Study of children development at ages one to five with hearing impairment at Mashhad's rehabilitation centers in 2017

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Abstract: Developmental disorders in children with hearing problems may cause impairment in a child by growth and development. The aim of this study is to determine the development of children with impaired hearing based on the ASQ tool at ages 1 to 5 years of rehabilitation centers in Mashhad. In this study, 300 children at ages 1 to 5 years old who are healthy and have hearing impairments at rehabilitation centers and welfare organizations of Mashhad in 1396 took part. The children with hearing impairment were selected as an available random sample from deaf complex and healthy children with cluster sampling from kindergartens. Both groups evaluated based on the age's questionnaire and the ASQ stages in five evolutionary domains. Using software data compared normal with hearing impairment child developmental situation. Average scores of communication in hearing impairment and healthy group was respectively 36.6 and 54.4 percent, fine motor skills in hearing impairment and healthy groups were respectively 47.8 and 52.2 percent, problem-solving in hearing impairment and healthy group was respectively 44.3 and 51.3 percent, being a social person in hearing impairment and healthy group was respectively 49.7 and 55.1 percent. The Mann-Whitney U test shows this difference meaningful ($P \leq 0.001$). The average score of gross motor skills in hearing impairment and the healthy group were respectively 54.3 and 59.9. The Mann-Whitney U test shows this difference meaningful ($P \leq 0.004$). Children with hearing impairment show more delays in terms of developmental than healthy children.

Keywords: Hearing impairments; Development; Child; ASQ

1. Introduction

Nowadays, one of the most important bases of access to countries development is attention to children as future generations. Therefore, it is necessary that child health placed on top of policy programs and health issues [1]. For this purpose, paying attention to the growth and developmental issue is of particular importance [1, 2]. Proper physical growth and development are one of the most reliable criteria for assessing the health condition of the child, especially in the first two years of life [3]. By the awareness of the growth and development of children, obvious deviations from natural patterns can detect, and thus, the disease in a child detected and prevented [3]. Another health assessment criterion non-infection of the child to problems associated with growth and development [4]. Developmental and behavioral problems after infection and trauma are the most common problems in pediatrics; half of the disorders did not detect by the age of school [5]. Approximately 15 - 20 percent of children in the U.S. have developmental and behavioral disabilities [6]. In Iran, this amount reported 18.7 to 22.5 percent in different cities [5].

It seems that an overall childhood disability, the deafness issue is discussed [4]. Hearing impairment is the third chronic illness that has become a general health problem [7]. For many children who have lost their hearing since the beginning of life, actually, the underlying problem is not just a lack of hearing, but the inability to progress and access the communication system [4]. Communication disorders are the most common disability in the United States. So that the number of patients suffering from hearing and speech impairment is more than all

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patients with heart disease, epilepsy, blindness, cerebral palsy, muscular dystrophy and multiple sclerosis [8]. According to the World Health Organization, over 5% of the world's populations (360 million people) are suffering from hearing impairment, including 32 million children [7]. Hearing damage involves 1 to 3 children per 1,000 live births [9]. According to research 20 to 40 percent of children born with hearing loss have more disability than hearing problems, which may prevent them from achieving their full potential in terms of speech, language, cognitive and social skills [10]. The developmental gap between children with hearing delay and normal hearing does not resolve by the progress of children towards adolescents and may even increase with the child's growth [11]. Children with hearing impairments are subject to behavioral problems, emotional deficiencies, and delay in academic education. Compared to their hearing peers, these children experience a lower quality of life and have mental - psychological problems such as anxiety, depression, and behavioral problems [12]. The hearing impairment inhibits the development of motor and mental and social skills [13]. Despite the high rate of evolutionary delays and disabilities, children with hearing impairment are often too late to identify. For example, children with hearing impairment, which have autism, identified for a year of a delay than children with natural hearing. Any delay in identifying the developmental inability in a child, any help inappropriate interventions, will be for the child's needs [14].

Implementing early and quality intervention significantly affects the lives of children with evolutionary inabilities, reducing the difficulties caused by disability on the social and family network. Parents are the best person who can observe and test the developmental disorders of the child [15, 16]. The most important therapeutic and caring approach to the early intervention of the evolutionary and hearing disorders is taking part parent and people around the child–implementing family-centered interventions to cure these disorders are much emphasized. Family and caregivers can also cooperate in carrying out interventions and play an important role in identifying and developing goals and objectives in their children's individual plans [17].

Since many of the screening devices are time-consuming and costly and also need child cooperation, there is a growing interest in using parent-based tools such as Age and Stage Questionnaire. Studies show that parents report evolutionary delays and are concerned about these delays, this delay includes language, fine movements, gross movements, cognitive, emotional and behavioral problems, while parents actively take part in the assessment of their child in the ASQ tool. After the review of ASQ in 1997, the tool has translated into many languages and has used in low risk and a high-risk population that has good psychometric properties [18].

Since hearing impairment is a sensory disorder, it will also follow an evolutionary disorder if they neglect these children. As mentioned earlier, the major developmental disorder associated with this defect is a speech disorder, which has been carried out by family isolation and social relations. therefore, lack of identification of these children has various physical, psychological and social complications for the child and family, so early detection and proper intervention is very important, it has not studied about the evolution of children with hearing impairment in Iran, and in other parts of the world it has studied with limited ages or at lower ages or they have screened limited part of a child's development; Thus, the present study aims to compare the evolution of children with hearing impairment and healthy children between 1 and 5 years of Mashhad city.

2. Method

In this analytical study, which is a historical cohort type, the research community is children from 1 to 5 years old in Mashhad in 2017. The sample size accomplished by using the mean comparison formula of the two societies based on the study (Jen Chen chwen) in Taipei (2003), the prevalence of the developmental disorder in children between 1 to 5 years old calculated 11.3. The sample size calculated 150 people by considering the first type of error 0.05 and the test power of 80% and 0.05 for sampling error and by using the formula that mentioned. The sample of the research comprised 300 healthy and with hearing impairment (150 children in each group) children between 1 to 5 years old that conducted from the hearing impairment centers and selected kindergartens in Mashhad in 2017. The arrival of children with hearing impairment was available as non-random; here, by referring to the exceptional education of Mashhad, the No. 3 third of Shaaban educational complex and the Imam Reza school introduced to carry out samples. Although the two centers located in relatively high - level zones, but children of different areas in terms of socio-economic refer to these two centers in Mashhad. In these two centers, girls and boys from the early age of hearing the impaired diagnosis, until entering certain schools for the deaf or ordinary schools are under rehabilitation and speech education, vocabulary development, musical intelligence, mathematical intelligence, and spatial cognition concepts. The arrival of healthy children in the study was done using random clustering. Similarly, by referring to the administration of welfare, the city of Mashhad divided into four regions of socio-economic (Ahmadabad, Vakilabad, Koushesh, and Seyyedi) and from each area, one kindergarten was selected randomly. The entrance criteria include: age between 1 to 5 years old, has no explicit congenital anomalies except hearing impairment, one parent take part in the study, at least has ability to read and write, living with parents in the full family, and permanent and double hearing loss approved by the ear, nose

and throat expert that included in the child's case, children selected. In healthy children groups, the same criteria considered, except that children had no hearing problems. The exit criteria include a lack of family inclination, and if the family did not complete four to five questions of the questionnaire, they excluded from the study.

Data collection tools include the demographic information form that completed through interviews with the mother, and the ages tool and ASQ stages, which completed by the parents after the researcher explanation to parents.

The ASQ tool contains 19 questionnaires for 19 different age groups filled by parents. Each questionnaire contains 30 questions about child development. The questions of each questionnaire divided into five developmental domains that are: 1- Area of communicating 2- Scope of gross motors 3- Scope of fine motors 4- Scope of problem-solving 5- Scope of social-individuals [19, 20].

Scores within each domain range from zero to 60 points depending on the answer given to that question. The not yet option will take zero points, sometimes 5 points and yes answer 10. Finally, the scores in each domain collected and according to the cut points of the tool, the child developmental investigated. If the gain score is higher than the mean, it considered natural if the score is between one deviation lower than the mean and two deviations lower than the mean; it considered as a mild disorder and must retest for the child after two weeks, but if the obtained score is less than two deviations than the mean or the matches it, it considered a severe disorder and requires reference to the expert [19, 20].

The unit selecting form validity of the research and the demographic information form carried out after studying books and scientific journals on the subject of research and consultation with the relevant experts. The validity and reliability (sustainability) of the ASQ tool in Sajedi's study (2006) was performed by the content validity method [20].

The development criteria examined using the ASQ tool in children with the help of parents. To provide ethical considerations after completion of the project and data collection, children with developmental disorders referred to relevant experts.

2.1. Reliability of the ASQ tool

Collected data analyzed using SPSS software version 16. The safety factor of the study considered 95 percent and the test power was 80 percent. To compare the developmental situation in two groups of the study, first, the normality of the quantitative variables, especially the ASQ scores and their different dimensions were tested by the Kolmogorov-Smirnov test and Shapirovilek test. Considering that the developmental scope scores did not have a normal distribution, the non-parametric Mann-Whitney test used. By using statistical tests, a two-way variance used to determine the effect of these demographic variables on each dimension of child development.

3. Results

The average age of children with hearing impairment and healthy one respectively were 14.9 ± 36.2 and 16.1± 37.5; which was homogeneous according to the Mann-Whitney test ($P \leq 0.61$). From 300 children taking part in both groups of children with hearing impairment and healthy ones, 73 children (48.7%) were girls and 77 children (51.3 %) were boys. The two groups compared to each other in terms of parental education, the parent's job, financial status, and family ratio and have a meaningful difference to each other (Table 1)

Table 1 Comparison of children frequency in terms of gender, mother's education, mother's job, father's education, father's job, and financial status and family relations in hearing impairment and healthy groups.

Variable	Hearing impairment group	Healthy group	Test Result
	Frequency(percent)	Frequency(percent)	
Gender			
Girl	73 (48/7)	73 (48/7)	P=1/0 *
Boy	77 (51/3)	77 (51/3)	
Mother's education			
Elementary school	62 (41/3)	4 (2/6)	P≤0/001 **
Secondary school	58 (38/7)	46 (30/7)	

College education	30 (20/0)	100 (66/7)	
Mother's job			
Housewife	108 (72/0)	77 (51/3)	P≤0/001 *
Occupant	42 (28/0)	73 (47/7)	
Father's education			
Elementary school Secondary school College education	34 (22/7) 87 (58/0) 29 (19/3)	10 (6/7) 68 (45/3) 72 (48/0)	P≤0/001 **
Father's job			
Unemployed	10(6/7)	0(0/0)	P≤0/001 *
Worker (laborer)	37(24/7)	17(11/4)	
Self-employed	70(46/7)	68(45/3)	
Employee (governmental jobs) None of them	31 (20/6) (1/3) 2	61(40/6) (2/6) 4	
Financial status			
Bad	38 (25/7)	16 (0/7)	P≤0/001 **
Average	88 (68/2)	84 (57/1)	
Good	24 (6/1)	50 (42/2)	
Family relation			
Paternal aunt's daughter and maternal uncle's boy	50 (33/3)	3(2/0)	P≤0/001 *
Maternal aunt's daughter and maternal aunt's boy	25 (16/7)	7 (4/7)	
Paternal uncle's daughter and Paternal uncle's boy	17 (11/3)	3 (2/0)	
No relations	58 (38/7)	137 (91/3)	

*=Chi square

**=Mann Whitney

Findings from Table 2 show the mean and standard deviation of the "communication" score for children with hearing impairment and healthy children that respectively is, 16.8 ± 36.6 and 8.4 54.4. The result of the Mann-Whitney-U test showed that the difference was statistically meaningful ($P \leq 0.001$); also in implemented classification, findings showed a higher percentage of children with hearing impairment in terms of "communication" score placed in "one deviation less than mean" class (32.0 percent against 6.7 percent), as well as "two standard deviations less than mean" (25.3 percent against 2.0 percent).

Table 2 Comparison of children frequency in terms of ASQ developmental scopes in hearing impairment and healthy groups.

Variable	Hearing impairment group	Healthy group	Test Result
	Frequency (percent)	Frequency (percent)	
Communication			
Normal	64 (42/7)	137 (91/3)	P≤0/001
One deviation criterion less	48 (32/0)	10 (6/7)	**
Two deviation criterion less	38 (25/3)	3 (2/0)	
Mean ± Deviation criterion	36/6±16/8	54/4±8/4	
Gross motors			P≤0/04
Normal	135 (90/0)	144 (96/0)	**
One deviation criterion less	8 (5/3)	4 (2/7)	
Two deviation criterion less	7 (4/7)	2 (1/3)	
Mean ± Deviation criterion	54/3±8/9	59/5±7/0	
Fine motors			P≤0/001
Normal	115 (76/7)	133 (88/7)	**
One deviation criterion less	31 (20/7)	14 (9/3)	
Two deviation criterion less	4 (2/7)	3 (2/0)	
Mean ± Deviation criterion	47/8±10/6	52/8±9/8	
Problem-solving			P≤0/001
Normal	95 (63/3)	127 (84/7)	**
One deviation criterion less	39 (26/0)	18 (12/0)	
Two deviation criterion less	16 (10/7)	5 (3/3)	
Mean ± Deviation criterion	44/3±14/2	51/3±11/2	
Social-individuals			P≤0/001
Normal	127 (84/7)	141 (94/0)	**
One deviation criterion less	14 (9/3)	5 (3/3)	
Two deviation criterion less	9 (6/0)	4 (2/7)	

less		
Mean ± Deviation criterion	49/7±10/6	55/1±8/1

** - Mann Whitney U

The mean and standard deviation of the "gross motors" scope in children with hearing impairment is 8.9± 54.3 and in healthy children is 7.0 ± 59.5. The results of the Mann-Whitney-U test showed that the difference is statistically meaningful, (P≤0.04); and in implemented classification in terms of "gross motors", 4.7 percent of children with hearing impairment get placed against 1.3 percent of healthy children on the "two standard deviations less than the mean" class.

The mean and standard deviation of the “fine motors” scope’s score in children with hearing impairments is 10.6 ± 47.8 and in healthy children is 9.8 ± 52.8. The results of the Mann-Whitney-U test showed that the difference is statistically meaningful (P≤0.001); as well as the implemented classification in terms of "fine motors", the highest developmental delay in children with hearing impairment against the healthy children in this scope was in “a standard deviation less than mean” class (20.7 percent in children with hearing impairment against 9.3 percent in healthy children).

The mean and standard deviation of the "problem solving" scope’s score in children with hearing impairment is 14.2 ± 44.3 and in healthy children is 11.2 ± 51.3. The result of the Mann-Whitney-U test shows that the difference is statistically meaningful (P≤0.001); also at implemented classification in terms of "problem-solving" score, 10.7 percent of children with hearing impairment were against 3.3 percent of healthy children in "two standard deviations less than the mean" class. The mean and standard deviation of the "social individual" scope’s score in children with hearing impairment is 10.6 ± 49.7 and in healthy children us 8.1 ± 55.1. The results of the Mann-Whitney-U test showed that the difference was statistically meaningful (P≤0.001); as well as in implemented classification in terms of “social individual” score, 6.0 percent of children with hearing impairment were against 7.2 percent of healthy children on the "two standard deviations less than mean" class. More results showed on Table 3 and Table 4.

Table 3 The result of two-sided variance analysis test of group effect and the demographic variables on communication score

Variable	Total effect (p)	Group effect (p)	Variable effect (p)	Interaction effect (p)
Age(month)	0/001	0/001	0/222	0/142
Gender	0/001	0/001	0/130	0/095
Mother’s education	0/001	0/001	0/942	0/233
Mother’s job	0/001	0/020	0/666	0/936
Father’s education	0/001	0/001	0/031	0/026
Father’s job	0/001	0/001	0/123	0/283
Financial status	0/001	0/001	0/002	0/01
Father’s physical problem	0/001	0/001	0/530	0/447
Mother’s physical problem	0/001	0/001	0/563	0/645
Family relation	0/001	0/001	0/886	0/955

Table 3 The result of two-sided variance analysis test of group effect and the demographic variables on gross motors score

Variable	Total effect (p)	Group effect (p)	Variable effect (p)	Interaction effect (p)
Age(month)	0/001	0/001	0/232	0/414
Gender	0/001	0/018	0/674	0/181
Mother’s education	0/001	0/176	0/652	0/524
Mother’s job	0/001	0/026	0/132	0/141
Father’s education	0/001	0/002	0/107	0/014
Father’s job	0/001	0/004	0/151	0/191
Financial status	0/001	0/003	0/004	0/015
Father’s physical problem	0/001	0/013	0/809	0/190
Mother’s physical problem	0/001	0/454	0/125	0/393
Family relation	0/001	0/232	0/327	0/368

4. Discussion

Comparison of children's development status, in this case, showed that, based on the ASQ tool, children with hearing impairment have meaningful developmental delays regarding healthy children. As the average "communication" score in children with hearing impairment is 48.6 percent less than healthy children. This difference may be because of the problem of speech and talk in children with hearing impairment groups. in a similar study conducted by Wiley et al. [21], more than half (58%) of children in 6 to 36 months had a problem in the communication scope, which was significant; and it's along with the current study, which is 57.3 percent. Although the sample volume in these two studies was significantly different, however, the delay in communication scope to the overall population of these children highly regarded. Hearing impairment is a major constraint in communication; these people are more likely to catch the mood disorders and tend to avoid taking part in social activity due to the lack of social interaction development [13]. Also, Tomblin study [22] showed that children with hearing impairment in the ages of 2 to 6 showed significant differences regarding normal children of the same age in terms of communication. In the Kyerematen study [23] children of low-income families get the lowest scores from problem-solving and communication scopes in ASQ developmental scopes. In the present study, the interaction of parent education and financial status on the score of communication was meaningful, that working parents with higher education, maybe provide a better education and training level for the child, rehabilitation training and development of communication in children with educated parents can do based on specific educational framework and rules, but in children who do not have these training, learning of social issues will base on test and trial, while in the current study, most of the children with hearing impairment have low education parents and lower incomes. By improving the economic and educational status of parents, communication scores also increased.

On the other hand, the average score of "gross motors" in children with hearing impairment is 9.5% less than healthy children, which this delay may occur because of the type of emotional-neural deafness in children with hearing impairment. According to accomplished studies children who had a problem in vestibular neuron they will have a problem in gross motors performance. Children with hearing aid means have less desirable motor skills, especially in the equilibrium part [25].

In contrast, motors delay in children with hearing impairments also have observed that probably because of effective factors on developmental disorders in pre-birth and after birth (low birth weight and hospitalization in NICU), and limitations in urban children's living environment, it has confirmed by previous studies that living environment features have been effective in child mental-motors development [26]. In this study, the interaction of two parent's education and financial status variables on the score of children with hearing impairment motors was meaningful; In the Leigh study [27] there was no meaningful correlation between the financial status and parental education. The better financial status of the family besides further parent education can provide more physical space for a child; it probably will be effective in the growing process of a child's motor development if this further space is along with motor training. Further reproduction prohibited without permission. Also, because of hearing impairment in these children, lack of understanding of orders and training or other information about motor activities reduces confidence in these children to discover their environment.

The study of Mohammadi Parsa [28] showed a significant correlation between poor economic situations and disruption in gross motors. Among the demographic factors in this study, the only influencing factor was the economic status of the household. This means that in lower socio-economic regions, the prevalence of the disorder was greater in gross motors

The average score of "fine motors" in children with hearing impairment is 10.4% lower than healthy children. This difference in these two groups can be due to a lack of adequate training in the hearing impairment group. In Wiley study [21], deaf children delayed 4 percent in fine motors; as mentioned, factors such as birth problems (low birth weight and hospital record in NICU) and environment constraints can dispose of a child in the appearance of motor delays.

The comparison of the "problem-solving" scope of children in this case showed; the mean score of problem-solving scope in children with hearing impairment is 15.8% less than healthy children. This difference can cause by delay in other scopes that by increasing age, due to delay in motor scope, delay in this scope reflects more. In this regard, based on Vidranski study [25] the effectiveness of problem-solving development in routine life and in emergency situations highly depend on the quality of child motors programs. These results are in the same way as the present study. Perhaps children who trained in motor areas will have better decisions when necessary to solve their problems. In contrast, this developmental delay also observed in healthy children that in Boskabadi study [29] children 57.0% abnormal development, which was the most delay. Therefore, it is in the same way as the current study. In the Karimi study [30], on children with weight ranging from 150 to 2500 g at age 5, the greatest disorder was gross and fine motors and problem-solving scopes. According to the findings of the current study, the most developmental delay of healthy children reported in this area.

The comparison of the development situation in the "social-individual" scope of children, in this case, showed the average score for the individual social scope score in children with hearing impairment is 10.8% less than healthy children. As the results showed, delay in communication, speech and language scope in these children may delay the child in social and interpersonal relationships, suitable (proper) conditions for growing and training these skills in these children can create with improving the economic and social conditions and improving rehabilitation education for these children, as a human can be socialized by interacting with environment and society, when these children ignored due to the communication problem, it may also have negative effects on the ability of them to talk and understand language and social status; also in children with hearing impairment, growth and development of this scope directly related to improving the work conditions of parents and higher education of the father, this comparison made meaningful in the mother's part's job, the parent's education and father's job, maybe family income, life discipline and social and economic status cause stress in the house. Stress may inhibit the child's growth in the individual and social context. In the Wiley study [21], children with hearing impairment had 10% delays in social individual scope. One of the most important limitations of the current study was the inability of taking part children that do not refer to centers, so they did not allow screening and taking part in the study.

6. Conclusions

The results of the current study showed that children with hearing impairment in terms of development have more delays than healthy children of their age. Although children with hearing impairment are more susceptible to appear these delays because of a kind of disability and environmental factors such as parental relations, the parent's education, the parent's job, and financial status; however, healthy children are not immune to the effects and risk consequences of environmental factors such as those mentioned above for appearing these developmental delays. Therefore, the regular follow-up of children with hearing impairment is important in terms of developmental because it improves the diagnosis and developmental early intervention in these children.

Therefore, it recommended that developmental screening with monitoring of growth in health centers and beyond has carried out in all centers where children are attending, and attempted for cauterizing and importance of this issue in the community for families.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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