Clinical Research

Development and Psychometric Evaluation of Fluoride Acceptance Scale in Turkish Language

Kevser TUNCER[1,a], Osman ATAŞ[2]

[1]*Fırat Üniversitesi, Halk Sağlığı Anabilim Dalı, Elazığ, Türkiye*
[2]*Fırat Üniversitesi, Çocuk Diş Hekimliği Fakültesi, Elazığ, Türkiye*

ABSTRACT

Objective: The use of fluoride is one of the few evidence-based preventive of dental caries. Fluoride rejection is a growing public health concern. Public health researchers need to develop fluoride rejection screening tools, diagnostic tools, and evidence-based strategies for optimal preventive dental care decisions. This study aimed to develop a Fluoride Acceptance Scale (FAS).

Material and Method: Six hundred and sixty-two volunteers were included for the research. An item pool consisting of 15 items was developed as a result of literature review. A 6-point Likert Scale ranging from 0 to 5 was used in this scale. Four items were removed at the content validity stage and one item at the internal consistency stage. Internal consistency stage 10 of them were accepted for the scale based on Cronbach's Alpha values. The mean Content Validity Indeks value of the scale was calculated as 0.95. The data were analyzed using SPSS Statistics Pack version 22.0 (IBM, Armonk, NY).

Results: In this study, Turkish Fluoride Acceptance Scale was developed to measure fluoride acceptance. The scale consisted of 10 questions and 2 factors: A: Fluoride Benefit and Protection (6 questions), B: Opposition to Fluoride (4 questions). The Cronbach's Alpha was 0.862, Kaiser-Mayer-Olkin was 0.826. Factor load values of all items (10 items) were found to be 0.5 and above.

Conclusion: The FAS can be used to assess fluoride acceptance in an easy and quick way and can assist in the development of health policies.

Keywords: Community dentistry, Fluoride, Pediatric Dentistry, Preventive Dentistry, Scale.

ÖZ

Türkçe Florür Kabul Ölçeğinin Geliştirilmesi ve Psikometrik Değerlendirmesi
Amaç: Florür kullanımı, diş çürüğünü önleyici az sayıdaki kanıta dayalı yöntemlerden biridir. Florür reddi, büyüyen bir halk sağlığı sorunudur. Halk sağlığı araştırmacılarının, optimal koruyucu diş bakımı kararları için florür reddi tarama araçları, teşhis araçları ve kanıta dayalı stratejiler geliştirmesi gerekir. Bu çalışma bir Florür Kabul Ölçeği (FAS) geliştirmeyi amaçlamıştır.

Gereç ve Yöntem: Araştırmaya 662 gönüllü dahil edilmiştir. Literatür taraması sonucunda 15 maddeden oluşan bir madde havuzu geliştirilmiştir. Bu ölçekte 0 ile 5 arasında değişen 6'lı Likert tipi bir ölçek kullanılmıştır. Kapsam geçerliği aşamasında dört madde ve İç Tutarlılık aşamasında bir madde çıkarılmıştır. İç Tutarlılık aşamasında 10 madde Cronbach's Alpha değerlerine göre ölçeğe kabul edilmiştir. Ölçeğin ortalama İçerik Geçerlilik İndeks değeri 0,95 olarak hesaplanmıştır. Veriler SPSS Statistics Pack versiyon 22.0 (IBM, Armonk, NY) kullanılarak analiz edilmiştir.

Bulgular: Bu çalışmada flor kabulünü ölçmek için Türk Flor Kabul Ölçeği geliştirilmiştir. Ölçek 10 soru ve 2 faktörden oluşuyordu: A: Florür Faydası ve Korunması (6 soru), B: Florür Karşıtlığı (4 soru). Cronbach's Alpha 0.862, Kaiser-Mayer-Olkin 0.826 idi. Tüm maddelerin (10 madde) faktör yük değerleri 0,5 ve üzerinde bulunmuştur.

Sonuç: FAS, florür kabulünü kolay ve hızlı bir şekilde değerlendirmek için kullanılabilir ve sağlık politikalarının geliştirilmesine yardımcı olabilir.

Anahtar Sözcükler: Florür, Çocuk Diş Hekimliği, Koruyucu Diş Hekimliği, Ölçek, Toplum Diş Hekimliği.

Fluoride is one of the caries prevention strategies endorsed by the evidence-based professional medical and dental associations (1). Fluoride is applied topically and ingested systemically to prevent dental caries. Systemic fluoride is obtained from sources such as mains water, processed foods, beverages whereas topical fluoride is taken up through toothpastes, mouthwashes, gels, foams and polishes (2). Today, fluoride for the prevention of caries mainly comes from fluoridated tap water, toothpaste and mouthwash. In the United States, intake of water and processed beverages provides about 75% of a person's fluoride intake (3). One of the methods used for fluoride supplementation is fluoride toothpastes (4). In addition, the American Dental Association (ADA) recommends the use of fluoride-releasing varnish (F-varnish) for caries prevention in young patients with intermediate and high risk. There is strong clinical evidence demonstrating the anticancer efficacy of F-varnish for high-risk populations (5). Recent research has found that F-varnish has long-term efficacy for preventing cavities (6). Prevention of dental caries is achieved by the use of fluo-

[a]Yazışma Adresi: Kevser TUNCER, Fırat Üniversitesi, Halk Sağlığı Anabilim Dalı, Elazığ, Türkiye
Tel: 0424 233 3555   e-mail: nurkev23@hotmail.com

ride at home, by individual and professional practice, and by fluoridation of water or salt at the community level (7). Decayed-missing-filled teeth (DMFT), which results from low concentration, and fluorosis, which results from high concentration, have been determined to be associated with the concentration of fluoride added to drinking water. Thus, studies have tried to determine the optimum concentration level of fluoride in the drinking water (8, 9).

Fluoride denial is the caregiver's refusal of topical fluoride routinely provided to children during preventive dentistry and medical visits. A study conducted in 2014 found that topical fluoride rejection rates ranged from 4.8% to 12.9% (10). Among the factors associated with fluoride rejection, immunization rejection has been observed. About 80% of dentists believe fluoride rejection is a problem, while 42.3% believe it is a growing problem (11). In a study conducted in Turkey, 36.4% of the participants stated that they did not know for what purpose fluoride is used in dentistry. 33.7% of them were of the opinion that the fluoride in toothpaste had a caries-preventing effect, and 14.6% of them were of the opinion that it was toxic / harmful (12).

The use of fluoride is one of the few evidence-based preventive treatments available and important in the prevention of dental caries, especially in high-risk children. Parental topical fluoride rejection is a growing public health concern. Public health researchers need to develop fluoride rejection screening tools, diagnostic tools, and evidence-based strategies for optimal preventive dental care decisions (13). However, such a tool about fluoride was not found in the literature. Therefore, in order to bridge this gap and to make this phenomenon comparable with other population group and some other time, this study aims to develop a Fluoride Acceptance Scale (FAS).

MATERIAL AND METHOD

Verbal consent was obtained from the participants. Ethical permission was obtained from Firat University Non-Interventional Research Ethics Committee (26.04.2022-8119).

Development of the Instrument:
Item Development
Identification of domain and item generation
As it is stated in the introduction part, public health researchers need to develop fluoride rejection screening tools, diagnostic tools, and evidence-based strategies for optimal preventive dental care decisions (13, 14). However, such a tool about fluoride could not be found in the literature. Therefore, in order to bridge this gap and to make thisphenomena comparable with other population group and some other time, this study aims to develop a Fluoride Acceptance Scale (FAS).

In order to develop the Fluoride Acceptance scale, first a literature review was conducted (1-19). It was revealed that there was not any fluoride acceptance or rejection scales in the literature.

An item pool consisting of 15 items was created as a result of literature review. Both positive and negative expressions were used in the items. A 6-point Likert Scale ranging from 0 to 5 (strongly disagree:0, slightly agree:1, somewhat agree:2, quite agree:3, strongly agree:4, very strongly agree:5) was used.

Data Collection: The questionnaire was filled by 662 volunteers who applied to Firat University Faculty of Dentistry Hospital as patients and their companies on 2-6 May 2022. Inclusion criterias for the study are being between the ages of 18-65 and not having a problem that prevents communication. The questionnaire form used in the study include socio-demographic information form (gender, marital status, educational status, health worker, visiting dentist/per year, self-reported fluoride knowledge, permission for fluoride), the Fluoride Acceptance Scale, and the short form of the vaccine rejection scale developed by Kılıçarslan et al (19).

Data Analysis: The data were analyzed using SPSS Statistics Pack version 22.0 (IBM, Armonk, NY). A few missing values were tested with EM (expectation-maximization) Missing Value Analysis which is used to determine that the data are missing completely at random. Missing values are then replaced by imputed values. The missing data were completed with the most preferred (mode) values. Frequency, percentages, means and standard deviations were calculated for descriptive data. Statistical significance value was accepted as $p < 0.05$.

Validity
Face Validity: To obtain Face Validity, the conceptual relationship of the scale with fluoride acceptance was evaluated by the authors, through asking their colleagues' opinion and the pilot scheme.

Content validity: A total of 10 experts, 2 public health experts, 3 public health academicians, 3 dental academicians, 1 public dentist, 1 private dentist, were asked to evaluate the necessity, clarity and specificity of the items. Expert opinions were evaluated with Content Validity Index (CVI) Lawshe tecnique. For each item, the opinions of the experts as 4: Item is appropriate 3: Item should be slightly revised 2: Item should be reviewed seriously 1: Item is not appropriate, and their opinions were collected in the area they recommended to be edited (15).

Pre-testing questions: The scale was piloted in a group of 50 people and feedback on the clarity and intelligibility of the items was received.

Sampling and survey administration: In scale development, it is recommended to reach participants equal to 5 or 10 times the number of items or to reach 200-300 participants (20, 21). By using quota sampling methods, 662 volunteers over the age of 18 were reached from those who applied to Firat University Faculty of Dentistry as patients and their companies.

Factor Structure of the Scale: Barlett's Test of Sphericity, Kaiser-Mayer-Olkin were performed.

Convergent and Discriminant Validity: A negative correlation was found between the developed Fluoride Acceptance Scale and the Vaccine Rejection Scale.

Reliability

Internal Consistency: Cronbach's Alpha was used.

Split-half Reliability: The split-half reliability was performed by using Guttman's split-half coefficient.

Test-retest Reliability: To assess the test-retest reliability, the scale was administered to 30 participants twice, 15 days apart. Pearson's correlation coefficient was calculated for each item, and the factor structure obtained for the scale.

RESULTS

Six hundred and sixty-two volunteers were included in the study. The mean age was 37.91±9.99 years. Among the participants 60.4% were male. The socio-demographic characteristics of the participants are given in table 1.

Table 1. Sociodemographic characteristics of participants.

		n	%
Gender	Male	400	60.4
	Female	262	39.6
Marital status	Married	504	76.1
	Single	134	20.2
	Others	24	3.6
Educational Status	Primary School	26	3.9
	High School	140	21.1
	Associate degree-Under graduate	344	52.0
	Post Graduate	152	23.0
Health Worker	Yes	140	21.1
	No	522	78.9
Going to Dentist (per year)	Less than 1	304	45.9
	Once	166	25.1
	Twice and more	192	29.0
Self-Reported Fluoride Knowledge	None	160	24.2
	Middle Level	436	65.9
	Very Good	66	10.0
Permission for fluoride	Yes	278	42.0
	No	180	27.2
	Undecided	204	30.8

Validity

Face Validity: Through pilot scheme, the authors of the research and their colleagues concluded that the items of the scale were conceptually related to fluoride acceptance.

Content validity: At this stage, where 10 experts evaluated 15 questions, 4 items for which 3 or more experts said "Item is not appropriate" (Fluoride is protective against dental diseases. Fluoride is beneficial for general health. I avoid any kind of fluoride application. I have information about fluoride applications.) were removed from the scale. For the rest 11 items, the CVI value of each item was 0.9-1. A value of 0.80 indicates an acceptable level (22). The mean CVI value of the

scale was calculated as 0.95. Then, the opinions of two Turkish language experts were obtained.

Concurrent validity could not be performed since there was not fluoride-related scale in the literature. The relationship of the Fluoride Acceptance Scale with the Vaccine Rejection Scale (20) was examined in terms of Convergent and Discriminant Validity as it is associated with preventive health practice.

Relevance ratings of experts was calculated as 0.89 (must be higher than 0.70 (16)).

Pre-testing questions: The scale was piloted in a group of 50 people and feedback on the clarity and intelligibility of the items was collected.

Sampling and survey administration: By using quota sampling methods, 662 volunteers over the age of 18 were reached from those who applied to Fırat University Faculty of Dentistry as patients and their companies.

Factor Structure of the Scale: Barlett's Test of Sphericity was found to be significant ($p < 0.001$). In other words, there was a high correlation between the variables and the data came from multiple normal distributions. Kaiser-Mayer-Olkin was 0.826. Factor load values of all items (10 items) were found to be 0.5 and above.

As a result of Exploratory Factor Analysis, a two-factor structure consisting of 10 items was obtained (Table 2). These factors explained 39.6%, 28.7% of the variance, respectively. The cumulative amount of variance explained by the eigenvalues was 68.3% of the total variance.

Convergent and Discriminant Validity: A negative correlation was found between the developed Fluoride Acceptance Scale and the Vaccine Rejection Scale (Correlation Coefficient=-0.191, $p < 0.001$).

Reliability

Internal Consistency: After removing item 11th (Topical (to the tooth surface) fluoride applications applied in schools should be optional.) it was found out that Cronbach Alpha value increased, therefore analysis continued after removing the item 11th. For the rest 10 items, the Cronbach's Alpha value was 0.862, which indicated good inter-item correlation. Cronbach's Alpha Values are given in table 2.

Split-half Reliability: The split-half reliability was performed using Guttman's split-half coefficient. The Cronbach's Alpha value was 0.873 for Part 1 (comprising items 1-6) and 0.654 for Part 2 (comprising items 6-10) of the scale. Guttman's split-half coefficient was calculated as 0.774.

Test-retest Reliability: For assessing the test-retest reliability, the scale was applied to 30 participants twice, 15 days apart. Pearson's correlation coefficient was calculated for each item, and the factor structure obtained for the scale. Pearson's correlation coefficient is presented in table 2.

Table 2. Scale analysis information.

Item No	Factor Loading			Test-retest reliability (n =30)
	1	2	Cronbach's Alpha if Item Deleted	Pearson's correlation coefficient
2. Topical (to the tooth surface) application of fluoride is beneficial.	0.907		0.812	0.848
3. I find it convenient to use fluoride toothpaste.	0.873		0.824	0.890
4. I support the topical (tooth surface) application of fluoride in schools.	0.851		0.827	0.785
1. Fluoride makes teeth more resistant to caries.	0.850		0.832	0.830
7. I support adding fluoride to drinking water.	0.584		0.841	0.773
10. I act according to the advice of dentists about fluoride applications.	0.554		0.848	0.743
6. Topical application of fluoride (to the tooth surface) is harmful to general health.		0.795	0.834	0.766
5. Topical fluoride application (to the tooth surface) is harmful to dental health.		0.779	0.834	0.795
8. Adding fluoride to drinking water is harmful to dental health.		0.829	0.839	0.766
9. Adding fluoride to drinking water is harmful to general health.		0.759	0.837	0.908

DISCUSSION

Today, opposition to preventive health services is widespread. The disapproval of fluoride, which is effective in protecting dental health and does not have side effects on both dental and general health, is also on the agenda. A scale measuring fluoride acceptance or opposition could not be found in the literature. In this study, Turkish Fluoride Acceptance Scale was developed to measure fluoride acceptance.

The Cronbach's Alpha value of the scale was 0.862, indicating that it has a high internal consistency, and that the items included in the scale measure similar characteristics. In clinical practice, a Cronbach's alpha value of 0.7 is considered desirable (23). A KMO value of 0.826 means that the sample size is satisfying. KMO was found to be 0.826, which showed that the data is appropriate for factor analysis (24). Factor loads of all items were above 0.5. In addition, the factors explained 68.3% of the total variance. This was above the desired value (24). And there was a high correlation between the variables with Barlett's Test of Sphericity.

The split-half reliability value of 0.713 also indicates a good reliability. Test-retest reliability, and the intraclass correlation coefficient exceed 0.7 for all the items. 6 of the items also has an intraclass correlation coefficient value of > 0.8. This shows that the scale measures a time-invariant structure. The developed scale is not intended for any group, which allows it to be used widely (19). The scale was developed in Turkish. Thus, adaptation to other languages is needed.

Concurrent validity was examined by using Vaccine Rejection Scale. The negative correlation between fluoride acceptance and vaccine refusal can be associated with the coexistence of opposition to preventive health services.

Fluoride rejection is on the rise and there are dentists who do not regard this as a problem (11). Moreover, it has been observed that there are many parents who do not allow the application of fluoride varnish to their children at schools. Most of the parents do not give permission due to lack of information. In countries where oral and dental health problems are common, topical fluoride applications play an important role in community oral health programs and preventive dentistry. It has emerged that parents should be informed in detail about preventive practices that have an important place within the scope of community oral and dental health programs (17). However, people are more informed and interested in their health and management than ever before and are more empowered to discuss treatment options with their healthcare professionals. In recent years, more focus has been placed on the concept of quality of life and its importance in health research and clinical practice. Policymakers and the public are increasingly recognizing the underlying importance of the broader social determinants of public health and oral health. This scale will help to identify target groups in which fluoride acceptance is low and by identifying fluoride acceptance and related factors, it may assist prevention policies. It will also enable tracking of regions, communities and change over time.

Conclusion

As a result, the FAS was developed by using item analysis and factor analysis on items with content validity. Construct validity was also verified. Internal consistency reliability and test-retest reliability were found to be acceptably high. As a screening tool for adults and parents, the FAS can be used to assess fluoride acceptance in an easy and quick way and can assist in the development of health policies. The scale can be used in studies designed to predict the society's view of preventive health services and the future of dental health.

REFERENCES

1. American Academy of Pediatric Dentistry. Fluoride therapy. The Reference Manual of Pediatric Dentistry. Chicago, 2021: 302-5.
2. Carey CM. Focus on fluorides: update on the use of fluoride for the prevention of dental caries. J Evid Based Dent Pract 2014; 14: 95-102.
3. Horowitz HS. The 2001 CDC recommendations for using fluoride to prevent and control dental caries in the United States. J Public Health Dent 2003; 63: 3-8.
4. Vogel GL. Oral fluoride reservoirs and the prevention of dental caries. Monogr Oral Sci 2011; 22: 146-57.
5. American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: Evidence–based clinical recommendations. J Am Dental Assoc 2006; 137: 1151-9.
6. Arruda AO, Senthamarai Kannan R, Inglehart MR, Rezende CT, Sohn W. Effect of 5% fluoride varnish application on caries among school children in rural Brazil: a randomized controlled trial. Community Dent Oral Epidemiol 2012; 40: 267-76.
7. Pollick H. The Role of Fluoride in the Prevention of Tooth Decay. Pediatr Clin North Am 2018; 65: 923-40.
8. Dean HT. The investigation of physiological effects by the epidemiological method. Fluorine Dental Health 1942: 23-31.
9. Dean HT, Arnold FA, Elvove E. Domestic water and dental caries. Public Health Reports 1942; 57: 1555-94.
10. Chi DL. Caregivers who refuse preventive care for their children: the relationship between immunization and topical fluoride refusal. Am J Public Health 2014; 104: 1327-33.
11. Chi DL, Basson, AA. Surveying Dentists' Perceptions of Caregiver Refusal of Topical Fluoride. JDR Clin Translat Res 2018; 3: 314-20.
12. Duman S, Oktay E, Vural H. Evaluation of Parents' Opinions and Information Sources on Dental Fluoride. Selcuk Dent J 2022; 9: 111-8.
13. Chi DL. Parent Refusal of Topical Fluoride for Their Children: Clinical Strategies and Future Research Priorities to Improve Evidence-Based Pediatric Dental Practice. Dent Clin North Am 2017; 61: 607-17.
14. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer. Front Public Health 2018; 11: 149.
15. Karakoç FY, Dönmez L. Ölçek Geliştirme Çalışmalarında Temel İlkeler. Tıp Eğitimi Dünyası 2014; 13: 39-49
16. Bikmaz Bilgen Ö, Doğan N. The Comparison of Interrater Reliability Estimating Techniques J Measur Evaluat Educat Psychol 2017; 8: 63-78.
17. Kalyoncu İÖ, Has S, Eren Giray F, Kargül B. Velilerin 'Okullarda Florürlü Vernik Uygulaması' Programi Hakkinda Tutum ve Yaklaşimlarinin Değerlendirilmesi. Atatürk Üniversitesi Diş Hekimliği Fakültesi Dergisi 2019; 29: 556-62.
18. Lee JY, Watt RG, Williams DM, Giannobile WV. A New Definition for Oral Health: Implications for Clinical Practice, Policy, and Research. J Dent Res 2017; 96: 125-7.
19. Kılınçarslan MG, Sarıgül B, Toraman Ç, Şahin EM. Development of Valid and Reliable Scale of Vaccine Hesitancy in Turkish Language. Konuralp Med J 2020; 12: 420-9.
20. Çapık C, Gözüm S, Aksayan S. Kültürlerarası Ölçek Uyarlama Aşamaları, Dil ve Kültür Uyarlaması: Güncellenmiş Rehber. Florence Nightin J Nurs 2018; 26: 199-210.
21. Yi H, Shin K, Shin C. Development of the sleep quality scale. J Sleep Res 2006; 15: 309-16.
22. Taşkın Ç, Akat, Ö. Araştırma Yöntemlerinde Yapısal Eşitlik Modelleme. Bursa: Ekin Yayınevi; 2010.
23. Kate N, Grover S, Kulhara P, Nehra R. Scale for positive aspects of caregiving experience: development, reliability, and factor structure. East Asian Arch Psychiatry 2012; 22: 62-9.
24. Chesson A, Hartse K, Anderson WM et al. Practice parameters for the evaluation of chronic insomnia. An American Academy of Sleep Medicine report. Standards of Practice Committee of the American Academy of Sleep Medicine. Sleep 2000; 23: 237-41.