ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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# Validity and Reliability of the Turkish Version of the Health Belief Model Based Bicycle Helmet Attitudes Scale Among University Students

## Sağlık İnanç Modeli Temelli Bisiklet Kaskı Tutum Ölçeği'nin Türkçe Versiyonunun Üniversite Öğrencilerinde Geçerlik ve Güvenirliği

Asiye KARTAL[a], Eda KILINÇ[a], Nazan KOŞTU[a]

[a]Department of Public Health Nursing, Pamukkale University Faculty of Health Sciences, Denizli, TURKEY

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**ABSTRACT Objective:** Measuring health beliefs and attitudes that support bicycle helmet use assists healthcare professionals in increasing the use. This study aimed to provide the Turkish society with an instrument that can measure students' attitudes related to health beliefs in bicycle helmet use and to analyze its validity-reliability. **Material and Methods:** This methodological research was carried out in psychological counseling and guidance department of Pamukkale University in Turkey among students between January and March 2019 (n=326). The data were collected in face-to-face interviews with the socio-demographic question form and the Bicycle Helmet Attitudes Scale. Internal consistency coefficient and test-retest analyses were used for the reliability of the scale, and content validity index and confirmatory factor analyses for its validity. **Results:** Turkish form of the scale is composed of 56 items and 10 factors. Cronbach alpha values of the sub-dimensions ranged from 0.70 to 0.88. The confirmatory factor analysis concluded $\chi^2$/df=2.18; root mean square error of approximation=0.06; comparative fit index=0.94; incremental fit index=0.94. The test-retest correlation value of the sub-dimensions is between 0.50 and 1.00. The confirmatory factor analysis showed acceptable values and acceptable fit for the model fit statistics. **Conclusion:** Turkish form is an instrument with sufficient validity and reliability indicators. The Turkish form which can be easily applied to individuals of all age groups can determine health belief levels associated with individuals' bicycle helmet use and identify vulnerability, severity, benefit, barrier and cues to action.

**Keywords:** Head protective devices; attitude to health; nursing

**ÖZET Amaç:** Bisiklet kaskı kullanımını engelleyen/destekleyen; sağlık, inanç ve tutumları ölçmek, bisiklet kaskı kullanımını artırmada, sağlık profesyonellerine destek sağlamaktadır. Bu çalışmada amaç, öğrencilerin bisiklet kaskı kullanımında sağlık inancıyla ilişkili tutumlarını ölçebilen bir ölçüm aracını Türk toplumuna kazandırmak ve geçerlik-güvenirliğini analiz etmektir. **Gereç ve Yöntemler:** Bu metodolojik araştırma, Türkiye'de bulunan Pamukkale Üniversitesinin psikolojik danışma ve rehberlik bölümünde öğrenim gören öğrenciler arasında Ocak ve Mart 2019 tarihlerinde yapılmıştır (n=326). Veriler, sosyodemografik veri formu ve Bisiklet Kaskı Tutum Ölçeği kullanılarak yüz yüze görüşme yöntemi ile toplanmıştır. Ölçeğin, güvenirliği için iç tutarlılık katsayısı ve test-tekrar test analizleri, geçerliliği için kapsam geçerliği indeksi ve doğrulayıcı faktör analizi kullanılmıştır. **Bulgular:** Ölçeğin Türkçe uyarlaması 56 madde ve 10 faktörden oluşmuş olup, alt boyutların Cronbach alfa katsayısı ise sırasıyla 0,70 ile 0,88 arasındadır. Doğrulayıcı faktör analizi sonucunda $\chi^2$/df=2,18; ortalama hata karakök yaklaşımı=0,06; karşılaştırmalı uyum indeksi=0,94; artımlı uyum indeksi=0,94 değerindedir. Alt boyutların test-tekrar test korelasyon değeri 0,50 ile 1,00 arasındadır (p<0,01). Doğrulayıcı faktör analizi sonucunda, model uyum istatistikleri için kabul edilebilir değer ve uyum göstermiştir. **Sonuç:** Türkçe ölçek yeterli geçerlik ve güvenirlik göstergeleri olan bir ölçüm aracıdır. Tüm yaş grubundaki bireylere kolaylıkla uygulanabilen Türkçe ölçek, bireylerin bisiklet kaskı kullanımına ilişkin sağlık inanç düzeylerini belirlenmekle birlikte duyarlılık, ciddiyet, yarar, engel ve onları eyleme geçirecek algıların neler olduğu saptanabilir.

**Anahtar Kelimeler:** Baş koruyucu cihazlar; sağlık tutumu; hemşirelik

Bicycle used almost everywhere in the world represents a healthy, physical activity that facilitates transportation as well as bringing about several accidents. Although developing and industrialized countries encourage the use of safe bicycles, cycling accidents are a major part of road traffic in-

**Correspondence:** Eda KILINÇ
Faculty of Health Sciences, Pamukkale University, Denizli, TURKEY/TÜRKİYE
**E-mail:** ekilinc@pau.edu.tr

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juries and may even cause permanent disability and death.[1-3]

According to the data from Center for Disease Control and Prevention (CDC), it was reported that 800 bicyclists were killed and 515,000 bicyclists were treated in emergency rooms as a result of bicycle accident in the US.[4] In 2015, more than 1,000 bicyclists were reported to die in the US. These results indicate that deaths due to bicycle accidents in the US have increased. Of the bicyclists who had an accident, about half were children and adolescents younger than 20 years old, and 26,000 of the accidents caused traumatic brain injuries that were treated in emergency rooms.[5] In a study performed in Turkey, it was found that 42.8% of those who had a bicycle accident aged between 1 year and 19 years old and that 13.7% of the accidents were life critical.[6]

High rates of deaths and injuries as a result of bicycle accidents create problems for public health globally. Everyone must use protective equipment when riding a bicycle to minimize this risk of death and injury.[7] Since bicycle helmet, which is a protective equipment, significantly reduces face, nose fractures and fractures around eye and brain injuries, its use need to be promoted and popularized.[7-9] Despite such protection provided by helmets, most bicyclists do not wear helmets at all. The study performed by Kılınç on adolescents observed that only 7.6% of them wore bicycle helmets.[10] Ross et al. observed that only 12% of them were wearing their helmets all the time.[11] According to 10-year accident records in Germany, only 7.5% of bicycle users were wearing bicycle helmets.[12] Researchers have investigated barriers to helmet use to better understand low rates of helmet use. CDC highlighted several barriers to helmet use including cost, comfort, lack of information and negative peer pressure associated with helmet use. It was reported that the most important risk group is children and adolescents and men are more at risk than women.[13] Considering the barriers to helmet use among university students in particular, these barriers include lack of comfort when wearing a helmet, cost, riding the bicycle for short distances, disturbance of physical appearance, and being an object of derision.[14] Contrary to these barriers, there are also positive attitudes and perceptions that increase helmet use among undergraduates. These include long-distance cycling, owning a helmet, story of a close friend who injured in a bicycle accident, perception of being vulnerable to injuries, belief in protection of helmets to prevent head traumas, having peers who regularly wear a helmet, past injuries or long-term hospitalization.[14,15]

As understood from the research results, students' beliefs about their own health affect whether or not to wear a helmet. Health Belief Model (HBM) is one of the most common behavioral theories used in bringing positive protective health behaviors to students and preventing injuries.[16] The focal point of the model is to help people be aware of and change their beliefs.[17,18] HBM involves a few basic concepts that facilitate predicting how individuals will act to prevent or control injuries; these concepts are vulnerability, severity, benefit towards a behavior, barriers, cues to action, and self-efficacy.[19] HBM argues that there is a relationship between the perception of barrier that causes students not to take safety precautions when cycling and students' beliefs and behaviors and that their health behaviors are affected by their beliefs, values and attitudes.[20] In this context, Ross et al. developed the HBM-based Bicycle Helmet Attitudes Scale (BHAS) which can be easily self-applied on the students of the Department of Psychology to determine helmet use attitudes among undergraduates. There is no valid and reliable instrument that can measure student attitudes associated with health belief in bicycle helmet use in the literature in Turkey. Accordingly, the purpose of this research was to test the validity and reliability of the Turkish form of BHAS developed by Ross et al. 2010.[11]

## MATERIAL AND METHODS

### STUDY DESIGN AND SETTING

The aim of this methodological study is to evaluate the validity and reliability of Turkish form of the BHAS.

The research questions were the following:

a. Is the BHAS a valid and reliable measurement tool?

b. Do the psychometric characteristics of the BHAS indicate that it is an appropriate tool for measuring the bicycle helmet attitude in individuals with university students?

## SAMPLE

The research population was composed of the first-to-fourth-grade undergraduates (n=410) studying in the Psychological Counseling and Guidance (PCG) Department of Faculty of Education at a public university in Denizli province in Turkey. In methodological research, it is recommended that number of individuals to be selected is 5-to-10 times the total number of scale items in validity-reliability studies.[21-23] Accordingly, 326 individuals amounting to about 6 times the total number (57) of the scale items formed the sample of this research. A student group, who volunteered for the study and receive education on a level comparable to the student group (psychology department) for whom the scale was developed, was included in the sample.

## MEASUREMENTS

*Socio-demographic question form:* This form was created by the researchers upon a literature review. The form consists of questions about socio-demographics of the students such as age, gender, educational background, and income level.

*Bicycle Helmet Attitudes Scale:* This scale was developed by Ross et al. to determine attitudes toward helmet use among undergraduates. The scale is composed of 57 items and 10 subscales. Subscales of the scale and their Cronbach's alpha reliability coefficients are as follows: *Perceived Exemption from Harm* ($\alpha$=0.79), *Perceived Danger of Cycling* ($\alpha$=0.80), *Perceived Severity of Harm* ($\alpha$=0.80), *Emotional Benefits* ($\alpha$=0.86), *Safety Benefits* ($\alpha$=0.84), *Personal Vanity and Discomfort Barriers* ($\alpha$=0.87), *Cost Barriers* ($\alpha$=0.75), *Friends and Family* ($\alpha$=0.80), *Parent Rules in Childhood* ($\alpha$=0.90), and *Media* ($\alpha$=0.70). The instrument is graded on a 6-point Likert-type scale (1="Strongly disagree", 6="Strongly agree"). Students make an evaluation of the extent to which they agree with each item in the scale. Only item 50 is reverse-coded. The average score for each sub-dimension is calculated by dividing the total sub-dimension score by the number of items. Students' low scores on the Perceived Exemption from Harm, Personal Vanity and Discomfort Barriers and Cost Barriers subscales indicate high health beliefs while high scores indicate low health beliefs. In the other sub-dimensions, the increase in the score correlates with the belief in health. For instance, lower score obtained by the student in the *Perceived Severity of Harm* subscale indicates that the student has greater awareness of the potential consequences due to cycling injuries. Higher score in the *Safety Benefits* subscale reflects a stronger belief about bicycle helmet's ability to protect people from harm in an accident.[11]

## DATA COLLECTION

The data were collected by the researchers from the undergraduates who met the sample criteria and agreed to participate in the research face-to-face, in the classroom setting between January 2019 and March 2019. The data were collected from the participants by a questionnaire method based on self-report. Data collection took about 20 minutes under the observation of the researchers.

Before starting the research, a test-retest analysis was performed on 48 students (they were asked to write down their nicknames, and these 48 individuals were matched with their nicknames in the retest) to carry out the reliability analysis of BHAS. The same form was applied to the students twice at one-month interval, and it was ensured that they completed it in full.

## LANGUAGE ADAPTATION OF THE SCALE

In this study, the scale was translated from English to Turkish by two English experts separately for the linguistic validity. These two translations were then combined by three academician nurses who are fluent in English and made it a single tool to be agreed upon. Next, a translator who speaks Turkish and English at native fluency translated the scale back to its original language which is English. After the consistency between the original and retranslated form of the scale had been confirmed, the original English scale and its retranslated Turkish form were submitted to ten academician nurses for evaluating the concordance of the translation. Revisions were made

according to the expert opinions, and the final form was created in Turkish.

### PILOT STUDY

The pilot application of BHAS was conducted with 30 undergraduates outside the research group. Clarity and comprehensibility of the items were tested in the pilot study to finalize the scale.

### ETHICAL CONSIDERATIONS

Before starting the research, permission was obtained via e-mail from Thomas P. Ross who is the lead author and co-author of the scale to test the Turkish validity and reliability of BHAS. This study was conducted in accordance with the Declaration of Helsinki principles. Ethics committee approval (020/65031, 25.09.2018) for the study was received from Pamukkale University Non-invasive Clinical Research Ethics Committee. Written permission was obtained from the department of the research before the study. The students were clearly informed of the research and their informed consent was obtained in writing.

### STATISTICAL ANALYSIS

The data were evaluated with IBM Predictive Analytics Software (PASW) Statistical Product and Service Solutions (SPSS, Chicago, IL, USA) version 22 and The LISREL 8.7 program (Scientific Software International, Inc., Lincolnwood, IL, USA).

Socio-demographics were represented by the number and percentage distribution. Test-retest correlation for time invariance, item-total correlation for internal consistency reliability, and Cronbach's alpha reliability coefficient for calculating the homogeneity were utilized to determine the reliability levels of the scale.[21,22,24]

Content Validity Index (CVI) for determining the validity of the scale and Confirmatory Factor Analysis (CFA) were used to determine the factor structure. In the CFA, goodness-of-fit indices were checked to determine the adequacy of the tested model. Acceptable values in model fit statistics of CFA were $\chi 2/SD<3$; Root Mean Square Error of Approximation (RMSEA) <0.08; Comparative Fit Index (CFI) >0.90; Incremental Fit Index (IFI) >0.90; Non-normed Fit Index (NNFI) >0.90.[22,24-26]

## RESULTS

### PARTICIPANT CHARACTERISTICS

The mean age of the participants was 20.80±1.38 years old. Of the participants, 70.9% are female and 29.1% are male, 74.5% of the participants described their families' economic level as being "moderate", 77.4% of the participants stated that they frequently rode a bicycle within the past year, and the remaining (22.6%) said that they rode a bicycle less frequently.

### RELIABILITY RESULTS OF THE SCALE

#### Internal Consistency Reliability and Cronbach's Alpha Reliability Coefficient

The item analysis results of BHAS and the Cronbach's alpha values of the subscales are given in Table 1. The analysis concluded the item-total correlation coefficients of the item 1 to be below 0.20 ($r$=-0.10). Afterwards, this item was omitted from the scale one by one, and it was checked how the alpha values of the subscales were affected. Item 1 was excluded from the scale as the Cronbach's alpha of its subscale increased from 0.64 to 0.70. Upon the exclusion of item 1, the Cronbach's alpha coefficients and item total correlations of the subscales were recalculated and are shown in Table 2.

### STABILITY

Test-retest reliability was performed on the same sample group ($n$=48) one month later to assess the stability of the scale over time. Then, the test-retest reliability could be calculated by means of the intraclass correlation coefficient (ICC). ICC correlation between from 0.50 to 1.00 for each subscale ($p$<0.001) (Table 3).

### VALIDITY RESULTS OF THE SCALE

#### Content Validity

Expert opinion was referred to after the language adaptation for assessing the scale's content validity. The experts were faculty members specialized in public health nursing (8 individuals), pediatric nursing (2 individuals) and nursing principles (1 individ-

**TABLE 1:** Item-total correlations of Bicycle Helmet Attitudes Scale.

| Items | Mean | SD | Corrected item-total correlation | If item deleted alpha |
|---|---|---|---|---|
| **Factor 1: Perceived Exemption from Harm (α=0.64)** | | | | |
| 1. I do not ride fast enough to need head protection in an accident. | 2.77 | 1.22 | **-0.10** | 0.69 |
| 2. I think wearing a helmet is unnecessary in very short rides. | 3.36 | 1.36 | 0.55 | 0.54 |
| 3. I can easily avoid accidents while riding my bicycle because I have been riding a bicycle for years. | 4.38 | 1.33 | 0.23 | 0.64 |
| 4. Bicycle helmets are sometimes not very important for bicyclists. | 4.00 | 1.33 | 0.54 | 0.55 |
| 5. Bicycle helmets are more important for long-distance bicyclists. | 2.33 | 1.33 | 0.40 | 0.60 |
| 6. I do not need a helmet because I am not racing. | 4.03 | 1.47 | 0.50 | 0.55 |
| **Factor 2: Perceived Danger of Cycling (α=0.72)** | | | | |
| 7. While I am riding my bicycle, I face the risk of being injured by other bicyclists. | 3.84 | 1.46 | 0.56 | 0.64 |
| 8. While I am riding my bicycle, I face the risk of being injured by motor vehicles. | 4.90 | 1.05 | 0.50 | 0.67 |
| 9. If I had an accident and hit my head while riding my bicycle to school or work, I could have my brain injured. | 5.08 | 0.86 | 0.49 | 0.68 |
| 10 It is dangerous to ride a bicycle on slippery/wet roads. | 5.24 | 0.80 | 0.37 | 0.70 |
| 11. I have a high risk of being injured while riding my bicycle. | 4.41 | 1.23 | 0.55 | 0.65 |
| 12. I generally believe riding a bicycle on street is a dangerous activity. | 2.97 | 1.41 | 0.33 | 0.73 |
| **Factor 3: Perceived Severity of Harm (α=0.88)** | | | | |
| 13. If I injured my head while riding my bicycle, it could severely affect my social life with my friends. | 3.39 | 1.48 | 0.77 | 0.84 |
| 14. If I injured my head while my bicycle, it could severely affect my relationship with my family. | 3.07 | 1.46 | 0.67 | 0.88 |
| 15. If I injured my head while riding my bicycle, it could severely affect my school achievement. | 3.89 | 1.35 | 0.80 | 0.83 |
| 16. If I injured my head while riding my bicycle, it could severely affect my ability to work. | 4.04 | 1.25 | 0.71 | 0.85 |
| **Factor 4: Emotional Benefits (α=0.89)** | | | | |
| 17. I feel safe while riding my bicycle without a helmet. | 3.22 | 1.29 | 0.62 | 0.88 |
| 18. I feel guilty while riding my bicycle without a helmet. | 2.80 | 1.26 | 0.66 | 0.87 |
| 19. Wearing a helmet while riding my bicycle reduces my anxiety. | 4.06 | 1.22 | 0.79 | 0.86 |
| 20. I think I should keep myself safe by wearing a helmet while riding my bicycle for people who care about me. | 4.21 | 1.16 | 0.68 | 0.87 |
| 21. Wearing a helmet while riding my bicycle makes me feel safer. | 4.44 | 1.15 | 0.77 | 0.86 |
| 22. I feel I am more aware of the possible dangers of riding a bicycle when I wear a helmet. | 4.60 | 1.05 | 0.68 | 0.87 |
| 23. Wearing a helmet while riding my bicycle makes me more careful. | 4.04 | 1.31 | 0.62 | 0.88 |
| **Factor 5: Safety Benefits (α=0.82)** | | | | |
| 24. I generally think people who prefer to wear a helmet are safe and responsible. | 4.73 | 1.13 | 0.52 | 0.82 |
| 25. Helmets are effective in reducing my risk of being injured in an accident about cycling. | 5.20 | 0.76 | 0.68 | 0.77 |
| 26. In the event of an accident, helmet would protect my head. | 5.32 | 0.72 | 0.70 | 0.76 |
| 27. I believe I could prevent a severe head trauma if I had a bicycle accident while wearing my helmet. | 5.12 | 0.86 | 0.72 | 0.75 |
| 28. In the event of an accident, wearing a helmet would save me money by avoiding expensive medical treatment | 4.65 | 1.00 | 0.53 | 0.81 |

*continue* →

**TABLE 1:** Item-total correlations of Bicycle Helmet Attitudes Scale. (*continued*)

| Items | Mean | SD | Corrected item-total correlation | If item deleted alpha |
|---|---|---|---|---|
| **Factor 6: Personal Vanity and Discomfort Barriers (α =0.82)** | | | | |
| 29. I would be ashamed of wearing a bicycle helmet. | 4.65 | 1.23 | 0.51 | 0.80 |
| 30. As an adult, I think wearing a helmet only to ride around the city is stupid. | 4.80 | 1.10 | 0.57 | 0.79 |
| 31. I would look stupid if I wore a helmet if no one else was wearing one. | 4.77 | 1.18 | 0.63 | 0.78 |
| 32. Honestly, those who wear a helmet look stupid. | 5.27 | 0.95 | 0.52 | 0.80 |
| 33. Wearing a helmet is too hot. | 3.46 | 1.28 | 0.53 | 0.80 |
| 34. Wearing the bicycle helmet strap squeezes my neck and sometimes irritates my skin. | 3.57 | 1.19 | 0.56 | 0.79 |
| 35. Bicycle helmet strap is uncomfortable and makes me feel like being chocked. | 3.39 | 1.23 | 0.59 | 0.79 |
| **Factor 7: Cost Barriers (α=0.86)** | | | | |
| 36. Cost of helmets are generally more than their worth. | 3.45 | 1.33 | 0.62 | 0.85 |
| 37. A sales cost of a helmet can affect whether I wear a helmet or not. | 3.30 | 1.45 | 0.68 | 0.84 |
| 38. The best helmets (the most cool-looking and comfortable ones) are too expensive for me to buy. | 3.07 | 1.36 | 0.59 | 0.86 |
| 39. I would not want to spend money for a bicycle helmet. | 3.75 | 1.40 | 0.71 | 0.84 |
| 40. It is not worth spending money for a helmet. | 4.60 | 1.13 | 0.55 | 0.86 |
| 41. A bicycle helmet is not worth its cost. | 4.42 | 1.26 | 0.66 | 0.85 |
| 42.I believe bicycle helmets are very expensive. | 3.54 | 1.39 | 0.68 | 0.84 |
| **Factor 8: Friends and Family (α=0.85)** | | | | |
| 43. I have a few friends who routinely wear a helmet when riding their bicycles. | 2.78 | 1.66 | 0.30 | 0.89 |
| 44. If I had a bicycle helmet, I would keep it in sight not to forget to wear it. | 3.95 | 1.38 | 0.68 | 0.81 |
| 45. If I had a bicycle helmet, I would generally keep it next to or near my bicycle. | 3.94 | 1.39 | 0.68 | 0.81 |
| 46. I know I would feel bad if I did not wear a helmet because my family or those who care about me would like me to wear a helmet. | 3.63 | 1.43 | 0.72 | 0.80 |
| 47. My friends think I should wear a helmet while riding my bicycle. | 2.96 | 1.39 | 0.74 | 0.80 |
| 48. My close friends think I should wear a helmet while riding my bicycle. | 3.01 | 1.44 | 0.74 | 0.80 |
| **Factor 9: Parent Rules in Childhood (α=0.86)** | | | | |
| 49. My parents used to make me wear a helmet when I was a child. | 2.23 | 1.25 | 0.78 | 0.79 |
| 50. My parents never insisted that I wore a helmet.* | 4.19 | 1.53 | 0.50 | 0.92 |
| 51. My parents used to make me wear a helmet while riding my bicycle when I was a child. | 2.22 | 1.23 | 0.83 | 0.77 |
| 52. My parents encouraged me to wear a helmet in my adolescence. | 2.17 | 1.16 | 0.77 | 0.80 |
| **Factor 10: Media (α=0.85)** | | | | |
| 53. I recall seeing TV commercials, billboards or posters about the importance of wearing a helmet while riding a bicycle during the past year. | 2.38 | 1.37 | 0.58 | 0.85 |
| 54. During the past year, I have received advice from my doctor on wearing a helmet while riding my bicycle. | 1.60 | 0.82 | 0.65 | 0.82 |
| 55. During the past year, I have received a letter from my doctor via mail reminding me of wearing a helmet while riding a bicycle. | 1.52 | 0.75 | 0.67 | 0.82 |
| 56. I recall seeing articles or newspaper ads showing helmet sales and discounts at sports shops during the past year. | 1.94 | 1.20 | 0.72 | 0.79 |
| 57. I recall events (flyers, etc.) which promotes bicycle helmet use on campus or in the community during the past year. | 1.87 | 1.13 | 0.76 | 0.78 |

*Reverse-coded item; p<0.01; SD: Standard deviation.

**TABLE 2:** Re-estimated reliability coefficients as a result of excluded items of BHAS subscales or combined subscales.

| Subscales | Excluded items | Number of items | Item total subscale correlation | Re-estimated Cronbach's Alpha |
|---|---|---|---|---|
| Factor 1: Perceived exemption from harm | Item 1 | 5 | **0.23-0.57** | **0.70** |
| Factor 2: Perceived danger of cycling | - | 6 | 0.33-0.56 | 0.72 |
| Factor 3: Perceived severity of harm | - | 4 | 0.67-0.80 | 0.88 |
| Factor 4: Emotional benefits | - | 7 | 0.62-0.79 | 0.89 |
| Factor 5: Safety benefits | - | 5 | 0.52-0.72 | 0.82 |
| Factor 6: Personal vanity and discomfort barriers | - | 7 | 0.51-0.63 | 0.82 |
| Factor 7: Cost barriers | | 7 | 0.55-0.71 | 0.86 |
| Factor 8: Friends and family | - | 6 | 0.30-0.74 | 0.85 |
| Factor 9: Parent rules in childhood | - | 4 | 0.50-0.83 | 0.86 |
| Factor 10: Media | - | 5 | 0.58-0.76 | 0.85 |

BHAS: Bicycle Helmet Attitudes Scale.

**TABLE 3:** Test-retest correlation values of the subscales.

| Subscales | Number of items | Test-retest correlation values |
|---|---|---|
| Factor 1: Perceived exemption from harm | 5 | 0.73 |
| Factor 2: Perceived danger of cycling | 6 | 0.72 |
| Factor 3: Perceived severity of harm | 4 | 0.50 |
| Factor 4: Emotional benefits | 7 | 0.88 |
| Factor 5: Safety benefits | 5 | 0.86 |
| Factor 6: Personal vanity and discomfort barriers | 7 | 0.81 |
| Factor 7: Cost barriers | 7 | 0.70 |
| Factor 8: Friends and family | 6 | 1.00 |
| Factor 9: Parent rules in childhood | 4 | 0.83 |
| Factor 10: Media | 5 | 0.68 |

p<0.01.

ual). The Davis technique was used for evaluating the opinions obtained with CVI.[27] The items scored lower than 3 points in the BHAS-Turkish form were modified in line with the expert opinions, and various additions and omissions were made to ensure coherence. It was calculated CVI=0.96 according to the expert opinions.

## Construct Validity

As a result of the CFA of the BHAS, the following values were found: p<0.001, $\chi^2$/SD=2.18, RMSEA=0.06, Standardized Root Mean Square Residual (SRMR)=0.08, NNFI=0.94, CFI=0.89. CFA were used to analyze the construct validity of BHAS (Table 4). Acceptable values and acceptable fit were achieved for the model fit statistics, which consisted of ten factors. The model diagram of the final form of the scale is shown in Figure 1. When the standardized solution values in Figure 1 were analyzed in order to interpret the error variances of the BHAS, the lowest error value was found for the 13$^{th}$ item, at 0.14, and the highest error value was 0.93 for the 43$^{th}$ item (Figure 1). Error variances must be less than 0.90.[28] However, the value of items 3 and 43 was found to be greater than 0.90. When Figure 2 was analysed to interpret the t values of the BHAS, it was determined that the 3$^{th}$ item value was 12.47 and 43$^{th}$ item value was 12.62 (Figure 2).

**TABLE 4:** Goodness-of-fit indices of the Bicycle Helmet Attitudes Scale.

| Goodness-of-fit indices | Value | Fit |
|---|---|---|
| $\chi^2$ | 3123.15, p<0.001 | |
| $\chi^2$/(df) | 3123.15/1.427=2.18 | Perfect fit |
| RMSEA, p value | 0.060 (p<0.001) | Acceptable fit |
| SRMR | 0.080 | Acceptable fit |
| CFI | 0.94 | Acceptable fit |
| IFI | 0.94 | Acceptable fit |
| NNFI | 0.94 | Acceptable fit |

RMSEA: Root Mean Square Error of Approximation;
SRMR: Standardized Root Mean Square Residual; CFI: Comparative Fit Index;
IFI: Incremental Fit Index; NNFI: Non-normed Fit Index.

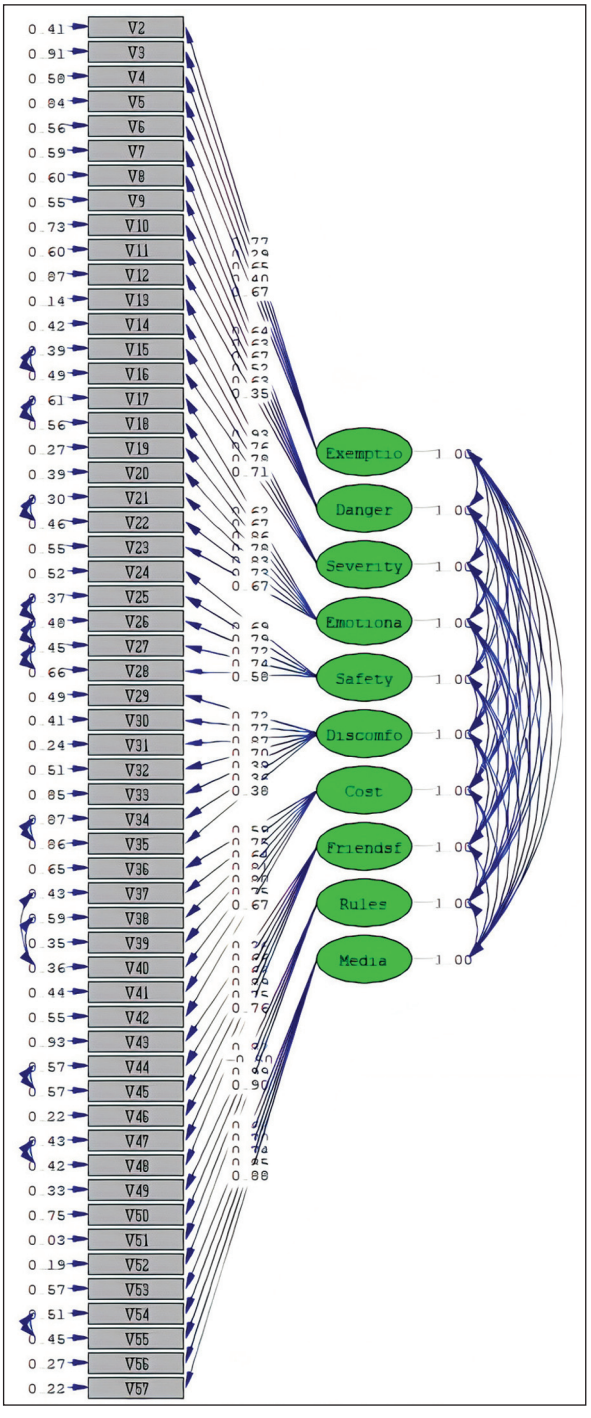


**FIGURE 1:** Chi-square:312.15, df:1427, P-value:0.00000, RMSEA:0.060. Bicycle Helmet Attitudes Scale's path diagram for confirmatory factor analysis. **RMSEA:** Root Mean Square Error of Approximation.

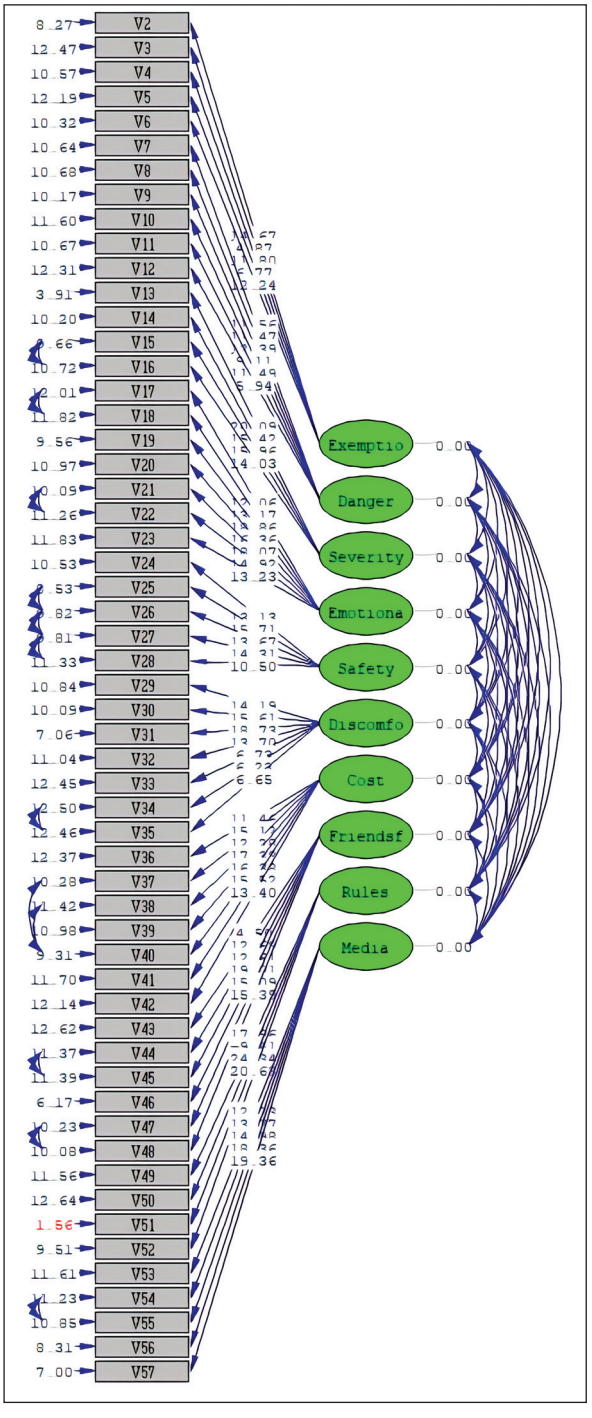


**FIGURE 2:** Chi-square:312.15, df:1427, P-value:0.00000, RMSEA:0.060. Confirmatory factor analysis of Bicycle Helmet Attitudes Scale t values. RMSEA: Root Mean Square Error of Approximation

## DISCUSSION

### ANALYSIS OF SCALE'S RELIABILITY

An instrument needs to be reliable in the first place for it to be considered valid. Reliability is a basic feature that every instrument must have. Item-total correlations of the 57 items were examined for the reliability study of this scale. The item-total reliability determines whether the scale items are consistent or should be corrected, and an "*r*" value is found for

each item. Item total correlation, a widely used method for checking the homogeneity of a scale made up of several items. If the correlation value of any item is low, it indicates that the item in question measures a different feature than other scale items do.[22,29] Literature suggests item-total correlations values over 0.20 show a good level of correlation.[29] Based on the literature data, we can state that item total correlation coefficients of all items except one were at a good level in our study. Any item with a correlation coefficient below 0.20 should be removed from the instrument; however, it is recommended to disregard that item only if the alpha coefficient increases after its removal but not if it decreases or does not change.[29] In the present study, the total item correlation coefficient of Item 1 was -0.10; and thus, below the established cut-off point. The alpha coefficient was re-calculated when this item excluded from the scale and it was checked how the Cronbach's alpha values of the subscale was affected. Cronbach's alpha as a reliability indicator is an alpha coefficient method. Item 1 was excluded from the scale as the Cronbach's alpha of its subscale (Perceived Exemption from Harm) increased from 0.64 to 0.70. The owner of the scale was informed of the item 1 excluded from the Turkish form of the scale and his approval was obtained.

Cronbach's alpha reliability coefficient, which is another way to test the reliability of the scale, gives information about how consistent the scale items are with each other.[21,22] Higher alpha coefficients of the scale items indicate that the scale is composed of items consistent with each other and having the same features. In this context, the alpha coefficient is expected to be as close to 1 as possible.[21,22] Literature data have shown that measurement instrument is reliable if Cronbach's alpha coefficient is smaller than 0.40, it has a low reliability if the coefficient is between 0.40 and 0.59, it is quite reliable between 0.60-0.79 and it is reliable at a high level between 0.80 and 1.00.[21] The alpha coefficients of the original scale vary between 0.70 and 0.90.[11] In this Turkish form, the alpha coefficients of the subscales range from 0.70 to 0.90. In the original scale, the sub-dimension with the lowest alpha value is Media, while in the Turkish scale, it is Perceived Exemption from Harm. Due to being highly reliable, the Turkish form having very similar results with the original scale exhibits high level of internal consistency.

The test-retest method ensures that the scale provides consistent results and become time-invariant. Higher ICC determines the measurement invariance. In this method, the scale applied to the sample group for the first time is applied to the same group for the second time. In the interval method, the questionnaire can be applied to the same sample twice at a certain interval. In the assessment of the test-retest value, the invariance increases with time as the ICC value approaches 1.[21,22] The interval method was preferred in this study, and the scale was applied to 48 students twice at one-month interval for investigating the time invariance. The test-retest value of the original scale was not assessed. The test-retest correlation coefficients of the subscales were found to be between 0.50 and 1.00 in this study. This study was therefore determined to be highly time-invariant.

## ANALYSIS OF SCALE'S VALIDITY

The Turkish form and the original English form were submitted for expert opinions for language and content validity to determine whether the items/statements in the instrument create a sample group that represents the feature to be measured. There can be no less than three and no more than twenty individuals in the expert group.[22] In our study, opinions were obtained from ten experts, and this is an adequate number for the expert group.

The Davis technique was utilized for evaluating the results obtained with CVI. It is expected that the total scale CVI is at least 0.80.[22] In this study, CVI was found to be 0.96, and this value was determined to be representing the feature to be measured with the scale.

Factor analysis is one of the most common methods used in evaluating the construct validity of a scale.[21,30] When the integrity of the scale is tested by factor analysis, this analysis also helps exclude the irrelevant factors from the scale at the same time. The construct validity of the scale was evaluated using CFA.

CFA was used to examine the factor structure of the scale.[22,26] CFA was performed with the first 57-

item version of the scale. Factor loadings are recommended to be above 0.20 in CFA.[21,31] In this analysis, the factor loading of Item 1 was found to be below 0.20, and CFA was performed again after the item had been excluded from the total scale. As 10-factor and 56-item BHAS was normally distributed, the covariance matrix was calculated using the Maximum Likelihood method. Since some of the goodness-of-fit indices were not acceptable in the first stage of CFA, they were re-analyzed upon the suggested modifications in accordance with the literature.[21,30,31] The modifications made among the items are shown in the Path diagram (Figure 1). As a result of modifications, the factor loadings of the 56-item scale are above 0.20 and range from 0.29 to 0.99. The model was found to have a good fit and factor loading in the CFA that was carried out after the modifications (Figure 1).

Whether the factor structure of the Turkish form is fit for the original scale was evaluated with CFA. CFA is a method based on the evaluation of fit indices that show the fit between data and structure. Among the fit indices of CFA, if $\chi^2/df$ <3; CFI and IFI are greater than 0.90; and RMSEA is less than 0.08, it refers to acceptable fit, SRMR values equal to or smaller than 0.08 indicate good fit.[22,30,32]

According to the literature, it is suggested that error variances should be less than 0.90 and t value greater than 1.96 in CFA.[28] When the standardized solution values in Figure 1 were analysed for the interpretation of the error variances of the BHAS, the two items that had an error value higher than 0.90 were the 3rd and 43rd items. Although the error value of these items was high, the t value (item 3=12.47; item 43=10.08) was statistically significant (Figure 2); thus, it was decided to keep it in the scale.[28] Although the t value of Item 51 was 1.56, the error variance (0.03) was kept at the scale since it was less than 0.90. As a result of this research, it was found that the values obtained met the acceptable values required to provide the fit statistics.

As a result of the statistical analyses of our study, BHAS adapted into Turkish language is composed of 56 items and 10 factors and have a high level of reliability and validity. The Turkish form can be easily applied to individuals of all ages. Using BHAS, individuals' health belief levels about bicycle helmet use can be determined as well as identifying perceived vulnerability, perceived severity, perceived benefits and cues to action.

***Perceived Exemption from Harm*** subscale; higher scores on this subscale indicate more agreement with reasons for not needing to wear a helmet. ***Perceived Danger of Cycling***; higher scores reflect stronger agreement that riding a bicycle can be dangerous. ***Perceived Severity of Harm***; higher scores reflect more awareness regarding the potential seriousness of consequences associated with a bicycling injury. ***Emotional Benefits***; higher scores reflect more agreement about how helmet use can make one feel better. ***Safety Benefits***; higher scores reflect stronger agreement that helmets can protect people from harm in an accident. ***Personal Vanity and Discomfort Barriers***; higher scores indicate agreement that helmets are unattractive and uncomfortable. ***Cost Barriers***; higher scores suggest economic reasons for not wearing a helmet. ***Friends and Family;*** higher scores reflected stronger agreement that participants experience encouragement from loved ones to wear a helmet. ***Parental Rules;*** higher scores reflect agreement that their parents had rules about helmet use while respondents were growing up. ***Media***; higher scores indicate more exposure to media and community messages encouraging helmet use.[11]

## CONCLUSION

As a result of the statistical analyses of our study, BHAS adapted into Turkish language is composed of 56 items and 10 factors, and have a high level of reliability and validity. The Turkish form can be easily applied to individuals of all ages. Using BHAS, individuals' health belief levels about bicycle helmet use can be determined as well as identifying perceived vulnerability, perceived severity, perceived benefits and cues to action. By using this scale, health belief model-based educational programs can be developed by nurses in order to encourage the use of bicycle helmets, which is primary protective devices, among age groups. Consequently, individuals' perceptions of benefits and obstacles regarding bicycle helmet use can be revealed, and this will contribute to more com-

prehensive training programs to be prepared by researchers.

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*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

### *Conflict of Interest*

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### *Authorship Contributions*

***Idea/Concept:*** *Eda Kılınç, Asiye Kartal;* ***Design:*** *Eda Kılınç, Asiye Kartal;* ***Control/Supervision:*** *Asiye Kartal* ***Data Collection and/or Processing:*** *Eda Kılınç;* ***Analysis and/or Interpretation:*** *Asiye Kartal, Nazan Koştu;* ***Literature Review:*** *Eda Kılınç;* ***Writing the Article:*** *Eda Kılınç, Asiye Kartal, Nazan Koştu;* ***Critical Review:*** *Asiye Kartal, Nazan Koştu;* ***References and Fundings:*** *Eda Kılınç;* ***Materials:*** *Eda Kılınç.*

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