Journal of Sports Research and Innovation
ISSN: 2956-980X

Original Research Articles

Investigation of Chronotypes Of Individuals Engaging In Exercise in Terms of Certain Variables

İsmail İlbak[1], Burak Gönültaş[2], Stefan Stojanovic[3], Bojan Jorgic[3]

[1]İnönü University, Institute of Health Sciences, Department of Physical Education and Sports, Malatya, Türkiye
[2]Ege University, Institute of Health Sciences, İzmir, Türkiye
[3]University of Nis, Faculty of Sport and Physical Education, Nis, Serbia

Abstract

Background: While it is evident from the literature that inter-individual differences in chronotypes have a significant impact on various variables, it is crucial to continue these studies to gain a better understanding of chronotype mechanisms. In this context, the aim of our research was to examine the relationship between the chronotypes of individuals engaged in exercise and factors such as the timing of their exercises, exercise frequency, and daily sleep duration. **Methods:** This research was designed using quantitative research methods, employing a survey model. The sample size for this study was determined using G*Power 3.1.9.7 (University of Düsseldorf, Düsseldorf, Germany) software. The population of this study consisted of 800 individuals, with a sample size of 182 individuals. Data collection tools in the study included a demographic information form and the "Turkish form of MESSi" scale, which was developed by Randler et al. (2016) and adapted into Turkish by Demirhan et al. (2019) for assessing morningness-eveningness stability. The data obtained from the research were analyzed using IBM Statistics (SPSS version 25.0, Armonk, NY) software. **Results:** Findings from the study indicated that when examining the mean scores participants obtained from the Turkish form of MESSi, there was a statistically significant difference only in the Evening subscale in terms of the timing of exercise. However, no statistically significant differences were found regarding exercise frequency and daily sleep duration. **Conclusions**: As a result of this research, it was concluded that there is a relationship between exercise time and chronotype, and that individuals with Evening chronotype prefer to exercise between 12:00-18:00 in the afternoon and 18:00-24:00 in the evening. Therefore, it can be said that our chronotype is an important factor affecting our choice of time to exercise. It is recommended that future researchers conduct research on this subject with larger sample groups.

Keywords: Exercise Timing, Exercise Duration, Daily Sleep Duration, Chronotype, Circadian Rhythm

Received: 25.12.2023
Reviewed: 16.01.2024
Published: 09.02.2024

Introduction

The chronotype, which is characterized as an individual's predisposition towards either morning or evening (1), is a highly complex phenomenon influenced by various factors such as biological factors like body temperature, cortisol, and melatonin levels; technological and social factors like media device usage, lighting, and daily life activities; and environmental factors like climate, latitude, and longitude(2–5).

Chronotypes are generally classified into three different types: morning types (M-types), evening types (E-types), and neither types (N-types) (1,2,6). In this classification,

M-type individuals prefer to be active in the early hours of the day, while E-type individuals prefer to be active in the later hours of the day. N-type individuals, on the other hand, do not exhibit any preference for morning or evening activities (7).

Investigations into studies on chronotypes have revealed that individuals with the same chronotype tend to share certain common characteristics. In this context, M-type individuals have been found to be more attentive (8–10) and inclined toward healthier behaviours (11). On the other hand, E-type individuals are prone to behavioural issues (such as depression, loneliness), personality disorders (substance use, eating disorders, internet addiction, daytime sleepiness), and lower academic performance (12–14).

When reviewing the literature regarding sports performance, it has been observed that individuals with M-type chronotypes perceive less effort during strenuous morning sports activities, whereas M-type and N-type individuals report perceiving higher effort and exhibiting higher levels of fatigue during demanding morning sports activities (15–17). Similarly, it has been reported that E-type individuals produce more torque in the afternoon or evening compared to the morning (15). In other studies, it has been reported that M-type individuals achieved higher performance levels in half-marathon and full-marathon races (16), 2000-meter rowing (17), and 200-meter swimming trials (18) compared to N and E chronotypes.

The literature summary presented above clearly indicates that inter-individual differences in chronotypes are influenced by numerous factors. However, it is essential to continue these studies to gain a better understanding of chronotype mechanisms. In this context, the aim of our research is to examine the relationship between the chronotypes of individuals who engage in sports and factors such as the timing of their exercises, exercise frequency, and daily sleep duration.

Material and Methods

Research Design

This study utilized a survey model, which is a research design aimed at understanding and presenting an existing situation or a past event in its natural state. The research was conducted with the participation of voluntary individuals after obtaining ethical approval from the Ethics Committee of İnönü University Faculty of Health Sciences Malatya, Türkiye.

Population and Sample

The population of this research consists of 800 individuals who participate in training sessions at the Kaptan-Fit sports club in Malatya, Türkiye. To determine the sample size for the study, the ANOVA: fixed effects omnibus one-way test was employed using G*Power 3.1.9.7 software (University of Düsseldorf, Düsseldorf, Germany). In this context, with α error level set at 0.05, effect size at 0.25, and 1-β error probability at 0.80, it was determined that the sample size should be a minimum of 159 individuals to achieve an 80% confidence level. In this context, 182 individuals participated in the research. Demographic information for the sample group is presented in Table 1.

Table 1. Demographic characteristics of the sample group

Variables		f	%
Gender	Male	110	60.4
	Female	72	39.6
	Total	182	100.0
Frequency of exercise	At least 1-2 days	79	43.4
	At least 3-4 days	68	37.4
	At least 5-6 days	26	14.3

	Everyday	9	4.9
	Total	182	100.0
Timing of exercise	Morning 06-12 am	46	25.3
	Afternoon 12-18 pm	96	52.7
	Evening 18-24 pm	40	22.0
	Total	182	100.0
Daily sleep duration	6 hours or less than 6 hours	50	27.5
	7 hours	57	31.3
	8 hours	43	23.6
	9 hours or more than 9 hours	32	17.6
	Total	182	100.0

Table 1 shows the demographic information of the participants as frequency (f) and percentage (%).

Data Collection Tools

In this research, data were collected using a form that gathered participants' demographic information and the "Turkish form of MESSi" scale, which was developed by Randler et al. (2016) (19) and adapted into Turkish by Demirhan et al. (2019) (20) . The scale is called the "Morningness–Eveningness Stability Scale." The Turkish form of MESSi scale consists of three subscales: morning affect (MA), eveningness (EV), and distinctness (DI).

Statistical Analysis

The data were analysed using IBM Statistics (SPSS version 25.0, Armonk, NY) software package. After testing the normality of the data with the Shapiro-Wilk's test and checking homogeneity with Levene's test, it was determined that the data did not follow a normal distribution. Therefore, for pairwise comparisons, the Mann-Whitney U and chi-square tests were used, and for comparisons involving more than two groups, the Kruskal-Wallis H test was employed. The statistical significance level was set at $p<0.05$. To determine which variables contributed to the observed differences, the Tamhane's T2 post-hoc test was used.

Results

According to Table 2, when examining the mean ranks obtained from the Turkish form of MESSi for participants, a statistically significant difference was observed in the EV subscale. However, there was no statistically significant difference in the MA, DI subscales, or the total scale score.

Table 2. Kruskal-Wallis H Test Results for the Relationship Between Participants' Exercise Timing and Turkish form of MESSi Subscales

Subscales	Timing of exercise	n	M.R.	χ^2	p	D
MA	1) Morning 06-12 am	46	102.20	5.700	.058	
	2) Afternoon 12-18 pm	96	93.02			
	3) Evening 18-24 pm	40	75.56			
EV	1) Morning 06-12 am	46	68.91	13.711	.001*	2>1 3>1
	2) Afternoon 12-18 pm	96	94.71			
	3) Evening 18-24 pm	40	109.76			
DI	1) Morning 06-12 am	46	87.42	.381	.826	
	2) Afternoon 12-18 pm	96	92.59			
	3) Evening 18-24 pm	40	93.58			

Total scale score	1) Morning 06-12 am	46	83.50	1.438	.487
	2) Afternoon 12-18 pm	96	93.86		
	3) Evening 18-24 pm	40	95.03		

*p<.05; M.R: Mean Rank; χ2: Chi-Square; D: differences

According to Table 3, when examining the mean ranks obtained from the Turkish form of MESSi for participants, there was no statistically significant difference in the EV, MA, DI subscales, or the total scale score.

Table 3. Kruskal-Wallis H Test Results for the Relationship Between Participants' Exercise Frequency and Turkish form of MESSi Subscales

Subscales	Frequency of exercise	n	M.R.	χ^2	p
MA	1) At least 1-2 days	79	83.08	4.602	.203
	2) At least 3-4 days	68	94.57		
	3) At least 5-6 days	26	106.60		
	4) Every day	9	98.61		
EV	1) At least 1-2 days	79	89.57	1.532	.675
	2) At least 3-4 days	68	96.78		
	3) At least 5-6 days	26	88.44		
	4) Every day	9	77.39		
DI	1) At least 1-2 days	79	86.05	1.936	.586
	2) At least 3-4 days	68	96.83		
	3) At least 5-6 days	26	96.46		
	4) Every day	9	84.72		
Total scale score	1) At least 1-2 days	79	84.59	3.504	.320
	2) At least 3-4 days	68	97.67		
	3) At least 5-6 days	26	100.44		
	4) Every day	9	79.67		

*p<.05; M.R: Mean Rank; χ2: Chi-Square

According to Table 4, when examining the mean ranks obtained from the Turkish form of MESSi for participants, there was no statistically significant difference in the EV, MA, DI subscales, or the total scale score in relation to participants' daily sleep duration.

Table 4. Kruskal-Wallis H Test Results for the Relationship Between Participants' Daily Sleep Duration and Turkish form of MESSi Subscales

Subscales	Daily Sleep Duration	n	M.R.	χ^2	p
MA	1) At least 6 hours	50	94.35	1.714	.634
	2) At least 7 hours	57	86.12		
	3) At least 8 hours	43	98.45		
	4) At least 9 hours or more	32	87.28		
EV	1) At least 6 hours	50	77.38	5.474	.140
	2) At least 7 hours	57	98.35		
	3) At least 8 hours	43	92.37		
	4) At least 9 hours or more	32	100.19		
DI	1) At least 6 hours	50	89.85	.213	.975
	2) At least 7 hours	57	90.13		

	3) At least 8 hours	43	93.53		
	4) At least 9 hours or more	32	93.78		
Total scale score	1) At least 6 hours	50	83.06	1.991	.574
	2) At least 7 hours	57	93.25		
	3) At least 8 hours	43	97.76		
	4) At least 9 hours or more	32	93.17		

*p<.05; M.R: Mean Rank; $\chi 2$: Chi-Square

Discussion

The findings of this research, which examined the relationship between the chronotypes of individuals and factors such as the preferred time for exercise, exercise frequency, and daily sleep duration among individuals who exercise, have indicated that an individual's chronotype is a significant factor influencing the preferred time for exercise. In this context, individuals with an Evening chronotype were found to prefer exercising between afternoon (12:00-18:00) and evening (18:00-24:00). However, no statistically significant relationship was detected between chronotype and exercise frequency or daily sleep duration ($p<.05$).

The chronotype, which reflects individuals' tendency to be more alert and active during the morning (morningness) or evening (eveningness) hours, is influenced by both genetic and environmental factors. It plays a crucial role in determining an individual's energy levels and productivity throughout the day (2,7,20). Additionally, physiological processes with approximately 24-hour cycles, such as blood pressure, body temperature, hormonal secretion, and energy metabolism of nutrients, can have significant effects on athletic performance (21). These factors may influence the exercise timing preferences of individuals with different chronotypes.

Most of the studies in the literature related to our research have reported that both professional and amateur athletes exhibit maximum athletic performance around the late afternoon, approximately between 16:30 and 19:00 (22–26). This increase in athletic performance is considered a result of synchronization between physiological, psychological, and metabolic rhythms (27,28). In this context, the optimal time of day for any physical exercise according to circadian rhythms is around 16:30-19:00 (29). The findings of our research also indicate that individuals with an evening chronotype prefer to exercise in the late afternoon or evening. In this regard, it is believed that the exercise preferences of individuals with evening chronotypes are influenced by physiological, psychological, and metabolic factors.

While differences in psychophysiological responses to physical activity can be partially explained by some variables being objective and others subjective (30), the mechanisms behind chronotype are not yet fully understood. Therefore, it is important for studies like these to continue in order to gain a better understanding of chronotype mechanisms.

Conclusion

In conclusion, it is a fact that our chronotype is an important factor influencing our preference for the timing of exercise. It is believed that adjusting the timing of exercise according to individuals' chronotypes has a significant impact on maximizing the benefits of exercise. In addition, determining the chronotypes of especially professional athletes and planning training programs accordingly is considered to be a significant factor in improving sports performance. Therefore, it is recommended for coaches to take into account the chronotypes of athletes when making their plans. For future researchers in this area, it is recommended to conduct research with larger sample groups.

Author Contributions: Conceptualization, I.I.; methodology, I.I. and B.G.; software, I.I.; validation, I.I., S.S. and B.J.; formal analysis, I.I. and S.S.; investigation, I.I.; resources, I.I.; data curation, I.I. and B.G.; writing—original draft preparation, I.I. and S.S.; writing—review and editing, I.I., B.G. and B.J.; visualization, I.I.; supervision, I.I., B.J. and S.S; project administration, B.G and I.I.; funding acquisition, I.I. All authors have read and agreed to the published version of the manuscript.
Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of İnönü University Faculty of Health Sciences Malatya, Türkiye (approval No. 2023/4972).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data are included in the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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