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Psycho-communicative interruptions in hearing-impaired Egyptian Arabic-speaking children

Hany Desoky¹, Omnia Raaft² and Safinaz Nagib Azab^{3*}

Abstract

Background: Hearing is critical for normal development and acquisition of language and speech, and hearing impairment exists when there is diminished sensitivity to the sounds normally heard. Several studies have suggested that one out of every two to three school-aged children with any degree of hearing impairment have academic, social, and behavioral difficulties. Purpose: to compare the degree of hearing loss regarding the psychological profile: behavioral, social, emotional, and cognition of hearing-impaired children, and then correlate this profile to language scale.

Results: Hearing-impaired children showed more language, emotion, and behavioral difficulties and spent less time communicating than children with normal hearing. The lowest academic, social, and behavioral scores were in severe hearing-impaired group than in the other two groups.

Conclusion: Even slight/mild hearing impairment can result in negative consequences in the psychological profile, behavioral, social, and emotional, and there is significant relationship between delayed language, anxiety, and child behavior problems. Without appropriate interventions, these children are at risk of developing mental health disorders.

Keywords: Hearing impairment, Psychological profile, Language, Speech

1 Background

Hearing, auditory perception, or audition is the ability to perceive sound by detecting vibration changes in the pressure of the surrounding medium through time, through the ear [1]. Hearing is critical for normal development and acquisition of language and speech [2]. Hearing impairment exists when there is diminished sensitivity to the sounds normally heard [3]. According to Smith, the term hearing impairment is usually reserved for people who have relative insensitivity to sound in the speech frequencies [4]. The severity of a hearing impairment is categorized according to the increase in volume above the usual level necessary before

the listener can detect it. Along the world approximately one child in 1000 is hearing impaired from birth, and the number rises to about 1.6 per 1000 in adolescents. The causes are hereditary in 30–39%, acquired in 19–30%, and the cause remains unknown in 31–48% of children [5]. Language plays a central role in development. It is not only the medium for social exchange, but aids in internalizing social norms and the development of behavioral control [6]. Hearing-impaired children do not acquire language and speech the same as normal hearing children because they cannot hear the language spoken around them. In normal language acquisition, auditory comprehension precedes the development of language [7]. So children who have hearing impairment as they move into school are at risk of a raft of difficulties. Impacts of poor oral language skills go well beyond early literacy development and “school readiness” to

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increasingly apparent associations with emotional, behavioral, and social difficulties [8]. Hearing-impaired children can be viewed as being different from the majority because of their observable hearing aids, use of sign language, and/or their distinct speech production. Moreover, hearing-impaired children's language problems and impaired socially skilled behaviors have been frequently reported [9]. Culpepper et al. [10] report that school-aged children who are hearing impaired may be as much as five times more likely to suffer from emotional disturbance, defined as a pattern of behavior that deviates from the acceptable patterns of behavior in school that impact their ability to maintain normal social relationships. Questionnaires are frequently used in quantitative marketing research and social research. They are a valuable method of collecting a wide range of information from a large number of individuals, often referred to as respondents. Adequate questionnaire construction is critical to the success of a survey [11].

2 Objectives

The aim of this work is to compare between the different degrees of hearing loss regarding the psychological profile (behavioral, social, emotional, and cognition) of hearing-impaired children and then correlate this profile to their language scale.

3 Methods

This research was conducted during the period between the months July 2018 and April 2019. The study protocol was approved by the Otolaryngology Department Council. Consent to participate in this research was obtained from the subjects' parents before commencement of the study. This study was applied on 75 child, 53 males and 22 females. Their ages ranged from 72 months (6 years) to 93 months (7 years and 3 months) with a mean 81.15 ± 5.53 diagnosed as hearing impairment. They were divided into three equal groups each one consists of 25 patients. *Group A* (mild hearing impairment) consisted of 16 males and 9 females with age range (72–93 months) with a mean 80.08 ± 5.83 .

Group B (moderate hearing impairment) consisted of 19 males and 6 females with age range (72–90 months) with a mean 82.96 ± 5.22 .

Group C (severe hearing impairment) consisted of 18 males and 7 females with age range (72–90 months) with a mean 80.40 ± 5.29 . The subjects were randomly selected from a group of typically developing Egyptian children in Nurseries and schools in Beni-Suef city area. All children were coming from families of moderate socio-economic status. They were all reported to be free from profound hearing impairment (>90 decibel) or those with cochlear implantation; hearing impairment with other psychological disorder (autism, attention-

deficit hyperactivity disorder); neurological or physical handicap, e.g., BDMH (brain damage motor handicap); and serious medical/chronic problems. The children were diagnosed as sensorineural or conductive hearing loss (mild-moderate-moderate to severe and severe), Arabic spoken as a primary language (monolingual Arabic-speaking family, where Arabic is the primary language), and regular use of satisfactory hearing aids.

All children were subjected to the following protocol of assessment:

- 1- *Audiological assessment*: Many formal audiologic testing to determine the type and etiology of hearing loss and the optimal treatment plan, such as auditory brainstem response (ABR) and pure tone audiometry to measure the degree of hearing impairment.
- 2- *Psychometric and cognitive assessment by Stanford-Binet Intelligence Scales Fourth Edition (SB: FE)* [12].
- 3- *Language assessment by Language scales* [13].
- 4- *Social-emotional assessment questionnaires (a specialized battery for our study)*: The questionnaires are translated to Arabic language and back-translated by two of the psychiatric staff. Then, pilot study was done for checking their reliability. The Questionnaires include:
 1. *Children's Loneliness Scale (CLS)*: The instrument includes 24 items, 16 of which assess loneliness and social dissatisfaction (e.g., are you lonely at school?). The remaining items are fillers focusing on children's hobbies and other activities, designed to help children relax during the interview. Children were asked to rate the extent to which each statement is true by saying "yes," "no," or "sometimes" [14]. Items are rated with points: 1 (no), 2 (sometimes), or 3 (yes). A total score is computed by summing all items which assess loneliness and social dissatisfaction. Filler items (i.e., items 2, 5, 7, 11, 13, 15, 19, and 22) are omitted and do not contribute to the total score. Items 1, 3, 4, 8, 10, 14, 16, 18, 21, and 23 are reverse coded so that higher scores reflect a greater degree of loneliness on all items. Total scores range from 15 to 45. Higher scores indicate greater loneliness and social dissatisfaction. It is important to note that in the original administration the authors inadvertently omitted item 20, "Is it hard to get along with the kids at school?" [15]. Thus, the range of total scores of 15 to 45 is derived by summing all loneliness and social

dissatisfaction items excluding item 20. If item 20 is included in the total score, the range of total scores is 16 to 48.

2. *Screen for Child Anxiety Related Emotional Disorders (SCARED)*: The SCARED has 41 sentences describing various feelings and behaviors possibly associated with anxiety symptoms [16]. The SCARED was chosen to measure the children for anxiety disorder; SCARED could significantly discriminate between anxious and depressed children. Items that can be grouped into five subscales. Four of these subscales measure anxiety disorder symptoms as conceptualized in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision DSM-IV-TR: panic disorder, generalized anxiety disorder, separation anxiety disorder, and social anxiety. The SCARED questionnaire in this study rated each symptom on a 3-point scale: 0 (no), 1 (sometimes), or 2 (yes). The subscales of the questionnaire are panic disorder (13 items), generalized anxiety disorder (9 items), separation anxiety disorder (8 items), social anxiety (4 items), and school anxiety (4 items). A total score of ≥ 25 may indicate the presence of an anxiety disorder. Scores higher than 30 are more specific.
 - A score of 7 for items 1, 6, 9, 12, 15, 18, 19, 22, 24, 27, 30, 34, 38 may indicate *panic disorder or significant somatic symptoms*.
 - A score of 9 for items 5, 7, 14, 21, 23, 28, 33, 35, 37 may indicate *generalized anxiety disorder*.
 - A score of 5 for items 4, 8, 13, 16, 20, 25, 29, 31 may indicate *separation anxiety disorder*.
 - A score of 8 for items 3, 10, 26, 32, 39, 40, 41 may indicate *social anxiety disorder*.
 - A score of 3 for items 2, 11, 17, 36 may indicate *significant school avoidance*.
3. *Child Behavior Checklist scale*: As the final measurement of social and emotional adjustment. The Child Behavior Checklist (CBCL) is a device by which parents or other individuals who know the child well rate a child's problem behaviors and competencies. This instrument can either be self-administered or administered through an interview [17]. The CBCL/6-18 is to be used with children aged 6 to 18 year. It consists of 113 questions, scored on a 3-point Likert scale (0=absent, 1= occurs sometimes, 2=occurs often) [17]. Total scores may be computed for social competence, behavior problems, internalizing problems, externalizing

problems, and sex problems, plus scores for each of the 8 syndrome scales [18].

- *Internalizing problems combines*:
 - 1- Anxious/depressed child Q numbers 14, 29, 30, 31, 32, 33, 35, 45, 50, 52, 71, 91, 112
 - 2- Withdraw /depressed child Q numbers 5, 42, 65, 69, 75, 102, 103, 111
 - 3- Somatic complaints Q numbers 47, 49, 51, 54, 56a, 56b, 56c, 56d, 56e, 56f, 56g
- *Externalizing problems combines*:
 - 1- Rule-breaking behavior numbers 2, 26, 28, 39, 43, 63, 67, 72, 73, 81, 82, 90, 96, 99, 101, 105, 108
 - 2- Aggressive behavior Q numbers 3, 16, 19, 20, 21, 22, 23, 37, 57, 68, 86, 87, 88, 89, 94, 95, 97, 104
- *Also there are*:
 - 1- Social problems Q numbers 11, 12, 25, 27, 34, 36, 38, 48, 62, 64, 79
 - 2- Thought problems Q numbers 9, 18, 40, 46, 58, 59, 60, 66, 70, 76, 83, 84, 85, 92, 100
 - 3- Other problem Q numbers 6, 7, 15, 24, 44, 53, 55, 56h, 74, 81, 77, 93, 99, 107, 108, 109, 110, 113
 - 4- Items are rated with point: 0 (no), 1 (sometimes), or 2 (yes).

For the syndrome scales, T (total) scores less than 67 are considered in the normal range, T scores ranging from 67–70 are considered to be borderline clinical, and T scores above 70 are in the clinical range [18].

For total problems, externalizing problems, and internalizing problems, T scores less than 60 are considered in the normal range, 60–63 represent borderline scores, and scores greater than 63 are in the clinical range [18].

3.1 Data management

The data was collected, coded, and entered to computer. The data was analyzed with the program (SPSS) statistical package for social science version 16 under windows7. Statistical tests used in this thesis were description of qualitative variables by frequency and percentage. Description of quantitative variables in the form of mean and standard deviation (mean \pm SD). Chi-square (χ^2) test was used for comparison of qualitative variables with each other. Comparison between quantitative variables was carried by using Student's t-test of two independent samples, ANOVA of more than two independent samples. Association between quantitative variables was carried by using correlation.

Significance level (p) was expressed as following:
P value > 0.05 is insignificant.

P value < 0.05 is significant.

P value < 0.001 is highly significant.

4 Results

There is significant difference between the three groups A, B and C (mild, moderate and severe hearing impairment) as regards the total language age (Table 1). Also, there is significant difference between the three groups A, B, and C (mild moderate and severe hearing impairment) as regards the IQ (Table 2). *Children's Loneliness Scale (CLS)* shows significant difference between the three groups A, B, and C (mild, moderate, and severe HI) as regards the NO. and % of children with mild hearing impairment which were less than the other two groups, and there was no significant difference between the three groups as regards the mean and SD (Table 3). Subtypes of *Child Anxiety Related Emotional Disorders (SCARED)* test as regards the no. and % show significant difference between the three groups A, B, and C (mild, moderate, and severe HI) in *generalized* and *social disorders* (value = .0001), and there was no significant difference between the three groups in *panic* (value = .353), *separation*, and *school avoidance* disorders (value = .191) (Fig. 1). *Child Behavior Checklist (CBCL)* results as regards the no. and % show no significant difference between the three groups A, B, and C (mild, moderate, and severe HI) in *externalization behavior problem* (p value .227) and total CBCL (p value .678), but there was a significant difference between the three groups in *internalization behavior problem* (p value .0001) (Fig. 2). There is a significantly positive correlation between all children chronological ages (the three groups A, B, and C) and their total language ages ($R = .0288$) (Fig. 3). There is a highly significantly positive correlation between IQ scores of all children (the three groups A, B, and C) and their total language ages ($R = .716$) (Fig. 4). There is a significantly negative correlation between total language ages and *Child Anxiety Related Emotional Disorders (SCARED)* ($R = -.197$) (Fig. 5). There is a significantly negative correlation between anxiety scores and IQ total scores ($R = .422$) of all children (the three groups A, B, and C) (Fig. 6). There is a significantly

Table 2 IQ scores of the study group

Item	Groups	N	Mean	Std. deviation	P value and sig.
IQ	A	25	75.76	3.345	.059 (S)
	B	25	74.24	2.067	
IQ	A	25	75.76	3.345	.0001 (S)
	C	25	71.92	.954	
IQ	B	25	74.24	2.067	.0001 (S)
	C	25	71.92	.954	

negative correlation between total language ages of all children (the three groups A, B, and C) and their total CBCL scores ($R = .341$) (Fig. 7).

5 Discussion

Hearing is critical for normal development and acquisition of language and speech. Hearing impairment in children may affect the development of behavior and language and can cause work-related difficulties for adults [19]. Hearing loss brings with it some emotions and psychological problems before acceptance of the loss. These emotions can include denial and anger, as well as a sense of isolation [20]. Our hypothesis was that the more affected children with hearing impairment, the more language and psychological impairment. So the primary aim of the present study was to compare the degree of hearing impairment regarding the cognitive and psychological profile of hearing-impaired children and then correlate this profile to their language profiles. All children with different degrees of hearing impairment had delayed language development and this can be explained by the interference of hearing impairment with the child detection and recognition of speech as well as the development of auditory skills that are prerequisites of the development of receptive and expressive language skills, as well as speech intelligibility [21]. Such auditory skills include detection, discrimination, recognition, comprehension, and attention, and in turn, a delay in the early development of these auditory skills caused by hearing loss negatively impacts child's ability to learn and use an auditory–oral language system [22]. Strong positive associations between the degree of hearing

Table 1 Total language age of the study group

Item	Groups	N	Mean	Std. deviation	P value and sig.
Total language age	A	25	58.08	7.500	.001 (S)
	B	25	50.56	7.927	
Total language age	A	25	58.08	7.500	.0001 (S)
	C	25	29.56	5.424	
Total language age	B	25	50.56	7.927	.0001 (S)
	C	25	29.56	5.424	

Table 3 Children's Loneliness Scale (CLS)

Items Number	Groups of hearing impairment			Total (75)	P value and sig.
	(A) Mild (25)	(B) Moderate (25)	(C) Severe (25)		
NO. of children with loneliness	15	23	21	59	.016 (S)
% within group	60.0%	92.0%	84.0%	78.7%	
Mean	19.68	20.52	18.32	19.51	.31 (Ns)
SD	6.447	4.417	3.838	5.041	

impairment and language skills were proved and mild hearing-impaired children had better receptive and expressive language than the other two groups. So there total language ages were highest than the other two groups. These results were also found by Halliday and Bishop [23] who discovered that even subtle deficits in sound processing can lead to marked impairments in language development and severe hearing impairment in childhood often leads to marked delays and deficits in the acquisition of spoken and written language. However, children with mild hearing impairment usually attend regular schools and communicate with the others and when these children receive hearing aids, they usually find that school is easier and their school performance improves. But the other two groups entails not only lowered hearing thresholds, but also distortion of sounds, and this means that language input is partial and degraded in spite of the significantly positive correlation between the children chronological ages and their total language ages, the older the child age, the higher the speech perception abilities whatever the degree of hearing impairment and the higher its ability to learn

[24]. Children intelligence quotient (IQ) scores and their determinants are generally considered predictors of eventual school performance, quality of life, and psychiatric morbidity. Focusing on the relationships between the cognitive assessment (IQ) and the three groups of the study, it will be found that IQ scores range between below average and dull average in hearing-impaired children whatever the degree of hearing impairment with strong positive associations between the IQ score and the degree of hearing impairment as mild hearing-impaired children have higher IQ than the other two groups which is in agreement with Swanepoel et al. [25] who discovered that children with severe hearing impairment may have a higher frequency of poor cognitive and academic performance when compared with children with mild or even moderate hearing impairment. Also the descriptive analysis shows highly significantly positive correlation between cognitive assessment (IQ) and total language ages in the hearing-impaired children; the higher the language age, the higher the IQ score. As primary reasons why students with hearing deficits perform, on average, lower than their peers on cognitive

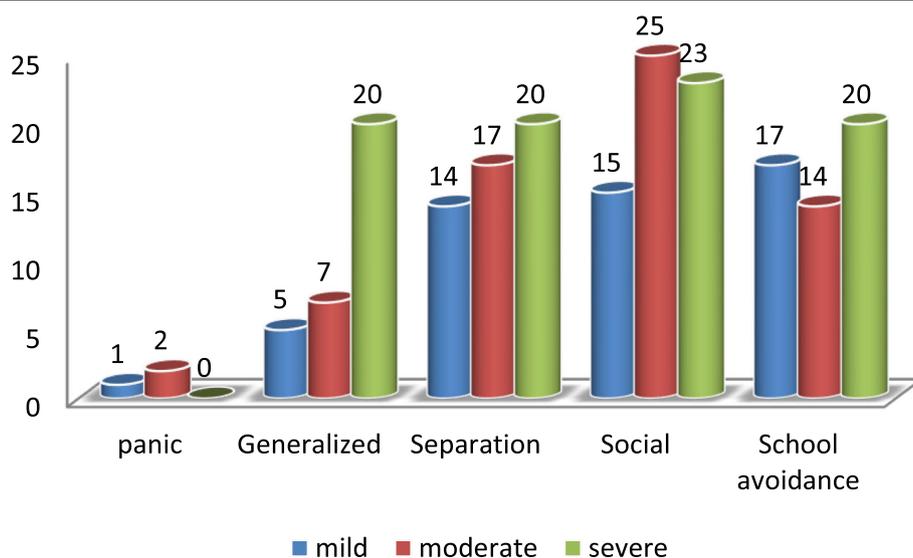


Fig. 1 Subtypes of anxiety test as regards the no. and % show significant difference between the three groups A, B, and C (mild, moderate, and severe hearing impairment) in *generalized* and *social disorders* (value =.0001) and there was no significant difference between the three groups in *panic* (value=.353), *separation* and *school avoidance* disorders (value=.191)

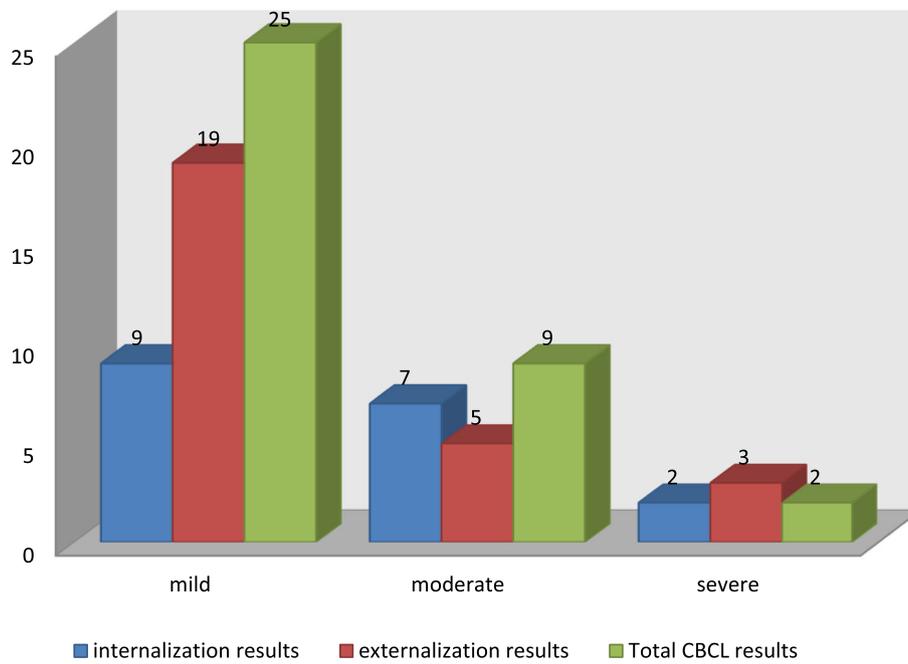


Fig. 2 Child Behavior Checklist results as regards the no. and % show no significant difference between the three groups A, B, and C (mild, moderate, and severe hearing impairment) in externalized behavior problem (p value .227) and total CBCL (p value .678) but there was a significant difference between the three groups in internalized behavior problem (p value .0001)

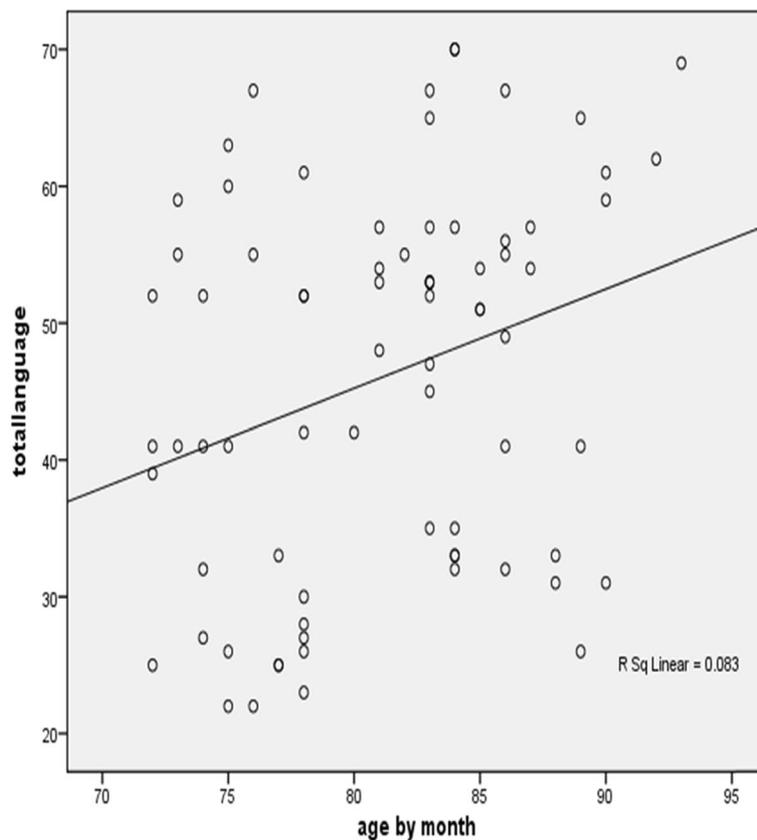


Fig. 3 Shows significant positive correlation between all children chronological ages (the three groups A, B, and C) and their total language ages ($R = .0288$)

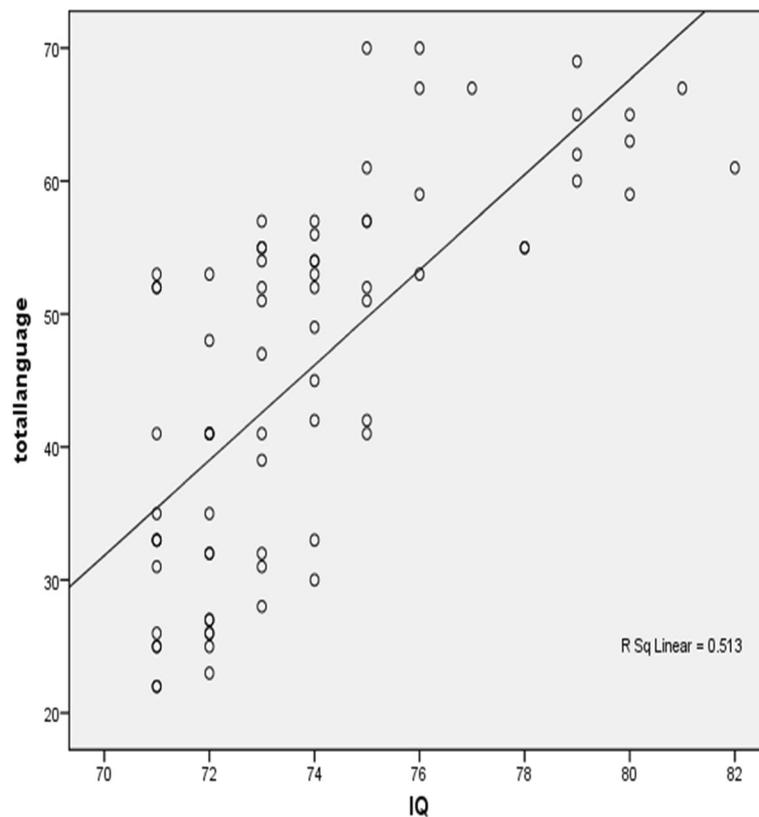


Fig. 4 Shows highly significant positive correlation between intelligence quotient (IQ) scores of all children (the three groups A, B, and C) and their total language ages ($R = .716$)

assessments such as IQ tests, language and communication skills of these hearing-impaired children are often delayed due to their disability and these students' language skills and reading level are lower than average, which may also affect cognitive skills which was proved by [26] as children with hearing impairment may have a higher frequency of language problem and had significantly lower intelligence coefficients when compared with children with normal hearing. The descriptive analysis shows that hearing-impaired children—whatever the degree of hearing impairment—feel lonely even if they are mild hearing impaired without significant difference between the three groups because children feel that they are different from their peers and start to avoid them. Also limited access to services and exclusion from communication can have a significant impact on everyday life, causing feelings of loneliness and isolation. So, even slight/mild hearing impairment can result in negative consequences for the bio psychosocial development of children who often report feeling lonely, without friends and unhappy in school [27]. Anxiety is a normal human emotion that everyone experiences at times. Many people feel anxious, or nervous, when faced with a problem at work, before taking a test, or making an

important decision. Anxiety disorders, however, are different; they can cause such distress that it interferes with a person's ability to lead a normal life [28]. Hearing-impaired children with anxiety disorders had an increased physical and psychological reaction to stress. Their reaction to danger, even if it is a small one, is quicker and stronger [29]. Research question investigated the feeling of anxiety in hearing-impaired children and the analysis shows that the three groups have different degrees of anxiety feeling and each group shows number of children with anxiety. Mild hearing-impaired children have less anxiety feeling than the other two groups. Mild hearing-impaired children have less disability and better communication than the other two groups which lead to less stress and anxiety disorder so the results are expected. Knutson et al. [30] found that the risk for clinically significant emotional distress and anxiety disorder (generalized anxiety disorder, social, separation, school avoidant disorder, and panic disorder; each has its own characteristics and symptoms) was two to four times higher among persons with hearing impairment than among persons with normal hearing. Child behavior problems had been shown to negatively impact a range of developmental, social, and educational

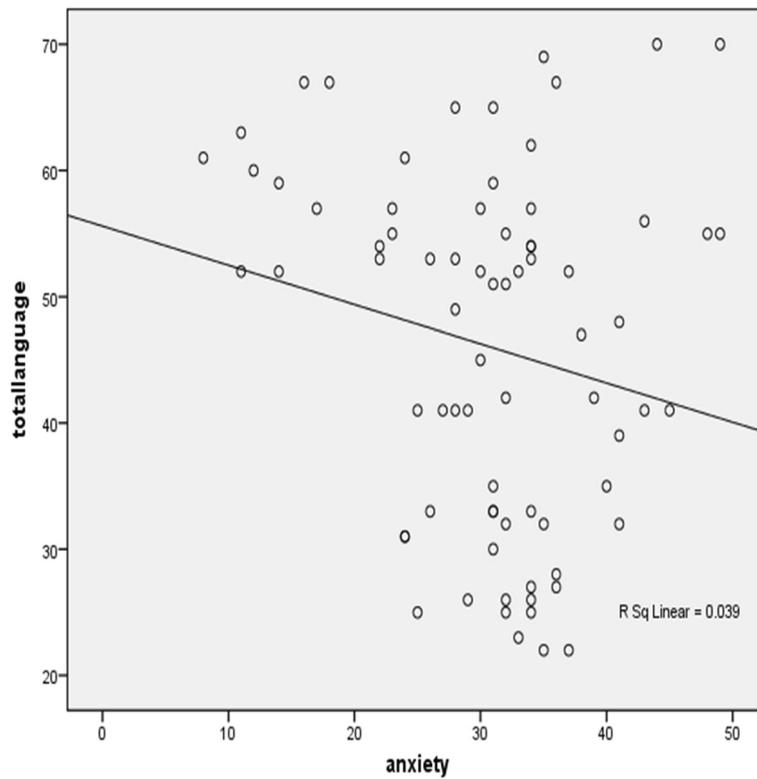


Fig. 5 Shows significant negative correlation between total language ages and *Child Anxiety Related Emotional Disorders (SCARED)* ($R = -.197$)

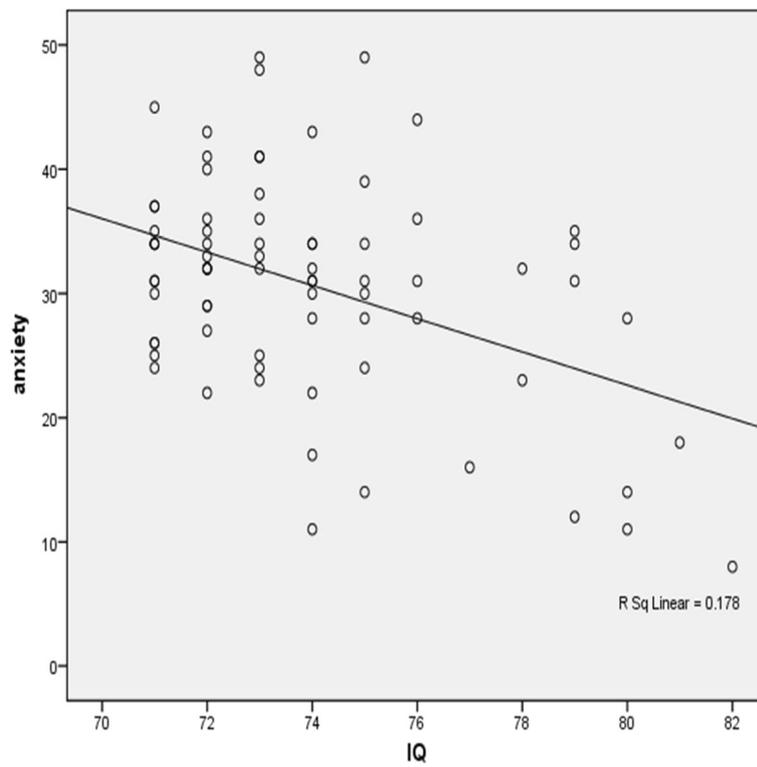


Fig. 6 Shows significant negative correlation between anxiety scores and intelligence quotient (IQ) total scores ($R = .422$) of all children (the three groups A, B, and C)

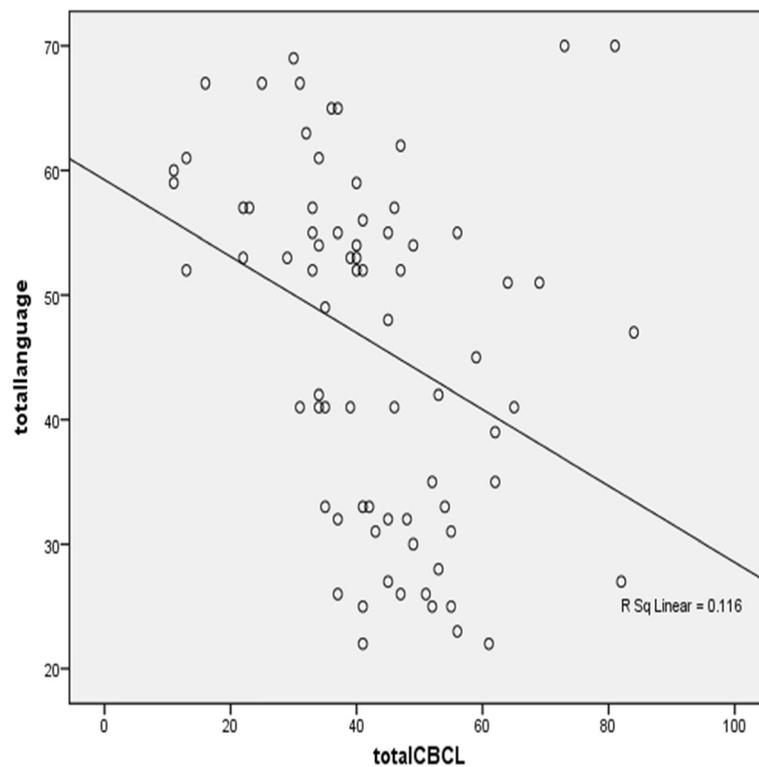


Fig. 7 Shows significant negative correlation between total language ages of all children (the three groups A, B, and C) and their total Child Behavior Checklist (CBCL) scores ($R = .341$)

outcomes. There are indications of emotion dysregulation in hearing-impaired children compared to normal hearing peers [31]. The current research question investigated the behavior problems in hearing-impaired children by the Child Behavior Checklist (CBCL) that has been divided into internalized behavior problems and externalized behavior problems. The descriptive analysis shows the presence of internalization behavior problems in large number of children in all degrees of hearing impairment whether it is mild, moderate, or severe with severe hearing-impaired children are the highest. Findings were proved by Van Eldik et al. [32] who survey that children with hearing loss, in particular, exhibit higher rates of internalization behavior problems than children with normal hearing. Externalizing behavior problems in hearing-impaired children are fairly common and are often dismissed as a normal developmental phase [33]. But the current descriptive analysis shows the presence of externalization behavior problems in all degrees of hearing impairment in the three groups with no statically significant difference between them in agreement with Hadley [34] who suggested that hearing-impaired children may have problems related to proactive interference and parent ratings on the Child Behavior Checklist (CBCL) indicated that one half of the hearing-impaired children had elevated levels of externalizing

behavior problems, whereas teacher ratings indicated that one third had significant behavioral problems. These results were also founded by Castrogiovanni [35] who found that school-aged children with any degree of hearing impairment have academic, social, and behavioral difficulties. Hearing-impaired children, even with a minor degree, often miss information during play and are a target for bullying (person who is curl to other). Strong negative correlation had been found between the feeling lonely and cognitive (IQ) and language skills. The negative outcome resulting from poor verbal communication skills was social isolation while hearing-impaired children with good cognitive and language scale are able to react and make good relationship with children and feeling of lonely start to decrease [36]. Strong negative correlation between language and cognitive scale with behavior problem and anxiety disorder is expected that hearing-impaired children, who experience significant disruptions in auditory input, are likely to show delays not only in the production of oral language but in other important aspects of development such as anxiety and behavioral control. With regard to socioemotional aspects [37], studies have reported that hearing-impaired children encounter difficulties acquiring spoken language, which often affects their communication abilities and social development. In turn, the children's

friendship relations and social feelings and mild hearing-impaired children have better language and cognitive scale than moderate or severe ones and the more the affected the child with hearing impairment the more the behavior problem and anxiety disorder or even other psychological interruptions.

6 Conclusion

Children with hearing impairment—whatever its degree—face multiple concurrent health's, developmental, and communicative and exhibit psychological and behavioral problems when they do not understand what is going on around them. Without appropriate interventions, these children are at risk of developing mental health disorders.

Abbreviations

HI: Hearing impairment; DSM-IV: Diagnostic & Statistical Manual of Mental Disorder fourth addition; CLSDS: Children's Loneliness and Social Dissatisfaction Scale; SCARED: Screen for Child Anxiety Related Emotional Disorders; CBCL: Child Behavior Checklist; ADHD: Attention-deficit hyperactivity disorder; BDMH: Brain damage motor handicap; ENT: Ears, nose, and throat; APR: Auditory Brainstem Response; PLS-4: Preschool Language Scale; AC: Auditory comprehension; EC: Expressive Communication

7 Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s43088-021-00124-9>.

Additional file 1: Appendix 1. Loneliness & Social Dissatisfaction. Questionnaire: **Appendix 2.** The Screen for Child Anxiety Related Emotional Disorders (SCARED): **Appendix 3.** Child Behavior Checklist.

Additional file 2. English Appendix 1.

Additional file 3. English Appendix 2.

Additional file 4. English Appendix 3.

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Authors' contributions

"HD" the acquisition, analysis, and interpretation of data. "OR" design of the work; the acquisition, analysis, and interpretation of data; and revision of the work. "SN" the conception and design of the work, the acquisition and analysis of data, and revision of the work. All authors have read and approved the modified submitted version that involves the author's contribution to the study.

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Availability of data and materials

All data generated or analysed during this study are included in this published article and its supplementary information files.

Declarations

Ethics approval and consent to participate

This study was approved by the ethics committee of Faculty of Medicine Beni-Suef University, (reference number is not available). Consent to participate in this research was obtained from the subjects' parents before commencement of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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