Original Article

Development and Psychometric Characteristics Evaluation of Preconception Knowledge and Attitude Scale

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Abstract

Background: Maternal knowledge, attitudes and health status before conception is an important determinant of fetal health. However, there are no scales in the literature to evaluate for preconception health, knowledge, and attitudes of women before pregnancy.
Aim: The aim of the study was to develop a valid and reliable measurement tool that can measure the preconceptional knowledge and attitudes of reproductive age women.
Methodology: A methodological design was used in this research. The sample consists of 913 women (402 married, 511 single) aged 18–45 years. Preconception Knowledge and Attitude Scale's item pool is based on literature and expert opinions. Psychometric characteristics evaluation of the scale included the content, face and construct validity, internal consistency reliability, item-total correlation, test-retest method. The data were analyzed using LISREL 8.54 and SPSS 18.0 package programs.
Results: Principal component analysis and varimax rotation revealed that the reduced scale was 43 items and 7-factor which have eigenvalues more than >1 and explain 40% of the total variance. Cronbach's Alpha coefficient was found to be 0.86 for the total scale and between 0.44 and 0.82 for the subscales. Confirmatory factor analysis results showed that the model fit index values were acceptable. The test-retest reliability of the scale was found as 0.98 ($p<0.001$).
Conclusions: The study showed that Preconceptional Knowledge and Attitude Scale was a reliable and valid scale. The scale can be use to assess preconceptional knowledge and attitudes of women by health professionals.

Keywords: Infant health; maternal health; nurse-midwife; preconception care; scale development; women's health.

Introduction

Preconceptional care is a preventive health service that aims to improve the health of s couples before having children (Hemsing, Greaves and Poole, 2017; Johnson et al., 2008). Its target to identify risk factors that exist before pregnancy and to eliminate these risks or to minimize adverse effects on birth outcomes and health of future generations (Hemsing, et al., 2017; Shawe et al., 2015; Mazlina et al., 2014; Baysoy and Ozkan, 2012; Coskun, 2011; Johnson et al., 2008; Jack et al., 2008). Having a healthy baby is an important issue in all cultural heritage (Mazlina et al., 2014). When maternal health levels are optimized before pregnancy it is known that the probability of increases having a healthy baby (Hemsing, et al., 2017; Baysoy and Ozkan, 2012; Johnson et al., 2008; Jack et al., 2008). Because maternal health status before conception is an important determinant of fetal health. However, many women continue to become pregnant with preventable risks (Mazlina et al., 2014; Baysoy and Ozkan, 2012; Johnson et al., 2008; Jack et al., 2008). If these risks are correctly identified and managed before pregnancy, both baby and maternal health can be improved. That's why it, the health status of the candidate women in reproductive age should be assessed before pregnancy (Moss and Harris, 2015; Shawe et al., 2015; Mazlina et al., 2014; Baysoy and Ozkan, 2012; Johnson et al., 2008; Jack et al., 2008). Preconceptional care includes risk assessment,

health promotion counseling as well as intervention and treatment for identified risks (Gokdemir and Eryilmaz, 2017; Mazlina et al., 2014; WHO, 2013; Lu, 2007). All of the childbearing age women are recommended to take preconceptional care with or without a plan for having children in the near future (Hemsing, etal., 2017; Gokdemir and Eryilmaz, 2017). In preconceptional care; genetic, chronic and metabolic diseases, sexually transmitted and other infectious diseases, anemia, vitamin deficiency, smoking and/or alcohol use, continuous use of prescription or over-the-counter drugs are evaluated (WHO, 2013; Baysoy and Ozkan, 2012; Jack et al., 2008). Furthermore, women's immune status is screened, and if necessary are vaccinated against especially rubella, hepatitis B and tetanus (Baysoy and Ozkan, 2012; Jack et al., 2008). Preconceptional interventions are target to individual health risks, attitudes, information, and a change of behavior (Cairncross et al., 2019). Its should be initiated at least 3 months before the pregnancy (Gokdemir and Eryilmaz, 2017; Coskun, 2011). Since 1980, there have been significant developments in the field of preconception care in the

World (Gokdemir and Eryilmaz, 2017; Shawe et al., 2015; Baysoy and Ozkan, 2012). In a report published in 2006 (Johnson et al., 2008) by the American National Centers for Disease Control and Prevention (CDC) reported that there were at least 14 methods that improve pregnancy outcomes before or during pregnancy. These are folic acid supplementation, rubella vaccination, hepatitis B vaccination, screening and treatment of sexually transmitted infections and HIV/AIDS, management of maternal diabetes, hypothyroidism, phenylketonuria, obesity control, quitting alcohol and smoking, and avoiding teratogenic drugs such as epilepsy medications, isotretinoin, and oral anticoagulants. Preconceptional care programs are conducted in many countries such as the USA, Canada, Belgium, the Netherlands, Denmark, Italy, the United Kingdom, Sweden, and Hong Kong (Gokdemir and Eryilmaz, 2017; Shawe et al., 2015; Baysoy and Ozkan, 2012; Atrash, et al., 2008). Moreover, nurses and midwives are known to have important roles in preconceptional care. However maternal and infant health care are more focused on pregnancy, childbirth and the postpartum period in Turkey. Preconceptional care is not at the desired level (Gokdemir and Eryilmaz, 2017; Baysoy and Ozkan, 2012; Coskun, 2011). Free preventive services before marriage, during pregnancy, at birth and throughout the postnatal period are provided that covers testing for HIV, hepatitis B, Hepatitis C, and thalassemia, per the requests of the couples in Turkey (Baysoy and Ozkan, 2012). Also, couples without preconceptional care, who carry risks of some genetic diseases, disorders can be identified using some diagnostic tests before preimplantation and during the prenatal period (Ekici, 2014; Baysoy and Ozkan, 2012). However, these tests are both laborious and more expensive compared to preconceptional care (Parikh et al., 2018; Ekici, 2014). Maternal and fetal risks and health expenditures increase when women have a risky pregnancy (WHO, 2013; Johnson et al., 2008; Jack et al., 2008). Whereas, a simple evaluation of the mother candidates using standardized questionnaires in the preconception period may reveal many risks. Furthermore, questionnaire screening is simple, cheap, and practical. In particular, it can be used to evaluate maternal health, knowledge, and attitudes with a holistic approach (Cairncross et al, 2019; Baysoy and Ozkan, 2012; Cam and Arabaci, 2010; Coonrod et al, 2009; Frey and Files, 2006). However, there are no scales in the literature to evaluate reproductive age women preconception health, knowledge, and attitudes of women before pregnancy (Cairncross et al, 2019; Baysoy and Ozkan, 2012; Frey and Files, 2006). That's why, a standardized, valid and reliable data collection tool is required for health professionals to identify preconception counseling needs of individuals and to provide comprehensive counseling (Cairncross et al, 2019; Gokdemir and Eryilmaz, 2017; Baysoy and Ozkan, 2012).

Aim of the Research: This study aim was conducted to develop a valid and reliable scale that can determine the preconception knowledge and attitudes of married and single women between the ages of 18-45.

Methodology

Study design : The study was conducted with a methodological design to test the reality and validity of the Preconception Knowledge and Attitude Scale (PKAS).

Study setting and sample : The data were collected from a State Hospital, a family medicine unit, and state University units (except for health-related departments) between January 2013 to June 2015 in Turkey. The sample size when developing a scale is recommended to be at least 5-10 times larger than the number of items in the

scale (Esin, 2014; Beavers et al., 2013; Erkus, 2012; Cam and Arabaci 2010; Tavsamcıl, 2010; Worthington and Whittaker, 2006). PKAS was developed with 913 women and participants were selected by the simple random sampling method. The inclusion criteria for this study, the ages of 18 to 45, no communication impairment (normal vision and hearing status, etc.), not being pregnant or in the postnatal and menopausal periods, did not undergo any gynecological surgery that prevents fertility. The exclusion criteria; health workers and health students, women who previously attended the pilot test (n=38) and didn't complete (n=55) all forms.

Data Collection Tools : The data were collected by face to face interview methods using the Personal Information Form and PKAS draft. It took the participants about 20-30 minutes to fill in these forms.

Personal Information Form: The personal information form was prepared in accordance with the literature (Baysoy and Ozkan, 2012; Coskun, 2011; Coonrod et al, 2009; Johnson et al., 2008; Jack et al., 2008; Frey and Files, 2006). This form consists of 22 questions including socio-demographic, obstetric and preconceptional features of women.

Preconceptional Knowledge and Attitudes Scale (PKAS) and development procedure : While developing PCAS was followed by the stages recommended in the literature. These stages can be briefly summarized as follows. 1) Item generation through a comprehensive review of the existing literature, 2) Getting expert review and content validity test, 3) Pilot test, 4) Data collection and psychometric testing for scale (DeVellis, 2012; Esin, 2014; Erkus, 2012; Cam and Arabaci, 2010; Tavsancıl 2010; Seker and Gencdogan, 2006).

In the first stage, the literature reviewing was conducted and potential scale items were written for PKAS (Baysoy and Ozkan, 2012; Coskun, 2011; Coonrod et al, 2009; Johnson et al, 2008; Jack et al, 2008; Atrash, et al., 2008; Lu, 2007; Frey and Files, 2006). At this stage, especially recommendations of the American National Centers for Disease Control and Prevention (CDC) were taken into account (Johnson et al, 2008; Jack et al, 2008). A total of 87 items relevant to components of preconception care was written for the item pool. The items were rated on a five-point Likert type scale ranging from 5= "strongly agree", 4= "agree", 3="moderately agree", 2= "slightly disagree", 1= "strongly disagree". The negative expressions were reversely scored (Erkus, 2014; Cam and Arabaci, 2010; Tavsancil, 2010). In the next stage, the 87 items were sent via e-mail to 29 experts for reviewing, but 16 experts properly evaluated the scale. Among the 16 experts, 8 academicians were specialized in obstetrics and gynecology nursing, 3 public health nursing, 1 scale development expert, 1 psychology, 1 obstetrician/gynecologist and 2 were a family physician. They evaluated the draft PKAS with the Lawshe Technique and scored each item as "3 = basic", "2 = useful but not important", "1 = not required" and write their recommendations for each item. After the expert opinions, the Content Validity Rate (CVR) for each item was calculated (Lawshe, 1975). Minimum CVR value was accepted as 0.49 because the number of experts contributing to this study is 16. Eleven items were removed because their CVR values were less than 0.49 (Cam and Arabaci, 2010; Veneziano and Hooper, 1997; Lawshe, 1975). PKAS was reduced to 76 items after the expert opinions and applied to 38 women (17 married and 21 singles) for a pilot test. The clarity of all items was evaluated and revisions suggested by the women were included in PKAS. At this stage, one item causing confusion was divided into two and a scale of 77 items (56 positives and 21 negatives) was obtained (In, 2014; Erkus, 2012; Cam and Arabaci, 2010; Tavsancıl 2010).

Psychometric testing for PKAS: After the pilot test had revised PKAS form was applied to 913 women and the data transferred to the computer. Subsequently, exploratory factor analysis (EFA) was used to reveal the factor structure of the PKAS. The "Principal Component Analysis", "Varimax Rotation" and "Scree Plot Test" were used for EFA. Kaiser-Meyer-Olkin (KMO) and Bartlett's Sphericity test were used to measure for sampling adequacy before EFA. Since the sample size was sufficient, items with a corrected item-total correlation of 0.20 were included in PKAS (Cam and Arabaci, 2010; Erkus, 2006; Seker and Gencdogan, 2006). The lowest factor load of value was accepted as 0.30, excluding one item (Beavers et al., 2013; Yong and Pearce, 2013; Laher, 2010; Worthington, 2006; Sencan, 2005). Also, confirmatory factor analysis (CFA) was performed for the PKAS model obtained by EFA. The goodness of fit index values of the scale was calculated with the structural equation model (SEM) and CFA (Capik, 2014; Erkorkmaz et al, 2013; Hooper, et al., 2008). In addition, Cronbach's Alpha coefficient, split-half testing, corrected item-total correlation, and score

difference between upper and lower 27% groups were calculated (Erkus, 2012; Cam and Arabaci, 2010; Tavsancil, 2010; Seker and Gencdogan, 2006). Test-retest reliability was assessed by applying PKAS to 169 women (76 married and 93 single) with an interval of approximately 15 days (In, 2014; Tavsancil, 2010).

Data analysis : The data were analyzed by SPSS 18.0 and LISREL 8.54 software package. Descriptive statistics were used for the evaluation of socio-demographic characteristics. Expert opinions and CVR was used for content validity. The internal consistency was assessed by Cronbach's Alpha coefficient, item-total score correlation, split-half testing. Independent samples t-test was used to compare the upper and lower 27% groups. The structural validity was assessed by EFA and CFA. Pearson's correlation analysis was used for test-retest. The level of statistical significance was accepted as $p<0.05$.

Ethical approval : Ethical approval was obtained from the Ethics Committee of the University (Permission No: B.30.2.ATA.0.A1./00.00/.3745). Work permission was granted by University Rectorate and the local Provincial Health Directorate. The research complies with the provisions of the Helsinki Declaration. Participants informed and their written approvals were obtained in the study.

Results

Participants characteristics: The sample consisted of 913 women (402 married and 511 single) with a mean age of 26.98±7.31 years (18-45). Their educational level had primary and secondary school graduates 15.5%, had high school graduates 69.5%, and had university graduates 15%. Approximate half of women wanted to have children in the future, 22.2% are undecided and 27.8% do not want children. The rate of them who heard the concept of preconceptional counseling and care was 41.2%. Singles women heard it mostly from television (23.5%). Married women heard from a doctor (22%), a nurse or midwife (21.6%).

Psychometric characteristics of the PKAS

Content and face validity : The PKAS form that consisting of 87 items was reviewed by 16 experts for content validity and eleven items were removed because their CVR values were less than 0.49. A pilot test was conducted to investigate the face validity of PKAS. Pilot test results showed that 3 items should be corrected slightly and one item should be divided into two. As a result of the pilot test, a more understandable test scale consisting of 77 items (56 positives and 21 negatives) was obtained.

Construct validity : The KMO value of PKAS was 0.90 and Bartlett's sphericity test results found $\chi2=7845.59$ statistically significantly ($p <0.001$). These results showed that good sampling adequacy for factor analysis. After the negative items of the scale had reversed, the Cronbach Alpha's coefficient and corrected item-total correlation values were calculated. At this stage, the 34 items were removed from the PKAS because of the item-total score correlation was lower than <0.20 or negatively affected the Cronbach's Alpha value (Table 1). The EFA revealed that initially, 11 factors with an eigenvalue greater than >1 were obtained, which explained 50% of the total variance. Scree Plot Test (Figure 1) was evaluated and Varimax Rotation performed with principal components analysis. The final version of PKAS consists of 43 items, 7-factor structure which eigenvalues more than >1 and explains 40% of the total variance. Table 2 shows the factor loads obtained by the varimax rotation method. Each of PKAS subscales consists of at least 3 items, and the factor loads of the scale items excluding the 20th item ranged from 0.30 to 0.71. In the next step, the CFA was performed to determine whether the model obtained by EFA analysis was suitable (Figure 2). The first-level CFA results shows that $\chi2 = 1737.55$; df = 84; P = 0.000; $\chi2/sd=2.70$, RMSEA=0.034, NFI= 0.92, NNFI= 0.92, CFI= 0.93, GFI= 0.91and AGFI= 0.89. These results show that PKAS' goodness of fit index values are acceptable (Table 3).

Table 1. Corrected Item-Total Score Correlation and Cronbach's Alpha Coefficient of the 43-item Preconception Knowledge and Attitude Scale

Item No	Arithmetic Mean	Standard Deviation	Scale Mean	Scale Variance	Corrected Item-Total Score Correlation	If the Item is Deleted Cronbach's Alpha Coefficient
Item 1	4.87	4.87	189.66	219.27	0.23	0.86
Item 3	4.44	4.44	189.70	218.33	0.30	0.86

Item 6	4.70	4.70	190.09	211.87	0.37	0.86
Item 7	4.09	4.09	189.99	214.67	0.30	0.86
Item 9	4.65	4.65	189.83	213.30	0.43	0.86
Item 11	4.63	4.63	190.44	212.11	0.25	0.86
Item 13	4.84	4.84	190.69	209.90	0.27	0.86
Item 15	4.59	4.59	189.88	211.22	0.45	0.86
Item 17	4.54	4.54	189.90	213.61	0.36	0.86
Item 18	4.73	4.73	189.69	216.65	0.41	0.86
Item 20	4.75	4.75	189.82	215.15	0.35	0.86
Item 21	4.79	4.79	189.94	210.72	0.43	0.86
Item 22	4.61	4.61	190.88	210.86	0.21	0.87
Item 23	4.57	4.57	189.99	211.15	0.38	0.86
Item 25	4.22	4.22	189.80	213.32	0.46	0.86
Item 26	4.83	4.83	190.42	211.55	0.23	0.87
Item 27	4.79	4.79	189.78	212.29	0.48	0.86
Item 28	4.80	4.80	189.74	213.49	0.48	0.86
Item 29	4.87	4.87	189.92	210.90	0.43	0.86
Item 31	4.62	4.62	189.96	211.64	0.43	0.86
Item 32	4.22	4.22	189.77	213.18	0.48	0.86
Item 33	4.69	4.69	190.31	209.26	0.33	0.86
Item 35	4.39	4.39	189.70	214.56	0.50	0.86
Item 38	4.58	4.58	189.74	214.70	0.47	0.86
Item 40	4.35	4.35	189.73	215.27	0.38	0.86
Item 41	4.66	4.66	189.66	216.23	0.42	0.86
Item 43	4.67	4.67	189.94	211.87	0.47	0.86
Item 45	4.21	4.21	189.91	213.32	0.35	0.86
Item 46	4.49	4.49	190.32	210.02	0.31	0.86
Item 47R	4.00	4.00	189.84	213.93	0.42	0.86
Item 48	4.55	4.55	189.82	215.22	0.33	0.86
Item 49	4.87	4.87	190.15	211.22	0.27	0.86
Item 50	4.83	4.83	189.95	211.72	0.38	0.86
Item 51	4.54	4.54	190.18	210.88	0.37	0.86
Item 53	4.70	4.70	189.87	213.97	0.30	0.86
Item 54	4.09	4.09	190.55	210.18	0.29	0.86
Item 56	4.63	4.63	189.86	213.23	0.42	0.86
Item 59	4.71	4.71	189.84	212.99	0.41	0.86
Item 61	4.59	4.59	190.32	210.52	0.33	0.86
Item 63	3.65	3.65	190.17	209.54	0.41	0.86
Item 64	4.73	4.73	190.04	213.95	0.28	0.86
Item 67	4.79	4.79	190.53	212.86	0.23	0.86
Item 76	4.61	4.61	189.99	211.35	0.34	0.86

The Scale's	Arithmetic mean	Variance	Standard deviation	Number of items	All Scale Cronbach's Alfa	Range
	194.53	222.37	14.91	43	.86	198

Table 2. Factor Loads Matrix Obtained with the Varimax Rotation Method

Items	Item description	Factors					
		2	3	4	5	6	7
Factor 1. Attitudes Towards of Preconceptional Health Protection and Improving							
Item 28	If I am smoker prior to pregnancy, I will quit smoking and stay away from any kind of smokes		**.71**				
Item 35	I believe that individuals wishing to be parents should search for treatment against sexually		**.67**				

	transmitted diseases if they any symptoms on their sexual organs (e.g., having discharges from genital organs) prior to pregnancy.							
Item 40	I believe that if parents to be have alcohol addiction, they should quit drinking before conception.	**.64**						
Item 32	I believe that individuals wishing to be parents should be mentally healthy.	**.58**						
Item 41	I am against drug addiction and usage of addictive drugs by individuals wishing to be parents.	**.57**						
Item 29	If my husband smokes, I will effort for him to quit before conception and keep away from smoking areas.	**.53**						
Item 48	Individuals wishing to be parents should have adequate knowledge on baby care prior to pregnancy.	**.44**						
Items	**Item description**	**Factors**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Item 27	When I consider conceiving, I never take any medicine without consulting my doctor.	**.43**						
Item 18	If I take certain medicine regularly, I consult my doctor regarding whether or not they should be rearranged before conception.	**.42**						
Item 25	If I have anemia, I will treatment prior to pregnancy	**.37**						
Factor 2. Attitudes Towards of Planning Pregnancy								
Item 61	I would decide with my husband about how many baby I should deliver.	**.67**						
Item 59	Before having a child, I decide on about the time of pregnancy with my husband.	**.62**						
Item 51	If I do not want to have a child, I decides on the birth control method with my husband.	**.60**						
Item 45	If I want to have a child and my husband also agrees, I conceive.	**.47**						
Item 63	I get support from my relatives when I get pregnant.	**.39**						
Item 47R	I will be pregnant in order to rescue my marriage if marriage is going bad.	**.39**						
Item49	If I have a happy marriage, I want to have a child.	**.33**						
Items	**Item description**	**Factors**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Factor 3. Attitudes Toward of Previous Life Conditions Before Having a Child								
Item 64	I conceive after organising my working conditions.			**.66**				
Table 2 (Continuation). Factor Loads Matrix Obtained with the Varimax Rotation Method								
Item 53	I should have enough income (money) to take care of a child before having children.			**.58**				
Item 46	I appropriate waiting see at least 1-2 years after marriage to have children.			**.53**				
Item 67	If I have a child, I will become a good mother			**.50**				
Item 43	Individuals wishing to be parents should have got enough time to take care of a child.			**.45**				
Factor 4. Attitudes Towards of Preconceptional Risk Factors								
Item 17	If I have a disease such as heart disease, diabetes or epilepsy, I avoid conceiving until my doctor allows me.			**.55**				

Item 76	I don't approve that social pressure by relatives or others married couples to have children.				**.46**			
Item 54	I oppose that individuals younger than 18 years of age become parents.				**.40**			
Item 56	It is dangerous for me to conceive with intervals of less than two years.				**.39**			
Item 15	If I have a risk of delivering a disabled baby (due to having a disabled family member, consanguineous marriage etc), I receive genetic counseling before conception.					**.38**		

Table 2 (Continuation). Factor Loads Matrix Obtained with the Varimax Rotation Method

Items	**Item description**	**Factors**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Factor 4. Attitudes Towards of Preconceptional Risk Factors								
Item 50	If I get exposed to violence by my husband, I don't want to have a child.					**.32**		
Item 20	When I decide to conceive, I will tell my doctor that I plan to conceive if I need to take medicine due to any reason.					**.29**		
Item 33	I believe that consanguineous marriage should be avoided to have a healthy baby.					**.30**		
Factor 5. Attitudes Towards of Preconceptional Health Behaviors								
Item 6	If I decide to have a child, I receive preconception counseling to promote my health before conception.						**.59**	
Item 13	I will be vaccinated against some diseases such as rubella, icterus and tetanus prior to conceive.						**.50**	
Item 7	I must be in normal weight prior to conceive.						**.42**	
Item 9	If there is any disease history in my family, I consult my doctor regarding that disease prior to conceive.						**.39**	
Item 11	I make my teeth treated before conceive.						**.39**	

Table 2 (Continuation). Factor Loads Matrix Obtained with the Varimax Rotation Method

Items	**Item description**	**Factors**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Factor 6. Behaviors that should be Avoided in the Preconceptional Period								
Item 26	I avoid having an X-ray when I decide to conceive.						**.68**	
Item 22	I avoid consume foods containing raw meat (raw meatballs, salami and sausage etc).						**.62**	
Item 21	When I decide to conceive, I avoid chemical substances such as rat poison, insecticides and pesticides.							**.49**
Item 31	I believe that individuals wishing to be parents should be away from stressing conditions and stressors.							**.41**
Item 23	I avoid contacting unvaccinated animals (cat, dog etc.) and their wastes.							**.37**
Factor 7. Related to Preconception Health Sensitivity Status								
Item 1	Individuals who will be parents should improve their health status before pregnancy occurs.							**.61**
Item 3	Individuals who will be parents should be health check-up before pregnancy occurs.							**.56**
Item 38	Women who have experienced problems in their previous pregnancies should consult their doctors before conceiving again.							**.36**
Explained Variance %		9.14	6.46	5.70	5.27	4.62	4.44	4.04

Explained Total Variance %	9.14	15.60	21.29	26.57	31.18	35.62	**39.67**

Table 3. Results of Confirmatory Factor Analysis for Preconception Knowledge and Attitude Scale

Fit index	Excellent	Acceptable	CFA Results for PKAS
P -Value	0.05≤p≤1.00	0.01≤p≤0.05	**P = 0.000**
Chi-Square/ Degrees of Freedom	0≤χ2≤2 sd	2df≤χ2≤5 sd	**2.70**
Root Mean Square Error of Approximation (RMSEA)	0≤RMSEA≤0.05	0.08≤RMSEA≤0	**0.034**
Comparative Fit Index (CFI)	0.97≤CFI≤1.00	0.90≤NNFI≤0.95	**0.93**
Goodness of Fit Index (GFI)	0.95≤GFI≤1.00	0.90≤GFI≤0.95	**0.91**
Adjusted Goodness of Fit Index (AGFI)	0.90≤AGFI≤1.00	0.85≤AGFI≤0.90	**0.89**
Normed Fit Index (NFI)	0.95≤NFI≤1.00	0.90≤NFI≤0.95	**0.92**
Non-Normed Fit Index (NNFI)	0.97≤NNFI≤1.00	0.90≤NNFI≤0.95	**0.92**

References: (Esin, 2014; Capik, 2014; Erkorkmaz et al., 2013; Hooper, Coughlan and Mullen, 2008; Schreiber et al., 2006; Sencan, 2005).

Table 4. Correlation Matrix of PKAS Factors and Cronbach's Alpha Coefficient

	1	2	3	4	5	6	7	Total
1st Factor	1							
2nd Factor	.489*	1						
3rd Factor	.42*	.45*	1					
4th Factor	.53*	.38*	.43*	1				
5th Factor	.39*	.26*	.26*	.38*	1			
6th Factor	.41*	.24*	.20*	.40*	.29*	1		
7th Factor	.35*	.26*	.26*	.33*	.37*	.25*	1	
Preconceptional Knowledge and Attitude Scale Total Score	.80*	.68*	.65*	.77*	.59*	.62*	.50*	1
Arithmetic Mean	52.47	31.49	22.01	35.78	17.18	21.46	14.14	194.53
Standard Deviation	4.00	3.55	3.11	3.96	2.51	3.40	1.25	14.91
Cronbach's Alpha Coefficient	.82	.64	.62	.56	.50	.55	.44	.86
Minimum and Maximum Scores	10-50	7-35	5-25	8-40	5-25	5-25	3-15	43-215
Range	35	20	20	27	18	20	7	120

(*) p<0.001.

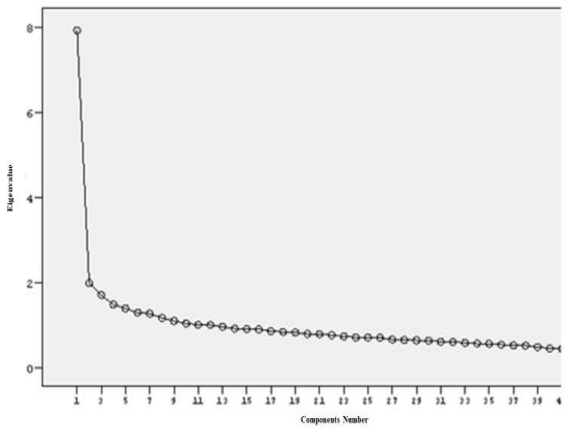

Figure 1: Scree Plot Diagram

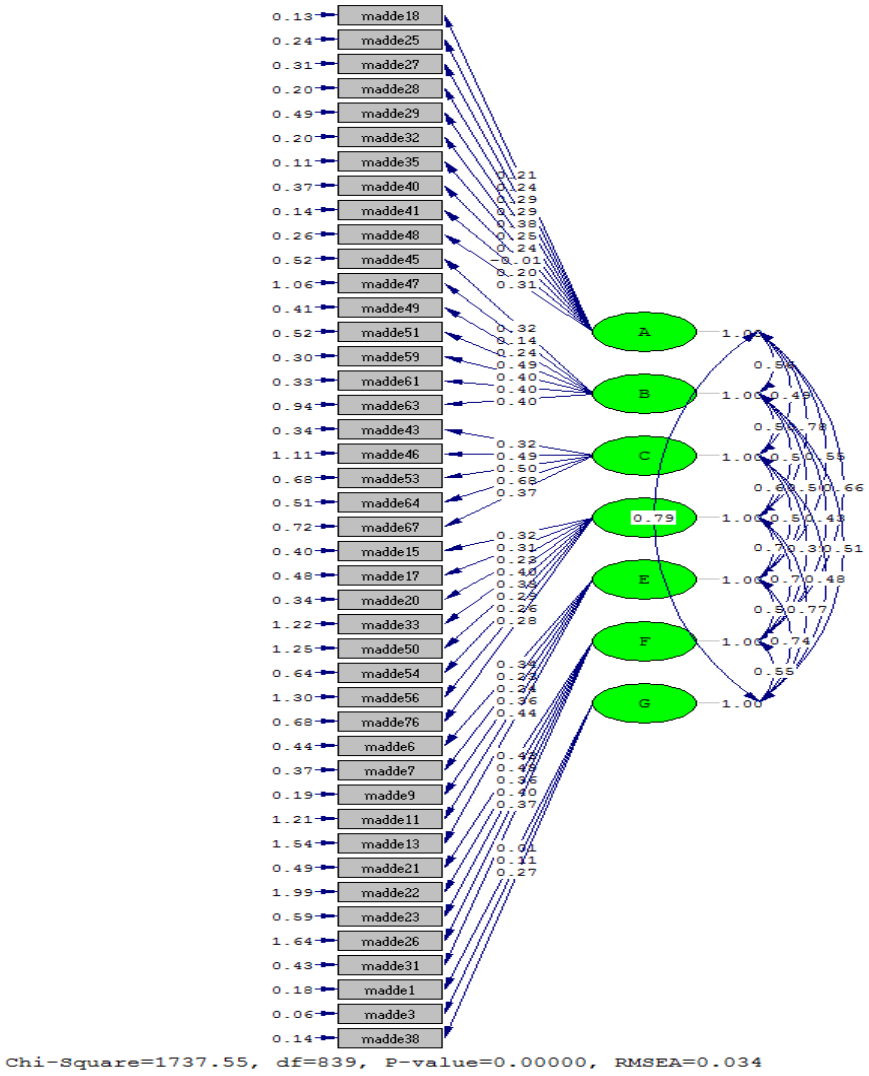

Figure 2: The Path Diagram

Reliability

The item-total correlation coefficient, Cronbach's Alpha coefficient values, and split-half reliability were used to evaluate the internal consistency of PKAS. The correlation between each PKAS item and the total score was statistically significant ($r>0.25$, $p<0.001$). Cronbach's Alpha coefficient were 0.86 for the total scale and ranged from 0.44 to 0.82 in the sub-scales. Cronbach's Alpha coefficient was found as 0.78 for the first half of the scale and 0.76 for the second half. The Guttman, Split-Half Coefficient and Spearman-Brown Coefficient values were 0.76. These values show that each half of the scale has high reliability. A minimum score of 43 and a maximum of 215 points can be obtained from PKAS. The increased score indicates that preconceptional information and attitudes are more positive. The discrimination of PKAS items was evaluated by taking into consideration the total scores of 27% lower and upper groups. All the t-values and the total score were found significant ($p < 0.001$). Table 4 shows Cronbach's Alpha coefficient, correlation matrix, minimum and maximum scores of PKAS factors. Test-retest was carried out to determine the time invariance of the scale, and the Pearson product-moment correlation results were examined. The final test measurements as a result of the test-retest were found to be 0.98 ($p<0.001$). This result showed

that the first and second measurement results repeated at 15 days intervals were similar.

Discussion

These study findings provide evidence of the validity and reliability of a newly developed scale. Health professionals can measure the preconceptional knowledge and attitudes of women between the ages of 18-45 with this scale.

Thus, they can plan appropriate preconception care interventions for women. PKAS is a Likert-type scale that developed using a four-step model approach as described earlier in the article. As far as we know, this scale is the first tool developed to measure women's preconceptional knowledge and attitudes. When developing a Likert type scale recommended evaluating the construct validity of the scale by performing EFA and CFA. EFA is a process before CFA and the KMO value must be at least 0.50 for EFA to be performed (Esin, 2014; Yong and Pearce, 2013; Cam and Arabaci, 2010; Laher, 2010; Sencan, 2005). In this study, the KMO value is above the acceptable 0.50 value and the Bartlett sphericity test is statistically significant ($p < 0.001$). Moreover, the sample size adequacy was “marvelous” because of KMO value 0.90 (Beavers et al., 2013). EFA result shows that the PKAS scale consisted of 43 items and 7-factors structure with an eigenvalue >1, explaining 40% of the total variance. It is reported that in the literature, the percentage of factor loadings to explain total variance is required to be ≥0.40%.

The explanation of a high variance rate indicates that it has a strong factor structure this scale (Sencan, 2005). Also, there are at least 3 items in each subscale of PKAS as suggested in the literatüre (Erkus, 2012; Cam and Arabaci, 2010; Sencan, 2005). In the literature, no definite limit is reported regarding the minimum factor load. However, it is generally recommended to be above >0.30 (Beavers et al., 2013; Yong and Pearce, 2013; Tavsancil, 2010; Cam and Arabaci, 2010). The factor load values of all PKAS were above 0.30 except for the 20th item. Item 20 was an important item closely related to the factors obtained as a result of EFA. It did not affect the Cronbach’s Alpha value negatively, and the factor load was very close to the recommended 0.30 value.

For these reasons, it was kept on the scale (Cam and Arabaci, 2010; Tavsancil, 2010; Seker and Gencdogan, 2006). After the EFA had CFA was performed using SEM analysis to confirm the factor structure of the scale. The CFA results were determined $\chi 2/sd$ value less than 3 and the RMSEA value less than 0.05. These values showed that the model fit of PKAS was good (Capik, 2014; Erkorkmaz et al., 2013; Hooper, Coughlan and Mullen, 2008; Seker and Gencdogan, 2006; Schreiber et al., 2006; Sencan, 2005). Moreover, other model fit index values obtained for PKAS were above the recommended reference values in the literature (Esin, 2014; Capik, 2014; Erkorkmaz et al., 2013; Hooper, Coughlan and Mullen, 2008; Schreiber et al., 2006; Sencan, 2005).

Therefore, it can be said that the data are consistent with the model and that PKAS provides structure validity. Internal consistency is an important indicator of scale reliability (Tavsancil, 2010; Seker and Gencdogan, 2006). While PKAS was developing the internal consistency was evaluated by calculating Cronbach’s Alpha Coefficient value, the split-half technique, and item-total score correlations (Seker and Gencdogan, 2006; Shur, 2003). It is stated in the literature that Cronbach's Alpha coefficient should be at least 0.40 and preferably between 0.70 to 0.90 (Tavakol and Dennnick, 2011; Cam and Arabaci, 2010; Tavsancil, 2010). Cronbach’s Alpha values calculated for overall PKAS (0.86) and both halves (0.78 and 0.76) were higher than the recommended value of 0.70.

Although Cronbach Alpha’s values in some sub-dimensions of the scale were acceptable, they were found below the desired level. This finding can be explained by having less than 10 items in this sub-dimension of the scale (Tavakol and Dennnick, 2011; Seker and Gencdogan; 2006). In the literature recommended that the corrected item-total score correlation value should not be less than 0.20 for scale reliability (Erkus, 2012; Tavsancil, 2010; Seker and Gencdogan; 2006).

For each PKAS item, this value >0.20 and p-values were significant. All these findings in this study show that the internal consistency of PKAS is acceptable (Erkus, 2012; Tavsancil, 2010; Cam and Arabaci, 2010; Seker and Gencdogan; 2006). Invariance is another indicator of reliability. It can be assessed by the test-retest and equivalent form reliability methods (Cam and Arabaci, 2010; Tavsancil, 2010). In this study, test-retest was carried out to determine the time invariance of the scale, and the Pearson product-moment correlation results were examined.

The final test measurements as a result of the test-retest were found to be r=0.98 (p<0.001). In the literature, it is suggested that the reliability coefficient value should be a minimum of 0.70 and preferably 0.80. Moreover, the value of near 1.00 indicates that there is a strong positive linear relationship between the two measurements. Hence, this finding shows that the scale's invariance to time was perfect (Esin, 2014; Tavsancil, 2010).A limitation of this study is that criterion validity could not be evaluated owing to the lack of a measurement tool similar to PKAS. Further, the data were collected in a single center and based on personal self-report.

However, PKAS is prepared based on CDC recommendations and a comprehensive literature review. Hence, it can be translated into other languages and adapted to another culture. PKAS validity and reliability should be further evaluated in different samples and communities.

Conclusion: The results of the analysis showed that PKAS was a valid, reliable and consistent measurement instrument. PKAS consisted of 43 items and 7 subscales could be used to assess the preconceptional knowledge and attitudes of married and single women.

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