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ORIGINAL ARTICLE

# Symptom status, body perception, and risk of anxiety and depression in breast cancer patients receiving paclitaxel: a prospective longitudinal study

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## Abstract

**Background** Paclitaxel regimen which is widely used in clinical treatment causes many negative physical and psychological consequences on women with breast cancer (BC). This longitudinal study firstly aimed to investigate symptom status, body perception changes, and the risk of anxiety and depression in BC patients receiving during paclitaxel regimen.

**Materials and methods** This descriptive and prospective study was conducted with 84 BC patients receiving paclitaxel regimen. "Chemotherapy Symptom Assessment Scale (C-SAS)," "Body Perception Scale (BPS)," and "Hospital Anxiety and Depression Scale (HADS)" were applied at five time points ($T_1$, before the first Paclitaxel infusion; $T_2$, at the end of first cycle; $T_3$, at the end of fourth cycle; $T_4$, at the end of eighth cycle; $T_5$, at the end of twelfth cycle). Data was analyzed using descriptive statistics, Cochrane Q, and linear mix model regression analysis.

**Results** The frequency of needling and numbness in hands and feet, pain, and skin or nail changes significantly increased in the subsequent assessment points ($T_2$, $T_3$, $T_4$, and $T_5$) compared to the initial assessment ($T_1$) ($p < 0.05$). The mean scores of BPS significantly decreased at $T_2$, $T_4$, and $T_5$ compared to $T_1$ ($F = 8.152$, $p < 0.001$). The mean scores of the anxiety subscale of the HADS scale decreased at the $T_3$, $T_4$, and $T_5$ compared to $T_1$ ($F = 6.865$, $p < 0.001$), and the mean scores of the depression subscale significantly increased at the $T_5$ compared to $T_1$ ($F = 3.708$, $p = 0.006$).

**Conclusions** The oncology nurse should comprehensively evaluate the patients who scheduled to receive paclitaxel treatment, and provide counseling to the patients during these specific weeks. Better management of the symptoms that increase with the paclitaxel regimen with repeated interviews under the supervision of the nurse will also prevent the deterioration of body perception. In addition, since the risk of depression increases over time in patients receiving paclitaxel, nurses should periodically screen the risk of depression, and timely consult the patients for the appropriate support.

**Keywords** Anxiety · Body perception · Breast cancer · Depression · Nursing · Paclitaxel

## Introduction

Breast cancer (BC) is the most common type of cancer among women worldwide, causing significant rates of mortality and morbidity [1, 2]. In recent years, adjuvant and neoadjuvant systemic therapies have started to take an important place in BC treatment to reduce the associated mortality rate, in addition to the classical treatment methods such as surgery, chemotherapy, and radiotherapy [3].

Paclitaxel is frequently preferred during adjuvant and neoadjuvant therapies [4]. Paclitaxel is a taxane group drug and can be administered weekly (12 weeks) or every 21 days (four cycles) after four cycles of Adriamycin–cyclophosphamide (AC) treatment in patients with early-stage BC [5–7]. With the increasing clinical use of paclitaxel in BC, it is reported that therapeutic response, survival, and disease-free survival rates have increased [6].

Paclitaxel, which cannot cross the blood–brain barrier, induces symptoms by causing toxic effects in the periphery. Dynamic instability of microtubules in the cell is necessary

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for mitosis. Paclitaxel stabilizes the microtubule by binding to the lumens of the cell, stops mitosis, and eventually causes apoptosis. In particular, neurons are frequently affected by paclitaxel even though they are not dividing cells [8]. Paclitaxel often causes significant symptoms such as neutropenia, nausea, vomiting, diarrhea, oral mucositis, amenorrhea, alopecia, arthralgia, myalgia, peripheral neuropathy, skin and nail changes, liver and renal toxicity, and hypersensitivity reactions in BC patients depending on the number of cycles, and the dose administered [5, 6, 9–11]. In particular, during the weekly administered paclitaxel regimen, patients are found feeling uncomfortable due to arthralgia and myalgia, taste changes, peripheral neuropathy, fatigue, cognitive problems, and insomnia [12]. In addition, neurotoxicity is reported to be associated with the increasing cumulative dose of the paclitaxel [11]. Patients with BC receiving paclitaxel also experience anxiety, depression, and decrease in body perception due to physiological effects of paclitaxel including alopecia, changes in sexual life, menstrual disorders, weight changes, and changes in nails/skin [13–15].

Parallel to the increasing symptom status during the BC treatment, patients find it increasingly difficult to adapt to the treatment. Changes in physical, cognitive, and emotional statuses may also cause a decline in body perception [16]. Body perception in BC patients is negatively affected during the paclitaxel regimen as a result of edema, weight changes, alopecia, differentiation in skin color and nails, oral mucositis, menstrual cycle disorders, and sexual life problems [17, 18]. At the same time, as in many cultures, imputed meanings related to aesthetic appearance, femininity, attractiveness, sexuality, and motherhood in Turkish culture make the treatment process even more difficult for patients with BC [19, 20]. Several studies have also highlighted that chemotherapy and mastectomy, which have an important place in the BC treatment, negatively affect the body perception in BC patients [13, 14, 21].

Another clinical situation that needs to be considered is that emotional changes, including distress, anxiety, and depression in BC patients. Experienced symptoms, decreased body perception, and increased anxiety during BC treatment cause more difficulty in coping with the treatment process in BC patients, and lead to the formation of a risk group for depression [17]. Previous studies conducted with BC patients reported that alopecia, weight changes, fatigue, and difficulties in sexual life are directly related to higher anxiety, and depression levels in those undergoing surgery and chemotherapy [15, 22, 23]. Besides, numerous studies have emphasized that the anxiety levels are higher in the first year after a BC diagnosis [24], which gradually decrease during the treatment [25].

In the literature, no studies have been found that investigated changes in symptom status, body perception, and the risk of anxiety, and depression prospectively in patients with BC scheduled to receive paclitaxel regimen. This study is the first attempt to fill this research gap by investigating changes in body perception, symptom status, and the risk of anxiety and depression concurrently, and determining the time intervals of deterioration in these three variables in BC patients who scheduled to receive paclitaxel regimen. Therefore, this study aimed to determine the symptom status, body perception changes, and the risk of anxiety and depression in patients with BC for a total of 12 weeks. It is assumed that determining the time intervals during the paclitaxel treatment when the risk of anxiety and depression occurs can enable the planning of comprehensive education programs and counseling sessions for BC patients and reduce the symptom burden and the deterioration in body perception with structured nursing interventions.

### Research questions

- How do the symptom status change in BC patients during the paclitaxel regimen?
- How do body perception levels change in BC patients during the paclitaxel regimen?
- How do the symptoms of anxiety and depression change in BC patients during the paclitaxel regimen?

## Methods

### Study design and setting

This descriptive and prospective study was conducted between July 29, 2019, and June 15, 2020, at three centers including the Hacettepe University Oncology Hospital, Health Sciences University Dr Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, and Ankara City Hospital located in Ankara, Turkey. Participants were recruited from the outpatient clinics of the Departments of Clinical Oncology of the three local public hospitals. All patients selected for this study received a total of 12 paclitaxel infusions in the oncology outpatient clinic once a week, for a total of 12 weeks.

### Participants

The population of the study consisted of patients with BC who received the first cure of the paclitaxel regimen in the daytime treatment units. The patients who met the inclusion criteria were included in the study without using any sampling method. Considering the correlation coefficient as 0.30 between the BPS and the HADS total scores, the sample size was calculated at least 84 patients with a power of 80% through the G Power 3.1.10 program. Patients aged between

18 and 65 years, who were diagnosed of BC and had completed four cycles of AC regimen prior to the paclitaxel regimen and all the 12 cycles of the paclitaxel, were included in the study. Those who had communication problems, had a psychiatric diagnosis (major depression, etc.), had a different cancer diagnosis, had previous history of radiotherapy, using relaxation techniques or antidepressants during the study, could not complete 12 cycles of the paclitaxel regimen, and were not willing to participate were excluded from the study. In this context, a total of 88 patients were assessed; four patients were excluded due to following reasons: did not want to continue the study ($n=2$), could not be reached after the fourth cycle ($n=1$), and did not want to receive her treatment due to fear of coronavirus-19 disease (COVID-19) ($n=1$). Finally, this study was completed with 84 patients.

## Data collection tools

### Demographic and clinical information form

This form developed based on the literature [4–6, 26], and consisted of age, height, weight, body mass index, educational level, marital status, income level, employment status, whether having children or not, accompanying comorbidities, duration of BC diagnosis, BC stage, previous treatments, mastectomy status, people living together with, and residency in Ankara, Turkey.

### Chemotherapy Symptom Assessment Scale (C-SAS)

This scale was developed to determine the symptom status of cancer patients receiving chemotherapy treatment [20]. The Turkish version of the C-SAS was studied by Aslan et al. (2006) [19]. It includes 24 different symptoms that may occur during chemotherapy. Patients are asked to identify the status of experiencing each symptom as "yes"/"no." Since each symptom is evaluated separately, the arithmetic mean values are not used in evaluating the scale scores. In the Turkish validity and reliability study of the scale, the Cronbach alpha coefficient was found as 0.82 [19, 20]. In this study, Cronbach's alpha coefficient was calculated as 0.62.

### Body Perception Scale (BPS)

This scale was developed by Secord and Jourard (1953) [27]. It contains 40 five-point Likert-type questions about body region or function. These 40 items include five assessment criteria related to each organ or body function (starting from 1 = "I do not like" to 5 = "I like very much"). Total score that can be obtained from the scale varies between 40 and 200. An increase in the total score indicates that a person's satisfaction with the part or functionality that makes up his/her body increases. The Turkish validity and reliability study of the scale was conducted by Hovardaoğlu (1993) and the Cronbach alpha coefficient was found as 0.91 [28]. In this study, the Cronbach's alpha coefficient value was calculated to be 0.84.

### Hospital Anxiety and Depression Scale (HADS)

HADS was developed by Zigmond and Snaith (1983) [29] to determine the risk status for anxiety and depression in patients with physical disorders, and its Turkish version was studied by Aydemir et al. (1997) [30]. It includes 14 questions and two sub-dimensions as anxiety and depression. Seven questions (odd numbered) measure anxiety (HAD-A) while the other seven questions (even numbered) measure depression (HAD-D). In the scale, questions are scored on a four-point Likert scale, each ranging from 0 to 3. The lowest score that a patient can get from each sub-dimension is 0, and the highest score is 21. As the total scores increase, patients are considered at risk for anxiety and depression. In the Turkish validity and reliability study of the scale, the Cronbach alpha coefficient was found as 0.85 and 0.77 for the anxiety and depression sub-dimensions, respectively [30]. In this study, the Cronbach's alpha coefficient values were calculated as 0.86 and 0.79 for the anxiety and depression sub-dimensions in this study, respectively.

### Data collection procedure

Baseline data ($T_1$) were collected on the day of the first paclitaxel infusion, before the first infusion was given, using the demographic and clinical information form, C-SAS, BPS, and HADS from the patients who met the inclusion criteria. The patients were prospectively followed by the principal investigator (PI) during the paclitaxel regimen for a total of 12 weeks. The C-SAS, BPS, and the HADS were reapplied to the patients by the PI at the end of the first cycle (first week, $T_2$), fourth cycle (fourth week, $T_3$), eighth cycle (eighth week, $T_4$), and twelfth cycle (twelfth week, $T_5$) during the paclitaxel regimen.

## Statistical analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS version 23; IBM, Armonk, New York). Descriptive statistics (mean, median, standard deviation, minimum, maximum, percentage, and frequency) were used in the evaluation of the socio-demographic data. Data were analyzed for normality using Kolmogorov–Smirnov test. The Cochran's Q test, a nonparametric way, was used to determine the changes in the frequency of symptoms evaluated by C-SAS. Longitudinal processing was used for the analysis of repeated measurements. Linear mix model of repeated measurements was used to analyze the progression

of BPS and HADS scores at $T_1$ (reference category), $T_2$, $T_3$, $T_4$, and $T_5$. The statistical significance value in the study was set as $p < 0.05$.

### Ethical considerations

Ethical approval was obtained from the Hacettepe University Non-Interventional Clinical Research Ethics Committee (2019/06–10), and institutional permissions were obtained from hospital administrations. All information was collected in accordance with the Declaration of Helsinki. Informed consent forms were obtained from all the patients included in the study. The PI gave information to the patients about the importance, purpose, and contributions of the study in the first interview, received the contact numbers of the patients, and applied the data collection tools using a face-to-face interview technique.

## Results

The descriptive characteristics of the patients are given in Table 1. Most of the sample had completed primary school (60.7%) and did not work (73.8%); however, half of the patients reported having a mid-level income. The great majority of participants were married (85.7%) and had children (89.3%). A total of 47.6% of the patients had stage-2 BC, 77.4% had undergone breast surgery and chemotherapy treatments before, and 26.2% had come from other cities to receive their scheduled treatment. The big majority of patients (94%) lived with their family, and nearly half (45.2%) of those had at least one additional chronic disease. The mean age of patients was 49.57 ± 8.14 years. The mean value of the body mass index was 29.49 ± 5.50, and the average number of children was 2.14 ± 1.04. The mean time of

**Table 1** Participants' characteristics ($n = 84$)

| Variable | Category | Number (*n*) | Percent (%) |
|---|---|---|---|
| Educational level | Primary school | 51 | 60.7 |
| | Middle School | 10 | 11.9 |
| | High school | 19 | 22.6 |
| | Associate/license | 4 | 4.8 |
| Marital status | Single | 12 | 14.3 |
| | Married | 72 | 85.7 |
| Income level | Low | 40 | 47.6 |
| | Middle | 42 | 50.0 |
| | High | 2 | 2.4 |
| Employment | Not working | 62 | 73.8 |
| | Working | 22 | 26.2 |
| Having a child | Absent | 9 | 10.7 |
| | Present | 75 | 89.3 |
| People that living together | Alone | 5 | 6.0 |
| | With family | 79 | 94.0 |
| Residency in Ankara | Yes | 62 | 73.8 |
| | No | 22 | 26.2 |
| Comorbidities | Present | 38 | 45.2 |
| | Absent | 46 | 54.8 |
| BC stage | Stage 1 | 10 | 11.9 |
| | Stage 2 | 40 | 47.6 |
| | Stage 3 | 34 | 40.5 |
| Previous treatments | Chemotherapy | 19 | 22.6 |
| | Surgery and chemotherapy | 65 | 77.4 |
| Mastectomy status | No | 21 | 25.0 |
| | Yes | 63 | 75.0 |
| Variable | Min | Max | X ± SD* |
| Age | 29 | 64 | 49.57 ± 8.14 |
| BMI | 17.92 | 46.48 | 29.49 ± 5.50 |
| Duration of BC diagnosis (months) | 3 | 12 | 5.51 ± 1.66 |
| Number of children | 0 | 4 | 2.14 ± 1.04 |

*$X \pm SD$, mean, standard deviation; *BC*, breast cancer; *BMI*, body mass index

diagnosis was 5.51 ± 1.66 months; the time since diagnosis was 3–6 months in 81% of the patients.

Changes in symptom frequency among the patients were prospectively evaluated at five different time points ($T_1$, $T_2$, $T_3$, $T_4$, and $T_5$) during the 12-week paclitaxel regimen (Table 2). Cochran's Q test results showed the differences in matched sets of symptoms in this longitudinal study. When the symptoms of nausea and vomiting (after treatment), constipation, weight loss or weight gain, changes in appetite, problems with the eyes, feelings of extraordinary fatigue, headaches, anxiety or distress, pessimism and sadness, changes in sexual life, and changes in the menstrual cycle were compared with symptom statuses of the baseline assessment ($T_1$), a significant decrease was observed in the aforementioned symptoms in all the subsequent measurements ($T_2$, $T_3$, $T_4$, and $T_5$) ($p < 0.05$). Besides, the frequency of feeling needling, numbness, and pain in the hands and feet increased in the subsequent assessments ($T_2$, $T_3$, $T_4$, and $T_5$) compared to the baseline assessment ($T_1$) ($p < 0.05$). In addition, according to the baseline assessment ($T_1$) and the assessment at the end of the first cycle ($T_2$), the increase in the frequency of sleep disturbances in the fifth assessment ($T_5$) cycle remained statistically significant ($p < 0.05$). Finally, the frequency of skin and nail changes gradually increased from T2 to T5 ($p < 0.05$). However, the differences between the measurements ($T_1$, $T_2$, $T_3$, $T_4$, $T_5$) were not statistically significant in terms of nausea and vomiting (before treatment), diarrhea, dyspnea, signs of infection, bleeding or bruising, hair loss, weakness, and problems with the mouth and throat ($p > 0.05$).

Regarding the changes in the mean BPS scores of the patients during the paclitaxel regimen, the corresponding scores were 134.75 ± 13.73 at $T_1$, 130.54 ± 14.63 at $T_2$, 132.33 ± 12.01 at $T_3$, 129.60 ± 12.62 at $T_4$, and 124.07 ± 10.44 at $T_5$ (Table 3). When the reference category was taken as the $T_1$ (before the first paclitaxel infusion), body perception scores at $T_2$ time were 4.214 less than the $T_1$. The corresponding scores at $T_4$ time were 5.155 less than $T_1$. Body perception scores at $T_5$ time were 10.679 less than $T_1$. No significant effect was found at $T_3$ time compared to the reference category (T1) (Table 4). Considering Table 3, the effects of measurements repeated at different times on BPS scores were statistically significant based on the linear mix model established ($F = 8.152$, $p < 0.001$).

During the paclitaxel regimen in this study, the mean scores of the HADS-A sub-dimension were 6.61 ± 4.74 at $T_1$, 5.63 ± 3.86 at $T_2$, 4.48 ± 3.33 at $T_3$, 4.18 ± 3.01 at $T_4$, and 4.30 ± 3.15 at $T_5$ (Table 3). When the reference category was taken as the $T_1$ (before the first paclitaxel infusion), anxiety scores at $T_3$ time were 2.131 lower than $T_1$. Anxiety scores at $T_4$ time were 2.429 less than $T_1$. Anxiety scores at $T_5$ time were 2.310 less than $T_1$ (Table 5). No significant effect was found at $T_2$ time compared to the reference category (T1). As for the mean scores of the HADS-D sub-dimension, it was found to be 6.00 ± 4.16 at $T_1$, 5.64 ± 3.37 at $T_2$, 6.13 ± 3.65 at $T_3$, 6.90 ± 3.23 at $T_4$, and 7.44 ± 2.85 at $T_5$. The mean depression scores decreased in $T_2$ compared to $T_1$, increased in $T_3$ compared to $T_2$ and $T_4$ compared to $T_3$, and increased again in $T_5$ compared to $T_4$ (Table 3). Depression scores at $T_5$ time were 1.440 higher than $T_1$. And no significant effect was determined at $T_2$, $T_3$, and $T_4$ times compared to the reference category (Table 5). Table 5 summarizes the results of the mixed linear model analysis for HADS-A and HADS-D scores, respectively. The effects of measurements repeated at different times on anxiety ($F = 6.865$, $p < 0.001$) and depression ($F = 3.708$, $p = 0.006$) scores were statistically significant.

## Discussion

In this prospective study, we investigated the symptom status, body perception level changes, and the symptoms of anxiety and depression in BC patients receiving paclitaxel treatment using five different measurement points. While frequency of symptoms nausea-vomiting, fatigue, headaches, anxiety-distress decreased, needling, numbness, pain in the hands and feet, sleep disturbances, and skin-nail changes increased during the paclitaxel regimen in the present study. Like our findings, neuropathy, skin and nail toxicities, arthralgia, and myalgia were frequently reported in patients receiving paclitaxel regimen [8, 31–33]. Chemotherapy is reported to first affect the receptors in the gastrointestinal tract, inducing neurotransmitter release and stimulating the muscles in the stomach to create nausea/vomiting response in the relevant part of the brain [34], and triggers the mechanisms of acute, delayed, and anticipatory emesis. Previous studies have highlighted that chemotherapy-induced peripheral neurotoxicity, neuropathic pain, anxiety, and depression have been reported to be important risk factors for sleep disturbance and poor sleep quality in BC survivors [35]. Fatigue may be associated with cancer itself, and ongoing treatment, sleep problems, anxiety, depression, and peripheral neuropathy may also contribute to neuromuscular fatigue [36]. As paclitaxel cannot cross the blood–brain barrier, it frequently causes problems in the periphery, such as neuropathy. Proposed mechanisms for taxane-induced peripheral neuropathy and neuropathic pain include inflammation, peripheral nerve toxicity with nociceptor sensitization, resultant hyperalgesia, and immune system activation [35, 37]. In this prospective study, we firstly evaluated the symptom status before and after the treatment in BC patients and also reported that anxiety decreased and pain increased [38]. Bao et al. (2016) [39] confirmed that 58.4% of the BC patients receiving taxane chemotherapy had numbness

**Table 2** The Changes in Chemotherapy Symptom Assessment Scale According to Paclitaxel Cycles ($n=84$)

| Variable | | Status | $T_1$ | | $T_2$ | | $T_3$ | | $T_4$ | | $T_5$ | | *p* value | Q | Difference between end of cure measurements |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (*n*) | (%) | (*n*) | (%) | (*n*) | (%) | (*n*) | (%) | (*n*) | (%) | | | |
| Nausea-vomiting before treatment | | Present | 2 | 2.4 | 2 | 2.4 | 2 | 2.4 | 1 | 1.2 | 0* | 0 | $p=0.934$ | 0.429 | - |
| | | Absent | 82 | 97.6 | 82 | 97.6 | 82 | 97.6 | 83 | 98.8 | 84 | 100 | | | |
| Nausea after treatment | | Present | 75 | 89.3 | 19 | 22.6 | 10 | 11.9 | 7 | 8.3 | 10 | 11.9 | **$p<0.001$** | 188.960 | T1-T2 ($p<0.001$, $Q=0.667$)<br>T1-T3 ($p<0.001$, $Q=0.774$)<br>T1-T4 ($p<0.001$, $Q=0.774$)<br>T1-T5 ($p<0.001$, $Q=0.810$) |
| | | Absent | 9 | 10.7 | 65 | 77.4 | 74 | 88.1 | 77 | 91.7 | 74 | 88.1 | | | |
| Vomiting after treatment | | Present | 19 | 22.6 | 3 | 3.6 | 1 | 1.2 | 0* | 0 | 0* | 0 | **$p<0.001$** | 29.200 | T1-T2 ($p<0.001$, $Q=-0.190$)<br>T1-T3 ($p<0.001$, $Q=-0.214$) |
| | | Absent | 65 | 77.4 | 81 | 96.4 | 83 | 98.8 | 84 | 100 | 84 | 100 | | | |
| Constipation | | Present | 44 | 52.4 | 31 | 36.9 | 21 | 25.0 | 15 | 17.9 | 15 | 17.9 | **$p<0.001$** | 43.461 | T1-T3 ($p<0.001$, $Q=0.274$)<br>T1-T4 ($p<0.001$, $Q=0.345$)<br>T1-T5 ($p<0.001$, $Q=0.345$)<br>T2-T4 ($p<0.001$, $Q=0.190$)<br>T2-T5 ($p=0.026$, $Q=0.190$) |
| | | Absent | 40 | 40.7 | 53 | 63.1 | 63 | 75.0 | 69 | 82.1 | 69 | 82.1 | | | |
| Diarrhea | | Present | 15 | 17.9 | 3 | 3.6 | 10 | 11.9 | 10 | 11.9 | 10 | 11.9 | 0.052 | 9.385 | - |
| | | Absent | 69 | 82.1 | 81 | 96.4 | 74 | 88.1 | 74 | 88.1 | 74 | 88.1 | | | |
| Pain | | Present | 35 | 41.7 | 59 | 70.2 | 54 | 64.3 | 58 | 69.0 | 64 | 76.2 | **$p<0.001$** | 33.026 | T1-T2 ($p<0.001$, $Q=0.286$)<br>T1-T3 ($p=0.006$, $Q=0.226$)<br>T1-T4 ($p<0.001$, $Q=0.274$)<br>T1-T5 ($p<0.001$, $Q=0.345$) |
| | | Absent | 49 | 58.3 | 25 | 29.8 | 30 | 35.7 | 26 | 31.0 | 20 | 23.8 | | | |
| Dyspnea | | Present | 5 | 6.0 | 6 | 7.1 | 6 | 7.1 | 6 | 7.1 | 6 | 7.1 | 0.997 | 0.154 | - |
| | | Absent | 79 | 94.0 | 78 | 92.9 | 78 | 92.9 | 78 | 92.9 | 78 | 92.9 | | | |
| Signs of infection | | Present | 2 | 2.4 | 3 | 3.6 | 3 | 3.6 | 3 | 3.6 | 3 | 3.6 | 0.991 | 0.286 | - |
| | | Absent | 82 | 97.6 | 81 | 96.4 | 81 | 96.4 | 81 | 96.4 | 81 | 96.4 | | | |
| Bleeding or bruising | | Present | 1 | 1.2 | 0* | 0 | 2 | 2.4 | 0* | 0 | 1 | 1.2 | 0.717 | 0.667 | - |
| | | Absent | 83 | 98.8 | 84 | 100 | 82 | 97.6 | 84 | 100 | 83 | 98.8 | | | |
| Pins and needles in hands, feet | | Present | 24 | 28.6 | 20 | 23.8 | 38 | 45.2 | 57 | 67.9 | 74 | 88.1 | **$p<0.001$** | 111.957 | T1-T4 ($p<0.001$, $Q=0.393$)<br>T1-T5 ($p<0.001$, $Q=0.595$)<br>T2-T3 ($p=0.003$, $Q=0.214$)<br>T2-T4 ($p<0.001$, $Q=0.440$)<br>T2-T5 ($p<0.001$, $Q=0.643$)<br>T3-T4 ($p=0.018$, $Q=0.226$)<br>T3-T5 ($p<0.001$, $Q=0.429$)<br>T4-T5 ($p<0.005$, $Q=0.202$) |
| | | Absent | 60 | 71.4 | 64 | 76.2 | 46 | 54.8 | 27 | 32.1 | 10 | 11.9 | | | |
| Problems with the skin or nails | Present | | 68 | 81.0 | 55 | 65.5 | 63 | 75.0 | 72 | 85.7 | 79 | 94.0 | **$p<0.001$** | 30.481 | T2-T4 ($p=0.003$, $Q=0.202$)<br>T2-T5 ($p<0.001$, $Q=0.286$)<br>T3-T5 ($p=0.006$, $Q=0.190$) |
| | Absent | | 16 | 19.0 | 29 | 34.5 | 21 | 25.0 | 12 | 14.3 | 5 | 6.0 | | | |
| Hair loss | Present | | 84* | 100 | 0* | 0 | 3 | 3.6 | 2 | 2.4 | 7 | 8.3 | $p=0.148$ | 3.818 | - |
| | Absent | | 0 | 0 | 84 | 100 | 81 | 96.4 | 82 | 97.6 | 77 | 91.7 | | | |
| Problems with the mouth and throat | Present | | 65 | 77.4 | 52 | 61.9 | 54 | 64.3 | 57 | 67.9 | 59 | 70.2 | $p=0.058$ | 9.117 | - |
| | Absent | | 19 | 22.6 | 32 | 38.1 | 30 | 35.7 | 27 | 32.1 | 25 | 29.8 | | | |
| Change in appetite | Present | | 72 | 85.7 | 41 | 48.8 | 54 | 64.3 | 44 | 52.4 | 43 | 51.2 | **$p<0.001$** | 33.990 | T1-T2 ($p<0.001$, $Q=0.369$)<br>T1-T3 ($p=0.039$, $Q=0.214$)<br>T1-T4 ($p<0.001$, $Q=0.333$)<br>T1-T5 ($p<0.001$, $Q=0.345$) |
| | Absent | | 12 | 14.3 | 43 | 51.2 | 30 | 35.7 | 40 | 47.6 | 41 | 48.8 | | | |

**Table 2** (continued)

| Variable | | Status | $T_1$ | | $T_2$ | | $T_3$ | | $T_4$ | | $T_5$ | | *p* value | Q | Difference between end of cure measurements |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (*n*) | (%) | (*n*) | (%) | (*n*) | (%) | (*n*) | (%) | (*n*) | (%) | | | |
| Losing or gaining weight | Present | | 50 | 59.5 | 12 | 14.3 | 34 | 40.5 | 32 | 38.1 | 37 | 44.0 | **$p<0.001$** | 33.368 | T1-T2 ($p<0.001$, $Q=0.452$)<br>T1-T4 ($p<0.005$, $Q=0.214$)<br>T2-T3 ($p=0.004$, $Q=-0.262$)<br>T2-T4 ($p=0.012$, $Q=-0.238$)<br>T2-T5 ($p=0.001$, $Q=-0.298$) |
| | Absent | | 34 | 40.5 | 72 | 85.7 | 50 | 59.5 | 52 | 61.9 | 47 | 56.0 | | | |
| Problems with the eyes | Present | | 51 | 60.7 | 7 | 8.3 | 15 | 17.9 | 16 | 19.0 | 29 | 34.5 | **$p<0.001$** | 75.139 | T1-T2 ($p<0.001$, $Q=0.524$)<br>T1-T3 ($p<0.001$, $Q=0.429$)<br>T1-T4 ($p<0.001$, $Q=0.417$)<br>T1-T5 ($p=0.001$, $Q=0.262$)<br>T2-T5 ($p=0.001$, $Q=-0.262$) |
| | Absent | | 33 | 39.3 | 77 | 91.7 | 69 | 72.1 | 68 | 81.0 | 55 | 65.5 | | | |
| Fatigue | Present | | 84* | 100 | 68 | 81.0 | 73 | 86.9 | 74 | 88.1 | 75 | 89.3 | $p=0.332$ | 3.412 | - |
| | Absent | | 0 | 0 | 16 | 19.0 | 11 | 13.1 | 10 | 11.9 | 9 | 10.7 | | | |
| Feeling exceptionally tired | Present | | 66 | 78.6 | 10 | 11.9 | 20 | 23.8 | 10 | 11.9 | 20 | 23.8 | **$p<0.001$** | 123.529 | T1-T2 ($p<0.001$, $Q=-0.655$)<br>T1-T3 ($p<0.001$, $Q=-0.536$)<br>T1-T4 ($p<0.001$, $Q=-0.655$)<br>T1-T5 ($p<0.001$, $Q=-0.536$) |
| | Absent | | 18 | 21.4 | 74 | 88.1 | 64 | 76.2 | 74 | 88.1 | 64 | 76.2 | | | |
| Difficulty sleeping | Present | | 35 | 41.7 | 35 | 41.7 | 41 | 48.8 | 42 | 50.0 | 51 | 60.7 | **$p=0.016$** | 12.169 | T1-T5 ($p=0.027$, $Q=0.190$)<br>T2-T5 ($p=0.027$, $Q=0.190$) |
| | Absent | | 49 | 58.3 | 49 | 58.3 | 43 | 51.2 | 42 | 50.0 | 33 | 39.3 | | | |
| Headaches | Present | | 48 | 57.1 | 26 | 31.0 | 40 | 47.6 | 30 | 35.7 | 32 | 38.1 | **$p=0.001$** | 18.491 | T1-T2 ($p=0.001$, $Q=0.262$)<br>T1-T4 ($p=0.018$, $Q=0.214$) |
| | Absent | | 36 | 42.9 | 58 | 69.0 | 44 | 52.4 | 54 | 64.3 | 52 | 61.9 | | | |
| Feeling anxious or troubled | Present | | 61 | 72.6 | 47 | 56.0 | 44 | 52.4 | 48 | 57.1 | 43 | 51.2 | **$p=0.008$** | 13.673 | T1-T3 ($p=0.021$, $Q=-0.202$)<br>T1-T5 ($p=0.011$, $Q=-0.214$) |
| | Absent | | 23 | 27.4 | 37 | 44.0 | 40 | 47.6 | 36 | 42.9 | 41 | 48.8 | | | |
| Feeling pessimistic, upset | Present | | 52 | 61.9 | 38 | 45.2 | 34 | 40.5 | 39 | 46.4 | 43 | 51.2 | **$p=0.015$** | 12.289 | T1-T3 ($p=0.011$, $Q=-0.214$) |
| | Absent | | 32 | 38.1 | 46 | 54.8 | 50 | 59.5 | 45 | 53.6 | 41 | 48.8 | | | |
| Change in sexual life | Present | | 54 | 64.3 | 0* | 0 | 5 | 6.0 | 5 | 6.0 | 1 | 1.2 | **$p<0.001$** | 129.542 | T1-T3 ($p<0.001$, $Q=0.543$)<br>T1-T4 ($p<0.001$, $Q=0.583$)<br>T1-T5 ($p<0.001$, $Q=0.631$) |
| | Absent | | 30 | 35.7 | 84 | 100 | 79 | 94.0 | 79 | 94.0 | 83 | 98.8 | | | |
| Change in the menstrual cycle | Present | | 46 | 54.8 | 1 | 1.2 | 2 | 2.4 | 1 | 1.2 | 1 | 1.2 | **$p<0.001$** | 160.280 | T1-T2 ($p<0.001$, $Q=-0.536$)<br>T1-T3 ($p<0.001$, $Q=-0.524$)<br>T1-T4 ($p<0.001$, $Q=-0.536$)<br>T1-T5 ($p<0.001$, $Q=-0.536$) |
| | Absent | | 38 | 45.2 | 83 | 98.8 | 82 | 97.6 | 83 | 98.8 | 83 | 98.8 | | | |

$T_1$, before cure; $T_2$, end of 1st cure; $T_3$, end of 4th cure; $T_4$, end of 8th cure; $T_5$, end of 12th cure; *Q*, Cochran Q test (Bonferroni Correction)

*Since the value on the boxes is "0," it could not be included in the statistical analysis

**Table 3** Time-related changes in the Body Perception Scale and Hospital Anxiety and Depression Scale Scores ($n=84$)

| | Mean (SD) | Coefficient of variation | $F$; $p$ |
|---|---|---|---|
| Time (BPS) | | | |
| $T_1$ | 134.75 (13.73) | 10.2% | 8.152 |
| $T_2$ | 130.54 (14.63) | 11.2% | **0.000*** |
| $T_3$ | 132.33 (12.01) | 9.1% | |
| $T_4$ | 129.60 (12.62) | 9.7% | |
| $T_5$ | 124.07 (10.44) | 8.4% | |
| Total | 130.2571 (13.19) | 10.10% | |
| Time (HADS-A) | | | |
| $T_1$ | 6.61 (4.74) | 71.8% | 6.865 |
| $T_2$ | 5.63 (3.86) | 68.6% | **0.000*** |
| $T_3$ | 4.48 (3.33) | 74.4% | |
| $T_4$ | 4.18 (3.01) | 72.1% | |
| $T_5$ | 4.30 (3.15) | 73.4% | |
| Total | 5.04 (3.78) | 75.0% | |
| Time (HADS-D) | | | |
| $T_1$ | 6.00 (4.16) | 69.4% | 3.708 |
| $T_2$ | 5.64 (3.37) | 59.7% | **0.006*** |
| $T_3$ | 6.13 (3.65) | 59.6% | |
| $T_4$ | 6.90 (3.23) | 46.8% | |
| $T_5$ | 7.44 (2.85) | 38.3% | |
| Total | 6.42 (3.53) | 54.9% | |

$T_1$, before cure; $T_2$, end of 1st cure; $T_3$, end of 4th cure; $T_4$, end of 8th cure; $T_5$, end of 12th cure; *BPS*, Body Perception Scale; *HADS*, Hospital Anxiety and Depression Scale; *SD*, standard deviation

*$p<0.05$

in their hands and feet. In contrast to the present study, Azim et al. (2011) showed that women receiving adjuvant therapy had more serious sexual problems compared to those receiving other treatments [40]. In the current study, BC patients receive paclitaxel regimen.

In after four cycles of AC chemotherapy were followed within the scope of the standard paclitaxel regimen used only in the treatment of early-stage BC. Due to the high side effect profile of the AC cycle, many symptoms were found to be quite high at the beginning of the cycle and relatively lower at the end of the first cycle. The researchers assumed that the gradual decrease in the symptom frequency perceived by the BC patients in the later stages of adjuvant paclitaxel courses in the study sample could be due to easier tolerance for the paclitaxel therapy as against for the systematic and aggressive chemotherapy protocol, including the AC treatment. It is also known that repeated courses of paclitaxel cause peripheral neuropathy due to axonal degeneration at cumulative doses [41]. In our study, the increase in numbness and pain in the hands and feet confirms the previous literature.

This study also evaluated the changes in body perception levels during the paclitaxel regimen. Based on the findings, the body perception scores of the patients were found to be highest at $T_1$, and lowest at $T_5$. Similarly, Villar et al. (2017) found that the body perception levels of the BC patients receiving chemotherapy decreased in the last evaluation compared to the first evaluation [38]. Two studies carried out in Brazil and Israel reported that the body perception levels of BC patients receiving chemotherapy decreased by 74.8% and 80.9%, respectively [42, 43]. In a systematic review conducted by Paterson et al. (2016), the body perception of BC patients was negatively affected in 35 out of the 36 studies [14]. It is presumed that the changes in symptom status such as alopecia, skin and nail changes, and neuropathic pain in BC patients during the paclitaxel regimen might be influential on the perceived negative changes in body perception. These conditions may lead to a significant decrease in the body perception levels over time.

Another important finding of this study was that the mean scores of the HAD-A subscale decreased in the first four measurements ($T_1$, $T_2$, $T_3$, and $T_4$) and relatively increased in the last measurement ($T_5$). Similarly, Villar et al. (2017) reported that the anxiety levels decreased significantly following the chemotherapy and radiotherapy treatments in BC patients [38]. Moreira and Canavarro (2010) also concluded that the anxiety levels of BC patients decreased during the period following surgery and chemotherapy [22]. Bergerot et al. (2017) stated that the anxiety levels of the cancer

**Table 4** Coefficients of Effects of Body Perception Scale ($n=84$)

| | Estimate | Std. error | $t$ | $p$ | 95% confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound |
| $T_1$ (reference category) | | | | | | |
| $T_2$ | −4.214 | 1.970 | −2.139 | **0.033*** | −8.087 | −0.342 |
| $T_3$ | −2.417 | 1.970 | −1.227 | 0.221 | −6.289 | 1.456 |
| $T_4$ | −5.155 | 1.970 | −2.617 | **0.009*** | −9.027 | −1.282 |
| $T_5$ | −10.679 | 1.970 | −5.420 | **0.000*** | −14.551 | −6.806 |

$T_1$, before cure; $T_2$, end of 1st cure; $T_3$, end of 4th cure; $T_4$, end of 8th cure; $T_5$, end of 12th cure

*$p<0.05$

**Table 5** Coefficients related to the effects of Hospital Anxiety and Depression Scale Scores ($n=84$)

| | Estimate | Std. error | $t$ | $p$ | 95% confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound |
| HADS-A | | | | | | |
| $T_1$ (reference category) | | | | | | |
| $T_2$ | −0.976 | 0.567 | −1.721 | 0.086 | −2.091 | 0.139 |
| $T_3$ | −2.131 | 0.567 | −3.757 | **0.000*** | −3.246 | −1.016 |
| $T_4$ | −2.429 | 0.567 | −4.282 | **0.000*** | −3.543 | −1.314 |
| $T_5$ | −2.310 | 0.567 | −4.072 | **0.000*** | −3.424 | −1.195 |
| HADS-D | | | | | | |
| $T_1$ (reference category) | | | | | | |
| $T_2$ | −0.357 | 0.537 | −0.665 | 0.507 | −1.413 | 0.699 |
| $T_3$ | 0.131 | 0.537 | 0.244 | 0.808 | −0.925 | 1.187 |
| $T_4$ | 0.905 | 0.537 | 1.684 | 0.093 | −0.151 | 1.961 |
| $T_5$ | 1.440 | 0.537 | 2.681 | **0.008*** | 0.384 | 2.497 |

$T_1$, before cure; $T_2$, end of 1st cure; $T_3$, end of 4th cure; $T_4$, end of 8th cure; $T_5$, end of 12th cure; *HADS* Hospital Anxiety and Depression Scale

*$p<0.05$

patients were highest on the first day and lowest on the last day of chemotherapy [44]. Considering all the findings of the studies, higher anxiety levels in the patients before the paclitaxel regimen may be related to the initiation of a new chemotherapy regimen and the uncertainties that may be experienced during the process. The decrease in the anxiety levels of the BC patients over time may be due to the relatively lower and moderate symptom severity during the paclitaxel regimen, and the improvement of physiological and psychological, individual coping strategies along with the increase in knowledge of and experience related to BC and its treatment.

We have also examined the changes in depression scores. Accordingly, the depression scores decreased at the end of $T_2$ compared to $T_1$ and gradually increased at $T_3$, $T_4$, and $T_5$. Confirming the findings of this study, Byar et al. (2006) had reported earlier that depression levels were low at the beginning and increased as the treatment progressed in BC patients receiving adjuvant chemotherapy [45]. Oh and Cho (2020) also stated that while the depression rate was 4% in South Korean BC patients before the chemotherapy started, it reached 30% after the chemotherapy [46]. Considering all the results, the lower levels of depression at the end of the first cycle and the higher levels as the course progressed may be related to the symptoms, the lack of comprehensive management of these symptoms, and the changes in body perception and anxiety levels following 12 weeks of paclitaxel regimen. The increase in the symptoms of depression at the end of the treatment may be attributed to the uncertainties in the prognoses and the treatment options to be continued.

## Limitations

Our findings should be interpreted in the context of some limitations. Since the treatment hours were at the same time in all the three study centers, some patients were missed and could never include in the study. Another limitation is that the first, fourth, eighth, and the twelfth (end of cure) assessments of 36 patients were compulsorily completed via phone interviews due to the announcement of the COVID-19 pandemic and the suspension of research in hospitals in Turkey as March 2020. Finally, we were limited with our demographic and clinical information form including cancer stage, previous treatments, number of children that may be associated with perceived anxiety, and depression. Therefore, further studies examining different variables that may increase the level of anxiety and depression, for example, providing care for children or older people, presence of family support, and employment status, are needed.

## Conclusions

To the best of our knowledge, this is the first study evaluating BC patients receiving paclitaxel in terms of symptom status, body perception levels, and the risk of anxiety and depression at five different time points during the paclitaxel protocol. Findings from this longitudinal study indicate that an increase in symptoms including pain, pins and needles in hands-feet, problems with the skin or nails, and difficulty sleeping, while a decrease in anxiety, and body perception and increase in depression at the end of paclitaxel regimen compared with the baseline. Paclitaxel regimen had a negative impact on both perceived

physical and psychological health on a population of BC. Our findings indicate that BC patients are particularly susceptible to such disruptions. Oncology nurses should be aware which symptoms may increase or decrease in BC patients receiving paclitaxel and plan their interventions for better management of these symptoms, and periodically screen and consult them regarding the changes in body perception, and the risk of anxiety and depression. Thus, vulnerable BC patients may be identified at an early stage and referred to professionals for appropriate support. This study showed that a comprehensive follow-up of BC patients by oncology nurses becomes important to alleviate the symptoms, improve body perception, and decrease the risk of anxiety and depression.

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**Author contribution** Gamze Gökçe Ceylan is the first author of this study. She has responsibility in conceptualization, data curation, formal analysis, investigation, methodology, resources, visualization, and writing. Zehra Gök Metin is the co-author of the study. She has responsibility in data curation, methodology, project administration, supervision, validation, and writing—review and editing. The final version of this manuscript is approved by all of the authors.

**Data availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Code availability** Not applicable.

## Declarations

**Ethics approval** Ethical approval was obtained from Hacettepe University Non-Interventional Clinical Research Ethics Committee (2019/06–10), and institutional permissions were obtained from hospital administrations to start the study. All information was collected in accordance with the Declaration of Helsinki.

**Consent to participate** Informed consent was obtained from all individual participants included in the study.

**Consent for publication** Informed consent was obtained from all individual participants included in the study.

**Conflicts of interest** The authors declare no competing interests.

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