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Research Article

The Relationship between the Severity of Constipation and Exercise Status in the Japanese Population according to Questionnaire Survey

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Objective. The Japanese guideline for the treatment of chronic constipation recommends that nonpharmacological treatment be applied. However, only a small proportion of patients with constipation seek medical care, and even when they do visit a hospital for constipation in Japan, most are only prescribed medication. This is because the effectiveness of exercise therapy for constipation is still unclear. The purpose of this study was to evaluate the prevalence of constipation in Japanese subjects and the relationship between constipation and exercise. *Methods*. We conducted a questionnaire survey over a period of four months to determine the prevalence of chronic constipation in nonexercise and exercise groups, as well as the effectiveness of exercise on chronic constipation. Subjective constipation was defined by the constipation scoring system. Multiple regression analysis was performed on risk factors for high constipation scoring system scores, and factors related to constipation symptoms were extracted. *Result*. We analysed responses regarding 556 participants ranging in mean age 35.6 ± 17.2 years. The constipation scoring system score was significantly higher in the nonexercise group than in the exercise group. Independent predictors for the constipation scoring system score were sex, implementation of exercise, and presence of disease under treatment. *Conclusion*. The result showed that independent predictors for the constipation scoring system score were sex, implementation of exercise, and presence of disease under treatment. Thus, the present study demonstrated that exercise affects constipation symptom.

1. Introduction

Constipation is common in adults, affecting 2-28% of the population with a higher prevalence in women and older people [1, 2]. The number of people with constipation is increasing in Japan due to poor nutrition, inadequate sleep, limited exercise, mental stress, and aging [3]. Constipation not only has a significant impact on the quality of life but also on a country's economy [4]. In addition, it has been reported that constipation leads to an elevated risk of more serious complications such as cardiovascular disease and kidney disease and is associated with an increase in mortality [5, 6]. Therefore, it is very important to prevent and improve constipation properly in Japan, due to its aging population.

The Japanese guideline for the treatment of chronic constipation was finally published in 2017 [7]. Constipation is defined as a condition in which stools that should be expelled from the body are not expelled in sufficient quantity and with comfort [7]. The guidelines recommend that nonpharmacological treatment, which consists of diet and exercise therapy, is the first step of a common treatment for all types of chronic constipation [7]. However, only a minority of patients with constipation seek medical care, and even when they do visit a hospital for constipation in Japan, most

of them are only prescribed medication to improve their condition [8]. Lifestyle modifications such as dietary changes and physical exercise are treated as an adjunctive therapy. Regarding exercise, patients with constipation are only instructed to "move more" or "exercise regularly" [7]. This is because the effectiveness of exercise therapy for constipation is still unclear due to a lack of supporting evidence, and even Japanese guidelines do not provide specific patient instructions. Thus, physicians cannot strongly recommend exercise, even if they personally believe it to be an effective and critical factor. Despite the availability of management guidelines and treatments, there is still a paucity of data on the actual situation of Japanese patients with chronic constipation. If the relationship between exercise and constipation symptoms can be clarified, exercise can be strongly recommended for those with constipation symptoms.

Some criteria are internationally recognized for defining constipation [9, 10]. A translation-modified version of ROMA IV is used as a diagnostic criterion for constipation in Japan [7]. However, the Japanese translation is somewhat difficult for the general public, and thus, we determined that it was not suitable for our online survey. As a tool for assessing the prevalence and severity of constipation symptoms, the constipation scoring system (CSS) has also been adopted worldwide [11]; since CSS is the more commonly used notation, we adopted the more easily understood CSS in this online survey for the general public. Similar to ROMA IV, CSS focuses not only on the frequency of bowel movements but also on symptoms during defecation. In the present study, we estimated that exercise affected these defecation symptoms. This is because muscle problems are thought to be a factor in defecation problems, and participants who exercise are expected to have less muscle dysfunction associated with constipation.

The present study is aimed at evaluating, in the general Japanese population, the prevalence of constipation using the CSS, physical exercise habits, and relationship between constipation and physical exercise.

2. Methods

The questionnaire was used for data collection and analysis. We conducted a questionnaire survey over four months, from May to September 2021, to determine the prevalence of chronic constipation and the effectiveness of exercise on chronic constipation. The survey was uploaded and shared on the Google's online survey platform. A link to the online survey was widely distributed via e-mail and advertised with fliers, as well as shared on social media platforms such as Facebook and Instagram.

This study has been approved by both Human Ethics Committee of University and Hospital (approval numbers 2020022 and 20120870, respectively). We presented informed consent forms for visitors of this investigation. The online questionnaire was designed in such a way that participants first visit a document explaining the purpose, methods, benefits, and harms of the study, which they had to acknowledge before proceeding. We also specified in the document that participants must be at least 16 years old.

2.1. Questionnaire Items. We evaluated the exercise habits and constipation status of the participants through an online questionnaire survey. The prevalence and severity of constipation have been evaluated by CSS. The CSS conducted 8 variables describing the following symptoms of constipation: frequency of bowel movements, difficult or painful evacuation, incomplete evacuation, abdominal pain, length of time per attempt, assistance for evacuation including laxatives, unsuccessful attempts at evacuation per 24 hours, and duration of constipation as history. Based on the questionnaire, scores ranged from 0 to 30, with 0 indicating normal and 30 indicating severe constipation. The severity of constipation was classified as mild for scores of 1–5, moderate for scores 6–10, severe for scores 11–15, and very severe being 16-30. A cut-off score of 15 suggests constipation [11].

Exercise behaviours were assessed using a questionnaire designed under the supervision of the Health Service Bureau, Ministry of Health, Labour and Welfare of Japan [12]. The questionnaire was subsequently modified to fit the online participants. Regarding their exercise behaviour, participants were asked the following questions: "do you exercise?", "do you exercise for over 30 minutes per day?", "do you exercise at least twice a week?", and "have you continued to exercise over the past year?". Response categories included "no" and "yes"; when all answers were "yes," a person was categorized as habitually exercising. We would then also ask them to write down the specific type of exercise they do.

If the answer to only the first question is "yes," then participants were defined as exercisers. The participants' data were assigned to two groups: a nonexercise group ($n = 307$) that answered "no exercise" on the questionnaire and an exercise group ($n = 249$) that answered "exercise."

2.2. Statistical Analysis. The Statistical Package for Social Sciences software, version 20.0.0, for Windows (SPSS Inc., Chicago, IL) was used to analyse the data collected from the questionnaire. Data were expressed as mean ± standard deviation (SD). A P value of < 0.05 denoted the presence of a statistically significant difference.

A comparison of clinical characteristics between nonexercise and exercise groups was performed using the Mann–Whitney U test, and a comparison between the CSS score and exercise state was analysed using the box-and-whisker plot method. Multiple regression analysis was performed with a CSS score as the dependent variable and with age, sex, BMI, exercise state, presence of disease under treatment, and use of electric bidet toilets as independent variables. Multiple regression analysis of the risk factors for high CSS score was performed using a forced entry method, and we judged multicollinearity by the variance inflation factor (VIF). We chose those factors with significant differences, including age ($P < 0.05$), between two groups and the factors previously reported to be associated with constipation, including sex, BMI, exercise, presence of disease under treatment, and use of electric bidet toilets for the multiple regression analysis.

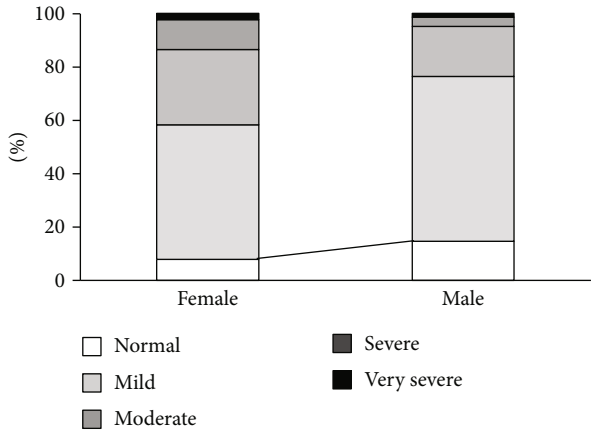

Figure 1: Prevalence of constipation in female and male.

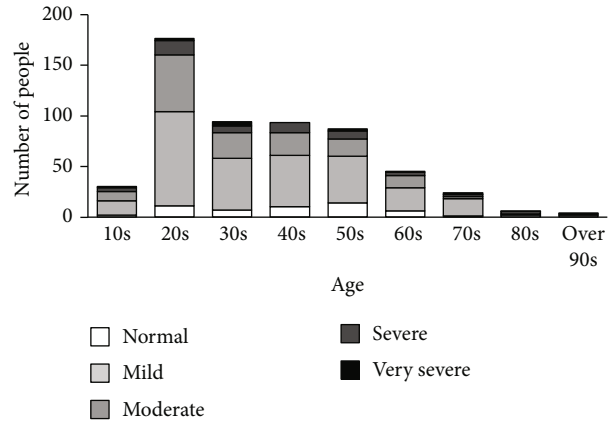

Figure 2: Number of constipation prevalence by CSS and age in all participants.

3. Results

We analysed responses regarding 556 participants (412 females and 144 males) ranging in mean age 35.6 ± 17.2 years, 503 with constipation and 53 without. Figure 1 shows the prevalence of constipation in females and males. Males had a slightly higher percentage of subjects without constipation symptoms. There tended to be fewer participants over the age of 70.55.8% of all the participants did not exercise, 44.6% exercised, and only 23.4% habitually exercised. According to the CSS classification, 52.7% of the participants were classified as having mild constipation, 26.6% as moderate constipation, 9.0% as severe constipation, and 2.3% as very severe constipation. The highest number of cases belonged to the mild constipation category in all age groups. Figure 2 shows the prevalence and the distribution of constipation symptom severity by age in all participants. The characteristics of the 556 study participants are summarized in Table 1. The CSS score was significantly higher in the nonexercise group ($n = 307$) than in the exercise group ($n = 249$) (5.56 ± 4.07 vs. 4.28 ± 3.83, $P < 0.001$) (Table 1 and Figure 3). In addition, age ($P < 0.001$) was significantly higher in the exercise group than in the nonexercise group, while BMI and male sex were not significantly different between both groups (Table 1).

The multiple regression analysis results are shown in Table 2. In the multiple regression analysis, independent predictors for CSS score were sex, implementation of exercise, and presence of disease under treatment ($R^2 = 0.08$).

4. Discussion

This present study investigated the association between severity of constipation and exercise in Japan. Assuming a CCS cut-off value of 15 points, the prevalence of constipation is about 2%, as in previous reports. However, more than 90% of the participants had some constipation-related symptoms such as difficult or painful evacuation, incomplete evacuation, abdominal pain, or use of laxatives. This indicates that constipation symptoms are very widespread, even if they do not lead to a diagnosis of constipation (Figure 2). The result also showed that independent predictors for the CSS score were sex, implementation of exercise, and presence of disease under treatment. As such, the present study demonstrated that exercise affects constipation symptoms.

Our results showed that sex was a significant predictor of the occurrence of constipation. This observation is in line with previous findings suggesting that the prevalence of constipation increased with a greater proportion in women. Conversely, previous studies have shown mixed and inconsistent results on the relationship between constipation and exercise [13–15]. Despite the widely recognized fact that regular exercise reduces the risk of constipation, some studies have reported that there is no relationship [13, 14] or that moderate-intensity exercise training interventions have no effect on constipation complaints in the elderly [15]. The inconsistency in research reports may be due in part to the wide variety of causes and mechanisms for constipation, including being of female sex, older age, inactive, having low caloric intake, dietary fiber intake, mental stress, poor posture due to aging, and taking many medications [16, 17]. This study suggested a relationship between exercise and constipation symptoms because there were differences in said symptoms such as frequency of bowel movements, difficult or painful evacuation, abdominal pain, length of time per attempt, unsuccessful attempts at evacuation per 24 hours, and duration of constipation as history between the exercise and nonexercise groups (Table 1). Implementation of exercise was derived as an independent predictor for the CSS (Table 2). Pelvic floor dysfunction and decreased abdominal pressure can cause defecation problems. The pelvic floor is a complex component of the body whose global function is reliant on the delicate relationship between musculoskeletal connections to pelvic bones that support the abdominal cavity and the pelvic viscera. Pelvic floor disorders are very common and increase in prevalence with age. It is estimated that 50% of people with chronic constipation have pelvic floor muscle dysfunction [18], which is caused by impaired relaxation and coordination of pelvic floor and abdominal muscles during evacuation resulting in possible defecation problems [17, 19]. The development of pelvic floor dysfunction appears to be a complicated process which is currently not fully understood. However, risk factors for

Table 1: Characteristics of the study participants.

	Exercise ($n = 249$)	Nonexercise ($n = 307$)	P value	
Age (years)	38.6 ± 17.8	33.2 ± 16.3	<0.001	**
Gender				
Male	72	72		
Female	177	235	0.144	
BMI (kg/m^2)	20.13 ± 2.48	20.29 ± 2.02	0.283	
Frequency of bowel movements	0.13 ± 0.46	0.31 ± 0.79	0.005	*
Difficult or painful evacuation	0.78 ± 0.94	1.01 ± 1.07	0.012	*
Incomplete evacuation	0.99 ± 0.97	1.13 ± 0.98	0.068	
Abdominal pain	1.04 ± 0.98	1.38 ± 0.98	<0.001	**
Length of time per attempt	0.36 ± 0.56	0.49 ± 0.72	0.033	*
Assistance for evacuation including laxatives	0.13 ± 0.44	0.14 ± 0.45	0.787	
Unsuccessful attempts at evacuation per 24 hours	0.29 ± 0.55	0.41 ± 0.64	0.022	*
Duration of constipation as history	0.55 ± 1.16	0.70 ± 1.19	0.031	*
Severity of constipation CSS score	4.28 ± 3.83	5.56 ± 4.07	<0.001	**

BMI: body mass index; CSS: constipation scoring system. Data are mean ± SD. $^*P < 0.05$ and $^{**}P < 0.001$ compared exercise with nonexercise.

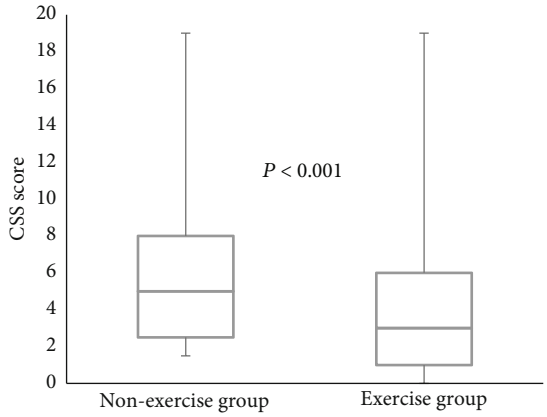

Figure 3: Association between the CSS and exercise status. Box-and-whisker plot of the constipation scoring system (CSS) score in the nonexercise group and exercise group shows the minimum and maximum values. The lower hinge, medium, and upper hinge of the box correspond to the 25, 50, and 75th percentiles, respectively.

developing pelvic floor disorders include childbirth, obesity, chronic constipation, or chronic straining during defecation, as well as age and age-related muscle weakness [20–22]. It is well known that aging and a sedentary lifestyle are associated with a decline in muscle function; but in the presence of adequate exercise or physical activity, these changes in muscle strength can be substantially reduced [23, 24]. Therefore, exercise maintains the strength of the pelvic floor muscle and/or abdominal muscles and can relieve constipation symptoms. In addition, motion with a twist of the trunk stimulates the gastrointestinal tract, and regular exercise increases parasympathetic activity at rest. Accordingly, exercise is thought to regulate internal organs and improve bowel movements. Thus, it is reasonable to suppose that exercise, or rather a lack of it, contributes to the severity of constipation. In this study, the number of people who habitually exercise was very small (23.4%). With that in mind, we compared two groups, a nonexercise group ($n = 307$) that answered "no exercise" on the questionnaire and an exercise group ($n = 249$) that answered "exercise," and it became clear that exercise has an effect on constipation symptoms. This suggested that even if one is not exercising regularly and continuously, some kinds of exercise alone could be effective in relieving symptoms related to constipation. This study first focused on the relationship between exercise and constipation with the intention of being a pilot study. Hence, the type of exercise itself that is effective for constipation has not yet been clarified in any study, including ours. We speculate that there may be a specific exercise routine necessary for constipation relief. Therefore, in future intervention studies, we would like to examine specifically the type, duration, and frequency of exercise that is effective for constipation.

In general, though the prevalence of constipation increases with age [1, 2], the present results show that this factor does not affect the severity of constipation (Table 2). This is presumably because the elderly are less familiar with the Internet than younger people, and we were unable to secure enough participants over the age of 70 in the present study. Furthermore, there is a possibility that the results were affected by the older age of the exercise group compared to the nonexercise group (Table 1) due to an increase in health consciousness among the elderly, alongside broader opportunities to participate in organized exercise activities such as sports.

It may be surprising to some that more than 90% had constipation-related symptoms in this study. The fact that many of the participants were young women in their 20s, who are known to be constipated, may have influenced the results. However, since stool reflects our dietary and nutritional status as well as the characteristics of gut microbiota

Table 2: Association between the constipation scoring system (CSS) score and other variables in the multiple regression analysis.

Variables	B	SE	95% CI of B		β	t	VIF	P value
Age	-0.013	0.011	-0.035	0.009	-0.056	-1.165	1.364	0.244
Gender	-1.209	0.489	-2.170	-0.249	-0.132	-2.473	1.698	0.014
BMI	0.064	0.096	-0.124	0.252	0.036	0.668	1.690	0.505
Implementation of exercise	-1.170	0.335	-1.829	-0.512	-0.145	-3.491	1.028	0.001
Presence of disease under treatment scores	1.538	0.419	0.715	2.362	0.164	3.669	1.190	< 0.001
Use of electric bidet toilets	0.014	0.102	-0.187	0.216	0.006	0.140	1.200	0.888

Multiple regression analysis was performed with the constipation scoring system (CSS) score as the dependent variable and with age, gender, BMI, exercise state, presence of disease under treatment, and use of electric bidet toilets as independent variables. B: partial regression coefficient; SE: standard error; CI: confidence interval; β: standardized partial regression coefficient; VIF: variance inflation factor; BMI: body mass index.

[25], it would be reasonable to assume that few people can defecate consistently without feeling any difficulty or residual sensation of defecation.

Electric bidet toilets, which function by automatically spraying the anus with a stream of water after defecation, are becoming increasingly popular in Japan. Encouraging defecation by spraying water into the rectum has been warned against as it may induce constipation. However, in this study, there was no relationship found between electric bidet toilets and constipation. It is estimated that about one-third of electric bidet toilet users wash their anus before defecating [26], and although the present study only investigated whether or not they use electric bidet toilets, further investigation of their relationship with bowel movements is necessary.

The study has several potential limitations. First, it was not possible to obtain a complete picture of the relevant history of the subjects. Such history included smoking and drinking habits, diet, occupation and career, medication use, education level, and marital status. Second, there was a bias in the age and sex of the participants due to recruitment being done mainly via the Internet. The fact that there were more young women and fewer elderly participants was a major limitation, and the possibility of a selection bias cannot be denied. Our result may also be susceptible to response bias if participants with constipation were more likely to have responded to the survey. However, also the case that lack of exercise is presumed to be a contributing factor to constipation in those who use and do not use the Internet. With rare exceptions, Internet-based recruitment may have significantly increased the utility of the study and thus the response rate and power, with little impact on validity or generalizability [27]. Finally, there is a generalizability limitation in relation to other countries and cultures. Although our results in this study are useful findings, they are limited by only including Japanese population. Because constipation is also affected by differences in eating habits, there is no guarantee that similar results will be obtained in other countries or cultures. However, we believe that the results of this study in the Japanese, whose eating habits today are westernized, can be generalized to other countries. Consequently, the results of this study should be considered preliminary due to several potential limitations.

The survey was conducted during the COVID-19 pandemic. Among the elderly, the total physical activity time was reported to be significantly decreased as a result [28]. This may lead to a higher incidence of constipation in the elderly in the near future; however, the small number of elderly participants in this study may have had little impact on the results.

From the results of this study, we found that many people had symptoms of constipation, and we believe there is a need to conduct further research in the future. In addition, since there was a significant difference regarding the presence of exercise, which was the theme of this study, it is necessary to conduct intervention studies regarding the content of exercise in the future.

5. Conclusions

We found that habitual exercise was more common among the elderly, and there was a relationship between the severity of constipation and exercise status in a cross-sectional study. We believe that it is important to actively introduce exercise in the treatment of constipation in the future. Although the type of exercise could not be specified in this study, further studies may allow for illumination of this issue.

Data Availability

The data used to support the findings of this study are restricted by the Ethics Committee in order to protect subjects' privacy. Data are available from corresponding author, for researchers who meet the criteria to access confidential data.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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