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Original Article

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The Relationship Between Vascular Access Type and Sleep Quality, Anxiety, Depression in Hemodialysis Patients

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ABSTRACT

Objective: Depression, anxiety, and poor sleep quality are common problems in patients with chronic kidney disease and are closely related to mortality and quality of life. The aim of this study is to investigate all factors, including vascular access type, that affect anxiety symptoms, depression, and poor sleep quality in hemodialysis patients.
Methods: The study included 101 patients. The patients were divided into 2 groups as patients with central venous catheter and with arterio-venous fistula. The basic demographics and laboratory data of the patients were recorded. Anxiety symptom, depressive symptom, and sleep quality were assessed using the Beck Anxiety Inventory, the Beck Depression Inventory, and Pittsburgh Sleep Quality Index, respectively. Regression analysis was used to determine the factors affecting poor sleep quality, depression, and anxiety symptoms.
Results: Anxiety symptoms were found in 76.2%, suspicion of depression in 64.4%, and poor sleep quality in 63.4% of the patients. In the group of patients with central venous catheter, the number of patients with anxiety symptoms, suspicion of depression, and poor sleep quality were significantly higher than arterio-venous fistula group (96.8% vs 67.2%, *P*: .001, 90.3% vs 52.9%, *P*: .001, 80.6% vs 55.7%, *P*: .024, respectively). Regression analysis showed that a high Beck Anxiety Inventory score affected sleep quality; female gender and high Beck Depression Inventory and Pittsburgh Sleep Quality Index scores affected anxiety; and inflammation and malnutrition affected suspicion of depression.
Conclusion: Sleep disorders, depression, and anxiety are common in patients with chronic kidney disease. Although the rate of poor sleep quality, anxiety symptoms, and suspicion of depression was found to be significantly higher in the group with central venous catheter than in the group with arterio-venous fistula, no effect of vascular access was detected in the regression analysis.
Keywords: Anxiety, depression, hemodialysis, sleep quality, vascular access type

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INTRODUCTION

Depression, anxiety, and sleep disorders are common problems in patients with chronic kidney disease (CKD). Poor sleep quality due to sleep disorders is seen in 60-80% of dialysis patients.[1,2] In a review, depression was found in 27% and anxiety in 32% of patients with CKD.[3]

When depression, anxiety, and sleep disorders are not diagnosed and treatment is not undertaken, mortality increases significantly.[4-6] In a study conducted on peritoneal dialysis patients, results showed that anxiety affects mobility 2-fold.[7] In a recent study on sleep quality, the Pittsburgh Sleep Quality Index (PSQI) score was found to be an independent risk factor for all-cause mortality in hemodialysis patients. It was stated that if the PSQI score was 7 or more, all-cause mortality increased 2.96 times.[8]

Many studies have been conducted to find the underlying causes of these disorders. In a study conducted by

Saulo et al[11], it was reported that the factors affecting depression were not sociodemographic characteristics, and low albumin and high parathormone levels accompanied depressive patients.[12] In another study, anemia and hypoalbuminemia were found to be independent risk factors for the development of depression.[10] In a study conducted with 180 hemodialysis patients, male sex, albumin, calcium levels, impaired quality of life, and psychological inflexibility were associated with both depression and anxiety.[9] However, the role of vascular access type was not investigated in these studies. Also, the results of these studies were contradictory to each other. Therefore, the aim of this study is to investigate all factors, including vascular access type, that affect anxiety symptoms, depression, and poor sleep quality in hemodialysis patients.

METHODS

Patients and Study Design

A total of 101 patients followed in the hemodialysis unit between 2019 and 2021 were included in the study. Patients with communication problems, cognitive dysfunction, or a known psychological disorder, those younger than 18 years of age, those who underwent hemodialysis for less than 6 months, hospitalized in the last month, and had neurological disorders such as hemiplegia and hemiparesis were excluded from the study. Patients' age, gender, comorbidities, CKD etiology, smoking, duration of hemodialysis, vascular access type, and enter-exit mean blood pressure were recorded. According to vascular access type, the patients were divided into 2 groups: patients with central venous catheter (CVC) and patients with arterio-venous fistula (AVF). Ethical approval of the study was obtained from our Hospital Ethics Committee (Approval number: E-19/39/01.10.2019). In addition, a signed consent form was obtained from the patients.

Laboratory Analyses

C-reactive protein (CRP), red cell distribution width (RDW), neutrophil–lymphocyte ratio (NLR), albumin, calcium, phosphorus, parathormone, alkaline phosphatase (ALP), total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), non-HDL and triglyceride, platelet, mean platelet volume as well as complete blood count, uric acid, fasting blood glucose were measured. The prognostic nutritional index (PNI) was used to evaluate malnutrition in patients. The PNI was calculated according to the following formula: 10 × serum albumin value (g/dL) + 0.005 × peripheral lymphocyte count (/mm^3). A lower PNI indicates a high risk of malnutrition. The PNI which was created initially to be applied in patients undergoing intensive care and post-surgery cancer patients has been shown to be effective objective method for determining the progression of many diseases and for evaluating malnutrition[12] Over time, these indexes were applied in CKD and dialysis patients. It was found that these indexes could be predictors of malnutrition, CKD progression, and mortality.[13] Bu paragraf tercih ettiğiniz metotlarla ilgili olarak tartışma kısmına taşınmalı.

Questionnaires

Quality of sleep was measured using the PSQI. The PSQI is a 19-item self-report scale that evaluates sleep quality and disturbance in the past month. It consists of 24 questions. Nineteen questions are self-report questions, and 5 questions are questions to be answered by the spouse or roommate. The questions of the scale consist of 7 components. These are Subjective Sleep Quality, Sleep Latency, Sleep Duration, Sleep Efficiency, Sleep Disturbances, Sleeping Drug Use, and Daytime Dysfunction. Each component is evaluated over 0-3 points. The total score of the 7 components gives the scale total score. The total score ranges from 0 to 21. A total score greater than 5 indicates "poor sleep quality."[15] The validity and reliability study of the PSQI was performed in Turkey by Ağargün et al.[16]

Beck Anxiety Inventory (BAI) evaluates the frequency of anxiety symptoms experienced by the individual. It is a self-assessment scale consisting of 21 items and scored between 0 and 3. With the questions asked to the patient, it is questioned how much the feeling of distress has bothered him/her in the last week. According to the scores obtained from the BAI, 0-7 points no anxiety, 8-15 points lower, 16-25 points medium, and 26-63 points high anxiety levels are interpreted. The validity and reliability study of the BAI was performed in Turkey by Ulusoy et al.[17]In our study, patients with a score of 8 or higher according to BAI were considered to have anxiety symptoms. Patients with a score of 7 or less were considered to have no anxiety symptoms.

The Beck Depression Inventory (BDI) scale was used to determine the risk of depression and to measure the severity of depression symptoms. The scale consists of 21 items. It is rated from 0 to 3. Overall scores range from 0 to 63. The validity and reliability study of the BDI was performed in Turkey by Hisli.[18] In our study, patients with a score of 14 and above according to the BDI score were considered to have suspicion of depression. Patients with a score of 13 or less were considered to have no suspicion of depression.

Statistical Analysis

Analyses were conducted using BM Statistical Package for the Social Sciences version 22.0 (IBM SPSS Corp.; Armonk, NY, USA). All data were first checked for normality of distribution using

MAIN POINTS

- Sleep disorders, depression, and anxiety are common in patients with chronic kidney disease and are independent risk factors for mortality.
- Although the rate of poor sleep quality, anxiety symptoms, and suspicion of depression was found to be significantly higher in the group with central venous catheter than in the group with arterio-venous fistula, no effect of vascular access was detected in the regression analysis.

the Kolmogorov–Smirnov and Shapiro–Wilk test. Normally distributed data are presented as the mean ± standard deviation. Non-normally distributed data are presented as the median (inter-quartile range). Independent samples *t*-test was used to compare parametric continuous variables between groups. Mann–Whitney *U*-test was employed for the comparison of non-parametric variables. Pearson's χ^2 or Fisher's exact was used for categorical variables. Univariate and multivariate binary logistic regression analyses were applied to determine the factors affecting poor sleep quality, depression, and anxiety in hemodialysis patients. A significant difference was considered when $P < .05$.

RESULTS

Basic Demographics of Patients

The mean age of the patients included in the study was 51.2 ± 15.5 years, and 43% of them were women. The mean duration of hemodialysis was 6.1 ± 5.1 years. Of the patients, 30% underwent hemodialysis through a CVC. There were no patients with a non-tunneled catheter. The CKD etiology was primarily diabetes mellitus (DM) (30.7%) followed by hypertension (27.7%), unknown (26.1%), glomerulonephritis (10%), and structural disorders (10%).

The study detected anxiety symptoms in 76.2%, suspicion of depression in 64.4%, and poor sleep quality in 63.4% of the patients. The PSQI score was 5.42 ± 2.65, the BAI score was 15.6 ± 10.45, and the BDI score was 15.58 ± 10.9. The basic demographics and laboratory data of the patients are shown in Table 1.

Patients with Arterio-Venous Fistula and Central Venous Catheter and with Groups Comparison

There was no difference between the 2 groups in terms of age, gender, and smoking status. The incidence of DM and cerebrovascular events (CVE) was slightly higher in the group with CVC (*P*: .001; *P*: .014, respectively). Anxiety symptoms, suspicion of depression, and poor sleep quality were significantly higher in the patients with CVC than patients with AVF in terms of percentage (96.8% vs. 67.2%, *P*: .001, 90.3% vs. 52.9%, *P*: .001, 80.6% vs 55.7%, *P*: 0.024, respectively). In addition, the BDI score (17^{17}), BAI score (19^{10}), and PSQI score (6^{3}) were significantly higher in the patients with CVC than patients with AVF in terms of score (*P*: .001, *P*: .002, and *P*: .011, respectively). In the group with CVC, the inflammation parameters CRP (*P*: .026), NLR (*P*: .013), RDW (*P*: .004) were higher and albumin (*P*: .001) was lower. In addition, PNI, which is a malnutrition parameter, was found to be lower in the group with CVC. The comparison of the basic demographics and laboratory data of the 2 groups is shown in Table 1.

Regression Analysis of Factors Affecting Sleep Quality in Hemodialysis Patients

Poor sleep quality was detected in 63.4% of the patients, and the PSQI score was 5.42 ± 2.63. Although according to univariate regression analysis, factors affecting the sleep quality of patients are high BDI and BAI scores, presence of CVC, low albumin, and PNI, it was determined that the key factor was a high BAI score (odds ratio (OR): 1.091, 95% CI: 1.035-1.154; *P*: .001) in multivariate regression (Table 2).

Regression Analysis of Factors Affecting the Development of Anxiety in Hemodialysis Patients

Anxiety symptoms were observed in 76.2% of the patients. Symptoms were mild in 46.15%, moderate in 33.35%, and severe in 20.5% of patients. Factors affecting anxiety in regression analysis were female gender (OR: 10.183; 95% CI: 2-50.6; *P*: .005), high BDI score (OR: 1.205; 95% CI: 1.066-1.363; *P*: .003), and high PSQI score (OR: 1.643; 95% CI: 1.125-2.4; *P*: .01) (Table 3).

Regression Analysis of Factors Affecting the Development of Depression in Hemodialysis Patients

Suspicion of depression was detected in 64.4% of the patients. The main factor triggering suspicion of depression was high BAI score, and in the regression analysis, it was found that it affected the development of depression 1.45 times (OR: 1.45, 95% CI: 1.218-1.724, $P < .001$). Other factors triggering suspicion of depression were low PNI, high NLR, and the presence of DM (Table 4).

DISCUSSION

The prevalence of sleep disorders is quite high in patients with CKD, especially in patients with end stage kidney disease. Sleep apnea is detected at a rate of 30%-70%,[19,20] and insomnia is detected at a rate of 50%-70% in these patients.[21,22] Poor sleep quality caused by sleep disorders is seen in 60%-80% of patients.[2,3] Calcium phosphorus metabolism disorders, uremic toxins,[21] restless legs syndrome,[23,24] itching, decrease in melatonin level, disruption of melatonin diurnal rhythm,[22] and volume load[25] are some of the underlying causes of poor sleep quality.

In the current study, poor sleep quality was detected in 63.4% of the patients. The PSQI score was 5.42 ± 2.63. The proportion of patients with poor sleep quality in the group undergoing hemodialysis through CVC was significantly higher than in the group undergoing hemodialysis through AVF. High CRP and NLR ratios in the CVC group may be the underlying cause of poor sleep quality. The study conducted by Taraz et al[26] reported that inflammation affects sleep quality. In addition, high rate of suspicion of depression and anxiety symptoms in the CVC group may affect sleep quality. Multivariate regression analysis also showed that the presence of anxiety (high BAI score) affected sleep quality 1.09 times.

Anxiety and depression are seen slightly more frequently in dialysis patients than in the normal population. In a study conducted by Brito et al[27] with 205 patients, depression symptoms were observed in 41.7% of the patients, while 32.3% had anxiety symptoms. In another study conducted with 687

Table 1. The Comparison of Patients with AVF and CVC Groups

Parameters	All Patients	AVF (n = 70)	CVC (n = 31)	*P*
Age (years)	51.2 ± 15.5	51.77 ± 16	49.9 ± 14.75	.588
Gender (female) (%)	43.6	37.1	58.1	.081
DM (%)	34.7	24.3	51.8	.001
HT (%)	70.3	71.4	67.7	.708
CVE (%)	4.95	1.4	12.9	.014
CVD (%)	20.8	20	22.6	.794
Smoking (%)	28.7	27.1	32.3	.638
Anxiety symptoms (%)	76.2	67.1	96.8	.001
Suspicion of depression (%)	64.4	52.9	90.3	<.001
Poor sleep quality (%)	63.4	55.7	80.6	.024
Hemodialysis duration (years)	6.1 ± 5.1	6 (7)	2 (3)	<.001
Enter MBP (mmHg)	95.5 ± 16.6	100 (24)	93 (23)	.684
Exit MBP (mmHg)	76.7 ± 14.7	73 (20)	73 (20)	.888
FBG (mg/dL)	121 ± 60.9	92.5 (31.5)	106 (115)	.003
Albumin (g/dL)	3.95 ± 0.46	4.1 (0.4)	3.9 (0.7)	.001
CRP (mg/L)	8.06 ± 7.95	5.2 (7.15)	7 (7.15)	.026
Calcium (mg/dL)	8.73 ± 0.9	8.8 (0.9)	8.9 (0.8)	.871
Phosphorus (mg/dL)	5.1 ± 1.5	4.97 ± 1.35	5.37 ± 1.86	.224
Parathormone (ng/L)	635.3 ± 753.5	3 (483)	375 (685)	.760
ALP (IU/L)	180 ± 192.4	122.5 (87)	144 (119)	.583
WBC (10^6/L)	7285 ± 2032	7295 ± 2021	7265 ± 2091	.946
Hemoglobin (g/dL)	10.9 ± 1.5	11.2 ± 1.43	10 ± 1.36	<.001
RDW (%)	15 ± 1.62	14.6 (1.4)	15.3 (2.1)	.004
Platelet (10^9/L)	193.9 ± 70.328	189 (80.5)	161 (149)	.834
NLR	3.44 ± 1.67	2.79 (1.53)	3.77 (2.8)	.013
T. cholesterol (mg/dL)	142.3 ± 5.5	143 ± 34.7	141.8 ± 37.9	.877
HDL (mg/dL)	142.47 ± 82.191	36 (12)	35 (11)	.740
LDL (mg/dL)	77.9 ± 27.3	77 ± 26.4	80.1 ± 29.5	.631
Triglyceride (mg/dL)	37 ± 11.88	123.5 (97)	120 (86)	.531
PNI	47.17 ± 5.88	48.55 ± 4.97	44 ± 4.64	.002
PSQI score	5.42 ± 2.65	5 (3)	6 (3)	.011
BAI score	15.61 ± 10.45	11 (13.5)	19 (10)	.002
BDI score	15.58 ± 10.89	10 (13)	17 (17)	.001
Kt/v	1.49 ± 0.85	1.52 (0.13)	1.46 (0.09)	.653

ALP, alkaline phosphatase; AVF, arterio-venous fistula; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CVC, central venous catheter; CVD, cardiovascular disease; CVE, cerebrovascular events; CRP, C-reactive protein; DM, diabetes mellitus; FBG, fasting blood glucose; HDL, high-density lipoprotein; HT, hypertension; LDL, low-density lipoprotein; MBP, mean blood pressure; MPV, mean platelet volume; NLR, neutrophil–lymphocyte ratio; PNI, prognostic nutritional index; PSQI, Pittsburgh Sleep Quality Index; PTH, parathormone; RDW, red cell distribution width; T. cholesterol, total cholesterol; WBC, white blood cell.

Table 2. Regression Analysis of Factors Affecting Sleep Quality in Hemodialysis Patients

Parameters	OR	95% CI	*P*	OR	95% CI	*P*
	Univariate			Multivariate		
BDI score	1.059	1.012-1.109	.014	0.978	0.925-1.053	.698
DM (%)	1.418	0.595-3.378	.430			
CVE (%)	0.527	0.206-1.345	.180			
VA type (%)	0.302	0.110-0.827	.02	2.171	0.709-6.649	.175
BAI score	1.093	1.035-1.154	.001	1.091	1.035-1.154	.001
Hemodialysis duration (years)	1.013	0.935-1.099	.749			
FBG (mg/dL)	1.003	0.996-1.010	.384			
CRP (mg/L)	1.071	0.995-1.153	.07			
NLR	1.155	0.889-1.501	.280			
PNI	0.906	0.835-0.982	.017	0.961	0.808-1.141	.648
Albumin (g/dL)	0.321	0.113-0.914	.033	1.034	0.115-9.335	.976
Hemoglobin (g/dL)	0.999	0.763-1.308	.993			
RDW (%)	1.268	0.889-1.501	.280			

BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CRP, C-reactive protein; CVE, cerebrovascular events; DM, diabetes mellitus; FBG, fasting blood glucose; NLR, neutrophil–lymphocyte ratio; PNI, prognostic nutritional index; RDW, red cell distribution width, VA, vascular access.
Reference data of albumin: 3.5-5.2, reference data of hemoglobin: 12.5-16, reference data of RDW: 11.5-14, reference data of FBG: 75-99, reference data of CRP: <5.

Table 3. Regression Analysis of Factors Affecting the Development of Anxiety in Hemodialysis Patients

Parameters	OR	95% CI	*P*	OR	95% CI	*P*
	Univariate			Multivariate		
PNI	0.887	0.805-0.977	.015	1.126	0.841-1.508	.427
Gender (%)	3.9	1.322-11.5	.014	10.183	2.01-50.6	.005
DM (%)	1.812	0.645-5.09	.259			
CVE (%)	1.278	0.449-3.633	.646			
BDI score	1.275	1.129-1.440	.000	1.205	1.066-1.363	.003
VA type (%)	0.068	0.009-0.531	.01	0.255	0.023-2.893	.270
Hemodialysis duration (years)	1.001	0.914-1.096	.096			
PSQI score	1.574	1.216-2.038	.001	1.643	1.125-2.4	.01
RDW (%)	1.556	1.027-2.359	.037	1.323	0.697-2.510	.391
Albumin (g/dL)	0.172	0.044-0.665	.011	0.455	0.01-20.875	.687
CRP (mg/L)	1.05	0.996-1.808	.143			
NLR	1.288	0.918-1.808	.143			
Hemoglobin (g/dL)	0.99	0.760-1.105	.888			
FBG (mg/dL)	1.018	1.001-1.036	.034	1.021	1-1.042	.055

BDI, Beck Depression Inventory; CRP, C-reactive protein; CVE, cerebrovascular events; DM, diabetes mellitus; FBG, fasting blood glucose; NLR, neutrophil–lymphocyte ratio; PNI, prognostic nutritional index; PSQI, Pittsburgh Sleep Quality Index; RDW, red cell distribution width; VA, vascular access.
Reference data of albumin: 3.5-5.2, reference data of hemoglobin: 12.5-16, reference data of RDW: 11.5-14, reference data of FBG: 75-99, reference data of CRP: <5.

Table 4. Regression Analysis of Factors Affecting the Development of Suspicion of Depression in Hemodialysis Patients

Parameters	OR	95% CI	*P*	OR	95% CI	*P*
	Univariate			Multivariate		
PNI	0.783	0.697-0.881	<.001	0.731	0.593-0.90	.003
PSQI score	1.55	1.237-1.943	.003	1.440	0.923-2.221	.099
Age (years)	1.030	1.004-1.062	.025	0.955	0.890-1.026	.209
CVE (%)	0.505	0.206-1.211	.163			
VA type (%)	0.120	0.033-0.432	.001	1.951	0.213-17.9	.554
Hemodialysis duration (years)	1.012	0.955-1.115	.651			
DM (%)	4.028	1.476-10.98	.007	8.29	1.61-45.2	.011
Albumin (g/dL)	0.044	0.009-0.220	.001	0.244	0.005-12.98	.486
RDW (%)	1.575	1.086-2.284	.017	0.765	0.419-1.397	.383
FBG (mg/dL)	1.014	1.003-1.026	.015	1.004	0.988-1.021	.607
CRP (mg/L)	1.071	0.890-1.155	.086			
Hemoglobin (g/dL)	1	0.980-1.308	.888			
NLR	1.377	1.015-1.868	.04	0.508	0.279-0.927	.027
BAI score	1.383	1.212-1.579	.001	1.45	1.218-1.724	.001

BAI, Beck Anxiety Inventory; CRP, C-reactive protein; CVE, cerebrovascular events; DM, diabetes mellitus; FBG, fasting blood glucose; NLR, neutrophil–lymphocyte ratio; PNI, prognostic nutritional index; PSQI, Pittsburgh Sleep Quality Index; RDW, red cell distribution width; VA, vascular access.
Reference data of albumin: 3.5-5.2, reference data of hemoglobin: 12.5-16, reference data of RDW: 11.5-14, reference data of FBG: 75-99, reference data of CRP: <5.

dialysis patients, depression was detected in 42% and anxiety was detected in 22% of the patients. In 27% of the patients with anxiety, severe depression symptoms were also present.[28] Compared to these studies, the prevalence of anxiety symptoms and suspicion of depression was found to be slightly higher in the current study.

In patients with CKD, the loss of the patient's primary role in the family, insufficient family support, decreased physical activity, being dependent on someone or on a machine, and dietary restrictions trigger depression, while continuous intervention in vascular access during dialysis, loss of vascular access, and insufficient creatinine clearance trigger anxiety.[27]

There are a limited number of studies investigating the effect of the type of vascular access, and the results obtained are in conflict with each other. In a study investigating the presence of both depression and anxiety, no significant difference was found between the group with AVF and the group with arterio-venous grafts in terms of the presence of depression and anxiety.[28] However, in another study conducted with 1461 hemodialysis patients, the BDI score was found to be significantly higher in the group with CVC than in the group with AVF.[29]

In the current study, suspicion of depression and anxiety symptoms were significantly higher in the group with CVC than in the group with AVF, both in terms of scores (BDI and BAI scores) and percentage. This situation may be due to the higher incidence of DM disease and CVE complications. Developed complications can cause patients to experience a constant fear of death. In addition, in the multivariate regression analysis, we found that factors affecting anxiety were female gender and high PSQI and BDI scores, while factors affecting depression were DM, malnutrition (PNI score), inflammation (NLR), and high BAI score.

In this study, the anxiety, depression, and sleep quality results of the patients were obtained only cross-sectionally, and therefore, possible changes that could be seen in the same patients over time could not be determined. The limitations of this study are that the questionnaires are not repeated over time, drug use is not questioned, and the number of patients is low.

CONCLUSION

Sleep disorders, depression, and anxiety are common in CKD patients and are independent risk factors for mortality. Although the rate of poor sleep quality, anxiety symptoms, and suspicion of depression was found to be significantly higher in

the group with CVC than in the group with AVF, no effect of vascular access was detected in the regression analysis. However, these questionnaires should be administered from time to time for dialysis patients. Precautions should be taken against other factors triggering these disorders and treatment should not be delayed..

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of University of Health Sciences, Ankara Training and Research Hospital (Date: October 1, 2019, Decision No: E-19/39).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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