Predictors of meeting physical activity recommendation before and during COVID-19 pandemic in adults

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Abstract

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Keywords

regular physical activity, adults, COVID-19

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Abstract: Introduction: This study aimed to determine the variables that predict whether WHO's global recommendation for physical activity (PA) before and during the COVID-19 pandemic can be met among adults. Material and Methods: A total of 921 adults voluntarily participated in this study. A demographic information form and the Physical Activity Assessment Questionnaire for Turkish people were administered by self-report. The participants were also asked whether they regularly do PA and if the duration of PA is over 150 minutes. Results: The number of adults doing regular PA at the level recommended by WHO significantly decreased during the COVID-19 pandemic, and the rate of not doing regular PA significantly increased compared to the period before the COVID-19 pandemic (p<0.05). Variables that reduce the likelihood of doing regular PA at the recommended level include being male, being under 45 years old, being married, having high school education or below, having a moderate and low-income, having a high BMI, and having a high recreational sedentary screen time (RSST) during the COVID-19 pandemic. Conclusions: The results of this study provide a priori information for implementations aimed at improving the recommended PA level for adults during social isolation or lockdown.

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1. Introduction

On December 31st of 2019, the World Health Organization (WHO) China Country Office was informed about cases of pneumonia with unknown etiology (unknown cause) detected in Wuhan City in the Hubei Province of China [1]. On 11 March 2020, WHO declared COVID-19 a global pandemic [2], with 124,101 confirmed cases [3]. While the number of cases was increasing rapidly, WHO and ACSM made calls and launched campaigns to get the pandemic under control [4, 5].

WHO released the first free online course concerning the novel coronavirus on its OpenWHO learning platform as of January 25, 2020 [6]. WHO and FIFA launched the 'Pass the message to kick out coronavirus' awareness campaign on March 23, 2020, led by world-renowned footballers who called on people around the world to protect their health

through hand washing, coughing etiquette, not touching one's face, maintaining physical distance and staying home if feeling unwell [7]. In Turkey, measures were also taken; many arrangements and calls were made to practice social distancing and isolation to reduce the negative effects of the COVID-19 pandemic and minimize the spread of the disease. As in many countries [8], indoor and outdoor sports and recreational facilities, such as gyms, were temporarily closed on March 16, 2020, in all provinces of Turkey per a circular letter issued by the Ministry of the Interior [9]. The Turkish Ministry of Health [10] underlined the importance of measures such as following the rules of social distancing and staying at home. In accordance with these regulations, studies on the importance of PA in pandemic conditions were conducted worldwide. For example, Pinto et al. [11] reported that physical inactivity may increase during the COVID-19 pandemic due to the self-isolation and quarantine requirements imposed for fear of being infected. Step counts declined in both European countries (ranging from 7% to 38%) and the United States (12%) during the week ending March 22, 2020 [12]. Furthermore, an important connection between health and PA during COVID-19 was shown. For example, it was stated that there was an association between the severity of COVID-19 and non-communicable diseases (NCDs) [13], and the mortality rate increased in COVID-19 patients with NCDs [14]. It was proven before the COVID-19 pandemic [15] and emphasized during the COVID-19 pandemic by WHO [5] that regular PA has an important role in improving health and reducing NCDs [16]. PA was also reported to reduce the risk of severe viral infection [17].

The benefits of regular PA mentioned above, which include the prevention of chronic diseases and strengthening of the immune system, have gained more importance during the COVID-19 pandemic. Accordingly, the ACSM, one of the leading institutions in the field of PA, exercise and health, has highlighted the importance of doing exercise and provided various resources for staying active at home since the very beginning of the COVID-19 pandemic [4]. WHO has campaigned to encourage people to be physically active at home during the COVID-19 pandemic. In the campaign called "Connecting the world to combat coronavirus: #HealthyAtHome - Physical activity", WHO [5] explained the importance of regular PA during COVID-19 as follows: "The COVID-19 pandemic means that many of us are staying at home and sitting more than we usually do. At a time like this, it's very important for people of all ages and abilities to be as active as possible."

According to the studies conducted before the COVID-19 pandemic, the PA level might vary depending on gender, age, body mass index (BMI), education level, occupation [18] and marital status [19]. The prevalence of physical inactivity was lower in males, younger individuals and those with higher income or education levels [20]. Therefore, a low PA level in females, older individuals, those with a lower income or a lower education level might make them vulnerable to COVID-19. Since lifestyles have changed dramatically in favor of inactivity with the COVID-19 pandemic, it is necessary to determine the predictors of PA to gain insight into the effects of pandemic conditions on PA levels and to provide roadmaps for PA in diverse socio-economic backgrounds. Within this scope, the purpose of this study was to analyze whether adults do regular PA at the recommended level according to socio-demographic variables and to determine the predictors of regular PA before and during the COVID-19 pandemic.

2. Materials and Methods

2.1. Partcicipants

A total of 921 individuals aged between 18 and 64 years old, participated in this study, including 477 females (mean age: 35.76 years old, SD=11.68) and 444 males (mean age: 38.10 years old, SD=13.30). This study was approved by the Institutional Review Board of Baskent University (Project no: KA20/155). Informed consent was obtained from each participant. Also, the research approval was taken from the COVID-19 Scientific Research Platform under the Republic of Turkey Ministry of Health, General Directorate of Health Services (No: 2020-05-05T14 04 17).

2.2. Instruments

Demographic Information Form (DIF): The DIF includes questions about age, gender, marital status, education level, income level and employment status. Participants also reported their height (in meters) and weight (in kilograms). The body mass index (BMI; kg/m²) was calculated by the researchers. In order to determine the income level, the participants were asked, "Which of the following is your income level?" and requested to tick one of the options of "low, medium, or high."

Physical Activity Assessment Questionnaire (PAAQ): The Physical Activity Assessment Questionnaire was developed for Turkish people by Karaca et al. [21] in 2000. PAAQ is a self-report questionnaire which asks participants to give their weekly average frequency and duration of engaging in PA over the last year. PAAQ includes occupation-related, home-related, transportation, climbing stairs and sport indexes. The reliability of the PAAQ indexes was between $r = .36$ and $r = .73$, and the validity was $r = .72$ [21]. The MET-hours/week and MET/week of individuals for each PA domain can be determined using the PAAQ [21]. In this study, the home-related index was analyzed. Home-related activities such as cleaning, cooking, and ironing were called *housework*. TV viewing, using a computer or iPad, and playing or viewing computer/video games were called *recreational sedentary screen activities*. Housework time was calculated as hours per week, and RSST was calculated as hours per day.

Meeting Physical Activity Recommendations: According to the WHO Physical Activity and Sedentary Behavior Guidelines [22], all adults should undertake regular PA and at least 150–300 minutes/week of moderate-intensity aerobic PA. In this study, the participants were asked whether they do PA regularly and if the duration of PA is over 150 minutes/week to find out whether they meet the recommendation for PA. The participants were classified as meeting the recommended level if their regular PA duration was ≥ 150 min/week, as doing regular PA but failing to meet the recommended level if the duration was < 150 min/week, and as not doing regular PA at all if the duration was zero.

Procedures: The online questionnaire form was sent to the participants electronically, and the participants were asked to fill in the form using a mobile phone, tablet, desktop or laptop device. On the first page of the questionnaire form, the participants were given information about the research and asked to sign the online informed consent form. Data were collected between 02 and 17 May 2020. The questions that were asked in this study cover both the pre-COVID-19 and during-COVID-19 periods. While answering the questions that cover the during-COVID-19 period, the participants were asked to consider the date range between March 17, 2020 and April 23, 2020. In Turkey, the number of cases confirmed was 1 on March 11, 2020, 47 in total on March 17, 2020, and 98,674 on April 23, 2020 [23]. Places likely to increase the risk of disease transmission due to the close proximity of individuals (such as parks, recreational areas and gym) were closed between these dates in all provinces in accordance with the circular letter issued by the Ministry of the Interior [9].

2.3. Statistical Analysis

In the data analysis, firstly, regular PA before and during the COVID-19 pandemic was examined using chi-square analysis. Afterwards, chi-square and eta analyses were performed to determine the relationship between each of the predictor variables (gender, age, marital status, education level, income level, employment status, BMI, RSST, time spent on housework) and regular PA before and during the COVID-19 pandemic. Finally, Multinomial Regression Analysis was conducted to determine which variables predict a regular PA status. There are three categories of the dependent variable which are "not doing exercise per week", "at least 150 minutes exercise per week", "less than 150 minutes of exercise per week". "Not doing exercise per week" was a subcategory of the dependent variable and was taken as a reference value. In the regression analysis, linearity, independence of errors, and multicollinearity assumptions were tested. The linearity assumption was examined by the interaction term. Accordingly, when the significance levels of

the relationship between the independent variables used in this study were examined, no interaction was seen between them ($p > 0.05$), and this indicates that the linearity assumption was met. Then, odds ratios (OR) were calculated with 95% confidence intervals. The independence of errors assumption was tested with Durbin-Watson statistics, and the Durbin-Watson value obtained in our study indicated that the errors are independent, so this assumption was met. The multicollinearity assumption was tested with the VIF values in our study, VIF values of less than three between the independent variables before and during COVID-19 indicated that no multiple connections existed between these variables, so this assumption was also met [24].

3. Results

Table 1 shows the participants meeting PA recommendations before and during the COVID-19 pandemic, and the chi-square analysis indicated a significant relationship between regular PA and the COVID-19 pandemic.

Table 1. Meeting physical activity recommendations before and during the COVID-19 pandemic.

		Regular PA			
		≥ 150 minutes per week	< 150 minutes per week	not doing regular PA	Total
Before COVID-19	f	453	275	193	921
	%	49.2	29.9	21.0	100.0
During COVID-19	f	267	274	380	921
	%	29.0	29.8	41.3	100.0

Chi-Square: 109.080 df = 2 p = 0.001 Cramer's V: 0.243

Accordingly, before the COVID-19 pandemic, almost half of the participants were doing the regular PA for over 150 minutes per week, but the percentage of participants doing the regular PA for over 150 minutes decreased to 29% during the COVID-19 pandemic. In addition, 41.3% of the participants indicated that they have not been doing any regular PA during the COVID-19 pandemic.

Table 2 shows the relationships between regular PA before and during the COVID-19 pandemic in terms of specific variables: gender, age, marital status, education level, income level, and employment status.

Before the COVID-19 pandemic, there was a significant relationship between regular PA and gender (Chi-Square: 12.919, df = 2, $p = 0.002$, Cramer's V: 0.118), age (Chi-Square: 25.414, df = 2, $p = 0.001$, Cramer's V: 0.117), marital status (Chi-Square: 32.299, df = 2, $p = 0.001$, Cramer's V: 0.187) and employment status (Chi-Square: 10.538, df = 2, $p = 0.005$, Cramer's V: 0.107). However, there were no significant relationships between regular PA and education (Chi-Square: 5.194, df = 2, $p = 0.075$, Cramer's V: 0.075) and income levels (Chi-Square: 6.555, df = 4, $p = 0.161$, Cramer's V: 0.060). There were also weak relationships between regular PA and RSST (Eta: 0.312) and time spent on housework (Eta: 0.238), whereas there was a strong relationship between regular PA and BMI (Eta: 0.853)

During the COVID-19 pandemic, however, there was only a significant relationship between regular PA and gender (Chi-Square: 10.864, df = 2, $p = 0.004$, Cramer's V: 0.109) and income level (Chi-Square:14.281, df = 4, $p = 0.006$, Cramer's V: 0.088). The results showed a weak relationship between regular PA and RSST (Eta: 0.335) and time spent on housework (Eta: 0.277), whereas there was a strong relationship between regular PA and BMI (Eta: 0.859).

Table 2. Meeting PA recommendations through regular PA in terms of certain variables before and during the COVID-19 pandemic.

			Before COVID-19				DURING COVID-19			
			≥150 min./week	<150 min./week	irregular PA	Total	≥150 min./week	<150 min./week	irregular PA	Total
Gender	Female	n	209	164	104	477	117	158	202	477
		%	43.8	34.4	21.8	100.0	24.5	33.1	42.3	100.0
	Male	n	244	111	89	444	150	116	178	444
		%	55.0	25.0	20.0	100.0	33.8	26.1	40.1	100.0
Age	<30	n	196	86	48	330	93	92	145	330
		%	59.4	26.1	14.5	100.0	28.2	27.9	43.9	100.0
	30–44	n	133	101	85	319	82	102	135	319
		%	41.7	31.7	26.6	100.0	25.7	32.0	42.3	100.0
	≥45	n	124	88	60	272	92	80	100	272
		%	45.6	32.4	22.1	100.0	33.8	29.4	36.8	100.0
Marital Status	Married	n	182	153	120	455	122	130	203	455
		%	40.0	33.6	26.4	100.0	26.8	28.6	44.6	100.0
	Single	n	271	122	73	466	145	144	177	466
		%	58.2	26.2	15.7	100.0	31.1	30.9	38.0	100.0
Education Level	≤ High School	n	132	64	42	238	56	70	112	238
		%	55.5	26.9	17.6	100.0	23.5	29.4	47.1	100.0
	≥ University	n	321	211	151	683	211	204	268	683
		%	47.0	30.9	22.1%	100.0	30.9	29.9	39.2	100.0
Income Level	Low	n	56	38	15	109	26	40	43	109
		%	51.4	34.9	13.8	100.0	23.9	36.7	39.4	100.0
	Moderate	n	310	196	135	641	172	196	273	641
		%	48.4	30.6	21.1	100.0	26.8	30.6	42.6	100.0
	High	n	83	40	40	163	65	37	61	163
		%	50.9	24.5	24.5	100.0	39.9	22.7	37.4	100.0
Employment Status	Employed	n	277	171	143	591	149	154	207	510
		%	46.9	28.9	24.2	100.0	29.2	30.2	40.6	100.0
	Unemployed	n	176	104	50	330	118	120	173	411
		%	53.3	31.5	15.2	100.0	28.7	29.2	42.1	100.0

BMI mean values before COVID-19 and during COVID-19 were 24.7 ± 0.4 kg/m² and 24.7 ± 0.5 kg/m², respectively. Recreational sedentary screen time mean values before COVID-19 and during COVID-19 were 13.76 ± 14.67 hours/day and 23.78 ± 21.56 hours/day, respectively. Housework mean hours before COVID-19 and during COVID-19 were 8.55 ± 8.79 hours/week and 11.90 ± 10.68 hours/week, respectively.

Table 3 compares regular PA before and during the COVID-19 pandemic regarding certain predictor variables: gender, age, marital status, education level, income level, employment status, RSST, time spent on housework and BMI.

Before the COVID-19 pandemic, RSST, gender, and marital status were the predictors of over 150 minutes of regular PA per week compared to no regular PA. Accordingly, males were more likely to do over 150 minutes of regular PA weekly than females (OR = 1.99; 95% CI: 1.29–3.07). Married individuals were less likely to do over 150 minutes of regular PA weekly than single ones (OR = 0.49; 95% CI: 0.31–0.78). Furthermore, participants with higher daily RSST were less likely to do over 150 minutes of regular PA per week (OR = 0.88; 95% CI: 0.82–0.95).

During the COVID-19 pandemic, BMI predicted the likelihood of over 150 minutes of regular PA weekly compared to no regular PA. Accordingly, participants with lower BMI levels were more likely to do over 150 minutes of regular PA weekly than those with higher BMI levels (OR = 0.95; 95% CI: 0.91–0.99). Participants with higher daily RSST were less likely to do over 150 minutes of regular PA per week (OR = 0.93; 95% CI: 0.88–0.98). Additionally, when compared to those who did not have regular PA, males were less likely to do over 150 minutes of regular PA weekly than females (OR = 0.52; 95% CI: 0.34–0.80), and married individuals were less likely to do over 150 minutes of regular PA weekly than single ones (OR = 0.44; 95% CI: 0.28–0.68). Participants under 30 years of age (OR = 0.42; 95% CI: 0.24–0.73) and between the ages of 30 and 44 (OR = 0.60; 95% CI: 0.39–0.92) were less likely to do over 150 minutes of regular PA weekly than participants above 45 years old. In terms of education or income level, participants with high school degree (OR=0.59; 95% CI: 0.38–0.93) or moderate (OR=0.63; 95% CI: 0.41–0.95) and low-income levels (OR=0.52; 95% CI: 0.27–0.99) were less likely to do over 150 minutes of regular PA weekly than university degrees or high-income levels.

Table 3. Multinomial logistic regression model of predictors for meeting physical activity recommendations before and during the COVID-19 pandemic.

	Before COVID-19*					During COVID-19**				
	B	Std. Error	B	Std. Error	B	Std. Error	B	Std. Error	B	Std. Error
≥ 150 minutes per week										
RSST (hour/day)	-0.13	0.04	**0.001**	0.88	0.82–0.95	-0.07	0.03	**0.009**	0.93	0.88–0.98
Housework (hour/week)	0.12	0.08	0.139	1.13	0.96–1.32	0.09	0.07	0.183	1.09	0.96–1.24
BMI	-0.04	0.02	0.076	0.96	0.91–1.01	-0.05	0.02	**0.022**	0.95	0.91–0.99
Gender										
Male	0.69	0.22	**0.002**	1.99	1.29–3.07	-0.65	0.22	**0.002**	0.52	0.34–0.80
Female	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Age										
< 30	-0.12	0.31	0.686	0.88	0.48–1.61	-0.87	0.28	**0.002**	0.42	0.24–0.73
30–44	-0.44	0.23	0.056	0.65	0.41–1.01	-0.51	0.22	**0.019**	0.60	0.39–0.92
≥ 45	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Marital Status										
Married	-0.71	0.24	**0.003**	0.49	0.31–0.78	-0.83	0.23	**0.001**	0.44	0.28–0.68
Single	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Education Level										
≤ High School	-0.19	0.25	0.448	0.83	0.50–1.36	-0.52	0.23	**0.024**	0.59	0.38–0.93
≥ University	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Income Level										
Low	0.18	0.37	0.620	1.20	0.58–2.49	-0.66	0.33	0.047	0.52	0.27–0.99
Moderate	0.08	0.23	0.718	1.09	0.69–1.72	-0.47	0.22	**0.029**	0.63	0.41–0.95
High	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Employment Status										
Employed	-0.38	0.24	0.113	0.69	0.43–1.09	-0.19	0.20	0.341	0.83	0.56–1.22
Unemployed	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
< 150 minutes per week										
RSST (hour/day)	-0.08	0.04	0.051	0.92	0.85–1.00	0.02	0.03	0.395	1.02	0.97–1.07
Housework (hour/week)	0.00	0.09	0.971	1.01	0.85–1.19	0.04	0.06	0.502	1.04	0.92–1.18
BMI	-0.02	0.03	0.438	0.98	0.93–1.03	-0.08	0.02	**0.001**	0.93	0.89–0.97
Gender										
Male	-0.10	0.24	0.690	0.91	0.57–1.45	-0.03	0.21	0.895	0.97	0.64–1.47
Female	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Age										
< 30	-0.22	0.34	0.512	0.80	0.42–1.55	-0.76	0.28	**0.007**	0.47	0.27–0.82
30–44	-0.27	0.24	0.268	0.76	0.48–1.23	-0.18	0.21	0.399	0.84	0.55–1.27
≥ 45	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Marital Status										
Married	-0.16	0.26	0.541	0.85	0.51–1.42	-0.61	0.22	**0.007**	0.55	0.35–0.85
Single	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Education Level										
≤ High School	-0.34	0.28	0.218	0.71	0.41–1.22	-0.18	0.22	0.422	0.84	0.54–1.29
≥ University	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Income Level										
Low	0.75	0.40	0.062	2.12	0.96–4.66	0.33	0.33	0.319	1.39	0.73–2.67
Moderate	0.40	0.26	0.131	1.48	0.89–2.48	0.14	0.24	0.562	1.15	0.72–1.82
High	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.
Employment Status										
Employed	-0.52	0.26	**0.043**	0.60	0.36–0.98	0.07	0.20	0.718	1.07	0.73–1.59
Unemployed	*Ref.*	.	.	.	.	*Ref.*	.	.	.	.

a. The reference category is: not doing exercise; b. This parameter is set to zero because it is redundant.

* Before COVID-19: -2 Log likelihood = 1743.382, X^2 = 74.398, df = 22, $p < 0.05$, Nagelkerke's R^2 = 0.092

** During COVID-19: -2 Log likelihood = 1831.055, X^2 = 74.889, df = 22, $p < 0.05$, Nagelkerke's R^2 = 0.092

Before the COVID-19 pandemic, RSST, gender, and marital status were the predictors of over 150 minutes of regular PA per week compared to no regular PA. Accordingly, males were more likely to do over 150 minutes of regular PA weekly than females (OR = 1.99; 95% CI: 1.29–3.07). Married individuals were less likely to do over 150 minutes of regular PA weekly than single ones (OR = 0.49; 95% CI: 0.31–0.78). Furthermore, participants with higher daily RSST were less likely to do over 150 minutes of regular PA per week (OR = 0.88; 95% CI: 0.82–0.95).

During the COVID-19 pandemic, BMI predicted the likelihood of over 150 minutes of regular PA weekly compared to no regular PA. Accordingly, participants with lower BMI levels were more likely to do over 150 minutes of regular PA weekly than those with higher BMI levels (OR = 0.95; 95% CI: 0.91–0.99). Participants with higher daily RSST were less likely to do over 150 minutes of regular PA per week (OR = 0.93; 95% CI: 0.88–0.98). Additionally, when compared to those who did not have regular PA, males were less likely to do over 150 minutes of regular PA weekly than females (OR = 0.52; 95% CI: 0.34–0.80), and married individuals were less likely to do over 150 minutes of regular PA weekly than single ones (OR = 0.44; 95% CI: 0.28–0.68). Participants under 30 years of age (OR = 0.42; 95% CI: 0.24–0.73) and between the ages of 30 and 44 (OR = 0.60; 95% CI: 0.39–0.92) were less likely to do over 150 minutes of regular PA weekly than participants above 45 years old. In terms of education or income level, participants with high school degree (OR=0.59; 95% CI: 0.38–0.93) or moderate (OR=0.63; 95% CI: 0.41–0.95) and low-income levels (OR=0.52; 95% CI: 0.27–0.99) were less likely to do over 150 minutes of regular PA weekly than university degrees or high-income levels.

Before the COVID-19 pandemic, the only predictor of doing regular PA for less than 150 minutes per week was employment status compared to the lack of regular PA. Accordingly, employed participants were less likely to do less than 150 minutes of regular PA weekly than not employed participants (OR = 0.60; 95% CI: 0.36–0.98).

On the other hand, marital status, age and BMI were the main predictors of regular PA for less than 150 minutes per week during the COVID-19 pandemic. Accordingly, when compared to no regular PA, married individuals (OR=0.55; 95% CI: 0.35–0.85) or participants under the age of 30 (OR = 0.47; 95% CI: 0.27–0.82) were less likely to do less than 150 minutes of regular PA weekly than singles or participants above the age of 45 years. Participants with lower BMI levels were also more likely to do less than 150 minutes of regular PA weekly than those with higher BMI levels (OR = 0.93; 95% CI: 0.89–0.97).

4. Discussion

This study was conducted to determine whether the WHO's global recommendation for PA (minimum 150 minutes MVPA per week) has been met by Turkish adults and to determine the predictors of regular PA before and during the COVID-19 pandemic. The WHO global recommendation on PA for good health in adults [22] is 150 minutes of moderate-intensity activity (or the equivalent) per week. PA was one of the routines affected by the pandemic [11, 25]. Compared to the period before the COVID-19 pandemic, in the present study, meeting the recommended PA declined during the COVID-19 pandemic. It can be assumed that the daily routines of individuals have changed due to the measures taken to prevent the spread of the coronavirus, namely social isolation, curfews, and the closing of gyms [9]. Other studies also reported that the PA level decreased during the COVID-19 pandemic [25, 26]. For example, Fitbit®, a fitness products company, reported an important decrease in the number of steps taken by its users worldwide since mid-March 2020 [12].

Determining the variables that predict the PA level during the COVID-19 pandemic might contribute to foreseeing and/or improving the strategies designed to encourage PA for potential subsequent waves of this pandemic or similar cases that may require social isolation [27]. In this study, the Multinomial Logistic Regression Analysis was performed to determine the predictors that may impact a change in the participants' PA level before and during COVID-19. In this study, male participants were more likely to do the regular

PA at the recommended level before COVID-19 than females, while this probability decreased during the COVID-19 pandemic (Table 3). Also, participation in regular PA at the recommended level was higher for males than for females before and during COVID-19 (Table 2). When it was assumed that males prefer fitness exercises more, the fact that the gyms were closed during the COVID-19 pandemic might have caused this decrease in the participation of males in PA. The fact that females generally prefer activities such as walking in parks and outdoor spaces and have not been able to do such activities due to lockdown restrictions might explain the decrease in their PA levels. López-Sánchez et al. [28] stated that, both before and during the COVID-19 pandemic, the vigorous PA duration (min/day) of males with chronic conditions was higher than for females, but moderate-intensity PA duration (min/day) was higher in females than males. During the COVID-19 quarantine, moderate-intensity PA significantly decreased in both genders with chronic conditions, but vigorous-intensity PA significantly decreased only in males [28]. In their study, Giustino et al. [29] found that MET-minutes/week values of men were higher than those of women before the COVID-19 quarantine period, while the MET/week values of both men and women decreased during the COVID-19 quarantine period and this decrease was slightly higher in men. Another study, which had a similar finding, determined that women of all age groups performed less PA than men before the quarantine period, but this gap disappeared during the lockdown [30].

In our study, the participants' marital status significantly predicted the PA level both before and during the COVID-19 pandemic (Table 3). Meeting the recommended PA level by singles was higher than for married individuals before and during the COVID-19 pandemic (Table 2). The studies on marital status and PA level before the COVID-19 pandemic also support this finding [19]. The PA level of married individuals was reported to be lower than that of singles [31]. Bergman et al. [32] found that the probability of single females engaging in higher PA categories was about twice that of married ones. Sobal and Hanson [33] assumed that married individuals have less time for leisure activities than those in non-married relationships due to family obligations, such as raising children and time restrictions. Studies on the impact of marital status on PA level during the COVID-19 pandemic are very limited. According to Smith et al. [34], marital status was not associated with meeting the recommended daily PA level during this global epidemic.

In the present study, the rate of individuals under 30 who met the recommended PA level was higher than of other age groups before the COVID-19 pandemic. In comparison, the rate of individuals aged 45 and older who met the recommended PA level was higher during the COVID-19 pandemic (Table 2). In addition, persons older than 45 years were more likely to participate in PA at the recommended level during the COVID-19 pandemic (Table 3). In the study conducted by Hawkins et al. [35] before the COVID-19 pandemic, total PA counts of participants aged 18–39 were higher than the activity counts of participants over 40. According to Belanger et al. [36], the participation rate in PA at the recommended level by male individuals aged 16–24 was higher than the rate of individuals in the other age groups (25–34, 35–44, 45–54, 55–64, 65+). However, in the present study, it was found that the PA level decreased in young adults during the COVID-19 pandemic. These results are consistent with those of Antunes et al. [27], who reported that the PA levels of individuals aged 18–34 during the COVID-19 pandemic were significantly lower than in older age groups. However, López-Bueno et al. [37] found that the percentage of those who met the WHO's recommendation for PA in all age groups was lower in the pre-COVID-19 period compared to the during-COVID-19 pandemic. In the present study, the health benefits of PA may have become more important, as age increases during the COVID-19 pandemic.

The education level is one of the variables that predict doing regular PA at the recommended level during the COVID-19 pandemic in the present study. Moreover, participants

with a high school or lower degree were less likely to do regular PA for 150 minutes or more per week (Table 3). The studies conducted before the COVID-19 pandemic reported that those with a higher education level had a lower prevalence of sedentary lifestyles [38]. Similarly, studies showed that the rate of participation in PA increases as the education level increases. For example, according to Makinen et al. [39], university graduates have a higher leisure time PA than individuals with a lower education level. This may be explained by the higher health awareness of individuals with higher education levels [39]. Some studies were conducted on the relationship between educational level and PA before the COVID-19 pandemic. However, to the authors' knowledge, limited studies were conducted on the relationship between education level and PA level during the COVID-19 pandemic. The findings of the current study suggest that individuals with higher education levels have a higher awareness of the importance of participating in regular PA during the COVID-19 pandemic. In particular, leisure time PA increases as the education level increases [40], and the sitting time and the prevalence of sedentary risk behavior (spending >4 h sitting per day) are lower in individuals with lower levels of income [20]. Accordingly, it can be deduced from the findings that individuals with a high education level have sufficient means and awareness to do regular PA during social isolation.

Income level was one of the variables that predicts doing regular PA at the recommended level during the COVID-19 pandemic (Table 3). The rate of participation in regular PA at the recommended level for higher income levels is higher than at other income levels during the COVID-19 pandemic (Table 2). This could be due to the fact that the increasingly regular PA that can be done at home during the COVID-19 pandemic and that individuals with a high-income level might have more means for doing regular PA. In other words, individuals with a low-income level might have limited access to the internet proper indoor spaces, and equipment which enables them to do physical activities at home. Therefore, it is evident that socio-economic inequalities might have affected the PA level during the pandemic [41]. In their study, Dunton et al. [42] found that the weekly walking time of adults with annual household incomes of $27,00–$59,999 tended to decrease more during the COVID-19 pandemic compared to individuals with annual household incomes of $100,000 and higher. Therefore, the positive correlation between doing PA at home and higher MVPA time may indicate that these individuals may have participated in online exercise classes at home instead of going to a gym or fitness center or exercised with the equipment they had at home during the COVID-19 pandemic [42]. On the other hand, many people, especially those with low-incomes, do not have the necessary equipment, internet access or indoor space to make at-home PA realistic. Thus, the current pandemic is almost certain to exacerbate socio-economic inequalities in PA [41]. Although it was reported that PA levels had changed by PA domains before the COVID-19 pandemic [38], the impact of activities that can be done at home on the PA level gained importance during the COVID-19 pandemic.

In our study, participants who did not do regular PA before and during the COVID-19 were more likely to have a higher BMI (Table 3). Giustino et al. [29] stated that the overweight group had the lowest PA level during the lockdown. The participants who were underweight or had normal weight before the COVID-19 pandemic maintained their BMI consistently during the COVID-19. Based on the study by Giustino et al., the increase in BMI due to the decrease in the PA level supports this finding of our study. However, He et al. [43], analyzed the relationships between body weight, PA and lifestyle during the COVID-19 pandemic, which were different from the findings of our study. He et al. [43] stated that changes in the body weight inversely correlated with changes in steps per day and moderate or vigorous-intensity exercise during the quarantine. Therefore, it could be suggested that there are inconsistent findings in the literature comparing the changes in BMI before and during the COVID-19 period.

In our study, RSST was found to have increased during the COVID-19 pandemic compared to before COVID-19. Participants were less likely to do regular PA over 150 minutes per week before and during COVID-19 periods as the daily RSST increased. It was highlighted that reducing sedentary behavior and recreational screen time plays an important role in preventing all causes of mortality and cardiovascular diseases [44]. Although it was found in our study that daily RSST increased during the COVID-19 pandemic, the finding that this variable also reduced the probability of doing regular PA at the recommended level before the COVID-19 pandemic is important as it indicates the necessity to dwell on this variable independently of the pandemic conditions.

Employment status was not a predictor of regular PA before or during the COVID-19 pandemic (Table 3). It is known that work activities which took up a great majority of time during the day before the COVID-19 pandemic plays an important role in shaping the habit of daily PA. Therefore, long working time with a lower work activity level increases the risk of inactivity [45]. However, Paivarinne et al. [46] reported that work activities were associated with leisure time PA. Accordingly, it can be argued that the type of work activities or types of occupation may affect an individual's regular PA or the PA level during the day. However, the type of work activities was not included as a variable in this study.

5. Conclusions and Recommendations

The results of the present study should be considered with its limitations and strengths. The limitations of this study are that regular PA was not measured with an objective method such as an accelerometer. When it is assumed that the pandemic is something new and unpredictable for many people, the data of any study which reflects the during-COVID-19 period could be valuable as a reflection of how individuals react in an unpredictable situation. The first six weeks of the pandemic (the period covered by the data of this study) was also the lockdown period in Turkey. Thus, it reflects a specific period of time, which may be considered as one of the strengths of this study. The number of subjects is another strength of this study.

The findings of this study would provide a priori information for the practices that will encourage meeting the recommended PA level in adults during social isolation or lockdown periods. According to the multinomial regression analysis, being a male, under the age of 45, being married, having a high school education level or lower, having a medium and low income level, having a high BMI and having high RSST decrease the probability of participation in PA at the recommended level during periods of social isolation which require staying at home for any reason. Prioritizing practices that encourage individuals with these specified characteristics to participate in regular PA during social isolation may reduce the risk that individuals will have chronic health problems in the future.

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