



Validity and reliability of innovative behaviors of nurses and midwives scale: A scale development study

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Abstract

Aim: This research was carried out to develop a measurement instrument to determine the innovative behaviors of nurses and midwives.

Materials and Methods: This study, which is of a methodological nature, was applied with 216 nurses and midwives between 01.06.2021-31.09.2021. The item pool of the scale was created by the researchers with the literature as twenty-three items in a five-point Likert type and submitted to the opinions of twelve specialists.

Results: The three-factor scale structure designed by making explanatory and confirmatory factor analysis was confirmed with the validity and reliability. According to the analysis results; the scale consisted of three sub-dimensions (managerial and personal; physical and occupational; organizational and environmental) and 15 items. It was founded that the content validity index of the scale items was 0.468-0.851; factor loads were 0.510-0.871; item-total score correlations were 0.467-0.768, and the Cronbach's alpha reliability coefficient of the sub-dimensions ranged between 0.703-0.876 and it was 0.912 for the whole scale.

Conclusion: As a result of the validity and reliability analyzes of the Attitude Scale towards Innovative Behaviors of Nurses and Midwives, it was founded that it can be used as a valid and reliable scale.



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Introduction

Innovativeness; is to create innovation by bringing different perspectives to a phenomenon and to adapt to innovative thinking [1]. Innovativeness is accepted as a social and communicative process, and it develops the potential to generate new and valuable ideas as well as the development of ideas obtained from other individuals [2]. Innovative behaviors can also be examined with dimensions such as idea discovery, idea generation, idea implementation and idea advocacy [3]. Innovative behaviors are important of providing better care and reducing health care costs in the processes of protecting and maintaining health and preventing and treating diseases [4]. New ideas are adjusted, adopted, restructured, advocated, supported and experienced to help solve or improve health problems, products or services [5]. The literature includes studies stating that many situations, such as education, organizational culture, personality traits [6,7] colleague, man-

agement support, freedom, autonomy, social and cognitive incentives, lack of resources, technology [8,9], can affect innovative behaviors. In order to develop innovative behaviors of health professionals, it is recommended to motivate individuals to join in researches and other activities, to give chances, and to provide enough time and resources [6].

Innovativeness has critical importance in increasing the life quality of individuals and reducing health care costs [10]. But surprisingly, barely is known about the nature of innovation in healthcare settings and its relationship to performance [11]. It is quite important to answer the question of which characteristics and conditions affect the innovative behaviors of individuals and groups. Although there are dissimilar scales in the written works [12,13] to determine the innovativeness levels of individuals in general; there isn't any measurement tool that can be used to assess the factors that may directly affect the innovative behaviors of healthcare professionals. In this context, it can be expressed that there is a need for the development of structures consisting of criteria that will enable

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to determine the factors affecting the innovative behaviors of healthcare professionals. As well as being a scale that aims to determine the factors affecting innovative behaviors, this scale is important in the sense that it measures the statements about health professionals and there is no such scale in the literature.

Materials and Methods

Research aim and type

This work is methodological research carried out with the purpose of developing a scale to definitive the factors affecting the innovative behaviors of nurses and midwives.

Research question

“Is the scale developed to determine the innovative behaviors of nurses and midwives a valid and reliable measurement tool?”

Research population

The people of the research be formed of healthcare professionals working as nurses or midwives in Turkey. The sample consisted of 216 nurses and midwives between 01.06.2021-31.09.2021. In determining the sample size, it was planned to 10 people per item on average in line with the literature information [14,15], and 216 people were reached in line with the number of things (21 items) of the draft scale. Among the criteria for being taken in the study were that the contributors were working as nurses or midwives and volunteered to participate in the study. Ethical permission (Yalova University Ethics Committee, dated 08.05.2021 and numbered 2021-32) was obtained in order to conduct the research. The "Volunteer Informed Consent Form" was used to inform the participants and ethical principles were observed at all stages of the research.

Data collection tools

Information form

The structured information form used to determine the demographic characteristics of the participants was formed by the researchers in line with the written works [8,13]. The socio- demographic and descriptive characteristics of nurses and midwives (age, gender, working year, etc.) were questioned in the information form.

Attitude scale towards innovative behaviors of nurses and midwives (ASIBNM)

The scale, developed by the researchers after validity and reliability analysis, be formed of a total of 15 items and 3 sub-dimensions (Managerial and Personal Sub-Dimension; Physical and Occupational Sub-Dimension; Organizational and Environmental Sub-Dimension) (Supplement 1).

In Managerial and Personal Sub-Dimension; it can be said that innovative actions of individuals are influenced by the attitudes of the managers, the motivation sources of the individuals, autonomy and social supports. It can be stated

that; as the score obtained from this sub-dimension increases, innovative behaviors are affected by managerial and personal factors.

In Physical and Occupational Sub-Dimension; it can be said that innovative actions of individuals are impacted by the financial and physical opportunities in the working environment, the love for the profession and occupational experience. It can be stated that; as the score obtained from this sub-dimension increases, innovative behaviors are affected by physical and occupational factors. *In Organizational and Environmental Sub-Dimension;* it can be said that innovative attitudes of individuals are influenced by the workload, long working conditions and lack of support in practice. It can be stated that as the score obtained from this sub-dimension increases, innovative behaviors are affected by organizational and environmental factors.

The scale is a “5-point Likert Type” and the scale items are scored as 1 “I strongly disagree”, 2 “I disagree”, 3 “I am not sure”, 4 “I agree”, and 5 “I strongly agree”. There is no reverse scored item in the scale. A lowest level of 15 points and a highest of 75 points can be given from the scale. It can be said that, as the scores to be given from the scale increase, the innovative behaviors of individuals are affected by personal, organizational and environmental factors.

Scale development stages

In the first stage, an item pool was made by reviewing the written works by the researchers. A total of 23 scale items were included in the item pool. In the preparation of draft scale questions, qualitative and quantitative studies examining innovative behaviors were examined by researchers [8,13].

Secondly, content validity was ensured. For content validity, the scale items were offered to the aspects and suggestions of twelve specialists. The content validity ratio of the items in the scale and the content validity index of the scale were evaluated using the “Davis Technique”. The specialists score the conformity of each item as “1” not relevant, “2” should be seriously reviewed, “3” should be slightly reviewed, and “4” highly relevant, and they can also make open-ended suggestions about the items. “The content validity ratio for the item” is calculated by dividing the number of specialists who grade the conformity of an item as 3 points and 4 points by the total number of specialists, and the “content validity index” is computed by dividing the content validity ratio of all items by the number of items, and both are recommended to be >0.80 [16]. After this evaluation, 2 items remaining below the recommended content validity ratio were detached from the scale. In the third stage, the scale was applied to a small sample group in order to assess the clarity and comprehensibility of the scale items. The draft scale was implemented to a group of 54 nurses and midwives who had similar characteristics with the sample group. In this pilot study, feedback was also received from the participants with regard to the comprehensibility of the scale items.

At the last stage, the draft scale was given its final shape in line with their recommendations and applied to the sample

group that was ten times the number of items. In order to decide whether the measured data reflected the characteristic intended to be measured and whether the measurement complied with the rules; content, validity and reliability analyzes were made and the scale was given its final form. The scale took its final form with a total of 15 scale items.

Analysis of data

The data obtained in the research were analyzed using the SPSS “Statistical Package for Social Sciences” for Windows Program 25.0. Descriptive statistical methods (number, percentage, mean, standard deviation) were used while evaluating the data. Whether the data is normally distributed or not can be evaluated with histogram, Q-Q graph and box-plot graphs in addition to normality tests; as well as the distribution measures such as the skewness and kurtosis, coefficient of variation [17]. In order to ensure normality, the values should be observed close to a 45-degree line in the scattering diagram of the data and should be positioned by centering the median line of the box in the box-plot graph [18]. The normal distribution was checked with “conformity tests of normality and kurtosis skewness values”. Reliability analysis is performed to test the consistency of the statements in the scales with each other and whether the statements measure the same subject [19]. This was studied with Cronbach Alpha in this study.

Results

Socio demographic characteristics

It was founded that the mean working years of the workers in the profession was 6.89 ± 7.53 and 89.4% were female and 10.6% were male. It was founded that 91.2% of the participants were nurses and 8.8% were midwives. When the educational status of the contributors is examined, it is seen that the majority of them (64.4%) have a bachelor’s degree. It was determined that 60.6% of the participants were single and 39.42% were married. It was also determined that, 34.7% of their units were Internal Units, 13% were Emergency Departments, 23.1% were Intensive Care Units, 17.1% were Surgical Services, 5.1% were First Level Health Services and 6.9% were Administrative Units. Socio demographic characteristics in the Table 1 (Supplement 1).

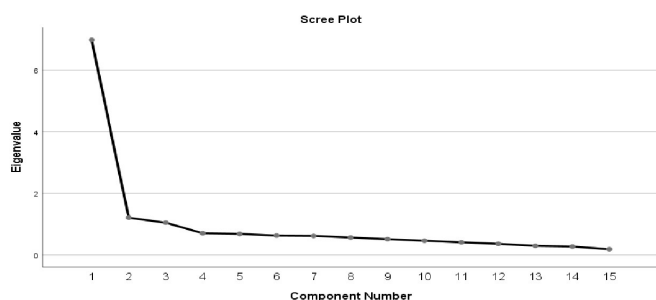


Figure 1. Scree plot to determine the number of factors.

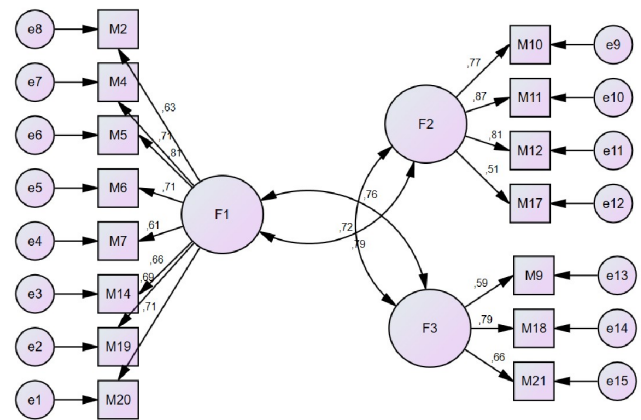


Figure 2. First level multi-factor model confirmatory factor analysis of the attitude scale towards the innovative behaviors of nurses and midwives.

Table 1. Demographic characteristics of the participants (n=216).

Variables	Avg±SD	
Years of work in the profession	6.89±7.53	
	n	%
Gender		
Female	193	89.4
Male	23	10.6
Profession		
Nurse	197	91.2
Midwife	19	8.8
Educational Status		
High School	12	5.6
Associate Degree	13	6.0
Bachelor’s Degree	139	64.4
Master’s Degree	42	19.4
PhD	10	4.6
Marital Status		
Single	131	60.6
Married	85	39.4
The unit where you work		
Internal Unit	75	34.7
Emergency Service	28	13.0
Intensive Care	50	23.1
Surgery Service	37	17.1
1st Level Health Services	11	5.1
Administrative Unit	15	6.9
Total	216	100.0

SD: Standard Deviation.

Explanatory factor analysis results

As seen in Table 2, “explanatory factor analysis” was made in order to reveal the factor pattern of the Attitude Scale towards Innovative Behaviors of Nurses and Midwives (Supplement 1). Before the exploratory factor analysis application, the “Kaiser-Meyer-Olkin (KMO)” test was applied to test the conformity of the sample size for factorization. It was determined that the KMO value was 0.910 and it was ended that the sample size and the items were “adequate” for making factor analysis. In addition,

Table 2. Explanatory factor analysis results with respect to the attitude scale towards innovative behaviors of nurses and midwives.

Factors			
Statements	1	2	3
M6	0.851		
M5	0.740		
M4	0.711		
M7	0.615		
M20	0.575		
M19	0.531		
M14	0.522		
M2	0.468		
M11		0.755	
M17		0.751	
M12		0.711	
M10		0.610	
M9			0.792
M21			0.773
M18			0.620
Eigenvalue	6.981	1.212	1.050
Explained Variance	24.965	18.998	17.659
KMO = 0.910; $\chi^2(105) = 1563.911$; Bartlett Test of Sphericity (p) = 0.000			
Total explained variance=61.621			

KMO: Kaiser-Meyer-Olkin.

when the results of the “Bartlett Sphericity Test” were examined, it was seen that the obtained chi-square value was significant ($\chi^2(105) = 1563.911$ p<0.01). Accordingly, it was accepted that the data came from a multivariate normal distribution. After confirming the conformity of the data for factor analysis, explanatory factor analysis was made using “Principal Components Analysis” and “Varimax Rotation Methods” to examine the factor structure of the scale. When the factor pattern for all items was examined, it was determined that the scale revealed an ideal three-dimensional distribution. Therefore, the relevant scale was accepted as three dimensions and the factor pattern was stated to be acceptable. Therefor the factor analysis, overlapping items “1,3,8,13,15,16” were excluded from the analysis. The scale of developed explains 61.521% of the total variability. In addition, the first factor explains 24.965% of the total variability, the second factor explains 19.998% of the total variability, and the third factor explains 17.659% of the total variability.

When the graph, which includes the number of elements on the horizontal axis and the eigenvalues elements on the vertical axis, is surveyed, it is seen that the high-accelerated fall decreases after the fourth point. The trend of the declines seen from the first point shows the degree of additive to the variance. After the fourth point, the additive of each factor to the variance lessens and it is seen that the additives of the variances to be added are very close to each other. Eigenvalue and percentages of variance and the data obtained from the graph were decided to be three

Table 3. Item analysis results of the items of the attitude scale towards innovative behaviors of nurses and midwives.

	r	t	p value
	(Lower 27%-Upper 27%)		(Lower 27%-Upper 27%)
Factor 1			
M2	0.573	-8.621	0.000 *
M4	0.651	-9.318	0.000 *
M5	0.754	-11.862	0.000 *
M6	0.688	-12.367	0.000 *
M7	0.577	-10.776	0.000 *
M14	0.595	-10.260	0.000 *
M19	0.620	-10.985	0.000 *
M20	0.657	-10.700	0.000 *
Factor 2			
M10	0.637	-11.476	0.000 *
M11	0.768	-13.390	0.000 *
M12	0.682	-11.139	0.000 *
M17	0.467	-12.859	0.000 *
Factor 3			
M9	0.519	-11.506	0.000 *
M18	0.563	-12.212	0.000 *
M21	0.577	-11.662	0.000 *

n = 216, ** n1 = n2 =59; r= Item Total Score Correlation * Significant values for p < 0.05.

factors in line with the explanatory factor analysis (Figure 1).

Table 3 includes “the independent group t-test” results showing the distinctiveness power of all items and item total correlation (Supplement 1). The minimum required value in order for the “item-total test correlation” to be sufficient is specified as 0.30. From the scale items whose item correlations we examine, items remaining below 0.30 should not be included in the analysis. “The item-total test correlation values” of the answers given by the participants to the scale questions were examined and it was founded that there were no items that remained below 0.30. “The item-total test correlation values” of all items vary between 0.467 and 0.768. As seen in the item-total test correlation table, it was founded that all items were related to each other. In order to decide the openness of the matters included in the scale, the raw scores obtained from the scale were ranked from largest to smallest, and the score averages of the groups in the lower 27% and upper 27% were matched with the independent group t-test. It was seen that there was a reliably significant dissimilarity between the averages of the lower and upper group item scores. With reference to that, it can be said that the scale is characteristic in terms of measuring the desired standard.

“Reliability analysis” is carried out to test whether the statements included in the scales are consistent with each other and whether all the statements measure the same subject [19]. In reliability analysis, it is evaluated as follows: if the “Cronbach’s Alpha (α)” coefficient value varying between 0-1 is between 0.00-0.40, the scale is not reliable; if it is between 0.40-0.60, the scale has low reliability;

Table 4. Descriptive statistics and reliability analysis of the attitude scale towards innovative behaviors of nurses and midwives.

Scale and sub-dimensions	n	Min.	Max.	Avg.	SS	Number of Items	Cronbach Alfa
F1	216	1.00	5.00	4.39	0.54	8	0.876
F2	216	1.00	5.00	4.34	0.62	4	0.803
F3	216	1.00	5.00	4.35	0.65	3	0.703
Scale total	216	1.11	5.00	4.36	0.52	15	0.912

Table 5. Findings for confirmatory factor analysis.

Index	Perfect Fit Criterion	Acceptable Fit Criterion	Post Modification	Result
χ^2/SD	$0 \leq \chi^2/df \leq 3$	$3 \leq \chi^2/df \leq 5$	2.074	Perfect Fit
RMSEA	$0.00 \leq RMSEA \leq 0.05$	$0.05 \leq RMSEA \leq 0.08$	0.071	Acceptable Fit
CFI	$0.95 \leq CFI \leq 1.00$	$0.85 \leq CFI \leq 0.95$	0.938	Acceptable Fit
NFI	$0.95 \leq NFI \leq 1.00$	$0.80 \leq NFI \leq 0.95$	0.888	Acceptable Fit
IFI	$0.95 \leq IFI \leq 1.00$	$0.80 \leq IFI \leq 0.95$	0.939	Acceptable Fit
TLI	$0.95 \leq TLI \leq 1.00$	$0.80 \leq TLI \leq 0.95$	0.925	Acceptable Fit
GFI	$0.90 \leq GFI \leq 1.00$	$0.80 \leq GFI \leq 0.90$	0.909	Perfect Fit
AGFI	$0.95 \leq AGFI \leq 1.00$	$0.85 \leq AGFI \leq 0.95$	0.975	Acceptable Fit

Chi square/ Degrees of Freedom (χ^2/SD) Root Mean Square Error of Approximation (RMSEA) Comparative Fit Index (CFI) Normed Fit Index (NFI) NNFI: Non-Normed Fit Index Goodness of Fit Index (GFI) Adjusted Goodness of Fit Index (AGFI).

if it is between 0.60-0.80, the scale is quite reliable and if it is between 0.80-1.00; the scale is highly reliable [20]. When the results were examined, “Cronbach’s Alpha” was found to be 0.912 in the Attitude Scale towards Innovative Behaviors of Nurses and Midwives, and it was determined to be a quite reliable scale. In addition, it was seen that sub-dimension reliability was in the range of 0.703-0.876 in the Table 4 (Supplement 1).

In addition, “Split half”, also known as the method of splitting in half, is one of the methods used for reliability. The rationale in the method of splitting in half is to separate the matters in the data set into two and assess the relation between the divide in two. “The Cronbach’s Alpha” value of the first half “M9,M18,M21,M2,M4,M5,M6,M7” is 0.842 and the second half “M7,M14, M19,M20,M10,M11,M12,M17” is 0.853. According to the results, the correlation in both halves was calculated to be 0.783; the “Spearman Brown Coefficient” was 0.878 and the “Gutman Split Half Coefficient” was 0.877, and it was determined that the scale was reliable.

Results of the confirmatory factor analysis

According to the “confirmatory factor analysis”, it was defined that the structural equation modeling outcomes of the scale was noteworthy at $p=0,000$ level and related to the 15 items and three-factor scale structure creating the scale. Outcomes of first-level multi-factor analysis, Considering the righteousness of fit indexes of the Attitude Scale towards the Innovative Behaviors of Nurses and Midwives; it was determined that it revealed acceptable fit with RMSEA 0,071 and perfect fit with χ^2 (Cmin/df) 2,074; AGFI 0,952 and GFI 0,909. Consequently, it was defined that the construct validity of the scale was ensured. “Results of the confirmatory factor analysis” was given in the Table 5 (Supplement 1).

The t statistics show whether the items are statistically significant. Accordingly, first of all, it is seen that the entire t value is significant and the factor load value of all items is above 0.30. It can be concluded that; if the factor load values are above 0.30, the items are suitable for the structure and the structure is confirmed. It was concluded that the factor loads of all items were between 0.510 and 0.871 (Figure 2).

Discussion

The scale development study was first started by examining similar studies in the literature. In line with the written works, a 23-item draft scale was created [8]. The scale items obtained were submitted to specialist opinion for content validity. Content validity is to determine how much each item can symbolize the purpose intended to be evaluated and how much it can serve this purpose [21]. The number of specialists in the study was determined as 12 people [14,15]. With specialist opinions, comprehensibility and simplicity of the scale items and whether they are capable of covering the needed factual or judgmental data is determined [21,22]. “Davis technique” was used to evaluate the conformity of items submitted for specialist opinion [23]. In the Davis (1992) technique, specialists evaluate each scale item with a score between 1 (not relevant) and 4 (highly relevant). The “content validity ratio” is obtained by dividing the number of specialists who evaluate the conformity of an item as 3 and 4 points by the total number of specialists, while the “content validity index” is calculated by splitting the content validity ratio of all items by the number of items [15]. Davis (1992) suggested that the specialist fit should be 80 or above >80 in the development of a new measurement tool [23]. Accordingly, since the 2 items remaining below this score were removed from the draft scale, it is thought that the

content validity was ensured. In the next stage, a pilot application was made to a small group of 54 people. It is stated that the pre-trial application can be carried out on a group representing [24].

It is a general rule to have leastways 10:1 contributor for each item of the scale related to determining the sample size in reliability and validity analyzes, and it is stated that the ideal number can be reached as this ratio increases [25]. In similar studies, it is seen that the number of samples has reached 10 times more than the number of measure matters [15]. Accordingly, 216 people were reached for the total size of 21 items in the study. Before the exploratory factor analysis application, it was founded that the KMO value, which was performed to test the conformity of the sample size for factorization, was 0.910, and it was concluded that the sample size and items were adequate for performing “factor analysis”.

The next step in the scale development study is to determine the item-total test correlation. The item-total test correlation should be at least 0.30 and scale items remaining below this value should not be added in the analysis [20]. Since values of all items vary between 0.467 and 0.768, it can be said that the items can measure the desired quality.

Construct validity provides an explanation of the result existed from the scale and what this result is attached to. For this purpose, explanatory and “confirmatory factor analyzes” can be used. Explanatory factor analysis is used to create measurement tools, while confirmatory factor analysis is used to test whether these created models are verified on the studied sample [26]. In the explanatory factor analysis, factor load value and overlapping state are used [4]. The overlapping state is explained as the case where difference between the load values of an item in two different factors is <0.10 , and in this case, it is recommended to remove one of the items [4]. As a result of the factor analysis in the research, overlapping items (1-3-8-13-15-16) were excluded from the analysis. Factor load value is defined as the coefficient that explains the relationship of an item with a factor. It is a good measure for selection to have 0.40 or higher factor load values [27]. In the study, it was determined that the “factor loads” of all items were between 0.510 and 0.871. Therefore, factor loading values of 15 items were determined to be good-excellent in all sub-dimensions. It can be concluded that; if the factor load values are above 0.30, the items are acceptable and confirmed for the structure.

In confirmatory factor analysis, the structure explained is confirmed by the help of goodness of fit statistics and in this category, it is examined with chi-square (CMIN), chi-square/df, RMSEA, GFI statistics [28]. With respect to confirmatory factor analyzes for construct validity, Akyüz (2018) states that “Chi-square fit test should be between 2 and 3, Root Mean Square Error of Approximation (RMSEA) value should not exceed 0.08; Comparative Fit Index (CFI) value should be above 0.85 or 0.95; The Goodness of Fit Index (GFI) value should be high due to its similarity to R2 in multiple regression.” Considering the goodness of fit indexes of the scale in the study; it was determined that it revealed acceptable fit with RMSEA 0.071; and perfect fit with χ^2 (Cmin/df) 2,074; AGFI 0,952 and GFI 0,909.

We can say that the construct validity of the scale was provided [26].

Reliability analyzes were performed in our study. This analysis is done to test the consistency of the items with each other and whether they measure the same subject [19]. When the results were examined, “Cronbach’s Alpha” was found to be 0.912 in the Attitude Scale towards Innovative Behaviors of Nurses and Midwives, and it was determined to be a quite reliable scale. In addition, “Split half”, also known as the method of splitting in half, is one of the methods used for reliability. The fact that the correlation coefficient between the two halves is found to be high, significant and positive in the halving method shows that the whole scale is consistent with each other [4]. According to the results, the correlation in both halves was calculated to be 0.783; the “Spearman Brown Coefficient” was 0.878 and the “Gutman Split Half Coefficient” was 0.877, and it was determined that the scale was reliable.

Conclusion

The results of the research show that the Attitude Scale towards Innovative Behaviors of Nurses and Midwives (ASIBNM) is a valid and reliable measurement tool consisting of fifteen items and three sub-dimensions in determining the factors affecting innovative behaviors. It is thought that testing the scale with studies carried out in different institutions and with different sample groups will contribute to the development of the scale.

Ethical approval

Ethical permission (Yalova University Ethics Committee. Dated 08.05.2021 2021 and numbered 2021-32) was obtained in order to conduct the research.

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