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RESEARCH PAPER

Use and Acquisition of Communicative Functions and Communicative Forms by Portuguese European Toddlers with and without Hearing Impairment

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Purpose: The purpose of this study was to identify and compare communicative functions and forms in toddlers without (age group 8 to 18 months) and with hearing impairment (age group 13 to 18 months). **Methods:** Participants were 37 toddlers with normal hearing, 4 toddlers with hearing impairment. **Results:** The results indicate an increase in the average of the communicative functions conveyed along the increase of the age groups. There is an association between the age group and the type of communicative functions taught. Although there is no relationship between the hearing impairment condition and the average use of communicative functions, the two groups make different use of the type of communicative functions as well as the communicative forms. **Conclusion:** Is of paramount importance to understand the relationships between communicative forms and communicative functions in the assessment and intervention of communication skills in toddlers. In the case of toddlers with hearing impairment is fundamental to be aware that is not the frequency but the type of communication skills that they establish with their interlocutors.

Key Words: Toddlers, Communicative functions, Communicative forms, Hearing impairment.

INTRODUCTION

Developing communication and language skills is essential for the person's ability to participate and function in their social environment. From birth, newborns have a set of basic innate abilities that acquire an intentional character promoted by the experiences and opportunities offered to them through interactions with others. In this context of interaction with their interlocutors, children develop the different communicative forms available to them to express different communicative intentions. Although these communicative forms are used as risk indicators in assessing children at an early age (Donnellan et al., 2020), few studies focus on the relationship between the use of communicative forms and communicative functions in a global perspective in the context of interaction with their caregivers.

Evidence has focused on the study of the use and acquisition of communicative forms independently, with a body of studies directed at gesture (e.g., Iverson & Goldin-Meadow 2005; Liszkowski et al., 2007; Rowe et al., 2008; Stewart et al., 2021; Tomasello et al., 2007), to vocalizations (e.g., Donnellan et al., 2020; Perucchini et al., 2021; Yoo et al., 2018), to eye gaze (e.g., Çetinçelik et al., 2021; Farroni et al., 2002), to crying patterns (e.g., Barr, 2010; Mahmoudian et al., 2019; Yoo et al., 2018).

In the specificity of the research on children with hearing impairment, most studies focus on oral language development (e.g., Lee et al., 2012; Pianesi et al., 2016; Sharma et al., 2020; Wang et al., 2018) and sign languages (e.g., Allen, & Morere, 2020; Kushalnagar et al., 2010). Nevertheless, some studies focusing on the pragmatic skills of children with hearing impairment highlight that these skills are often at risk (Mood et al., 2020; Vaidya et al., 2021) and often go

unrecognized (Szarkowski et al., 2020).

When analyzing the communicative acts, Vaidya et al.(2021) found that in the early expressive language age range of 6~12 months, the children with hearing loss had better non-verbal communicative functions than typically developing children. Moreover, in the 12~24 months expressive language age range, children with hearing loss had better communicative functions related to responding to communication. However, there was a more restricted range of overall communicative functions compared to typically developing children. Also, Kelly et al.(2020) refer that infants with hearing impairment engage less frequently than typically hearing infants in the early communicative behaviours that predict later spoken language development, including show gestures, give gestures, index-finger pointing, communicative vocalizations, and early word use.

These findings are important since there is an interplay between early social interaction, language and executive function development in deaf and hearing infants (Morgan et al., 2021). Also, prelinguistic communication skills in hearing-impaired children are associated with later spoken vocabulary development (Roberts, 2019).

Since contemporary socio-cognitive studies claim that children have a unique ability to interpret the intentions of their interlocutors and that this ability lays the foundation for language development (Liszkowski et al., 2008), it becomes imperative to understand the early stages of intentionality in children with typical and atypical development, especially in children with hearing impairment. This study integrates a more extensive investigation developed in the context of the acquisition and use of communicative gestures in Portuguese children aged 8 to 18 months, with and without hearing impairment. The goals are to identify and compare communicative functions and forms in young children without (age group 8 to 18 months) and with (age group 13 to 18 months) hearing impairment as mediated by the research question: Does the use of communicative forms to express different forms of communication change within the hearing impairment condition?

Table 1. Characterization of the sample

	N	Number of participants excluded	Gender	
			Female	Male
Group A (months)				
8~9	10	0	5	5
10~12	13	3	6	4
13~18	19	2	9	8
Group B (months)				
13~18	5	1	3	1
Total	47	6	23	18

N: number of cases

MATERIALS AND METHODS

Participants

This study included 41 dyad (caregiver/child) participants, 37 of whom formed group A (typically developing children) and four of whom formed group B (children with hearing impairment).

The mean age of the children who met the criteria for inclusion in the study was 13.1 months (standard deviation, 3.49; minimum, 8 and maximum, 18). The children were divided into three age groups according to the period of development of intentionality (Bates, 1979; Bates et al., 1975), namely: perlocutionary period (age group of children from 8 to 9 months); illocutionary period (age group of children from 10 to 12 months); and locutionary period (age group of children from 13 to 18 months). For group A (GA), the inclusion criteria were: 1) age between 8 and 18 months and 2) typical developmental pattern. Exclusion criteria were: 1) presence of developmental disorders/delays. For group B (GB), the inclusion criteria were: 1) age between 8 and 18 months and 2) severe and profound hearing loss. Exclusion criteria were: 1) presence of comorbidity of developmental disorders/delays. Considering these criteria, five children from group A and one child from group B were excluded from the sample (Table 1).

All children in GB had a cochlear implant and their parents had no hearing impairment. At the time of data collection, children from GB were receiving auditory training in a Portuguese hospital by a clinical team that included otolaryngology, audiology and speech and language therapy.

Data collection tool

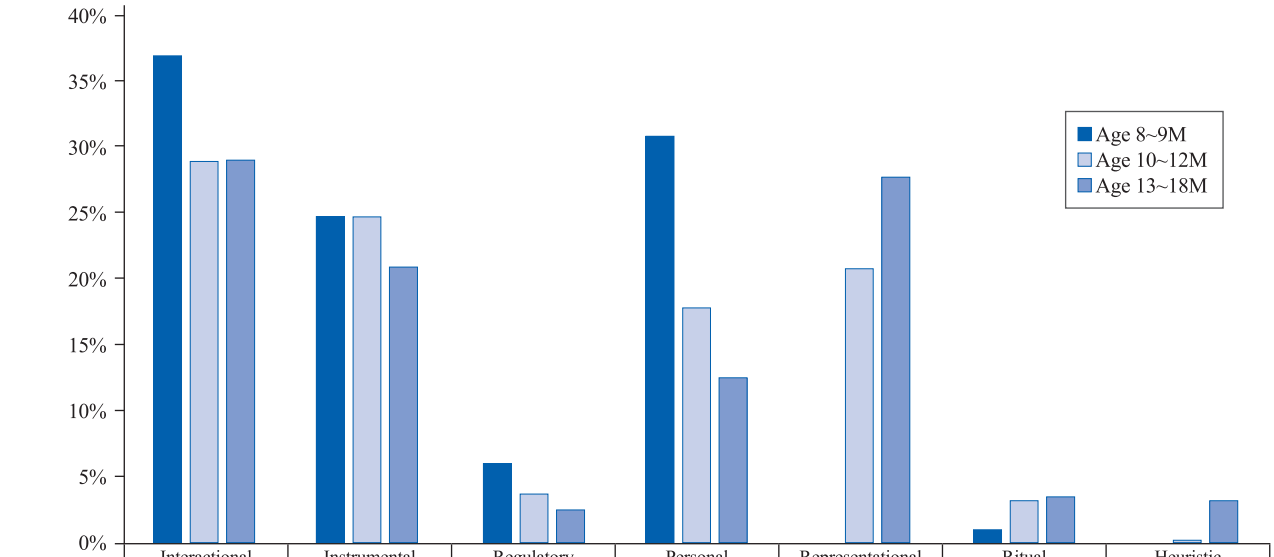
Data collection was carried out using the assessment instrument: gestures and communicative functions-8 to 18

months (IAGFC), which was developed by Lima & Cruz-Santos(2021). This instrument was developed with the aim to observe the gestures and communicative functions of children in the pre-linguistic period. Eight playful tasks were created for the children to develop, supported by interaction with their parents. The tasks were designed and structured according to two specific criteria. Firstly, they had to be playful tasks in order to promote the children's motivation and involvement, and secondly, they had to be family tasks for parents and children in order to promote spontaneity and a positive experience for both. Each task is designed to support the child's need to communicate. In different steps, parents are instructed to use gestures/words and three strategies to promote communication, namely eye contact, structured waiting and facial expressions of expectation. Thus, all tasks are structured in three distinct steps: in the first step, the child is expected to manifest the behaviour spontaneously; in the second step, the caregiver provides the model of the expected behaviour; and in the third step, the child is given two further opportunities to demonstrate the behaviour without the caregiver's contingent model.

Procedures for the collection of data

The procedure for the application of the IAGFC has been as follows: the room was prepared and organized to receive the participants, ensuring the best spatial organization and lighting for the audiovisual recording. A multimedia specialist decided on the audiovisual recording equipment and its positioning according to the characteristics of the room.

Using a script, all tasks were explained to the parents before the interaction. Based on different scripts developed for this purpose, the tasks were presented to the caregivers in random order, except for the tasks that were sequential. During the interaction, the principal researcher of this study only intervened when requested by the caregiver and/or the child. Note that during the explanation of the tasks, all the communicative gestures to be used were exemplified. In collaboration with the parents, the child's behavioural characteristics and motor skills were measured. On the basis of these characteristics, the interaction took place on the mattress or on a table adapted to the child. After analyzing the lighting conditions, the room organization, the positioning of the participants and the audiovisual recording cameras were studied. Three high-definition cameras were used for audiovisual recording. Audio and visual signals were used to synchronize the three audiovisual recordings.



	Interactional	Instrumental	Regulatory	Personal	Representational	Ritual	Heuristic
Age 8~9M	37.00%	24.80%	6.10%	30.90%	0.00%	1.10%	0.00%
Age 10~12M	29.00%	24.80%	3.80%	17.90%	20.90%	3.30%	0.30%
Age 13~18M	29.10%	21.00%	2.60%	12.60%	27.80%	3.60%	3.30%

Figure 1. Frequency of the types of communicative functions that are provided in the age groups of the GA. M: months, GA: group A.

RESULTS

A total of 3,366 communicative acts were analyzed and coded, of which 2,894 were observed in the communicative acts of the GA children (n = 37) and 472 in the communicative acts of the GB children (n = 4). In each communicative act, a single communicative function was coded, which was expressed by the children through different communicative forms. For quantitative variables, the non-parametric tests chi-square, Kruskal-Walis, and Mann-Whitney were applied due to the non-normality of the data and the non-homogeneity of the variance.

Next, according to the goals of this study, data collected and analyzed regarding the acquisition of communicative functions will be presented, followed by a comparison of children with hearing impairment and children with typical development at the age range of 13~18 months old.

Based on Figure 1, it is possible to verify the frequency of the type of communicative functions during the development of children.

According to the age group, children made a differentiated use of the types of communicative functions ($\chi^2 = 184.42$; $p < 0.001$). The data analysis regarding the comparison of the types of communicative functions used between the groups is shown in Figure 2.

Children with hearing impairment and typically developing children use different types of communicative functions ($\chi^2 = 87.73$; $p < 0.001$). Regarding the comparison of the means of use of communicative functions between typically developing children and children with hearing impairment, the results are presented in Table 2. The mean of the use of communicative functions is similar between typically developing and hearing impaired children, as indicated by the values of the inferential analysis (U = 437,424.00; $p = 0.075$).

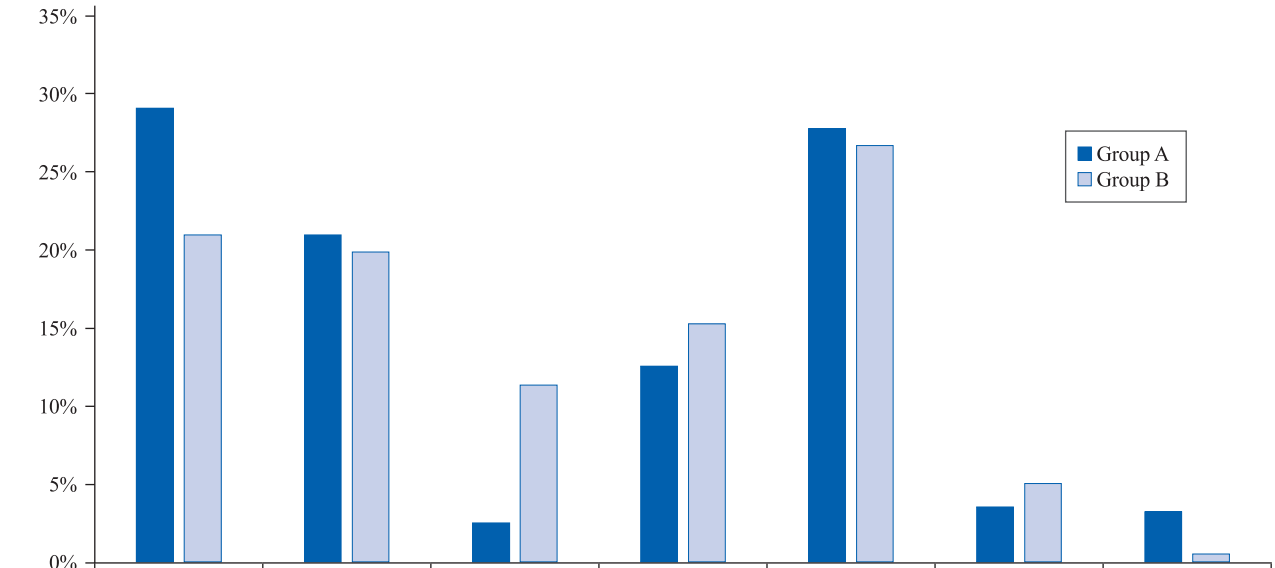
Figure 3 shows data on the comparison of communicative forms used by typically developing and hearing-impaired children in the locutionary period (13~18 months).

To examine the association between the communicative forms and the hearing impairment condition, an inferential analysis was performed and statistically significant differences were found in the use of the communicative

Table 2. Comparison of means for use of communicative functions by GA and GB children

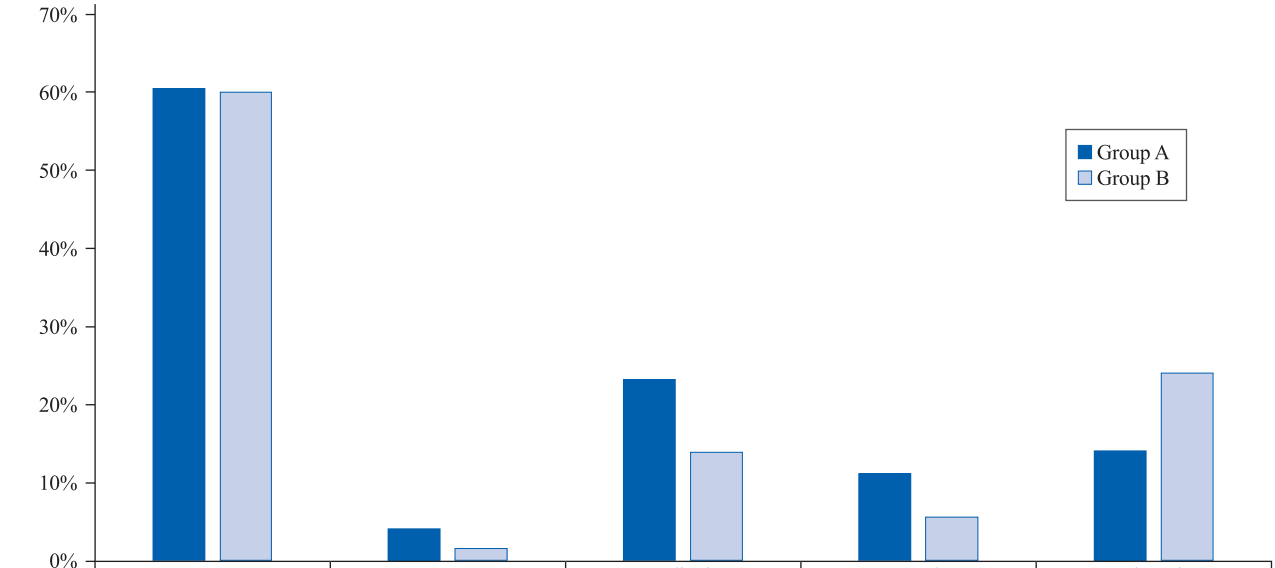
Group		Minimum	Maximum
Group A (n = 1,760)	119.84 ± 38.18	24	172
Group B (n = 472)	122.52 ± 20.93	81	138
Total (n = 2,232)	120.41 ± 35.25	24	172

GA: group A, GB: group B



	Interactional	Instrumental	Regulatory	Personal	Representational	Ritual	Heuristic
Group A	29.10%	21.00%	2.60%	12.60%	27.80%	3.60%	3.30%
Group B	21.00%	19.90%	11.40%	15.30%	26.70%	5.10%	0.60%

Figure 2. Comparison of the types of communicative functions conveyed by GA and GB children. GA: group A, GB: group B.



	Gesture	Cry	Vocalization	Word	Body Action
Group A	60.50%	4.20%	23.30%	11.30%	14.20%
Group B	60.00%	1.70%	14.00%	5.70%	24.20%

Figure 3. Comparison of the use of forms of communication between GA and GB children. GA: group A, GB: group B.

forms related to vocalization ($\chi^2 = 19.23$; $p < 0.001$), to the use of the word ($\chi^2 = 12.76$; $p < 0.001$), and to body action ($\chi^2 = 26.98$; $p < 0.001$). No association was found between the hearing impairment condition and the use of the gesture ($\chi^2 = 0.038$; $p = 0.845$) and the use of the crying ($\chi^2 = 6.62$; $p = 0.010$) was detected.

Interobserver agreement

Interobserver agreement was assessed in 10% of the audiovisual recordings collected by applying the IAGFC to the participants, and these values, expressed by Cohen's Kappa, reached significant levels for the types of communicative functions.

DISCUSSIONS

Discussion and final considerations

The results of this study are fully in line with the research question posed, as they suggest that there are differences in the way the communicative acts of children with hearing impairment differ from those of typically developing children.

Although children with hearing impairment have similar mean use of communicative functions as typically developing and hearing-impaired children, there are differences in the use of different types of communicative functions. These findings corroborate the results of a more restricted range of overall communicative functions compared to typically developing children referred by Vaidya et al.(2021).

It is important to note that some studies report that children with hearing impairment engage less in interactions (e.g., Kelly et al., 2020; Mood et al., 2020; Sohail et al., 2023). However, the present research results indicate that the mean of engagement in communicative acts is similar between children with or without hearing impairment at the age range of 13~18 months old. Possible explanations could be related to: 1) early identification of the participants of this study since Sohail et al.(2023) refer that early identified children had significantly higher receptive and expressive language scores compared to late-identified children; 2) the type of amplification, since all children had a cochlear implant and the age at which a child receives a cochlear implant is a critical factor, and earlier implantation is associated with better outcomes in pragmatic language skills, as it allows for more effective auditory input during crucial developmental periods (Khodeir et al., 2021; Yoshinaga-Itano et al., 2020); and 3) the socialization practices within different cultures can impact the way children with hearing impairment learn to communicate, since in cultures where communal interactions are emphasized, children may have

more opportunities to engage in social exchanges, and thereby enhancing their pragmatic skills (Owuor et al., 2020).

Therefore, the goals of this research are very relevant in the Portuguese context, a country where there is still little evidence collected, but also at an international level, because of the systematic identification of communicative forms and their association with communicative functions in children with typical and atypical development. Therefore, we expect that the results of this research will have an impact on the effectiveness of the processes of identification, assessment and intervention of communicative competencies. The results of this study indicate that the process of development of communicative functions is related to the communicative forms used in all three age groups studied. In fact, there is a progression between the forms and the communicative functions, given that the lower the age, the less complex the form used and the less complex the level of communicative intentionality, in contrast to what occurs throughout development to express more complex communicative functions, when more symbolic communicative forms emerge to perform collaborative communication. As toddlers became more understanding of the mental states of the interlocutor by the ability to share the attention and intention of their interlocutors, it has profound implications for their communicative and social development (Aureli et al., 2009; Tomasello et al., 2007).

In the specificity of children with hearing impairment we conclude that in comparison with children with typical development there are no differences in the average use of communicative functions, but there are differences in the distribution of frequencies in the types of functions used. Although children with hearing impairment are able to cooperate with their interlocutor in communicative acts, in fact the condition of hearing impairment seems to be related to their involvement in communicative acts more directed to their own needs than children with typical development. In addition, the same pattern is observed in the communicative forms, i.e., children with hearing impairment use the same communicative forms as typically developing children, but with different frequencies. Children with hearing impairment make less use of the word, so their communicative acts are mostly supported by the communicative gesture, which corroborates the evidence of studies conducted in other cultures (Ambrose, 2016; Vohr et al., 2008; Zaidman-Zait & Dromi, 2007). The analysis of both the forms and the communicative functions suggests that the communicative profile and the pattern of communication and language development of children with hearing impairment are different from those of typically developing children.

Limitations

As a limitation, the number of participants in the GB should be highlighted, since at the time of data collection a survey was carried out on the number of children in relation to the inclusion and exclusion criteria of this study, and only four children (aged 8 months to 18 months) with hearing impairment were identified in the five reference hospitals in Portugal, and these were the total number of participants in the study. This justifies the small number of participants in this research project and highlights the fact that hearing impairment is considered a low prevalence condition.

Ethical Statement

Written informed consent was obtained from the study participants, and Ethics Committee of SRM Medical College Hospital and research centre approved the study proposal (approval number: 3182/IEC/2021).

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Declaration of Conflicting Interests

There is no potential conflict of interest disclosed by the authors.

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Author Contributions

Conceptualization: Etelvina Lima and Anabela Cruz-Santos. Data collection: Etelvina Lima. Formal analysis: Etelvina Lima and Anabela Cruz-Santos. Writing—original draft: Etelvina Lima and Anabela Cruz-Santos.

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