usage between pregnant women and their partners. Coyne et al. reported that there was a positive correlation of time spent playing games between men and women among couples aged 18-79 years in the US. In addition, they suggested that game usage is the couple's collaborative recreation and that women may play games in response to their partner's game playing (Coyne et al., 2012). Therefore, for pregnant women whose partners play games, it is necessary to pay attention to excessive game usage during pregnancy.

There were no differences in drinking habits and eating habits between women who continued to use games after pregnancy and women who stopped using games after pregnancy. The reason may be that there were no women for whom the IGDS score was five or more, a score that indicates strongly suspected gaming addiction.

In addition, among women who played games before pregnancy, there was a positive correlation between game time before pregnancy and that during early pregnancy. If women before pregnancy have an opportunity to think about their game usage by considering the benefits and risks of game usage, game usage time during pregnancy may change. If women and couples before pregnancy carefully consider game usage as well as their lives and health, women and their families may be able to spend healthier lives after pregnancy. That is considered to be one of preconception care measures.

In the present study, we showed that many women stopped using games or reduced their game usage time after becoming pregnant. Considering the high rate of game use in the young generation, game use by women may increase in the future. We previously reported that the proportion of pregnant women at early gestation who played games was 40.4% (Sato et al., 2023), and this proportion may increase in the future. Careful observation may be needed for women who continue to use games during pregnancy. It is not entirely clear from the results of the present study whether playing games is harmful to pregnant women's health. However, it is clear that some women continued to play games with anxiety. Therefore,

women should give more consideration to their gameplay habits before they become pregnant, and preconception care by healthcare workers may be required.

This report is the first report on a comparison of game usage and game usage-related factors in women before pregnancy and during early pregnancy. The report provides useful information for considering various problems in pregnant women who play games and for establishing measures to deal with these problems. However, this study has several limitations. A causal relationship was not clarified since this study was a cross-sectional design. We recruited subjects in a limited area and the number of subjects was relatively small. Therefore, generalization of the results obtained in the present study is limited. In addition, we may need more detailed information about why women stopped using games after pregnancy and why they reduced their game usage time.

In conclusion, we found that many women stopped playing games or reduced their game time when they became pregnant. Although there were no pregnant women whose IGDS score was 5 or more, careful observation may be required for pregnant women who continue to play games during pregnancy. Further studies are needed to determine whether playing games is hazardous or not for pregnant women.

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## CONFLICT OF INTERESTS

The authors have not declared any conflicts of interests.

## REFERENCES

- Coyne SM, Busby D, Bushman BJ, Gentile DA, Ridge R, Stockdale L (2012). Gaming in the game of love: Effects of video games on conflict in couples. *Family Relations* 61(3):388-396. <https://doi.org/10.1111/j.1741-3729.2012.00712.x>
- Desai RA, Krishnan-Sarin S, Cavallo D, Potenza MN (2010). Video-gaming among high school students: health correlates, gender differences, and problematic gaming. *Pediatrics* 126(6):e1414-e1424. <https://doi.org/10.1542/peds.2009-2706>
- Ethen MK, Ramadhani TA, Scheuerle AE, Canfield MA, Wyszynski DF, Druschel CM, Romitti PA (2009). Alcohol consumption by women before and during pregnancy. *Maternal and Child Health Journal* 13(2):274-285. <https://doi.org/10.1007/s10995-008-0328-2>
- Hedman C, Pohjasvaara T, Tolonen U, Suhonen-Malm AS, Myllylä VV (2002). Effects of pregnancy on mothers' sleep. *Sleep Medicine* 3(1):37-42. [https://doi.org/10.1016/S1389-9457\(01\)00130-7](https://doi.org/10.1016/S1389-9457(01)00130-7)
- Kuss DJ, Griffiths MD (2012). Internet gaming addiction: A systematic review of empirical research. *International Journal of Mental Health and Addiction* 10(2):278-296. <https://doi.org/10.1007/s11469-011->

- 9318-5
- Lemmens JS, Valkenburg PM, Gentile DA (2015). The Internet Gaming Disorder Scale. *Psychological Assessment* 27(2):567-582. <https://doi.org/10.1037/pas0000062>
- Padilla-Walker LM, Nelson LJ, Carroll JS, Jensen AC (2010). More than a just a game: video game and internet use during emerging adulthood. *Journal of Youth and Adolescence* 39(2):103-113. <https://doi.org/10.1007/s10964-008-9390-8>
- Pickett KE, Wakschlag LS, Dai L., Leventhal BL (2003). Fluctuations of maternal smoking during pregnancy. *Obstetrics and Gynecology*, 101(1):140-147. [https://doi.org/10.1016/s0029-7844\(02\)02370-0](https://doi.org/10.1016/s0029-7844(02)02370-0)
- Sato H, Yasui T (2023). Game Usage in Pregnant Women at Early Gestation in Japan. *Global Journal of Health Science* 15(2):1-1. <https://doi.org/10.5539/gjhs.v15n2p1>
- Souma M (2011). The relation between maternal-fetal attachment and behavior in daily life of primigravid women. *Journal of Japan Academy of Midwifery*. 25(2):203-214. <https://doi.org/10.3418/jjam.25.203>
- Stevens MW, Dorstyn D, Delfabbro PH, King DL (2021). Global prevalence of gaming disorder: A systematic review and meta-analysis. *The Australian and New Zealand Journal of Psychiatry* 55(6):553-568. <https://doi.org/10.1177/0004867420962851>
- Sumi S, Nishiyama T, Ichihashi K, Hara H, Kuru Y, Nakajima R (2018). Internet gaming disorder scale Japanese version. *Japanese Journal of Clinical Psychiatry* 47(1):109-111.
- Ueda K, Kitano N, Suzuki K (2020). Description of Maternal Smoking Status Before and After Pregnancy: A Longitudinal, Community-Based Cohort Study. *Journal of Epidemiology* 30(7):295-300. <https://doi.org/10.2188/jea.JE20180187>
- Weaver JB 3rd, Mays D, Sargent WS, Kannenberg W, Hopkins GL, Eroğlu D, Bernhardt JM (2009). Health-risk correlates of video-game playing among adults. *American Journal of Preventive Medicine* 37(4):299-305. <https://doi.org/10.1016/j.amepre.2009.06.014>
- World Health Organization (2020). Congenital anomalies. Fact Sheet 2020; <https://www.who.int/news-room/fact-sheets/detail/tobacco>, <http://www.who.int/mediacentre/factsheets/fs370/en/>. Accessed 5 January 2023.
- Yamamoto Y, Kaneita Y, Yokoyama E, Sone T, Takemura S, Suzuki K, Kaneko A, Ohida T (2008). Alcohol consumption and abstention among pregnant Japanese women. *Journal of Epidemiology*, 18(4):173-182. <https://doi.org/10.2188/jea.JE2007419>
- Yasuda T, Ojima T, Nakamura M, Nagai A, Tanaka T, Kondo N, Suzuki K, Yamagata Z (2013). Postpartum smoking relapse among women who quit during pregnancy: cross-sectional study in Japan. *Journal of Obstetrics and Gynaecology Research* 39(11):1505-1512. <https://doi.org/10.1111/jog.12098>.