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# The relationship between disability and depression, anxiety, and sleep quality in patients with coccydynia

## *Koksidinili hastalarda özürlülük ile depresyon, anksiyete ve uyku kalitesi ilişkisi*

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**Summary**

**Objectives:** In this study, our aim was to investigate the relationship between sleep quality, anxiety, depression, and disability in patients with coccydynia.

**Methods:** This prospective cross-sectional study evaluated 60 patients diagnosed with coccydynia. Clinical and demographic characteristics of the patients were recorded. Outcome measures included the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), and Pittsburgh Sleep Quality Index (PSQI), which were analyzed.

**Results:** Depressive symptoms and anxiety were detected in 47 (78.3%) and 49 (81.6%) of the 60 patients, respectively. Additionally, 46 (76.7%) patients were identified as poor sleepers. Our results demonstrated a statistically significant positive correlation between the quality of sleep and anxiety and depressive symptoms scores ($p<0.001$); there was also a statistically weak positive correlation with disability index values.

**Conclusion:** Depressive symptoms, anxiety, and poor sleep quality are exacerbated by disability in coccydynia. While coccydynia has been previously associated with neurotic disorders, the mechanisms underlying poor sleep quality remain unclear.

Keywords: Anxiety; coccyx; depression; sleep quality.

**Özet**

**Amaç:** Bu çalışmada, koksikodinili hastalarda uyku kalitesi ile anksiyete, depresyon ve özürlülük arasındaki ilişkiyi incelemeyi amaçladık.

**Gereç ve Yöntem:** Bu prospektif kesitsel çalışmada, koksikodini tanısı almış 60 hasta değerlendirildi. Hastaların klinik ve demografik özellikleri kayıt altına alındı. Görsel Analog Skala (VAS), Oswestry Özürlülük İndeksi (ODI), Beck Depresyon Envanteri (BDI), Beck Anksiyete Envanteri (BAI) ve Pittsburgh Uyku Kalitesi İndeksi (PSQI) değerlendirme araçları kullanılarak hastalar değerlendirildi.

**Bulgular:** Koksidinili 60 hastanın 47'sinde (%78.3) depresif semptomlar ve 49'unda (%81.6) anksiyete tespit edildi. Ayrıca, 46 hasta (%76.7) düşük uyku kalitesine sahipti. Uyku kalitesi ile anksiyete ve depresif semptomlar arasında istatistiksel olarak anlamlı pozitif bir ilişki bulundu ($p<0.001$); özürlülük indeksi değerleri ile ise istatistiksel olarak zayıf pozitif bir korelasyon saptandı.

**Sonuç:** Koksidinili hastalarda özürlülük arttıkça depresif semptomlar, anksiyete ve düşük uyku kalitesi de artmaktadır. Koksikodini daha önce nevrotik bozukluklarla ilişkilendirilmiş olsa da, düşük uyku kalitesine yol açan mekanizmalar net değildir.

Anahtar sözcükler: Anksiyete; depresyon; koksiks; uyku kalitesi.

## Introduction

The coccyx, commonly known as the tailbone, is a vestigial anatomical structure at the lower end of the vertebral column in humans. It comprises 3 to 5 fused bones in the terminal portion of the vertebral column. The coccyx is attached to the sacrococcygeal, sacrospinous, and sacrotuberous ligaments, as well as the levator ani, coccygeus, gluteus maximus, and iliococcygeus muscles. These ligaments and muscles, attached to the coccyx, support the pelvic floor and play a crucial role in controlling voluntary bowel movements. Additionally, the coccyx

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serves as a connecting structure between the spine and the hip bone, providing support and stability, especially while sitting. Coccydynia, a condition characterized by pain due to injury or inflammation of the coccyx, causes significant discomfort during sitting or transitioning from sitting to standing.[1,2] In advanced stages, coccydynia can lead to persistent pain, affecting patients even while lying down, resting, or sleeping.[3] This condition profoundly impacts the quality of daily life, necessitating adjustments in movement to alleviate pain. A variety of factors, including fractures, neoplasms, infectious pathologies, perineural cysts, visceral pain from urogenital and colorectal structures, and prior trauma, have been identified in patients with coccydynia.[4,5]

The prognosis of coccydynia differs from individual to individual. If left untreated, it can become chronic, leading to persistent pain. Over time, the pain may intensify, and functional disorders, such as the need to sit in specific postures due to sensitivity and an inability to tolerate pressure in the coccyx area, may develop.[6] These challenges can drastically diminish the quality of life, as simple daily activities become increasingly difficult.

Numerous studies have established a link between coccydynia and psychiatric disorders.[7–10] Bremmer first noted the association between coccydynia and neurosis in 1896.[11] Later, in 1959, Smith discussed the connection between coccydynia and psychiatric conditions like hysteria and obsessive-compulsive disorder.[12] It has been reported that 61% of patients with coccydynia also experience anxiety and/or depression.[9] This co-occurrence of pain and mood disorders might be attributed to serotonin transport polymorphisms within a shared pathophysiological mechanism involving an imbalance of inhibitory and excitatory neurotransmitters or cytokines.[13] Additionally, pain has been linked to sleep disorders, as well as depression and anxiety. Conditions such as poor sleep quality, difficulty initiating sleep, short sleep duration, sleep disorders, and sleep deprivation are more prevalent in patients with pain.[14] The shared pathophysiology of sleep regulation and pain perception may involve the serotonergic, mesolimbic dopaminergic pathways, immune system, endogenous opioid, and melatonin systems.[15]

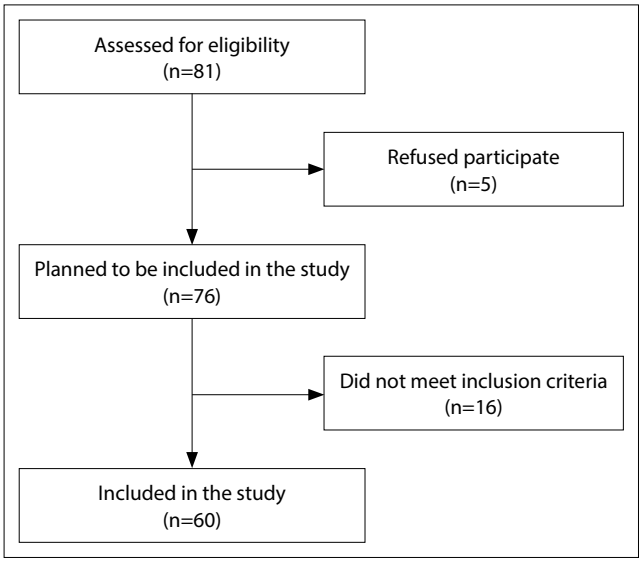


**Figure 1.** Flow diagram.

Although numerous studies have explored the connection between coccydynia and psychiatric diseases, research on the relationship between coccydynia and sleep quality is limited. Therefore, the objective of this cross-sectional study is to examine the correlation between sleep quality and anxiety, depression, and disability in patients with coccydynia.

## Materials and Methods

### Patient Selection

In this prospective cross-sectional study, we evaluated patients diagnosed with coccydynia who were consecutively admitted to a tertiary-level hospital between August and November 2021. A senior pain medicine consultant made the diagnosis of coccydynia based on an extensive medical history, clinical examination, and imaging procedures. The inclusion criteria included an age range of 18–70 years and consent to participate in the study. The exclusion criteria were cognitive impairment that would hinder the ability to respond to questionnaire items, a psychotic disorder, a history of neurological disease (including cerebrovascular accident, polyneuropathy, Parkinson's disease, dementia, epilepsy), and a diagnosis of rheumatological disease, fibromyalgia, or malignancy. Out of 81 patients assessed, 60 met the inclusion criteria, while 21 did not (Fig. 1).

### Ethical Approval and Consent

The local ethics committee (Sivas Cumhuriyet University, Faculty of Medicine, Ethics Committee for Clinical Research) approved this study, with the decision

number 2021-06/20. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. It was registered with ClinicalTrials.gov, under the registration number NCT05047380. All participants underwent controlled interviews and provided written informed consent to participate in this study.

## Assessment Scales

### Patient Data Collection

We recorded the age, gender, body mass index (BMI), and duration of coccydynia for each patient. The assessment of patients involved the use of several scales: the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), and Pittsburgh Sleep Quality Index (PSQI).

**VAS:** The VAS was utilized to assess the severity of the patients' pain on a scale from 0 to 10 cm, with higher scores indicating more severe pain.

**BDI:** The BDI, developed by Beck et al.,[16] evaluates physical, emotional, cognitive, and motivational symptoms of depression. Comprising 21 questions, higher scores indicate greater severity of depressive symptoms. Depression is classified as ≤9 points (normal), 10–16 points (mild), 17–29 points (moderate), and 30–63 points (severe). The validity and reliability of the BDI in Turkish were confirmed by Hisli et al.[17]

**BAI:** Also developed by Beck et al.,[18] the BAI assesses the presence and severity of anxiety. It consists of 21 questions, with higher scores indicating increased anxiety. Anxiety is classified as ≤9 points (normal), 10–18 points (mild), 19–29 points (moderate), and 30–63 points (severe). Ulusoy et al.[19] approved its validity and reliability in Turkish.

**PSQI:** The PSQI, encompassing 19 questions, evaluates various domains including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.[20] Higher scores on this questionnaire indicate poorer sleep quality. The score range is 0–21, with >5 points indicating poor sleep quality and ≤5 points indicating good sleep quality. Agargun et al.[21] confirmed its validity and reliability in Turkish.

**Table 1.** Demographic and clinical data of patients

| Characteristic | Data | | |
|---|---|---|---|
| | Mean±SD | n | % |
| Gender | | | |
| Female | | 53 | 88.3 |
| Male | | 7 | 11.7 |
| Age (years) | 44.3±12.1 | | |
| BMI (kg/m$^2$) | 28.84±5.39 | | |
| Duration of disease (years) | 12.8±11.5 | | |
| VAS scores | | | |
| Movement | 4.1±3.8 | | |
| Resting | 8.1±1.8 | | |
| Night | 4.2±3.6 | | |
| Sitting duration (minutes) | 20.3±25.3 | | |
| PSQI | 8.85±4.18 | | |
| Quality of sleep | | | |
| Poor | | 46 | 76.7 |
| Good | | 14 | 23.3 |
| BDI | 16.88±8.48 | | |
| Depression | | | |
| Mild | | 20 | 33.3 |
| Moderate | | 22 | 36.7 |
| Severe | | 5 | 8.3 |
| BAI | 19.41±11.73 | | |
| Anxiety | | | |
| Mild | | 14 | 23.3 |
| Moderate | | 17 | 28.3 |
| Severe | | 18 | 30.0 |
| ODI | 42.35±18.35 | | |

SD: Standard deviation; BMI: Body mass index; VAS: Visual Analogue Scale; PSQI: Pittsburgh Sleep Quality Index; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; ODI: Oswestry Disability Index.

**ODI:** The ODI measures functional recovery and severity of pain, self-care, lifting, walking, sitting, standing, social life, sleep, travel, and pain level across 10 items.[22] As the total score increases, so does the level of disability. The maximum score is 50 points, with 31–50 classified as severe, 11–30 as moderate, and 1–10 as mild disability. The total score obtained from the patient is converted into percentage values to evaluate the disability percentage. Yakut et al.[23] validated its reliability and applicability in Turkish.

## Statistical Analysis

We conducted the statistical analysis using IBM SPSS Statistics Standard Concurrent User Version 26 (IBM

**Table 2.** Comparison of depression, anxiety, sleep quality, disability, and pain severity values according to gender

| Measurement | Female (n=53) | Male (n=7) | p |
|---|---|---|---|
| BDI | 16.96±8.40 | 16.28±9.75 | 0.845* |
| BAI | 19.88±12.04 | 15.85±8.89 | 0.398* |
| PSQI | 9.26±4.18 | 5.71±2.81 | **0.034*** |
| ODI | 43.74±18.42 | 31.88±14.96 | 0.109* |
| VAS-movement | 4.0 (8.5) | 3.0 (6.0) | 0.839+ |
| VAS-resting | 9.0 (3.0) | 7.0 (4.0) | **0.015+** |
| VAS-night | 5.0 (7.5) | 0.0 (5.0) | 0.089+ |

*: Student t test; +: Mann-Whitney U test; Data presented as mean±standard deviation or median (Interquartile Range); VAS: Visual Analogue Scale; PSQI: Pittsburgh Sleep Quality Index; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; ODI: Oswestry Disability Index.

**Table 3.** Comparison of depression, anxiety, sleep quality, disability, and pain severity values according to age, bmi, and disease duration

| Measurement | Age | BMI | Duration of disease |
|---|---|---|---|
| BDI | r=-0.065; p=0.620 | r=0.070; p=0.595 | rho=0.334; p=0.009 |
| BAI | r=0.039; p=0.767 | r=0.094; p=0.477 | rho=0.316; p=0.014 |
| PSQI | r=0.017; p=0.900 | r=-0.093; p=0.480 | rho=0.124; p=0.344 |
| ODI | r=-0.014; p=0.914 | r=0.218; p=0.093 | rho=0.104; p=0.431 |
| VAS-movement | rho=-0.079; p=0.548 | rho=0.014; p=0.916 | rho=0.035; p=0.793 |
| VAS-resting | rho=0.105; p=0.423 | rho=0.192; p=0.142 | rho=0.145; p=0.270 |
| VAS-night | rho=0.001; p=0.999 | rho=0.194; p=0.137 | rho=0.173; p=0.186 |

r: Pearson correlation coefficient; rho: Spearman correlation coefficient; BMI: Body Mass Index; VAS: Visual Analogue Scale; PSQI: Pittsburgh Sleep Quality Index; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; ODI: Oswestry Disability Index.

Corp., Armonk, New York, USA). Descriptive statistics were presented as the number of units (n), percentage (%), mean±standard deviation (SD), median (M), and interquartile range (IQR). We used the Shapiro-Wilk test to evaluate the normal distribution of numeric variables. The Levene test assessed the homogeneity of variances. For comparing gender and numeric variables, we employed the Student's t-test for data with a normal distribution and the Mann-Whitney U test for data without a normal distribution. We assessed the correlation between numeric values using either Pearson or Spearman correlation analysis, depending on the normality of the data. A p-value of <0.05 was considered statistically significant.

## Results

Characteristics, pain severity, BAI, BDI, ODI, and PSQI of the 60 patients are presented in Table 1. According to BMI, the number of underweight (<18.5), healthy weight (18.5–24.9), overweight (25–29.9), obese (30–39.9), and morbidly obese (≥40) patients was 1 (1.70%), 12 (20.0%), 26 (43.3%), 17 (28.3%), and 4 (6.7%), respectively. In Beck depression and anxiety tests, depressive symptoms were not detected in 13 (21.7%) patients, and anxiety was not detected in 11 (18.3%) patients.

Table 2 details the comparison of outcome results by gender. Depressive symptoms, anxiety, disability, VAS-movement, and VAS-night values were significantly similar across genders. Resting pain level and PSQI points were statistically higher in female patients than in male patients (p<0.05). There was a statistically weak positive correlation between the duration of the disease and the depression and anxiety points of patients. The effect of age and BMI on depressive symptoms, anxiety, disability, pain level, and quality of sleep was identified as nonsignificant, as shown in Table 3. Furthermore, a statistically mid-level positive correlation was observed between the quality of sleep and anxiety and depression points, as well as a statistically weak positive correlation with disability index values (Table

**Table 4.** Correlations between anxiety, depression, sleep quality, pain severity, and disability values

| Measurement | PSQI | BDI | BAI | ODI |
|---|---|---|---|---|
| BDI | r=0.456; p<0.001† | – | – | – |
| BAI | r=0.459; p<0.001† | – | – | – |
| ODI | r=0.385; p=0.003¥ | r=0.446; p<0.001‡ | r=0.454; p<0.001‡ | – |
| VAS-movement | rho=0.252; p=0.052¥ | rho=0.139; p=0.294‡ | rho=0.365; p=0.004‡ | rho=0.470; p<0.001 |
| VAS-resting | rho=-0.002; p=0.998¥ | rho=0.001; p=0.995† | rho=-0.156; p=0.243† | rho=0.284; p=0.029¥ |
| VAS-night | rho=0.244; p=0.063¥ | rho=0.199; p=0.131‡ | rho=0.139; p=0.292‡ | rho=0.562; p<0.001 |

†: Adjusted for gender and disease duration; ‡: Adjusted for disease duration; ¥: Adjusted for gender; VAS: Visual Analogue Scale; PSQI: Pittsburgh Sleep Quality Index; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; ODI: Oswestry Disability Index.

4). The correlation coefficients between sleep quality scale points and VAS values were not statistically significant. There was a statistically mid-level positive correlation between ODI values and anxiety, depression, VAS-movement, and VAS-night points; and a weak positive correlation with VAS-rest values. While there was a statistically weak positive correlation between anxiety and VAS-movement, the correlation coefficients between VAS-rest and VAS-night values were not statistically significant. The correlation coefficients between depression points and VAS values were also not statistically significant (Table 4).

## Discussion

In this study, an increase in disability among coccydynia patients was observed to lead to heightened depression and anxiety, as well as diminished sleep quality. Additionally, it was noted that depression and anxiety were correlated with poor sleep quality, independent of pain level and disability. The demographic characteristics of the patients selected for our study align with findings in existing literature. Factors such as female gender and obesity predispose individuals to coccydynia. It is thought that in obese individuals, an imperfect pelvic rotation while sitting increases pressure on the coccyx. Additionally, the posterior placement of the coccyx in females, especially when sitting and during labor, is believed to increase coccygeal pressure. In our study, 78.3% of the patients were either overweight or obese. Coccydynia is typically observed around 40 years of age, and in our study, the mean age was 44.3±12.1.[24] The literature indicates that coccydynia occurs five times more frequently in females than in males; however, in our study, the rate was identified as eight times higher.[24]

Resting pain, a common symptom of coccydynia, was found to be more severe than pain experienced at night or during movement. Our questionnaire results showed that 78.3% of patients experienced depressive symptoms and 80% experienced anxiety, aligning with the high depression and anxiety scores reported in the literature. Hanley et al.[10] reported that among 98 coccygectomy patients, major depressive disorder was observed in 25 and anxiety in 23. Similarly, Scott et al.[9] found that 61% of coccydynia patients experienced anxiety and/or depression. In another study evaluating the surgical outcomes of 8 coccygectomy patients, at least one psychiatric disorder was identified in 7 patients.[8] Another study examining the relationship between coccygeal pain and depression found that antidepressant treatment alleviated coccygeal pain in most patients.[7] The condition's relation to the coccygeal plexus, which is responsible for coccyx innervation, is a significant factor. Overactivity in the coccygeal plexus nerves can lead to pain due to excessive contraction in the ligaments and muscles attached to the coccyx.[8] Mohanty suggested that increased resting tension in pelvic floor structures can be a reaction to stress and fear.[25] The chronic tension in these muscles may lead to the development of musculofascial trigger points.[3] A trigger point in pelvic floor muscles was found in 98% of coccydynia patients.[9] The hypothesis is supported by evidence showing reduced pain levels following pelvic muscle massages and stretching exercises.[25,26] Pain during dyspareunia and defecation in coccydynia patients indicates pelvic floor muscle involvement.[9] Patients with chronic pain are twice as likely to suffer from depression and 50% more likely to experience anxiety compared to those without pain.[27] The reciprocal rela-

tionship between pain and psychiatric disorders is possibly due to shared pathophysiological mechanisms.[28] The periaqueductal gray, substantia nigra, amygdala, and hypothalamus play roles in both depression and anxiety, as well as in the central modulation of pain response.[29] Research shows a correlation between pain intensity, the number of pain locations, days with pain, and levels of depression and anxiety, regardless of pain's etiology.[27] Kivrak et al.[28] argued that there is no gender difference in pain perception and noted that anxiety is more common in females, with anxiety scores being indicative of pain perception. Our study did not find a significant relationship between gender and depression or anxiety. Furthermore, unlike previous literature, we did not observe a relationship between depression and pain level. The study only identified a weak correlation between anxiety and pain level during movement. According to our data, anxiety and depression in coccydynia are primarily derived from disability.

Sleep is a crucial rehabilitative, physiological, and neurobiological process, accounting for approximately one-third of a person's lifetime. There is a cyclical relationship between sleep and pain: chronic pain can lead to sleep disorders, while sleeplessness can exacerbate chronic pain.[14] Changes in pain progression may occur due to disrupted sleep patterns. Just two nights of sleep deprivation can amplify pain in otherwise healthy individuals. Furthermore, prolonged periods of sleeplessness can increase pain severity. Even in healthy individuals, partial sleep deprivation can induce hyperalgesia, and interrupted sleep can lead to spontaneous pain the following day.[30] Karaman et al.[31] reported that 40% of patients with chronic pain experience poor sleep quality, which is associated with factors such as age, female gender, low income level, and high pain intensity. Conversely, Keilani et al.[14] found that the relationship between sleep quality and pain is influenced not by sociodemographic variables or pain duration but by pain intensity itself. In our study, 46% of patients with coccydynia were found to have poor sleep quality. While female gender was associated with lower sleep quality, consistent with existing literature, no correlation was found between sleep quality and pain level, including night pains.

The sleep quality in coccydynia patients shows a diminished correlation with depression and anxiety. To our knowledge, no study in the literature specifically examines the relationship between sleep and coccydynia. However, many studies have indicated that chronic pain and sleep problems are often accompanied by depression and anxiety, regardless of the pain's etiology.[14]

One limitation of our study is the unassessed income level of the patients. Lower income levels are often associated with poorer sleep quality and a higher frequency of psychiatric disorders.

## Conclusion

Coccydynia is a condition characterized by pain and resulting disability. In our study, most patients with coccydynia exhibited depressive symptoms and anxiety, which were found to negatively affect or impair their sleep quality. This raises a critical question: does coccydynia lead to psychiatric disorders and poor sleep quality, or do psychiatric disorders and poor sleep quality contribute to the development of coccydynia? Answering this question remains a challenge, underscoring the need for further research in this area. Understanding the directionality and interplay of these factors is essential for developing more effective treatment strategies for coccydynia and its associated conditions.

***Ethics Committee Approval: The Cumhuriyet University Clinical Research Ethics Committee granted approval for this study (date: 23.06.2021, number: 2021-06/20).***

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