Turkish adaptation of quality of life questionnaire for children with hearing loss and the assesment of the effects of hearing loss on quality of life among children aged 7-12

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ABSTRACT

Monitoring the effects of Hearing Loss on Quality of Life, which is frequently seen on children and causes inefficiency in speech, education, and social development, is not only important for listening skills, using hearing devices, and linguistic and speech skills but also important for the treatment. And, if no treatment possible, then it is also critical for rehabilitation with different equipment. By making use of the Quality of Life Questionnaire, developed by Streufert at University of Washington in 2008 to Turkish and Turkish culture, this study was conducted in order to assess the effect of hearing loss of children between the age of 7 and 12 on their quality of life, as well as determining the effects of the hearing loss-related variables on the quality of life.

The study was carried out on 115 kids between the ages of 7 and 12; 35 with unilateral HL, 45 with bilateral HL, and 35 of them without any hearing loss. The questionnaire was named İŞYAK (İşitme Kayıplılar için Yaşam Kalitesi Ölçeği - as with Turkish initials – Quality of Life Questionnaire for Hearing Loss). If the İŞYAK was confirmed on the sample in Turkish culture was examined by using Confirmatory Factor Analysis (CFA). In addition to CFA, the data obtained from the İŞYAK and Quality of Life Scale for Children (ÇİYKÖ) were compared by using variance analysis, and it was determined that there were significant differences between the normally hearing children and the children having hearing loss in terms of school, physical activity scores of ÇİYKÖ and all the dimensions of İŞYAK (environment, activity, emotions). In conclusion, besides the general similarities with the results obtained from the study on developing İŞYAK, differences were observed in the demographic variables.

The statistical analyses conducted on İŞYAK showed that İŞYAK can be used both in clinical and as well as in rehabilitation centers as a special questionnaire for determining the quality of life for the kids with hearing loss with reliable and valid results.

1. Introduction

The rehabilitation and clinical follow-up of children having hearing loss are the dynamic processes that should be closely monitored. The objective of interventions in this process is to improve the hearing performance and communication skills of individual, as well as minimizing the limitations and obstacles that might emerge as a result of the hearing loss [1,2]. Although recovering the hearing loss by making use of various amplification instruments (such as traditional hearing aid or cochlear implants) is of significant importance in supporting the communication skills and hearing performance, another important point is to what extent this improvement is reflected on the children's quality of life. The assessments at this point can be made by evaluating the quality of life of children having hearing loss.

The earlier the hearing loss occurs in the life of child, the more severe effects it would have on the development of child. Similarly, if the problem can be identified earlier, the more successful outcomes can be achieved in preventing these effects [3]. Although it is known that severe or advanced levels of hearing losses have negative effects on various domains such as speech, social, and sensual domains [4], it was shown in the literature that even mild or unilateral hearing losses might cause academic difficulties, mental development retardations or language problems [5–7].

Many of the questionnaires applied to children and adolescents having hearing loss focus on the educational performance and hearing function. The hearing aids can improve the hearing levels. But, at the

same time, it is also necessary to determine their positive effects on the quality of life. In order to accurately evaluate the benefits of interventions, the healthcare professionals should have age- and problem-specific instruments [8].

Despite this obvious necessity, a hearing loss-specific instrument for assessing the quality of life couldn't be developed until late 2000s. The most remarkable step taken in this parallel was the Hearing Environments and Reflection on Quality of Life [HEAR-QL] questionnaire developed by Streufert 2008 [9].

As well as there are few studies examining the quality of lives of children having chronic problems, there are few scales developed specifically for the children with hearing loss. Among them, HEAR-QL is the first and specific scale developed for the children with hearing loss. Although there are health-related quality of life questionnaires translated into Turkish language and modified for the Turkish culture, the number of questionnaires for the adolescents and children is limited. The Pediatric Quality of Life [PedsQL], which was used in the present study as a comparison scale, is the scale for quality of life that is most widely used in medicine throughout the world, translated into Turkish with the capitals ÇİYKÖ and is most suitable to the structure of İŞYAK. However, it is not specifically for the individuals with hearing loss and it has a general character.

Although the general quality of life of the pediatric patients having hearing loss is not significantly affected clinically and statistically significantly, there may other aspects of the life, which are influenced. The quality of life scales used may not be sensitive to those specific aspects. To date, it was shown that HEAR-QL is more sensitive to the changes in quality of life of the children having hearing loss, that it is more valid and reliable and even more effective than the PedsQL that is the most widely used scale [10].

While developing HEAR-QL, the fundamental instrument that was utilized was Handicap Inventory for Adults [HHIA] [11].

The authors stated that HHIA was chosen because it is short and abstract, easy to implement and interpret, and it has perfect internal consistency reliability and high test-retest reliability [9]. HHIA is considered as an instrument that is useful for determining the emotional results and social and situational effects of hearing loss among the adults [12]. But it is clear that this instrument cannot be effective in determining the daily lives of younger individuals [13].

In the present study, it was aimed to adapt HEAR-QL 26 to our language, and to create an instrument that is useful for assessing the hearing-related quality of life, which is also a new branch in world, in our country.

2. Material and Methods

In this study, three groups were founded with 97 children, who were between ages of 7 and 12 years and for follow-up and treatment. The groups was normal hearing group consisting of 35 persons, unilateral hearing loss group consisting of 35 persons, and bilateral hearing loss group consisting of 45 persons.

All the children involved in the assessments were aged between 7 and 12 years, have normal otolaryngologic examination results, have mother language of Turkish, have no cognitive impairment (IQ < 70). In audiological examination in accordance with ICD-9 code, the children in hearing loss group have hearing loss in minimum 1 ear with mean score higher than 25 dBHL in 500, 1000, 2000 and 4000 Hz. The children in normal hearing group have mean score of 25 dBHL at 500, 1000, 2000, and 4000 Hz and not less than 30 dBHL at 4000 Hz. Moreover, the ones having diagnosis of temporary hearing loss were not involved in any of the groups. And then, HEAR-QL 26 was translated into Turkish by two audiologists having a command of Turkish and English, one sworn translator, and one linguist independently, and then named "İşitme Kayıplı Çocuklar için Yaşam Kalitesi Ölçeği- İŞYAK". The translations obtained were examined by researcher and ear, nose, throat specialist having command of these languages and this

discipline, and then examined by gathering them into a single table. The items of scale were individually discussed; the Turkish form was prepared by keeping the items, on which a consensus was achieved, as are, whereas the items, on which there is no consensus, were modified in the way they can be understood in the same manner by everyone. At the other step of translation, the scale, Turkish version of which was prepared, was translated into English, which is its original language, by an expert, who was no expertise on this subject but knew both cultures well. The equivalency was examined by comparing the items in original version to those in English version translated from Turkish language. At the last step, in order to determine if the translated form is understandable for children aged between 7 and 12 years, the scale was applied to 35 children, and they were asked to specify the items that they couldn't understand. Thus, the intercultural semantic equivalency of scale translated form English to Turkish was tested and a preliminary application was made. At the end of these steps, no item was excluded from or added into the scale. As a separate step, test-retest procedure was applied to all the participants, who showed the required cooperation, and their parents 3–4 weeks later than the implementation.

İŞYAK's child version that was translated is a measurement tool developed for children aged between 7 and 12 years and consisting of 3 factors (environment, activities, and emotions). The participants were asked to mark the option that reflects how frequently the items caused problems for them [14]. The options were "never" (4), "rarely" (3), "sometimes" (2), "frequently" (1) and "almost always" (0). The scores were as follows: 0 = 0, 1 = 25, 2 = 50, 3 = 75, and 4 = 100 [9].

The other scale used for comparison was the Scale for Children's Quality of Life (PedsQL). PedQL is a measurement tool consisting of 23 items and 4 factors (*Physical, Emotional, Social, and School*) with proven validity [15]. In the present study, this scale's versions that are suitable for 8-12 year-old children and their parents were used.

İŞYAK was firstly examined by using Confirmatory Factor Analysis (CFA). In order to determine the validity level of adopted scale, in addition to CFA, the scores obtained from İSYAK and PedsQL were compared to each other in order to determine if the measurement tool distinguish the groups, and the distinctive validity test was performed. The structural validity was tested by using cutoff scores. In order to determine the reliability of measurement tool, the Cronbach Alpha Coefficient (Cronbach α) was calculated at the dimension level and at inventory level, and the coefficient obtained was examined in terms of internal consistency. Moreover, in order to determine the time consistency of results obtained from the measurement tool, the reliability coefficient was calculated using test-retest procedure. During the process of collecting the proofs for reliability of measurement tool, the Variance Analysis (ANOVA) that is one of the parametric statistical analyses was used in order to determine if there was a significant difference between the individuals having permanent bilateral and unilateral hearing losses and having no hearing loss, whereas Tukey's b test was used as "post-hoc test" in order to examine significant differences obtained from previous analysis. Moreover, in order to determine if the normal distribution, which is one of the fundamental assumptions of parametric statistics, was met, "Kolmogorov-Smirnov" test and histogram graph were used.

The Confirmatory Factor Analysis was performed using LISREL 8.80 software, whereas SPSS 22.0 ("*Statistical Package for Social Sciences*") software was used for the other analyses.

2.1. Ethical considerations

Ethical approval for this study was received from the institutional review board of the university in 2014. Prior to collecting the data, each participant and their parents received information about this study, including the purpose, potential risks, and being able to withdraw at any time if they did not want to participate in this study. Including informed consent, protecting confidentiality or anonymity were considered when conducting this study. The permission for the adaptation
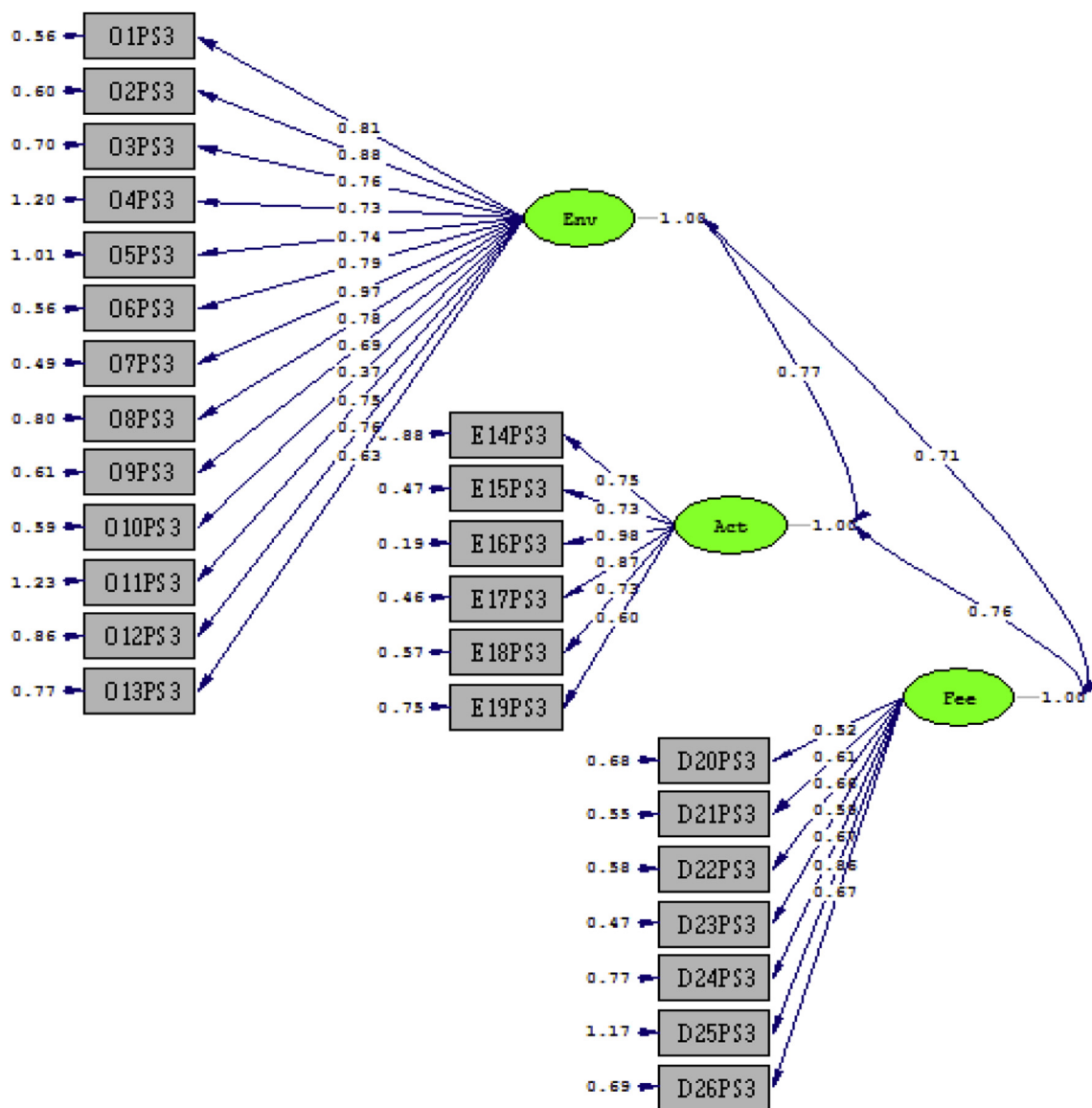
Fig. 1. Path diagram of confirmatory factor analysis of İŞYAK

of HEAR-QL was obtained from Michael MUSKUS from Department of Technological Permissions, Washington University, under coordination of the university's center of technology transfer.

3. Results

The Confirmatory Factor Analysis (CFA) was used for determining if the three-dimensional structure obtained from the original sample of scale is valid in Turkish sample. CFA is a robust statistical method that is used in order to determine the known factor structure of a measurement tool can be validated with a different sample or sub-sample [16]. The schema used for CA is presented in Fig. 1. The goodness of fit indexes obtained from CFA is presented in Table 1. In parallel with these results, it was found that the model showed perfect fit for χ2/sd, NNFI, CFI, and IFI indexes and good fit for other indexes.

Table 1
The goodness of fit indexes obtained from CFA.

Indexes	RMSEA	RMSEA	NFI	NNFI	CFI	IFI	SRMR
Coefficient	1,85	0,08	0,88	0,93	0,94	0,94	0,08

As seen in Table 2, the differences of İŞYAK scale scores were examined in terms of gender, hearing status, use of hearing aid, income level, and parental educational status. The mean İŞYAK scores showed significant differences in terms of hearing status, use of hearing aid, economic status, and parental income level ($p < .05$). Besides that, the mean İŞYAK scores showed no significant difference in terms of gender ($p > .05$). In parallel with the studies, in which the scales were developed, the cutoff score was taken to be 93.5 for İŞYAK scale and 69.6 for PedsQL. Given the cutoff score of 93.5, it can be stated that 93.30% of children having loss and 70.37% of normal children are categorized accurately. Thus, this cutoff score has high classification level in both groups. Given the cutoff score of 69.6 for PedsQL scale, it can be stated that 34.28% of children having hearing loss and 85.18% of normal children are categorized accurately.

In order to examine the distinctive validity of İŞYAK, the variance analysis used in determining if there is a statistically significant difference between the İŞYAK and PedsQL scores of participants having hearing loss and those of normal participants. The descriptive statistics of İŞYAK from the aspect of compared groups are presented in Table 3, and the results of variance analysis are presented in Table 4. As seen in Table 4, in terms of Environment [$F (2.94) = 18.745$, $p < .05$],

Table 2
Distribution of İŞYAK scores by demographical and clinical variables.

Variable	Mean Score from İŞYAK (Standard Deviation)	p
GENDER		
Girl	80.23 (17.81)	.715
Boy	78.85 (19.43)	
HEARING STATUS		
Unilateral	75.74 (21.87)	.000
Bilateral	71.88 (15.27)	
Normal	95.19 (4.83)	
USE OF HEARING AID		
Using hearing aid	72.12 (15.51)	.003
Using no hearing aid	83.76 (18.88)	
INCOME LEVEL		
< 1000 TL	71.19 (21.81)	.010
1000 TL – 3000 TL	78.70 (16.65)	
3000 TL <	89.72 (11.67)	
MOTHER'S EDUCATIONAL STATUS		
Illiterate	39.90 (33.36)	.000
Elementary School	75.69 (16.65)	
Secondary School	72.39 (14.53)	
High School	85.76 (11.97)	
University	91.05 (12.08)	
FATHER'S EDUCATIONAL STATUS		
Illiterate	47.12 (−)[a]	.000
Elementary School	66.76 (22.59)	
Secondary School	80.77 (7.38)	
High School	82.66 (17.11)	
University	86.16 (13.35)	

[a] There is only one person in this category.

Table 3
Descriptive statistics of İŞYAK scores of participant having unilateral, bilateral, and no hearing loss.

Variable	Group	N	$\bar{X}$	SS*
ÝþYAK *Environment*	Unilateral	30	75.94	21.87
	Bilateral	40	73.83	15.27
	Normal	27	83.33	4.83
	Total	97	77.13	18.53
ÝþYAK *Activity*	Unilateral	30	74.67	23.55
	Bilateral	40	74.38	18.22
	Normal	27	78.15	8.98
	Total	97	75.52	20.79
ÝþYAK *Emotions*	Unilateral	30	84.17	20.66
	Bilateral	40	80.75	22.61
	Normal	27	90.37	1.77
	Total	97	84.48	20.29

Activity [$F (2.94) = 15.642$, $p < .05$], Emotions [$F (2.94) = 10.387$, $p < .05$] and Total İŞYAK, [$F (2.94) = 20.411$, $p < .05$] scores, the mean values of normal participants were higher than those of participants having unilateral and bilateral hearing losses. In parallel with this result, it was specified that İŞYAK successfully distinguished normal children and children having unilateral and bilateral hearing losses in terms of all the scale's dimensions and total score. In Fig. 2, the mean scores of İŞYAK by the groups are presented. In terms of distinctive reliability, it was also examined if the scores of normal children and children having hearing loss (bilateral and unilateral) obtained from İSYAK and PedsQL scales differed from the aspects of dimensions and total score (Table 5). As it is seen, there were significant differences between children having hearing loss and normal children in terms of Environment, Activity, Emotions, and Total Score of İŞYAK and School, Physical Activity, and Total Score dimensions of PedsQL ($p < .05$).

As seen in Table 6, the internal consistency coefficients obtained from the measurement tool were higher than 0.70, and they were also higher than the acceptable limit for all the dimensions. In parallel with this result, it can be stated that the items performed the measurement regarding the dimensions, under which they are asked. For test-retest assessment, the correlation coefficient between two implementations performed with 3 weeks interval was found to be $r = 0.833$ ($p < .05$) when all the responders were taken into account. During the development phase of measurement tool, the correlation coefficient was calculated to be 0.83 by using test-retest method. In parallel with this result, it can be emphasized that a consistency coefficient that was very close to the initial study was obtained.

4. Discussion

In the present study, in parallel with the efforts made in order to adapt the pediatric version of HEAR-QL quality of life scale, the translation into Turkish language was performed. When they were instructed to ask the statements that they cannot understand, it was generally observed that the children had difficulties in understanding the words used in Turkish language but adapted from the English language, such as restaurant and party. Even though no item was added in or excluded from the scale, the words widely used in Turkish population were preferred. However, although the data were collected from 115 participants, 18 participants were excluded from the analyses. Although the words popularly used in Turkish culture were preferred, the children having hearing loss could not understand the items in scale and cannot give an answer. Thus, it is believed that the exclusion of 18 participants was because of the low educational and sociocultural levels of participating families. Although the demographic variables used in adaptation of İŞYAK were similar to those determined to be important for the quality of life while developing İŞYAK, the ethnic origin was not
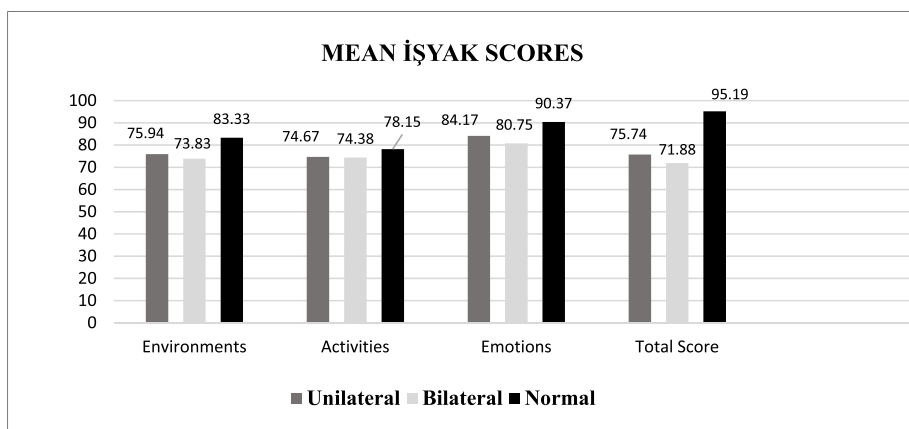
Table 4
Variance analysis results of İŞYAK scores of participant having unilateral, bilateral, and no hearing loss.

Variable	Source of variance	Sum of squares	SD	Quadratic mean	F		p	Significant difference
İŞYAK *Environment*	Intergroup	9398.752	2	4699.376	18.745		.000	Uni-Nor, Bi-Nor
	Intragroup	23565.890	94	250.701				
	Total	32964.642	96					
İŞYAK *Activity*	Intergroup	10358.889	2	5179.445	15.642		.000	Uni-Nor, Bi-Nor
	Intragroup	31126.425	94	331.132				
	Total	41485.314	96					
İŞYAK *Emotions*	Intergroup	7141.752	2	3570.876	10.387		.000	Uni-Nor, Bi-Nor
	Intragroup	31972.107	93	343.786				
	Total	39113.860	95					
İŞYAK *Total*	Intergroup	8932.404	2	4466.202	20.411		.000	Uni-Nor, Bi-Nor
	Intragroup	20349.989	93	218.817				
	Total	29282.393	95					

Fig. 2. Comparison of groups by mean İŞYAK scores.

Table 5

Comparison of the results of İŞYAK and PedsQL with normal and hearing loss children with variance analysis.

Scale	Normal hear (n = 27)	Hearing loss (Unilateral + Bilateral) (n = 70)	p	Unilateral (n = 30)	Bilateral (n = 40)
ÇÝYKÖ					
Physical Functioning	83,33	74,73	.037	75,94	73,83
Emotional	78,15	74,50	.388	74,67	74,38
Social	90,37	82,21	.058	84,17	80,75
School	79,07	69,29	.035	66,67	71,25
Total	82,81	75,12	.031	75,43	74,89
ÝþYAK					
Environmental	91,17	68,60	.000	71,47	66,44
Activity	99,54	81,22	.000	84,77	78,65
Emotions	98,94	77,80	.000	80,05	76,16
Total	95,19	73,53	.000	75,74	71,88

Table 6

Cronbach Alpha coefficients on dimensions and scale.

Dimension-Scale	Number of items	Alpha coefficient
İŞYAK *Environmental*	13	.916
İŞYAK Activity	6	.844
İŞYAK Emotions	7	.782
İŞYAK Total	26	.937

used since there is no significant ethnic variability in Turkish society. In the present study, the parents of only one child have divorced. It is known that the children living with married parents have higher academic success, behavioral development, self-confidence, and peer relationships [17]. The presence of 1 pair of divorced parents decreases the negative effect on the quality of life.

In the literature, it was shown that the educational status of parents has significant influence on the educational and behavioral achievements of children [18–20]. In the present study, we achieved no result indicating that the educational status of the parents might have an effect on the children's quality of life. The point to pay attention in this study is that the educational status of the parents was not homogeneous. Since analyzing the variables affecting the quality of life is not the main objective of the present study, no sub-arrangement related with the homogeneity was made.

The mean score of İŞYAK by the demographic variables showed significant difference in terms of hearing status, use of hearing aid, and parents' educational and financial status, while there was no significant difference in the original study in terms of parents' educational and income status. It is believed that the socioeconomic development of the country might have played role in these two variables.

Differently from the study on developing the İŞYAK, vast Majority (96.7%) of children having unilateral hearing loss were not using any hearing aid. The effect of unilateral hearing loss on the children, the

amplification preferences regarding these children, and the intervention strategies were the controversial subjects [21]. In literature, it was reported that these children are academically more unsuccessful than their peers hearing normally [22], and that there might problems related with their speech skills [23]. Moreover, it is also known that, if they are more carefully followed-up in terms of amplification, the children having more severe hearing loss can be more successful in academic domain [24]. For this reason, it is obvious that more careful assessments should be done about if this group of children receives sufficient and required support for amplification.

Using the factor analysis, the sub-samples of environment, activities, and emotions were analyzed in terms of the fitting to Turkish sample. As stated by Guillemin, Bombardier, and Beaton (1993), the cultural adaptation is based on ensuring the measurability of a similar phenomenon on a different culture. "Goodness of Fit" indexes and factor analysis play important role in determining this. The assessment coefficients obtained from goodness of fit ranged between perfect and good [25].

The sensitivity and specificity rates can be determined using cutoff scores [26]. The rate of identifying the individuals having targeted disorder and abnormal clinical symptoms is the sensitivity. If a test has high level of sensitivity, then it indicates that there is no problem with passing the test. The specificity is defined as the rate of individuals, who have no abnormal clinical symptoms and don't have the targeted disorder. If the level of specificity is high, then not passing the test indicates that the individual has the targeted disorder. In order for a test to have a high clinical usefulness, it must have high levels of specificity and sensitivity [27]. Having cutoff score of 93.5, İŞYAK's Turkish version accurately specifies 93.3% (0.93) of children having hearing loss and 70.37% (0.70) of children having no hearing loss. Having cutoff score of 69.6, PedsQL scale used as comparison tool here could distinguish the children having hearing loss at the rate of 34.28% (0.34). Lalkhen (2008) stated that the value "1" is perfect for sensitivity and

specificity but the measurement would maintain its validity to the level of 0.5. From this aspect, İŞYAK has high level of specificity and sensitivity [28].

As in the original study (except for the activity subscale), no difference was observed between the İŞYAK scores of children, who have unilateral and bilateral hearing losses. But, even if there was no statistically significant difference, the children having unilateral hearing loss had better scores in "quality of life" scores in total score and subscales when compared to the children having bilateral hearing loss.

Lalkhen (2008) defined the test-retest reliability as "a statistical method implemented for determining the measurement errors by repeating the assessments on the same participants as similarly as possible". In other words, when İŞYAK is a reliable and consistent instrument yielding similar results when applied at different times [28].

George and Mallery (2003) reported the Cronbach alpha values as follows: > 9-perfect, > 8-good, > 7-acceptable, > 6-questionable, > 5-weak, and < 5-unacceptable. In the present study, perfect values were achieved for Environment (0.916) subscale and total score (0.937), whereas good values were achieved for Activity (0.844) subscale and alt acceptable values for Emotions (0.782) subscale. These results suggest that the present study has a strong reliability [29].

5. Conclusion

As a result of evaluations made following a path consistent with the literature, it has been observed that ISYAK is a valid and highly reliable tool. The statistical analyses conducted on İŞYAK showed that İŞYAK can be used both in clinical and as well as in rehabilitation centers as a special questionnaire for determining the quality of life for the kids with hearing loss with reliable and valid results.

Author contributions

All authors have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Declaration of competing interest

- The authors declared that they did not receive support for this study.
- Authors did not report conflict of interest.
- All authors have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Acknowledgments

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