Araştırma Makalesi
Research Article

Adnan Menderes Üniversitesi Sağlık Bilimleri Fakültesi Dergisi 2025: 9(1); 1-11
Journal of Adnan Menderes University Health Sciences Faculty
doi: 10.46237/amusbfd.1416020

Covid-19 Pandemi Döneminde Diyabetli Bireylerde Fiziksel Aktivite Düzeyinin Uyku Kalitesi ve İyilik Hali Üzerine Etkileri

Effects of Physical Activity Level on Sleep Quality and Well-Being in Individuals with Diabetes During Covid-19 Pandemic Period

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ÖZ

Amaç: Bu çalışma COVID-19 pandemi döneminde karantinada evde kalma süresinin artmasına bağlı olarak, farklı fiziksel aktivite düzeyine sahip diyabetli bireylerin uyku kalitesi ve iyilik hali düzeylerinin karşılaştırılması amacı ile planlandı.
Yöntem: Bu çalışmaya yaş ortalaması 52.4 (8.42)olan 120 diyabetli (53 kadın. 67 erkek) birey dahil edildi. Katılımcıların fiziksel aktivite düzeyi "Uluslararası Fiziksel Aktivite Anketi- Kısa Form (UFAA-KF)", uyku kalitesi "Pittsburgh Uyku Kalitesi İndeksi (PUKİ)" ve iyilik hali ise "İyilik Hali Ölçeği (İHÖ)" ile değerlendirildi.
Bulgular: Katılımcıların fiziksel aktivite düzeyleri incelendiğinde olguların 48'i (%40) "aktif olmayan", 64'ü (%53.3) "minimal aktif" ve sekiz olgu (%6.7) "çok aktif" olarak bulundu. Fiziksel aktivite düzeyleri arasında PUKİ toplam puanı ve İHÖ toplam puanı açısından istatistiksel olarak anlamlı bir fark vardı ($p<0.001$). UFAA-KF toplam puanı ile PUKİ toplam puanı arasında güçlü düzeyde ve negatif yönde ($r=-0.730$; $p<0.001$) ve UFAA-KF toplam puanı ile İHÖ arasında güçlü düzeyde ve pozitif yönde anlamlı bir korelasyon saptandı ($r=0.638$; $p<0.001$).
Sonuç: Araştırma kapsamında fiziksel aktivite düzeyi ile uyku kalitesi ve iyilik hali arasında saptanan ilişki sonucu göz önünde bulundurulduğunda, tüm diyabetli bireylerde yaşamın her döneminde özellikle de sedanter yaşam süreçlerinde düzenli ve yeterli fiziksel aktivite bireylerin uyku kalitesi, enerji ve iyilik hali üzerinde olumlu etkiler ve depresyon ve anksiyete gibi durumların azalmasını sağlayabilir.

Anahtar Kelimeler: COVID-19, Diyabetes mellitus, Fiziksel aktivite, Karantina.

ABSTRACT

Objective: This study was planned to compare the sleep quality and well-being levels of individuals with Diabetes Mellitus (DM) with different levels of physical activity (PA) due to the increased periods of quarantine at home during the COVID-19 pandemic.
Method: 120 individuals with DM with a mean age of 52.4 (8.42) years (53 females, 67 males) were included in the study. All information was gathered through face-to-face interviews. The participants' PA levels were measured by the International Physical Activity Questionnaire-Short Form (IPAQ-SF), sleep quality by the Pittsburgh Sleep Quality Index (PSQI), and well-being by the Well-Being Questionnaire-22 (WBQ-22).
Results: The participants' levels of PA were "inactive" for 48 (40), "moderate active" for 64 (53.3%), and "high active" for eight (6.7%). Statistically, there was a significant difference between PA levels in terms of PSQI total score and WBQ-22 total

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Geliş Tarihi: 07.01.2024– Kabul Tarihi: 29.06.2024
Yazar Katkıları: A) Fikir/Kavram, B) Tasarım, C) Veri Toplama ve/veya İşleme, D) Analiz ve/veya Yorum, E) Literatür Taraması, F) Makale Yazımı, G) Eleştirel İnceleme

score (p<0.001). It has been detected that there is a significantly strong negative correlation between the IPAQ-SF total score and the PSQI total score (r=-.730; p<0.001), and a strong positive correlation between the IPAQ-SF total score and WBQ-22 total score (r=.638; p<0.001).

Conclusion: Considering the detected results of relationship between PA level sleep quality and well-being in the present study, we suggest that regular and adequate PA in every period of life, especially such a sedentary life process may have positive impacts on the sleep quality, energy and well-being, and reduce conditions such as depression and anxiety for individuals with DM.

Key words: COVID-19, Diabetes mellitus, Physical activity, Quarantine.

1. INTRODUCTION

Diabetes Mellitus (DM) is a chronic condition characterized by excessive blood sugar levels and dysfunction of carbohydrate, lipid, and protein metabolism (hyperglycemia). Diabetes is the third most common disease in the world, with the highest mortality and morbidity, after cancer and cerebrovascular disease (1, 2).

In chronic diseases, organ damage or loss, as well as uncertainty about the disease's future state, can lead lower quality of life and worsen general well-being (3). Chronic diseases, such as diabetes, that take a long time to show symptoms and be diagnosed, require extensive treatment periods and follow-up protocols, and can cause some changes in people's lives, can have a negative impact on a person's mental health, quality of life, and well-being in the short and long term (4).

Physical Activity (PA) is part of routine self-care in individuals with DM. Unfortunately, during the pandemic, restrictions and social isolation have limited the PA outside the home of people with diabetes. The increase in the time spent at home during the quarantine period causes the individual to stay away from her daily routine life, causing both a negative change in her/his mood and a more sedentary life (5).

The COVID-19 pandemic has affected all biological, psychological, social, and cultural aspects (6). This period has caused many people with diabetes to stay at home and become more sedentary than before. In addition to helping prevent the negative effects of chronic diseases, PA is also protective against a sedentary lifestyle (7, 8). It has been reported that poor sleep is common in diabetes individuals and is related to lower level of quality of life (9-12). Studies published in the previous decade have reported that sleep disruption boosts the risk of diseases like cardiovascular disease and cancer, has a major impact on the incidence of depression, and most importantly, sleep quality plays a critical role in promoting health (13). It has determined that moderate PA benefits sleep quality in all age groups in the healthy population (14).

Therefore, this study was planned to compare the sleep quality and well-being levels of individuals with diabetes with different levels of PA due to the restriction of level and diversity of PA as a result of the increased periods of quarantine at home during the COVID-19 pandemic.

2. METHOD

This was a cross-sectional study, and it was performed with the participation of the individuals with DM with the range of 25-65 ages who applied to the internal medicine outpatient clinic of Kocaeli Private Gebze Surgical Medical Center between 21 May and 23 June 2021. Before the data collection all participants signed an informed consent form. The research protocol was approved by the ethics committee of the Marmara University Faculty of

Medicine (Protocol no: 09.2021.597), and it was carried out according to the Declaration of Helsinki's guidelines.

The inclusion criteria for volunteers were as follows: (1) aged 25-65 years old; (2) diagnosed with DM at least 1 year ago by a specialist doctor; (3) able to perform daily living activities independently; (4) not having a mental problem, sensory or motor aphasia to understand and answer the assessment questions correctly. Moreover, the exclusion criteria were: (1) pregnancy or lactation; (2) receiving sleep treatment; (3) individual with another sleep disorder such as obstructive sleep apnea; (4) presence of neuropathy or foot ulcer that may negatively affect physical activity; (5) individuals with any orthopedic, rheumatological or cardiovascular problems or with history of previous surgery.

Sample Size

The sample size and power analysis were performed using the G*Power (3.1.9.7, Axel Buchner, Universitat Kiel, Germany) program. The sample size calculation for this study was based on detecting a mean of exercise time (min/week) in Duarte et al.'s (15) study (effect size d= 0.267), with a statistical power of 80%, an alpha level of .05, and possible sample loss of up to 20%, it was determined that a minimum of 110 participants was needed for this study.

Data Collection

All interviews were held face to face in a single session, in line with World Health Organization (WHO) recommendations and in accordance with pandemic rules (use of masks, social distance standards, etc.). The "Subject's Evaluation Form" was used to record the demographic and clinical information of the participants. The PA level of the participants was measured by using the International Physical Activity Questionnaire-Short Form (IPAQ-SF), sleep quality by using the Pittsburgh Sleep Quality Index (PSQI) and well-being by using the Well-Being Questionnaire (WBQ-22).

International Physical Activity Questionnaire-Short Form (IPAQ-SF)

The individuals' PA levels were assessed using the IPAQ-SF, a validated questionnaire developed by Craig et al. in 2003 (16). In 2010, Saglam et al. performed the validity and reliability research of this questionnaire in Turkey (17). The PA examines the reference periods expressed as "last 7 days" or "last week", as well as by taking that activity's estimated metabolic equivalent (MET) into account and finally converting the METs into an energy expenditure score. The IPAQ assigns a MET value to light exercise such as walking (3.3 METs), moderate (4.0 METs), and intensity activity (8.0 METs). PA levels were classified the following values as physically inactive, moderate PA level, and high PA level: "<600 MET-min./week", "600-3000 MET- min./week", ">3000 MET- min./week", respectively (16, 17).

Pittsburgh Sleep Quality Index (PSQI)

The PSQI was used to assess the participants' sleep quality. The PSQI was developed by Buysse et al in 1989 to assess sleep quality in psychiatry practices and clinical studies, and validity and reliability studies were conducted (18). The validity and reliability study of Turkish version of PSQI was conducted by Ağargün et al in 2005 (19). The PSQI includes a 19-item self-report measure of sleep quality and degree of sleep difficulties over the past month, with a

score ranging from 0 to 21 (18). Accordingly, "good sleep quality" and "poor sleep quality" were defined in our study as PSQI scores of ≤5 and >5, respectively.

Well-Being Questionnaire-22 (WBQ-22)

The WBQ-22 was originally drafted by Clara Bradley (20). It was developed as a tool to evaluate new treatments for DM by providing a measure of mood, anxiety, and characteristics of positive well-being. These items were taken from the general Well-being scale of psychology (20). The validity and reliability study of Turkish version of WBQ-22 in Turkey were conducted by Savli and Sevinc in 2005 (21). The Questionnaire assesses a quality of life component recognized as particularly relevant to patients and was designed to evaluate the general well-being impression of patients with DM. This scale comprises 22 items altogether, divided into four subscales: energy, depression, anxiety, and positive well-being. Scores on each subscale range from 0 to 3 (0= never; 3= always). After any necessary reversals, ratings are assigned for the items. More of the particular mood state is indicated by a higher score (20, 21).

Statistical Analysis

All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) version 23.0 (SPSS Inc., Chicago, IL, USA). A 95% confidence interval (95% CI) was selected, a p-value <0.001 was considered statistically significant, and Bonferroni corrections were applied for multiple comparisons. The Kolmogorov-Smirnov test was used to determine normality. Continuous variables were presented as a mean ± standard deviation, and categorical variables were presented as percentages. The "Kruskal-Wallis test" was used to compare PSQI and WBQ-22 scores among individuals with different PA levels, and the "Mann-Whitney U test" was used to compare data of the PSQI subgroups. The spearman correlation analysis was performed to investigate the relationship between IPAQ-SF, PSQI, and WBQ-22 total scores.

3. RESULTS

A total of 120 individuals with DM (52.40 ± 8.42 years, 55.8% men) were included in this study. The mean (standard deviation) height, weight, and Body Mass Index (BMI) of the participants were 168.96 (±7.68), 76.90 (±8.50) and 27.17 (±3.83), respectively. The majority of participants were type 2 DM (62.5%). A total of 53.3% of the patients were moderate inactive, according to IPAQ-SF. PSQI assessment showed that 56.7% of the participants had poor sleep quality (Table 1). The other descriptive characteristics of the participants are presented in Table 1.

There was significant difference in the scores of WBQ-22 subscales between the groups who have different PA levels ($p<0.001$). Individuals with "high active" PA levels had lower depression and anxiety scores, and higher energy and positive well-being compared to "inactive" and "moderate active" individuals (Figure 1).

There was statistically significant difference between the groups who have different PA levels in terms of PSQI total scores and in terms of WBQ-22 total scores ($p<0.001$), and the results of Bonferroni correction was determined that this difference was between "inactive" and "moderate active" and between "inactive" and "high active" groups ($p<0.001$) (Figure 2). The participants with "high active" PA level had better sleep quality (PSQI≤5), and a higher overall

well-being score compared to individuals with “inactive” and “moderate active” PA level (Figure 2).

Table 1. Descriptive Characteristics of Participants.

Variable	Category	n (%)
Type of diabetes	Type 1	45 (37.5%)
	Type 2	75 (62.5%)
Gender	Female	53 (44.2%)
	Male	67 (55.8%)
Smoking	Yes	49 (40.8%)
	No	71 (59.2%)
Alcohol abuse	Yes	13 (10.8%)
	No	107 (89.2%)
Profession	1. Laborer	29 (24.2%)
	2. Civil servant	16 (13.3%)
	3. Retired	35 (29.2%)
	4. Housewife	37 (30.8%)
	5. Unemployed	3 (2.5%)
Treatment type for diabetes mellitus	1. Oral medication	63 (52.5%)
	2. Insulin	16 (13.3%)
	3. Oral medication + insulin	41 (34.2%)
Variable	**Category**	**Mean (95% CI) n (%)**
IPAQ-SF	Inactive (<600 MET- min./week)	308.85 (265.20-356.19) 48 (40%)
	Moderate active (600-3000 MET-min./week)	1565.42 (1423.79-1710.68) 64 (53.3%)
	High active (>3000 MET- min./week)	3084.63 (3044.65-3132.13) 8 (6.7%)
	Total score	1078.66 (934.54- 1219.37) 120 (100%)
	Sitting score	9.33 (8.83-9.84) 120 (100%)
PSQI	Good	2.79 (2.44-3.12) 52 (43.3%)
	Poor	12.06 (11.19-12.91) 68 (56.7%)
	Total score	8.04 (7.08-9.03) 120 (100%)
WBQ-22	Depression	7.65 (6.82-8.56)
	Anxiety	7.79 (6.90-8.70)
	Energy	5.86 (5.18-6.57)
	Positive well-being	10.09 (9.16-11.03)
	Total score	36.51 (33.19-39.80) 120 (100%)

SD: Standard Deviation, **95% CI:** 95% Confidence Interval, **IPAQ-SF:** International Physical Activity Questionnaire-Short Form, **PSQI:** Pittsburgh Sleep Quality Index, **WBQ-22:** Well-Being Questionnaire-22

The correlation between IPAQ-SF, PSQI, and WBQ-22 total scores was also examined. There was a strong negative correlation between the total scores of IPAQ-SF and PSQI (r=-.730; 95% CI -.799 to -.642; p<0.001). Additionally, a significantly strong positive correlation was found between the total scores of IPAQ-SF and WBQ-22 (r=.638; 95% CI .503 to .743; p<0.001). On the other hand, there were a weak positive correlation between sitting time and total scores of PSQI (r=.361; 95% CI .188 to .515; p<0.001), and a weak negative correlation between sitting time and total scores of WBQ-22 (r=-.335; 95% CI -.483 to -.172; p<0.001)

(Table 2). It was observed that individuals with high PA levels and low sitting times had a better sleep quality and better state of well-being.

Additionally, a highly significant strong negative correlation was found between the total scores of PSQI and WBQ-22 scales (r=-.836; 95% CI -.877 to -.781; p<0.001).

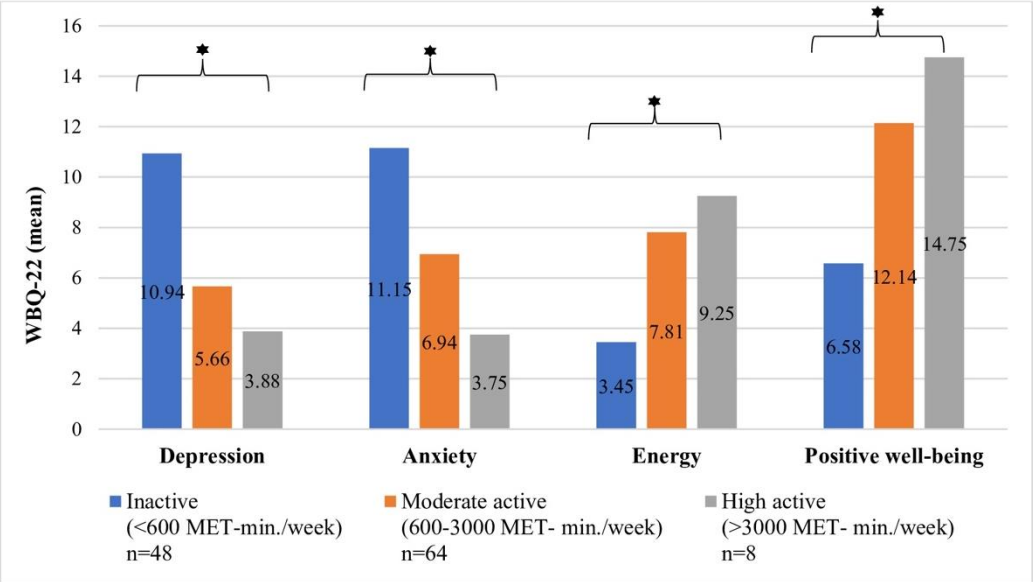

Figure 1. Comparison of WBQ-22 Subscales Between PA Levels (Kruskal-Wallis test).
WBQ-22: Well-Being Questionnaire-22, MET: Metabolic Equivalent, *<0.001

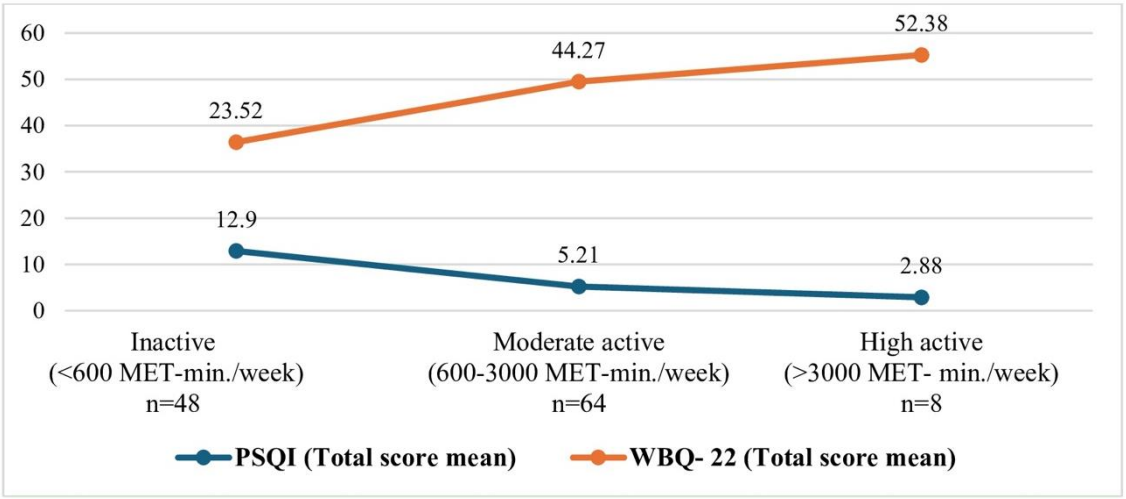

Figure 2. Mean Change of PSQI and WBQ-22 Total Scores Between the PA Levels.
PSQI: Pittsburgh Sleep Quality Index, WBQ-22: Well-Being Questionnaire-22, MET: Metabolic Equivalent

Table 2. The Relationship Between IPAQ-SF, PSQI and WBQ-22 Total Scores, and Sitting Duration.

Variable	IPAQ-SF total score		Sitting duration*	
	r (95% CI)	p	r (95% CI)	p
PSQI total score	-.730** (-.799, -.642)	**<0.001**	.361** (.188, .515)	**<0.001**
WBQ-22 total score	.638** (.503, .743)	**<0.001**	-.335** (-.483, -.172)	**<0.001**

IPAQ-SF: International Physical Activity Questionnaire-Short Form, PSQI: Pittsburgh Sleep Quality Index, WBQ-22: Well-Being Questionnaire-22, 95% CI: 95% Confidence Interval, *: hour/day

4. DISCUSSION

Results of this study revealed that most individuals with DM to be physically inactive, had poor sleep quality, and had a low level of well-being. To the best of our knowledge, this study is the first research to examine the effects of having different level of PA on sleep quality and well-being of individuals with diabetes during the stay at home because of the restrictions applied for the COVID-19 pandemic period. The results of our study revealed that diabetic individuals with high active PA level had good sleep quality and higher well-being levels, and there was a strong significant relationship between PA, sleep quality and well-being.

It was also determined that sleep quality and well-being were higher significantly as the sitting time was lower and the PA level was higher.

Because of the lockdown precautions taken to eliminate and/or reduce the risk of transmission of the COVID-19 virus that started in 2019, the duration of stay at home has increased and consequently the PA has been restricted. It is known that people with chronic diseases such as diabetes, hypertension, cardiac and lung problems, especially in the elderly, were at higher health-related risk during the COVID-19 pandemic (22). During this period, PA levels of many diabetic individuals decrease as the increase in the duration of lockdown. It has been reported that poor sleep quality is common in individuals with DM and that poor sleep quality negatively affects the quality of life (9-12).

The research on health-related effects of the pandemic period has been limited. In a study conducted by Zhang et al. including 255 individuals with diabetes, it was reported that the participants generally had moderate levels of PA and that daily regular PA had positive effects on the subscales of quality of life, especially on psychological aspects (23). Similarly, in the present study, the participants generally had moderate levels of PA, and that the individuals with higher PA level has lower anxiety and depression scores of the subscales of WQB-22. In addition, energy and positive well-being were also questioned in the subscales of WQB-22, and it was determined that these parameters were higher in participants with moderate and high PA levels.

It is stated that during the curfew period because of the COVID-19 pandemic, healthy people have a low level of PA, and this negatively affects health-related quality of life (5). A few studies have been reported that COVID-19 pandemic reduces PA levels by approximately 60% along with it severe and moderate PA levels decrease by 34%, and by 29% of the increased sedentary life (24, 25). Another study showed that there was a high increase in the inactivity levels of individuals with type 2 diabetes during quarantine period (26). In the study conducted by Zhang et al in 2020, it was shown that 14.11% of the participants were inactive, 69.41% moderate active and 16.57% high active (23). In this study, we determined that 40% of the participants were inactive, 53.3% were moderately active, and 6.7% were high active. The results of our study, when compared with previous research, it has been shown that the COVID-19 pandemic process might be a potential cause for the decrease in PA levels in individuals with diabetes.

In the literature, there are many studies that report that poor sleep quality is common in individuals with diabetes and is associated with quality of life. It has been shown that one of the most common symptoms in type 2 diabetes patients is sleep disorders, and the prevalence of poor sleep quality is between 30% and 50% (27), and it has been reported that poor sleep

quality significantly reduces the diabetes-related quality of life in these individuals (10, 28). On the other hand, anxiety is one of the most common comorbidities in individuals with Type 2 diabetes (29) and its prevalence varies between approximately 22.4% and 75% (30). According to another study, comorbid anxiety disorders are associated with low quality of life in individuals with Type 2 diabetes (29). Additionally, it was found that the combined effect of poor sleep quality and anxiety decreased the quality of life in individuals with type 2 diabetes (31). In our study, we found a strong relationship between sleep quality and well-being and showed that anxiety and depression scores increased as PA levels decreased especially in a period such as the COVID-19 pandemic process, when people remain inactive and are seriously affected psychologically due to the pandemic, indicating an inverse relationship between sleep quality and PA levels and anxiety and depression.

The results obtained by Lou et al. in 994 diabetes individuals, considered those with a PSQI score of 8 and above to be poor sleep quality and reported that the prevalence of this poor sleep quality was 33.6% (9). Furthermore, Lou et al., in their study showed a strong correlation between poor sleep quality and quality of life, and they thought that depression and anxiety might have an important role in reducing the diabetes-related quality of life by affecting sleep quality (9). It has well known that a significant interaction between poor sleep quality and anxiety symptoms and that these symptoms were associated with low quality of life (31). In a study by Balducci et al in 2021, which investigated the level of inactivity and PA levels in individuals with diabetes during the COVID-19 pandemic, they reported that moderate PA could improve the well-being-related quality of life (32). According to the strong relationship detected between sleep quality and well-being in the present study, high PA levels may cause good sleep quality, leading to higher levels of quality of life, especially during such a quarantine period that affects the activity level. In addition, we found that individuals with high and moderate PA levels have higher energy and positive well-being scores, as well as lower scores for anxiety and depression. This may be one of the contributing factors for the high level of quality of life.

In further studies, it is recommended to investigate similar research questions grouping diabetes types with larger samples. In addition, future studies may aim to examine the effect of different interventions to increase the level of PA to improve sleep quality and well-being.

This research has some limitations. All measurements were based on individuals' self-reported statement. On the other hand, possible confounding factors could not be analyzed in this study, as it is not possible to evaluate and control other variables that may affect sleep quality and quality of life during the COVID-19 period. In addition, the fact that we did not analyze the participants by age group and diabetes type was another limitation. Since this study is not a follow-up study, our results have not included the comparison of the PA levels, sleep quality and well-being scores of the people before the pandemic period in order to analyze more accurate the effects of a possible decrease in PA level.

5. CONCLUSION

In conclusion, maintaining regular and adequate PA in every period of life, especially during curfew times, may increase their sleep quality, energy, and positive well-being, and reduce conditions such as depression and anxiety of all diabetes individuals.

Primary health care workers and especially physiotherapists, should plan personalized PA programs and include them in diabetics self-management programs in line with the PA guidelines recommended for diabetes individuals during the COVID-19 pandemic period or similar situations that may occur. Online trainer-led home-based exercise platforms should be prepared and presented for individuals with diabetes who need structured PA during quarantine and similar periods when it is difficult to reach healthcare professionals. In this way, it is possible to prevent the negative effects of inactivity that may occur on sleep quality and well-being in individuals with diabetes.

Ethical Consideration of the Study

The research protocol was approved by the ethics committee of the Marmara University Faculty of Medicine (Protocol no: 09.2021.597), and it was carried out according to the Declaration of Helsinki's guidelines.

Acknowledgement

The authors acknowledge Dr. Ilker ÇOLAK and physiotherapist Nihat SERT for their invaluable contributions in scientific consultation and data collection to this paper.

Conflict of Interest Statement

The authors report no actual or potential conflicts of interest.

Funding

This study did not receive any specific grant or funding.

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