JETR

JOURNAL OF
EXERCISE THERAPY
AND REHABILITATION

Journal of Exercise Therapy and Rehabilitation. 2024;11(1):18-27. DOI: 10.15437/jetr.1375131

ORIGINAL ARTICLE

Kanserden sağ kalanlarda uyku kalitesi ve sedanter davranış: olası bir bağlantı var mı?

Sleep quality and sedentary behavior among cancer survivors: is there a possible link?

Alper TUĞRAL[1], Yeşim BAKAR[1], Murat AKYOL[2]

Öz

Amaç: Kanserden kurtulanlarda yalnızca tedavi sırasında değil, hayatta kalma sırasında da uyku düzeninin bozulması sıklıkla görülebilmektedir. Bu çalışma, kanser hastalarında uyku kalitesi ile sedanter davranış arasındaki olası bağlantıyı analiz etmeyi amaçladı.

Yöntem: Demografik ve klinik bilgiler değerlendirme formu aracılığıyla elde edildi. Uyku kalitesi ve fiziksel inaktivite düzeyi sırasıyla Pittsburgh Uyku Kalitesi İndeksi (PUKİ) ve Sedanter Davranış Anketi (SBA) ile değerlendirildi. Bu kesitsel çalışma İzmir Bakırçay Üniversitesi Tıp Fakültesi Tıbbi Onkoloji ünitesinde Nisan-Haziran 2023 tarihleri arasında gerçekleştirildi.

Bulgular: Bu çalışma, çoğunluğu meme kanseri (n=55) olmak üzere toplam 80 hasta ile tamamlanmıştır. Ortalama PUKİ skoru 7,68±4,02 idi. SDA skorları hafta içi ve hafta sonu sırasıyla 8,16±3,90 ve 6,85±3,86 saat idi. PUKİ ve SDA toplam puanları arasında anlamlı bir ilişki gözlenmedi. (p>0,05). Yaş uyku bozuklukları (r=-,24, p=0,03), gündüz işlev bozukluğu (r=-,34, p=0,002), ve SDA'nın "TV izleme" maddesi ile sırasıyla hem haftaiçinde (r=,35, p=0,001) hem de haftasonunda (r=,38, p=0,001) ilişkili bulundu.

Sonuç: Bu çalışma, kanser hastaları arasında sedanter davranış ile uyku kalitesi arasında anlamlı bir ilişki olmadığını göstermiştir, ancak bu örneklemde önemli derecede kötü uyku kalitesi oranı dikkat çekicidir. Bununla birlikte, ekran süresi ve yaş arasındaki önemli ilişkiler nedeniyle özellikle yaşlı kanser hastaları için artan ekran süresinin iyi yönetilmesi gerektiğini ve daha genç kanserden kurtulanlar arasında ise uyku hijyeni ve gündüz işlev bozukluğunun daha fazla dikkate alınması gerektiğini önermek mantıklı olabilir.

Anahtar kelimeler: Kanserden sağ kalanlar, Uyku kalitesi, Fiziksel inaktivite.

Abstract

***Purpose**: Disrupted sleep patterns can be frequent in cancer survivors not only during treatment but also during survival. This study aimed to analyze the possible link between sleep quality and sedentary behavior among cancer patients.*

***Methods:** Demographic and clinical information was obtained through an assessment form. Sleep quality and physical inactivity level were assessed by the Pittsburgh Sleep Quality Index (PSQI) and Sedentary Behavior Questionnaire (SBQ), respectively. This cross-sectional study was conducted between April and June 2023 in the Medical Oncology unit of Izmir Bakırçay University Faculty of Medicine.*

***Results:** This study was completed with a total of 80 patients with most of the types of cancer being breast (n=55). The mean PSQI score was 7.68±4.02. SBQ scores were 8.16±3.90, and 6.85±3.86 hours on weekdays and weekends, respectively. No significant association was observed between PSQI and SBQ total scores (p>.05). Age was correlated with sleep disturbances (r=-.24, p=0.03), daytime dysfunction (r=-.34, p=0.002), and first item of SBQ (watching TV) both on weekdays (r=.35, p=0.001) and weekends (r=.38, p=0.001), respectively.*

***Conclusion:** This study showed that there was no significant relationship between sedentary behavior and sleep quality among cancer patients, however, the remarkable rate of poor sleep quality was evident in this sample. However, it might be reasonable to suggest that the increased screen time especially for older cancer patients due to significant associations between screen time and age, should be well managed while sleep hygiene and daytime dysfunction should be considered further among younger cancer survivors.*

***Keywords**: Cancer survivors, Sleep quality, Physical inactivity.*

1: İzmir Bakırçay University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Izmir, Türkiye.
2: İzmir Bakırçay University, Faculty of Medicine, Department of Medical Oncology, Izmir, Türkiye.
Corresponding Author: Alper Tuğral: alper.tugral@bakircay.edu.tr
ORCID IDs (order of authors): 0000-0002-8017-2384;0000-0002-5603-2891;0000-0003-0886-3559
Received: October 12, 2023. Accepted: February 24, 2024.

INTRODUCTION

Cancer is the leading cause of death worldwide according to the World Health Organization report in which nearly seven million deaths occur due to cancer globally, annually.[1] On the other hand, thanks to early screening and interventional procedures, the ten-year disease-free survival time was nearly reached up to 90% in the most frequently seen type of cancer such as breast.[2] This increased ratio of survivors of cancer also brings the need for thorough management strategies due to experienceable and various side effects of cancer treatment such as sleep problems. It is stated that the management of sleep problems is of utmost importance among cancer patients since these problems can persist for up to years after discontinuation of systemic therapy.[3] Reports also highlighted that sleep problems can have an impact on the survival rate among cancer survivors.[4]

Sleep is a vital part of a healthy life in order to maintain and physiological and psychological balance of human nature. Disrupted sleep patterns and diminished sleep quality are well-known problems among cancer patients consequently contributing to multimodal treatment.[5] The incidence of sleep problems can be as high as over 90%.[6] Not only cancer treatment itself, but also other factors such as experienced symptoms and lifestyle factors can exacerbate sleep problems.[7-9] Disrupted sleep is known to have an impact on cancer recurrence, productivity, participation, and increased healthcare costs among cancer patients.[10] Though there might be numerous reasons for poor sleep quality among cancer survivors,[11] the share of physical inactivity cannot be underestimated. Regular physical activity was shown to be beneficial for improved sleep quality irrespective of its duration, density, and type.[12] Huang et al.[13] reported that the deleterious effect of poor sleep was exacerbated by physical inactivity in the context of all causes and disease-specific mortality with an above ten-year follow-up in a sample of nearly four hundred thousand people. Yonenaga et al.[14] also reported that poor physical activity patterns were highly associated with diminished disability and survival among lung cancer patients. Tabaczynski et al.[15] reported that even ten minutes of decreased physical inactivity daily leads to increased quality of life among kidney cancer survivors. Decreased physical activity patterns are also notable among cancer patients from diagnosis, during, and end of the treatment.[16-18] Yet, possible synergistic effects of the level of physical inactivity and sleep quality on the clinical outcomes still need to be studied to maintain the well-being level of patients with cancer not only during the treatment but also in survivorship.

To date, there is a need for a detailed snapshot of the patterns of physical inactivity instead of physical activity among cancer patients. Therefore, we aimed to cross-sectionally assess the sleep quality and sedentary behavior of cancer patients in this study. We hypothesized that poor sleep quality is significantly associated with increased time spent in physical inactivity patterns.

METHODS

Study design

This cross-sectional descriptive study was conducted between April and June 2023 with the approval of Izmir Bakircay University Ethical Board of Clinical Studies (954/934/29032023). The non-probability purposive sampling method was used. This study was performed according to the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Participants

Patients who had cancer and were referred to the medical oncology unit whether for systemic chemotherapy or routine control were screened and invited to participate. Being a volunteer to participate, aged between 18 and 75 years old, and having communication skills in the mother language were set as inclusion criteria. Cognitive and mental deficits, having an active infection, having orthopedic and/or neurological conditions that might hamper participation in any physical activity pattern, having an advanced disease stage, comorbidities, and/or distant metastasis were set as exclusion criteria. For each patient willing to participate in this study, a signed informed consent was obtained.

Assessments

Demographic information

Patients' demographics (age, body mass index, gender, marital status, etc.) and clinical

conditions (surgical operation, chemotherapy situation, etc.) were assessed and gathered via a simple data form.

Pittsburgh Sleep Quality Index

The sleep quality was assessed via the Turkish version of the Pittsburgh Sleep Quality Index (PSQI) questionnaire. The PSQI has 19 items that assess sleep quality over the past month. Subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction were the subcomponents of PSQI which are all added together to achieve the total score of PSQI. The total score ranges from 0 to 21, while each component score ranges from 0 to 3. Higher scores indicate worse sleep quality or vice versa. In addition, scores higher than 5 in total indicate poor sleep quality. The PSQI has been validated among cancer patients.[19]

Sedentary Behavior Questionnaire

The Sedentary Behavior Questionnaire (SBQ) is a valid and reliable questionnaire that consists of a total of 9 items, and each of them is scored for both "on a typical weekday" and "on a typical weekend". Each item is scored from "None" to "6 hours or more. The Turkish reliability and validity of SBQ were studied by Bakar et al.[16] The higher scores indicate more sedentary behavior. Scores for calculated for both weekdays and weekends.[20]

Statistical analysis

The data was shown as mean and standard deviation or numbers and percentages according to the data whether continuous or categorical. The normality was checked via the Kolmogorov Smirnov test along with skewness and kurtosis. Bivariate correlations between demographical (age, BMI, etc.), and clinical data (surgical operation) were performed via Pearson's r or Spearman's rho according to the normality assumptions or with point-biserial correlation. Between-group differences were assessed via independent samples t-tests or Mann-Whitney U tests. A priori power calculation was performed according to the medium effect size for bivariate correlations (Cohen's d: 0.3) in 95% CI aiming at least to reach 80% power, the output yielded that there was a need for a total of 84 participants needed. However, according to the post-hoc power calculation when considering the retrieved correlation between age and the "Watching TV" parameter, we achieved 83% of power. The calculations were performed via GPower 3.1.9.[21] The p-value below 0.05 was accepted as statistically significant. All analyses were performed via IBM SPSS v.20 (IBM Corp, New York).

RESULTS

A total of 92 patients with different kinds of cancer were screened. However, according to the predefined inclusion and exclusion criteria, 12 of them were excluded due to various reasons. A detailed participation process is illustrated as a flow-chart in Figure 1. Therefore, this study was completed with a total of 80 patients with most of the types of cancer being breast (n=55, 68.7%). Only 5 patients did not have a history of chemotherapy. Nearly half of the patients (46.2%) were under the active chemotherapy process. 59 out of 80 patients had a surgical operation history. Detailed clinical and sociodemographic characteristics of patients are shown in Table 1.

Table 1. Sociodemographic and clinical characteristics of the patients (N=80).

Patients (N=80)	Mean±SD
Age (years)	52.87±12.01
Body mass index (kg/m^2)	27.10±5.28
Gender	n (%)
Female	67 (83.7)
Male	13 (16.3)
Marital status	
Married	66 (82.5)
Single or divorced	14 (17.5)
Type of cancer	
Breast	55 (68.7)
Colon	13 (16.3)
Rectum	2 (2.5)
Stomach	3 (3.7)
Lung	3 (3.7)
Kidney	1 (1.3)
Prostate	2 (2.5)
Uterus	1 (1.3)
History of surgical operation	
Yes	59 (73.7)
No	21 (26.3)
History of chemotherapy	
Under active chemotherapy	37 (46.2)
Having completed	38 (47.5)
None	5 (6.3)

The mean sleeping time of patients was found as 6.83±1.73 hours. The mean time spent falling asleep was found 25.20±19.82 minutes. The total PSQI score was found as 7.68±4.02. According to the scoring guideline of PSQI, 52 out of 80 patients (65%) showed poor sleep quality by having a PSQI score above 5. Patients who had surgical operations showed higher PSQI scores than those without (7.91 vs 7.30), but it did not reach the significance (t=-.590, p=.557). Patients who were under active chemotherapy showed lower scores in PSQI than those who had completed their chemotherapy (7.17 vs. 8.12), it also showed no significance (t=-1.046, p=.299). When patients with BC and those with other cancer types were analyzed, no significant difference was observed in PSQI (t=.424, p=.67) and SBQ (t=-.906, p=.368). In the total group, the highest and lowest mean scores were obtained in the "sleep disturbances" and the "use of sleeping medication" components, respectively. A significant correlation was found between time spent falling asleep (minutes) and PSQI total score (r=.495, p<0.001). The details of PSQI as well as its subcomponents are shown in Table 2.

The mean sedentary time on weekdays and weekends was found as 8.16±3.90 and 6.85±3.85 hours, respectively. The major contribution to the sedentary time was "watching TV" both on the weekdays and weekends (3.36±1.93 for weekdays and 2.85±2.03 hours for weekends, respectively). The least contribution to the sedentary time was found to "playing a musical instrument" for both weekdays and weekends (0.003±0.02 for weekdays and 0.01±0.11 hours for weekends, respectively). Patients who were under active chemotherapy showed higher levels of sedentary time for both weekdays (8.57 vs. 7.80 hrs), and weekends (7.20 vs. 6.54 hrs), compared to patients who had completed their chemotherapy. However, it was not significant (t=.881 p=.38; t=.757, p=.45). The details of sedentary time are shown in Table 3.

No significant correlations were found between PSQI and SBQ total scores (r=.058, p=.611 for PSQI and SBQ weekdays and r=.019, p=.870 for PSQI and SBQ weekend, respectively). Likewise, total scores of PSQI and SBQ did not show any significant correlations with age, BMI, and surgical operation history. The details of the correlation analysis between PSQI, SBQ age, BMI, and surgical operation history are presented in Table 4. However, there were significant correlations to which need attention between sub-components of PSQI and SBQ. Age was significantly correlated with "sleep disturbances" (r=-.246, p=0.03) and "daytime dysfunction" (r=-.339, p=0.002) subcomponents of PSQI. Age was also significantly correlated with items "Watching TV", "Playing on a computer/video game" and "Sitting listening to music" of SBQ in both weekdays and weekend sedentary time (r=.319 p=0.004; r=-.267 p=0.018; r=-.240, p=0.03 for weekdays and r=.393 p<0.001; r=-.256 p=0.023; r=-.247, p=0.028 for weekends, respectively). "Subjective sleep quality" and "sleep latency" components of PSQI did not show significant correlations between any of the items of SBQ (p>.05). The "Sleep disturbances" subcomponent was significantly correlated with the weekday "Sitting and talking/being busy on the phone" item of SBQ (r=.229, p=0.042) as well as the weekdays and weekend "Doing handicraft or handiworks" item of SBQ (r=.451, p<0.001; r=.337, p=0.002). The significant correlations are shown in Table 5

DISCUSSION

The present cross-sectional study showed the poor quality of sleep among cancer survivors in parallel with the literature findings.[9,22,23] We think that significant associations between age and specific sleep quality parameters should be seriously taken into account to manage sleep problems among cancer survivors. Due to the insignificant association between sleep quality and physical inactivity level, it might be reasonable to conclude that different features associated with physical inactivity should be considered when assessing sleep quality in cancer survivors.

There might be numerous symptoms or complaints experienced by cancer patients during cancer treatment due to its burdensome nature. However, poor sleep was reported to be the most frequent symptom among cancer patients from diagnosis to the end of life.[10,24-26] According to US data, poor sleep quality can affect up to nearly 75% of cancer survivors. In parallel with this, we also found that nearly 65% of our patients suffer from poor sleep quality by having a PSQI score over 5. We found the mean

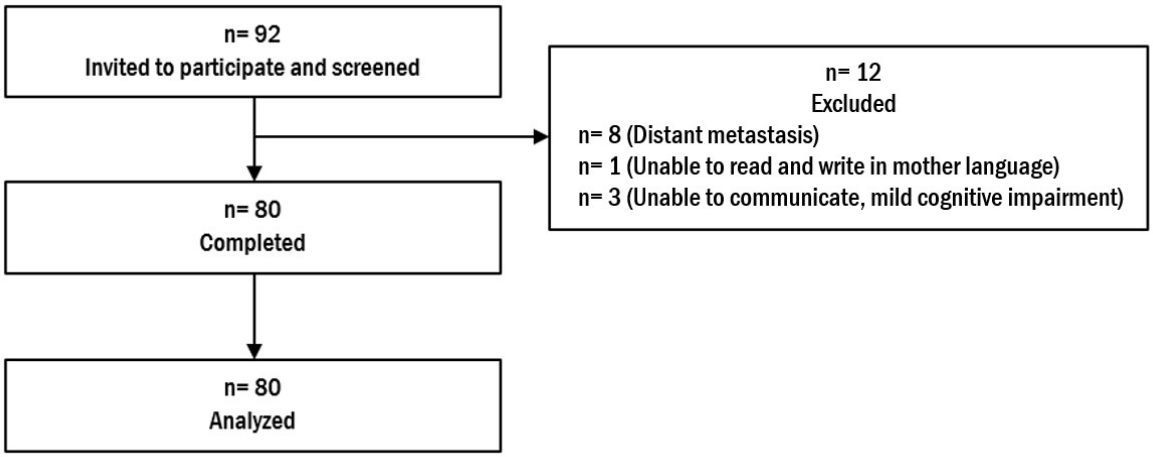

Figure 1. Flow chart of the study participation process.

Table 2. The mean scores of patients in subcomponents of the Pittsburgh Sleep Quality Index and the Sedentary Behavior Questionnaire (N=80).

Pittsburgh Sleep Quality Index (PSQI)	Mean±SD	
Subjective Sleep Quality	1.15±0.74	
Sleep Latency	1.39±0.90	
Sleep Duration	1.06±1.06	
Habitual Sleep Efficiency	0.96±1.17	
Sleep Disturbances	1.63±0.70	
Use of Sleeping Medication	0.56±1.12	
Daytime Dysfunction	0.91±0.95	
Total PSQI Score	7.68±4.02	
	Weekdays (hours)	Weekend (hours)
Sedentary Behavior Questionnaire (SBQ)	Mean±SD	Mean±SD
1. Watching TV	3.36±1.93	2.85±2.03
2. Playing on a computer/video game	0.41±0.85	0.39±0.90
3. Sitting listening to music	0.64±1.03	0.51±0.81
4. Sitting and talking/being busy on the phone	1.14±0.94	1.09±0.86
5. Doing paperwork or computer work	0.23±0.65	0.09±0.30
6. Sitting reading a book or magazine	0.74±1.03	0.62±0.78
7. Playing a musical instrument	0.003±0.02	0.01±0.11
8. Doing handicraft or handiworks	0.87±1.67	0.72±1.58
9. Sitting and driving in a car, bus, or train	0.76±0.91	0.56±0.75
Total SBQ Score	8.16±3.90	6.85±3.86

Table 3. Correlation analysis between age, body mass index, surgical operation history, the Pittsburgh Sleep Quality Index, and the Sedentary Behavior Questionnaire.

		BMI (kg/m²)	Surgical operation	PSQI	SBQ-Weekday	SBQ-Weekend
Age (years)	r	0.133	0.196	-0.128	0.040	0.114
	p	0.250	0.084	0.265	0.970	0.310
Body Mass Index (kg/m²)	r	-	0.102	-0.080	-0.040	-0.063
	p		0.370	0.940	0.710	0.580
Surgical operation	r		-	0.091	0.058	0.054
	p			0.423	0.608	0.630
PSQI	r			-	0.058	0.019
	p				0.611	0.870
SBQ-Weekday	r				-	0.790
	p					<0.001

BMI: Body mass index. PSQI: Pittsburgh Sleep Quality Index. SBQ: Sedentary Behaviour Questionnaire. r=Spearman's rho.

score of PSQI was over 7.5, which was relatively comparable to the findings of the study of Courneya et al.[23] in which the mean score was found over 6 with nearly the same standard deviations as ours (4.02 vs 4.10). Fox et al.[9] also reported that the mean score of PSQI was 7.31 in patients with BC during chemotherapy which was also in parallel with ours. Divani et al.[22] reported that poor sleep quality is the most prominent during active therapy compared to baseline and completion of the therapy among cancer survivors. (8.31 vs 7.11-7.33). The results are seen as in parallel with each other, however, only half of our sample was under active chemotherapy compared to other studies in which their total sample was under active chemotherapy. On the other hand, Lopez et al.[8] reported that results can be biased since the treatment itself solely can cause sleep disturbances. Although it was reported that 80% of cancer patients think that sleep problems occur due to the treatment, values prior to the treatment were already worse.[27] Yet, it should also be noted that not only chemotherapy but also cancer itself could devastatingly contribute to decreased sleep quality.[22] In contrast, we found that our patients who were under active chemotherapy showed better scores than patients who had completed their chemotherapy although the results were insignificant. This finding can be attributed to the relatively younger age of our patients and the timing of application of the PSQI since Jim et al.[28] reported that the "roller coaster" effect which delineates the symptoms highest soon after the chemotherapy infusion and then decline is observed till the next infusion. In a meta-analysis,[29] it was reported that the sleep quality decreased after the first months of the initiation of treatment.

On the other hand, patients who had a positive surgical history showed worse scores in PSQI than those without. This might be an expectable result due to surgery can cause additional symptoms such as pain.[30] Sanford et al.[7] also reported worse scores (PSQI>5) in patients with BC who had surgery during the whole trajectory of the treatment. We found the highest and lowest scores in the "sleep disturbances" and "use of sleeping medication" sub-components of PSQI in our patients. Our results are comparable with the study of Demiralp et al.[31] in which the lowest scores were obtained in sleeping medication and they also reported a mean of nearly 1.5 units in the sleep disturbances subcomponent (1.5 vs. 1.63). It was also expectable since Roscoe et al.[32] reported the change in circadian rhythm in patients with cancer right after the initiation of the treatment. This change could naturally affect sleep hygiene by having an impact on autonomic responses. The subcomponent of "sleep disturbances" of PSQI covers mostly during or initiation/maintenance of sleep. Our finding

which indicates that the moderately significant correlation between time spent falling asleep and PSQI also supports this situation. Fleming et al.[33] reported that the prevalence of sleep disorders increased from 8% to 46% in patients with newly diagnosed nonmetastatic cancer. Although numerous factors can have an impact on poor sleep quality, however, it was reported that cancer patients cannot be adequately referred to sleep medicine specialists.[10,34]

Cancer etiology can be complex. However, environmental and lifestyle factors have been extensively studied in the last decades not only improving health outcomes but also investigating the risk factors.[35] Physical inactivity is extensively known as one of the major risk factors for cancer.[36] To improve the clinical outcomes of cancer, such factors have been widely studied. For instance, McTiernan et al.[37] reported that all types of physical activity reduce the risk of many types of cancer including breast and colon cancer. Not only aerobic exercise but also leisure and occupational physical activity were reported as significantly associated with reduced cancer risk.[38] Friedenreich et al.[39] also highlighted the significant effect of physical activity levels after cancer diagnosis which reduces all causes and cancer-specific mortality in different kinds of cancer at the rate of 30%. Yet, it is a well-known fact that cancer patients tend to reduce their physical activity level after diagnosis for several reasons. There are a lot of studies in which it was reported that cancer patients reduced their physical activity by up to 80%.[40,41] Adherence rates to the recommended levels of physical activity are also detrimentally low among cancer survivors.[16-18,42] Side effects of cancer treatment were the most reported barriers to failed adherence to physical activity.[40] To integrate a desired physical activity level among cancer survivors, varied barriers should be studied in detail.[43,44] In this regard, we chose to assess physical inactivity instead of physical activity in cancer patients. Surprisingly, there was no significant correlation between sleep quality and sedentary time in our patients. This result might have originated for some reasons. First, questionnaires used in this study need to be filled out by considering the last four weeks and the last week for PSQI and SBQ, respectively. This could have caused a recalling bias among patients by over or underestimating the levels of sleep quality and sedentary behavior. Second, because the majority of our patients were unemployed or retired and also lacked the ability to play a musical instrument, some items of the SBQ, such as "playing a musical instrument" and "doing paperwork or computer work," may not have been inclusive for our patients. Although there were no significant relationships among the total scores of SBQ and some socio and clinical demographic characteristics of patients (BMI, age, surgical history, etc.), age was significantly correlated with each item of SBQ in which screen time (TV and computer) and media (Listening music) is scored. A positive significant correlation between the age and the first item of SBQ indicates that increased TV time among older cancer survivors should be thoroughly assessed to improve physical inactivity levels. However, weak but negative correlations between age, the "Playing on a computer/video game" and "Sitting listening to music" items of SBQ should also be taken into account for younger patients for the same reason. On the other hand, the "sleep disturbances" score was significantly and positively correlated with the "Sitting and talking/being busy on the phone" item of SBQ in which "being busy on the phone" is questioned. This might be an expectable result due to the increased time spent with smartphones can cause sleep problems by affecting visual and postural problems. Although much research on this topic has been studied with healthy and young populations (adolescents, college students, etc.),[45,46] as far as we know, there was no research on this topic in patients with cancer associated with sleep and physical activity. Metin et al.[47] recently reported that increased smartphone usage was significantly correlated with musculoskeletal problems among university students. Similarly, "sleep disturbances" was significantly and moderately correlated with the "Doing handicraft or handiworks" item of SBQ in our study. In Eastern societies such as Turkey, knitting lace and some wearable stuff is quite common. A majority of our patients were female, and this result can be based on this occasion. We think that prolonged times of spending with a relatively constant posture as well as repetitive fine motor movements of hand, finger, and wrist may contribute to the potential musculoskeletal complaints and pain, and therefore the

significant correlation between the "sleep disturbances" and "Doing handicraft or handiworks" item of SBQ might be the one which highlights and supports our interpretation.

This study has some strengths. However, questionnaires were applied in real-time, and we tried to emphasize the possible connection between sedentariness and sleep quality among cancer patients can be accepted as a possible strength of this study.

Limitations

This was a single-centered cross-sectional study. Therefore, the results of this present study may not be generalizable to the cancer populations. Second, a small heterogeneity of types of cancer included in this study can also be accepted as a limitation. In addition, the majority of our sample was female, therefore the generalizability of these results to males might be arguable. Third, relatively all our patients were white and Caucasian, therefore, the generalizability of the results can be arguable. Recall bias due to the cross-sectional nature of this study can also be counted as a limitation. Fourth, some items of the SBQ may not have been relatively comprehensive for all patients, as noted previously.

Conclusion

Since the survival of cancer has increased in the last decades thanks to the advancement of the treatment and early diagnosis of cancer, managing short- and long-term side effects is of utmost importance. To maximize patients' benefits from treatment, the significance of maintaining a healthy lifestyle factor such as sleep quality and desired physical activity are indisputable. In this regard, determining the potential effects of failed adherence to physical activity might carry a critical role in other parameters such as sleep quality. We suggest that increased screen time especially for older cancer patients should be thoroughly considered to prevent physical inactivity. We may also offer usage of smartphones should also be thoroughly investigated in further studies among the cancer population since increased time with the phone caused decreased sleep quality in the context of sleep disturbances. In fact, since the great majority of our sample was based on patients with breast cancer, the findings of this study are relatively limited for patients with other types of cancer. Future studies with a more homogenous sample might contribute further to these findings. We think this study also contributed to the knowledge by relatively underlining the need for specific tools and instruments associated with the assessment of physical inactivity among cancer patients.

Acknowledgement: The Authors would like to thank patients who voluntarily participated in this study during their adjuvant therapy.

Authors' Contributions: AT: Study design, concept, literature search, data acquiring, data analysis/interpretation, writing, critical reviewing; **YB:** Study design, data interpretation, critical reviewing; **MA:** data acquiring, data analysis/interpretation, case referral, critical reviewing.

Funding: *None*

Conflicts of Interest: *None*

Ethical Approval: The protocol of the present study was approved by Izmir Bakircay University Ethical Board of Clinical Studies (issue: 954/934 date: 29.03.2023).

REFERENCES

1. Soerjomataram I, Bray F. Planning for tomorrow: global cancer incidence and the role of prevention 2020-2070. Nat Rev Clin Oncol.2021;18:663-672.
2. Wang L, Li J, Wang T, et al. Long-term recurrence rate and survival in different aged patients with breast cancer undergoing breast conserving therapy. Zhonghua Wai Ke Za Zhi. 2021;59:127-133.
3. Lowery-Allison AE, Passik SD, Cribbet MR, et al. Sleep problems in breast cancer survivors 1–10 years posttreatment. Palliat Support Care. 2018;16:325-334.
4. Innominato PF, Spiegel D, Ulusakarya A, et al. Subjective sleep and overall survival in chemotherapy-naïve patients with metastatic colorectal cancer. Sleep Med. 2015;16:391-398.
5. Chen D, Yin Z, Fang B. Measurements and status of sleep quality in patients with cancers. Support Care Cancer. 2018;26:405-414.
6. Lin S, Chen Y, Yang L,et al.Pain, fatigue, disturbed sleep and distress comprised a symptom cluster that related to quality of life and functional status of lung cancer surgery patients. J Clin Nurs. 2013;22:1281-1290.

7. Sanford SD, Wagner LI, Beaumont JL, et al. Longitudinal prospective assessment of sleep quality: before, during, and after adjuvant chemotherapy for breast cancer. Support Care Cancer. 2013;21:959-967.
8. López E, de la Torre-Luque A, Lazo A, et al. Assessment of sleep disturbances in patients with cancer: Cross-sectional study in a radiotherapy department. Eur J Oncol Nurs. 2016;20:71-76.
9. Fox RS, Ancoli-Israel S, Roesch SC, et al. Sleep disturbance and cancer-related fatigue symptom cluster in breast cancer patients undergoing chemotherapy. Support Care Cancer. 2020;28:845-855.
10. Otte JL, Carpenter JS, Manchanda S, et al. Systematic review of sleep disorders in cancer patients: can the prevalence of sleep disorders be ascertained? Cancer Med. 2015;4:183-200.
11. Mogavero MP, DelRosso LM, Fanfulla F, Bruni O, Ferri R. Sleep disorders and cancer: State of the art and future perspectives. Sleep Med Rev. 2021;56:101409.
12. Fang YY, Hung CT, Chan JC, Huang SM, Lee YH. Meta-analysis: Exercise intervention for sleep problems in cancer patients. Eur J Cancer Care. 2019; 28:e13131.
13. Huang B-H, Duncan MJ, Cistulli PA, et al. Sleep and physical activity in relation to all-cause, cardiovascular disease and cancer mortality risk. Br J Sports Med. 2022;56:718-724.
14. Yonenaga Y, Naito T, Okayama T, et al. Impact of physical inactivity on the risk of disability and hospitalization in older patients with advanced lung cancer. J Multidiscip Healthc. 2021;14:1521-1532.
15. Tabaczynski A, Courneya KS, Trinh L. Replacing sedentary time with physical activity and sleep: associations with quality of life in kidney cancer survivors. Cancer Causes Control. 2020;31:669-681.
16. Boyle T, Vallance JK, Ransom EK, et al. How sedentary and physically active are breast cancer survivors, and which population subgroups have higher or lower levels of these behaviors? Support Care Cancer. 2016;24:2181-2190.
17. Frikkel J, Götte M, Beckmann M, et al. Fatigue, barriers to physical activity and predictors for motivation to exercise in advanced Cancer patients. BMC Palliat Care. 2020;19:43.
18. Courneya KS, Katzmarzyk PT, Bacon E. Physical activity and obesity in Canadian cancer survivors: population-based estimates from the 2005 Canadian Community Health Survey. Cancer. 2008;112:2475-2482.
19. Beck SL, Schwartz AL, Towsley G, et al. Psychometric evaluation of the Pittsburgh Sleep Quality Index in cancer patients. J Pain Symptom Manage. 2004;27:140-148.
20. Bakar Y, Tugral A, Ozel A, et al. Reliability and Validity of Sedentary Behavior Questionnaire in Turkish Population: Evaluation of Psychometric Properties. Middle East J Rehabil Health Stud. 2018;5:e63576.
21. Faul F, Erdfelder E, Lang A-G, et al. G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Method. 2007;39:175-191.
22. Divani A, Heidari ME, Ghavampour N, et al. Effect of cancer treatment on sleep quality in cancer patients: A systematic review and meta-analysis of Pittsburgh Sleep Quality Index. Support Care Cancer. 2022;30:4687-4697.
23. Courneya KS, Segal RJ, Mackey JR, et al. Effects of exercise dose and type on sleep quality in breast cancer patients receiving chemotherapy: a multicenter randomized trial. Breast Cancer Res Treat. 2014;144:361-369.
24. Berger AM, Parker KP, Young-McCaughan S, et al. Sleep/wake disturbances in people with cancer and their caregivers: state of the science. Oncol Nurs Forum. 2005;32:E98-126.
25. Cleeland CS, Zhao F, Chang VT, et al. The symptom burden of cancer: evidence for a core set of cancer-related and treatment-related symptoms from the Eastern Cooperative Oncology Group Symptom Outcomes and Practice Patterns study. Cancer. 2013;119:4333-4340.
26. Vena C, Parker K, Cunningham M, et al. Sleep-wake disturbances in people with cancer part I: an overview of sleep, sleep regulation, and effects of disease and treatment. Oncol Nurs Forum. 2004;31:735-746.
27. Collins KP, Geller DA, Antoni M, et al. Sleep duration is associated with survival in advanced cancer patients. Sleep Med. 2017; 32:208-212.
28. Jim HS, Small B, Faul LA, et al. Fatigue, depression, sleep, and activity during chemotherapy: daily and intraday variation and relationships among symptom changes. Ann Behav Med. 2011;42:321-333.
29. Chang W-P, Chang Y-P. Meta-analysis of changes in sleep quality of women with breast cancer before and after therapy. Breast Care (Basel). 2020;15:227-235.
30. Souza RCdS, Dos Santos MR, das Chagas Valota IA, et al. Factors associated with sleep quality during chemotherapy: An integrative review. Nurs Open. 2020;7:1274-1284.
31. Demiralp M, Oflaz F, Komurcu S. Effects of relaxation training on sleep quality and fatigue in patients with breast cancer undergoing adjuvant chemotherapy. J Clin Nurs. 2010;19:1073-1083.
32. Roscoe JA, Morrow GR, Hickok JT, et al. Temporal interrelationships among fatigue,

circadian rhythm and depression in breast cancer patients undergoing chemotherapy treatment. Support Care Cancer. 2002;10:329-336.
33. Fleming L, Randell K, Stewart E, et al. Insomnia in breast cancer: a prospective observational study. Sleep. 2019;42:1-10.
34. Smith HS, Barkin RL, Barkin SJ. Personalized pharmacotherapy for treatment approaches focused at primary insomnia. Am J Ther. 2011;18:227-240.
35. Rowland JH, Bellizzi KM. Cancer survivorship issues: life after treatment and implications for an aging population. J Clin Oncol. 2014;32:2662-2668.
36. Ferlay J, Colombet M, Soerjomataram I, et al. Cancer statistics for the year 2020: An overview. Int J Cancer. 2021;149:778-789.
37. McTiernan A, Friedenreich CM, Katzmarzyk PT, et al. Physical activity in cancer prevention and survival: a systematic review. Med Sci Sports Exerc. 2019;51:1252-1261.
38. Masala G, Bendinelli B, Assedi M, et al. Up to one-third of breast cancer cases in post-menopausal Mediterranean women might be avoided by modifying lifestyle habits: the EPIC Italy study. Breast Cancer Res Treat. 2017;161:311-320.
39. Friedenreich CM, Stone CR, Cheung WY, et al. Physical activity and mortality in cancer survivors: a systematic review and meta-analysis. JNCI Cancer Spectr. 2019;4(1):pkz080.
40. Ottenbacher AJ, Day RS, Taylor WC, et al. Exercise among breast and prostate cancer survivors-what are their barriers? J Cancer Surviv. 2011;5:413-419.
41. Chan A, Ports K, Neo P, et al. Barriers and facilitators to exercise among adult cancer survivors in Singapore. Support Care Cancer. 2022;30:4867-4878.
42. Speed-Andrews A, Rhodes R, Blanchard C, et al. Medical, demographic and social cognitive correlates of physical activity in a population-based sample of colorectal cancer survivors. Eur J Cancer Care (Engl). 2012;21:187-196.
43. Romero SA, Li QS, Mao JJ. Factors and barriers associated with changes in physical activity after cancer diagnosis. J Clin Oncol, 2017;35:5162-5162.
44. Fernandez S, Franklin J, Amlani N, et al. Physical activity and cancer: a cross-sectional study on the barriers and facilitators to exercise during cancer treatment. Can Oncol Nurs J. 2015;25:37-48.
45. Mac Carthaigh S, Griffin C, Perry J. The relationship between sleep and problematic smartphone use among adolescents: A systematic review. Dev Rev. 2020;55:100897.
46. Zhang MX, Wu AM. Effects of smartphone addiction on sleep quality among Chinese university students: The mediating role of self-regulation and bedtime procrastination. Addict Behav. 2020;111:106552.
47. Metin G, Topuz S, Yagci G. Smartphone use Affects gait performance, spinal kinematics and Causes spinal musculoskeletal discomfort in young adults. Musculoskelet Sci Pract. 2023;66:102819.