

Article

Relationship between physical education in the first year of university and exercise habits and physical and mental health in the following spring

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Abstract

The present study examined the relationship between taking physical education and health-related courses in the first year of university and the acquisition and maintenance of exercise habits and physical and mental health in the student's second year. The study population consisted of university students was 2,483 in FY2017 and 2,352 in FY2018. Of these, the 2,293 students (1,744 men, 18.5 ± 1.0 years old; 549 women, 18.6 ± 1.0 years old) who responded to the self-administered questionnaire survey on daily living habits in both years were included in the analysis. The results showed that taking physical education and health-related courses in the first year was significantly related to exercise habits the following spring. The results also suggested that these courses were more strongly related to mental health than physical health. In addition, men were significantly more likely to acquire a new exercise habit and had more improved mental health. In the future, it is necessary to clarify the causal relationship between taking physical education and health-related courses and exercise habits and the maintenance and acquisition of physical and mental health, in addition to developing effective support methods for students who dislike gender differences and exercise.

Keywords: Sports science exercise, Exercise habits, Physical health, Mental health.

1. Introduction

Implementing a lifestyle intervention program aimed at establishing an exercise routine is important for maintaining good health (Kiuchi et al., 2021). Physical activity prevents chronic diseases such as cardiovascular disease, diabetes, cancer, hypertension, obesity, depression, and osteoporosis, as well as early death (Warburton et al., 2006). It has been reported that regularly maintaining a high level of physical activity during youth and adolescence prevents atherosclerosis (Kwaśniewska et al., 2014). However, according to the National Health and Nutrition Survey conducted in 2019 (Japan National Health and Nutrition Survey, 2019), the percentage of young people practicing regular exercise is low, with only 12.9% of women and 28.4% of men in their 20s exercising for 30 minutes or more at least twice a week for more than a year. Even in our previous study, approximately 15% of the male students and 40% of the female students either dislike exercise or have no connection with it (Hamada et al., 2018). Establishing exercise habits is an important issue for young people to acquire proper lifestyle habits.

For university students to maintain physical activity, it may be useful to take physical education classes (NASPE, 2007). However, it is not clear whether the effect will be sustained after the end of the course. In addition, there have not been studies on people who have lost their exercise habits or did not have established exercise habits in the first place.

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In physical education classes for general students, the goal is to have students experience the joy of physical exercise so that they can maintain their exercise habits after taking the class. There are also some faculties that make physical education a compulsory skill, where students who originally disliked exercise, or who were not involved in exercise but did not like it, take the same classes as other students. What is the status of their acquisition and maintenance of exercise habits? Answering these questions is the primary objective of this study.

Mental health is especially important in young people. There are students whose mental health declines or whose lifestyle is disrupted after enrollment (Huang et al., 2003). Mental health also has a significant effect on graduation and career decisions (Grøtan et al., 2021, Lim et al., 2018), and physical exercise contributes to mental health (Tyson et al., 2010). However, it is not clear whether taking physical education skills and health-related courses is related to maintaining physical and mental health. The second objective of this study is to examine this point.

In order to achieve these two objectives, we examined the relationship between taking a physical education class in the first year of university and these students' exercise habits and physical and mental health the following spring.

2. Methods

2.1. Subject

This study was conducted on undergraduate students enrolled in K University in the 2017 fiscal year. The number of students who responded to the annual lifestyle survey using self-administered questionnaires at the time of enrollment and at the time of regular health examinations in spring of 2018 was 2,483 in FY2017 and 2,352 in FY2018. Of these, 2,293 students (1,744 men, 18.5±1.0 years old; 549 women, 18.6±1.0 years old) who responded in both years were included in the analysis. Since some students did not respond or responded inappropriately to individual question items, the number of subjects included in the individual analyses was less than 2,293.

2.2. Survey Items

Among the lifestyle surveys, there is a self-assessment of physical and mental health. In all cases, the respondents were asked to choose the most applicable from the following five options: (1) very good, (2) moderately good, (3) neither good nor bad, (4) somewhat bad, and (5) very bad. The number of students who chose "very bad" was extremely small; therefore, together with (4) "somewhat bad," there were four main groups.

The exercise habits were categorized into the following six categories: (1) I have exercised for 30 minutes or more once or twice a week for at least one month; (2) I have exercised for 30 minutes or more three times a week for at least one month; (3) I have recently started to exercise, but it has not been one month yet; (4) I used to exercise, but not for the last month; (5) I do not like exercise or sports, so I do not exercise at all; and (6) I do not like exercise or sports, but I have never been involved in them. In this study, (1) to (3) were combined into "I have an exercise habit," (4) into "I used to exercise but did not have an exercise habit when I entered school," (5) into "I dislike exercise and do not exercise," and (6) into "I do not dislike exercise but have no relation to exercise." These four groups were used as the four strata in the stratified analysis. When asking only about the status of exercise habits, the analysis was divided into two groups: "I do," which summarized options 1) through 3); and "I do not," which included options (4) through (6).

The enrollment status of the students was confirmed by course registration data provided by the Educational Affairs Department, and the students were divided into four groups: those who took only the sports science exercise as the practical physical education subject, those who took both the sports science exercise and health-related subjects, those who took only the health-related subjects, and those who did not take either subject. The health-related courses included Health Studies, Mental Health, and General Medicine. These classes share the common point that having exercise habits is useful for maintaining physical and mental health. Students may take up to three courses, although they are only allowed to take one sports science exercise in physical education. However, in this study, the difference in the number of courses taken, attendance rate, and final examination scores were not considered.

2.3. Analysis

We examined how the status of exercise habits varied during the first year of university, and whether it depended on if the students took sports science exercise or health-related courses. Statistical significance was examined using the McNemar test.

A cross-tabulation table was created to examine how the completion of sports science exercise and health-related courses was related to the status of exercise habits and students' self-evaluation of their physical and mental health at

the time of entering their second year. Here, the Kormogorov-Smirnov (K-S) test was performed to reject the normality of the data distribution, and then the χ^2 test was performed. At this time, we conducted a stratified analysis based on self-assessment of health and exercise habits at the time of admission. In other words, the self-assessment of exercise habits and health level was analyzed in each of the four strata based on the results of the daily life habit survey at the time of admission. Residual analysis was added for the groups whose data bias was determined to be significant in the cross-tabulation analysis.

Multiple logistic regression analysis was conducted using the status of exercise habits and the level of physical and mental health obtained from the daily life habit survey at the time of entering the second year as the objective variables. When exercise habit was used as the objective variable, it was divided into "I do" and "I do not," as described above. The self-assessment of physical and mental health was also divided into two groups: the "good" group, which chose either (1) very good or (2) fairly good; and the "not good" group, which chose either (3) neither good nor bad, (4) somewhat bad, or (5) very bad. The explanatory variables were gender, exercise status at the time of enrollment, self-assessment of physical health, self-assessment of mental health, and breakfast intake - every day, 4-5 days, 2-3 days, and almost never. These variables were used because exercise status differs between men and women (Hamada et al., 2018), breakfast intake is significantly associated with maintaining exercise habits (Hamada et al., 2018) and self-assessment of health is significantly related to graduation and employment (Grøtan et al., 2021, Lim et al., 2018). In addition, if students take the Sports Science Seminar in the first semester, there will be an eight-month gap before the survey at students' in their second year. In the second semester of the study, there is a two-month period before the survey. To examine the possibility that this difference was related to the status of exercise habits in the second year, multiple logistic regression analysis was conducted only for those who had taken the Sports Science Seminar. Whether they had taken the first or second semester was employed as an explanatory variable. All data were entered into the spreadsheet software Excel and analyzed using Excel Statistics 2018. A p-value of less than 0.05 was determined to be statistically significant.

2.4. Ethical considerations

Lifestyle surveys were conducted by the Health Office of the Student Affairs Division, and grades were managed by the school physician. The questionnaire stated that the purpose of the survey was to provide enhanced health support. In addition, the results of the survey will be compiled and statistically analyzed, and the results obtained may be published in academic conferences and journals, but it is also clearly stated that the names of individuals and the content of their responses will never be shared with outside parties. The students were instructed to inform the school physician or the school nurse if they disagreed with the use of the information in the survey form for the purpose of the study and were given the opportunity to express their disagreement.

3. Results

3.1. Changes in exercise habits (Table 1)

Students who reported having an exercise habit at the time of enrollment still maintained an exercise habit at the end of March and beginning of April 2018, while students who reported no exercise habit had a higher frequency of not having an exercise habit in 2018 ($p < 0.001$ by the McNemar test). This was not related to whether they had taken sports science exercise or health-related courses. However, there were some students who acquired new exercise habits and some who stopped exercising. The number of students in the former category was higher (592 vs. 144), and the percentage of students who had no exercise habit at the time of enrollment who gained exercise subjectivity was higher than the percentage of students who had an exercise habit but lost it (36.8% vs. 23.4%).

Table 1. Changes in exercise habits over the year since enrollment in 2017: students taking sports science exercises and health-related courses are studied by course.

Relationship between physical education in the first year of university and exercise habits and physical and mental health in the following spring

Takehira Nakao, Takahiro Adachi, Hiromasa Okumura, Hidetsugu Nishizono, Iwao Hara, Haruhiko Yasukouchi and Hiromi Muratani

		Exercise habit (enrollment) in 2017		
		I do	I do not	Total
Took only the sports science exercise subject				
At the time of entering the second year	I do	211	274	485
	I do not	65	393	458
	Total	276	667	943
<i>p</i> < 0.001 (McNemar test)				
Took both the sports science exercise and health-related lecture subject				
At the time of entering the second year	I do	112	102	214
	I do not	19	120	139
	Total	131	222	353
<i>p</i> < 0.001 (McNemar test)				
Took only the health-related lecture subject				
At the time of entering the second year	I do	24	35	59
	I do not	8	74	82
	Total	32	109	141
<i>p</i> < 0.001 (McNemar test)				
Did not take either subject				
At the time of entering the second year	I do	124	181	305
	I do not	52	429	481
	Total	176	610	786
<i>p</i> < 0.001 (McNemar test)				

3.2. Students taking sports science exercise and health-related courses in the first year, and their exercise habits in the second year

There were 615 students who maintained an exercise habit at the time of enrollment, 1,134 students who used to exercise but did not have an exercise habit at the time of enrollment, 222 students who answered that they did not like exercise and did not do it, and 252 students who answered that they did not dislike exercise but did not have any relationship with it. This distribution was rejected for normality by the K-S test at $p < 0.001$.

Then, we conducted a χ^2 test on the bias between taking sports science exercise and health-related courses in the first year and students' exercise status in the second year according to exercise status at the time of entrance. The bias in the data was significant for the group with an exercise habit at the time of enrollment ($p = 0.023$) and the group that used to exercise but had no exercise habit at the time of enrollment ($p = 0.003$). According to the residual analysis, the number of students who responded that they had an exercise habit in their second year (112 and 88) was significantly higher than the expected value (100 and 73) among students who took both the sports science exercise and health-related courses, and the number of students who had no exercise habit (52 and 252) was also significantly higher than the expected value (41 and 225).

3.3. Self-assessment of the level of physical health after completing sports science exercises and health-related lecture courses in the first year and after entering the second year

At the time of enrollment, 783 students answered that their physical health was very good, 1,090 students answered that it was fairly good, 349 students answered that it was neither good nor bad, and 66 students answered that it was somewhat to very bad. This distribution was rejected for normality by the K-S test at $p < 0.001$.

In addition, a χ^2 test was conducted to examine the bias in the self-assessment of physical health in the second year, based on the self-assessment of physical health at the time of admission and the completion of sports science exercise and health-related courses in the first year. Data bias did not reach the level of significance in either group, and we could not find a relationship between the completion of sports science exercise and health-related courses and the physical health self-assessment.

3.4. Self-evaluation of mental health after entering second year, and after completing sports science exercises and health-related lecture courses in the first year

At the time of enrollment, 844 students self-evaluated their mental health as very good, 949 students self-evaluated it as fairly good, 424 students as neither good nor bad, and 69 students as somewhat to very bad. This distribution was rejected for normality at $p < 0.001$ by the K-S test.

In addition, a χ^2 test was conducted to examine the bias in the self-assessment of mental health between the completion of sports science exercise and health-related courses in the first year and in the second year. The bias in the data was significant only for the "neither good nor bad" group in terms of mental health when entering university ($p = 0.006$). In the residual analysis, the number of students who self-evaluated their mental health as moderately good (76 students) was significantly higher than the expected value (66 students), and the number of students who self-

evaluated their mental health as somewhat to very bad (7 students) was significantly lower than the expected value (13 students). The number of students who self-evaluated their mental health as very good (14 students) was significantly higher than the expected value (8 students) among those who took both the sports science exercise and health-related courses. For students who took only health-related courses, the number of students who self-evaluated their mental health as somewhat to very poor (0 students) was significantly lower than the expected value (3 students), but the expected value itself was less than 5. However, for students who did not take either the sports science exercise or the health-related courses, the number of students who self-evaluated their mental health as very good (23 students) was significantly lower than the expected value (30 students), and the frequency of students who self-evaluated their mental health as somewhat to very bad (24 students) was significantly higher than the expected value (15 students).

3.5. Factors associated with exercise habit in the second year (not doing vs. doing) - Multiple logistic regression analysis of all subjects (Table 2)

Multiple logistic regression analysis was conducted on 2,213 subjects who responded appropriately about their exercise status in the daily life habit surveys at the time of entrance and in the second year and who also responded to the explanatory variables listed in the Methods section. Significant associations were detected between having an exercise habit in the second year and having a good self-assessment of mental health at the time of admission, being male, taking sports science exercise, taking health-related courses, and eating breakfast more frequently. They were also more likely to eat breakfast. Exercise status at the time of entrance was also significantly related to exercise habits in the second year.

Table 2. Factors associated with exercise habits (0: not doing vs. 1: doing) at the time of promotion to the second grade - Multiple logistic regression analysis for all subjects. (n=1,058)

Variable	Standard partial regression coefficient [95% CL]	Odds ratio	P value
Self-assessment of the level of physical health in the first year			
0 neither good nor bad, somewhat bad, very bad	0.0185 [-0.2311, 0.3269]	1.0490 [0.7963, 1.3866]	0.7366
1 very good, moderately good			
Self-assessment of the level of mental health in the first year			
0 neither good nor bad, somewhat bad, very bad	0.1127 [0.0121, 0.5361]	1.3154 [1.0122, 1.7094]	0.0403
1 very good, moderately good			
Sex			
1 men	-0.1914 [-0.6754, -0.2261]	0.6371 [0.5090, 0.7976]	p<0.001
2 women			
The sports science exercise lecture			
0 do not take	0.1997 [0.2172, 0.5965]	1.4991 [1.2425, 1.8086]	p<0.001
1 take			
The health-related lecture			
0 do not take	0.1145 [0.0540, 0.4960]	1.3165 [1.0554, 1.6421]	0.0148
1 take			
Breakfast intake at the time enrollment			
1 almost every day			
2 four to five days a week	-0.1531 [-0.2503, -0.0629]	0.8550 [0.7786, 0.9390]	0.0011
3 two to three days a week			
4 almost never			
Exercise status at the time enrollment			
1 I have an exercise habit			
2 I used to exercise but did not have an exercise habit when I entered school	-0.7645 [-0.9608, -0.7199]	0.4316 [0.3826, 0.4868]	p<0.001
3 I dislike exercise and do not exercise			
4 I do not dislike exercise but have no relation to exercise			
Constant term	[1.3792, 2.2943]	6.2762 [3.9791, 9.9173]	p<0.001

3.6. Factors associated with exercise habit in the second year (no exercise vs. exercise) - Multiple logistic regression analysis conducted by exercise status at admission (Table 3)

Looking at the exercise habits in the second year of school according to the exercise status at the time of admission, 469 (76.6%) out of 612 students who had exercise habits at the time of admission continued to exercise, while 482 (42.7%) out of 1,129 students who used to exercise but did not at the time of admission resumed exercise. However, 53 (24.0%) out of 221 students who answered that they disliked exercise and did not do it and 54 (21.5%) out of 251 students who answered "I don't dislike it, but I have nothing to do with exercise" did exercise when they were promoted to their second year.

In the group that used to exercise but did not at the time of enrollment, being male and taking the sports science exercise course were significantly associated with having an exercise habit at the time of enrollment. It was also significant that those who ate breakfast more often were more likely to have an exercise habit. In the group that answered that they disliked exercise and did not do it when they began school, no items significantly related to exercise habits were detected, even though 24.0% of the students had acquired exercise habits by the time they advanced to their second year. In the group that responded that they did not dislike exercise but had no relationship with it, 21.5%

Relationship between physical education in the first year of university and exercise habits and physical and mental health in the following spring

Takehira Nakao, Takahiro Adachi, Hiromasa Okumura, Hidetsugu Nishizono, Iwao Hara, Haruhiko Yasukouchi and Hiromi Muratani

of these students acquired exercise habits, and this was significantly related to the completion of sports science exercise.

Table 3. Factors associated with exercise habits (0: not doing vs. 1: doing) at the time of promotion to the second grade - Multiple logistic regression analysis conducted by exercise status at the time of entrance.

Variable	I have an exercise habit (n=469 / 612)			I used to exercise but did not have an exercise habit when I entered school (n=482 / 1,129)			I dislike exercise and do not exercise (n=53 / 221)			I do not dislike exercise but have no relation to exercise (n=54 / 251)		
	Standard partial regression coefficient [95% CL]	Odds ratio	P value	Standard partial regression coefficient [95% CL]	Odds ratio	P value	Standard partial regression coefficient [95% CL]	Odds ratio	P value	Standard partial regression coefficient [95% CL]	Odds ratio	P value
Self-assessment of the level of physical health in the first year												
0 neither good nor bad, somewhat bad, very bad	-0.0638	0.8263	0.5653	-0.0324	0.9183	0.6511	0.1419	1.3366	0.3975	0.3975	2.5827	0.0589
1 very good, moderately good	[-0.8385, 0.4581]	[0.4234, 1.5811]		[-0.4548, 0.2843]	[0.6346, 1.3288]		[-0.5485, 1.1585]	[0.5788, 3.1850]		[-0.0357, 1.9334]	[0.9649, 6.9130]	
Self-assessment of the level of mental health in the first year												
0 neither good nor bad, somewhat bad, very bad	0.2002	1.7464	0.0590	0.0909	1.2496	0.2073	0.1262	1.3022	0.0465	0.0465	1.1102	0.8007
1 very good, moderately good	[-0.0213, 1.1364]	[0.9789, 3.1157]		[-0.1235, 0.5690]	[0.8839, 1.7666]		[-0.5563, 1.0845]	[0.5733, 2.9578]		[-0.7073, 0.9165]	[0.4930, 2.5004]	
Sex												
1 men	-0.2218	0.5214	0.0134	-0.1695	0.6547	0.0069	-0.2896	0.5603	-0.1808	-0.1808	0.6916	0.2667
2 women	[-1.1674, -0.1349]	[0.3112, 0.8738]		[-0.7310, -0.1160]	[0.4814, 0.8903]		[-1.2155, -0.0569]	[0.2966, 1.6585]		[-1.0195, 0.2819]	[0.3608, 1.3257]	
The sports science exercise lecture												
0 do not take	0.1280	1.3107	0.1882	0.2010	1.5040	0.0012	0.1647	1.3420	0.3986	0.3986	2.2255	0.0142
1 take	[-0.1324, 0.6735]	[0.8760, 1.9602]		[0.1611, 0.6563]	[1.1748, 1.9276]		[-0.3465, 0.9353]	[0.7069, 2.5400]		[0.1605, 1.4395]	[1.1741, 4.2185]	
The health-related lecture												
0 do not take	0.2381	1.7137	0.0272	0.1001	1.2759	0.1005	0.0409	1.1132	-0.0488	-0.0488	0.8042	0.7655
1 take	[0.0605, 1.0166]	[1.0626, 2.7638]		[-0.0471, 0.2344]	[0.9540, 1.7064]		[-0.7099, 0.9244]	[0.4917, 2.5205]		[-0.9316, 0.6855]	[0.3939, 1.9847]	
Breakfast intake at the time enrollment												
1 almost every day	-0.0966	0.9021	0.3040	-0.2148	0.8053	p<0.001	-0.0262	0.9742	-0.0647	-0.0647	0.9361	0.6854
2 four to five days a week	[-0.2996, -0.0935]	[0.7411, 1.0980]		[-0.3424, -0.0907]	[0.7101, 0.9133]		[-0.3505, 0.2982]	[0.7043, 1.3475]		[-0.3857, 0.2536]	[0.6006, 1.2886]	
3 two to three days a week												
4 almost never												
Exercise status at the time enrollment												
1 I have an exercise habit	4.4808	1.1557	0.0014	-0.3958	0.6832	0.5997	-2.0788	0.4561	0.4473	-3.3097	0.1462	0.0066
2 I used to exercise but did not have an exercise habit when I entered school	[1.7838, 11.2558]	[0.6732, 1.9842]							[1.251, 1.5779]		[0.0165, 0.5851]	
3 I dislike exercise and do not exercise												
4 I do not dislike exercise but have no relation to exercise												
Constant term	[0.5787, 2.4209]											

3.7. Multiple logistic regression analysis (Table 4) with the explanatory variable of whether the student took the Sports Science Seminar in the first or second semester, and only for students who took the Seminar

A total of 1,261 students were included in the analysis, and 692 had exercise habits in their second year. The percentage was significantly higher for students who took the Sports Science Seminar in the first semester than for those who took it in the second semester. Being male, taking health-related courses, and eating breakfast more frequently were also significantly associated with having exercise habits in the second year. These three factors were comparable to the results obtained in the analysis of all students (Table 2), but the association with self-assessment of mental health did not reach a significant level.

Table 4. Multiple logistic regression analysis of exercise habits at the time of promotion to the second year for students who took the sports science seminar - "I do" is 1, "I don't" is 0: The explanatory variables include whether the student took the seminar in the previous or subsequent semester. (n=682)

Variable	Standard partial regression coefficient [95% CL]	Odds ratio	P value
Self-assessment of the level of physical health in the first year			
0 neither good nor bad, somewhat bad, very bad	0.0262	1.0756	0.7173
1 very good, moderately good	[-0.3217, 0.4675]	[0.7249, 1.5960]	
Self-assessment of the level of mental health in the first year			
0 neither good nor bad, somewhat bad, very bad	0.1190	1.3714	0.1031
1 very good, moderately good	[-0.0640, 0.6956]	[0.9380, 2.0050]	
Sex			
1 men	-0.1762	0.6526	0.0050
2 women	[-0.7246, -0.1289]	[0.4875, 0.8790]	
The sports science exercise lecture			
0 do not take	-0.1656	0.7180	0.0066
1 take	[-0.5703, -0.0923]	[0.5654, 0.9119]	
The health-related lecture			
0 do not take	0.1498	1.4084	0.0151
1 take	[0.0663, 0.6186]	[1.0686, 1.8563]	
Breakfast intake at the time enrollment			
1 almost every day	-0.1250	0.8820	0.0413
2 four to five days a week	[-0.2462, -0.0049]	[0.7818, 0.9951]	
3 two to three days a week			
4 almost never			
Exercise status at the time enrollment			
1 I have an exercise habit			
2 I used to exercise but did not have an exercise habit when I entered school	-0.6815	0.4506	p<0.001
3 I dislike exercise and do not exercise	[-0.9593, -0.6352]	[0.3831, 0.5298]	
4 I do not dislike exercise but have no relation to exercise			
Constant term	[1.8241, 3.1879]	12.2560	p<0.001
		[6.1974, 24.2372]	

3.8. Factors associated with self-assessment of physical health (very to moderately good vs. neither good nor bad or somewhat to very bad) in the second year - Multiple logistic regression analysis of all students (Table 5)

A total of 2,258 students were included in the analysis, and in their second year, 1,823 students answered that their physical health was very to somewhat good. These students were judged to be in the "good" group. Significantly related to being in this group were self-assessment of physical health at entry and exercise status at entry. Taking sports science exercise and breakfast consumption did not reach the level of significance.

Table 5. Self-assessment of physical health at the time of promotion to the second year - Multiple logistic regression analysis with "very to fairly good" as 1 and "neither good nor bad" or "somewhat to very bad" as 0. (n=1,823)

Variable	Standard partial regression coefficient [95% CL]	Odds ratio	P value
Self-assessment of the level of physical health in the first year			
0 neither good nor bad, somewhat bad, very bad	0.5787 [1.2589, 1.7359]	4.4700 [3.5214, 5.6742]	p<0.001
1 very good, moderately good			
Sex			
1 men	0.0512 [-0.1433, 0.3837]	1.1277 [0.8665, 1.4676]	0.3712
2 women			
The sports science exercise lecture			
0 do not take	0.0933 [-0.0362, 0.4148]	1.2084 [0.9645, 1.5141]	0.0998
1 take			
The health-related lecture			
0 do not take	-0.0686 [-0.4290, 0.0988]	0.8478 [0.6512, 1.1038]	0.2201
1 take			
Breakfast intake at the time enrollment			
1 almost every day	-0.1008 [-0.2089, 0.0036]	0.9025 [0.8115, 1.0036]	0.0584
2 four to five days a week			
3 two to three days a week			
4 almost never			
Exercise status at the time enrollment			
1 I have an exercise habit			
2 I used to exercise but did not have an exercise habit when I entered school	-0.2217 [-0.3642, -0.1228]	0.7839 [0.6948, 0.8845]	p<0.001
3 I dislike exercise and do not exercise			
4 I do not dislike exercise but have no relation to exercise			
Constant term	[0.2879, 1.2584]	2.1666 [1.3336, 3.5197]	0.0018

3.9. Factors associated with self-assessment of mental health level (very to moderately good vs. neither good nor bad or somewhat to very bad) in the second year - Multiple logistic regression analysis of all students (Table 6)

A total of 2,258 students were included in the analysis, and in their second year, 1,811 students answered that their mental health was very to somewhat good. These students were judged to be in the "good" group. The factors significantly associated with being in this group were self-assessment of mental health at the time of enrollment, as well as being male, taking sports science exercise, and exercise status at the time of enrollment.

Table 6. Self-assessment of mental health at the time of promotion to the second year - Multiple logistic regression analysis with "very to fairly good" as 1 and "neither good nor bad" or "somewhat to very bad" as 0. (n=1,811)

Variable	Standard partial regression coefficient [95% CL]	Odds ratio	P value
Self-assessment of the level of mental health in the first year			
0 neither good nor bad, somewhat bad, very bad	0.6109 [1.2508, 1.7019]	4.3927 [3.4931, 5.5240]	p<0.001
1 very good, moderately good			
Sex			
1 men	-0.1189 [-0.5312, -0.0280]	0.7561 [0.5879, 0.9723]	0.0294
2 women			
The sports science exercise lecture			
0 do not take	0.1392 [0.0581, 0.5067]	1.3263 [1.0598, 1.6598]	0.0136
1 take			
The health-related lecture			
0 do not take	0.0203 [-0.2230, 0.3209]	1.0502 [0.8001, 1.3784]	0.7243
1 take			
Breakfast intake at the time enrollment			
1 almost every day	-0.0719 [-0.1803, 0.0339]	0.9294 [0.8350, 1.3045]	0.1805
2 four to five days a week			
3 two to three days a week			
4 almost never			
Exercise status at the time enrollment			
1 I have an exercise habit			
2 I used to exercise but did not have an exercise habit when I entered school	-0.1819 [-0.3199, -0.0799]	0.8188 [0.7262, 0.9232]	0.0011
3 I dislike exercise and do not exercise			
4 I do not dislike exercise but have no relation to exercise			
Constant term	[0.6203, 1.5523]	2.9633 [1.8595, 4.7223]	p<0.001

4. Discussion

4.1. Effects of taking sports science exercise and health-related courses on the maintenance and acquisition of exercise habits

Many students acquired exercise habits in their first year of university (592 students, calculated from Table 1). This was due in large part to the fact that 484 (42.7%) of the 1,134 students who had previously exercised but were not in the habit of exercising at the time of enrollment were exercising in their second year. It is also important for students with exercise habits to maintain their exercise habits later in life, but it has been reported that it is difficult for students

of any age to maintain their exercise habits (WHO, 1996). In this study, 144 out of 615 students had lost their exercise habit.

However, multiple logistic regression analysis limited to students who took the sports science exercise course, a practical physical education course at the university, showed that students who took the course in the first semester were more likely to have exercise habits in their second year than those who took the course in the second semester (Table 4). This is the opposite of what we expected, and there is no clear explanation for it. There may have been many students in the previous semester who took the Sports Science Seminar with the clear intention of exercising, but we did not question the students' enthusiasm towards taking the course. Further study is needed to determine how long the educational effects of university physical education will last.

According to the cross-tabulation table analysis, taking sports science exercise and health-related courses in practical physical education subjects was significantly related to the maintenance and acquisition of exercise habits among students who had exercise habits at the time of admission and those who were not exercising at the time of admission but had exercised before. Therefore, according to the multiple logistic regression analysis, overall, both sports science exercise and health-related courses were significantly associated with exercise habits when students entered their second year (Table 2). By stratum, taking sports science exercise was significantly associated with having an exercise habit in their second year for students who did not exercise at the time of enrollment but had exercised before and for students who did not dislike but had no relationship with exercise (Table 3). It is possible that the intended purpose of the sports science exercise, which was to let them experience the joy of exercise and to help them acquire exercise habits, was achieved in these students. However, in the group that answered that they had exercise habits at the time of entrance, health-related courses were significantly related to exercise habits in their second year (Table 3). For students who have already been exercising, conveying systematic knowledge of the benefits of exercise may help them maintain their exercise habits.

Even among the students who answered that they did not like to exercise and did not exercise, 53 (24.0%) out of 222 students exercised in the second year. However, the factors significantly associated with the acquisition of exercise habits were not clear (Table 3). It is unclear what kind of education is desirable for students who do not like to exercise. Timo et al. (Timo et al., 2016) reported a positive correlation between exercise competence and physical activity in a sample of 333 students. For students who do not like exercise, it may be difficult to convey the joy of exercise per se, and it may be necessary to think of ways to increase exercise competence - that is, to include steps that bring about small successes - and to organize teams.

4.2. Effects of taking sports science exercise and health-related courses on self-assessment of physical and mental health

We were not able to find a certain relationship between the self-assessment of physical health and the completion of sports science exercise and health-related courses. Regarding the self-assessment of mental health, the data bias was significant in the group that self-assessed their mental health as neither good nor bad at the time of admission. In the residual analysis, students who took the sports science exercise and health-related courses had higher self-evaluation of mental health in their second year than at the time of admission. On the other hand, students who did not take any of the courses self-evaluated their mental health as somewhat to very poor in their second year significantly more frequently than expected. Taking sports science exercise and health-related courses may be more related to mental health than to physical health.

The results of multiple logistic regression analysis, in which the self-evaluation of health at the time of students' promotion to their second year was divided into "not good" and "good," showed that completion of the sports science exercise and health-related courses was not significantly related to the self-evaluation of physical health (Table 5), but completion of the sports science exercise was significantly related to the self-evaluation of mental health (Table 6).

These results show the relationship between the students' mental health and their completion of the sports science exercise. The association between physical activity and good mental health has already been reported (Tyson et al., 2010). It is necessary to enrich practical physical education subjects in the hope that the pattern of taking sports science exercise => exercise habit => maintaining good mental health will be established. Blumenthal et al. (Blumenthal et al., 1989) reported that physical exercise contributes to mental health even in older populations.

From a long-term perspective, Power et al. (Power et al., 1996) reported that low self-assessment of health status at a young age is associated with a higher frequency of transition to a lower social stratum in the future, and that prevalence

increases as social stratum decreases. In other words, maintaining a high self-assessment of physical and mental health at a young age will facilitate learning at university, which in turn will define future social stratification to some extent and lead to the maintenance and promotion of health throughout life.

To the best of our knowledge, there are no long-term follow-up studies comparable to those of Power et al. (Power et al., 1996) in Japan. Cross-sectional studies have reported significant associations between mental health and education level and income and physical health, especially among women (Honjo et al., 2006). It is also well recognized that socioeconomic class is an important social determinant of health (Sugisawa et al., 1996).

4.3. Gender differences and breakfast habits

In terms of exercise habits (Table 2) and self-assessment of mental health (Table 6) in the second year, men were significantly more likely to have exercise habits and better mental health. When students' exercise habits in their second year were examined according to exercise status at the time of admission (Table 3), a significant gender difference was found between the groups that had exercise habits at the time of admission and those that did not exercise at the time of admission but used to do so. In terms of motivation for physical activity, it may be necessary to take into account the gender composition of the teams for each event in physical education classes and to devise ways to organize the classes themselves.

Regarding breakfast habits, the higher the frequency of breakfast intake, the higher the percentage of those who had exercise habits. Furthermore, regarding exercise habits, the better the mental health (Table 2) and self-assessment of mental health (Table 6) in the second year, the more likely students were to have exercise habits. In a 2004 study of 71 female students, it was found that students with no exercise habits had a higher rate of missing breakfast (Shimbo et al., 2004). Our previous study (Hamada et al., 2018) of sophomores in 2017 also reported that the frequency of exercise habits was higher among students who ate breakfast almost every day, both men and women. Therefore, the relationship between breakfast intake and exercise habits may be widely accepted.

4.4. Future issues

In this study, we examined exercise habits at students' time of promotion to their second year. Further study is needed to determine whether exercise habits can be maintained later in life and whether the physical education courses offered in the first year of university can contribute to this. In addition, there were few female students in this study (549 out of 2,293, or 23.9%), which was insufficient for conducting a stratified analysis by gender. If more in-depth analysis becomes possible, it may lead to the creation of curricula that are tailored to the characteristics of men and women. In this study, reasons for course enrollment, differences in faculty members' abilities, types of exercise, intensity, frequency, and student performance were not used as explanatory variables. To examine how enrolling in physical education and health-related subjects are related to maintaining physical and mental health in detail, it is necessary to extract subjects under certain conditions and examine these using methods such as covariance structure analysis. In this study, we did not examine the causal relationship between taking sports science exercise and health-related courses in practical physical education subjects and maintaining or acquiring exercise habits. In the future, it will be necessary to conduct a prospective intervention study in which factors other than enrollment in physical education and health-related courses are matched, and considerations other than the classroom framework will also be necessary.

5. Conclusions

For students who used to exercise but did not at the time of enrollment and students who do not dislike exercise but have no relationship with it, taking the sports science exercise course, which is a practical physical education course once a week, was associated with the acquisition of exercise habits. Contrarily, for students who were exercising at the time of enrollment, taking health-related courses was associated with the maintenance of exercise habits. In addition, the self-assessment of mental health was related to the completion of sports science exercise. In the future, it will be necessary to develop more effective support methods for students who dislike exercise and a curriculum that takes gender differences into account.

Author Contributions

Conceptualization, T.N., H.N., H.M.; methodology, T.N., H.M.; software, T.N., T.A., I.H., H.Y. and H.M.; validation, T.N., T.A., I.H., H.Y. and H.M.; formal analysis, H.M.; investigation, T.N.; resources, T.N., T.A., I.H., H.Y. and H.M.; data curation, H.M.; writing—original draft preparation, T.N.; writing—review and editing, T.N.; visualization, T.N.; supervision, I.H., H.N. and H.M.; project administration, T.N. and H.M.; funding acquisition, T.N.

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Institutional Review Board Statement

This study was approved by the Ethics Committee of Kyushu Sangyo University after review of the research plan (No. H27-0008).

Informed Consent Statement

Informed consent was obtained in the form of opt-out.

Conflicts of Interest

The authors declare no conflict of interest.

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