MAKÜ

Mehmet Akif Ersoy University Journal of Health Science Institude

Volume 13, Issue 1

April 2025

OPEN ACCESS

https://dergipark.org.tr/en/pub/maeusabed

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Mehmet Akif Ersoy University Journal of Health Sciences Intitute (MAKU J. Health Sci. Inst.) is the publication of Mehmet Akif Ersoy University Health Sciences Institute. It is published three times annually. The journal is an international, independent, double-blind peer-reviewed, open access and online publishing journal, which aims to publish scientific articles in the field of medical sciences (veterinary, medicine, dentistry, nursing and sports sciences) are published. The language of the journal is English.

Mehmet Akif Ersoy University Journal of Health Sciences Institute is currently indexed in DOAJ databse.

The journal welcomes article submissions and does not charge any article submission fees.

Aim and Scope

Aim:

- **To disseminate high-quality research:** The journal aims to publish impactful scientific articles that contribute to the advancement of medical sciences.
- **To foster international collaboration:** By being an international journal, it seeks to connect researchers and promote the exchange of knowledge across borders.
- **To ensure accessibility and transparency:** The open-access nature of the journal aims to make research freely available to anyone, promoting wider readership and potential impact.

Scope:

Multidisciplinary focus: The journal covers a broad range of medical sciences, including:

- Veterinary medicine
- Human medicine
- Dentistry
- Nursing
- Sports sciences
- Technoology use in these disciplines

Original research: The emphasis on "scientific articles" suggests the journal prioritizes original research studies, potentially including:

- Experimental studies
- Clinical trials
- Observational studies
- Reviews (potentially systematic reviews and meta-analyses)
- **Rigorous peer review:** The double-blind peer-review process aims to ensure the quality and validity of published research.

In essence, the journal aims to be a leading platform for researchers in various medical fields to share their findings with a global audience, contributing to the progress of medical knowledge.

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Research Article

MAKU J. Health Sci. Inst.
2025, 13(1)

The Relationship Between Perceived Self-Efficacy and Perceived Stress in Physical Examination for Undergraduate Nursing Students: A Cross-Sectional Study

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ABSTRACT

This study aimed to examine the relationship between perceived self-efficacy and perceived stress in physical examination for undergraduate nursing students. A cross-sectional study was conducted with 212 undergraduate nursing students. Participants completed the General Self-Efficacy Scale and the Perceived Stress Scale. Pearson's correlation and multiple linear regression analyses were used to examine the relationship between self-efficacy and stress. The results showed a significant negative correlation between perceived self-efficacy and perceived stress ($r = -0.41$, $p < 0.001$). Students with higher levels of self-efficacy reported lower levels of stress. Additionally, self-efficacy was a significant predictor of perceived stress, accounting for 23% of the variance in stress levels. The findings suggest that enhancing nursing students' self-efficacy may be an important strategy for reducing stress during physical examination. Further research is needed to explore the specific mechanisms by which self-efficacy impacts stress in this population.

Key words: Self-efficacy, Stress, Nursing students, Physical examination

Recevived: 20-02-2025

Revision request: 24/03/2025

Revision received: 25/03/2025

Accepted: 06/04/2025

Available online: 02/05/2025

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INTRODUCTION

Contemporary healthcare system transformations and escalating care demands underscore the critical need for highly qualified and professionally competent nurses. Nurses' professional competencies extend beyond direct patient care to encompass accurate health assessments and informed clinical decision-making. Thus, the first phase in the nursing process health assessment, is a crucial component of professional nursing practice (Anderson et al., 2014; Görgülü, 2014; Eyüboğlu & Çalışkan, 2019).

Health assessment consists of stages such as taking the patient's health history, performing physical examination, analysing the data obtained from health records and recording these data. Physical examination, which is an important part of this process, is an important area of responsibility of nurses in health service delivery and is a basic tool in critical processes such as evaluation of the health status of the individual, early identification of health problems, creation of appropriate nursing care and monitoring of changes in the patient's condition (Birks et al., 2014; Demiray et al., 2020; Kıskaç & Rashıdı, 2024).

DOI: 10.24998/maeusabed.1643599

Physical examination includes the methodical evaluation of both subjective and objective data and is performed systematically by techniques such as inspection, palpation, percussion and auscultation (Bickley & Szilagyi, 2015; Kıskaç & Rashıdı, 2024).

Physical examination constitutes a fundamental pillar of safe and efficacious nursing practice (Kıskaç & Rashıdı, 2024). The use of these skills by nursing students offers many positive contributions such as verifying the data obtained from the patient, providing systematic care, strengthening nurse-patient communication, learning observation and analytical thinking, maintaining continuity of care and increasing professional autonomy. However, the acquisition and application of these skills can be a challenging process for students (Çalışkan et al., 2020; Gök & Zencir, 2022). As effective learning and implementation of these practices depends not only on technical knowledge and skills but also on students' self-confidence (self-efficacy) and stress level (Bandura, 1997; Lazarus and Folkman, 1984). Therefore, it is of great importance to gain physical examination skills in nursing education and to reduce stress levels by supporting students' self-efficacy perceptions in this field.

Self-efficacy is a person's belief in his or her ability to produce a desired level of performance. It relates to a person's belief in their ability to organise and execute action plans necessary to manage possible situations (Bandura 1995; Bandura, 1997). Although self-efficacy is often considered in an academic context, it can also involve the performance of psychomotor tasks, which makes this construct of particular interest for practice disciplines such as nursing, where psychomotor skill acquisition is a critical component of student education (Stump et al., 2012; Molina et al., 2014). Students' perceptions of self-efficacy affect their performance, their decisions regarding the choice of activities they participate in, their emotional reactions while performing behaviours and their persistence in performing these actions (Bandura, 1997; Molina and et al., 2014). Bandura (1997) stated that when students are faced with a task, if they believe that they can do it, they can show maximum effort and persist despite failure. It is important to focus on nursing students‘ self-efficacy perceptions in order to increase students’ success, improve the effectiveness of teaching programmes and improve the standard of patient care (Baran et al., 2020; Çevik Durmaz et al., 2020; Koç et al., 2019).

Stress is a process that occurs when the individual's resources to cope with environmental demands are inadequate (Lazarus & Folkman, 1984). The stress sources of nursing students include lack of knowledge, the thought of harming the patient, fear of doing wrong, taking responsibility for the care of a sick person from the early stages of their education, and low self-confidence (low self-efficacy perception) during practical applications (Lo, 2002; Elliot, 2002; Oner Altıok & Üstün, 2013; Karaca et al., 2017). Exposure of nursing students to prolonged and uncontrollable stress in their learning processes negatively affects their professional identity development and health (Shue et al., 2002; Edwards et al., 2010; Oner Altıok & Üstün, 2013) and decreases their academic success by impairing their thinking and decision-making competences (Atay & Yılmaz, 2011; Karaca et al., 2014). It is very important for students to be able to cope with stress in order to benefit from their educational experiences at the desired level and to develop positive professional identity. Self-efficacy perceptions play a decisive role on students' ability to cope with stress (Bulfone et al., 2016). In a study conducted by Göger & Çevirme (2019), the effect of self-efficacy levels of nursing students on educational stress was examined and it was found that students with high self-efficacy perception experienced lower stress. While a high level of self-efficacy perception enables students to take an active role in learning processes and perform more safely and effectively in clinical practice, high levels of stress negatively affect this process and reduce students' potential to develop their clinical skills (Bandura, 1997; Lazarus & Folkman, 1984; Gibbons et al., 2008; Şahin & Buzlu, 2017; Göger & Çevirme, 2019). In this context, examining the relationship between self-efficacy perceived by nursing students during physical examination and the stress they experience is of great importance in terms of improving the quality of nursing education. To our knowledge, this is the first study to investigate the relationship between perceived self-efficacy and perceived stress in nursing students. This study aims to contribute to the development of nursing education programmes and to better support students during clinical practice by investigating the relationship between nursing students' perceptions of self-efficacy in physical examination skills and the level of stress they experience.

MATERIAL AND METHODS

Study Design and Setting

The study was a descriptive cross-sectional study conducted to examine the relationship between self-efficacy perceived by nursing students during physical

examination practices and the stress they experience. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (File 1). The study was conducted at X University School of Health.

Study Population and Sample

The population of the study consisted of 470 nursing students studying in the 2nd, 3rd and 4th grades at X University School of Health. In the study, no sample selection was made and 212 students who accepted to participate in the study, who were over 18 years of age and who participated in the five-week laboratory where physical examination practices were explained and demonstrated were included in the sample group. In the study, 90 nursing students studying in the first year who did not take the physical examination laboratory were excluded from the sample.

Data Collection

Data were collected online between November 2024 and January 2025 using the 'Student Descriptive Information Form', 'Perceived Self-Efficacy in Physical Examination Scale for Undergraduate Nursing Students (PPSES)' and 'Perceived Stress Scale for Nursing Students (PSSS)'.

- Student Introductory Information Form: The form, which was prepared in line with the literature (Karaca et al., 2015; Çalışkan et al., 2020, Utli et al., 2023) consists of six questions inquiring students' demographic characteristics (age, gender, etc.) and academic achievement.
- Perceived Self-Efficacy in Physical Examination Scale for Nursing Undergraduate Students (PPSES): The Turkish validity and reliability of the scale developed by Nasaif et al. (2022) was conducted by Utli et al. (2023). The scale aims to define students' perceptions of their confidence levels in performing physical examination. The scale has six sub-dimensions and 48 items, including face and neck, eye, cardiovascular, ear, nose and throat, chest and other skills. The items in the scale are in the form of statements. Each item begins with the statement 'How confident are you in your ability,' and continues with students naming the specific skill they need to learn for each body system. In the scale, a four-point rating (1= I do not trust at all; 2= I trust to some extent but not very much; 3= I trust; 4= I trust a lot) was adopted. The average score for each sub-dimension are the questions that evaluate each system. The total scale mean score is calculated by taking the sum of the scores of all items. The average score determines the general level of trust perceived by the students for each factor. The Cronbach Alpha value of the scale is 0.986 (Utli et al., 2023) which was 0.97 in the present study. Permission was obtained from the corresponding author of the scale via e-mail.
- Perceived Stress Scale for Nursing Students (PSSS): The Turkish validity and reliability of the original Chinese scale developed by Sheu et al. (2002) was conducted by Karaca et al. (2015). The scale consists of a total of 29 items and six sub-dimensions. In the evaluation of the items, a five-point Likert-type evaluation was used as '4- Very stressful for me, 3, 2, 1, 0- Not stressful for me'. Total score varies between 0-116. A high score indicates a high degree of stress (Karaca et al., 2015). The Cronbach Alpha value of the scale is 0.93 (Karaca et al., 2015) which was 0.96 in the present study. Permission was obtained from the corresponding author of the scale via e-mail.

Data Analysis

This study investigated the self-efficacy levels perceived by participants during physical examinations and the independent variables influencing these perceptions. The study employed a multi-stage analytical approach. Initially, descriptive statistics were calculated. Subsequently, stepwise regression analysis was conducted, using perceived stress sub-dimensions as predictor variables and perceived self-efficacy in physical examination as the predicted variable. Finally, self-efficacy subscale scores for physical examination were compared across subgroups based on gender, age, grade level, region of residence, and academic achievement. Prior to group comparisons, the score distribution structure within each independent variable subgroup was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk normality tests. Normality was assumed if the p-value exceeded 0.05. Additionally, skewness and kurtosis coefficients were examined, with values between -2 and +2 indicating a normal distribution.

In addition, the Z values obtained by dividing the kurtosis and skewness coefficients by their standard errors were examined and it was assumed that the distribution was normal if these values were between -1.96 and +1.96 (Howitt & Cramer, 1997). Distributions meeting at least two of the three different criteria used in determining normality were accepted as normal. According to the results of the

analysis, all score distributions were found to be normal. Accordingly, independent samples t-test was used to compare independent variables with two subgroups, and one-way analysis of variance (ANOVA) was used to compare independent variables with more than two subgroups.

RESULTS

Descriptive statistics of the participants' scores obtained from the subscales of perceived self-efficacy and perceived stress in physical examination are presented in Table 1.

Analysing the scores obtained by the participants from the subscales of perceived self-efficacy in physical examination, it was observed that the scores in the "Other" subscale ranged between 23 and 84 and the mean score was 50.28±13.49. This shows that the participants had different levels of self-efficacy perception in areas including general skills during physical examination. In the "Chest" subscale, the scores ranged between 8 and 32 and the mean score was 18.05±5.24. In the "Cardiovascular" subscale, the scores ranged between 7 and 28 and the mean score was 17.41±4.42. This result shows that the participants' self-efficacy perceptions towards cardiovascular examination are concentrated in a certain range.

Participant-reported stress levels varied across subscales. Stress related to patient care had the highest mean score (18.16±6.70, range 0-32). Stress from instructors/nurses (13.81±5.10, range 0-24), homework/ workload (12.00±4.11, range 0-20), peers/daily life (7.66±3.78, range 0-16), lack of professional knowledge/ skills (6.88±2.62, range 0-12), and the environment (6.72±2.67, range 0-12) had progressively lower mean scores.

The correlation coefficients between the participants' perceived self-efficacy in physical examination and perceived stress subscales are presented in Table 2. The correlation coefficients between perceived self-efficacy in physical examination and perceived stress subscales showed that all relationships were negative. Moderate and negatively significant relationships were found between stress due to lack of professional knowledge and skills and all self-efficacy subscales ($r = -0.25$ to $r = -0.34$, $p < 0.01$). Similarly, moderate negative relationships were observed between the stress experienced while caring for the patient and self-efficacy subscales ($r = -0.21$ to $r = -0.29$, $p < 0.01$). The

Table 1. Descriptive Statistics Obtained from Participants' Perceived Self-Efficacy and Perceived Stress Subscales in Physical Examination

The Scale	Subscale	N	Min	Max	X̄±S.D
Perceived Self-Efficacy in Physical Examination	Face and Neck	221	3.00	12.00	7.69±1.70
	Eye	221	5.00	20.00	11.14±3.09
	Cardiovascular	221	7.00	28.00	17.41±4.42
	Ear, Nose and Throat	221	4.00	16.00	7.71±2.90
	Chest	221	8.00	32.00	18.05±5.24
	Other	221	23.00	84.00	50.28±13.49
Perceived Stress	Lack of professional knowledge and skills	221	0.00	12.00	6.88±2.62
	Experienced while caring for the patient	221	0.00	32.00	18.16±6.70
	Due to homework assignments and workload	221	0.00	20.00	12.00±4.11
	Due to instructors and nurses	221	0.00	24.00	13.81±5.10
	Environment-related	221	0.00	12.00	6.72±2.67
	From peers and daily life	221	0.00	16.00	7.66±3.78

Table 2. Descriptive Statistics Obtained from Participants' Perceived Self-Efficacy and Perceived Stress Subscales in Physical Examination

Scale	Face and Neck	Eye	Cardiovascular	Ear, Nose and Throat	Chest	Other
Lack of professional knowledge and skills	-0.25**	-0.26**	-0.29**	-0.29**	-0.31**	-0.34**
Experienced while caring for the patient	-0.26**	-0.21**	-0.25**	-0.29**	-0.29**	-0.29**
Due to homework assignments and workload	-0.19**	-0.13	-0.13	-0.19**	-0.16*	-0.21**
Due to instructors and nurses	-0.25**	-0.12	-0.12	-0.20**	-0.14*	-0.17*
Environment-related	-0.21**	-0.16*	-0.17**	-0.26**	-0.26**	-0.25**
From peers and daily life	-0.13	-0.08	-0.16	-0.10	-0.10	-0.15**

*Significant value at 0.05 level.
**Significant value at 0.01 level.

relationships between stress due to homework and workload and self-efficacy subscales were at a lower level, and significant but weak relationships were found in some subscales (r = -0.16 to r = -0.21).

Significant low-level negative correlations were found between stress from lecturers and nurses and some self-efficacy subscales (r = -0.12 to r = -0.25). However, no significant correlations were found for the Eye and Cardiovascular subscales (p > 0.05). There were low to moderate negative significant associations between environmentally-induced stress and all self-efficacy subscales (r = -0.16 to r = -0.26). The associations between stress from peers and daily life and self-efficacy were quite low, with only the other subscale showing a significant negative association (r = -0.15, p < 0.01). No significant relationship was found for the other subscales,

Table 3. Regression Analysis Results Related to the Prediction of Participants' Perceived Self-Efficacy Subscale Scores in Physical Examination

Predicted	Predictor	B	Error	β	t	p	df	F	p	R	R^2
Face and Neck	Constant	8,87	0,32		27,70	<0,001	1 219	15.43	<0.001	0.26	0.07
	-1	-0,07	0,02	-0,26	3,93	<0,001					
Eye	Constant	13,27	0,57		23,44	<0,001	1 219	16.20	<0.001	0.26	0.07
	-2	-0,31	0,08	-0,26	4,03	<0,001					
Cardiovascular	Constant	20,80	0,80		25,96	<0,001	1 219	20.49	<0.001	0.29	0.09
	-2	-0,49	0,11	-0,29	4,53	<0,001					
Ear. Nose and Throat	Constant	9,93	0,53		18,87	<0,001	1 219	20.43	<0.001	0.29	0.09
	-2	-0,32	0,07	-0,29	4,52	<0,001					
Chest	Constant	22,36	0,94		23,70	<0,001	1 219	23.80	<0.001	0.31	0.10
	-2	-0,63	0,13	-0,31	4,89	<0,001					
Other	Constant	62,21	2,41		25,83	<0,001	1 219	28.13	<0.001	0.34	0.11
	-2	-1,74	0,33	-0,34	5,30	<0,001					

(1)= Stress experienced while caring for the patient, (2)= Lack of professional knowledge and skills

Table 3. Regression Analysis Results Related to the Prediction of Participants' Perceived Self-Efficacy Subscale Scores in Physical Examination

Subscale	Variable	Level	N	X̄±S.D	df	t/F	p	η²	Difference
Face and Neck	Gender	Female	164	7.62±1.57	219	1.14	0.257	-	-
		Male	57	7.91±2.03					
	Class	2nd class (1)	107	7.37±1.58	2 218	3.88	0.022	0.03	2-1
		3nd class (2)	34	8.12±1.53					
		4th class (3)	80	7.94±1.85					
	Age	18-19(1)	44	7.25±1.37	3 217	2.94	0.034	0.04	4-1
		20-21(2)	111	7.64±1.79					
		22-23(3)	53	7.92±1.50					
		24 and above(4)	13	8.69±2.25					
	Region of residence	Mediterranean	77	7.66±1.75	4 216	0.56	0.694	-	-
		Aegean	76	7.54±1.54					
		Marmara	13	8.23±2.39					
		Central Anatolia	18	7.83±1.54					
		South/Eastern Anatolia	37	7.81±1.73					
	Success Status	Low	59	7.47±1.97	2 218	0.67	0.515	-	-
		Middle	73	7.75±1.42					
		High	89	7.79±1.72					
Eye	Gender	Female(1)	164	10.85±2.89	219	2.36	0.019	0.02	2-1
		Male(2)	57	11.96±3.52					
	Class	2nd class (1)	107	10.23±2.52	2 218	9.67	<0.001	0.08	2-1. 3-1
		3nd class (2)	34	11.85±2.35					
		4th class (3)	80	12.05±3.69					
	Age	18-19(1)	44	10.43±2.16	3 217	3.00	0.031	0.04	4-1
		20-21(2)	111	11.01±3.23					
		22-23(3)	53	11.51±3.10					
		24 and above(4)	13	13.15±3.76					
	Region of residence	Mediterranean	77	11.18±3.33	4 216	0.75	0.557	-	-
		Aegean	76	10.83±2.79					
		Marmara	13	11.54±3.10					
		Central Anatolia	18	10.67±2.91					
		South/Eastern Anatolia	37	11.78±3.29					
	Success Status	Low	59	10.88±2.75	2 218	0.29	0.752	-	-
		Middle	73	11.26±3.09					
		High	89	11.21±3.33					
Cardiovascular	Gender	Female	164	17.23±4.15	219	1.06	0.289	-	-
		Male	57	17.95±5.12					
	Class	2nd class (1)	107	15.63±3.98	2 218	20.11	<0.001	0.16	2-1. 3-1
		3nd class (2)	34	18.71±4.04					
		4th class (3)	80	19.25±4.22					
	Age	18-19(1)	44	16.09±3.8	3 217	7.93	<0.001	0.10	4-1, 4-2, 4-3
		20-21(2)	111	16.96±4.65					
		22-23(3)	53	18.30±3.77					
		24 and above(4)	13	22.08±3.35					
	Region of residence	Mediterranean (1)	77	17.18±4.09	4 216	2.96	0.021	0.05	3-1
		Aegean (2)	76	16.72±4.27					3-2
		Marmara(3)	13	20.77±5.17					
		Central Anatolia (4)	18	16.94±5.15					
		South/Eastern Anatolia (5)	37	18.35±4.28					
	Success Status	Low	59	16.08±4.77	2 218	4.95	0.008	0.04	3-1
		Middle	73	17.32±4.20					
		High	89	18.37±4.15					
Ear. Nose and Throat	Gender	Female(1)	164	7.42±2.78	219	2.51	0.013	0.03	2-1
		Male(2)	57	8.53±3.11					
	Class	2nd class (1)	107	6.53±2.02	2 218	19.89	<0.001	0.15	2-1, 3-1
		3nd class (2)	34	8.82±2.72					
		4th class (3)	80	8.80±3.35					
	Age	18-19(1)	44	6.32±1.7	3 217	7.53	<0.001	0.09	3-1, 4-1
		20-21(2)	111	7.59±2.78					
		22-23(3)	53	8.66±3.38					
		24 and above(4)	13	9.46±2.99					
	Region of residence	Mediterranean	77	7.32±2.7	4 216	0.89	0.472	-	-
		Aegean	76	7.63±2.77					
		Marmara	13	8.15±3.53					
		Central Anatolia	18	8.33±3.33					
		South/Eastern Anatolia	37	8.19±3.13					
	Success Status	Low	59	7.63±2.82	2 218	0.86	0.426	-	-
		Middle	73	7.41±2.78					
		High	89	8±3.05					
Chest	Gender	Female(1)	164	17.55±5.02	219	2.46	0.015	0.03	2-1
		Male(2)	57	19.51±5.61					
	Class	2nd class (1)	107	15.47±4.04	2 218	33.43	<0.001	0.23	2-1, 3-1
		3nd class (2)	34	19.74±3.54					
		4th class (3)	80	20.8±5.59					
	Age	18-19(1)	44	16.07±3.81	3 217	13.64	<0.001	0.16	3-1, 4-1 3-2, 4-2 4-3
		20-21(2)	111	17.24±5.03					
		22-23(3)	53	19.81±5.17					
		24 and above(4)	13	24.54±4.84					
	Region of residence	Mediterranean	77	17.19±5.25	4 216	2.22	0.068	-	-
		Aegean	76	17.72±4.64					
		Marmara	13	21.15±5.9					
		Central Anatolia	18	18.89±4.66					
		South/Eastern Anatolia	37	19.03±5.99					
	Success Status	Low	59	16.93±5.29	2 218	2.37	0.096	-	-
		Middle	73	18.01±5.03					
		High	89	18.83±5.28					
Other	Gender	Female(1)	164	48.57±12.63	219	3.25	0.001	0.05	2-1
		Male(2)	57	55.18±14.73					
	Class	2nd class (1)	107	44.13±10.46	2 218	26.54	<0.001	0.20	2-1, 3-1
		3nd class (2)	34	56.12±7.49					
		4th class (3)	80	56.01±15.39					
	Age	18-19(1)	44	45.34±9.51	3 217	7.75	<0.001	0.10	3-1, 4-1 4-2
		20-21(2)	111	49.32±13.3					
		22-23(3)	53	53.15±14					
		24 and above(4)	13	63.46±14.73					
	Region of residence	Mediterranean	77	48.12±12.5	4 216	1.88	0.115	-	-
		Aegean	76	49.89±12.29					
		Marmara	13	58.08±15.78					
		Central Anatolia	18	51±15.68					
		South/Eastern Anatolia	37	52.46±15.17					
	Success Status	Low	59	48.08±13.31	2 218	1.07	0.345	-	-
		Middle	73	51.21±13.31					
		High	89	50.97±13.73					

indicating that self-efficacy perception was not significantly related to stress from peer relationships or daily life.

Regression analysis results regarding the prediction of participants' perceived self-efficacy subscale scores in physical examination are presented in Table 3. When the results of the stepwise regression analysis for the prediction of perceived self-efficacy subscale scores in physical examination were examined, it was seen that only the variables “Stress experienced while providing care to the patient” and “Stress caused by lack of professional knowledge and skills” were significant predictors. The other stress subscales (stress from assignments and workload, stress from instructors and nurses, stress from the environment, and stress from peers and daily life) were not included in the regression models because they were not significant. According to the results of the analysis for the prediction of the Face and Neck subscale, stress experienced while caring for the patient is a significant predictor ($\beta = -0.26$, $p < 0.001$). The regression model was significant ($F(1,219) = 15.43$, $p < 0.001$) and the variance explained was 7% ($R^2 = 0.7$). In the analyses for the prediction of Eye, Cardiovascular, Ear, Nose and Throat, Chest and Other subscales, stress due to lack of professional knowledge and skills was identified as a significant predictor ($\beta = -0.26$ to -0.34, $p<0.001$). All models were significant ($p < 0.001$) and the contribution of the variable to the explained variance ranged between 7% and 11% ($R^2 = 0.07 - 0.11$). In particular, $R^2 = 0.11$ was found for the Other subscale and the model had the highest variance explanatory power. In general, the strongest predictor variable on the perceived self-efficacy level in physical examination was stress due to lack of professional knowledge and skills. In addition, only the stress experienced while caring for the patient in the Face and Neck subscale was found to be a significant predictor. Other stress factors were not included in the models because they did not show a significant relationship with self-efficacy subscales.

The results of the analysis conducted to determine whether the participants' perceived self-efficacy subscale scores in physical examination differed according to the subgroups of independent variables showed that there were significant differences in some subscales according to gender, grade, age, region of residence and academic achievement status variables. Post-hoc tests were applied for the variables with significant differences and the differences between the groups were determined. The mean comparison results of the participants' perceived self-efficacy in physical examination subscale scores according to the subgroups of ındependent variables are also given in Table 4.

DISCUSSION

The results indicated a significant negative correlation between these two constructs, suggesting that higher self-efficacy is associated with lower stress levels. This aligns with existing literature that posits an inverse relationship between self-efficacy and stress (Gómara et al., 2020; Shehadeh et al., 2020). Individuals with strong self-efficacy beliefs tend to approach challenges with greater confidence and resilience, perceiving potentially stressful situations as manageable rather than threatening (Hartelt & Martens, 2024).

The findings further illuminate this relationship by identifying specific stressors that significantly influence self-efficacy. Stress due to lack of professional knowledge and skills emerged as the strongest predictor of self-efficacy in physical examination. This highlights the importance of robust educational programs that equip students with the knowledge and skills necessary to perform physical examinations competently. As students gain competence and confidence in their abilities, the perceived stress associated with these tasks is likely to decrease. Similarly, the stress experienced while caring for patients was also an important determinant of self-efficacy, especially in the Face and Neck subscale. This suggests that practical experience and exposure to real-world clinical scenarios may be crucial for developing self-efficacy in this specific domain. Interestingly, other stressors such as workload, instructors, nurses, environment and daily life did not significantly predict self-efficacy. This may indicate that these stressors, while potentially influential on overall well-being, do not directly affect students' confidence in their physical examination skills. Furthermore, the study indicated notable differences in self-efficacy based on demographic and academic factors. Older students, those in higher grade levels, and high-achieving students consistently reported higher self-efficacy perceptions. This could be attributed to the cumulative effect of experience, advanced training, and positive feedback received throughout their academic journey (Mitchell & McMillan, 2018). These findings highlight the need for targeted interventions to support younger, less experienced, and lower-achieving students in developing their self-efficacy. Strategies such as mentorship programs, individualized feedback, and opportunities for deliberate practice could be beneficial in addressing these disparities.

The negative correlation between stress related to lack of professional knowledge/skills and self-efficacy across all subscales reinforces the importance of comprehensive training in physical examination techniques. As students gain competence in these skills, they are more likely to perceive them as less stressful. This emphasizes the need for curricula to prioritize the development of both theoretical knowledge and practical skills in physical examination. Moreover, the significant negative relationship between stress experienced during patient care and self-efficacy further highlights the value of clinical experience in fostering self-efficacy. Providing students with ample opportunities to interact with patients and practice their skills in a supervised setting can contribute to increased confidence and reduced stress (Ibrahim et al., 2019; Ferreira et al., 2020).

The observed differences in self-efficacy based on student characteristics warrant further investigation. While older students and those in higher grade levels demonstrated higher self-efficacy, the reasons behind these differences require more in-depth exploration. Future research could examine the specific factors contributing to these disparities, such as clinical exposure, feedback mechanisms, and learning styles. Understanding these nuances can inform the development of tailored interventions to promote self-efficacy among all nursing students. Additionally, exploring the influence of gender, region of residence, and academic achievement on self-efficacy could provide valuable insights for creating more inclusive and effective educational strategies. For instance, understanding why female students reported higher self-efficacy in certain subscales could help identify best practices for promoting self-efficacy among male students in those areas. Similarly, investigating the impact of living in urban regions on self-efficacy could inform the development of targeted support for students from different geographical backgrounds. By addressing these individual and contextual factors, nursing programs can strive to create a learning environment that fosters self-efficacy and reduces stress among all students (Ibrahim et al., 2019; Shehadeh et al., 2020; Shrestha & Tuladhar, 2021). This, in turn, can contribute to improved clinical competence and better patient care outcomes. Furthermore, future research could explore the long-term impact of self-efficacy on career satisfaction, job performance, and professional development among nurses. Understanding the trajectory of self-efficacy throughout a nurse's career can inform the development of continuing education programs and professional development initiatives to support ongoing growth and resilience in the field (Ibrahim et al., 2019; Shrestha & Tuladhar, 2021).

The regression analysis results presented in Table 3 illuminate the relationship between perceived self-efficacy in physical examination and specific stress factors among nursing students. Notably, stress stemming from a lack of professional knowledge and skills emerged as the most robust predictor of self-efficacy. This finding aligns with existing literature highlighting the inverse relationship between self-efficacy and stress (Karabacak et al., 2013; Mohamadirizi et al., 2015; Gómara et al., 2020). Students who feel confident in their knowledge and skills are more likely to approach clinical situations with assurance, thereby mitigating stress and fostering a stronger sense of self-efficacy (Siddiqui, 2018; Shehadeh et al., 2020; Hartelt & Martens, 2024). Furthermore, stress experienced while providing patient care significantly predicted self-efficacy, particularly in the Face and Neck subscale. This suggests that direct patient interaction can be a source of stress for students, potentially impacting their confidence in performing physical examinations in sensitive areas like the face and neck. This underscores the importance of providing ample opportunities for supervised practice and feedback in these specific areas to build students' comfort and self-assurance (Woods et al., 2014; Tawfeek et al., 2021). The negative impact of stress related to evaluation by instructors and nurses on self-efficacy highlights the need for a supportive and constructive learning environment. Students who perceive high levels of judgment or criticism from faculty and clinical staff may be more likely to experience diminished self-efficacy. Fostering a culture of mentorship, constructive feedback, and peer-to-peer support can be instrumental in cultivating a learning environment that nurtures self-efficacy and mitigates stress (Klassen & Klassen, 2018; Ibrahim et al., 2019; Tawfeek et al., 2021).

The additional analyses examining differences in self-efficacy subscale scores based on demographic and academic factors indicated significant variations across gender, grade, age, region of residence, and academic achievement. These findings suggest that individual characteristics can influence self-efficacy development and highlight the need for tailored educational interventions to support students from diverse backgrounds. For instance, younger or lower-achieving students might benefit from targeted support and mentorship to enhance their self-efficacy and foster a positive learning experience. Similarly, addressing any gender-based disparities in self-efficacy could contribute to

more equitable clinical skill development among all students (Cattelino et al., 2018; Tawfeek et al., 2021).

Overall, these results underscore the critical role of stress management and targeted educational strategies in promoting self-efficacy among nursing students. By addressing specific stressors, such as lack of professional knowledge and patient care-related anxieties, nursing programs can empower students to develop the confidence and competence necessary for successful clinical practice. Further research exploring the effectiveness of interventions aimed at enhancing self-efficacy and reducing stress in nursing education is warranted.

CONCLUSION

In conclusion, this study provides evidence that nursing students' perceived self-efficacy in physical examination is negatively related to their perceived stress, with stress from lack of professional knowledge/skills and patient care being significant predictors. Efforts to enhance nursing students' self-efficacy in physical examination, such as through targeted training and feedback, may help reduce their perceived stress and improve their clinical competence. These findings suggest that nursing programs should focus on developing strategies to enhance self-efficacy in physical examination, particularly among younger, less experienced, and lower-achieving students.

LIMITATIONS

The outputs of this study should be interpreted taking into account some limitations. First, the study was conducted in a single institution due to limitations in available manpower, working time and funding. This may limit the generalizability of the study results to all nursing students. Therefore, we recommend that further cross-sectional studies with multicentre and larger sample sizes be conducted to increase the generalizability of the results. Secondly, considering that the data collection method used in this study was a questionnaire, the psychological state of the respondents, which was beyond the control of the researcher, may have affected their answers.

ETHICAL APPROVAL

This study was conducted according to the Declaration of Helsinki. The ethical approval was obtained from the Burdur Mehmet Akif Ersoy University's Clinical Research Ethics Committee (Date: 05.11.2024 Number: GO 2024/658). The participants were given information about the aim and procedure of the study.

AUTHOR CONTRIBUTIONS

Idea, concept and design: ŞBD, HC
Data collection and analysis: ŞBD, HC
Drafting of the manuscript: ŞBD, HC
Critical review: ŞBD, HC

CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

RESEARCH FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ACKNOWLEDGEMENTS

We would like to thank all the participants who made this study possible.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Mehmet Akif Ersoy University Journal of Health Sciences Institute

Research Article

MAKU J. Health Sci. Inst.
2025, 13(1)

Importance of B-type Natriuretic Peptide (BNP) Analysis and Hemogram Evaluation in Cats wıth Pericardial Effusion Detected on

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ABSTRACT

This study aimed to measure plasma N-terminus pro-B-type natriuretic peptide (NT-proBNP) levels and hemogram parameters in 20 cats diagnosed with pericardial effusion by echocardiographic examination and to determine whether NT-proBNP could be used as a cardiac biomarker in the confirmation of pericardial effusion.

The study was conducted on 40 cats, consisting of a patient group of 20 cats of different ages, breeds and genders diagnosed with pericardial effusion by echocardiographic examination at the Cat Hospital Animal Hospital, and a control group of 20 healthy cats in terms of heart diseases. Blood samples were taken from the patient group and the control group cats for total blood count and NT-proBNP analysis. NT-proBNP values were determined from the prepared serum samples using the Vcheck200 – BIONOTE device. Total blood count was performed using the IDEXX ProCyte Dx TM Hematology Analyzer. After pericardial effusion was detected in echocardiography examination, M-mode measurement parameters such as left ventricular free wall thickness (LVPW) in systole and diastole, interventricular septum wall thickness (IVSD) in systole and diastole, end-diastole and end-systole left ventricular internal diameter (LVID), left atrium internal diameter (LA), aortic diameter (AO), LA/AO ratio, left ventricular ejection fraction (EF), and fractional shortening (FS) were evaluated.

In conclusion, in the statistical analysis of the data obtained in this study, while no statistically significant difference was observed between the groups in total blood count, it was determined that NT-proBNP increased significantly in cats with pericardial effusion. Therefore, it was concluded that NT-proBNP may be a good biomarker in terms of evaluating the wall stress caused by the fluid accumulated in the pericardium in cats with pericardial effusion.

Key words: cat, echocardiography, N-terminus pro-B-type natriuretic peptide, pericardial effusion

Recevived: 31/12-/024

Revision request: 27/01/2025

Revision received: 30/01/2025

Accepted: 31/01/2025

Available online: 02/05/2025

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INTRODUCTION

Pericardial effusion refers to an increase in the physiological fluid level within the pericardial sac and may cause cardiac tamponade (Davidson et al., 2008). Pericardial effusion is the most frequently detected pericardial disorder. Pericardial effusion causes hemodynamic disorders at various levels after an increase in intrapericardial pressure (Ware, 2011). Effusions and decreased cardiac output affect both the cardiovascular picture and the general condition of cats. In other words, if the fluid volume in the pericardial sac increases and intrapericardial pressure increases, it can lead to cardiac tamponade and gradually decreasing cardiac output, followed by signs of right heart failure. The symptomatic condition indicates a poor prognosis (Cote et al., 2011).

DOI: 10.24998/maeusabed.1610651

Pericardial effusion has been reported to develop secondary to common diseases including hypertrophic cardiomyopathy (HCM), neoplasia, feline infectious peritonitis (FIP), peritoneopericardial diaphragmatic hernia (PPDH), anemia, uremia, systemic infections and idiopathic pericarditis (Hall et al., 2007; Davidson et al., 2008; Ciaravolo et al., 2022). In one study, pericardial effusion secondary to HCM, DCM, RCM or mitral valve disease was detected in 28% of cats (Stokol et al., 2008).

Clinical findings resulting from pericardial effusion are due to changes in cardiac function. They depend on the rate of fluid accumulation and the severity of cardiac tamponade (Owens, 1977). Since clinical signs are not specific in cats with pericardial effusion, it is important to evaluate any cat with abdominal breathing for pericardial disease. Weakness and exercise intolerance are also important findings. Pericardial effusion can be detected in cats with small volume levels without any clinical signs (French, 2010). Regular monitoring and imaging of cats for heart disease is the recommended approach by physicians (Little and Freeman, 2006).

In asymptomatic patients, radiographic and echocardiographic examination is an important method in the diagnosis of heart diseases. The heart and respiratory system should be evaluated together in the examination (Krüger et al., 2016). In echocardiographic examination, pericardial effusion appears as a non-echoic space around the heart. If a cat has a concomitant pleural effusion, the pericardium gives a hyperechogenic thin white image at the base of the heart (Stokol et al., 2008). Echocardiography is a more reliable tool in the diagnosis of heart diseases. However, echocardiography is a more time-consuming and expensive procedure. For this reason, the evaluation of cardiac biomarkers is recommended for diagnosis with faster results and more affordable costs (Gavazza et al., 2021).

Cardiac biomarkers are useful in evaluating asymptomatic cats for cardiomyopathy, assessing prognosis, and distinguishing between cardiogenic and noncardiogenic causes in cats with respiratory findings. Cardiac biomarkers, particularly natriuretic peptides, have gained increasing acceptance over time as sensitive, specific, and safe tools useful in identifying patients with heart failure and determining its severity (Fox et al., 2009; Hsu et al., 2009).

The aim of this study was to measure plasma NT-proBNP levels and hemogram parameters in 20 cats diagnosed with pericardial effusion by echocardiographic examination and to determine whether NT-proBNP could be used as a cardiac biomarker in the confirmation of pericardial effusion

MATERIAL AND METHODS

The presented study was conducted in accordance with the decision of Kırıkkale University Animal Experiments Local Ethics Committee dated 15/11/2023 and numbered E-217201.

Animal material

The animal material of the study consists of a total of 40 cats, 20 cats (Patient group) and 20 healthy cats

Table 1. Individual information of cats in the Patient and Control groups

Patient Group (with pericardial effusion) (n=20)			**Control Group (Healthy) (n=20)**		
Age	Gender	Breed	Age	Gender	Breed
1	Female	Scottish Fold	1	Male	Tabby
1.5	Male	Britishshorthair	1	Female	Britishshorthair
2	Female	Britishshorthair	1	Female	Britishshorthair
2	Female	Scottish Fold	2	Male	Tuxedo
2	Male	Britishshorthair	3	Female	Tabby
2	Male	Britishshorthair	3	Female	Tabby
2	Male	Tabby	3	Female	Scottish Fold
3	Female	Scottish Fold	6	Male	Tabby
3	Male	Scottish Fold	6	Male	Sarman
3	Male	Britishshorthair	6	Male	Chinchilla
6	Female	Tabby	6	Female	Tabby
8	Male	Sarman	6	Female	Scottish Fold
8	Female	Tabby	6	Female	Britishshorthair
9	Male	Britishshorthair	7	Female	Tabby
9	Male	Britishlonghair	7	Female	Tabby
10	Male	Tabby	8	Male	Tabby
11	Male	Tuxedo	9	Male	Tabby
12	Male	Tabby	11	Female	Britishlonghair
13	Male	Persian	11	Male	Sarman
13	Female	Tabby	14	Female	Angora cat

(Control group), aged between 1-14 years, of different breeds and genders, diagnosed with pericardial effusion at Cat Hospital Animal Hospital (Table 1).

Sampling procedures

In order to perform the necessary blood evaluation from the patient group and the control group, 1 ml of blood was taken from the vena cephalica antebrachii into EDTA tubes and 3 ml of blood into tubes without anticoagulant. Serum was prepared by centrifuging the blood taken into empty tubes for 5 minutes at 3200 rpm without wasting time (LC – 04B, HASVET). NT-proBNP values were determined from the prepared serum samples quickly with the commercial kit Vcheck Feline NT-proBNP, BIONOTE and Vcheck200 – BIONOTE device.

Hemogram analysis from blood samples taken in anticoagulant tubes was performed with IDEXX ProCyte Dx TM Hematology Analyzer. In the study, Mindray brand DC-N3model ultrasonography device and 3.0 – 7.0 MHz P7-3 Phased Array transducer probe belonging to the device were used for echocardiographic examination. The right parasternal 4th and 5th intercostal region of the cats that were laid on the examination table in the right laterolateral position was lightly shaved. The cats were kept calm without using any sedatives. Afterwards, 2D, M mode and B mode imaging were performed in the long and short axis.

In echocardiographic examination, priority was given to pericardial effusion visualization and measurement. Additionally, left ventricular free wall thickness (LVFW) in systole and diastole, interventricular septum wall thickness (IVSD) in systole and diastole, left ventricular internal diameter end-diastole and end-systole (LVID), left atrium internal diameter (LA), aortic diameter (AO), LA/AO ratio, left ventricular ejection fraction (EF), fractional shortening (FS) parameters were measured.

Table 2. Clinical findings of the cats in the patient group.

	Symptoms					
Case No.	Exercise intolerance	Dyspnea	Abdominal breathing	Friction sound on auscultation	Muffled heart sound on auscultation	Ascites
1			x		x	
2						
3		x		x	x	
4		x	x	x		
5			x		x	
6	x	x				
7					x	x
8						
9	x					
10						
11			x		x	
12	x	x		x	x	x
13	x		x			
14						
15						
16						
17	x		x			
18	x			x		
19		x	x		x	x
20						

Statistical significance between groups was taken as $P<0.05$.

Statistical analyses

In this study, hematological, BNP and cardiac parameters were examined in patient and healthy groups. Normality tests were applied to evaluate the differences in hematological, cardiac and BNP parameters between healthy and patient groups and Mann-Whitney U test was used as a non-parametric test. Spearman correlation analysis was applied to examine the relationships between the parameters. In addition, interaction analyses were performed to evaluate the interactions between demographic variables such as disease status, race, age and gender on certain hematological and cardiac parameters. In these analyses, the effects of the interactions between disease status and race, age and gender on hematological, BNP and cardiac parameters were examined. In these analyses, partial eta-squared was calculated to evaluate how much of the variance in these parameters was explained by the interactions. All analyses were performed using SPSS 16.0 package program (Coakes et al., 2009).

RESULTS

Clinical findings

It was determined that the healthy cats in the control group did not have any findings of heart disease in their clinical examination and had normal values in the cardiac biomarker reference assessment. The cats with pericardial effusion, which constituted the patient group of the study, were also evaluated in terms of clinical examination findings and cardiac biomarkers. In the clinical examination of these cats, it was determined that 11 cats were asymptomatic, 6 cats had muffled heart sounds in auscultation, 4 cats had friction rubs in auscultation, 5 cats had respiratory distress, 6 cats had exercise intolerance, 3 cats had ascites, and 7 cats had abdominal breathing (Table 2).

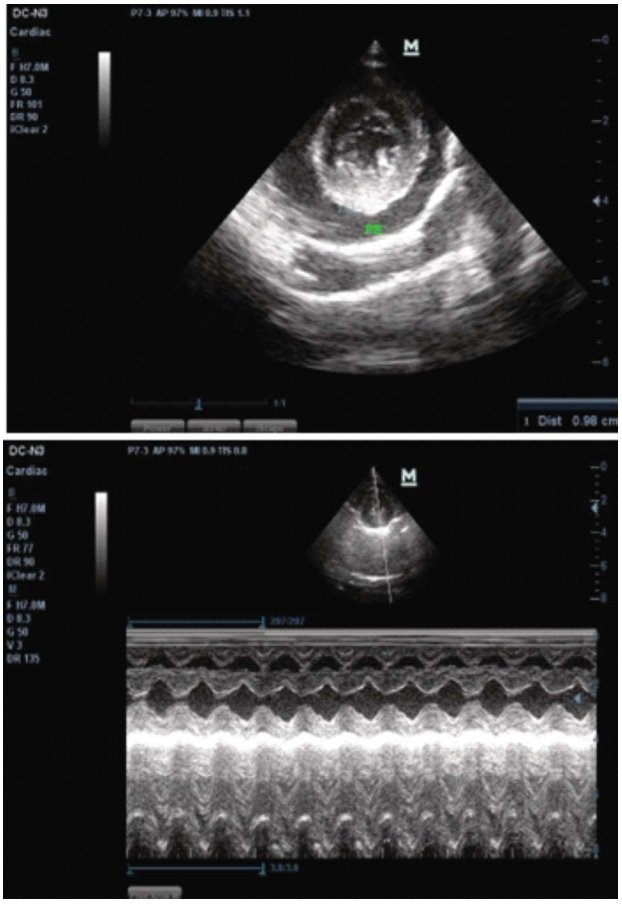

Figure 1. Echocardiography image of a case with severe pericardial effusion resulting in cardiac tamponade.

Complete blood count findings

Of the 20 cats with pericardial effusion in the patient group, anemia was detected in 3, leukocytocytosis in 3, neutrophilia in 5, monocytosis in 5, and thrombocytopenia in 3. As can be seen, although changes were detected in some blood parameters individually in cats with effusion, it is noteworthy that there is no statistically significant difference with the control group values (Table 3).

Echocardiographic examination findings

Echocardiographic imaging was performed on 20 cats diagnosed with pericardial effusion and 20 cats in the control group used in the study. Based on the clinician's perspective, of the 20 cats diagnosed with pericardial effusion, 2 had severe pericardial effusion, 5 had moderate pericardial effusion, and 13 had mild pericardial effusion. Of the moderate pericardial effusion cases, 1 had peritoneal pericardial diaphragmatic hernia, 5 had hypertrophic cardiomyopathy, and 11 had left atrial

Table 3. Total blood count results of the patient and control groups

Parameter	Patient group		Control group		
	n	Mean ± Standard Deviation	n	Mean ± Standard Deviation	P
RBC (M/µL)	20	9.98 ± 3.15	20	10.52 ± 1.60	0.74
HCT (%)	20	42 ± 12	20	43 ± 0.83	0.66
Hb (g/dL)	20	13.79 ± 4.08	20	14.32 ± 2.48	0.73
MCV (fL)	20	43.15 ± 10.22	20	41.08 ± 4.90	0.31
MCH (pg)	20	14.31 ± 2.65	20	13.63 ± 1.43	0.44
MCHC (g/dL)	20	32.22 ± 1.93	20	33.25 ± 1.56	0.08
RDW (%)	20	25 ± 4	20	26 ± 3	0.40
Reticulocyte (K/ µL)	20	24.72 ± 17.19	20	29.02 ± 22.25	0.74
WBC (K/ µL)	20	11.34 ± 7.11	20	9.74 ± 5.02	0.80
Neutrophil (K/ µL)	20	6.48 ± 5.13	20	4.91 ± 4.33	0.40
Lymphocyte (K/ µL)	20	3.66 ± 2.74	20	3.71 ± 1.58	0.28
Monocyte (K/ µL)	20	0.81 ± 1.02	20	0.46 ± 0.43	0.50
Eosinophil (K/ µL)	20	0.32 ± 0.31	20	0.56 ± 0.40	0.02
Platelet (K/ µL)	20	313.55 ± 192.28	20	248.30 ± 123.95	0.33
MPV (fL)	20	17.05 ± 1.78	20	16.88 ± 1.94	0.91

Table 4. Echocardiographic findings of cats in the patient group

Case No.	Echocardiographic changes								
	IVSd ↑	LVIDd ↓	LVPWd ↑	IVSs ↑	LVIDs ↓	LVPW ↑	Left atrial dilatation (LA/AO) ↑	EF ↓	FS ↑
1				x					
2			x				x		
3	x	x	x	x	x	x	x		
4	x	x	x		x		x		x
5			x				x		
6									
7			x	x		x			
8									
9	x		x	x	x	x			x
10			x			x			
11	x			x			x		
12	x		x	x		x			
13	x	x	x	x		x	x	x	
14	x			x	x		x		x
15							x		
16			x	x		x			
17			x				x		
18	x		x	x		x	x		
19	x		x	x	x	x	x		x
20									

Tablo 5. Individual values obtained in echocardiographic examination of both groups

Groups	Breed	Age	IVSd	LVIDd	LVPWd	IVSs	LVIDs	LVPWs	EF	FS	LA	AO	LA/AO
		(year)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)		(cm)	(cm)	(cm)	
Patient	B. Shorthair	1.5	0.42	1.54	0.39	0.76	0.76	0.73	0.92	0.64	1.38	1.07	1.28
Patient	Tabby	6	0.35	1.3	0.53	0.5	0.7	0.71	0.82	0.47	1.43	0.81	1.76
Patient	B.Shorthair	3	0.8	1.06	0.8	0.92	0.39	0.97	0.94	0.63	1.46	0.77	1.89
Patient	B. Shorthair	2	0.73	1.12	0.6	0.64	0.36	0.7	0.96	0.68	1.35	0.76	1.77
Patient	Tabby	8	0.42	1.72	0.51	0.51	0.86	0.64	0.83	0.49	1.35	0.77	1.75
Patient	Smokin	11	0.38	1.87	0.44	0.68	0.71	0.64	0.92	0.62	1.31	0.93	1.4
Patient	Mix	8	0.33	2.35	0.45	0.82	0.59	0.85	0.8	0.48	1.17	1.5	0.78
Patient	B.Shorthair	2	0.38	1.42	0.39	0.67	0.82	0.6	0.77	0.43	1.14	0.92	1.23
Patient	B. Shorthair	9	0.65	1.36	0.56	0.96	0.36	1.01	0.97	0.73	1.51	0.99	1.52
Patient	Scottish Fold	3	0.47	1.36	0.54	0.67	0.67	0.94	0.86	0.51	1.17	1.06	1.1
Patient	Tabby	10	0.6	1.42	0.39	0.79	0.7	0.7	0.86	0.51	1.37	0.78	1.75
Patient	Persian	13	0.7	1.46	0.59	0.94	0.8	0.95	0.8	0.46	1.43	1.01	1.41
Patient	Tabby	21	0.91	1	0.48	0.94	0.79	1	0.48	0.21	1.54	0.63	2.44
Patient	B.Shorthair	2	0.51	1.21	0.33	0.71	0.35	0.7	0.96	0.71	1.34	0.73	1.83
Patient	Tabby	13	0.36	1.34	0.35	0.55	0.62	0.67	0.87	0.53	1.44	0.85	1.69
Patient	Scottish Fold	1	0.45	0.72	0.56	0.8	0.78	0.92	0.91	0.59	1.35	1.07	1.26
Patient	B. Longhair	9	0.44	1.88	0.52	0.7	0.76	0.63	0.95	0.67	1.54	0.86	1.79
Patient	Scottish Fold	3	0.67	2.3	0.54	0.91	1.3	0.91	0.72	0.44	2.02	1.17	1.72
Patient	Tabby	9	0.51	1.3	0.82	0.88	0.18	0.97	1	0.86	1.35	0.7	1.92
Patient	Scottish Fold	2	0.38	1.5	0.42	0.6	0.6	0.64	0.91	0.6	1.34	0.89	1.5
Control	Tabby	6	0.33	0.91	0.48	0.54	0.3	0.42	0.95	0.67	1.04	0.9	1.15
Control	Mix	6	0.49	1.15	0.36	0.68	0.77	0.36	0.96	0.68	0.9	0.79	1.13
Control	Tabby	8	0.48	1.12	0.45	0.51	0.51	0.51	0.88	0.54	0.75	0.71	1.05
Control	Angora cat	14	0.57	1.84	0.39	0.76	1.39	0.42	0.52	0.25	1.33	0.82	1.62
Control	Tabby	7	0.57	1.42	0.54	0.73	0.45	0.79	0.96	0.68	1.3	0.91	1.42
Control	Tabby	9	0.35	1.51	0.44	0.74	0.38	0.76	0.98	0.75	1.14	0.92	1.23
Control	Mix	11	0.51	1.21	0.42	0.64	0.42	0.67	1	0.88	1.25	0.73	1.71
Control	Chinchilla	6	0.57	1.09	0.42	0.64	0.42	0.67	0.93	0.51	1.03	0.62	1.66
Control	B. Longhair	11	0.56	1.35	0.54	0.83	0.39	1.04	0.96	0.71	1.15	0.95	1.21
Control	Scottish Fold	3	0.33	0.91	0.48	0.54	0.3	0.42	0.95	0.67	1.04	0.89	1.16
Control	Tabby	6	0.41	1.25	0.45	0.71	0.3	0.95	0.98	0.76	1.3	0.84	1.54
Control	Tabby	3	0.45	1.18	0.45	0.57	0.48	0.67	0.91	0.59	1.15	0.86	1.33
Control	Tabby	7	0.64	1.54	0.51	0.97	0.24	0.54	0.99	0.84	1.26	0.81	1.55
Control	Tabby	1	0.42	1.03	0.45	0.73	0.42	0.7	0.95	0.66	1.17	1	1.17
Control	Smokin	2	0.45	1.41	0.33	0.71	0.6	0.54	0.89	0.57	0.8	0.69	1.15
Control	B.Shorthair	1	0.36	1.12	0.39	0.64	0.39	0.48	0.95	0.65	1.19	0.86	1.38
Control	B.Shorthair	1	0.47	0.94	0.48	0.64	0.94	0.56	0.87	0.54	1.29	0.91	1.41
Control	Tabby	3	0.48	1.09	0.36	0.57	0.57	0.64	0.83	0.47	1.21	0.73	1.65
Control	Scottish Fold	6	0.32	1.31	0.33	0.54	0.55	0.59	0.91	0.58	1.14	0.9	1.26
Control	B. Shorthair	6	0.51	1.78	0.39	0.79	0.77	0.83	0.89	0.57	1.55	1.04	1.49

British Shorthair (B. Shorthair), British Longhair (B. Longhair)

dilatation. Cardiac tamponade was noted in 1 of the cases with severe pericardial effusion (Table 4, Figure 1).

In echocardiographic examination, a statistically significant difference was found between the LA/AO, LVPWs, LAIDd and EF values of cats with pericardial effusion and the control group ($P<0.05$) (Table 6). No statistically significant difference was found between the study group and the control group in other parameters (IVSd, IVSs, LVIDd, LVIDs, LVPWd, FS and AO) ($p>0.05$) (Table 5, Table 6). In this study, the left ventricular end-diastolic diameter was measured as 0.88 cm in 1 case with severe pericardial effusion. Afterwards, the right ventricular end-diastolic diameter was evaluated considering the possibility of cardiac tamponade. RVIDd was measured as 0.24 cm. It was found that there was a decrease in the internal diameter of both ventricles, left and right ventricular filling was limited and this finding was compatible with cardiac tamponade (Table 5).

NT-proBNP findings

Information including NT-proBNP values of cats with pericardial effusion and cats in the control group used in the study is shown in Table 7.

A significant difference was found in the statistical analysis of the NT - proBNP parameter between the groups (p = 0.009). This finding showed that the disease status had an effect on BNP levels (Table 7).

DISCUSSION and CONCLUSION

Pericardial effusion refers to an increase in the physiological fluid level within the pericardial sac (Davidson et al., 2008). Pericardial effusion is the most commonly detected pericardial disorder (Ware, 2011). Pericardial effusion causes hemodynamic disorders at various levels after an increase in intrapericardial pressure. If the increase in fluid volume within the pericardial sac causes an increase in intrapericardial pressure, it can lead to cardiac tamponade and gradually decreasing cardiac output, followed by symptoms of right heart failure (Ware, 2011). The symptomatic condition indicates a poor prognosis (Cote et al., 2011).

Pericardial effusion has been reported to develop secondary to common diseases including hypertrophic cardiomyopathy (HCM), neoplasia, feline infectious peritonitis (FIP), peritoneopericardial diaphragmatic hernia (PPDH), anemia, uremia, systemic infections and idiopathic pericarditis (Tilley et al., 1975; Hall et al., 2007; Davidson et al., 2008; Hsu et al., 2009; Yousaf et al., 2023). In one study, pericardial effusion secondary to HCM, DCM, RCM or mitral valve disease was detected in 28% of cats (Stokol et al., 2008). In our study, it was determined that 25% of the cases with pericardial effusion were due to HCM. In the study conducted by Hall et al. (2007), it was stated that the primary factor in 21.9% of pericardial effusion in cats was neoplasia. In our study, it was determined that effusion due to neoplasia was 5%, fusion due to PPDH was 5% and pericardial effusion where the primary factor was anemia was 15%. These rates indicate the diversity of the primary etiology of pericardial effusion, parallel to the literature data.

It has been determined that some cat breeds are more prone to heart diseases. Maine Coon, Ragdoll, Scottish, British, Persian and Siamese cats are among these breeds (Boeykens et al., 2024). Among the cats included in this study, 7 were British, 4 were Scottish, 1 was Persian and 6 were mixed breeds, a similarity is striking. Their ages ranged from 1 to 13 years old and 7 of these cats were female and 13 were male. Since the study was conducted with a limited number of cases, no significant results were found in the statistical evaluation related to gender, breed and age predisposition.

Table 6. Statistical analysis of echocardiographic findings

Parameter	Patient group		Control group		P
	n	Mean ± Standard Deviation	n	Mean ± Standard Deviation	
IVSd (cm)	20	0.52 ± 0.16	20	0.46 ± 0.09	0.42
LVIDd (cm)	20	1.46 ± 0.40	20	1.25 ± 0.26	0.66
LVPWd (cm)	20	0.51 ± 0.12	20	0.43 ± 0.06	0.39
IVSs (cm)	20	0.74 ± 0.14	20	0.67 ± 0.11	0.12
LVIDs (cm)	20	0.65± 0.24	20	0.52 ± 0.26	0.60
LVPWs (cm)	20	0.79 ± 0.14	20	0.62 ± 0.18	0.005
EF (%)	20	0.86 ± 0.11	20	0.91 ± 0.10	0.05
FS (%)	20	0.56 ± 0.14	20	0.62 ± 0.13	0.08
LA (cm)	20	1.39 ± 0.18	20	1.14 ± 0.18	0.000
AO (cm)	20	0.91 ± 0.19	20	0.84 ± 0.10	0.35
LA/AO	20	1.58 ± 0.36	20	1.36 ± 0.20	0.01

Statistical significance between groups was taken as $p<0.05$.

Table 7. NT-proBNP Values of Cats in Patient and Control GroupsClinical findings resulting from pericardial effusion

Parametre	Patient group		Control group		P
BNP (pmol/L)	n	Mean ± Standard Deviation	n	Mean ± Standard Deviation	
	20	564.060 ± 61.292	20	57.085 ± 10.68	0.007 (p<0.05)

Statistical significance between groups was taken as $p<0.05$.

are due to changes in cardiac function. It depends on the rate of fluid accumulation and the severity of cardiac tamponade (Owens, 1977). The heart and respiratory systems should be evaluated together during examination (Krüger et al., 2016). In our study, it was determined that 11 cats were asymptomatic, 6 cats had muffled heart sounds on auscultation, 4 cats had friction rubs on auscultation, 5 cats had respiratory distress, 6 cats had exercise intolerance, 3 cats had ascites, and 7 cats had abdominal breathing (Table 2).

In a study conducted in dogs with endocarditis, thrombocytopenia and leukocytosis were detected in approximately 90% of patients in the total blood count. However, there are very few studies in cats (Sykes et al., 2006). Hematological abnormalities characterized by neutrophilia and a regenerative left shift, a marker of mild toxicity, were reported in clinical case of endocarditis caused by Bartonella henselae in a cat (Chomel et al., 2003; Perez, 2010).

Finally, in a series of 13 cats with infectious endocarditis, inflammatory neutrophilia was observed in seven patients and anemia in six patients (Palerme et al., 2016). In our study, in line with literature data, anemia was

detected in three of the 20 cats in the patient group, leukocytosis in three, thrombocytopenia in three, neutrophilia in five, and monocytosis in five. However, although individual changes were observed in the patient group, no statistically significant difference was detected with the control group (Table 3). This may be attributed to the small number of patients studied and the fact that pericardial effusion may be caused by different etiological factors such as inflammatory and non-inflammatory.

In cats with no clinical signs, small-volume pericardial effusions can be detected by echocardiography (French, 2010). In asymptomatic patients, radiographic and echocardiographic examinations are important methods for the diagnosis of heart diseases. In echocardiographic examination, pericardial effusion appears as a non-echoic space around the heart (Stokol et al., 2008). In our study, in parallel with the literature data, out of 20 cats diagnosed with pericardial effusion, 2 had severe pericardial effusion, 5 had moderate pericardial effusion, and 13 had mild pericardial effusion (Figure 1).

After pericardial effusion, severe intrapericardial pressure occurs, causing increased pressure in the RA and RV, and this condition is defined as cardiac tamponade (Turgut, 2017). It is emphasized that pericardial effusion will compress the heart from the outside and limit RV and LV filling over time (Linney, 2014; Turgut, 2017). In this study, in a case with severe pericardial effusion, ventricular diastolic expansion was severely impaired, both ventricles had a reduced internal diameter (Table 4, Table 5), and left and right ventricular filling was limited. This condition was interpreted as echocardiographic findings confirming ventricular collapse and cardiac tamponade. Echocardiography is preferred because it is not an invasive tool in the diagnosis of pericardial effusion and its sensitivity is very high. However, since echocardiographic examination requires more time and is an expensive procedure, evaluation of cardiac biomarkers is recommended for diagnosis in terms of faster results and more affordable costs (Ward et al., 2018; Gavazza et al., 2021). In a retrospective study, Machen et al. (2014) showed that NT-proBNP measurements performed in 146 cats were useful in determining whether pleural effusion in cats was related to heart disease. Cardiac biomarkers, especially natriuretic peptides, have become increasingly accepted as sensitive, specific, and safe tools useful in identifying patients with heart failure and determining its severity (Fox et al., 2009; Hsu et al., 2009). In our study, NT - proBNP values were found to be significantly increased in cats with pericardial effusion and there was a highly significant difference in statistical analysis between the groups ($p = 0.009$).

In conclusion, the results obtained in the study revealed that NT-proBNP can be used as an important cardiac biomarker in confirming the diagnosis of pericardial effusion in cats (Table 7).

ETHICAL APPROVAL

The presented study was conducted in accordance with the decision of Kırıkkale University Animal Experiments Local Ethics Committee dated 15/11/2023 and numbered E-217201.

AUTHOR CONTRIBUTIONS

This study was derived from the Master's Thesis of the same name of the first author, conducted under the supervision of the second author.

CONFLICT OF INTEREST

There is no situation that would cause a conflict of interest between the authors.

RESEARCH FUNDING

The research was not supported by an institution or organization.

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Mehmet Akif Ersoy University Journal of Health Sciences Institute

MAKU J. Health Sci. Inst.
2025, 13(1)

Research Article

The Effect of Anesthesia Type on Hemodynamics and Bleeding in Pregnant Women with Anemia

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ABSTRACT

The aim of our study is to investigate and compare the effects of spinal and general anesthesia on maternal blood loss and hemodynamic data during cesarean section in pregnant women with anemia. 100 Patients with anemia who underwent cesarean section in our clinic were included. Age, gravida, body weight, gestational age, hemodynamic data, fibrinogen levels, hemoglobin levels at preoperative and postoperative 6th hour were recorded. There was no statistically significant difference between preoperative hemoglobin and postoperative hemoglobin values and the amount of bleeding ($p>0.05$). A statistically significant difference was found in the comparison of intraoperative 5th and 15th minute and postoperative diastolic blood pressures ($p<0.05$), and it was observed that the values of the spinal anesthesia group were lower. We found that the type of anesthesia did not affect the amount of perioperative and postoperative bleeding. The most common cause of maternal mortality is postpartum hemorrhage. Anemia should be corrected in the prenatal period to minimize the effect of postpartum hemorrhage. The most important factors in the choice of anesthesia method are the systemic problems and desire of the pregnant woman, the urgency of the operation, the preference of the surgeon and the experience of the anesthesiologist.

Key words: Nulla, dolor, velit, fermentum, sed

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Recevived: 07/11/2024

Revision request: 18/12/2024

Revision received: 07/02/2025

Accepted: 13/02/2025

Available online: 02/05/2025

INTRODUCTION

According to the World Health Organization (WHO) in 2001, anemia in pregnancy was defined as a hemoglobin value below 11 g/dL for all three trimesters. This definition is still valid today (WHO, 2001). Anemia causes an increase in maternal mortality with the effect of postpartum bleeding and infection, especially in low-income countries. Even a moderate bleeding in a pregnant woman with anemia may be fatal for the mother. According to WHO, anemia is directly or indirectly involved in 40% of maternal deaths (Brabin et al., 2001, Khan et al. 2006).

General anesthesia technique has been used in cesarean section operations for many years, but today, spinal anesthesia has become the method preferred by both the patient and the anesthesiologist (Lewis and Drife, 2004, Hughes et al., 2002). Both anesthesia techniques have advantages and disadvantages.

DOI: 10.24998/maeusabed.1571864

Postpartum hemorrhage remains an important cause of maternal morbidity and mortality worldwide. The choice of anesthesia for cesarean section in placenta previa and abruption of placenta, which are causes of antepartum bleeding, requires caution. General anesthesia is generally recommended for vaginal bleeding of more than 1500 mL, a decrease in hemoglobin of more than 4 g/dL, and massive bleeding that carries a high risk for the patient requiring acute blood transfusion of more than 4 units (Tsen, 2009, Avery, 2007). The aim of anesthesia for cesarean delivery is to ensure delivery with minimal risk to mother and baby, and therefore it is important to compare fetal and maternal outcomes associated with different anesthesia techniques (NIH, 2008).

The aim of this retrospective study was to investigate and compare the effects of spinal and general anesthesia on maternal blood loss and hemodynamic data in pregnant women with anemia.

MATERIAL AND METHODS

After ethics committee approval was obtained from the ethics committee of Taksim Training and Research Hospital, the files of patients with anemia and cesarean section were retrospectively reviewed. Data were collected from the files of patients and hospital information management system. A total of 100 patients who met the criteria, had anemia, underwent elective cesarean section with spinal anesthesia (Group SA, n= 50) and general anesthesia (Group GA, n= 50), ASA II, and hemoglobin value below 11g/dL were included in the study. Pregnant women under 18 years of age, fetal deformities, malpresentation, emergency cesarean section, uterine fibroids, twin pregnancy and fetal distress were excluded. The ages (years), gravida, parity, body weights (kg), gestational weeks, indications for cesarean section, hemodynamic data, fibrinogen levels, preoperative and postoperative 6th hour hemoglobin/hematocrit (Hg/Hct) levels were recorded from the files of patients. In our clinic, cesarean section was performed in all cases in the same procedure through a pfannenstiel incision. General anesthesia is administered to the GA group with 2 mg/kg propofol and 0.6-0.8 mg/kg rocuronium. Intraoperative anesthesia is maintained with 1.5 lt/min air, 1.5 lt/min oxygen and 1-1.5 sevoflurane. In the SA group, 10-12 mg of 0.5% bupivacaine is administered into the subarachnoid space with a 26 G spinal needle in the sitting position to block anesthesia of the T4-T6 dermatomes. Ephedrine or atropine is injected in patients who develop hypotension or bradycardia after spinal anesthesia. Both groups routinely receive 20 units of oxytocin infusion in 1000 mL of fluid and 3000 mL of intravenous fluid for 24 hours after delivery.

Determining the amount of bleeding during labor is one of the major problems in obstetric practice. In this study, the amount of blood loss was determined according to both the decrease in hemoglobin/hematocrit value and the following formula defined by Shook et al. (9). Amount of Bleeding = [Calculated blood volume* x (PreopHct - PostopHct)/PreopHct] (mL) * Calculated blood volume = Body weight x 85 (mL).

Statistical Analysis

The data were analyzed using the SPSS 17.0 package program. Before the analysis, normality test (Kolmogorov-Smirnov) was performed and parametric test was applied after it was seen that the data were normally distributed. In the analysis of the data, frequency distributions, mean and standard deviation values were tabulated and independent samples t test was used to compare the groups.

RESULTS

There was no statistically significant difference in the age, weight, height and gestational age of the groups as shown in Table-1($p>0.05$).

In our study, no statistically significant difference was found in the comparison of preoperative systolic blood pressures ($p>0.05$). A statistically significant difference

Table 1. Distribution and comparison of descriptive characteristics of the groups

	General Anesthesia		Spinal Anesthesia		t	p
	Mean±SS	Min.-Max.	Mean±S.S	Min.-Max.		
Age	30.4±4.5	22-39	29.5±5.9	20-42	864	0.39
Weight (kg)	75.7±10.3	54-94	73.4±13.4	50-114	1.192	236
Height (cm)	158.3±5.8	149-171	158.1±5.9	148-171	0.17	865
Gestational Age (weeks)	38.6±1.7	29-40	39±0.8	38.8-1.4	-1.716	89

Table 2. Comparison of preoperative blood values of the group

Preoperative Value	Type of Anesthesia	n	Mean	SD	t	p
Hg (g/dL)	General Anesthesia	50	9.804	0.9547	-0.197	0.844
	Spinal Anesthesia	50	9.836	0.6337		
Htc (g/dL)	General Anesthesia	50	29.536	30.447	-0.247	0.805
	Spinal Anesthesia	50	29.664	20.352		
Plt (µL)	General Anesthesia	50	244.24	58.843	0.029	0.977
	Spinal Anesthesia	50	243.88	63.673		
Fibrinogen (mg/dL)	General Anesthesia	50	328.76	76.182	-0.687	0.494
	Spinal Anesthesia	50	339.16	75.254		

Table 3. Comparison of postoperative blood values of the groups

Preoperative Value	Type of Anesthesia	n	Mean	SD	t	p
Hg (g/dL)	General Anesthesia	50	9.268	0.8888	17.490	0.083
	Spinal Anesthesia	50	8.984	0.7266		
Htc (g/dL)	General Anesthesia	50	28.02	2.782	1.741	0.085
	Spinal Anesthesia	50	27.11	2.420		
Plt (µL)	General Anesthesia	50	200.48	48.242	1.249	0.215
	Spinal Anesthesia	50	186.80	60.613		
Fibrinogen (mg/dL)	General Anesthesia	50	282.40	63.013	0.021	0.983
	Spinal Anesthesia	50	282.12	67.931		

was found in the comparison of intraoperative 5th and 15th minute and postoperative diastolic blood pressures ($p<0.05$), and it was observed that the values of the spinal anesthesia group were lower. In our study, a statistically significant difference was found between the 15th minute pulse rate values ($p<0.05$) and the spinal anesthesia group had lower values.

There was no significant difference in the preoperative hemogram and fibrinogen values of the groups ($p>0.05$). It is shown in Table-2. The mean fibrinogen value was 328.76 mg/dL in the general anesthesia group and 339.16 mg/dL in the spinal anesthesia group.

There was no statistically significant difference in the postoperative hemogram and fibrinogen values of the groups ($p>0.05$). It is shown in Table-3.

There was no statistically significant difference between the preoperative hemoglobin and postoperative hemoglobin values and the amount of bleeding ($p>0.05$). It is shown in Table-4.

DISCUSSION

According to WHO, 810 women died every day in 2017 due to preventable causes related to childbirth and pregnancy. The most common cause of maternal mortality is postpartum hemorrhage. It is also the most important cause of birth-related morbidity with a rate of 18% in developed and developing countries (Hughes, 2002). Cesarean section is the most common major obstetric operation and bleeding is the most common complication during and after cesarean section.

Table 4. Comparison of preoperative and postoperative hemoglobin differences and bleeding amounts of the groups

	Type of Anesthesia	n	Mean	SD	t	p
Preop-Postop Hg Difference	General Anesthesia	50	536	15.322	-13.140	192
	Spinal Anesthesia	50	852	7.385		
Amount of Bleeding (mL)	General Anesthesia	50	128.86	415.354	-1.329	187
	Spinal Anesthesia	50	216.92	216.526		

We wanted to perform our study in pregnant woman with anemia who had undergone cesarean section, which is a risky group in terms of complications, because maternal anemia has been found to be associated with fetal complications including intrauterine growth retardation, preterm delivery, low birth weight and maternal complications including preeclampsia and eclampsia (Tsen, 2009). Therefore, anemia is an important health problem in terms of women's and maternal health. There is a need for studies that will contribute to the literature to reduce maternal mortality.

Both general and regional anesthesia have their advantages and disadvantages, although recently spinal anesthesia is more preferred in the management of anesthesia for cesarean section. There is no completely ideal method of anesthesia management. Systemic problems and desire of the pregnant woman, urgency of the operation, preference of the surgeon and experience of the anesthesiologist are the most important factors in the choice of anesthesia method (Reisner and Lin, 1999). While general anesthesia is superior to spinal anesthesia due to faster induction, better cardiovascular stability and a lower frequency of hypotensive episodes, spinal anesthesia has advantages such as the patient being conscious, no risk of aspiration and not depressing newborn respiration (Reynolds, 2010, Bucklin, 2005).

Richman et al. (2006) concluded that the estimated blood loss was significantly lower in patients who underwent spinal or epidural anesthesia than in patients who underwent general anesthesia or combined general-epidural anesthesia (Richman et al., 2006). According to the authors, spinal anesthesia causes sympathetic block and vasodilation and thus venous return decreases, peripheral vascular resistance decreases as central venous pressure decreases and consequently blood pressure decreases. In addition, the reduction of intraoperative blood loss reduced the need for transfusion and transfusion-related illnesses. Similarly, in this study, systolic and diastolic blood pressures were significantly lower in the spinal group. This may explain the low blood loss. However, the disadvantage of this study is that it included all surgical cases related to general anesthesia or spinal anesthesia, such as cesarean section, general surgery and orthopedic operations. In our study, only the obstetric patient group was included.

In addition, similar to this study, a statistically significant difference was found in the comparison of intraoperative 5th and 15th minute and postoperative diastolic blood pressures in our study. The values of the spinal anesthesia group were found to be lower. We think that this is due to the sympathetic block that occurs in spinal anesthesia.

In our study, the mean preoperative hemoglobin value was 9.804 g/dL in the general anesthesia group and 9.836 g/dL in the spinal anesthesia group. No intraoperative or recovery unit complications or transfusion requirement occurred in any patient. The study of Milman stated that iron deficiency anemia decreased the mother's tolerance to peripartum blood loss, increased the risk of cardiovascular failure and hemorrhagic shock, and impaired wound healing (Milman, 2011). Murray et al. reported that a 1 g/dL increase in hemoglobin caused a significant decrease in maternal mortality (Murray-Kolb, 2012). The retrospective nature of our study is a limitation and postoperative complications of the patients were not analyzed.

There was no difference between the groups in terms of bleeding in our study. Kim et al. concluded that there was a decrease in intraoperative blood loss in the spinal group compared to the general anesthesia group and there was no significant difference in postoperative blood loss (Kim et all., 2012). Aksoy et al. showed that spinal anesthesia was associated with a lower risk of operative blood loss than general anesthesia in low-risk patients undergoing elective cesarean section (Aksoy et al., 2015). In a study conducted in Taiwan, it was found

that the probability of postpartum hemorrhage in women receiving general anesthesia was approximately 8 times higher than in women receiving spinal/epidural anesthesia (Chang, 2011).

In our study, we did not include high-risk patients with potentially increased intraoperative bleeding (e.g. multiple pregnancy, macrosomia, polyhydramnios, coagulation disorders, placentation anomalies, hypofibrinogenemia). The most important advantage of this study is that we did not include patients with risk factors that could potentially increase the amount of bleeding. In our study, the mean difference between preoperative and postoperative hemoglobin values was 0.536 in the general anesthesia group and 0.852 in the spinal anesthesia group. There was no statistically significant difference between the preoperative and postoperative hemoglobin difference and the amount of bleeding. In the study by Yalınkaya et al. the mean difference between preoperative and postoperative hemoglobin values was found to be 1.65 for the general anesthesia group and 1.65 for the spinal anesthesia group (Yalınkaya et al., 2009). Batool et al. showed that spinal anesthesia resulted in less blood loss and a decrease in hemoglobin and hematocrit when compared with general anesthesia (Batool et al., 2016). While some researchers have stated that there is increased blood loss in cesarean section especially with high dose anesthetic drugs, some authors have stated that there is no increased risk in the amount of bleeding when high-risk cases are excluded (Afolabi et al, 2003).

Study Limitations

The retrospective nature of our study was one of the main limitations. We also have limitations in determining the amount of bleeding. In a prospective study, the amount of bleeding could have been calculated more precisely and more accurate results could have been obtained.

In conclusion the most common cause of maternal mortality is postpartum hemorrhage and anemia should be corrected in the prenatal period to minimize the effect of postpartum hemorrhage. In our study, we observed that the type of anesthesia had no effect on bleeding. The most important disadvantage of our study is that it was retrospective and prospective studies are needed to evaluate the effect of the type of anesthesia on postpartum hemorrhage.

ETHICAL APPROVAL

The presented study was conducted in accordance with the decision of Taksim Education and Research Hospital Clinical Ethics Committee dated 13/11/2019 and numbered 150..

AUTHOR CONTRIBUTIONS

Idea, concept and desing: NY
Data collection and analysis: ASŞ
Drafting of the manuscript: FÖ
Critical review: NY

CONFLICT OF INTEREST

The authors declare no conflict of interest

DATA AVAILABILITY

The data used to prepare this manuscript ara available from the corresponding author when requested.

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Mehmet Akif Ersoy University Journal of Health Sciences Institute

Research Article

MAKU J. Health Sci. Inst.
2025, 13(1)

THE RELATIONSHIP BETWEEN SPIRITUAL ORIENTATION AND CARE BURDEN IN RELATIVES OF PATIENTS RECEIVING CHEMOTHERAPY

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ABSTRACT

One of the most used methods in cancer treatment is chemotherapy. Due to the intense effects of this treatment on the physical and emotional states of patients, patients encounter many problems. It is stated that the caregivers' burden of care increases during this treatment process and it is claimed that the spiritual orientation of the caregivers in coping increases. This study aimed to examine the relationship between spiritual orientation and care burden in relatives of patients receiving chemotherapy. This cross-sectional study was carried out with 131 relatives of patients who received chemotherapy in the chemotherapy unit of a university hospital in western Turkey. As a result of this study, it was determined that the relatives of the patients who received chemotherapy had a quite high level of spiritual orientation and that the majority of them had a low level of care burden; however, no relationship was determined between their spiritual orientation and care burden. In line with these results, nurses are recommended to consider the needs of individuals who give care to cancer patients receiving chemotherapy.

Key words: Cancer, Care Burden, Chemotherapy, Nursing Care, Spirituality

Recevived: 27/03/2025

Accepted: 24/04/2025

Available online: 02/05/2025

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INTRODUCTION

Cancer is an important health problem that has increasingly become widespread with the increasing number of cases and affects the entire society due to the disabilities and deaths it causes. Today, the number of individuals with cancer increases in line with the developments in cancer diagnosis and treatment methods whereas survival time is prolonged (Mystakidou et al., 2007). Despite the prolongation of survival times, treatment-related effects affect the quality of life of patients negatively (Bee et al., 2009).

One of the most used methods in cancer treatment is chemotherapy. Chemotherapy is mostly given in outpatient chemotherapy units. Due to the intense effects of this treatment on the physical and emotional states of patients, patients encounter many problems. These emerging problems affect patients' families and caregivers. Therefore, caregivers of patients receiving chemotherapy constitute a special group (Bee et al., 2009; Sert, 2015). Caregiving is an action that provides many personal satisfactions, increases intimacy and love, contributes to the personal development of individuals, and provides

DOI: 10.24998/maeusabed.1644889

positive effects such as self-respect, finding meaning with the experience of care but it has many difficulties as well (Cora et al., 2012; Sert, 2015; Stolz-Baskett et al., 2021; Toseland et al., 2011).

The care-giving/-receiving relationship turns into a one-sided, intense, and long-term dependence that causes problems in the life of the patient's relatives; a conflict occurs between the family roles, work and leisure life, social life of caregivers and caregiving roles, affecting the quality of life of individuals negatively (Nayak et al., 2014). Caregivers may also suffer from their caregiver roles, such as involuntary weight changes, sleep deprivation, depressive symptoms, anxiety, social isolation, and increased death risk (Li et al., 2022).

Besides all these, previous studies stated that the care burden of caregivers of individuals receiving chemotherapy increases during treatment (Küçükoğlu, 2019; Özdemir, 2018; Özdemir et al., 2017; Palos et al., 2011; Şahin et al., 2009). Caregivers have many different coping methods in this challenging process (Fitch, 2020; Serçekuş et al., 2014). Spirituality and religion are important coping strategies for family members who give care to cancer patients (Doumit et al., 2019; Gall & Bladeu, 2017; Hill et al., 2000; 2013; Leyva et al., 2014; Sterba et al., 2014). Spirituality is defined as a force that moves and motivates individuals to find meaning and goals in life (Stanard et al., 2000). Spirituality is a coping strategy that can help alleviate the negative aspects of negative life events. It was reported that spirituality is the most effective coping mechanism following emotional support (Meyerowitz et al., 2000).

Religious and spiritual orientations may also cause patient relatives to perceive this support as a comforting situation for them. In particular, factors such as cultural differences or the degree of closeness of the caregiver may cause caregivers to perceive caregiving as a duty. It can be suggested that people with high spiritual orientation perceive caregiving as a duty and fulfil it believing that it is good for their own mental health. For this reason, these people can be more effective in the caregiving process. On the other hand, no study has shown that individuals with no religious beliefs or with low spiritual orientation exhibit different behaviour in giving care to their patients.

In light of this information, the effects of spiritual orientations on the care burden perceived by caregivers need to be discussed. Revealing the factors that may be associated with the care burden and spiritual orientation of the relatives of patients receiving chemotherapy can be a guide in solving caregivers' problems. Furthermore, this can facilitate the need for support of the spirituality of patient relatives and the work to be done to reduce the care burden. In this context, this study aimed to examine the relationship between spiritual orientation and care burden in the relatives of patients receiving chemotherapy.

Research questions:

- What is the spiritual orientation of the relatives of patients receiving chemotherapy?
- What is the care burden of the relatives of patients receiving chemotherapy?
- Is there a relationship between spiritual orientation and care burden in the relatives of patients receiving chemotherapy?

MATERIAL AND METHODS

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Study Design and Ethical Statement

This analytical-cross-sectional study was conducted to examine the relationship between spiritual orientation and care burden in the relatives of patients receiving chemotherapy.

This study was approved by Aydın Adnan Menderes University Nursing Faculty Non-Invasive Clinical Research Ethics Committee (Ethics committee no: E-76261397-050.99-133536, 05.02.2022). Written institutional permission was taken from the hospital where the study was conducted. Participants were informed about the study and its purpose and their verbal consent was taken. This study was carried out based on the principles of the Declaration of Helsinki.

Population and Sample

This study was carried out with the relatives of patients receiving chemotherapy in the chemotherapy unit of a university hospital in western Turkey between March and June 2022. The sample size of the study was calculated based on the thesis study, titled "Unmet Needs, Care Burden, Anxiety, Depression Levels of Caregivers That Give Care to Patients Who Take Chemotherapy" published by Küçükoğlu in 2019 (n=120) (Küçükoğlu,

2019).. The minimum size of the sample was calculated as at least 110 individuals based on the mean scores on the scales used in the study, with a power of 90%, a Type I error of 0.05, and an effect size of 2.607. The study was completed with 131 patients considering a data loss of 10% (Karasar, 2008). The sample selection was made by random sampling from the caregivers accompanying their patients for chemotherapy.

Inclusion Criteria

- Relatives of patients who were aged 18 or over.
- Whose relatives received chemotherapy.
- Who were primarily responsible for the care of the patient.

Exclusion Criteria

- Those who gave care for a fee.

Data Collection Tools

In the study, a "Questionnaire", the "Spiritual Orientation Scale (SOS)" and the "Zarit Burden Interview (ZBI)" were for data collection.

Questionnaire: This form consists of questions regarding introductory information about patients and their relatives and patients' disease.

Spiritual orientation scale (SOS): The Spiritual Orientation Scale, which was developed by Kasapoğlu (2015), is a 7-point Likert-type scale consisting of 16 items ranked between 1=strongly disagree and 7=strongly agree. The scale consists of 16 items in total. The Cronbach Alpha coefficient of the scale is 0.87. The items of SOS are scored positively and a score of 16-112 can be obtained. A high score on the scale indicates a high level of spiritual orientation (Kasapoğlu, 2015). In this study, the Cronbach Alpha coefficient of the scale was found as 0.96.

Zarit Burden Interview (ZBI): This scale is used to evaluate the care burden perceived by relatives of patients receiving chemotherapy. The scale was developed by Zarit, Reever, and BachPeterson in 1980 (Zarit et al., 1980). Its Turkish adaptation and validity-reliability study were performed by İnci and Erdem (2006). The internal consistency coefficient of the scale was 0.95; the item-total correlation coefficients had moderate, strong, and very strong values (0.43-0.85); the test-retest invariance coefficient was 0.90.

The scale consists of 22 statements that determine the effect of caregiving on the life of the individual. The scale has a Likert-type rating scale from 0 to 4 as never, rarely, sometimes, often, or almost always. The minimum score obtainable from the scale is 0 and the maximum score is 88. The care burden increases as the scale score increases. A score of 0-20 indicates "no care burden"; a score of 21-40 indicates "light care burden"; a score of 41-60 indicates "moderate care burden"; and a score of 61-88 indicates "heavy care burden" (İnci & Erdem, 2016). In this study, the Cronbach Alpha coefficient of the scale was found to be 0.88.

Statistical Analysis

In the study, the data were analyzed in the Statistical Package for the Social Sciences (SPSS) for Windows 22 package program. In data evaluation, according to the results of the normality test (Kolmogorov-Smirnov test), it was determined that the data showed normal distribution (Kurtosis and Skewness between − 1.5 and + 1.5). All descriptive statistics were presented as numbers, percentages, and means. The independent samples t-test, one-way analysis of variance (ANOVA) and correlation analysis, and Tukey test were used to evaluate the data. The results were evaluated at a confidence interval of 95% and a significance level of $p<0.05$.

RESULTS

The mean age of the participants was 42.46±12.85 and 56.5% of them were female. Of the patient relatives, 49.6% had been giving care to their relatives for 1-6 months; 14.5% for 7-12 months; 13.7% for 13-24 months; 22.1% for more than 2 years. Of the patients, 65.6% were independent in their daily work; 28.2% were semi-dependent; 6.1% were dependent. The relatives of the patients helped the patients with hospital work (86.3%), drug supply (65.6%), housework (55.7%), nutrition (36.6%), and individual care (31.3%). 35.9% of the patient relatives provided financial support to their relatives during this process. 67.9% of the patients needed individual care after chemotherapy.

Complications experienced by patients after chemotherapy were nausea (53.4%), vomiting (32.8%), loss of appetite (59.5%), diarrhea (19.1%), anemia (14.5%), constipation (34.4%), mouth sores (19.1%), hair loss (61.8%), fatigue (67.2%), change in skin color (20.6%), pruritus (20.6%) and infection (4.6%). While giving care, the relatives of the patients had the most difficulty in providing psychological support to their patients (44.3%), transportation to the hospital (36.6%), and management of chemotherapy-related problems (35.9%). In addition, 22.1% of the patient relatives also had another relative to whom they were obliged to give care to.

The mean age of the patients receiving chemotherapy was 61.09±12.12 and 61.1% of them were female. The thirty-two point seven percent of the patients

received chemotherapy due to breast cancer; 25.3% due to lung cancer; 8.4% due to colon cancer; 7.5% due to ovarian cancer; 5.3% due to bladder cancer; 6.9% due to pancreatic cancer; 5.4% due to uterine cancer; 2.3% due to gastric cancer; 2.3% due to kidney cancer; 2.3% due to prostate cancer; 1.6% due to liver cancer. The patients received chemotherapy for 1-6 months (47.3%), 7-12 months (24.4%), 13-24 months (12.2%), 2-4 years (6.1%), and more than 4 years (9.9%).

The mean spiritual orientation score of the participants was 93.22±21.18 and the mean care burden score was 26.47±14.26. According to the Zarit Burden interview, 38.2% of the patient relatives did not have a care burden; 47.3% had a light care burden; 10.7% had a moderate care burden; 3.1% had a heavy care burden. When the relationship between spiritual orientation and the care burden of the participants was examined, no statistically significant relationship was determined ($r= 0.036$, $p=0.686$).

The distribution of spiritual orientation and care burden scores of the patient relatives according to the demographic variables is presented in Table 1. Education level, income level, family structure, and any disease of the participants affected their care burden ($p<0.05$). The care burden was significantly higher in those who were illiterate compared to those who received high school education, in those who perceived their income as low compared to those who perceived their income as normal, and in those who had a large family structure and those with any disease ($p<0.05$).

Table 1: Demographic information of caregivers

Variables	n	%
Age		
18-31	30	22.9
32-45	44	33.6
46-59	45	34.4
60-73	12	9.2
Gender		
Female	74	56.5
Male	57	43.5
Marital status		
Married	92	70.2
Single	39	29.8
Education level		
Illiterate	3	2.3
Primary school	37	28.2
Secondary school	18	13.7
High school	32	24.4
Undergraduate and graduate	41	31.3
Employment status		
Yes	50	38.2
No	81	61.8
Occupation		
Housewife	53	40.5
Self-employed	41	31.3
Government official	31	23.7
Student	6	4.6
Income level		
Income<expenses	56	42.7
Income=expenses	61	46.6
Income>expenses	14	10.7
Family structure		
Nuclear family	112	85.5
Large family	19	14.5
Place of residence		
Village-burgh	25	19.1
District	70	53.4
City	36	27.5
Degree of relationship with the patient		
Spouse	39	29.8
Children	6	4.6
Mother-father	70	53.4
Sibling-relative-friend	16	12.2
Living with the patient		
Yes	85	64.9
No	46	35.1
Presence of others who are given care		
Yes	29	22.1
No	102	77.9
Presence of any disease		
Yes	26	19.8
No	105	80.2

DISCUSSION

In this study, which aimed to examine the relationship between spiritual orientation and care burden in the relatives of patients receiving chemotherapy, it was determined that the patient relatives had a very high level of spiritual orientation and that the majority of them had a light care burden. However, no relationship was determined between their spiritual orientation and care burden.

The pain suffered by a loved one during cancer and the treatment process as well as the burden of giving care to that person strain caregivers a lot (Terakye, 2011). Caregivers have many different coping methods in this difficult process (Fitch, 2020; Serçekuş et al., 2014). Spirituality and religion are important coping strategies of family members who give care to cancer patients (Doumit et al., 2019; Leyva et al., 2014; Sterba et al., 2014). Previous studies revealed that caregivers often resort to different positive and negative religious/spiritual coping methods, such as worship, strong belief in God, establishing spiritual relationships with other individuals in the same situation, and considering disease a test/ punishment (Delgado-Guay et al., 2013; Doumit et al., 2019; Serçekuş et al., 2014). In their study, Delgado-Guay et al. (2013) reported that spirituality and religiousness help patients of caregivers cope with cancer and positively affect their patients' physical and emotional symptoms.

Table 2: Comparison between the demographic variables of the participants and their spiritual orientation and spiritual care burden scores

	Spiritual orientation	**Care burden**
Variables	**X ±SD**	**X ±SD**
Age		
18-31	88.50±21.89	24.66±15.36
32-45	91.06±22.48	25.81±11.20
46-59	97.84±19.54	27.00±16.59
60-73	95.66±18.99	31.41±11.95
[a]**Statistic/*p***	*F=1.43 p=0.237*	*F=0.687 p=0.562*
Gender		
Female	95.26±20.30	22.27±14.12
Male	90.60±22.16	25.53±14.51
[b]**Statistic/*p***	*t=1.251 p= 0.213*	*t=0.670 p=0.504*
Marital status		
Married	94.38±20.51	26.04±14.29
Single	90.51±22.71	27.49±14.13
[b]**Statistic/*p***	*t=0.955 p=0.341*	*t=-0.527 p=0.599*
Education level		
Illiterate	103.33±5.85	47.00±11.26
Primary school	97.95±18.52	28.11±14.09
Secondary school	92.28±21.90	31.06±16.18
High school	91.25±24.14	22.38±11.57
Undergraduate and graduate	90.20±21.23	24.73±14.16
[a]**Statistic/*p***	*F=0.916 p=0.457*	*F=3.147* ***p=0.017***
Employment status		
Yes	90.00±23.80	24.58±12.11
No	95.22±19.27	27.66±15.40
[b]**Statistic/*p***	*t=-1.376 p=0.171*	*t=-1.201 p=0.232*
Occupation		
Housewife	99.37±16.57	26.69±15.42
Self-employed	89.36±23.18	27.50±14.12
Government official	88.61±24.02	26.41±13.14
Student	89.16±19.22	18.00±9.12
[a]**Statistic/*p***	*F=2.600 p=0.06*	*F=0.776 p=0.510*
Income level		
Income<expenses	95.86±21.31	30.09±15.86
Income=expenses	91.30±20.09	23.72±13.14
Income>expenses	91.14±25.44	24.29±8.9
[a]**Statistic/*p***	*F=0.75 p=0.474*	*F=3.17* ***p=0.045***
Family structure		
Nuclear family	93.38±21.35	25.16±14.00
Large family	92.32±20.69	34.16±13.63
[b]**Statistic/*p***	*t=0.202 p=0.840*	*t=-2.596* ***p=0.011***
Place of residence		
Village-burgh	90.24±23.02	28.96±18.07
District	92.70±22.20	27.38±13.44
City	96.33±17.72	23.03±12.50
[a]**Statistic/*p***	*F=0.654 p=0.522*	*F=1.583 p=0.209*
Degree of relationship with the patient		
Spouse	99.28±15.73	29.13±16.08
Children	98.83±9.74	33.16±15.91
Mother-father	88.84±24.54	25.75±12.90
Sibling-relative-friend	95.56±15.97	20.81±13.70
[a]**Statistic/*p***	*F=2.337 p=0.077*	*F=1.813 p=0.148*
Living with the patient		
Yes	92.48±23.43	27.80±14.90
No	94.60±16.35	24.04±12.81
[b]**Statistic/*p***	*t=-0.547 p=0.585*	*t=1.446 p=0.151*
Presence of others who are given care		
Yes	99.13±17.98	28.58±16.87
No	91.83±21.88	25.87±13.45
[b]**Statistic/*p***	*t=1.420 p=0.158*	*t=0.903 p=0.368*
Presence of any disease		
Yes	94.65±22.08	33.30±16.16
No	92.87±21.04	24.76±13.28
[b]**Statistic/*p***	*t=0.382 p=0.703*	*t=2.802* ***p=0.006***

Bold values indicate statistical significance, X = Mean, SD = Standard deviation, [a] ANOVA test, [b]Independent simple t test p<0.05 post hoc test

In a qualitative study conducted with Muslim caregivers, it was revealed that the participants had religious/spiritual coping behaviors such as believing in God, praying, and thanking God and that these behaviors facilitated coping (Serçekuş et al., 2014). In this study, the spiritual orientation of the participants was high and their care burden was light. In a study conducted by Küçükoğlu (2019) in Turkey, it was determined that the caregivers of patients receiving chemotherapy had a light care burden. Likewise, it was determined that the care burden of individuals who give care to cancer patients was light-moderate (Berber, 2014; Çeler et al., 2018; Ghori et al., 2020; Kahrıman, 2014; Kaynar &Vural, 2018; Orak & Sezgin 2015).

Although there was no statistically significant relationship between spiritual orientation and care burden, it is thought that the higher the spiritual orientation of patient relatives, the more willing and resilient to meet the care needs of patients, thus reducing care burden. As a matter of fact, spirituality and religion are two concepts that have an important impact on the life of an individual diagnosed with cancer, and they are important components of the well-being of both patients and caregivers (Vardar et al., 2021). In this study, the fact that most of the patients (65.6%) were independent in their daily work and that most of the caregivers had been giving care to their relatives for 1-6 months might have been effective in the light care burden of the participants. As a matter of fact, studies showed that the care burden of caregivers of individuals receiving chemotherapy increases during treatment (Küçükoğlu, 2019; Özdemir et al., 2017; Özdemir, 2018; Palos et al., 2011; Şahin et al., 2009).

All the problems experienced during the treatment process of the cancer patient affect the care burden and some characteristics of the caregiver affect his/her care burden. In this study, it was determined that education level, perception of income level, family structure, and current disease status affect the care burden. In many studies, it was reported that the socio-economic status of the caregiver, health status, education level, needs of the caregiver, the duration of caregiving, the status of receiving help during care, interaction with the care-receiver, the status of living together, and responsibilities other than patient care affect the care burden (Al-Daken & Ahmad, 2018; Koç et al., 2016; Seo & Park, 2019; Williams, 2018).

In caregivers of patients with low-income levels, caregiver burden, anxiety, and depression score medians were higher than those with moderate- and sufficient-income levels and caregiver burden was higher in caregivers with low income (Berber, 2014; Küçükoğlu, 2019; Türkoglu & Kılıç, 2012; Yurtseven, 2018). Likewise, in this study, the care burden of those who perceived their income level as low was higher than those who perceived their income level as moderate.

In this study, it was determined that illiterate individuals had a higher care burden compared to high school graduates. In some studies in the literature, it was determined that there is no significant difference between the caregiver burden and the education level of the caregivers (Ceylan Gür, 2018; Yurtseven, 2018). In some studies, on the other hand, it was found that there is a relationship between education level and care burden and that primary school graduates perceive a high level of care as a burden compared to university graduates (Özdemir, 2018; Yıldız et. al., 2016). It is thought that education level affects the perception of the disease and treatment process and is effective in the problem-solving skills of individuals.

Limitations and Strengths of the Study

This study has some limitations. This study is limited to the population from which research data were collected and cannot be generalized to all caregivers of cancer patients. The entire population from which the research data were collected is Muslim. This might have affected the research results. This study is limited to the data collected with two scales

CONCLUSION

As a result of this study, it was determined that the relatives of patients receiving chemotherapy had a very high spiritual orientation and that the majority of them had a light care burden. However, no relationship was found between their spiritual orientation and care burden. In line with these results, nurses are recommended to consider the needs of individuals who give care to cancer patients receiving chemotherapy as much as patients in their care plans, be aware of the contribution of spiritual care to coping with the process, and support their spiritual orientation. It can be suggested to repeat the study in populations with different cultures and religious beliefs.

ETHICAL APPROVAL

This study was approved by Aydın Adnan Menderes University Nursing Faculty Non-Invasive Clinical Research Ethics Committee (Ethics committee no: E-76261397-050.99-133536, 05.02.2022). Written institutional permission was taken from the hospital where

the study was conducted. Participants were informed about the study and its purpose and their verbal consent was taken. This study was carried out based on the principles of the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

Idea, concept and design: ET, YD. EÖ.
Data collection and analysis: ET, YD. EÖ.
Drafting of the manuscript: ET, YD
Critical review: ET, YD

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ACKNOWLEDGEMENTS

The authors would like to thank the patients and their relatives who voluntarily participated in this study.

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