

# Effect of physical activity level and behavioral regulations in exercise on successful aging

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**Abstract.** *Study Objectives:* The COVID-19 pandemic not only changed many of our routines but also led to significant changes in our health and life habits. In this process, which is called the new normal, the aim of this study was to examine the effect of physical activity level and behavioral regulation in exercise on successful aging in adult individuals. *Methods:* A total of 484 volunteers, 202 females and 282 males, aged between 52 and 74, living in Ankara province participated in the study voluntarily. In the study, International Physical Activity Level Questionnaire-Short Form, Successful Aging Scale, and Behavioral Regulations in Exercise Scale-2 were used as data collection forms. The distribution normality was tested with kurtosis-skewness values. In the analysis of the data, descriptive statistics, Regression Analysis, Independent Samples t test, and One-way ANOVA were used. *Results:* There was a moderately significant positive correlation between the participants' mean scores of behavioral regulations in exercise and their mean scores of successful aging ( $r = 0.486$ ). Examination of the relationship between Behavioral Regulations in Exercise and the sub-dimensions of the Successful Aging Scale showed a moderate positive relationship with all sub-dimensions. On the other hand, there was no significant relationship between physical activity level and successful aging. According to the results of multiple regression analysis, behavioral regulations in exercise significantly predict successful aging. In addition, participants' physical activity levels and successful aging scale scores differ in terms of gender and income status. *Conclusion:* Exercising causes older individuals to have a healthier body and the chance of living with a better outlook. In addition, individuals can develop more positive emotions in coping with life and problems, which explains the effect of exercise on successful aging.

**Keywords:** Physical Activity, Successful Aging, Behavioral Regulation in Exercise

## Introduction

In the world and our country, individuals aged 65 and over are defined as “the elderly population”. Especially in developed and developing countries, the decrease in birth rates, as well as the prolongation of life expectancy at birth and old age, cause the elderly population and its share in the total population to increase relatively (1). According to the data of the World Health Organization in 2020, the number and rate of people aged 60 and over in the population is increasing, and the number of people aged 60 and over

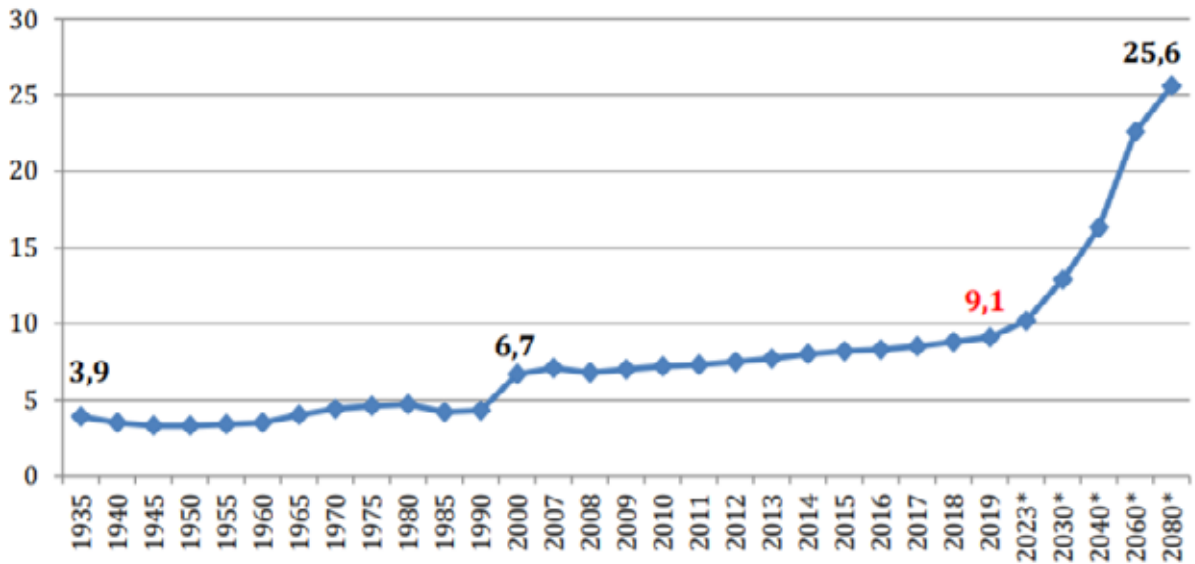
has been 1 billion in 2019. This number is estimated to increase to 1.4 billion in 2030 and 2.1 billion in 2050. Today, 125 million people are 80 and over. By 2050, there will be almost 120 million people living in China alone and 434 million people worldwide in this age group, and by 2050, 80% of older people are estimated to live in low- and middle-income countries (2). While the rate of the aging population in the world has been increasing significantly, the elderly population in our country was 628 thousand in 1935 and 7.5 million in 2019. The proportion of the elderly population in the total population increased by 2.3 times compared to

1935 and reached 9.1% in 2019. Population estimates also predict that the increasing trend in the elderly population will continue. According to population projections, the elderly population ratio will be 10.2% in 2023, 12.9% in 2030, 16.3% in 2040, 22.6% in 2060 and 25.6% in 2080 (Figure 1) (1).

The rapid increase in the elderly population as a result of the prolongation of life expectancy throughout the world increases the desire and effort to have a healthy old age (3). However, this worldwide phenomenon has brought important imperatives for states and communities on how to meet their needs as the number and proportion of older adults increase (4). The impact of an aging society is felt in many industries, from pension funds to increased spending on health-care and disability (5). A physically active lifestyle can help delay the occurrence of physical weakness and illness, thus significantly reducing health and social care costs (6). For this reason, society as a whole should accept the importance of the health of the elderly, their physical-cognitive functioning and their relationship

with life and the environmental factors included in this context, and the recent studies in the scientific world are also built on this requirement (5,7,8). Since needing care is a heavy social and economic burden in developed countries, they work intensively to prevent this. The common goal is a healthy life and a healthy old age. The concept of “healthy aging”, which defines this ideal and focuses especially on physical and mental health, is used more frequently in the field of medicine. In social sciences, the concept of successful aging has been introduced instead of this and has started to be widely preferred (3,9,10). Rowe and Kahn’s (1997) successful aging model is the most widely used and accepted model in scientific research, and successful aging has been collected under three main components: low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active participation in life (10). In the meta-analysis study conducted by Kim and Park (2017), the concept of successful aging was categorized in four areas, and these areas have been defined as avoiding illness and

### Yıllara göre yaşlı nüfusun toplam nüfus içindeki oranı



**Kaynak:** TÜİK, Genel Nüfus Sayımları, 1935-2000  
 TÜİK, Adrese Dayalı Nüfus Kayıt Sistemi, 2008-2019  
 TÜİK, Nüfus Projeksiyonları, 2023-2080

**Figure 1.** The proportion of the elderly population in the total population by years in Turkey

disability, having higher cognitive, mental, and physical functions, actively participating in life and spiritually adapting well to the next life (11).

Successful aging has been partly attributed to the absence of physical disability and physical performance and a lesser extent to cognitive impairment, and one of the most common components is physical functionality (12). Physical activity, which is one of the determinants of successful aging, stands out as the main preventive method to protect physical functionality (13). While no physical activity can stop the aging process, regular exercise at moderate levels can minimize the physiological effects of a sedentary lifestyle and increase active life expectancy by limiting the development and progression of chronic disease and disability conditions (6). In 6% of people, health risk factors such as inactivity, smoking, alcohol consumption, high waist-hip ratio, hypertension, and obesity increase with age (WHO, Global Health and Aging (2)).

Over the past 20-30 years, engaging in regular physical activity has been proven to have significant benefits in older adults. In the American College of Sports Medicine and the American Heart Health Association's physical activity and public health recommendations for older adults, performing regular physical activity in middle-aged and older adults have been reported to reduce the risk of cardiovascular disease, hypertension, type 2 diabetes, osteoporosis, obesity, colon and breast cancer, anxiety and depression (6,14). Regular physical activity prevents premature aging and contributes to the maintenance of the quality of life. There are many benefits of 40-50 minutes of daily walking or slow-paced jogging exercises, including reduction of risks for coronary heart disease by 50%, for high blood pressure, diabetes, and colon cancer by 30% (15). However, the exercises that increase over time, tire and wear out the body and become indispensable at disease level, which is taking the place of the activities performed to be healthy, cause adverse effects. One of the important concepts discussed while expressing the negative aspects of exercise is exercise addiction (16). Exercise addiction is a large area of speculation with only limited evidence for its existence (17). When exercise becomes excessive, it can have negative physical and psychological effects. Exercise addiction may also be accepted as a requisite,

compulsive, fanatic, or addictive exercise, it is defined as a situation in which moderate to high level physical activity becomes a compulsory behavior, and this situation may differ individually. This finding is supported by many scientific studies (18-20).

During the COVID-19 lockdown, those who are unaware that they are addicted to exercise cannot overcome their underlying disorders while simultaneously struggling with anxiety or panic attacks due to the inability to exercise outside. They start exercising at home and eventually, they can understand what it feels like to exercise moderately, how days without gym sessions can benefit them, and they can begin to loosen their commitment to the extreme exercise they desire (21). The slowdown in physical activities due to the problems encountered in old age and the change of many routines during the COVID-19 pandemic process also led to significant changes in our healthy living habits. In this process, which is called the new normal, the aim of the present study was to examine the effect of physical activity level and behavioral regulations in exercise on successful aging in adult individuals.

## Materials and Methods

### *Participants*

The sample of the study consists of a total of 484 volunteer participants between the ages of 52-74 living in Ankara who were selected by convenience sampling method. Among the individuals participating in the study, 202 are women and 282 are men. In this study, official permission for ethical approval was obtained from the Ethical Committee of Şırnak University with the number of 2021/35. Additionally, the study was conducted in accordance with the guidelines of the revised Helsinki Declaration

### *Data Collection Tools*

*The Successful Aging Scale (SAS):* The Turkish validity and reliability study of SAS, which was developed by Reker (2009), was conducted by Hazer and Özsungur (2017) (22). The scale consists of 3 sub-dimensions and a total of 13 items. These sub-dimensions are;

Healthy lifestyle (4 items), Adaptive coping (4 items), and Commitment to life (5 items). The scale is Likert type and evaluated between 1 (Strongly Disagree) and 5 (Strongly Agree). Cronbach Alpha reliability coefficients of the total and sub-components of the original scale range between .72 and .84. The items according to the patterns after varimax transformation of the 3 factors revealed in the Principal Components Factor Analysis explain 58.231% of the scale.

*The Behavioral Regulations in Exercise Scale:* The Behavioral Regulations in Exercise Scale developed by Mullen et al. (1997) was renewed by Markland and Tobin (2004) and was named as the Behavioral Regulations in Exercise Scale-2 (BRE-2 Scale) (Ersöz et al., 2012) (23). The scale, which can be applied from the age of 14, consists of 19 items and 5 sub-dimensions and is in the 5-point Likert type. The 5 sub-dimensions of the scale are named external regulation, introjected regulation, identified regulation, intrinsic regulation, and amotivation. The Turkish validity and reliability study of the scale was conducted by Ersöz et al. (2012) and the variance rate explained was 54.61%. The BRE-2 scale supports 3-factor with the 16-item structure for this study, and the reliability coefficients are 0.812 in the “introjected regulation” sub-dimension; 0.834 in the “intrinsic regulation” sub-dimension; and 0.861 in the “amotivation” sub-dimension. The items according to the patterns after varimax transformation of the 3 factors revealed in the Principal Components Factor Analysis explain 62.681% of the scale.

*International Physical Activity Questionnaire (IPAQ):* The IPAQ-Short Form, which was developed by Craig et al. (2003) and of which Turkish validity and reliability study was conducted by Öztürk (2005), was used to measure the physical activity levels of the participants (24). In IPAQ, the criterion is that physical activities are performed for at least 10 minutes at a time. IPAQ measures the duration of severe physical activity (football, basketball, aerobics, fast cycling, lifting weights, carrying loads, etc.), moderate physical activity (light load carrying, cycling at normal speed, folk dances, dance, bowling, table tennis, etc.), walking and sitting for a day in terms of minutes for the last 7 days. Total physical activity score (MET-min/week) is calculated by converting severe activity, moderate activity, and walking times into MET corresponding to basal metabolic rate.

### *Statistical analysis*

The analysis of the data was performed in the computer environment using the 22 SPSS (Statistical Package for Social Sciences) package program. Frequency and percentage analysis were used in descriptive data analysis. Distribution normality was tested by Skewness and Kurtosis values. Independent Samples t-Test method was used to determine whether there is a significant difference according to gender in the behavioral regulations in exercise and successful aging scores of the research group. One-way ANOVA for Independent Samples method was used to determine whether there is a significant difference according to age group and income status in the behavioral regulations in exercise and successful aging scores of the participants. Pearson correlation coefficient was used to determine the correlation between participants' behavioral regulations in exercise, successful aging, and physical activity questionnaire. In addition, the change between variables was tested with a multiple regression model. Significance was set at  $p < 0.05$ .

### **Results**

The mean score of participant's behavioral regulation in exercise is  $3.94 \pm .83$  as seen in Table 1. Examination of the sub-dimensions shows that participants have moderate levels of behavioral regulations in the introjected regulation ( $3.85 \pm .91$ ), intrinsic regulation ( $3.93 \pm .92$ ), and amotivation ( $3.95 \pm .96$ ). The mean score of participant's successful aging is  $3.94 \pm .73$ . While commitment to life sub-dimension had the highest level ( $3.90 \pm .82$ ), the healthy lifestyle sub-dimension had the lowest level ( $3.25 \pm .78$ ) in the sub-dimensions of successful aging.

Correlation analysis findings that examine the relationship between measurement scales reveal that there is a moderately positive correlation between the mean scores of behavioral regulations in exercise and the mean scores of successful aging ( $r = 0.486$ ). Examination of the relationship between Behavioral regulations in exercise and the sub-dimensions of the Successful Aging Scale showed a moderate positive relationship with all sub-dimensions. On the other

**Table 1.** Mean, standard deviation, and kurtosis skewness values of data collection tools

	Min.	Max.	$\bar{x}$	sd	Skewness	Kurtosis
<b>Behavioral Regulations in Exercise</b>	16	80	3.94	.83	-0.219	0.435
Introjected regulation	4	20	3.85	.91	-0.171	-0.011
Intrinsic regulation	6	30	3.93	.92	-0.124	0.208
Amotivation	6	30	3.95	.96	-0.224	0.123
<b>Successful Aging</b>	13	65	3.94	.73	-1.267	2.221
Healthy lifestyle	4	20	3.25	.78	-1.532	2.503
Adaptive coping	4	20	3.73	.69	-0.841	0.669
Commitment to life	5	25	3.90	.82	-0.839	0.171

**Table 2.** Pearson correlation analysis results between measurement scales

	1	2	3	4	5	6	7	8
<b>1-Behavioral regulations in exercise</b>	1							
2-Introjected regulation	.596*	1						
3-Intrinsic regulation	.678*	.546*	1					
4-Amotivation	.621*	.439*	.498*	1				
<b>5-Successful aging</b>	.486*	.441*	.422*	.402*	1			
6-Healthy lifestyle	.381*	.360*	.331*	.329*	.608*	1		
7-Adaptive coping	.531*	.422*	.541*	.523*	.613*	.613*	1	
8-Commitment to life	.349*	.331*	.385*	.348*	.605*	.549*	.476*	1
<b>9-Physical activity level</b>	.089	.024	.101	.105	.111	.035	.072	.098

$p < 0,05^*$

**Table 3.** Multiple regression analysis results between data collection forms

	B	Std. Error	$\beta$	t	p	Zero-order r	Partial r
Constant	19..225	2.128		9.033	0.000*		
Healthy lifestyle	-0.002	0.069	-0.003	-0.033	0.974	0.374	-0.002
Adaptive coping	0.468	0.082	0.456	5.712	0.000*	0.508	0.343
Commitment to life	0.195	0.151	0.093	1.294	0.197	0.354	0.082
R=0.513	R <sup>2</sup> = 0.263						
F <sub>(29,198)</sub> =0.000*	p<0.000						

hand, there was no significant relationship between physical activity level and successful aging.

#### *Dependent variable: Behavioral Regulations in Exercise*

Table 3 shows the results of the regression analysis examining the effect of behavioral regulations in exercise on successful aging. The results of this analysis indicate that 3 variables explain 26% of the total variance of the effect of behavioral regulations in exercise

on successful aging. The behavioral regulations in exercise significantly predicts the successful aging ( $\beta = 0.456$ ;  $t = 5.712$ ;  $p < 0.05$ ).

Examination of the gender effect on the physical activity level, successful aging, and behavioral regulations in the exercise scale scores of the individuals participating in the study showed significant differences in physical activity level and successful aging. The difference between genders in behavioral regulations in exercise scale was not significant. While the physical

**Table 4.** Comparison of physical activity level, successful aging, and behavioral regulations in exercise according to gender

Variables		N		ss	t	p
Physical activity level	Male	282	3.72	.62	-1.979	0.046*
	Female	202	3.84	.53		
Successful aging	Male	282	2.62	1.08	2.286	0.024*
	Female	202	2.38	.86		
Behavioral regulations in exercise	Male	282	2.70	.62	1.286	0.191
	Female	202	2.63	.57		

p<0.05

**Table 5.** One-way ANOVA results of the scales of physical activity level, successful aging, and behavioral regulations in exercise according to the income level

Variables		N		ss	F	p
Physical activity level	2000 and below	181	3.70 <sup>b</sup>	.71	9.443	.001*
	2001-5000	203	3.83 <sup>b</sup>	.42		
	5001 and above	100	4.06 <sup>a</sup>	.56		
Successful aging	2000 and below	181	3.37 <sup>b</sup>	.69	8.654	.001*
	2001-5000	203	3.79 <sup>a</sup>	1.11		
	5001 and above	100	3.36 <sup>b</sup>	1.12		
Behavioral regulations in exercise	2000 and below	181	2.65	.54	2.839	.059
	2001-5000	203	2.82	.65		
	5001 and above	100	2.70	.45		

p<0.05; a,b: There is a difference between groups containing different letters.

activity levels of female participants are higher than male participants, male participants have a higher level of successful aging than female participants (Table 4).

Analysis of the effect of income levels of the participants on physical activity level, successful aging, and behavioral modifications in exercise scale scores showed that the income level causes a significant difference in the physical activity level and successful aging scores. As the income level of the participants' increases, there is an increase in the level of physical activity, whereas the middle class group has higher levels of successful aging than the low and high income group. In addition, the scale of behavioral modifications in exercise does not make a significant difference in the research group in terms of income level (Table 5).

## Discussion and Conclusion

The present study, conducted during the COVID-19 pandemic period, is important in terms of examining

the level of physical activity and behavioral regulations in exercise within the scope of successful aging in adult individuals. The aim of this study was to examine the effect of successful aging level on physical activity level and behavioral regulations in exercise in 484 adults, of which 202 were women and 282 were men, aged between 52-74, living in Ankara.

The results of the study indicate a positive and moderately significant relationship between behavioral regulations in exercise and successful aging in adult individuals (p<0.05). The effect of behavioral regulations in exercise on successful aging explains 26% of the sub-dimensions, which are healthy lifestyle, adaptive coping, and commitment to life, and the behavioral regulations in exercise were determined to significantly predict successful aging. Performing exercise helps individuals to have the chance of living a new life by gaining a better look, as well as having a healthier body. In addition, individuals can develop more positive emotions in coping with life and problems, which explains the effect of exercise on successful

aging. There was no significant relationship between physical activity level and successful aging. Having a high mental and physical function, one of the three components of successful aging, involves the potential for function and activity and suggests that it is more important to know what individuals can do, not just what they are already doing (5,10).

When the physical activity level, successful aging, and behavioral modifications in exercise scale scores were examined in terms of gender, the results of the study showed that there was a significant difference in genders on physical activity level and successful aging. Physical activity levels of female participants were found to be higher than male participants. Tural (2020), in the study on 260 people during the pandemic period, reported that 51.5% of the individuals were not active and there was no significant difference according to gender (25). Although the quarantine process limits the participation of people of all ages in physical activity, this was considered to be related to the fact that women are more active in housework than men.

Male participants had higher levels of successful aging than female participants. Literature scan results show that many studies supporting that the male elderly have better successful aging than women elderly (26-28). In their study on individuals aged 90 and over, Nosraty et al. (2012) found that male participants aged more successfully than women. No difference was found between male and female adults in the mean scores of behavioral regulations in exercise in terms of gender. Gümüş (2017) also reported that behavioral regulations in exercise do not differ significantly in terms of gender (29). On the other hand, Tekkurşun and Türkeli (2019) showed a significant difference in the exercise addiction levels of men in their study. No significant difference between genders can be explained due to the lockdown restrictions and the measures to stay at home in quarantine during the COVID-19 process (16).

There was no significant difference between groups of income levels in terms of Behavioral regulations in exercise. In the study conducted by Çavuşoğlu and Yılmaz (2020) among university students, they stated that the income level did not cause a significant difference in behavioral regulation in exercise (30). These results indicate that income levels do not have a prominent effect to have a better outlook and physical structure and, on the factors, motivating exercise. On

the other hand, the income levels of the participants cause a significant difference in physical activity level and successful aging scores. As the income level of the participants increased, their level of physical activity increased. And, the level of successful aging of the middle class income group was higher than the participants in the low and high income groups. Other studies in the literature coincide with the results of our study (31-33). Yılmaz (2020), in the study on 190 individuals over 65 years of age, reported that successful aging of elderly individuals with equal income and expenditure is higher than those that have less income than their expenditure (32). On the other hand, McLaughlin et al. (2010) reported that people with high income levels have a higher prevalence of successful aging (33).

In conclusion, the present study points out that there is a moderately significant positive correlation between behavioral regulations in exercise and successful aging levels of adult individuals. Exercising causes older individuals to have a healthier body and the chance of living with a better outlook. In addition, individuals can develop more positive emotions in coping with life and problems, which explains the effect of exercise on successful aging. There was no significant relationship between physical activity level and successful aging. Having a high mental and physical function, one of the three components of successful aging involves the potential for function and activity and suggests that it is more important to know what individuals can do, not just what they are already doing.

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