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Psychometric Analysis of Iron-Deficiency Anemia Prevention Scale among Afghan Children

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Abstract

Background

Prevalence of iron deficiency among children under five years old in Afghanistan is about 44.2%. The current study was aimed at the psychometric analysis of iron-deficiency anemia prevention scale among a sample of mothers who had female primary school children in Kabul, Afghanistan.

Materials and Methods

This cross-sectional study was conducted in Kabul, the capital of Afghanistan. Three hundred mothers who had female elementary school children, were randomly selected to participate voluntarily in the study. The iron-deficiency anemia prevention scale was developed about face validity, reliability (internal consistency) and construct validity. Exploratory Factor Analysis (EFA) was carried out to determine the factorial structure and to explaining the variance of the variables.

Results

The initial questionnaire consisted of 50 items and nine items were eliminated in the psychometric process scale. All the studied factors in analyzing exploratory factor with factorial loadings of more than 0.4 were confirmed. In explanatory factor analysis, the results of the KMO test were calculated at 0.800. Totally, four personality variables described 58.626% of the assumed model changes. The Cronbach's alpha for the measured constructs including attitude, perceived susceptibility, perceived severity, perceived self-efficacy, behavior, knowledge of disease symptoms, and knowledge of preventive behaviors ranged from 0.72 to 0.93.

Conclusion

The current study provides some support to the internal validity and reliability of the iron-deficiency anemia prevention scale among mothers who had female primary school children in Afghanistan. This scale can be beneficial to planning health programs based on the promotion of iron- deficiency anemia prevention among elementary school girls by their mothers in Afghanistan and other similar cultural settings.

Key Words: Afghanistan, Children, Iron-deficiency Anemia, Mother, Psychometric.

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1- INTRODUCTION

Iron deficiency anemia occurs due to iron deficiency (1), which is the most common type of anemia and is caused by iron deficiency in the diet, long-term excessive blood loss or iron malabsorption (2). Anemia occurs in about one-third of the world's population while half of the populations suffer from anemia due to iron deficiency (3). The prevalence of iron deficiency as a cause of anemia varies in different countries; it is obviously more prevalent in developing countries (4), especially among pre-school children and women, 25 and 37%, respectively (5, 6). Iron deficiency in women causes impairment in physical and cognitive performance during pregnancy, preterm delivery, low birth weight and small head circumference, height, and chest size in babies. It results in limited cognitive, psychomotor, and physical development in children (7). It also reduces educational quality and intelligence quotient (IQ) (8). Statistics indicate that 8.8% of the world population suffers from moderate degrees of iron deficiency anemia, which is more prevalent in women, 9.9% compared to7.8% in men (9).

South and Central Asia and West Africa are reported with the highest levels of anemia (10). Prevalence of anemia among women between 15 and 49 years old at reproductive age in Afghanistan, was reported as 33%, 44.2% among children under five years old, 31.4% among non-pregnant women at reproductive age, and 44.4% among pregnant women (11). Moreover, Nazari et al. in their study reported that the prevalence rates of iron deficiency and iron-deficiency anemia in the Iranian children under 6 years of age were 27.7% and 18.2%, respectively (12). It is essential to recognize the reasons for anemia in different groups and ages (13), where the most common reason for children's anemia is known to be malnutrition (14). Therefore, to identify such behaviors and measure the existing behavior, it is required to do need assessment to clarify behaviors and effective factors to individual and environmental behaviors (15). Researchers need standard questionnaires, which help them to identify determinants of behavior and could be useful in order to design promotion programs (16). Since, to the our knowledge there have been no similar studies on the iron-deficiency anemia prevention scale conducted on mothers who had female primary school children, there were no tools developed for assessing the behavioral situation. Therefore, a need-assessment was carried out based on the intervention mapping approach (17), to develop measuring the effective cognitive behaviors and determinants of mothers in preventing iron deficiency anemia among mothers who had female primary school children in Kabul, Afghanistan.

2- MATERIALS AND METHODS

It was a cross-sectional study conducted on 300 mothers of female primary school students in Kabul, Afghanistan.

2-1. Participants and data collection

Researchers suggest that the number of participants required for performing factor analysis in order to determine the validity of the structure is five to ten participants per each item in the questionnaire; however, some experts suggest three samples (18). Given that the number of items and questions considered in the initial questionnaire developed in the present study was 50, we selected six participants for each item or question and 300 samples were chosen accordingly. Mothers of female students in first grade at primary school were chosen in the central region of Kabul, which had a diverse and suitable population and cultural, economic, social and religious dispersion. Clusters were determined and participants were

chosen through simple, random sampling. Assigning proportion to size in each cluster, the participants (mothers of female students in first grade at elementary school) were selected, interviewers attended the schools and invited the selected mothers to participate in the study and the required information was collected through interviews based on the questionnaire developed.

2-2. Inclusion and Exclusion Criteria

The inclusion criteria to research included being informed on research goals, consent to participate, and having a girl attending first grade of elementary school. Exclusion criteria were no agreement to participate and incomplete answers to questionnaire.

2-3. Ethical considerations

Participants were informed on the terms of the research, information confidentiality, and the purpose of the research. All participants were willing to enter the research. The Research Ethics Committee of Tarbiat Modares University approved the study protocol (IR.TMU.REC.1395.357).

2-4. Questionnaire Development

The research team reviewed the research literature on iron deficiency anemia and used the intervention mapping approach (15, 17) to develop a questionnaire. The developed questionnaire included the following sections: the first part of the questionnaire consisted of seven questions on personal information including marital status (married, divorced, widowed), number of children, ethnicity (Pashtun, Tajik, Hazara, Uzbek, etc.), occupation (housekeeper, employee, and laborer), age (year), and level of education (illiterate, primary, secondary, diploma, and university), family income (low, average, and high). In addition, two questions were answered choosing yes or no, including ‘did you take iron tablet complement during pregnancy?’ and ‘did you feed your infant iron syrup complement?’

The second part included 50 items related to eight psychological constructs and behavior. Using the research literature on iron deficiency anemia and intervention mapping approach, the research team developed the questionnaire with a Likert scale having a five-point response range (strongly agree, agree, no comment, disagree, and strongly disagree). Higher scores in each construct indicated a more favorable situation for each construct. **Table.1** shows some examples of the psychological constructs and behavior items.

Table-1: Examples of the psychological constructs items.

No	Construct	Number of Items	Sample item
1	Attitude	5	I believe that regular visits of health centers to test the blood iron levels of my child are effective in preventing iron deficiency anemia.
2	Perceived susceptibility	4	I care about the amount of physical activity performed by my child to prevent iron deficiency anemia.
3	Perceived severity	5	Iron deficiency anemia is a serious and dangerous condition.
4	Perceived self-efficacy	9	I am able to identify the appropriate food shopping venues for iron deficiency anemia.
5	Outcome Expectation	5	If I provide high iron rich food for my child, I will be more effective in preventing iron deficiency anemia.
6	Subjective norms	2	I think there is a possibility of iron deficiency anemia in my children.
7	Knowledge about the symptoms	9	Fragile nails.
8	Knowledge about the preventive behaviors	5	Regular physical activity.
9	Behavior	6	I monitor the condition of regular physical activity in my child.

2-5. Validation of the questionnaire

The present study made use of three methods to verify the validity of the questionnaire, including face validity, content validity, and construct validity.

2-5-1. Face validity

Qualitative and quantitative evaluations were conducted to check face validity. A number of experts in the field of education and psychology were interviewed face to face to determine the quality of questionnaire face validity, and the level of difficulty (the difficulty of understanding the phrases and words), the relevance (relevance and proper relationship of the expressions with the dimensions of the questionnaire), and the ambiguity (the probability of misconceptions with expression or lack of understanding the meanings of the words), and then changes were applied to the questionnaire. In the quantitative phase, to reduce the phrases, reduction of inappropriate phrases and determine the importance of each phrase, item impact was evaluated. For this purpose, experts were asked to rate the importance of each of the scales in a 5-point Likert scale from very important (point 5), important (point 4), average importance (score 3), slightly important (score 2), and not important (score 1). Then, the impact scores were calculated using the following equation: (importance × frequency (in percentage) = impact score) (19). In item impact method, if the impact score is equal to or greater than 1.5, the phrase is considered appropriate for further analysis and is preserved (19).

2-5-2. Content validity

To study the content validity quantitatively, two elements of content validity ratio (CVR), and content validity index (CVI) were used. To assess the content validity index of the questionnaire, twelve professionals in health and behavioral health, behavioral change, children, and health policy makers were required to monitor each item in terms of relevancy, simplicity and clarity, and, to determine content validity ratio, they were asked to examine each item based on the three-part spectrum (necessary, useful but not necessary, not necessary). The number of experts (n=12) was determined according to the Lawshe table with the minimum value given for the content validity ratio (0.62), and the minimum value given for content validity index (0.79) (20).

2-5-3. Construct validity

To determine the construct validity of the questionnaire developed in the present study, item analysis was conducted using classic item analyses (CIA) and factor analysis were used. In CIA, mean, standard deviation and Corrected Item-Total Correlation (CITC) values were evaluated in all constructs. To investigate the validity of constructs under study, exploratory factor analysis using Varimax were used. The Kaiser-Meyer Olkin (KMO) test was used to show the appropriateness of the size of the samples. To test the equivalence of the normal distribution of data, Bartlett's Test of Sphericity was conducted. Scree Plot was also used to verify the strength of exploratory agents. It should be noted that for determining the agents, special values≥1/3 were chosen (20). To determine the items, the factor load index was considered as at least 0.4 and the lack of multiple factor load with minimum difference as 0.15. In addition, Cronbach's alpha was used to determine the coefficients of internal consistency reliability. Based on the relevant literature, the Cronbach's alpha value of 0.7 and higher is considered acceptable for new scales (20).

2-6. Data analyses

Data analysis was performed using the statistical package for social sciences

(SPSS) (Version 20.0; IBM Corporation, Chicago, USA).

3- RESULTS

The current study was aimed the psychometric analysis of iron-deficiency anemia prevention scale among a sample of mothers who had female primary school children in Kabul, Afghanistan. Omitting the incomplete questionnaires, 285 questionnaires were analyzed and the response rate in the present study was reported as 98%. Results from quantitative analyses suggested that calculated values for all items were all greater than 1.5, so that none of the items were eliminated and were considered appropriate for subsequent analyses. According to the Lawshe table, the minimum value for CVR, and the minimum value for CVI were 0.62 and 0.79, respectively; which, according to the findings of the present study, all items under study had an acceptable ratio and validity index, except for two items related to the subjective norms including "If I regularly take my child to a health center for blood iron testing, my friends will approve it" and "I think there is a possibility of iron deficiency anemia in my children" that were excluded from the questionnaire. Removing the two items from the questionnaire in the previous stage, 48 items were finalized and applied for factor analysis. Using exploratory factor analysis, the KMO test or sampling adequacy index was calculated as 0.800. The Bartlett's test was also found to be significant at an acceptable level (P <0.001), which indicated that the data were appropriate to factor analysis. In addition, the findings showed that five items related to outcome expectation had a factor load over 0.4 with attitude; therefore, this part of the questionnaire was omitted (**Table.2)**.

Table-2: Omitted items from the questionnaire in factor analysis step.

	Items removed	Construct	Reason
1	If I take my child to the clinic regularly to check the blood iron supply, I'm relieved about preventing iron deficiency anemia in her.	Outcome Expectation	Factor loading >0.4 with attitude
2	If I prepare high iron supplied food for my child, I will be more effective in preventing iron deficiency anemia in her.	Outcome Expectation	Factor loading >0.4 with attitude
3	If I put dairy products in my family diet, my child will be more effective in preventing her iron deficiency anemia.	Outcome Expectation	Factor loading >0.4 with attitude
4	If I encourage my child to have regular physical activity, I will be more effective in preventing my child's iron deficiency anemia.	Outcome Expectation	Factor loading >0.4 with attitude
5	If I monitor regular consumption of iron supplements by my child, I will be more effective in preventing my child's iron deficiency anemia.	Outcome Expectation	Factor loading >0.4 with attitude

Using CIA, two items related to perceived severity and self-efficacy were eliminated due to having a CITC <0.4 and were excluded from the exploratory factor analysis (**Table.3)**.

Table-3: Items removed from the questionnaire with classic item analysis.

	Items removed	Construct	Reason
1	Iron deficiency anemia is a severe and dangerous condition.	Perceived severity	CITC<0.4
2	I am able to satisfy the family to have regular visits to health centers to check my child's blood iron status.	Perceived self-efficacy	CITC<0.4

In addition, the questionnaire had an acceptable internal consistency and Cronbach's alpha for different constructs ranged from 0.72 to 0.93, **Table.4**. Based on the results from factor analysis, six factors or construct and behavior, including 41 items, were extracted based on specific values over 1.3 and factor loading levels ≥0.4. These six constructs and behavior were based on the conceptual foundations of theory of planned behavior, social cognitive theory and health belief model including attitude (5 items), perceived susceptibility (4 items), perceived severity (4 items), perceived self-efficacy (8 items), behavior (6 items), knowledge of disease symptoms (9 items), and knowledge of preventive behaviors (5 items). A total of 41 items were finalized in six constructs and behavior, and could predict 58.626% of the changes in the hypothesized model. Moreover, **Figure.1** shows the gradient diagram of the questionnaire with exploratory factor analysis.

Table-3: The results of factor analysis and internal consistency assessment (Cronbach's alpha).

	Attitude	Self-efficacy	Behavior	Knowledge of symptoms	Severity	Susceptibility	Knowledge of preventive behaviors	Attitude
1	I believe that regular visits to health centers for testing my child's blood iron level is effective in preventing iron deficiency anemia.							0.743
2	I believe that regular consumption of dairy products by my child is effective in preventing iron deficiency anemia.							0.641
3	I believe that my child's regular physical activity is effective in preventing iron deficiency anemia.							0.764
4	I believe that my child's regular consumption of iron supplements is effective in preventing iron deficiency anemia.							0.690
5	I believe that eating vegetables and foods rich in iron (meat and beans) by my child is effective in preventing iron deficiency anemia.							0.599
	Susceptibility							
1	I care about my child's physical activity duration to prevent iron deficiency anemia.					0.798		
2	I care about the amount of dairy and iron-rich foods (meats and legumes) eaten by my child to prevent iron deficiency anemia.					0.845		
3	I care about regular consumption of iron supplements by my child to prevent iron deficiency anemia.					0.819		
4	I care about regular monitoring of my child's blood iron levels to prevent iron deficiency anemia.					0.741		
	Severity							
1	My child's affection with iron deficiency anemia affects the mental health of the family.				0.868			
2	My childhood affection with iron deficiency anemia affects family expenses.				0.882			
3	My child's affection with iron deficiency anemia affects her education.				0.898			
4	My child's affection with iron deficiency				0.874			

	anemia can affect her concentration and learning.							
	Self-efficacy							
1	I am able to visit health centers regularly to check the amount of iron in my child's blood.	0.776						
2	I am able to diagnose the initial symptoms of iron deficiency anemia in my child.	0.691						
3	I am able to identify appropriate food shopping centers to prevent iron deficiency anemia.	0.723						
4	I am able to make a list of appropriate preventive foods for iron deficiency anemia.	0.778						
5	I am able to make a list of the places where I buy iron supplement products.	0.700						
6	I am able to cook foods, which may improve iron deficiency anemia.	0.724						
7	I am able to monitor the regular physical activity of my children.	0.756						
8	I am able to monitor the regular consumption of iron supplements by my children.	0.738						
	Knowledge of symptoms							
1	Fragile nails			0.631				
2	Pale skin			0.615				
3	Anorexia			0.684				
4	Desire for soil and ice			0.599				
5	Shortness of breath			0.599				
6	Headache			0.641				
7	Weakness			0.650				
8	Bad mood			0.728				
9	Pale lower eyelids			0.545				
	Knowledge of preventive behaviors							
1	Having regular physical activity						0.586	
2	Regular consumption of iron supplements						0.801	
3	Dairy product consumption						0.790	
4	Consumption of vegetables						0.800	
5	Consumption of foods rich in iron (legumes, meat).						0.654	
	Behavior							
1	I take my children to the health centers regularly to check their blood iron supply.		0.800					
2	I cook rich-iron foods at home.		0.483					
3	I feed dairy products to my family daily.		0.878					
4	I monitor regular physical activity in my child.		0.864					
5	I buy iron supplements for my child to prevent iron deficiency anemia.		0.825					
6	I encourage my child to take iron supplements regularly to prevent iron deficiency anemia.		0.734					
Variance percentage		15.740	10.602	9.173	6.907	6.108	5.617	4.119
Total variance		58.267						
Cronbach's alpha coefficient for construct		0.88	0.85	0.77	0.93	0.87	0.73	0.72

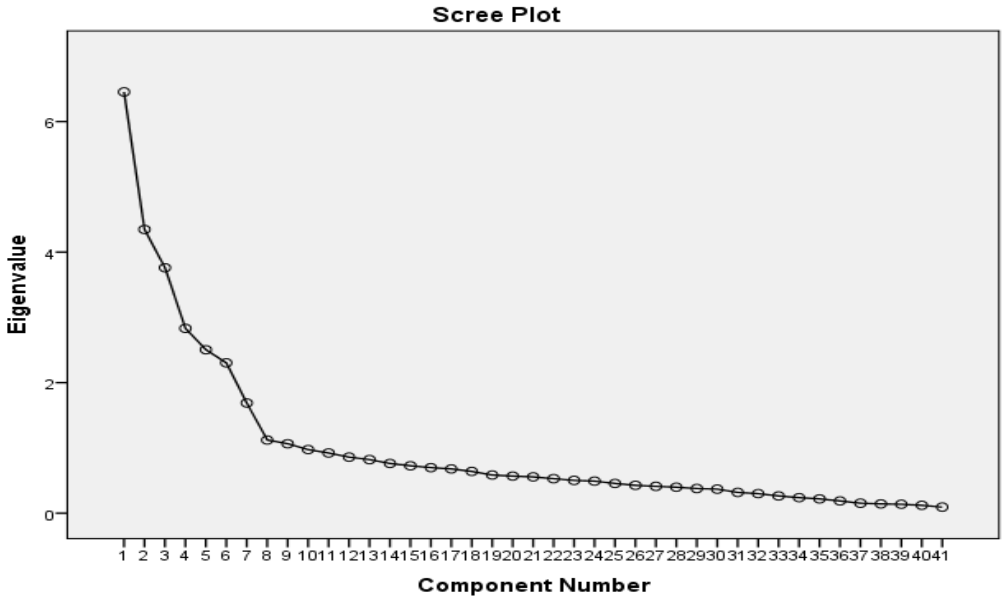

Fig.1: Gradient diagram of the questionnaire with exploratory factor analysis.

4- DISCUSSION

The current study was aimed at the psychometric analysis of iron-deficiency anemia prevention scale among a sample of mothers who had female primary school children in Kabul, Afghanistan. A total of 41 items of 50 items were finalized in six constructs and behavior, and these factors explained 58.626% of the changes in the hypothesized model. Therefore, according to the results, it was suggested that the questionnaire had good construct validity. Since beliefs and perceptions in individuals are affected by their other beliefs, or, in other words, the beliefs of individuals from their cultural context (15), it would be difficult to design items that accurately quantify specific domains free of errors. For example, in the present study, the attitude of mothers towards the prevention of iron deficiency anemia could also affect other belief constructs. The study of the domains in the present study suggested an acceptable correlation between items though incompatible internal consistency, which indicated that these domains could form an acceptable questionnaire for assessing the cognitive constructs and preventive behaviors of iron deficiency anemia among mothers who had female primary school children in Kabul, Afghanistan. In this regard, Mehrabian et al. (21) in their study on the prevention of iron deficiency anemia using BASNEF patterns reported that the instrument had validity, which was consistent with the results from the present study. Therefore, the findings of this study were in line with other relevant studies mentioned. In addition, our findings showed that 41 items in the eight final constructs explained 58.26% of the hypothetical pattern variations. In this regard, Conner et al. in their study on the use of nutritional supplements among women reported that 70% of behavior intentions were predicted by attitude, abstract norms and perceived behavioral control (22). In addition, Sun et al. conducted a study on 1090 women in China and reported that theory constructs of planned behavior and the pattern of health belief have been able to predict 35 to 55 percent of the variance in the consumption of soy-boosted iron (23). Sainsbury and Mullan also assessed the beliefs associated with the gluten-free diet in celiac disease using the theory of

planned behavior. Their findings indicated high validity and reliability of the measurement tool, and that attitude, abstract norms and control on perceived behavior could predict 41 percentage of the variance of the gluten-free diet in celiac disease (24). These findings were largely in line with the current research.

4-1. Study Limitations

Our study has several limitations. First, data collection was based on self-report questionnaires that can always include some errors or untrue responses. Second, our study did not assess the external validation of scale with the goal of establishing the relationship of our scale to other scales.

5- CONCLUSION

Overall, findings from our study provided support for the face, content, and construct validity, and internal consistencies of the psychometric analysis of iron-deficiency anemia prevention scale, evaluated in mothers who had female primary school children in Kabul, Afghanistan. Our scale contributes to the recent literature by presenting a scale that can be used to measure the psychological determinants of iron-deficiency anemia prevention.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGEMENT

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