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Comparison of Physical Activity Levels, Metabolic Syndrome Risks and Sleep Quality of Athletes and Sedentary University Students: A Cross-Sectional Study

Sporcu ve Sedanter Üniversite Öğrencilerinin Fiziksel Aktivite Düzeyleri, Metabolik Sendrom Riskleri ve Uyku Kalitelerinin Karşılaştırılması: Kesitsel Bir Çalışma

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ABSTRACT Objective: The aim of this study is to compare the physical activity levels, metabolic syndrome risks and sleep quality of athletes and sedentary university students. **Material and Methods:** A total of 400 students, including 200 athletes and 200 sedentary students studying at Gümüşhane University, were included in this study. In collecting data; Pittsburgh Sleep Quality Index was used to evaluate the sleep quality of the participants, International Physical Activity Questionnaire-Short Form was used to determine physical activity levels and Metabolic Syndrome Research Form was used to determine metabolic syndrome risk levels. **Results:** Average age of the participants was 19.94±1.48. A significant difference was detected between athletes and sedentary individuals in sleep quality and metabolic syndrome risk level. Individuals who exercise regularly and have high physical activity levels were found to have higher sleep quality and lower metabolic syndrome risks. In addition, these people are less exposed to various sleep problems such as falling asleep late, daytime sleepiness, inefficient sleep, etc. **Conclusion:** Increasing the level of physical activity improves sleep quality and reduces the risk of metabolic syndrome. Athletes have better sleep quality and lower risk of metabolic syndrome than sedantery. It is important to increase research in this area in young individuals. On the other hand, creating the right exercise program should be emphasized in studies. It is thought that our study will contribute to future studies in this regard.

Keywords: Health; metabolic syndrome; physical activity; sleep quality

ÖZET Amaç: Bu çalışmanın amacı sporcu ve sedanter üniversite öğrencilerinin fiziksel aktivite düzeyleri, metabolik sendrom riskleri ve uyku kalitelerinin karşılaştırılmasıdır. **Gereç ve Yöntemler:** Çalışmaya Gümüşhane Üniversitesi'nde öğrenimine devam eden 200 sporcu ve 200 sedanter olmak üzere toplam 400 öğrenci katılmıştır. Verilerin toplanmasında; katılımcıların uyku kalitelerinin değerlendirilmesi amacıyla Pittsburgh Uyku Kalitesi İndeksi (PUQI), fiziksel aktivite seviyelerinin belirlenmesi amacıyla Uluslararası Fiziksel Aktivite Anketi-Kısa Formu (IPAQ-Kısa) ve metabolik sendrom risk düzeylerinin belirlenmesi amacıyla Metabolik Sendrom Araştırma Formu (MSAF) kullanıldı. **Bulgular:** Katılımcıların yaş ortalaması 19,94±1,48 idi. Sporcular ve sedanter bireyler arasında uyku kalitesi ve metabolik sendrom risk düzeyi açısından anlamlı farklılık tespit edildi. Yüksek fiziksel aktivite düzeyine sahip ve düzenli egzersiz yapan bireylerin, daha yüksek uyku kalitesi ve daha düşük metabolik sendrom riskine sahip olduğu belirlendi. Ayrıca bu kişiler geç uykuya dalma, gündüz uyku hali, verimsiz uyku gibi çeşitli uyku sorunlarına daha az maruz kalmaktadır. **Sonuç:** Fiziksel aktivite seviyesinin artması uyku kalitesini artırmakta metabolik sendrom riskini azaltmaktadır. Sporcular, sporcu olmayan bireylere göre daha iyi uyku kalitesine sahiptir ve metabolik sendrom riskleri daha düşüktür. Genç bireylerde bu alandaki araştırmaların artırılması önemlidir. Öte yandan doğru egzersiz programının oluşturulması çalışmalarda vurgulanmalıdır. Çalışmamızın gelecek çalışmalara bu yönden katlı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Sağlık; metabolik sendrom; fiziksel aktivite; uyku kalitesi

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Having a physically active life is important in maintaining and improving the health condition.[1] The aim of every country is to have healthy generations. The most important step of this issue; having knowledge about their health and acquiring the right attitudes and behaviors to protect and promote health by individuals.[2]

There is a linear relationship between physical activity and health. Being physically active is very important for health. There is substantial evidence that regular physical activity is effective in preventing chronic diseases and reducing the risk of premature death.[1] Lack of adequate and regular physical activity is a serious problem in most countries. For this reason, the promotion of active lifestyle is an important component of the recommendations in the field of public health.[3] Along with technology and modernization, the level of physical activity decreases, and various health problems may arise in relation to this.[4]

Another health problem we encounter due to the sedentary life brought by modern urban life is metabolic syndrome. Metabolic syndrome is a fatal endocrinopathy in which systemic disorders such as abdominal obesity, glucose intolerance or diabetes mellitus, dyslipidemia, hypertension and coronary artery disease are added sequentially.[5] According to the World Health Organization data, the prevalence of metabolic syndrome is increasing all over the world. Sedentary life, overweight, unhealthy diet, alcohol and smoking are among the factors that predispose to metabolic syndrome.[6] With early treatment of metabolic syndrome; Type 2 diabetes and coronary artery disease that may be seen in the future can be prevented. Lifestyle changes are of great importance in treatment.[7]

One of the basic human needs that must be met is "sleep". Sleep is seen as an important variable of health, affecting the individual, quality of life and well-being. Sleep quality is a concept that is emphasized in scientific studies about sleep because poor quality sleep can be an indicator of many diseases and healthy sleep is in a strong relationship with physical and psychological well-being.[8] When the literature is examined, it is seen that physical activity has positive effects on sleep quality and metabolic syndrome.[9-16] In line with this information, our aims in this study are; to determine the physical activity levels, metabolic syndrome risks and sleep quality of university students, to compare the metabolic syndrome risks and sleep quality of athletes and sedantery, and to compare the metabolic syndrome risks and sleep quality of groups with low, medium and high physical activity levels.

MATERIAL AND METHODS

UNIVERSE AND SAMPLE

The universe of the study consists of 20,000 students studying at Gümüşhane University. Considering the 0.95 confidence interval and 0.05 deviation amount, the sample size for the universe of 20,000 was determined as 377 people according to Büyüköztürk et al.[17] In this direction, our study was completed with 400 people to represent the universe. Of the 400 participants, 200 were athletes and 200 were sedentary. Athletes consist of individuals who continue their education at the physical education and sports school of the relevant university and actively participate in a sports branch. Sedentary individuals, on the other hand, consist of students who continue their education at other schools of the relevant university and do not do sports in any branch.

DATA COLLECTION TOOLS

To all participants; "Pittsbugh Sleep Quality Scale (PSQI)", "International Physical Activity Questionnaire-Short Form (IPAQ-Short)", "Metabolic Syndrome Research Form (MSRF)" were applied. In addition, demographic information were questioned. Ethics committee approval was received for the research.

ETHICAL DIMENSION OF RESEARCH

The research was discussed at the meeting of Gümüşhane University Scientific Research and Publication Ethics Committee numbered 2019/8 and dated 13 September 2019 and was accepted with the letter numbered 95674917-108.99-E.32553. Research process in accordance with the principles of the Declaration of Helsinki has been carried out. Volunteer students were included to participate in the

study. Before the study, students were given necessary information. Survey forms were filled out via face-to-face interview. Students who did not volunteer were not included in the study.

STUDY INCLUSION AND EXCLUSION CRITERIA

Criteria for Inclusion in the Study; Continuing education at Gümüşhane University, being between the ages of 17-25, volunteering to participate in the study.

Exclusion Criteria; Students do not want to participate in the study or do not want to continue after starting, being over 25 years old, missing information on forms.

Pittsbugh Sleep Quality Scale (PSQI)

PSQI was developed by Buysse et al. Sensitivity of indeks was 89.6%; its specificity was 86.5% The validity and reliability study of PSQI for Türkiye was conducted by Ağargün et al., internal consistency coefficient (cronbach α) was determined as 0.8.[18,19]

There are 7 sub-components of PSQI. These components; subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping pills, daytime dysfunction. Each sub-dimension takes a value between 0-3 points. When the scores of all components are summed, the total score of the scale is obtained. The total PSQI score takes a value between 0-21 points. The higher score, the lower the sleep quality.[18]

International Physical Activity Questionnaire-Short Form (IPAQ)

The questionnaire was created by Craig et al. to determine the level of physical activity.[20] Turkish validity and reliability study of qaestionnaire was conducted by Öztürk.[21] The survey includes the last 7 days for the assessment to be made. The assessed physical activities must be performed for at least 10 minutes at a time. The total score is calculated by multiplying the minutes, days and MET values of the activities and expressed in "MET-minutes/week". Vigorous physical activities are multiplied 8 METs, moderate-intensity physical activities multiplied 4 METs, walking is multiplied by 3.3 METs. Total physical activity score (METdk/week) below 600 indicates low intensity physical activity, between 600-3,000 indicates moderate physical activity, when it is over 3,000 indicates vigorous physical activity.[21]

Metabolic Syndrome Research Form (MSRF)

MSRF, created by Erdoğmuş to evaluate the risk of metabolic syndrome, consists of 14 questions.[6] The answers given to the questions consist of 2 options: "Yes" and "No". Every yes answer increases the score. The total score varies between 0 and 14, and the higher the score, the higher the risk of metabolic syndrome.[6]

ANALYSIS OF DATA

SPSS 23.00 (SPSS Inc., Chicago, IL, USA) package program was used for data analysis. It was determined that the data showed normal distribution with the Kolmogorov-Smirnov and Shapiro-Wilk tests. Student's t-test was used for paired comparisons, one-way analysis of variance for multiple comparisons, and LSD tests for determining the difference. p=0.05 and p=0.001 values were used for the significance level in the interpretation of the results. It was concluded that p values below these values were statistically significant.

RESULTS

When the descriptive data of the students are examined; there are 43.5% female students in the group doing sports and there are 71% female students in the sedentary group. 53.5% of athlete group have 0-2,500 TL income and 35.5% of the same group have 2,501-5,000TL income. 59% of sedentary group have 0-2,500 TL income and 32.5% of the same group have 2,501-5,000TL income. 28% of athletes smoke, in sedantery this ratio is 29.5%. 87.5% of athletes are daytime students, in sedentary group daytime students ratio is 51.5% (Table 1).

The participants average age was 19.94±1.48 and their average body mass index (BMI) was 21.49±2.87 (Table 2).

Participants were divided into three groups according to their physical activity levels as low, moderate and vigorous. When sub-dimensions and total PSQI score are examined according to physical activity levels; it is seen that there are significant dif-

TABLE 1: Descriptive characteristics of the participants.

	Athlete group		Sedentary group	
Descriptive feature	**n**	**%**	**n**	**%**
Gender				
Woman	87	43.5	142	71
Man	113	56.5	58	29
Income status				
0-2,500 TL	107	53.5	1185	59
2,501-5,000TL	71	35.5	65	32.5
5,001 TL and above	22	11	17	8.5
Smoking				
Yes	56	28	59	29.5
No	144	72	141	70.5
Learning time				
Daytime	175	87.5	103	51.5
Night	25	12.5	97	48.5
Total	200	100	200	100

n: Number of student.

TABLE 2: Average age and BMI of the participants.

	n	Mean	SD	Minimum	Maximum
Age	400	19.94	1.48	17.00	25.00
BMI	400	21.49	2.87	16.00	33.00

BMI: Body mass index (kg/m^2); n: Number of student; SD: Standart deviation.

ferences between the groups. Subjective sleep quality was significantly better in the group with high physical activity level than in the low and moderate groups (p=0.000, p=0.003), and in the group with moderate physical activity level than in the low group (p=0.042). Sleep latency was significantly better in the group with high physical activity level than in the group with low physical activity level (p=0.001). Sleep disturbances were significantly less in the group with high physical activity level than in the low and moderate groups (p=0.000, p=0.001). Daytime sleepiness was significantly less in the group with high physical activity level than in the low and medium groups (p=0.005, p=0.026). There was no significant difference between the groups in the sub-dimensions of sleep duration, sleep efficiency, and sleeping pill use (p=0.895, p=0.341, p=0.489). Total PSQI score was significantly better in the group with high physical activity level than in the low and moderate groups (p=0.000, p=0.009) (Table 3).

Participants' sleep quality was evaluated according to their status as athletes and sedentary. Subjective sleep quality, sleep latency, sleep efficiency, sleep disorders, daytime sleepiness sub-dimensions and total PSQI scores were found to be significantly better in athletes than in sedentary individuals (p=0.000). No significant difference was found between athletes and sedentary individuals in terms of sleep duration and use of sleeping pills (p=0.530, p=0.899) (Table 4).

When MSRF scores were examined according to the physical activity levels of the participants, the risk of metabolic syndrome was found to be significantly lower in the group with high physical activity levels than in the low and moderate groups (p=0.000, p=0.000). Again, the risk of metabolic syndrome in the group with moderate physical activity levels was significantly lower than in the low group (p=0.001) (Table 5).

When MSRF scores of athletes and sedentary individuals were compared, it was determined that athletes had significantly lower metabolic syndrome risks than sedentary individuals (p=0.000) (Table 6).

DISCUSSION

As a result of our study, it was determined that individuals with high physical activity level had better sleep quality and lower risk of metabolic syndrome. Again, athletes had better sleep quality and lower risk of metabolic syndrome than sedantery.

When the groups with low, medium and high physical level activity were examined in our study; It appears that the level of physical activity positively affects sleep quality and metabolic syndrome risk level. As the level of physical activity increased, sleep quality increased. Also, sleep quality of athletes was significantly better than sedentary. In a study conducted on women by Kline et al., exercise level was found to be associated with sleep quality. They found that as the level of physical activity increased, sleep depth increased and sleep interruptions decreased.[22] In a study by Arbinaga et al., it was determined that as the physical activity level of university students decreased, their sleep quality also decreased. This significant relationship was detected in the sub-dimensions and the

TABLE 3: Examination of sleep quality according to physical activity level.

	Physical Activity	n	Mean	SD	F/LSD	p value
Subjective sleep quality	Low	93	1.39	0.82	11.69**	0.000
	Moderate	143	1.17	0.80	1>3	
	Vigorous	164	0.89	0.83	2>3	
	Total	400	1.11	0.84	1>2	
Sleep latency	Low	93	1.58	0.97	5.31*	0.005
	Moderate	143	1.34	1.04	1>3	
	Vigorous	164	1.14	1.05		
	Total	400	1.31	1.04		
Sleep duration	Low	93	0.40	0.81	0.11	0.895
	Moderate	143	0.41	0.79		
	Vigorous	164	0.37	0.78		
	Total	400	0.40	0.79		
Habitual sleep efficiency	Low	93	0.58	0.92	1.08	0.341
	Moderate	143	0.51	0.95		
	Vigorous	164	0.41	0.83		
	Total	400	0.48	0.90		
Sleep disturbances	Low	93	1.20	0.58	9.29**	0.000
	Moderate	143	1.13	0.66	1>3	
	Vigorous	164	0.89	0.59	2>3	
	Total	400	1.05	0.62		
Use of sleeping medications	Low	93	0.10	0.54	0.71	0.489
	Moderate	143	0.05	0.25		
	Vigorous	164	0.10	0.39		
	Total	400	0.08	0.39		
Daytime dysfunction	Low	93	1.19	1.07	4.68*	0.010
	Moderate	143	1.08	1.01	1>3	
	Vigorous	164	0.82	0.93	2>3	
	Total	400	1.00	1.00		
Total PSQI score	Low	93	6.47	3.54	8.50**	0.000
	Moderate	143	5.72	3.49	1>3	
	Vigorous	164	4.66	3.48	2>3	
	Total	400	5.46	3.57		

*p<0,05 **p<0,001 PSQI: Pittsbugh Sleep Quality Scale; LSD: Least significant difference; SD: Standart deviation.

total PSQI score.[23] Results of a study by Štefan et al. showed that poor sleep is associated with insufficient physical activity.[24] According to the results a study on university students by İyigün et al. physical activity level significantly associated with sleep disorders. It was concluded that as the level of physical activity increased, sleep quality increased.[25]

In our study, when the relationship between the metabolic syndrome risks of athletes and sedentary people's was examined; MSRF scores of sedentaries were found to be significantly higher than those of athletes. In addition, when the physical activity level is compared with the risk of metabolic syndrome; it has been determined that as the level of physical activity increases, the risk of metabolic syndrome decreases. In a study conducted on adults who are overweight and have type 2 diabetes it has been observed that functional high-intensity exercise applied for 6 weeks significantly reduces fat mass, blood pressure, blood lipids and metabolic syndrome score. The exercise program applied significantly increased insulin sensitivity.[26] In a study conducted on adults the effects of tai chi and walking exercises on metabolic syndrome parameters were investigated. According to the findings, in the group that does both sports, significant reductions in waist circumference

TABLE 4: Comparison of sleep quality of athletes and sedentary.

	Sports status	n	Mean	SD	t-test	p value
Subjective sleep quality	Athlete	200	0.82	0.74	-7.42**	0.000
	Sedentary	200	1.40	0.83		
Sleep latency	Athlete	200	1.06	1.03	-4.98**	0.000
	Sedentary	200	1.57	0.98		
Sleep duration	Athlete	200	0.37	0.79	0.63	0.530
	Sedentary	200	0.42	0.79		
Habitual sleep efficiency	Athlete	200	0.31	0.74	-3.89**	0.000
	Sedentary	200	0.66	1.00		
Sleep disturbances	Athlete	200	0.85	0.59	-6.79**	0.000
	Sedentary	200	1.25	0.59		
Use of sleeping medications	Athlete	200	0.90	0.36	0.13	0.899
	Sedentary	200	0.85	0.42		
Daytime dysfunction	Athlete	200	0.78	0.93	-4.60**	0.000
	Sedentary	200	1.23	1.02		
Total PSQI score	Athlete	200	4.30	3.22	-6.88**	0.000
	Sedentary	200	6.63	3.53		

*p<0,05 **p<0,001 PSQI: Pittsbugh Sleep Quality Scale; SD: Standart deviation.

TABLE 5: Relationship between physical activity level and metabolic syndrome risk.

	Physical activity	n	Mean	SD	F/LSD	p value
MSRF	Low	93	6.32	2.44	36,97**	0.000
	Moderate	143	5.52	2.31	1>3	
	Vigorous	164	3.89	2.27	2>3	
	Total	400	5.04	2.51	1>2	

*p<0,05 **p<0,001 MSRF: Metabolic Syndrome Research form; LSD: Least significant difference; SD: Standart deviation.

TABLE 6: Comparison of metabolic syndrome risks of athletes and sedentary people.

	Sport status	n	Mean	SD	t-test	p value
MSRF	Athlete	200	3.92	2.26	-9.89**	0.000
	Sedentary	200	6.17	2.28		

*p<0,05 **p<0,001 MSRF: Metabolic Syndrome Research form; SD: Standart deviation.

and fasting blood glucose which are the main criteria for the metabolic syndrome were detected.[27] Li et al. found that regular exercise reduced blood insulin level and fasting blood sugar in obese male college students. In study, the students were divided into groups and included in a combined exercise program of 150 minutes, 270 minutes and 450 minutes per week for 10 weeks, and the effects of exercise on various hormones and metabolic syndrome were examined. A significant decrease was observed in blood insulin levels and fasting blood glucose levels in the group that exercised for 270 and 450 minutes. In addition, there was a significant decrease in waist circumference in all groups.[28] In a study conducted on sedentary women, a decrease in insulin concentration and insulin resistance was determined as a result of the exercise program applied.[29] In a study conducted on sedantery women included in an 8-week aerobic exercise program; It was determined that the women included in the exercise program had a significant decrease in BMI and insulin resistance values compared to the control group.[30]

CONCLUSION

When the findings obtained from the study are examined; it is seen that the increased physical activity level positively affects sleep quality and reduces the risk of metabolic syndrome. Athletes have higher sleep quality than sedentary individuals. Similarly, athletes have a lower risk of metabolic syndrome than sedentary individuals. In the management of sleep quality and regulation of metabolic syndrome parameters, not only the performance of physical activity but also its duration, frequency and intensity are important. The results of our study also emphasize the importance of this situation. On the other hand, the study was conducted on individuals between the ages of 17-25. The results of the study show the importance of exercise in individuals in this age range. Starting exercise at the earliest possible age will be effective in reducing sleep disorders, metabolic syndrome and other health problems that will occur due to them in the future. The number of studies examining the effects of exercise on related health problems in young individuals should be increased, while more studies emphasizing the importance of the correct exercise prescription and the age at which exercise begins should be given more space. Therefore, it is thought that our study will contribute to the literature by guiding future studies in terms of starting exercise at the earliest possible age in the management of sleep disorders, metabolic syndrome and health problems that will occur due to them and creating the right exercise prescription.

LIMITATIONS OF THE RESEARCH

The most important limitations of the research are that the research was conducted in a single center and that the number of athletes who could be included in the research at the university where the research was conducted was less than in other universities.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

All authors contributed equally while this study preparing.

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