Research Article / Araştırma Makalesi

Development of the knowledge of exercise during pregnancy scale

Gebelikte egzersiz bilgisi ölçeğinin geliştirilme çalışması

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ABSTRACT

Objective: Benefits of exercise in pregnancy on maternal and fetal health are well-documented, whereas physical activity participation and knowledge of exercise during pregnancy are limited among pregnant women. This research purposed to develop a tool to measure knowledge of exercise during pregnancy.

Material and Methods: This is a methodological study. After review of the literature, a pool of items was created. These items were regulated into a Likert-type scale. The content validity of the 27-item pilot-scale was assessed by expert review. The pilot-scale was applied online to women aged over 18 years with a history of at least one full-term live delivery. After the pilot application, validity and reliability were analyzed.

Results: The content validity ratios (CVR) of items were between 0.500-0.900, and the content validity index (CVI) of the scale was 0.690. The scale underwent item analysis for reliability, and factor analysis for validity assessment. Subsequently, a total of 15 items were removed due to increasing Cronbach's alpha coefficient (k=10) and if having a communality value below 0.30 in the extraction column of the communalities table (k=5).

The remaining 12 items were collected under a single factor with an eigenvalue of 5.731 that explained 47.8% of the variance. The scale was found to be highly reliable (Cronbach's alpha 0.894, Spearman-Brown split-half reliability coefficient 0.796, Guttman split-half reliability coefficient 0.792). The confirmatory factor analysis indicated good fit for the 12-item scale.

Conclusions: The newly developed 12-item Knowledge of Exercise during Pregnancy Scale is valid and reliable for use with Turkish women to assess knowledge of exercise during pregnancy.

Keywords: Pregnancy, exercise, knowledge

ÖZ

Amaç: Gebelikte egzersizin, anne ve fetüs sağlığı üzerine yararları kanıtlanmış olmasına karşın gebelerin fiziksel aktiviteye katılımı ve kadınların gebeliğe özgü egzersiz bilgisi düşüktür. Bu çalışmada, gebelik dönemine özgü egzersiz bilgisini değerlendirebilecek bir ölçek geliştirilmesi amaçlandı.

Gereç ve Yöntem: Metodolojik tipte tasarlanan çalışmada, literatür taraması yapılarak madde havuzu oluşturuldu. Maddeler Likert ölçeği şeklinde düzenlendi. Toplam 27 maddeden oluşan pilot ölçeğin, kapsam geçerliği uzman görüşü alınarak sağlandı. Pilot ölçek, yaşı 18'in üzerinde ve en az bir kez miadında canlı doğum yapmış kadınlara dijital form aracılığıyla uygulandı. Pilot uygulamanın ardından ölçeğin geçerlilik ve güvenirlilik analizleri yapıldı.

Bulgular: Ölçekteki maddelerin kapsam geçerlilik oranı 0.500-0.900 arasında, ölçeğin kapsam geçerlilik indeksi 0.690'dır. Ölçeğin güvenirliğinin değerlendirildiği madde analizinde, madde çıkarıldığında Cronbach alfa katsayısında yükselme oluşturan 10 madde ve yapı geçerliğinin incelendiği faktör analizlerinde ortak yükler (communalities) tablosunun çıkarım (extraction) sütununda değeri 0.30'un altında kalan beş madde ölçekten çıkartıldı.

Ölçekte kalan 12 maddenin öz değeri 5.731 ve açıkladığı varyans oranı %47.8 olan tek faktörlü yapı altında toplandığı görüldü. Ölçeğin, güvenilirlik düzeyinin (Cronbach alfa: 0.894, Sperman-Brown yarımlar arası güvenirlik değeri: 0.796, Guttman yarımlar arası güvenirlik katsayısı: 0.792) yüksek olduğu saptandı. Ölçeğin 12 maddelik son halinin doğrulayıcı faktör analizi uyum değerlerini sağladığı belirlendi.

Sonuç: Geliştirilen 'Gebelikte egzersiz bilgisi ölçeği' Türk kadınlarında geçerlilik ve güvenilirlik sağlamış oldu. Böylece gebelikte egzersiz bilgisinin değerlendirilmesinde kullanılabilecek 12 maddelik ölçek literatüre kazandırıldı.

Anahtar Sözcükler: Gebelik, egzersiz, bilgi

INTRODUCTION

Pregnancy is an incomparable period of life for many women, and is characterized by hormonal, physiological and biomechanical changes, such as increased blood volume and heart rate, weight gain, and a forward shift of the center of gravity (1). During pregnancy, lifestyle choices and behaviors, including physical activity, significantly affect both maternal and fetal health (2).

Physical activity during pregnancy can improve maternal and fetal well-being. Physical fitness during pregnancy is

associated with a reduced risk of excessive weight gain, reduced incidence of preeclampsia and preterm delivery, improved sleep, decreased anxiety and depression, decreased back and low back pain, and improved health and body image perception (3). Moreover, physical activity is considered a supplemental intervention for glycemic control in women with comorbidities such as obesity or gestational diabetes (4).

The American College of Obstetricians and Gynecologists recommends that healthy pregnant women participate regularly in moderate-intensity physical activity for at least 20-30 minutes most days or every day of the week during pregnancy and the postpartum period (5). Again, the 2019 Canadian guideline for physical activity throughout pregnancy encourages pregnant women to exercise at least three days per week (or every day, if possible), and to participate in at least 150 minutes of moderate-intensity physical activity per week (2). The 2020 World Health Organization guideline similarly emphasizes physical activity during pregnancy (6).

Despite the well-documented benefits of physical activity during pregnancy, and the available exercise guidelines, physical activity participation and knowledge of exercise during pregnancy are limited among pregnant women. One study reported that less than 15% of pregnant women who did not have contraindications to exercise participated in the recommended level of physical activity (7). Another study revealed that only 23-29% of pregnant women met the minimum physical activity guidelines, moreover, women who were active before pregnancy reduced their physical activity during pregnancy (8). Current evidence suggests that physical activity does not return to pre-pregnancy levels in postpartum women due to reasons such as lack of time, fatigue, or depressive symptoms (9).

In order to improve physical activity participation during pregnancy, it is crucial to understand knowledge and attitudes among pregnant women, the reasons for non-participation, and facilitators to exercise participation (3). Facilitating behavioral changes and improving physical activity participation in pregnant women initially requires filling knowledge gaps (3). A reliable and valid measurement tool is needed to assess the knowledge of the target population (10). In our review of the literature, we did not find a valid and reliable tool for the measurement of knowledge of exercise during pregnancy. The aim of this study is to develop the Knowledge of Exercise during Pregnancqy Scale (KEPS).

MATERIAL and METHODS

This research was granted ethical approval by the local ethics committee (Date:08/01/2021, Number: 11). Informed consent was obtained from all participants. We created our scale by following the steps described in the literature (11).

Literature Review and Item Pool Development: We reviewed the literature between 2000-2021 in online biomedical databases, and analyzed available guidelines on physical activity and exercise during pregnancy from different countries (6,12-18). Subsequently, we developed a pool of items that could be understood by the Turkish population. Adequate content validity and level of knowledge measurements were achieved. The items were regulated into a 27-item 5-point Likert-type scale.

Expert opinion: Content validity of the 27 items was assessed using the opinions of 40 expert academicians (gynecology and obstetrics, sports medicine, family medicine, physiotherapy and rehabilitation, midwifery, nursing, sports sciences, exercise physiology, biostatistics) via e-mail (19). Expert opinion was obtained through an expert review form consisting of open- and closed-ended questions. The closed-ended questions evaluated with Lawshe's three-point rating method. The responses to the three-point rating scale were used to calculate content validity ratios (CVR) of the items and the content validity index (CVI) of the scale. The items were revised according to the suggestions in the experts' responses to the open-ended questions (19).

Pilot Application: After content validity assessment and revision, the pilot-scale was applied via Google Forms to women aged over 18 years who were literate in Turkish, and who had a history of at least one full-term live delivery. We purposed to include at least 10 times the number of items in the pilot-scale (19).

Statistical Analysis

CVR and CVI were used to assess content validity. For validity and reliability studies, the suitability of the sample for analysis was evaluated with the Kaiser-Meyer-Olkin (KMO) measure of sample adequacy and Bartlett's test of sphericity. The scale was then assessed with item analysis, item-to-total correlation, Cronbach's α, split-half method, and exploratory and confirmatory factor analysis. Confirmatory factor analysis was performed to assess whether the factors obtained in the explanatory factor analysis fit to the data. Data were analyzed using SPSS v23 and AMOS v24.

RESULTS

Expert opinion

To a total of 40 academicians were sent the 27-item scale via e-mail to assess content validity, 20 of whom replied (10females, 50%; 10 males, 50%). The areas of expertise of the responding academicians are presented in Figure 1.
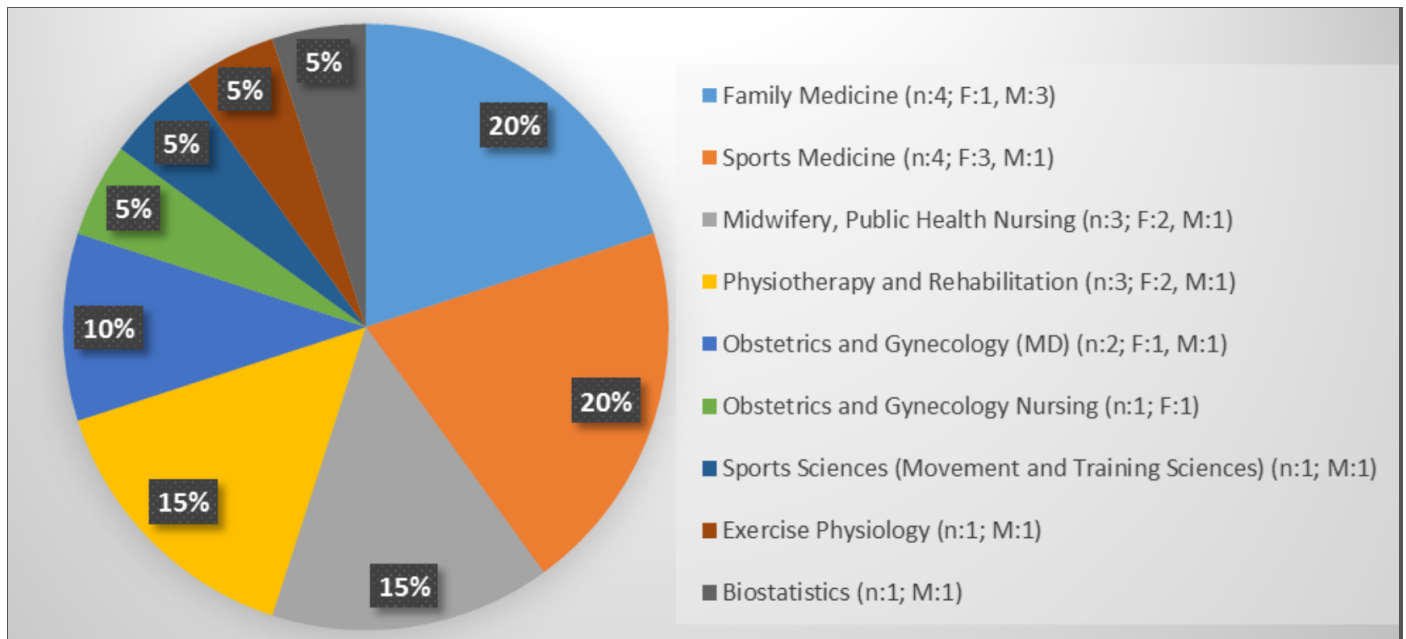
Figure 1. Areas of expertise of expert academicians

n: number of experts, F: female, M: male

Table 1. The items included in the pilot-scale

1	Exercise during pregnancy is beneficial for the mother's health
2	Exercising during pregnancy helps the expectant mother to control her weight
3	Exercising during pregnancy improves the mental well-being of the expectant mother
4	Exercise during pregnancy reduces the likelihood of developing gestational diabetes
5	Exercise during pregnancy is beneficial for the baby's health
6	Women who exercised before pregnancy should maintain exercise during pregnancy
7	Women who did not exercise before pregnancy should start exercising after the first trimester
8	Women pregnant with multiples (twins, triplets) should exercise during pregnancy
9	During pregnancy, calories that are burned during exercise should be replaced with snacks before exercise
10	Pregnant women should exercise on stable (non-slip, even) flooring to maintain balance
11	Pregnant women should exercise outdoors
12	Pregnant women should stretch before exercising
13	Pregnant women should walk for exercise
14	Pregnant women should perform leg-strengthening exercises
15	Pregnant women should cycle
16	Pregnant women should perform arm-strengthening exercises
17	Pregnant women should scuba dive
18	Pregnant women should drink water while exercising to prevent dehydration
19	Pregnant women should exercise indoors in a well-ventilated room
20	Pregnant women should exercise in the supine position after the second trimester
21	Pregnant women should perform abdominal strength exercises
22	Pregnant women should swim in hot waters, such as hot springs
23	Pregnant women should perform cooling exercises after exercising
24	Pregnant women should drink water after exercise to prevent dehydration
25	Exercising during pregnancy leads to an easier labor
26	Exercising during pregnancy leads to faster recovery after birth
27	Pelvic floor exercises during pregnancy reduce the likelihood of urinary incontinence after birth

Content validity

According to the number of experts (n=20) and the results of the closed-ended questions, the CVR threshold was calculated as 0.420 (19). The CVR values of 21 of the 27 items were within the 0.500-0.900 range. Six items were eliminated due to having CVR values below the threshold of 0.420 (CVR=0.400, k=5; CVR=0.300, k=1). The remaining 21-item scale had a CVI of 0.690. Due to having a CVI above 0.670, the scale was accepted to be content-valid (19).

According to the responses of the experts to open-ended questions, six new items were added to the scale. Hence, the content valid pilot-scale consisted of a total of 27 items: 24 positively worded and three negatively worded items (items 17, 20 and 22).

Pilot Application and Sociodemographic Findings

A total of 359 women responded to the pilot survey. For each item, a Z-score was calculated, and 36 participants with Z-scores outside the range of -4 and 4 were excluded

(19). The validity and reliability analysis included data from the remaining 323 participants. For these 323 women, the mean age was 40.2±7.7 years and the mean body mass index was 24.9±5.8 kg/m². Among the participants, 2.8% (n=9) had completed primary education and 9.6% (n=31) secondary education, 54.2% (n=175) had received post-secondary education, and 33.4% (n=108) had a master's degree or doctorate. The mean gravidity was 1.93±0.85, and the mean parity was 1.66±0.59. Some 25.7% (n=83) of the women reported having a known chronic disease, and 21.7% (n=70) regularly used medication for their condition. Regular physical activity participation rate was 54.8% (n=177).

Construct Validity and Reliability of the Pilot-Scale

The reliability of the pilot-scale (Table 1) was examined by item analysis. Item analysis did not reveal any items with a standard deviation of zero, lack of variables, or an item-to-total correlation coefficient below +0.25. However, 10 items (items 7, 9, 11, 15, 17, 18, 19, 20, 21 and 22) were extracted due to increasing Cronbach's alpha coefficient if removed (19). The content validity of the pilot-scale was examined by factor analysis, and subsequently, five items (items 8, 10, 14, 16 and 23) were eliminated due to having a communality value below 0.30 in the extraction column of the communalities table (19).

To determine reliability, we evaluated the discrimination power of each item by a comparative analysis of the upper 27% and the lower 27% using independent samples t-test, and the item discrimination index. The item discrimination analysis revealed a significant difference between the upper and lower 27% (p<0.001), and all t-values were positive. There was no floor or ceiling effect (19).

The content validity of the pilot-scale was examined by exploratory factor analysis with the direct oblimin method, a method for oblique rotation, and principal components analysis. The KMO measure of sampling adequacy was 0.913, and Bartlett's test of sphericity was highly significant

(x^2=1769.671, p<0.001). Therefore, the data and sample were suitable for principal components analysis. Moreover, the KMO measure indicated excellent sampling adequacy (KMO>0.90), and that the sample was suitable for factor analysis (p<0.05). The suitability of the items for factor analysis was investigated using anti-image correlation. All items' correlations were above 0.500 (range 0.856-0.968) (19).

Exploratory factor analysis did not reveal any items with a factor loading below 0.45 (i.e., moderate or poor item quality). There was no cross-loading between factors (19). According to the Kaiser criterion, the remaining 12 items were collected under a single factor with an eigenvalue greater than 1 (λ=5.731) that explained 47.8% of the variance (Figure 2). The single factor explained a sufficient amount of variance (i.e. >40%) (19).
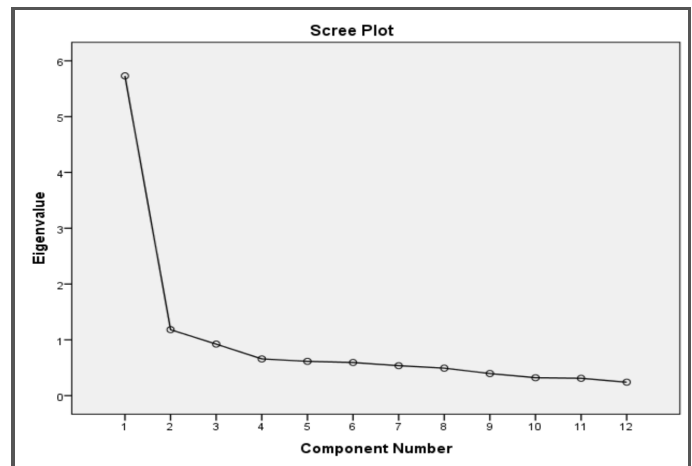

Figure 2. Number of factors and eigenvalue scree plot

In Table 2 are presented the mean scores, item-to-total correlations, item discrimination index, factor loading, and rotated factor loading results of the remaining 12 items of KEPS.

Table 2. KEPS items' mean scores, item-to-total correlation, item discrimination index, factor loading, and rotated factor loading results					
KEPS Item N	**Mean (SD)**	**Corrected Item-Total Correlation**	**Item Discrimination Index**	**Factor Loading**	**Rotated Factor Loading**
1	4.60 (0.54)	0.691	14.360	0.771	0.779
2	4.47 (0.63)	0.676	17.085	0.754	0.844
3	4.62 (0.51)	0.670	15.734	0.747	0.838
4	4.22 (0.79)	0.595	13.481	0.671	0.823
5	4.35 (0.66)	0.771	19.436	0.829	0.752
6	4.29 (0.70)	0.612	15.640	0.690	0.569
12	4.25 (0.65)	0.497	11.208	0.575	0.552
13	4.62 (0.51)	0.513	12.217	0.595	0.601
24	4.14 (0.61)	0.546	10.860	0.616	0.727
25	4.43 (0.55)	0.659	16.639	0.724	0.877
26	4.28 (0.66)	0.618	14.982	0.685	0.868
27	4.08 (0.77)	0.516	12.184	0.581	0.536

The reliability of the 12-item single-factor scale was demonstrated with Cronbach's alpha coefficient, the Spearman-Brown split-half reliability coefficient, and the Guttman half-split reliability formula. We found that the scale

was highly reliable (Cronbach's alpha 0.894, Spearman-Brown split-half reliability coefficient 0.796, Guttman split-half reliability coefficient 0.792) (19). After exploratory factor analysis, confirmatory factor analysis was performed to assess fit indices for the 12-item model. To improve fit, covariance was established between e1-e3, e8-e10, e10-e11, and e11-e12. The scale satisfied the model fit criteria (20) in confirmatory factor analysis (Table 3, Figure 3).
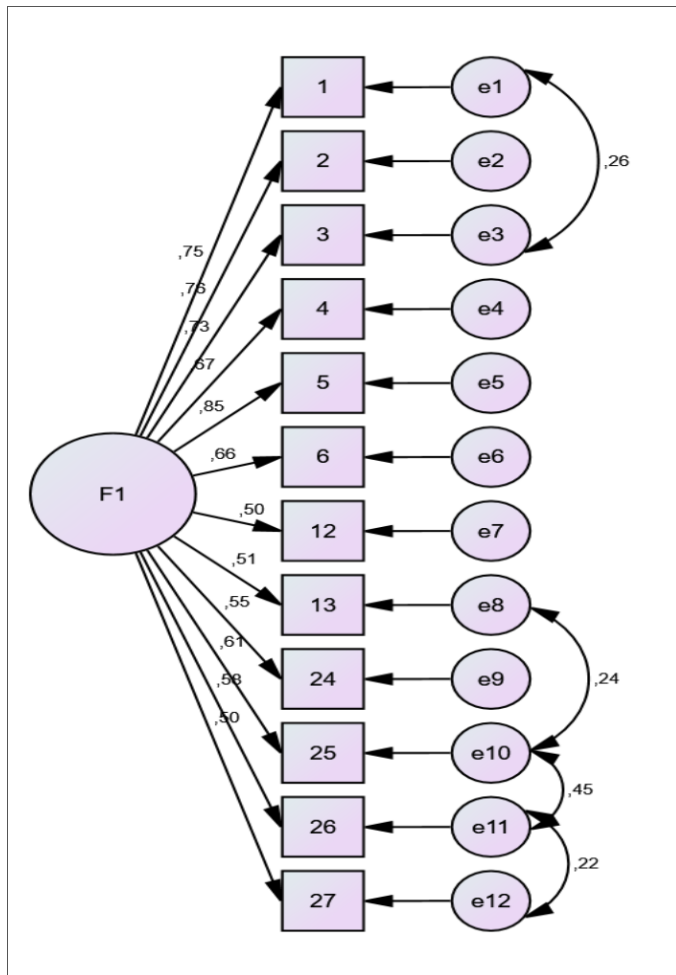

Figure 3. Confirmatory factor analysis path diagram

Table 3. Confirmatory factor analysis fit indices

Fit indices	Value
CMIN (Chi-square=c²)	138.744
p value	0.0001
Degrees of freedom (df)	500
c²/sd (CMIN/df)	2.775
Root Mean Square Error of Approximation (RMSEA)	0.074
Standardized Root Mean Square Residual (SRMR)	0.021
Comparative Fit Index (CFI)	0.949
Goodness-of-Fit Index (GFI)	0.929
Adjusted Goodness-of-Fit Index (AGFI)	0.889
Incremental Fit Index (IFI)	0.949
Tucker-Lewis Index (TLI)	0.932

After statistical analyses were complete, the items were numbered according to their order of appearance in the survey. All 12 remaining items were positively worded. The respondents are asked to respond on a 5-point Likert scale to indicate how much each item applies to them (1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree). The total score is calculated by summing the scores of each item. The final version of the scale is given in Appendix 1.

DISCUSSION

The benefits of exercise in pregnancy on maternal and fetal health are well-documented; however, the common and incorrect belief that exercise during pregnancy is harmful, as well as certain other factors, including age, ethnicity, socio-economic status, and working status, all hinder physical activity participation among pregnant women (7,21,22). One must first understand the barriers to exercise participation before seeking solutions. One such barrier is lack of awareness (23). That said, there are currently no tools to assess knowledge of exercise during pregnancy to the best of our knowledge. This study developed and validated the 'Knowledge of Exercise during Pregnancy Scale (KEPS)' for use with the Turkish population.

To determine the validity and reliability of KEPS, we initially assessed content validity using expert opinion. Six items were eliminated due to having CVR values below the threshold of 0.420, and six new items were added in line with the recommendations of experts. The resulting 27-item pilot-scale was analyzed for content validity. The reliability of the pilot-scale was examined by item analysis. Subsequently, 10 items (items 7, 9, 11, 15, 17, 18, 19, 20, 21 and 22) were removed due to increasing Cronbach's alpha coefficient if removed. The KMO measure indicated excellent sampling adequacy (KMO>0.90), and that the sample was suitable for factor analysis (p<0.05).

Following factor analysis, five items (items 8, 10, 14, 16 and 23) were removed from the scale due to having a communality value below 0.30 in the extraction column of the communalities table. The remaining 12 items were collected under a single factor with an eigenvalue greater than 1 (λ=5.731) that explained 47.8% of the variance. We found that the scale was highly reliable (Cronbach's alpha 0.894, Spearman-Brown split-half reliability coefficient 0.796, Guttman split-half reliability coefficient 0.792). After exploratory factor analysis, model fit was analyzed with confirmatory factor analysis, and covariance was established between e1-e3, e8-e10, e10-e11, and e11-e12 to improve fit. Subsequently, the model satisfied the model fit criteria. We thus developed the KEPS and contributed to the literature a new tool to assess knowledge of exercise during pregnancy.

Our review of the literature did not reveal any tools for the measurement of knowledge of exercise during pregnancy, but there were several studies that aimed to develop tools to measure physical activity levels during pregnancy. One systematic review examined 17 studies that aimed to develop physical activity questionnaires for pregnancy (10). This review focused on the reliability and construct validity of the physical activity questionnaires. The overall quality of evidence in measuring physical activity during pregnancy was determined to be very low to moderate. Only two questionnaires, one in Turkish and one in French, were found to show both sufficient reliability and construct validity. However, neither study (24,25) had performed comprehensive analyses for content validity nor had they referred to expert opinion.

The literature recommends using target population-specific content- and construct-valid and reliable measurement tools. Content analysis is a crucial step in tool development and confirms that all prominent domains of a given subject are covered by a measurement tool. If a measurement tool is not confirmed to be content valid during development, this may reflect poorly on the remaining steps of development and the validity of the tool (19). In this scale development study, we evaluated content and construct validity, reliability, and model fit in confirmatory factor analysis, and accordingly concluded that the newly developed KEPS is valid and reliable for use with Turkish women.

We believe that knowledge gaps are a significant barrier to physical activity participation among pregnant women, and their measurement can help to improve knowledge, to correct false beliefs, and improve exercise participation. The strengths of this scale are being a short, and self-administered questionnaire. The limitations of our study were being applied online and to women with a history of at least one full-term live delivery. The population of the study was limited to women with a history of at least one full-term live delivery in order to be able to include peri- and postpartum data in our analysis. The survey was applied online because of the COVID-19 pandemic, to prioritize the safety of participants.

CONCLUSION

This newly developed KEPS is valid and reliable for use with Turkish women and can be used to assess knowledge of exercise during pregnancy in research.

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Appendix 1. Development of the Knowledge of Exercise during Pregnancy Scale

TURKISH
Gebelikte Egzersiz Bilgisi Ölçeği

Bu ölçek, gebelik dönemine özgü egzersiz bilgisini ölçmek için hazırlanmıştır. Aşağıda yer alan her bir ifadeyi dikkatle okuyunuz.

Aşağıda yer alan her bir ifadeyi okuduktan sonra, 'gebelik dönemine özgü egzersiz' konusundaki düşüncenizi **1'den 5'e kadar bir sayı** ile belirtiniz.

1. Kesinlikle katılmıyorum
2. Katılmıyorum
3. Ne katılıyorum ne katılmıyorum (kararsızım)
4. Katılıyorum
5. Kesinlikle katılıyorum

		1	2	3	4	5
1	Gebelik döneminde egzersiz yapmak anne adayının sağlığına fayda sağlar					
2	Gebelik döneminde egzersiz yapmak anne adayının kilo kontrolünü sağlar					
3	Gebelik döneminde egzersiz yapmak anne adayının ruhsal olarak iyi hissetmesini sağlar					
4	Gebelik döneminde egzersiz yapmak anne adayında gebeliğe bağlı şeker hastalığı (gestasyonel diyabet) olasılığını azaltır					
5	Gebelik döneminde anne adayının egzersiz yapması bebeğin sağlığına fayda sağlar					
6	Gebelik öncesi dönemde egzersiz yapan kadınlar, gebelik döneminde de egzersize devam etmelidir					
7	Gebelik döneminde egzersiz öncesinde ısınma egzersizi yapılmalıdır					
8	Gebelik döneminde yürüyüş egzersizi yapılmalıdır					
9	Gebelik döneminde, egzersiz ile kaybedilen sıvıyı yerine koymak için egzersiz sonrasında su içilmelidir					
10	Gebelik döneminde egzersiz yapmak doğum sürecinin kolaylaştırır					
11	Gebelik döneminde egzersiz yapmak doğum sonrası iyileşmeyi hızlandırır					
12	Gebelik döneminde yapılan leğen kemiği tabanı kası (pelvik taban) egzersizleri kadının doğumdan sonraki yaşamında idrar kaçırma olasılığını azaltır					

ENGLISH
Knowledge of Exercise during Pregnancy Scale

This scale is designed to measure knowledge concerning exercise during pregnancy. Please read each statement carefully.

Please grade each item **from 1 to 5** by marking one box per row, depending on your opinion regarding the statement.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree (Undecided)
4. Agree
5. Strongly agree

		1	2	3	4	5
1	Exercise during pregnancy is beneficial for the mother's health					
2	Exercising during pregnancy helps the expectant mother to control her weight					
3	Exercising during pregnancy improves the mental well-being of the expectant mother					
4	Exercise during pregnancy reduces the likelihood of developing gestational diabetes					
5	Exercise during pregnancy is beneficial for the baby's health					
6	Women who exercised before pregnancy should maintain exercise during pregnancy					
7	Pregnant women should stretch before exercising					
8	Pregnant women should walk for exercise					
9	Pregnant women should drink water after exercise to prevent dehydration					
10	Exercising during pregnancy leads to an easier labor					
11	Exercising during pregnancy leads to faster recovery after birth					
12	Pelvic floor exercises during pregnancy reduce the likelihood of urinary incontinence after birth					