Financial Literacy and Exercise Behavior: Evidence from Japan

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Abstract: Lack of exercise, which increases the risk of many serious physical and mental illness, has been a common health issue in Japan. Recent studies confirm that financial literacy discourages irrational behavior like gambling and smoking. We therefore investigate how financial literacy, as a rational decision-making instrument, relates to peoples’ exercise behavior in Japan. We hypothesize that financial literacy encourages people to exercise regularly. Using Osaka University’s Preference Parameters Study (PPS) for 2010, we categorized respondents into two groups: those who exercise regularly or at least once a week and those who do not. Our probit estimation results show that financial literacy is positively related with exercise behavior, meaning that financially literate people are more likely to exercise regularly. As the COVID-19 health pandemic seems to exacerbate peoples’ physical inactivity, the results of our study show an alternative approach to encourage exercise. We therefore recommend that governments implement a financial literacy improvement policy to alleviate the lack of exercise.

Keywords: exercise; financial literacy; rationality; Japan

1. Introduction

The World Health Organization [1] states that physical inactivity is one of the world’s leading health issues. People with an inactive lifestyle are at risk of developing serious physical health conditions [2] and mental illnesses [1,3]. Physical inactivity also burdens the global healthcare system directly and leads to lower productivity in the economy [4]. Thus, governments and health organizations have been advocating exercise to promote the tremendous individual and societal benefits. Empirically, people who exercise regularly are more likely to delay the development of severe physical health problems [3,5,6] improve their physical health [7,8], and recover from mental health problems [6,9–13]. Some studies also suggest that exercise can prolong life expectancy [14,15], while in Japan, Monma et al. [16] found a positive association between a prefecture’s healthy life expectancy and the ratio of middle-aged male exercisers. Because of these benefits, exercisers are less likely to suffer from absenteeism and presenteeism and become more productive [17]. Consequently, an increase in physical activity such as regular exercise can increase global GDP by 0.25 to 0.36 percent [17]. Thus, broadly, exercise is a key issue to ensure sustainable development of a country.

Many national and international health policies focus on exercise as a means to promote physical activity. The Japanese government introduced a health policy in 1999 called “Health Japan 21,” which aims to reduce lifestyle-related diseases [18]. The Japanese government set a target for the proportion of exercisers aged 20–64 years at 36% for men and 33% for women and 58% for older men and 48% for older women [19]. Regrettably, the government did not achieve these goals. According to the Ministry of Health, Labor
and Welfare (MHLW), only 21.6% of men and 16.6% of women aged 20–64 years exercise regularly, while only 42.9% and 36.5% older men and older women exercise regularly, respectively [19]. The MHLW reports that the trend of regular exercise among men stagnated for a decade and the trend among women declined considerably [19]. Furthermore, the current measures to curb the COVID-19 pandemic, such as work from home and social distancing, may disrupt exercise routines [20]. Ultimately, lack of exercise may become more severe in Japan [21].

In this study, we investigated lack of exercise from the viewpoint of financial literacy as a proxy for rational decision making. Financial literacy empowers people with the knowledge on financial issues such as compounding, inflation, risk diversification and others, which help them to make better financial decisions. Moreover, financial literacy improves peoples’ understanding on the value of information, leading them to have more cognitive ability and rationality. In several related papers, Watanapongvanich et al. [22–24] argued that rationality proxied by financial literacy tends to reduce peoples’ involvement in risky health behavior such as smoking and gambling. Some studies also found an association between financial literacy and improved cognitive ability [25], while others found an association between financial illiteracy and limited cognitive ability [26–28]. Hence, people with a high level of financial literacy tend to have better cognitive ability, which is likely to make them more rational. Previous studies also provide evidence on how financial literacy contributes to rational economic behavior [29–40]. People with good financial literacy are more likely to have diverse investments [33,41], prepare for retirement [29,30,35,36,39,42], and make reasonable healthcare decisions [43]. These previous studies provide clear evidence of the role of financial literacy in enhancing cognitive ability and the ability to make rational economic and health decisions.

This study aims to examine the association between financial literacy and exercise behavior among Japanese people. We hypothesize that financial literacy enhances the likelihood that a person exercises regularly. Regular exercise could be perceived as a health investment, according to Grossman’s health capital model [44,45]; hence, this study adopts the view that regular exercise is a rational behavior. We argue that financially literate people, being able to make rational decisions, would practice rational health behavior like exercising regularly. Our study makes significant contributions to the existing literature in at least two ways. First, to the best of our knowledge, this is the first study that examines the relationship between exercise and financial literacy. We provide evidence that financially literate people, as rational decision makers, are more likely to exhibit positive health behavior like exercising regularly. Second, the rationality explanation of the lack of exercise among Japanese people provides an opportunity to observe a predominant health issue from a new perspective.

The remainder of this paper proceeds as follows. In the next section, we describe the data and methodology. In Sections 3 and 4, we present and discuss the empirical results. Section 5 offers our conclusions.

2. Data and Methods

2.1. Data

We used data from the Preference Parameters Study (PPS), an annual panel survey conducted by Osaka University’s Institute of Social and Economic Research. This database contains information on the Japanese sample’s socioeconomic status and preferences. We used data from the 2010 survey because this wave has information on the respondent’s choice to exercise and level of financial literacy. The survey has 5386 responses, of which we excluded 1675 responses, because some respondents did not provide information about their exercise habits or financial literacy. Thus, our sample comprises 3711 responses, or roughly 69% of the total sample.
2.2. Variables

Our dependent variable, “regular exercise,” is based on the PPS’s multiple-choice question “Do you exercise?” Respondents can answer 1 for exercise almost every day, 2 for exercise 2 to 4 times a week or so, 3 for exercise once a week or so, 4 for exercise once a month or so, and 5 for hardly exercise. As our hypothesis is that financial literacy encourages people to exercise regularly, we grouped these responses into a binary scale. Because engaging in high-intensity exercise only once or twice per week reduces mortality [46], we categorized respondents who answered 1–3 as regular exercisers and those who answered 4 or 5 as non-regular exercisers, where the variable “regular exercise” equals one in the former case and zero in the latter case.

Our main explanatory variable is financial literacy. We use the three questions proposed by Lusardi and Mitchell [47] to measure a respondent’s financial literacy level due to their simplicity and empirical support. These questions measure a respondent’s knowledge of compound interest, inflation, and risk diversification. Studies such as [22–24,34,48–55] adopted these three questions, which are as follows:

1. Suppose you had 10,000 JPY in a savings account and the interest rate is 2% per year and you never withdraw money or interest payments. After 5 years, how much would you have in this account in total?
   - More than ¥10,200 (correct answer)
   - Exactly ¥10,200
   - Do not know
   - Refuse to answer

2. Imagine that the interest rate on your savings account is 1% per year and inflation is 2% per year. After 1 year, how much would you be able to buy with the money in this account?
   - More than today
   - Exactly the same
   - Less than today (correct answer)
   - Do not know
   - Refuse to answer

3. Please indicate whether the following statement is true or false. “Buying a company stock usually provides a safer return than a stock mutual fund.”
   - True
   - False (correct answer)
   - Do not know
   - Refuse to answer

According to Lusardi and Mitchell [47], respondents who can answer questions a and b correctly seem to have essential economic and mathematic knowledge, while those who can answer question c correctly tend to have the necessary knowledge to make sound investment decisions [47]. Given this argument, we follow [22–24] and assign one point to each correct answer and zero point to each incorrect answer. Then, we find the normal average score to create the literacy variable.

In line with prior studies on the relationship between financial literacy and risky health behavior [22–24], we control demographic and socioeconomic effects such as gender, age, education status, marital status, household financial status, number of household members, and employment status; behavioral effect such as myopic view of the future, level of risk preference, current level of happiness, and anxiety about health; and risky health behavior such as drinking, smoking, and gambling. Table 1 provides the description for all the variables.
Table 1. Variable definitions.

| Variable               | Definition                                                                                           |
|------------------------|------------------------------------------------------------------------------------------------------|
| Regular exerciser      | Binary variable: 1 = regular exercise (exercise once a week or more) and 0 = otherwise               |
| Financial literacy     | Continuous variable: number of correct answers from the three financial literacy questions           |
| Male                   | Binary variable: 1 = male and 0 = female                                                             |
| Age                    | Respondent’s age                                                                                    |
| Age squared            | Age squared                                                                                         |
| University degree      | Binary variable: 1 = obtained university degree and zero otherwise                                    |
| Marriage               | Binary variable: 1 = married and 0 = otherwise                                                       |
| Divorce                | Binary variable: 1 = divorced or separated and zero otherwise                                        |
| Household size         | Continuous variable: number of people currently living in the household                              |
| Children               | Binary variable: 1 = have child/children and zero otherwise                                           |
| Unemployed             | Binary variable: 1 = respondent is unemployed and zero otherwise                                     |
| Household income       | Continuous variable: annual earned income of the entire household before taxes and with bonuses in 2009 (unit: JPY) |
| Log of household income| Log (household income)                                                                               |
| Household assets       | Continuous variable: balance of financial assets (savings, stock, insurance, etc.) of the entire household (unit: JPY) |
| Log of household assets| Log (household assets)                                                                               |
| Current smoker         | Binary variable: 1 = current smoker (sometimes–more than two packs a day) and 0 = non-smokers (do not smoke at all, quit, or hardly smoke) |
| Current drinker        | Binary variable: 1 = current drinker (drink sometimes–five cans of beer daily) and 0 otherwise       |
| Frequent gambler       | Binary variable: 1 = frequent gambler (gamble once a week or more) and 0 otherwise                   |
| Myopic view of the future | Binary variable: 1 = agree and completely agree with the statement, “Since the future is uncertain, it is a waste to think about it” and 0 otherwise |
| Level of risk preference| Continuous variable: percentage score from the question, “Usually, when you go outdoors, how high does the probability of rain have to be before you take an umbrella?” |
| Current level of happiness | Continuous variable: percentage score from the question “Overall, how happy would you say you are currently?” |
| Anxiety about health   | Binary variable: 1 = agree and completely agree with the statement, “I have anxieties about my health” and 0 otherwise |
2.3. Descriptive Statistics

According to the descriptive statistics in Table 2, almost half of the respondents (49.29%) are men. The average respondent is 49.8 years old and lives in a household of 3.52 people. The majority of the respondents are married (82.22%) and have children (84.42%), whereas a small proportion are divorced (3.48%) or unemployed (2.4%). The average household has an annual income equivalent to 6.48 million yen and holds assets worth 13.1 million yen. Roughly 27% of the respondents received a university degree. The average financial literacy score is 0.59. In term of the perception variables, 14.63% of respondents have a myopic view of the future and 41.98% have anxiety about their health. Furthermore, the respondent’s happiness level is 64.7% on average, and the level of risk preference is 49.08%. For the risky health behavior variables, approximately half of the respondents are current alcohol drinkers, whereas a minority of the respondents are regular exercisers (37.08%), current smokers (24.25%), or frequent gamblers (9.38%).

Table 2. Descriptive statistics.

| Variable               | Mean   | Standard Deviation (SD) | Min | Max |
|------------------------|--------|-------------------------|-----|-----|
| Regular exerciser      | 0.3708 | 0.4831                  | 0   | 1   |
| Financial literacy     | 0.5911 | 0.3434                  | 0   | 1   |
| Male                   | 0.4929 | 0.5000                  | 0   | 1   |
| Age                    | 49.8041| 12.6148                 | 20  | 76  |
| Age squared            | 2639.5380| 1240.2330              | 400 | 5776|
| University degree      | 0.2700 | 0.4440                  | 0   | 1   |
| Marriage               | 0.8222 | 0.3824                  | 0   | 1   |
| Divorce                | 0.0348 | 0.1832                  | 0   | 1   |
| Household size         | 3.5185 | 1.4354                  | 1   | 10  |
| Children               | 0.8442 | 0.3627                  | 0   | 1   |
| Unemployed             | 0.0240 | 0.1530                  | 0   | 1   |
| Household income       | 6,486,661| 3,783,265              | 1,000,000 | 20,000,000 |
| Log of household income| 15.5119| 0.6147                  | 13.8155 | 16.8112 |
| Household assets       | 13,100,000| 17,600,000           | 2,500,000 | 100,000,000|
| Log of household assets| 15.8055| 1.0130                  | 14.7318 | 18.4207 |
| Current smoker         | 0.2425 | 0.4287                  | 0   | 1   |
| Current drinker        | 0.5416 | 0.4983                  | 0   | 1   |
| Frequent gambler       | 0.0938 | 0.2916                  | 0   | 1   |
| Myopic view of the future | 0.1463 | 0.3535                  | 0   | 1   |
| Level of risk preference | 0.4909 | 0.1891                  | 0   | 1   |
| Current level of happiness | 0.6470 | 0.1825                  | 0   | 1   |
| Anxiety about health   | 0.4198 | 0.4936                  | 0   | 1   |

Tables 3–5 summarize the distribution for regular exercise by age group, demographic characteristics, and behaviors, respectively. Table 3 shows a significant difference in exercise behavior by age group. Roughly 30% of those aged 50 or less exercise regularly. Simultaneously, the proportion of exercisers tends to increase with age; around 40% of those aged 51 to 60 and approximately a half of the older respondents aged 61 or more exercise routinely. In Table 4, we see heterogeneous exercise behavior by gender and education status. A higher proportion of male respondents exercise frequently (40.73%) compared to female respondents (33.53%) and a higher proportion of exercisers have university degrees (41.52%) than do not (35.44%). On the other hand, we see no difference in exercise behavior between unemployed and employed respondents. In Table 5, exercise behavior varies for people with different smoking and drinking behaviors. The proportion of exercisers who smoke (29.33%) is substantially lower than the proportion of those who are non-smokers (39.56%). The proportion of exercisers who are alcohol drinkers (39.5%) is significantly higher than the proportion of those who are not drinkers (34.22%). Lastly, we observe
no different in exercise behavior between frequent gamblers (35.92%) and non-frequent gamblers (37.20%).

Table 3. Distribution of smoking behavior by age group.

| Exercise Behavior                  | Age          | Total |
|-----------------------------------|--------------|-------|
|                                   | ≤30          | 31–40 | 41–50 | 51–60 | ≥61 |       |
| Exercise once a week or more      | 83           | 200   | 293   | 363   | 437 | 1376    |
|                                   | 30.40%       | 28.99% | 31.57% | 37.58% | 51.17% | 37.08% |
| Otherwise                         | 190          | 490   | 635   | 603   | 417 | 2335    |
|                                   | 69.60%       | 71.01% | 68.43% | 62.42% | 48.83% | 62.92% |
| Total                             | 273          | 690   | 928   | 966   | 854 | 3711    |
|                                   | 100%         | 100%  | 100%  | 100%  | 100% | 100%    |

Mean difference $F = 28.15 ***$

Note: ***p < 0.01.

Table 4. Distribution of smoking behavior by demographic characteristic.

| Exercise Behavior                  | Gender | Education | Unemployed |
|-----------------------------------|--------|-----------|------------|
|                                   | Female | Lower than University Degree | University Degree and Higher | No | Yes | Total |
| Exercise once a week or more      | 631    | 960       | 416        | 1346 | 30 | 1376   |
|                                   | 33.53% | 35.44%    | 41.52%     | 37.16% | 33.71% | 37.08% |
| Otherwise                         | 1251   | 1749      | 586        | 2276 | 59 | 2335   |
|                                   | 66.47% | 64.56%    | 58.48%     | 62.84% | 66.29% | 62.92% |
| Total                             | 1882   | 2709      | 1002       | 3622 | 89 | 3711   |
|                                   | 100%   | 100%      | 100%       | 100% | 100% | 100%   |

Mean difference $t = -4.5541 ***$ $t = -3.4085 ***$ $t = 0.6663$

Note: ***p < 0.01.

Table 5. Distribution of smoking behavior by other risky behaviors.

| Exercise Behavior                  | Regular Smoker | Current Drinker | Frequent Gambler | Total |
|-----------------------------------|----------------|-----------------|------------------|-------|
|                                   | No | Yes | No | Yes | No | Yes | Total |
| Exercise once a week or more      | 1112 | 582 | 794 | 1251 | 125 | 1376 |
|                                   | 39.56% | 29.33% | 34.22% | 39.50% | 37.20% | 35.92% | 37.08% |
| Otherwise                         | 1699 | 1119 | 2112 | 3363 | 348 | 2335 |
|                                   | 60.44% | 65.78% | 65.00% | 64.08% | 62.92% |
| Total                             | 2811 | 1701 | 2010 | 348 | 3711 |
|                                   | 100% | 100% | 100% | 100% | 100% |

Mean difference $t = 5.5489 ***$ $t = -3.3267 ***$ $t = 0.4703$

Note: ***p < 0.01.

2.4. Methodology

Since our dependent variable regular exerciser is a binary variable, we performed a probit regression to test our hypothesis. We estimate the following equation:

$$Y_i = f(FL_i, X_i, \epsilon_i),$$

where $Y_i$ represents the $i$th respondent’s exercise behavior (respondent exercises at least once a week or otherwise), $FL$ is the average financial literacy score, $X$ is a vector of the respondent’s characteristics, and $\epsilon$ is the error term.

Watanapongvanich et al. [23] suggested that financial literacy can be highly correlated with household asset value and education variables like a university degree. Our results may
therefore suffer from a multicollinearity problem. Following Watanapongvanich et al. [23], we performed the variance inflation factor (VIF) test (available upon request) and find that multicollinearity is insignificant in all models (i.e., our VIF is below 10).

Our model specifications are the following.

\begin{align*}
\text{Exercise behavior}_i &= (1 = \text{regular exerciser and } 0 = \text{otherwise}) \\
&= \beta_0 + \beta_1 \text{financial literacy}_i + \beta_2 \text{male}_i + \beta_3 \text{age}_i \\
&\quad + \beta_4 \text{age squared}_i + \beta_5 \text{university degree}_i + \beta_6 \text{marriage}_i \\
&\quad + \beta_7 \text{divorce}_i \\
&\quad + \beta_8 \text{household size}_i + \beta_9 \text{children}_i + \beta_{10} \text{unemployed}_i \\
&\quad + \beta_{11} \log \text{of household income}_i \\
&\quad + \beta_{12} \log \text{of household assets}_i + \epsilon_i \\
\end{align*}

(1)

\begin{align*}
\text{Exercise behavior}_i &= (1 = \text{regular exerciser and } 0 = \text{otherwise}) \\
&= \beta_0 + \beta_1 \text{financial literacy}_i + \beta_2 \text{male}_i + \beta_3 \text{age}_i \\
&\quad + \beta_4 \text{age squared}_i + \beta_5 \text{university degree}_i + \beta_6 \text{marriage}_i \\
&\quad + \beta_7 \text{divorce}_i \\
&\quad + \beta_8 \text{household size}_i + \beta_9 \text{children}_i + \beta_{10} \text{unemployed}_i \\
&\quad + \beta_{11} \log \text{of household income}_i \\
&\quad + \beta_{12} \log \text{of household assets}_i + \beta_{13} \text{current smoker}_i \\
&\quad + \beta_{14} \text{current drinkers}_i + \beta_{15} \text{frequent gamblers}_i + \epsilon_i \\
\end{align*}

(2)

\begin{align*}
\text{Exercise behavior}_i &= (1 = \text{regular exerciser and } 0 = \text{otherwise}) \\
&= \beta_0 + \beta_1 \text{financial literacy}_i + \beta_2 \text{male}_i + \beta_3 \text{age}_i \\
&\quad + \beta_4 \text{age squared}_i + \beta_5 \text{university degree}_i + \beta_6 \text{marriage}_i \\
&\quad + \beta_7 \text{divorce}_i \\
&\quad + \beta_8 \text{household size}_i + \beta_9 \text{children}_i + \beta_{10} \text{unemployed}_i \\
&\quad + \beta_{11} \log \text{of household income}_i \\
&\quad + \beta_{12} \log \text{of household assets}_i + \beta_{13} \text{current smoker}_i \\
&\quad + \beta_{14} \text{current drinkers}_i + \beta_{15} \text{frequent gamblers}_i \\
&\quad + \beta_{16} \text{myopic view of the future}_i \\
&\quad + \beta_{17} \text{level of risk preference}_i + \epsilon_i \\
\end{align*}

(3)

\begin{align*}
\text{Exercise behavior}_i &= (1 = \text{regular exerciser and } 0 = \text{otherwise}) \\
&= \beta_0 + \beta_1 \text{financial literacy}_i + \beta_2 \text{male}_i + \beta_3 \text{age}_i \\
&\quad + \beta_4 \text{age squared}_i + \beta_5 \text{university degree}_i + \beta_6 \text{marriage}_i \\
&\quad + \beta_7 \text{divorce}_i \\
&\quad + \beta_8 \text{household size}_i + \beta_9 \text{children}_i + \beta_{10} \text{unemployed}_i \\
&\quad + \beta_{11} \log \text{of household income}_i \\
&\quad + \beta_{12} \log \text{of household assets}_i + \beta_{13} \text{current smoker}_i \\
&\quad + \beta_{14} \text{current drinkers}_i + \beta_{15} \text{frequent gamblers}_i \\
&\quad + \beta_{16} \text{myopic view of the future}_i \\
&\quad + \beta_{17} \text{level of risk preference}_i \\
&\quad + \beta_{18} \text{current level of happiness}_i + \beta_{19} \text{anxiety about health}_i + \epsilon_i \\
\end{align*}

(4)

3. Results

In Table 6, the first column shows estimates for Model 1, which includes the primary explanatory variable and demographic variables. The second column shows estimates for Model 2, which includes the variables in Model 1 as well as the behavior variables. The third column reports the estimates for Model 3, which includes additional variables like myopic view of the future and risk preference level. Lastly, the fourth column shows the estimates for Model 4, which includes additional variables like the current level of happiness and anxiety about health.
Table 6. Probit model regression results, financial literacy as the main explanatory variable.

| Variable                      | Model 1    | Model 2    | Model 3    | Model 4    |
|-------------------------------|------------|------------|------------|------------|
| Financial literacy            | 0.181 ***  | 0.165 **   | 0.158 **   | 0.145 **   |
|                               | (0.0682)   | (0.0686)   | (0.0688)   | (0.0693)   |
| Male                          | 0.140 ***  | 0.179 ***  | 0.182 ***  | 0.205 ***  |
|                               | (0.0450)   | (0.0501)   | (0.0502)   | (0.0505)   |
| Age                           | −0.0475 ***| −0.0436 ***| −0.0441 ***| −0.0367 ***|
|                               | (0.0132)   | (0.0133)   | (0.0133)   | (0.0135)   |
| Age squared                   | 0.000587 ***| 0.000541 ***| 0.000545 ***| 0.000490 ***|
|                               | (0.000133) | (0.000134) | (0.000134) | (0.000135) |
| University degree             | 0.102 *    | 0.0735     | 0.0673     | 0.0484     |
|                               | (0.0523)   | (0.0527)   | (0.0529)   | (0.0531)   |
| Marriage                      | 0.143      | 0.132      | 0.133      | 0.0663     |
|                               | (0.0882)   | (0.0888)   | (0.0887)   | (0.0898)   |
| Divorce                       | 0.0996     | 0.122      | 0.128      | 0.103      |
|                               | (0.142)    | (0.142)    | (0.142)    | (0.143)    |
| Household size                | −0.0353 ***| −0.0574 ***| −0.0569 ***| −0.0499 ***|
|                               | (0.0180)   | (0.0182)   | (0.0182)   | (0.0183)   |
| Children                      | −0.0290    | −0.0254    | −0.0291    | −0.0497    |
|                               | (0.0885)   | (0.0893)   | (0.0893)   | (0.0897)   |
| Unemployed                    | 0.0374     | 0.0440     | 0.0381     | 0.107      |
|                               | (0.144)    | (0.144)    | (0.144)    | (0.146)    |
| Log of household income       | 0.0647     | 0.0515     | 0.0510     | 0.0108     |
|                               | (0.0417)   | (0.0418)   | (0.0419)   | (0.0426)   |
| Log of household assets       | 0.137 ***  | 0.135 ***  | 0.133 ***  | 0.118 ***  |
|                               | (0.0241)   | (0.0243)   | (0.0243)   | (0.0245)   |
| Current smoker                | −0.289 *** | −0.282 *** | −0.258 *** | −0.258 *** |
|                               | (0.0551)   | (0.0552)   | (0.0555)   | (0.0555)   |
| Current drinker               | 0.134 ***  | 0.135 ***  | 0.129 ***  | 0.129 ***  |
|                               | (0.0461)   | (0.0461)   | (0.0463)   | (0.0463)   |
| Frequent gambler              | 0.00142    | 0.00771    | 0.0167     | 0.0167     |
|                               | (0.0758)   | (0.0760)   | (0.0758)   | (0.0758)   |
| Myopic view of the future     | −0.0375    | −0.0375    | −0.0193    | −0.0193    |
|                               | (0.0617)   | (0.0617)   | (0.0618)   | (0.0618)   |
| Level of risk preference      | −0.163     | −0.163     | −0.176     | −0.176     |
|                               | (0.117)    | (0.117)    | (0.118)    | (0.118)    |
| Current level of happiness    | 0.740 ***  | 0.740 ***  | 0.740 ***  | 0.740 ***  |
|                               | (0.132)    | (0.132)    | (0.132)    | (0.132)    |
| Anxiety about health          | −0.0730    | −0.0730    | −0.0448    | −0.0730    |
|                               | (0.0448)   | (0.0448)   | (0.0448)   | (0.0448)   |
| Constant                      | −2.799 *** | −2.628 *** | −2.490 *** | −2.267 *** |
|                               | (0.651)    | (0.653)    | (0.661)    | (0.665)    |

Note: Robust standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1.

According to Table 6, the effect of financial literacy on exercise behavior is robust and consistent. We find that financial literacy has a positive and significant impact on regular exercise at the 1% (Model 1) and 5% levels of significance (Models 2–4). The results indicate that financially literate people are more likely to exercise regularly. The other estimates also indicate consistency and robustness. Regardless of the model specification, the relationship between exercise behavior and demographic variables such as age, gender, and household size are consistent. We find that being male increases the likelihood of regular exercise at the 1% level of significance, whereas larger household size and older age significantly reduce the likelihood, at the 1% level of significance. However, the statistically significant age-squared variable indicates a non-linear relationship between age and exercise behavior.
As for the socioeconomic variables, only the relationship between the log of household assets and exercise is consistent and robust. We find that the log of household assets has a significant positive impact on the likelihood of regular exercise at the 1% significance level. Having a university degree also has a positive and significant effect on regular exercise at the 10% level of significance (Model 1); however, its effect is neither robust nor consistent. For the risky health behavior variables, the effect of being a current drinker or current smoker is robust and consistent. We find that current drinkers are more likely to exercise regularly, while smokers are less likely to do so at the 1% significance level. Lastly, we find that the current level of happiness is positively and significantly related to regular exercise at the 1% level of significance. Overall, our results are robust and consistent.

4. Discussion

The positive and significant results confirm our hypothesis that people with higher financial literacy have an increased tendency to exercise regularly. Prior findings that financial literacy discourages irrational behavior like smoking and gambling [22–24] support our results. Moreover, our finding is consistent with Grossman’s Human Capital Model [44,45]. Financially literate people or those with good investment knowledge will invest in health by exercising regularly. Due to the consensus that financial literacy encourages people to make reasonable health decisions, policy makers in Japan may consider introducing financial literacy enhancement policies to curb current health issues such as lack of regular exercise.

Among the demographic variables, we find that the effect of gender, age, and marital status are consistent with the results reported in prior studies. Our finding on gender is compatible with other studies [56–59], which confirm the existence of gender gap in exercise. This gap results from the imbalance in autonomous forms of motivation, where women are less likely to have intrinsic regulation, integrated regulation, and identified regulation [58]. Since males and females seem to have different levels of motivation in exercise, policy makers may consider reducing the gender gap by implementing a gender-sensitive policy [58]. For the age variables, we find a non-linear negative relationship, meaning that the likelihood of regular exercise decreases up to a certain age and begins to increase after that. The results are somewhat consistent with the findings of Hickey and Mason [60]. We argue that the negative relationship is a result of functional movement deficiency, which causes difficulty in the daily lives of older people, such as when exercising [8,61–63]. However, the higher likelihood of regular exercise at an older age could be the result of availability of time when people retire from jobs. Since functional strength training helps to reduce the risk of deficiency, policy makers could incorporate functional strength training into their future intervention programs [8]. For the marital status variables, our finding is consistent with Chung et al. and Ruseski et al., who found no association between marital status and exercise [64,65]. Nevertheless, Hallmann et al. [66] suggested that there is no academic consensus in this regard. Other variables like household size and children are also inconsistent with other studies. Although we find a negative impact of household size and insignificant effects of children on the likelihood of exercise, Ruseski et al. [65] reported a negligible household size effect on exercise in Germany. This inconsistency may be due to the sociocultural differences between Japan and other developed countries. Families in the current Japanese aging society may experience caregiver strain, which discourages them from exercising [67]. For the children variable, we find an insignificant effect of children on the likelihood of exercise, which contradicts Ruseski et al. [65]. This insignificant effect may be caused by child age. Studies like Eberth and Smith [68] found that families with children aged two or below are less likely to exercise, whereas families with children aged over two are more likely to exercise. Hence, the effect of children in our sample may offset each other. Nevertheless, data limitations prohibit us from exploring this line of inquiry further at this stage, though future studies may explore such relationships.

Among the socioeconomic variables, our findings on unemployment and assets are consistent with other studies. We find that unemployment has an insignificant effect on
exercise, similar to [69]. We also find a positive relationship between household assets and exercise, which is consistent with the static labor supply model. We can perceive people with a high level of assets as those with a high level of non-labor income. Therefore, people with a high level of assets have more leisure and exercise more, ceteris paribus. Our finding on assets is also consistent with Chung et al. [64], who find an association between household wealth and physical activity. Our results for socioeconomic variables like university degrees and household income are inconsistent with other studies. For the income variable, while we find an insignificant effect of income on exercise behavior, as in [70,71], Shuval et al. [72] indicated that income level affects physical activity. For the education variable, Huang and Humphreys [73] and Hoekman et al. [74] reported a positive relationship between education level and a physically active lifestyle. However, we find no such relationship. Our finding on university degrees seems to align with [75], in which the effect of education on sports participation in Belgium became less persistent over time, eventually becoming insignificant in 1999 and 2009. Since the PPS collected data on exercise behavior only in 2010, future studies may collect more data and do so more frequently to explore these inconsistent relationships in detail.

Among the risky health behavior variables, we find that smoking decreases the likelihood of regular exercise while drinking alcohol has the opposite effect. The findings are consistent with previous studies on the association between physical activities with smoking and drinking alcohol. Heydari et al. [76] and Kujala et al. [77] found a negative association between smoking and physical activity. Since smoking leads to ineffective oxygen delivery to smokers’ muscles, heart, and lung, smokers are more likely to be easily tired and have low physical fitness [78–80]. Therefore, smokers may not be able to exercise properly and give up exercise. On the other hand, as alcohol consumption strongly associates with sport culture and sports events [81] and group drinking activity is perceived as the bonding activity among athletes [82], the positive association between alcohol consumption and exercise seems acceptable. Our findings on the association between alcohol consumption and exercise are also consistent with previous studies [83–85]. However, our finding that frequent gambling does not have a significant relationship with exercise is inconsistent with Håkansson et al. [86], who found a positive association between problem gambling and physical activity. Among the behavioral variables, our finding on the positive association of happiness level with regular exercise is consistent with other studies [87–90]. Intuitively, people with a high level of happiness are more likely to have energy and feel less fatigue than people with depression or a low level of happiness. As a result of higher level of energy and less fatigue, happy people are more likely to exercise regularly. On the other hand, we found an insignificant effect of a myopic view of the future, risk preference, and health anxiety on exercise behavior. These findings are inconsistent with other studies. For the myopic view of future variable, Adams and Nettle [91] and Milfont et al. [92] found a positive relationship between forward-thinking and physical activity. Meanwhile, Hunter et al. [93] found a specific relationship between risk preference and physical activity. Lastly, Lejoyeux et al. [94] and Pugh and Hadjistavropoulos [95] indicated a positive association between health anxiety and exercise. The contradiction between our findings and others may arise from measurement and sample selection difference.

5. Conclusions

Recent studies suggest that financial literacy is a rational decision-making instrument that reduces the likelihood that people will engage in risky health behaviors like smoking and gambling [22–24]. These results motivated us to investigate whether financial literacy encourages a positive health behavior like exercising regularly among Japanese people. Based on a sample of 3711 from Osaka University’s 2010 PPS, we hypothesize that people with higher financial literacy are more likely to exercise regularly. Our results indicate a positive and significant relationship between financial literacy and regular exercise, supporting our hypothesis. We argue that financially literate people or those with good
investment knowledge will invest in health by exercising regularly. The findings emphasize the role of financial literacy in improving peoples’ rational decision-making capacity, as in previous studies [23,33,34,37,39,96]. Moreover, our study shows that respondents who are males, middle-aged, have smaller household size, have higher balance of financial assets, are not current smokers, current drinkers, and are currently happy are more likely to exercise regularly.

Our study has some limitations to consider when interpreting the results. First, we followed the guideline of the MHLW [97] to define regular exerciser as a person who exercises 30 min or more at a time and does so at least twice a week for at least a year. However, we could not check robustness of the results with alternative definitions of regular exercise such as exercising once or twice in a week for at least 150 min or high intensity exercise once or twice in a week due to limitation of data. Therefore, our study assumes that respondents engage in high-intensity exercise and define exercise accordingly. Moreover, this data limitation may also be the cause of the inconsistency between our findings and others, as mentioned earlier. Future studies may consider collecting more data to explore those relationships in the Japanese context more extensively. Second, our approach to measuring financial literacy is limited to Lusardi and Mitchell’s [47] three questions, which we use because they are widely adopted (e.g., [48,50,51,54,55]) and Nicolini and Haupt [98] recently demonstrated that these three questions are still viable. Hence, we argue that our choice to adopt Lusardi and Mitchell’s [47] three questions is justified. Nevertheless, few studies questioned the reliability of the measures of financial literacy in predicting financial behavior and economic outcomes [99,100]. Third, our study measures variables like a myopic view of the future, risk preference, and health anxiety through a limited number of questions, which may not be sufficient to detect the relationship between these variables and exercise behavior. The variable measurement issues could be responsible for the insignificant and inconsistent results.

Nevertheless, our study provides primary evidence that financial literacy, which enables people to make rational decisions, enhances the likelihood of engaging in rational health behaviors like exercising regularly. The study findings have implications for the ongoing health pandemic as peoples’ exercise habits have been affected due to lockdown and other virus controlling measures. Motivating people to do regular exercise when they cannot go outside has become a major challenge. The results of this study provide an opportunity to explain the problem of lack of exercise from a different perspective. The value of exercise, as an investment in health capital, would be better understood when people think rationally. Thus, educating people with the concept of health as a capital goods should be prioritized. We argue that the Japanese government should consider implementing financial literacy programs in light of these findings. Improving financial literacy among the Japanese population may lessen health issues such as a lack of regular exercise. Future studies may consider exploring the design of policies that aim to enhance people’s financial literacy effectively and efficiently.

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