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Interactive behaviors between mothers and their infants at risk for hearing loss

Comportamentos interativos entre mães e seus bebês com risco para deficiência auditiva

Mariana de Freitas Pereira Pederro¹ , Olga Maria Piazzentin Rolim Rodrigues² 

¹ Universidade Estadual Paulista “Júlio de Mesquita Filho”, Faculdade de Ciências, Departamento de Psicologia. Bauru, SP, Brasil.

² Universidade Estadual Paulista “Júlio de Mesquita Filho”, Faculdade de Ciências, Programa de Pós-Graduação em Psicologia do Desenvolvimento e Aprendizagem. Bauru, SP, Brasil. Correspondence to: O. M. P. R. RODRIGUES. E-mail: <olga.rolim@unesp.br>.

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Abstract

Objective

In the present study, we intended to describe and compare the interaction between mothers and infants at risk for hearing loss (Group 1) and mothers and infants who could hear (Group 2).

Method

A total of 25 dyads participated in each group and were filmed while free playing. The films were examined using the observation adapted protocol Mother-Child Interaction Coding System, for later comparison. Positive interactive behaviors were significantly more frequent among infants in Group 2.

Results

Infants in Group 1 showed more non-interactive behaviors than the other group. Mothers in Group 2 showed more positive sensitive and less non-responsive behaviors than mothers in Group 1.

Conclusion

The results show the importance of the infants’ first social relationships for their development process, especially when there is a risk factor involved, pointing to the need of interventions with families as of the diagnosis phase.

Keywords: Disabled children; Hearing loss; Mother-child relations.

Resumo

Objetivo

No presente estudo pretendeu-se descrever e comparar a interação de mães e bebês com risco para deficiência auditiva (Grupo 1) e de mães e bebês ouvintes (Grupo 2).

Método

Participaram 25 díades em cada grupo, filmadas em brincadeira livre. As filmagens foram analisadas com o protocolo de observação Sistema de Codificação da Interação Mãe Criança Revisado adaptado, para posterior comparação. Comportamentos interativos positivos foram significativamente mais frequentes entre os bebês do Grupo 2. Bebês do Grupo 1 apresentaram mais comportamentos não interativos do que o outro grupo.

Resultados

As mães do Grupo 2 apresentaram mais comportamentos sensíveis positivos e menos não responsivos do que as mães do Grupo 1.

Conclusão

Os resultados evidenciaram a importância das primeiras relações sociais do bebê para seu processo de desenvolvimento, principalmente quando há algum fator de risco envolvido, apontando para a necessidade de intervenções junto a famílias desde a fase de diagnóstico.

Palavras-chave: Crianças com deficiência; Perda auditiva; Relações mãe-filho.

Behavioral relationships consist of interactions between individuals and the environment. Behaviors originating from interactions between individuals are called social behaviors (Andery & Sério, 2006). The authors argued that knowing the social group in which the individual participates is important to identify those social antecedent stimuli that are significant as well as the processes involved. An example of a behavioral relationship involves the relationships between a mother and her baby.

Mother and infant interaction is built from the gestational period and vocal, visual, body and facial manifestations are essential in this relationship, characterizing the behaviors that ensure the construction of the emotional bond (Izidoro et al., 2020; Scortegagna et al., 2005). It is understood that the baby is born with a repertoire of reflexes and a predisposition to receive stimuli such as touch, voice and face, from the adult caregiver who is mainly a mother. As time goes by, this innate repertoire will be influenced by the contingencies that will be present in this interaction between the mother and her baby (Alvarenga et al., 2016).

Maternal responsiveness allows the child's capacity for self-regulation and the acquisition of language assured by emotional support and secure attachment, In other words when the mother responds contingently to the child's behavior, she conveys a feeling that her behavior generates changes in the environment, enhancing the learning of new behaviors (Ferreira et al., 2018). Latino (2015) studied the self-regulation behaviors of 100 infants, analyzing how they behave in stressful situations (absence of an adult or the termination/discontinuation of the mother's interaction with the baby). The data showed that children's self-regulation results from the baby's ability to mobilize resources (for example, being distracted by toys or other nearby objects or parts of their body, such as feet and hands) and also from the support they receive to back their efforts (such as the availability of mobiles and other toys that are accessible and easy to use).

Another important aspect is the presence of affectivity in the mother-baby interaction (Izidoro et al., 2020). This affectivity may also be associated with the hormone oxytocin, which plays an important role in establishing social bonds early in life, an increase of this hormone in mothers when they behave more affectionately, demonstrate involvement and synchrony with their babies (Scatliffe et al., 2019).

Over time, the mother will learn to establish a routine and discriminate the child's signals and preferences, which are characteristics of the beginning of the construction of the relationship between her and the baby (Zarske et al., 2021). In most cultures, the mother plays an essential role in the survival and well-being of her baby (Ribas & Seild de Moura, 2007) and her relationship with

the baby may or may not favor the infant's development. From the second semester of their life, infants will expand their interaction contexts that will go from dyadic to triadic, as they develop new motor, sensory and perceptual skills and interact with other objects (Izidoro et al., 2020). These new interactions help infants to direct their attention to the same object that your partner.

The mother's interaction with her child may be adequate, but not contingent, that is, the child's signal may not be responded to immediately by the mother or when there is this immediate response, but there is no involvement of affective aspects in this response (Chiodelli et al., 2020). Infants' interactional responses are shaped by maternal and paternal responses.

Nunes and Salomão (2021), in their study with mothers and fathers on the parental concepts associated to the child characteristics that attract mothers' attention most, highlighted the role of social interactions in the constitution of affective relationships and that parents tend to respond to babies contingently when they are influenced by their affective expressions in a positive way, which enhances babies' interaction and learning. The results of the study indicated that participants attributed a greater influence to environmental factors than biological factors when explaining the positive characteristics of infants, however, when explaining their infants' negative characteristics, they blamed it on the biological factors more than on the environmental factors.

Relationships between mothers and babies have been studied in several ways, including through filming. This was the most frequent study form found in review studies (Pederro & Rodrigues, 2019; Silva & Porto, 2016). It was also the method used in a national investigation by Alvarenga et al. (2018), Chiodelli et al. (2020, 2021), Conti et al. (2019), and Santos (2020). Silva and Porto (2016) reviewed 15 national scientific articles in the field of Psychology, retrieved from a search with the keywords "mother-baby" and "mother-baby interaction". They indicated that the authors agree on the importance of mother-baby interaction for the child development and the need for preventive interventions. As strategies for studying it, they highlighted filming, which captures details and makes it possible to review scenes, when necessary.

One of the objectives of the study by Santos (2020) was to investigate the interactive behaviors of mothers and their three-months-old babies using footage of the dyad in a free playing framework. The results showed that caregivers exhibited more positive interactive behaviors compared to other behaviors such as negative and non-interactive behaviors, however, there were few responsive behaviors, the majority being stimulation behaviors. Another study using video footage was that of Conti et al. (2019), with a longitudinal design, which examined the effects of a home visit program on mother-child interaction, through film taking in a free playing situation. The investigators conducted statistical analyses separately for girls and boys, and the results indicated a significant improvement in interactions between girls and their mothers, with an increase in girls' positive behaviors even in the absence of positive behaviors from their mothers.

The interactive behaviors of three-month-old infants and their mothers who showed signs of postpartum depression were assessed by Alvarenga et al. (2018) by filming the dyad in a free playing situation and found that the more the mothers touched or stimulated the infants with objects, plus the babies showed highly frequent behaviors for their age group, called stabilization. Conversely, when mothers acted intrusively, infants suffered an impaired motor development, causing a negative impact on their development. Hence, we can verify the influence on the infant's development of the maternal interactive behaviors.

Other investigations have been conducted to assess the interactions of infants and their caregivers (Campos, 2016; Chiodelli et al., 2020; Ekas et al., 2013; Libertus & Needham, 2011),

the relationships between mothers/fathers and babies with disabilities (Colus & Amorim, 2019; Gandolfine et al., 2021; Godoy & Gil, 2021; Portes & Vieira, 2022) and, even, the relationship of mothers and their babies with hearing impairment or at risk of hearing impairment (Ambrose, 2016; Paradis & Koester, 2015; Pederro, 2018, Yamada et al., 2014).

When compared with other problems that are detected by screening tests, hearing loss can be considered to have a high incidence, affecting around 7,8% of children (Barboza et al., 2013). Its prevalence ranges from one to six newborns for every 1,000 live births and, in the case of newborns released from the Neonatal Intensive Care Unit (NICU), the prevalence is one to four newborns per 100 babies (Ministério da Saúde, 2012).

Hearing loss can be mild, moderate, severe or profound, affecting one ear or both, with more than 5% of the world's population requiring rehabilitation due to their condition. Almost 80% of people with hearing loss live in low- and middle-income countries (World Health Organization, 2021). Also, according to the World Health Organization, the effects of hearing loss are more susceptible during critical periods of life, such as childhood and adolescence, among others.

The causes of hearing loss include premature birth, stay in the Neonatal Intensive Care Unit, congenital infections (rubella and toxoplasmosis, among others), postnatal bacterial or viral infections (herpes, cytomegalovirus, meningitis etc.). The presence of these risk factors requires special attention, even though all babies undergo Neonatal Hearing Screening (NHS), a mandatory exam since 2010 (Câmara dos Deputados, 2010). In 2012, the Ministry of Health issued the Neonatal Hearing Screening Care Guidelines (Ministério da Saúde, 2012).

Dias et al. (2022) carried out a literature review with the aim of demonstrating the importance of early diagnosis of hearing loss. The results of the 11 studies reviewed pointed to gains in development when the diagnosis was made as early as possible, enabling referral to the intervention services.

In the longitudinal study by Lima et al. (2019) to evaluate the effectiveness of an intervention program with six mothers of children affected by hearing impairment, aged two to three years. The mother-child interaction was assessed after four months and eight months of intervention, by film taking. For the six dyads, the results were positive after eight months of intervention, with statistically significant changes observed, an improvement, in all aspects, of the mother interaction with her hearing-impaired child.

Another study evaluated the joint involvement and emotional interactions availability between parents of children with moderate hearing loss and parents of children with typical hearing function, in which the dyads were filmed during a free playing session, in addition to the application of scales and tests (Dirks & Rieffe, 2019). The investigation demonstrated that children with hearing loss and their parents had more difficulty establishing a joint involvement and experienced shorter episodes of such involvement than the other group. Emotional availability and joint involvement were positively associated with the children's language ability. The investigators suggested that early intervention programs, focused on the interaction between children with moderate hearing loss and their parents, be developed. And when a child is suspected of hearing loss and is in the diagnosis phase, do we observe differences in the interaction between mothers and their babies, when compared to mothers and their hearing babies? In this case, the intervention should start as of the mother's hunch or the results of the ear test, a mandatory screening carried out in the first months of the baby's life.

The present study aimed to describe and compare the interaction of mothers and babies at risk for hearing loss and mothers and hearing babies, in a free play setting. The first hypothesis tested was that infants at risk of hearing loss when interacting with their mothers would show fewer positive social approach behaviors, such as eye contact, smiling and/or vocalizing positively, when compared to hearing babies. The second hypothesis was that mothers of babies at risk for hearing loss would also show fewer positive sensitive behaviors, such as visual contact with the baby, touching and caressing her baby, having more caring behaviors, when compared to mothers in the group of hearing babies.

Method

This study is characterized by a quasi-experimental design, comparing convenience groups, one composed of mothers and their babies with suspected hearing loss and the other, of mothers with the hearing babies.

Participants

A total of fifty mothers and their babies aged four to 12 months participated in this study. A total of 25 mothers and babies at risk for Hearing Loss (HL) (of any type and degree) and 25 mothers and their hearing babies. Initially, 32 mothers of babies with suspected hearing loss who were treated at the University of São Paulo Hearing Health Division of the Hospital for Rehabilitation of Craniofacial Anomalies (DSA HRAC/USP, Bauru/SP), were invited to participate in the study. Out of them, five were excluded, whose babies had cleft palate or other comorbidity and two did not accept the invitation. Out of the 42 babies seen at the Applied Psychology Clinic, at Universidade Estadual Paulista (Unesp, São Paulo State University) Bauru campus (CPA/Unesp, Bauru/SP), eight were excluded due to prematurity and the others were, as far as possible, matched in terms of chronological age and gender with infants suspected of having HL. In the case of two or more babies who were close with regard to their age, there was a draw to determine participation in the group of listening babies.

Babies at risk for hearing loss (G1) were referred to HRAC/USP, due to the presence of risk factors for this condition, the most frequent being the positive result in the Little Ear Test (Newborn Hearing Screening) (36%), the prematurity (24%) and ear malformation (12%). The babies in the Control Group (G2) were participants in the extension project "Monitoring the development of babies: assessment and guidance for parents", which took place at the Center for Applied Psychology, Faculty of Sciences, Unesp, Bauru campus. Table 1 shows the characterization of babies and mothers³ in the two groups.

The G2 infants were matched by age and gender with the G1 infants. In both groups (G1 and G2), it was observed that boys predominated (52%) and the most common age of infants was seven to 12 months (72%). The prevalent maternal age in G1 (60%) and G2 (56%) was up to 30 years. Mothers in G1 (56%) and G2 (60%), had completed secondary education. The majority of mothers in both groups reported being in a common-law marriage (G1, 84% and G2, 92%). Regarding the number of children in G2, one child prevailed (68%) and, for G1, two or more children (44%).

³ Despite having two grandmothers as participants, we will use the word "mother" throughout the text.

Table 1*Characterization of mothers and infants from both groups*

Variables	Mothers/infants at risk of HL (G1)		Mothers/ Hearing infants (G2)	
	N	%	N	%
Infant age				
4 to 6 months	7	28	7	28
7 to 9 months	9	36	9	36
10 to 12 months	9	36	9	36
Infant gender				
Male (1)	13	52	13	52
Female (2)	12	48	12	48
Maternal age				
Up to 25 years	9	36	7	28
From 26 to 30 years	6	24	7	28
From 31 to 35 years	4	16	4	16
36 years or over	4	16	7	28
Not informed*	2	8	0	0
Education				
Complete primary education	5	20	2	8
Complete high school	14	56	15	60
Complete higher education	4	16	8	32
Not informed*	2	8	0	0
Marital status				
Common Law	21	84	23	92
Others	2	8	2	8
Not informed*	2	8	0	0
Number of children:				
One child	11	44	17	68
Two or more	12	48	8	32
Not informed*	2	8	0	0

Note: *The data refer to two grandmothers who are responsible for the babies. HL: Hearing Loss, N: sample number.

Instruments

To collect sociodemographic data an initial interview, designed for this study, was used, seeking information prior to the baby's birth, birth conditions and current information about the infant. A digital camcorder was also used to record mother-baby interaction, as well as children's toys. To evaluate the dyad's interaction, the Revised Mother-Child Interaction Coding System (CITMI-R) (Alvarenga & Cerezo, 2013), adapted for the present study, was used.

The CITMI-R includes a set of categories and codes to evaluate interaction. To evaluate children's behaviors, there is an interactive category of Social Approach with positive, neutral and negative valence and a category called Non-Interactive. However, after the assessment began, the need for adaptations to ensure trustworthiness between observers was identified. To evaluate maternal behaviors, there are three interactive categories: Sensitive behavior with positive valence, Neutral and Negative behavior, and also a non-interactive category, Non-Responsive behavior. In the present study, categories were included and detailed, associated both to maternal and to the infant behavior. Table 2 and Table 3 shows the categories for the assessment of infants' behaviors.

Procedures

The mothers were contacted at their respective institutions and, after acceptance, a time was scheduled for data collection. First, the mother answered the questions in the Initial Interview

Table 2*Description of infants' interactive behaviors adapted from the Revised Mother Child Interaction Coding System*

Category	Acronym	Definition
Positive Social Approach	CV/Osv	Eye contact or looking at the mother with a smile and/or vocalizations* that indicate joy and/or satisfaction
	CV/Osvtom	Eye contact or looking at the mother with a smile and/or vocalizations* that indicate joy and/or satisfaction, using toys, objects and parts of the body (moving them)
Neutral Social Approach	CV/O	Eye contact or looking at the mother
	CV/Otom	Eye contact or looking at the mother with neutral vocalizations, using or not using toys, objects and parts of the body, moving them
Negative Social Approach	CV/Ochmp	Eye contact or looking at the mother, crying, with sudden movements of arms and legs and/or vocalizations of protest
Non-Interactive	SR (self-regulation)	Exploration of objects or the infant own body without interaction with the mother. They pay attention and keep their gaze directed to other parts of the room. Self-comfort behaviors (putting hands or feet in mouth, pacifier or other objects, such as clothes, closing eyes, looking away from mother, rocking back, forward or side to side, touching nearby objects, clapping hands together, blocking behaviors, such as bringing hands in front of the head).
	SI/chp	Infant, without interaction with mother, cries, moves, arching body and/or protests
	Apathy	Vague gaze, not directed at environmental stimuli

Note: *Vocalizations: babbling, sighing, different sounds. CV/Osv: Eye contact, smiling, vocalization; CV/Osvtom: Eye contact, smiling, vocalization, toys, touching; CV/O: eye contact; CV/Otom: eye contact, toys, objects and touching; CV/Ochmp: eye contact, crying, protest movements; SR: self-regulation; SI/chp: no interaction, crying and protest.

Table 3*Description of maternal interactive behaviors adapted from the Revised Mother-Child Interaction Coding System*

Category	Acronym	Definition
Positive Sensitive	CV/O/svtsbo	Eye contact or looking at the baby with a smile, gentle touches and/or baby talk, vocalizations, using toys, objects
	CV/O/cc	Eye contact or looking at the baby with a smile and vocalizations and caregiving behaviors*
Neutral Sensitive	CV/O/vnbo	Eye contact or looking at the baby with or without neutral vocalizations using toys, objects or gentle touches
	CV/O/vncc	Eye contact or looking at the baby, with or without vocalizations and caregiving behaviors*
Negative Sensitive	CVtb/vr-b/o	Eye contact or looking at the baby with sudden touches and/or interrupting the activity with rude or negative verbalizations, using toys, objects
	CV-tbr/cc	Eye contact or looking at the baby with sudden touches and/or interrupting the activity with rude or negative verbalizations and caregiving behaviors*
Not Responsive (without looking at the baby or maintaining eye contact)	Tom	Make toys and objects available to the baby
	Cc	Perform care behaviors (positioning the infant, cleaning the infant's mouth/nose, arranging clothes, removing the infant's hand/foot from the mouth)
	Oo	Visual contact with the camera and objects and other materials available in the room

Note: *Care behaviors: positioning the baby, cleaning the baby's mouth/nose, tidying clothes etc. CV/O/svtsbo: eye contact, smiling, vocalization, gentle touch, toys, objects; CV/O/cc: eye contact, caring behavior; CV/O/vnbo: eye contact, neutral vocalization, toys, objects; CV/O/vncc: eye contact, neutral vocalization, caring behavior; CVtb/vr- b/o: eye contact, harsh touches, rude verbalizations, toys, objects; CV-tbr/cc: eye contact, harsh touches, caring behavior; Tom: toys, objects and movements of body; Cc: caring behaviors; Oo: looking at objects.

and then the dyads were filmed for eight minutes, in a free interaction situation, with toys available, but their use was not suggested. The only instruction given to mothers was that they should play with their babies as they would normally do in everyday life.

Filming time was divided into five-second episodes. In each episode, maternal and baby behaviors were analyzed, according to the categories provided for by the analysis instrument. It was agreed that, in the first episode, the observer would begin by coding child behavior and then coding maternal behavior. This marking allowed the calculation of trustworthiness between observers. The episodes were assessed once or as many times as necessary to accurately detect the behaviors shown by the dyad. Analyses were carried out in 30% of the footage from each group, by a double-blind observer in order to assess reliability. This calculation was made after the collection was completed, with the selection of videos that were examined by an independent observer who was not a participant in the data collection.

Reliability data was 85% for babies' interactive behaviors and 50% for mothers' interactive behaviors. To describe the dyads' behavior, the absolute and relative frequency was used. For comparative analyses, the data were subjected to non-parametric statistical analysis (Mann Whitney test), comparing the two groups involved, since the Shapiro Wilk test did not indicate normality of the data.

Ethical Considerations

This investigation was approved by the Ethics Committee of the Faculty of Sciences, Unesp, Bauru campus (process no. 2.012.127) where data were collected from dyads with hearing babies and from the Hospital for Rehabilitation of Craniofacial Anomalies (Process No. 2.038.195) where data were collected from dyads with babies at risk for hearing loss, both registered on Plataforma Brasil.

Results

Interaction Behaviors of Infants at Risk for Hearing Loss and Infants with Normal Development

The data refer to the description and comparison of the interaction between the behaviors of G1 and G2 infants. Table 4 shows the data associated with the description of the babies' behaviors. Those behaviors that appeared with low frequency for both groups (up to three behaviors during the filming period) were excluded. In total, 2,384 episodes of G1 infants and 2,362 episodes of G2 infants were assessed. The infants in both groups exhibited mostly Non-Interactive behaviors (G1 = 97,10% and G2 = 91,79%), more specifically Self-Regulation (SR) behavior for both groups, with manipulation of toys. However, Positive Social Approach behaviors, mainly "Eye contact or

Table 4

Absolute and relative frequency of interactive behaviors of babies in both groups

Infant's behaviors	Infants at risk for HL (G1)		Hearing infants (G2)	
	N	%	N	%
Positive Social Approach				
CV/Osv	5	0.21	39	1.65
CV/Osvtom	2	0.08	30	1.27
Total	7	0.29	69	2.92
Neutral Social Approach				
Cv/O	35	1.47	83	3.51
CV/Otom	20	0.84	35	1.48
Total	55	2.31	118	4.99
Negative Social Approach				
CV/Ochmp	7	0.29	7	0.30
Total	7	0.29	7	0.30
Non-Interactive				
SR	2,299	96.43	2,158	91.36
SI/chp	5	0.22	9	0.38
Apathy	11	0.46	1	0.04
Total	2,315	97.11	2,168	91.79
Grand Total	2,384	100	2,362	100

Note: Cv/O: Eye contact or looking the mother; CV/Otom: Eye contact or looking at the mother with neutral vocalizations using or not using toys, objects and parts of the body moving them; CV/Ochmp: Eye contact or looking at the crying mother, with sudden movements of arms and legs and/or protest vocalizations; CV/Osv: Eye contact or looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction; CV/Osvtom: Eye contact or looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction, using toys, objects and parts of the body moving them, HL: Hearing Loss, N: Sample Number; SI/chp: Baby, without interaction with mother, cries, moves arching the body and/or protests; SR: Self-Regulation.

looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction" (CV/Osv), were more frequent among the hearing babies. They also showed more neutral behaviors, such as "Eye contact or looking at mother" (CV/O). Both groups equally showed few Negative Social Approach behaviors.

Statistical analyses were performed considering the averages of the infants' interactive behaviors, comparing the two groups. Table 5 shows that G2 infants showed significantly more behaviors of "Eye contact or looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction" (CV/Osv) ($p = 0.028$), as well as in the total behaviors ($p = 0.029$) presented from the interactive category of Positive Social Approach. In the Non-Interactive Behaviors category, G1 infants showed significantly more self-regulation behaviors ($p = 0.035$) and in the total number of behaviors in this category ($p = 0.021$).

Table 5

Comparative data of the two groups of babies considering the average of interactive behaviors

Infants' behaviors	Infants at risk for HL (G1)		Hearing babies (G2)		<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Positive Social Approach						
CV/Osv	0.16	0.62	1.56	3.02	0.028	640
CV/Osvtom	0.12	0.43	1.20	3.06	0.088	
Total	0.28	0.89	2.76	5.43	0.029	637
Neutral Social Approach						
CV/O	1.40	2.19	3.32	4.63	0.067	
CV/Otom	0.80	2.23	1.40	2.38	0.363	
Total	2.20	4.11	4.72	5.24	0.065	
Non-Interactive						
SR	91.96	6.16	86.32	11.41	0.035	615
SI/chp	0.20	0.81	0.36	1.60	0.659	
Apathy	0.44	1.68	0.04	0.20	0.244	
Total	92.60	5.98	86.72	11.12	0.021	658

Note: Bold numbers mean p equal to or less than 0.05. p : Significance level equal to or less than 0.05. CV/O: Eye contact or looking the mother; CV/Otom: Eye contact or looking at the mother with neutral vocalizations using or not using toys, objects and parts of the body moving them; CV/Osv: Eye contact or looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction; CV/Osvtom: Eye contact or looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction, using toys, objects and parts of the body moving them; HL: hearing loss; SI/chp: Baby, without interaction with mother, cries, moves arching the body and/or protests; SR: self-regulation.

Interaction Behaviors of Mothers of Babies at Risk for Hearing Loss and Mothers of Babies with Typical Development

The second set of data concerns maternal interactive behaviors and is shown in Table 6. A total of 2,384 maternal episodes from G1 and 2,363 from G2 were assessed. The mothers of both groups showed interactive behaviors whether Positive Sensitive or Neutral Sensitive. The first behavior was the most frequent for G2 and the second for G1 mothers. Considering the behaviors in the Positive Sensitive category, G2 mothers most frequently presented the behaviors "Eye contact or looking at the baby with a smile, soft touches and/or baby talk vocalizations, using toys, objects" (CV/O/svtsbo) and "Eye contact or looking at the baby with a smile and vocalizations and care behaviors" (CV/O/cc). From the Neutral Sensitive behavior class, the most frequent behavior for mothers in both groups was "Eye contact or looking at the baby with or without neutral vocalizations using toys, objects or with gentle touches" (CV/O/vnbo), with higher frequency for G1 mothers (47.61%). The frequency of the Non-responsive behavior class was higher for G1 mothers (14.51%). No mother from either group exhibited negative behaviors.

Statistical analyses of the means of maternal interactive behaviors were performed. G2 mothers presented significantly more behaviors in the Positive Sensitive class, such as “Eye contact or looking at the baby with a smile and vocalizations and care behaviors” (CV/O/cc) ($p = 0.031$) and in the total number of behaviors in this category ($p = 0.050$). The behaviors “Making toys or objects available to the baby” ($p = 0.017$), “Visual contact with the camera, objects and other materials available in the room” ($p = 0.027$) and the total of behaviors ($p = 0.009$), from the class of Non-Responsive behavior, were significantly more frequent in G1 mothers, as shown in Table 7.

Table 6

Absolute and relative frequency of maternal interactive behaviors

Maternal behaviors	Mothers of infants at risk for HL (G1)		Mothers of hearing babies (G2)	
	N	%	N	%
Positive Sensitive				
CV/O/svtsbo	893	37.46	1199	50.74
CV/O/cc	9	0.38	50	2.11
Total	902	37.84	1249	52.85
Neutral Sensitive				
CV/O/vnbo	1135	47.61	947	40.08
CV/O/vncc	1	0.04	9	0.38
Total	1136	47.65	956	40.46
Not Responsive				
Tom	107	4.49	54	2.28
Cc	78	3.27	66	2.79
Oo	161	6.75	38	1.61
Total	346	14.51	158	6.69
Grand total	2,384	100	2,363	100

Note: Tom: Make toys, objects available to the baby; Cc: Perform care behaviors - position the baby, clean the baby’s mouth/nose baby, tidying up clothes, taking the baby’s hand/foot out of the mouth; CV/O/vncc: Eye contact or looking at the baby, with or without vocalizations and care behaviors; CV/O/cc: Eye contact or looking at the baby with a smile and vocalizations and care behaviors; CV/O/svtsbo: Eye contact or looking at the baby with a smile, soft touches and/or “motherese” vocalizations, using toys, objects; CV/O/vnbo: Eye contact or looking at the baby with or without neutral vocalizations using toys, objects or with gentle touches; HL: Hearing Loss; N: Sample Number; Oo: Visual contact with the camera and objects and other materials available in the room.

Table 7

Comparative data of the two groups of dyads considering the average of maternal interactive behaviors

Maternal behaviors	Mothers of infants at risk for HL (G1)		Mothers of hearing infants (G2)		<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Positive Sensitive						
CV/O/svtsbo	35.72	25.32	47.98	22.58	0.077	
CV/O/cc	0.36	1.15	2.00	3.51	0.031	618
Total	36.08	25.60	49.98	23.21	0.50	568
Neutral Sensitive						
CV/O/vnbo	45.40	25.60	37.88	19.14	0.245	
CV/O/vncc	0.04	0.20	0.16	0.47	0.248	
Total	45.44	25.61	38.04	19.27	0.254	
Not Responsive						
Tom	4.28	3.51	2.16	2.46	0.017	698
Cc	3.12	3.16	2.64	2.54	0.558	
Oo	6.44	9.83	1.52	4.03	0.027	167
Total	13.84	12.48	6.32	5.94	0.009	769

Note: Bold numbers mean *p* equal to or less than .05. *p*: significance level equal to or less than 0.05. Tom: Provide toys for the baby, objects; Cc: Perform care behaviors - positioning the baby, cleaning the baby’s mouth/nose, arranging clothes, removing the baby’s hand/foot from the mouth; CV/O/cc: Eye contact or looking at the baby with a smile and vocalizations and care behaviors; CV/O/svtsbo: Eye contact or looking at the baby with a smile, soft touches and/or “motherese” vocalizations, using toys, objects; CV/O/vnbo: Eye contact or looking for the baby with or without neutral vocalizations using toys, objects or with gentle touches; CV/O/vncc: Eye contact or looking at the baby, with or without vocalizations and care behaviors; HL: Hearing Loss; Oo: Visual contact with the camera and objects and other available materials in the room.

Discussion

The present study's aim was to describe and compare the interaction of mothers and babies at risk for hearing loss and mothers and hearing babies, in a free play situation. The children's and mothers' interactive and non-interactive behaviors analysis made it possible to identify aspects of the relationship and their interaction strategies.

The study hypotheses were confirmed. The first hypothesis predicted that G1 infants would show fewer positive behaviors during interactions with their mothers than G2 infants. In the analysis of the infants' interactive behaviors, differences were observed between the groups, with infants in G1 showing fewer positive and neutral behaviors than infants in G2.

These results corroborate data from the study by Laing et al. (2010), who observed that children with congenital defects, who required surgery on the head, chest or abdomen in the first 28 days of life, demonstrated significantly less positive interaction with their mothers, when compared to children with typical development. Taking into account that Positive Social Approach behaviors include eye contact with the mother, the findings of this investigation also corroborate the findings obtained by Belini and Fernandes (2008), who investigated the interaction between mother and her baby with Down Syndrome (DS) and among mothers of babies with typical development and found the absence of eye contact between the infant with DS and the mother, in the context of the syndrome being suspected, but not yet confirmed.

The positive behaviors that infants exhibit, such as smiling, maintaining eye contact and vocalizing, as well as the negative behaviors, are enhanced in interactions with the mother (Chiodelli, 2016). The mother's face and her vocalizations can be antecedent stimuli for the baby's response of smiling, looking and vocalizing, which is followed by the response of smiling and vocalizing to the baby. Such sequences are characterized as a contingency of positive reinforcement, increasing the probability of babies behaving in similar contexts and, consequently, being able to feel emotions related to pleasure, comfort and safety (Alvarenga et al., 2016). The baby's condition, the baby with health problems, with suspected syndromes can interfere with the interaction between the dyad, pointing to the importance of interventions with parents, with the aim of increasing the occurrence of positive interactive behaviors in the dyad. One hypothesis is that the infant's condition may fuel the belief that he/she is not capable of responding to maternal interactive behaviors and that the mother may also not pay attention to her baby's interactive initiatives, not reinforcing them.

In the present investigation, in the positive social approach category, the most frequent behavior for infants in both groups was "Eye contact or looking at the mother with a smile and/or vocalizations that indicate joy and/or satisfaction". These results are supported by the evidence that babies have a spontaneous preference for faces compared to objects (Libertus & Needham, 2011). However, significant differences were found in relation to the frequency of behaviors in the Positive Social Approach category, indicating that G2 infants showed a greater number of positive behaviors when interacting with their mothers. On the other hand, infants in G1 showed significantly more non-interactive behaviors than those in G2. The results of the study by Chiodelli (2020), which investigated the interaction between caregivers (fathers and mothers) and preterm and full-term babies, in a free interaction context, also demonstrated that babies in the first group presented significantly higher averages for behaviors less interactive with their caregivers than full-term babies, confirming the data of the present study even with children with another type of risk. One hypothesis is that in the playful setting, toys were made available and mothers made use of them, passing them on to their babies.

Non-interactive behaviors were the most common among infants in both groups, more specifically in self-regulation, with manipulation of toys, during interactions with their mothers. An interesting fact is that G1 showed a significant predominance of these behaviors. A fact that corroborates the results of studies by Santos (2020) and Campos (2016) indicating that the babies evaluated were more involved in playing behaviors and used the toys available in the context of interaction. Self-regulatory behaviors were also found by Ekas et al. (2013) in their longitudinal study evaluating the interaction of mothers and fathers with their infants, at three, five and seven months of age, demonstrating that the infants' effective regulation strategies were to look away from the caregivers and put their hands in their mouths, both in interactions with their fathers or mothers. The data from the present study seem to indicate that the greater frequency of self-regulation behaviors in infants may be due to a little positive interaction that mothers have with them on a daily basis. Comparing the groups, it was observed that G1 mothers more frequently exhibited neutral behaviors concerning the use of toys, objects or soft touches during the interactive context and non-responsive behaviors, while G2 mothers showed more positive behaviors and neutral behaviors when they interact with the baby with caring behaviors.

These data corroborate the findings of Medeiros and Salomão (2012), who found that mothers showed more observation behaviors towards babies with visual impairments, that is, non-interactive behaviors. Other studies also resulted in less responsive and intrusive mothers, involving babies with congenital defects and autism (Laing et al., 2010, Moro & Souza, 2011). On the other hand, Ferreira et al. (2018) found that mothers of DS babies showed positive interactive behaviors more frequently. However, an important fact of this study is that mothers and their babies with DS were monitored in specialized institutions since the baby was born, probably having a good professional support network. In the present study, mothers were visiting the service for the first time, undergoing tests to confirm the diagnosis of hearing loss.

The second hypothesis of the study predicted that mothers of babies at risk for hearing loss would exhibit fewer positive behaviors when compared to mothers in the other group. The data obtained confirmed this hypothesis. Positive interactive behaviors were significantly more frequent among G2 mothers.

The interactive behaviors presented by the mothers, regardless of whether from G1 or G2, were divided into positive, neutral and non-responsive. In none of the groups were negative interactive behaviors observed. Such findings can be attributed to the fact that the mother knows that she is being filmed and what is expected of her. Chiodelli (2016) also argues that the filming situation can influence the production of the mother's interactive behaviors, causing her to act in accordance with what is socially expected.

It is important to consider the stressful situation that the mothers were experiencing, in relation to the audiological evaluation and a possible diagnosis of hearing loss in the baby. This fact can interfere with the quality of the dyad's interaction, such as not knowing what to do with a baby who may not be listening and will need other forms of communication. The risk and threat of a possible hearing loss results in anguish, sadness, fear, confusion and despair in mothers, as well as ambivalent feelings, seeming to interrupt the emotional interaction with the baby (Yamada et al., 2014).

Conclusion

This study aimed to describe and compare the interaction of mothers and babies at risk for hearing loss and mothers and hearing babies within a free play setting. The results showed

that babies at risk for hearing loss had a lower frequency of positive and neutral behaviors during interaction with their mothers and more non-interactive behaviors, especially in self-regulation, involving the manipulation of toys. Likewise, the mothers of babies in this group also engaged less positively with their babies a fact that justifies the bidirectionality of social interactions presented in this study's introduction.

The results highlight the importance of the infants' first social relationships for their development process, especially when there is a risk factor involved like, in this case, the possibility of hearing loss, showing the importance of interventions with the families both in the area of Health and in the area of Education as of the diagnosis phase. In the area of Health, interventions must be conducted by interdisciplinary teams, at three levels of care: basic, secondary and highly complex. Among the limitations of the study we include the difficulty in finding infants with proven hearing impairment, as the diagnostic process based on the ear test ends up extending along the infant's first year of life.

Finally, it is suggested that further studies be carried out on the social interaction between mother and the baby at risk or with proven hearing loss, in view of the scarcity of works on the topic. It is also suggested that interventional studies focus on the interaction of mothers who have babies with other disabilities to help them interact with their children from a very young age.

Por fim, recomenda-se que novos estudos sejam realizados sobre a interação social entre mãe e bebê com risco ou deficiência auditiva comprovada, devido à escassez sobre o tema. Sugere-se, também, estudos interventivos com foco na interação mãe-bebê com outras deficiências que a auxiliem a interagir com seus filhos desde muito novos.

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Contributors

Conceptualization: M. F. P. PEDERRO and O. M. P. R. RODRIGUES. Methodology: M. F. P. Pederro and O. M. P. R. RODRIGUES. Project administration: M. F. P. PEDERRO. Supervision: O. M. P. R. RODRIGUES. Writing – original draft: M. F. P. PEDERRO; Writing – review & editing: M. F. P. PEDERRO and O. M. P. R. RODRIGUES.