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Original Article

Investigating the factor structure and validation of the electronic form of the Family Togetherness Scale (FTS) in university students during the corona crisis

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Abstract

Introduction: The coronavirus outbreak has affected the use of printed forms tools, so validating the family functioning scale online can help solve problems in this area; therefore, this study aimed to validate the electronic form of the Family Togetherness Scale (FTS).

Materials and Methods: This descriptive study was conducted using a psychometric method. The statistical population consisted of all students of the Islamic Azad University of Tehran in 2020. The number of samples was determined based on psychometric criteria to 100 people for the convergent validity section and 695 for the construct validity section. The students were selected through cluster sampling method. Research data were collected through Family Togetherness Scale (FTS) and Family Assessment Device (FAD) in printed and electronic form by sending a questionnaire link to the participants' mobile phones. To examine the validity of the scale, content, concurrent, convergent, divergent, and factor analysis methods were used. We investigated its reliability using internal consistency and split-half reliability methods.

Results: The findings of exploratory factor analysis showed that the electronic form of the Family Functioning Scale consists of five factors and has appropriate validity and reliability. Confirmatory factor analysis also confirmed the five-factor model. This questionnaire was performed along with the Family Assessment Questionnaire. The results indicated the positive significant correlation between two scales ($r= 0.67$; $P< 0.001$).

Conclusion: Based on the results, Family Togetherness Scale (FTS) can be used to assess family functioning in Iranian populations.

Keywords: COVID-19, Factor structure, Family functioning, Scale

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Introduction

Family functioning encompasses the social and structural characteristics of the family environment (1). It refers to various constructs such as cohesion and conflict, adaptation, problem-solving, communication, roles, and emotional responsiveness (2). Assessing family functioning is important for studies on the effects of psychological injuries on families, informing about the status of family

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functioning, eliciting family support, and evaluating family interventions (3-6).

Family functioning also affects health outcomes, including mental health (7). Studies have shown a relationship between child mental health, child abuse, parental burnout and family conflicts, and parental violence with low levels of negative family functioning (4,8,9).

On the other hand, any study or action in the family functioning field requires appropriate assessment tools (10). Moreover, the social and structural environments of the persons affect how they perceive and experience psychological and social symptoms of mental health and interpersonal relationships (11). Therefore, using existing scales requires assessing the validity and reliability of these tools among specific populations and subpopulations. Also, family systems are dynamic and constantly evolving (12,13). These changes have been intensified by rapid technological advances and diversity in beliefs and practices (14).

Among these changes are 1-change in gender roles, 2-change in norms related to family structure and centrality of family, and 3-exposure to poverty and other adversities at the societal level that are necessary (15,16). Existing tools for assessing family functioning are revised accordingly.

Various scales have been used to measure family functioning in Iran (17-19). However, these tools have been validated in wealthy societies with small families that often assess specific dyadic relationships (for example, parent-child), and those that assess the family system sometimes have a limited range (for example, only measuring communication) (20). Also, the year of construction of these tools dates back to 30 to 40 years ago (20). During this time, many changes have occurred in the family structure and technology.

A new tool recently introduced to measure family functioning is the Family Togetherness Scale (FTS), which has tried to eliminate many limitations (21).

On the other hand, the outbreak of corona has affected field research, so many respondents are reluctant to fill out scales in self-contained forms due to fear of illness, and this lack of cooperation in students with obsessive-compulsive disorder has more manifestations. Moreover, it faces the results of studies and screening of these students with many problems (22). Therefore due to the lack of valid assessment scales for measuring family functioning in terms of cultural and contextual aspects in Iran, lack of validation of the electronic form of FTS (a new scale that has tried to eliminate previous scale limitations) and the many benefits of electronic forms such as preventing pandemics saving time and money increasing trust and anonymity of respondents, this study was conducted to determine the factor structure and validation of electronic form of Family Togetherness Scale (FTS) in university students.

Materials and Methods

This descriptive study was conducted using a psychometric method. The target population in the present study was all students of Islamic Azad University of Tehran in 2020. The sample size for concurrent validity was 100 people based on the Cochran formula $n= (Z\alpha/2 + Z\beta)^2 \times (1 - \rho^2) / \rho^2$ (23), where n is the number of people in the sample, $Z\alpha/2$ and $Z\beta$ are the zeta values for your desired confidence level and power, and ρ is the expected correlation coefficient between the two scales. Therefore, with a confidence level of 95% and a power of 80%, and an expected correlation coefficient of 0.36, the sample size is 100 people ($n= (1.96 + 0.84)^2 \times (1 – 0.36^2) / 0.36^2=100$).

The Cochran formula for simple random sampling was used to calculate the sample size in exploratory factor analysis. The Cochran formula is $n= Z^2 \times p \times q / d^2$ where n is the number of people in the sample, Z is the zeta value for the desired confidence level, p and q are the probabilities of occurrence and non-occurrence of a characteristic in the population, and d is the sampling error (24). Assuming a confidence level of 95%, p= 0.5, q= 0.5, and d= 0.046, the maximum value of n is 459 people ($n= 1.96^2 \times 0.5 \times 0.5 / 0.046^2= 450$), which with a ten percent dropout rate, 495 people were considered as samples for exploratory factor analysis. Also, based on existing criteria for sample size for confirmatory factor analysis, 200 people were considered a suitable sample for this analysis (25).

The cluster sampling method was used for convergent validity and factor analysis. It should be noted that first, the concurrent validity samples were selected, and the selected individuals from the statistical population were set aside for factor analysis.

The cluster sampling method in this study was as follows: First, the target population,

which included all students of Islamic Azad University in Tehran, was divided into related clusters (university). Then using a random table, four universities were selected as cluster samples. Using a random table, one faculty was selected as the second cluster in each of the selected universities. Then by referring to the selected faculties, using a random table, one class was selected as the third cluster. Finally, research questionnaires were presented to them by referring to the selected classes after obtaining informed consent from students. Thus the unit of sample under study was itself a class, and a random method was used to select clusters and classes.

The research questionnaires were designed and implemented electronically using Google Form software. For each questionnaire, a QR code was generated that could be read by a smartphone camera. By referring to the selected classes, the image of the QR code in front of each questionnaire was shown to students, and they were invited to scan the QR code, access the Google Form page related to the questionnaire, and complete and submit it. In this way, students' responses were received and stored online and electronically. Of course, before doing this work, informed consent from students was obtained for participating in the research. Eighteen students were not willing to cooperate in the research. Finally, 802 questionnaires were completed electronically. Demographic characteristics, including gender, age, and educational level, were recorded and collected from the samples.

The inclusion criteria included willingness to participate and being a student of Islamic Azad University in Tehran. The exclusion criteria was incomplete questionnaires. This research was conducted after obtaining informed consent from the participants in the study. It was important to note that all the points in the questionnaire will remain confidential so that the students choose the most accurate answers. This article is derived from the Ph.D. dissertation of the first author and has the ethics code IR.IAU.BA.REC.1401.014 from Islamic Azad University, Tehran Branch.

Research instruments

A) Family Togetherness Scale (FTS): Puffer and colleagues designed and validated this scale (2021). This questionnaire consists of 30 questions, which scored on a 5-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree); this scale measures five factors of relationships (questions 8, 14, 15, 16, 17, 18, 19), roles (questions 3, 6, 11 and 12, 13, 25 and 26), intimacy (questions 1, 2, 4, 5, 7, 9 and 10), conflict (questions 20, 21, 22, 23, 24) and problem-solving (questions 27, 28, 29 and 30). Internal consistency for the overall scale was 0.86, and subscales ranged from 0.61 to 0.82 (21). In this study, the questionnaire was translated and validated into Persian. The questionnaire was translated from English to Persian using the forward-backward translation method. In this method, two experts in translating psychological texts independently translated the questionnaire into Persian. Then in a joint session, they compared the two translations and produced an agreed version of the Persian questionnaire. This version was given to two other people who needed to be made aware of the original text of the questionnaire to translate it back into English. Then they compared the back translations with the original text of the questionnaire and resolved any differences or inconsistencies (26).

B) Family Assessment Device (FAD): This questionnaire was prepared by Epstein, Baldwin, and Bishop (1983) which has 60 items in a 4-option Likert scale (never=1 to often=4) and includes six components of problem-solving (questions 60, 50, 38, 24, 12, 2), relationships (questions 59, 52, 43, 29, 18, 14, 3), roles (questions 53, 45, 40, 34, 30, 23, 15, 10, 4), effective responsiveness (questions 57, 49, 39, 35, 28, 19, 9), effective involvement (questions 54, 42, 37, 33, 25, 22, 13, 5), behavioral control (questions 48, 47, 44, 32, 27, 20, 17, 7, 58, 55), and overall functioning (questions 1, 6, 8, 11, 16, 20, 26, 31, 36, 41, 46, 51, and 56). The reliability and validity have been reported as desirable in many studies (27-30). In Iran, its validity and reliability have been confirmed by Yousefi (2012) (31). The reliability coefficient was calculated by Cronbach's alpha and split-half methods as 0.81 and 0.87, respectively.

Data analyzed using SPSS software version 22 and LISREL version 8. Descriptive statistics were used to estimate frequency and percentage. In this study, content, concurrent, and construct validity were used to evaluate the validity of the questionnaire.

The translation process of a questionnaire from one language to another requires attention to many details. First, it needs to be ensured that

the translated version still maintains a direct and accurate connection with the original structure or concept. Second, the compatibility of this translation with the culture and language to which it has been translated must be ensured (32). Since content validity, one of the dimensions of validity, provides complete coverage of the concept or structure that we intend to measure, assessing a content validity of the questionnaire when translating into another language is essential (33). FTS has been translated from English to Persian in this study. Therefore, it is necessary to examine the content validity of this questionnaire.

In this study, the content validity of the questionnaire was examined using two indices of content validity index and content validity ratio. The content validity index is calculated by dividing the total agreement score by the total number of evaluators. The content validity ratio is calculated by dividing the difference between the number of experts who agree and half of the total number of experts by half of the total number (25).

The response options for the content validity index questionnaire included highly relevant, relevant, somewhat relevant, and irrelevant, and the response options for the content validity ratio questionnaire included essential, useful but not essential, and not essential (25).

This study calculated the content validity ratio and content validity index through 10 experts (five psychologists, two psychometricians, and three family counselors with Ph.D. degrees).

To examine concurrent validity, the Pearson correlation coefficient between scores of electronic forms of FTS 30-item and Family Assessment Device (FAD) was used. To examine construct validity and determine the factor structure of the scale under study, exploratory factor analysis was performed using the principal component analysis method with Varimax rotation. In this study Varimax method was used for rotating factors extracted from the principal component analysis method. The reason for this choice is that our goal in this study is to identify independent and distinct factors that explain the highest percentage of variance of observed variables. The Varimax method simplifies factor loading structure by facilitating the easy interpretation of factors and increases accuracy of the results of factor analysis. This method is common in behavioral sciences and is not sensitive to outliers or non-normality of data (34). In this analysis, factors with eigenvalues greater than one were considered as main factors (35). We used the confirmatory factor analysis to examine the fit of the scale. Also, we used Composite Reliability (CR), Average Variance Extracted (AVE), Maximum Shared Squared Variance (MSV), and Average Shared Squared Variance (ASV) indices for examining convergent and divergent validity (26).

Results

The participants consisted of 802 people, of whom 560 (69.83%) were women and 242 (30.17%) were men. The educational level was 301 (37.53%) associate degree, 379 (47.26%) bachelor's degree, 122 (15.20%) master's degree and higher. In terms of age, 241 (37.30%) were under 20 years old, 374 (46.60%) were 20 to 25 years old, and 129 (16.10%) were over 25 years old.

Of the total number of people in terms of the educational group, 80 people (9.98%) were in the art group, 21 people (2.62%) in the foreign languages group, 393 people (49.00%) in the humanities group, 99 people (12.34%) in the basic sciences group and 209 people (26.06%) in the engineering group. Also, of the total number of people, 152 people (18.95%) were married, and 650 people (81.05%) were single.

In the content validity stage, all questions were approved by experts. According to Table 1, the content validity ratio for the 30 questions of the scale ranged from 67 to 85 percent (36). Based on Lawshe's table for evaluating ten experts, a content validity ratio of more than 0.62 is required (37), and the content validity index was estimated to be 0.78, which is an acceptable value. The minimum acceptable value of the content validity index is 0.70 (37).

We used the Pearson correlation coefficient to examine the correlation between the scores on each item and participants' scores on the entire electronic form of the FTS. The results of the correlation of items with the total score indicate that all items have a positive and significant correlation with the total score and ranged from 0.45 to 0.85. To examine concurrent validity, an electronic form of the FTS was performed alongside FAD. The results showed that the correlation between the electronic form of FTS and the FAD was positive and significant ($r= 0.67$, $P< 0.001$).

Sample adequacy size and Bartlett's sphericity test were used to determine whether

the correlation matrix between questions of scale has enough fit for factor analysis. The results showed that the sample adequacy size (Kaiser-Meyer-Olkin (KMO)) for the present research is equal to 0.89, and Bartlett's sphericity test is significant (P= 0.005, df= 435, and $\chi 2$= 9964.85), which indicates sample size adequacy; therefore sample size for this analysis has been sufficient (35).

The results of the factor loading analysis of questions showed that all questions had a factor loading higher than 0.5. Therefore, all questions are retained. Also, the results showed that the scale is saturated with five factors that, based on the principal component method with Varimax rotation, explain 70.56 percent of the desired variance in total, which are factor one with 16.57 percent, factor two with 16.46 percent, factor three with 16.18 percent, factor four with 11.76 percent and factor five with 9.60 percent of the variance respectively. This scale consists of dimensions 1- relationships (questions 8, 14, 15, 16, 17, 18, and 19), 2- roles (questions 3, 6, 11, 12, 13, 25, and 26), 3- intimacy (questions 1, 2, 4, 5, 7, 9, and 10), 4- conflict (questions 20, 21, 22, 23, and 24) and 5- problem-solving (questions 27, 28, 29, and 30) (Table 1).

Table 1. Rotated component matrix of FTS in university students (n= 484)

Items	Dimensions					Content validity ratio	Corrected correlation Question with total score
	1	2	3	4	5		
i1	0.04	0.06	0.82	0.10	0.06	68	0.83
i2	0.07	0.06	0.83	0.04	0.06	85	0.67
i3	0.09	0.82	0.08	0.07	0.08	76	0.69
i4	0.08	0.06	0.85	0.06	0.08	73	0.77
i5	0.06	0.09	0.81	0.07	0.04	70	0.85
i6	0.05	0.81	0.04	0.11	0.07	73	0.72
i7	0.04	0.07	0.83	0.07	0.05	81	0.79
i8	0.81	0.08	0.04	0.10	0.05	84	0.69
i9	0.07	0.06	0.82	0.05	0.07	71	0.84
i10	0.02	0.09	0.80	0.07	0.08	75	0.75
i11	0.05	0.85	0.06	0.06	0.07	83	0.71
i12	0.05	0.83	0.06	0.08	0.08	76	0.69
i13	0.08	0.83	0.09	0.07	0.10	68	0.72
i14	0.85	0.06	0.05	0.10	0.01	75	0.76
i15	0.82	0.04	0.05	0.10	0.04	68	0.75
i16	0.82	0.07	0.05	0.09	0.04	68	0.78
i17	0.85	0.08	0.06	0.10	0.02	68	0.56
i18	0.83	0.06	0.05	0.09	0.05	67	0.64
i19	0.84	0.07	0.09	0.09	0.04	68	0.72
i20	0.12	0.05	0.08	0.83	0.04	73	0.69
i21	0.15	0.08	0.09	0.82	0.03	81	0.67
i22	0.11	0.08	0.08	0.84	0.09	77	0.51
i23	0.12	0.11	0.07	0.81	0.04	78	0.53
i24	0.11	0.12	0.09	0.80	0.06	82	0.55
i25	0.06	0.82	0.08	0.06	0.08	70	0.45
i26	0.06	0.83	0.08	0.06	0.07	73	0.53
i27	0.06	0.10	0.09	0.06	0.85	79	0.57
i28	0.04	0.13	0.11	0.07	0.81	85	0.66
i29	0.04	0.12	0.08	0.04	0.82	68	0.64
i30	0.06	0.10	0.08	0.05	0.85	77	0.51

The examination of fit indices of the Family Togetherness Scale measurement model showed that the model has a desirable fit. The ratio of Chi-square to degrees of freedom ($\chi 2$/df) was 1.78, Goodness of Fit Index (GFI) was 0.91, Adjusted Goodness of Fit Index (AGFI) was 0.91, Normed Fit Index (NFI) was 0.94, Non-Normed Fit Index (NNFI) was 0.95, Comparative Fit Index (CFI) was 0.96, Incremental Fit Index (IFI) was 0.96, Parsimony Normed Fit Index (PNFI) was 0.85, Standardized Root Mean Square Residual (SRMR) was 0.039 and Root Mean square Error of Approximation (RMSEA) was 0.064, indicating a suitable fit of the measurement model with the data (38). Therefore, there is evidence to support the five-factor model (Table 2 and Figure 1). The model of standardized coefficients is presented in Figure 1.

Convergent and divergent validity: Table 3 shows that all dimensions have CR higher than 0.7 and AVE higher than 0.5, indicating convergent validity. Also, all dimensions have MSV and ASV lower than AVE, indicating divergent validity. Therefore, it can be concluded that the five-dimensional model has appropriate validity (Table 3).

Table 2. General fit indices of FTS in university students (n= 192)

Index	$\chi 2$/df	GFI	AGFI	NFI	NNFI	CFI	IFI	PNFI	SRMR	RMSI
Results	1.78	0.91	0.91	0.94	0.95	0.96	0.96	0.85	0.039	0.064
Acceptable fit (38)	5	0.90	0.90	0.90	0.90	0.90	0.90	0.50	0.10	0.09

Table 3. Convergent and divergent validity indices for the five-dimensional model

Factors	CR	AVE	MSV	ASV
Factor 1	0.86	0.62	0.12	0.09
Factor 2	0.85	0.61	0.12	0.10
Factor 3	0.84	0.59	0.08	0.07
Factor 4	0.81	0.58	0.14	0.10
Factor 5	0.82	0.62	0.14	0.09

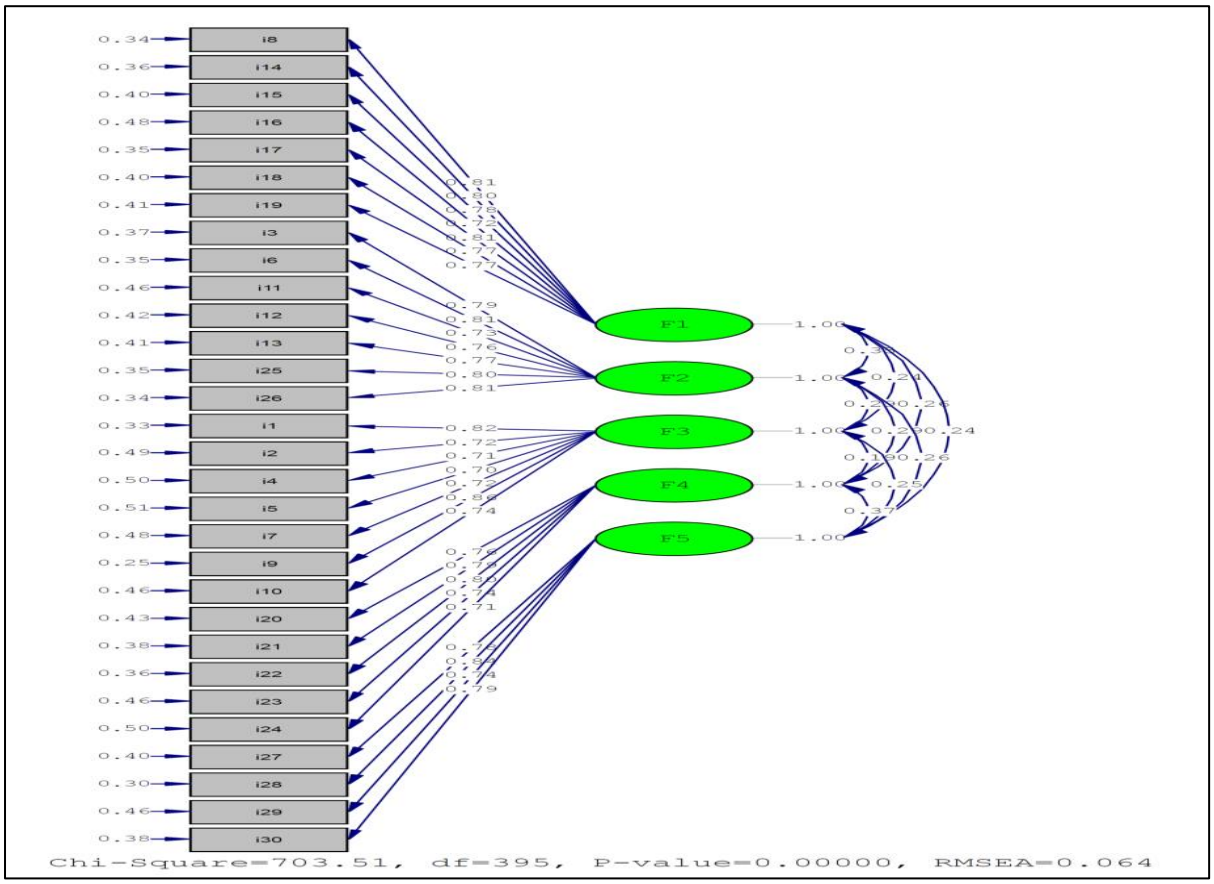

Figure 1. Standardized coefficients model in FTS in university students (n= 192)

In this study, internal consistency methods were used to examine the reliability of the electronic form of the FTS. For this purpose, Cronbach's alpha coefficient was calculated for the research data. The obtained alpha coefficient for the whole scale was 0.96, and accordingly, for the subscales of relationships, 0.95, roles 0.95, intimacy 0.95, conflict 0.90, and problem-solving 0.91. In addition, the reliability coefficient of the scale was calculated using the split-half method. The split-half coefficient for the first half of the data (15 questions) was 0.96, and for the second half of the data (15 questions) was 0.91, and the correlation between the two halves was 0.82 (Table 4).

The split-half coefficients for the first and second halves varied between 0.77 and 0.97 and between 0.58 and 0.91, respectively. The correlation coefficients between the two halves of the subscales varied between 0.81 and 0.94 (Table 4). These findings indicate a desirable internal consistency coefficient for the electronic form of the FTS.

Table 4. Internal consistency calculations of the FTS in university students (n= 25)

	Cronbach's alpha	coefficient First half reliability	coefficient Second half reliability	Coefficient of correlation between the two halves
Total Scale	0.96	0.96	0.91	0.82
Relationships	0.95	0.97	0.88	0.88
Roles	0.95	0.86	0.91	0.94
Intimacy	0.95	0.87	0.91	0.94
Conflict	0.90	0.92	0.58	0.84
Problem-solving	0.91	0.77	0.85	0.88

Discussion

Family functioning is a key factor that affects the well-being and mental health of individuals and families, especially in low- and middle-income countries where families face multiple stresses and challenges. However, there is a lack of valid and reliable measurement tools for family functioning in low- and middle-income countries that can capture the cultural and contextual aspects of family life in these environments. Therefore, this study aimed to examine the factorial structure and validity of the electronic version of the Family Togetherness Scale (FTS) among Iranian university students during the COVID-19 outbreak.

This study assessed content validity using the opinions of 10 experts and the content validity index. The results showed that all questions were appropriate according to the experts, and the content validity index was higher than the acceptable level. These findings are consistent with those of Puffer et al. who used the opinions of 5 experts and the content validity index to confirm the content validity of the scale (21).

This study estimated concurrent validity using the correlation between the electronic form of the FTS and the Family Assessment Device (FAD) 60-item questionnaire. The results showed a positive and significant correlation between the two scales. These findings align with those of Puffer et al. who used the correlation between the electronic form of the FTS 30-item scale and the FAD 12-item questionnaire to confirm the concurrent validity of the scale (21).

This study estimated construct validity using confirmatory factor analysis and model fit indices. The results showed that the five-factor model, which includes the factors of relationships (which indicate the level and quality of interest, concern, support, and acceptance among family members), roles (which indicate repeated behavioral patterns that individuals use to perform family tasks), intimacy (which indicate the level and quality of closeness, love, appreciation, and pleasure among family members), conflict (which indicate the level and quality of disagreement, argument, confusion, and rigidity among family members), and problem-solving (which indicate the ability of the family to solve problems in a way that creates effective family interactions), had a good fit with the research data. These findings are consistent with those of Puffer et al., who used confirmatory factor analysis and model fit indices to confirm the five-factor model of the scale (21).

However, some extracted dimensions, including subscales of roles, problem-solving, communication, and emotional bonding, are consistent with some dimensions of existing questionnaires. Regarding differences between this scale and others, some questionnaires do

not present dimensions such as relationships, intimacy, and conflict (27,30,39-47).

In this study, convergent and discriminant validity was estimated using the indices of CR, AVE, MSV, and ASV. The results showed that all dimensions had CR higher than 0.7 and AVE higher than 0.5, indicating convergent validity. Also, all dimensions had MSV and ASV lower than AVE, indicating discriminant validity. These findings are consistent with those of Puffer et al. who used the indices of CR, AVE, MSV, and ASV to confirm the convergent and discriminant validity of the scale (21).

In this study, reliability was estimated using Cronbach's alpha coefficient, split-half coefficient, and correlation coefficient of questions with the total score. The results showed that Cronbach's alpha coefficient for the whole scale and subscales were higher than acceptable. Also, the split-half coefficient for the first and second halves of the data and the correlation between the two halves were appropriate. In addition, the correlation coefficients of questions with the total score were acceptable. These findings align with those of Puffer et al. who used Cronbach's alpha, split-half, and correlation coefficient of questions with the total score to confirm the scale's reliability (21).

One of the strengths of this study is that it has presented a new questionnaire for measuring family functioning among Iranian university students during the COVID-19 outbreak, which can be used as a useful and practical tool for future research in this field. Also, this questionnaire has fewer questions, and its new and attractive subscales persuade respondents to evaluate different aspects of family functioning. Another strength of this study is the use of different methods of validity and reliability, which indicate the validity and reliability of the questionnaire.

Moreover, this study has tried to overcome the temporal and spatial limitations by using an electronic data collection method and being in online and electronic contact with students. Therefore, it is recommended to use the electronic form of the FTS in future research on family functioning assessment among students and conduct this study in other universities, especially public universities, for more generalizability. One of the limitations of this study is that it is limited to Islamic Azad University students in Tehran city and is only representative of some students or families in Iran. Therefore, the generalizability of the results to other populations is limited. Also, another limitation is that this study has only used students' perspectives on their family functioning and has ignored the perspectives of other family members, such as parents, brothers, or sisters, who may lead to agreement or discrepancy in perceiving family functioning. Therefore, it is suggested to repeat this study on more diverse samples of students or Iranian families in different social, cultural, and economic conditions to examine the generalizability of the results.

However, this study is limited to Islamic Azad University students in Tehran city and only represents some students or families in Iran. Therefore, the generalizability of the results to other populations is limited. Also, this study has only used students' perspectives on their family functioning. It has ignored the perspectives of other family members, such as parents, brothers, or sisters, who may lead to agreement or discrepancy in perceiving family functioning. Therefore, in future research, other family members should also be considered as samples in addition to students. Also, it is suggested that this study be repeated on more diverse samples of students or Iranian families in different social, cultural, and economic conditions to examine the generalizability of the results.

Conclusion

This study has presented a new questionnaire for measuring family functioning among Iranian university students during the COVID-19 outbreak, which can be used as a useful and practical tool for future research in this field. This study has estimated the validity and reliability of the questionnaire using different methods, and its results are consistent with several other studies that have used the same or similar questionnaires in the field of family functioning. Also, this study has tried to overcome the temporal and spatial limitations by using an electronic data collection method and being in online and electronic contact with students.

Acknowledgments

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