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ARTICLE

An observational study of parental language during play and mealtime in toddlers at variable likelihood for autism

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Abstract

Parental language input influences child language outcomes but may vary based on certain characteristics. This research examined how parental language differs during two contexts for toddlers at varying likelihood of autism based on their developmental skills. Parental language (quantity, quality, and pragmatic functions) was analyzed during dyadic play and mealtime interactions as a secondary data analysis of observational data from a study of toddlers at elevated and lower likelihood of autism. Child developmental skills and sensory processing were also assessed. Parents used more words per minute, directives, and verbs during play and more adjectives, descriptions, and questions during mealtime. Parental language differed based on child fine motor skills, receptive language, and levels of sensory hyporesponsiveness but not autism likelihood. Overall, this study found that parental language varies based on context and child developmental skills. Future research examining parental language should include pragmatic functions and context across developmental trajectories.

Keywords: autism; parental language; early intervention; play; mealtime

Introduction

Parental language input is a vital component of children's early developmental environments, supporting their understanding of and engagement with the world and people around them. Recent studies have provided strong evidence for the link between parental language input and child language skills. In their meta-analysis of observational studies of parental language input, Anderson and colleagues (2021) pooled effect sizes for parental language input and found significant moderate-to-large associations between both QUANTITY and QUALITY of parental language input and children's expressive and receptive language. Further, a study of adopted children and their mothers, which examined vocabulary inventories as child outcomes, provides support for the theory that language input, in the absence of shared genes, influences children's language development (Coffey et al., 2022). These findings demonstrate that the early developmental environment, via parental language input, has the potential to impact children's language developmental trajectories.

Despite the considerable number of studies examining parental language input in relation to child development, constructs are not uniformly defined. One of the most common approaches to operationalizing parental language input is to measure units of speech or syntax. Anderson et al. (2021) conceptualized parental language input into two main constructs in their meta-analysis: QUANTITY, including number of words, tokens, or utterances; and QUALITY, including diversity of vocabulary (e.g., number of different words) and complexity of syntax (e.g., mean length of utterance in morphemes). Quality has been further delineated by some into three dimensions: interactive, linguistic, and conceptual (Rowe & Snow, 2020). Still other studies conceptualize parental language input in terms of pragmatics, specifically examining speech acts (or functions of parents' utterances) such as "affirmative speech" (Srinivasan & Bhat, 2020) and "information-salient speech" (de Falco et al., 2011). For example, affirmative speech (e.g., "Good job") encourages a child while information-salient speech (e.g., "Are you hungry?" or "That car is red") gives or requests information. Incorporating classification of speech acts into an understanding of parental language input, particularly in relation to children's development and outcomes, provides insight into the dynamic ways parents use language to further influence children's learning contexts, support their children's understanding of their world, and build relationships with their children through every interaction. Thus, this study sought to analyze parental language input along multiple dimensions including quantity, quality, pragmatics, and context, to capture how parents provide language to very young children and whether their language input differs across context and child characteristics.

Parental language input and elevated likelihood for autism

Parental language input to young children plays a role in language outcomes for typically developing children, and there is also evidence for its impact on children with early developmental delays and at elevated likelihood of autism (EL-A; Ferjan Ramírez et al., 2019; Yoder et al., 2015). Children may be considered at EL-A based on familial risk, or based on assessment of parent-reported behaviors that indicate a child is at elevated likelihood of eventual autism diagnosis (the method of the present study). According to the transactional model, child behavior is both influenced by and influences a child's environment (Sameroff, 2010): parents adjust their language based on feedback from the child, the child responds to the ways parents alter their engagement with them, and so on. In fact, studies have suggested that parents change the complexity of their language over time based on their child's language skills (e.g., Fusaroli et al., 2019; Rowe, 2012).

Given the transactional nature of caregiver-child interactions, the early environmental context of children at EL-A may differ from that of children with lower likelihood of autism (LL-A) due to the nature of the neurodevelopmental differences associated with EL-A. For example, children at EL-A are less likely to initiate or respond to communication bids, through reduced sharing of objects (Srinivasan et al., 2016) or delayed language development and difficulties disengaging attention (Zwaigenbaum et al., 2005). Additionally, children at EL-A are more likely to demonstrate sensory hyporesponsiveness (i.e., reduced or delayed responses to stimuli) and hyperresponsiveness (i.e., avoidance of or aversive responses to stimuli) across both social and nonsocial contexts (Baranek et al., 2006). There is evidence that characteristics of children at EL-A or diagnosed with autism are associated with differences in their parents' language input. For example, greater hyporesponsiveness and lower communication scores in children at EL-A have been associated with reduced overall quantity of parental language input during free-play sessions (Kinard et al., 2017). Additionally, in a longitudinal study of children with autism in which parental language was measured during play, children's nonverbal cognition predicted parental language production, and children's language at one visit predicted parental speech at the next (Fusaroli et al., 2019). Furthermore, child skills also impact caregiver pragmatic language. Caregivers of infants at EL-A were found to be more likely to engage in directive strategies (e.g., verbal or nonverbal bids to direct attention) than caregivers of infants at LL-A were (Srinivasan & Bhat, 2020). In a sample of children with a diagnosis of autism and delayed expressive language skills, parents' use of directives following into their child's focus of attention predicted later language scores (Haebig et al., 2013). Further research examining parental language input in relation to skills of infants at EL-A is needed, as evidence of differences in the early child developmental context may signal a need to intervene earlier to promote increased or enriched parental language input during a crucial developmental point early in infant-caregiver transactions.

Impact of context on parental language input

In addition to child behaviors, another important influence on parental language input is the situational context within which parents and children interact. Two common contexts likely to impact parent-child interactions are the daily routines of play and mealtime. Ample studies of parental language during play have shown that play interactions can foster improved child language outcomes. For example, patterns of parental language input during play – higher levels of parental responsivity and synchronization, more verbal responses to joint attention, and higher mean length of utterance – are associated with stronger child expressive and receptive language skills in children with autism (Choi et al., 2020; Siller & Sigman, 2002). However, all play is not equal in terms of effects on parental language input. For example, parents use a higher number of utterances and novel vocabulary when playing with their child using manipulative toys compared to using a mobile device (Ewin et al., 2021). When compared to book reading, object play has been shown to result in more complex utterances and more verb use among parents (Doering et al., 2020; Ogura et al., 2006). Overall, toy play can elicit rich parental language input, especially with preverbal infants.

Mealtime also offers abundant opportunities for social interaction and has been cited for enabling children to engage in reciprocal social communication across cultures and social classes (Fjellström, 2008). For children at EL-A, mealtimes can encourage the use of facial expressions, gaze following, and joint attention, skills that are often targets of early intervention (Harding et al., 2013). Children may experience diverse language, practice simple turn taking, and acquire general knowledge during mealtimes (Snow &

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Beals, 2006). Mealtimes also provide opportunities for parents to introduce conceptual content that is decontextualized, allowing them to broaden conversation beyond the present (Rowe & Snow, 2020). However, for children with complex needs, mealtime language input may predominantly center on immediate mealtime issues related to feeding the child, limiting the diversity of language, topics, and concepts the child is exposed to (Ferm et al., 2005). Therefore, mealtime has the opportunity for rich parental language input, but may be underutilized among parents of children with developmental delays.

Although both play and mealtime are fruitful contexts for parent-infant interactions, the limited existing research is mixed on whether they elicit different types of parental language input. For example, some researchers have reported more complex language input during mealtime when compared to play (Weizman & Snow, 2001), while others have reported parental language during mealtime is less complex (Flynn & Masur, 2007; Hoff, 2010; Tulviste, 2003). Similarly, one study reported that parents use more directives during mealtime (Lawrence & Shipley, 1996) while another reported the opposite (Tulviste, 2003). These conflicting findings point to a need for further research to clarify the relative similarities and differences in parental language input in these contexts and their subsequent impacts on child outcomes, especially for populations of children with developmental vulnerabilities.

Current study

Parental language input to young children is instrumental in influencing language outcomes, particularly among young children at EL-A. However, parental language quantity, quality, and pragmatics may change based on the child's individual characteristics and the context in which the parent and child are interacting. Thus, this research aimed to determine how parental language input differs during play and mealtime interactions in toddlers at EL-A (based on parent-reported behaviors) and lower likelihood of autism (LL-A) and if parents modulate their language based on their child's developmental skills. The following specific aims were pursued in this study:

Aim 1 – To determine if context (play versus mealtime) influences parental language input. We hypothesized that parents, regardless of toddlers' autism likelihood status, would use more verbs, utterances per minute, and descriptive utterances during play compared to mealtime and more directives during mealtime.

Aim 2 – To determine if parental language input during play or mealtime differs based on toddlers' autism likelihood status. We hypothesized that parents of toddlers at EL-A would demonstrate less lexical diversity and more directive utterances during both play and mealtime.

Aim 3 – To explore the relationship between child characteristics (expressive and receptive language, fine motor skills, non-verbal cognition, and sensory reactivity) and parental language input during play and mealtime. We hypothesized that atypical child language, non-verbal cognition, and sensory reactivity scores would be associated with reduced quality and quantity (e.g., shorter MLU and less lexical diversity) and more directive utterances across play and mealtime.

Methods

Study design & ethics

This study involves secondary analysis of observational data from a parent study of families with toddlers (11 to 16 months) at EL-A, Parents and Infants Engaged, along with a companion study to collect data on families with toddlers at LL-A. The parent and companion studies were approved by the University of North Carolina at Chapel Hill Institutional Review Board. Results from this analysis are reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (Vandenbroucke et al., 2007).

Parent study

Parents and Infants Engaged (PIE) was a randomized controlled intervention trial conducted from March 2018 through March 2021 for pilot testing of a novel parent-mediated intervention for toddlers at EL-A who were identified based on parent-reported behaviors that indicated the toddlers were at elevated likelihood of eventual autism diagnosis (using the FYI-Lite, see measures). Toddlers at LL-A age-matched to those at EL-A were enrolled in the companion study, which included developmental assessments without an intervention component. Initial assessments occurred from March 2018 to March 2020. Participants were recruited through targeted mailings based on birth registries, as well as at community events, based on the toddler's age (11 through 16 months of age at time of recruitment). Exclusion criteria included families who spoke English <50% of the time at home and toddlers with identified vision, hearing, or physical impairments or genetic disorders. The criteria for amount of English spoken in the home was chosen to (1) reduce the likelihood of recruiting families insufficiently fluent in English to complete the questionnaires and protocols that were delivered in English and (2) ensure toddlers heard some amount of English at home. A functionally monolingual sample was intentionally not sought to increase diversity in recruited families.

Interested families were asked to complete the First Years Inventory-Lite 3.1b (FYI-LITE) (Baranek et al., 2014), a screener for early detection of likelihood of a later diagnosis of autism, either through an online form or in person. Toddlers were categorized into one of two groups based on FYI-LITE cut-off scores: LL-A or EL-A (see Measures). Families of EL-A toddlers and a quasi-randomly selected subset of LL-A toddlers were invited to participate in an initial assessment at the project laboratory. Quasi-random selection of LL-A toddlers occurred on a monthly basis by first stratifying completed FYI-LITEs by age group (11-13 or 14-16 months) and then attempting to contact families in each group according to a randomly ordered list. Additionally, for the LL-A group, recruitment targets were adjusted for parent-reported child sex to align with enrollment patterns in the EL-A group, to further ensure that the two groups were reasonably well-matched. Data for the current study were drawn from the baseline assessment, prior to implementing intervention with families of EL-A toddlers. All families completed written informed consents for study participation. The initial study visit included a sensory assessment, developmental assessment, and parent-child interaction vignette. Study data were collected and managed using REDCap electronic data capture tools hosted at the University of North Carolina at Chapel Hill (Harris et al., 2019).

Participants

Eighty-two families participated in an initial study visit. Six of these families did not have complete audio/video recordings of the play and mealtime vignettes, or the parent did not speak English during the parent-child interaction and thus were not included. As a result, this study used a subset of participants (n = 76; inclusive of both groups) from the parent and companion studies. See Table 1 for demographics.

Procedure

A segment of the initial assessment, the parent-child interaction vignette, was utilized for analysis of parental language input in this study. Included in this study as 'parents' were any adults who identified as a primary caregiver to the child; these were primarily mothers and fathers but did include two grandparents, hereafter referred to as parents. Parents and toddlers were audio and video recorded for the entire vignette. For the first activity, the parent and toddler participated in a five-minute free play in which they were instructed to play with a standard set of toys as they usually would at home. They then participated in a five-minute novel toy activity, not reported on here. Third, the parent and toddler were provided standardized foods, including foods chosen to have different tastes, textures, consistencies, and temperatures: raisins or gummies, Jell-O with fruit, a popsicle, Goldfish crackers, and vanilla pudding. Foods were slightly different for toddlers with allergies or dietary restrictions, in which case parents were asked to replace the item with a similar texture alternative. Parents were instructed to encourage their child to interact with all of the foods and were given five minutes initially with additional time provided if the child was still eating.

Measures

Demographic information

One parent for each child completed the online demographic information form and provided information about the child and family including age, race, ethnicity, parent education level, family composition, and annual income.

First Years Inventory- Lite

Upon recruitment, parents completed the First Years Inventory-Lite Version 3.1b (FYI-LITE) (Baranek et al., 2014), an adapted version of a screener for early detection of likelihood of a later diagnosis of autism. The FYI-LITE has 25 items that fall into one of two domains: social-communication or sensory-regulation. Toddlers were categorized into two groups, LL-A or EL-A, based on empirically determined FYI-LITE cut-off scores selected to maximize the positive predictive value of the FYI-LITE for eventual autism diagnosis within two age groups: 11 to 13 and 14 to 16 months. Toddlers in the LL-A group scored below the cut-off scores on the FYI-LITE, with toddlers recruited across the full range of subthreshold scores. Positive predictive value of the FYI-LITE is estimated to be similar to that of the full versions of the FYI, 2.0 (Turner-Brown et al., 2012) and 3.1 (Sideris et al., 2023), which is about 0.30 in a community sample such as in this study.

Table 1. Demographic Characteristics

Characteristic		EL-A (n = 43)	LL-A (n = 33)	p-value
Child Age, months		14.16 ± 1.73	14.61 ± 1.62	.395
Child Sex, %				
	Male	69.7%	66.6%	.807[a]
	Female	30.3%	33.3%	
Child Race, %				
	White	72.10%	90.91%	.077[a,b]
	Black or African American	11.63%	3.03%	
	Asian	4.65%	0%	
	More than one Race	6.97%	6.06%	
	Not Reported/Unknown	4.65%	0%	
Child Ethnicity, %				
	Hispanic/Latino	16.27%	6.06%	.284[a]
	Not Hispanic/Latino	81.40%	90.91%	
	Not reported	2.33%	3.03%	
Siblings, %				
	Yes	41.86%	27.27%	.080[a]
	No	39.53%	69.70%	
	Not Reported	18.61%	3.03%	
Parental Level of Education, %				
	9^{th}-11^{th} or HS/GED	11.63%	0%	.003**[a,b]
	Vocational	0%	3.03%	
	Associate's	9.30%	0%	
	Courses toward college degree	4.65%	0%	
	College Degree	34.88%	42.42%	
	Master's Degree	20.93%	36.36%	
	Professional Degree	0%	15.16%	
	Not Reported	18.61%	3.03%	
Total Household Income, %				
	Less than $20,000	9.30%	3.03%	.148[a,b]
	$20,001 - $40,000	2.33%	3.03%	
	$40,001 - $60,000	13.95%	9.09%	
	$60,001 - $80,000	11.63%	9.09%	
	$80,001 - $100,000	13.95%	30.31%	

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Table 1. *(Continued)*

Characteristic		EL-A (n = 43)	LL-A (n = 33)	p-value
	$100,001 - $150,000	16.28%	18.18%	
	$150,001 or greater	6.98%	21.21%	
	Not reported	25.58%	6.06%	
MSEL T-Scores, Mean (SD)				
	Expressive Language	34.84 (10.77)	45.73 (10.05)	<.001**
	Receptive Language	35.67 (13.23)	43.88 (13.14)	.009**
	Visual Reception	46.19 (10.58)	52.00 (11.23)	.024*
	Fine Motor	48.93 (13.20)	54.15 (9.52)	.060

Note. MSEL: Mullen Scales of Early Learning.
[a]To compute p-values for categorical variables, two-tailed, chi-square significance testing was used with the Fisher's exact test.
[b]For race, differences between groups was calculated for the number of White v. non-White participants. For parental education, differences between group were calculated for the number of parents with a college degree or higher v. those with less than a college degree. For income level, differences between groups were calculated for families with an income > $60,001 and those <$60,000.

Child language, cognitive, and motor skills

A trained research assistant (RA) administered the Mullen Scales of Early Learning (MSEL) (Mullen, 1995) as a measure of the toddlers' developmental skills. The MSEL has five subscales: gross motor, visual reception (nonverbal cognition), fine motor, expressive language, and receptive language; the latter four were used in the current study. Each subscale yields a T score (Mean=50; SD=10), based on age-based norm referenced distributions. The MSEL has strong convergent validity with other developmental assessments in young children (Bishop et al., 2011).

Child sensory reactivity

Trained RAs administered the Sensory Processing Assessment (SPA; Baranek, 1999) to measure toddlers' sensory processing patterns. The SPA provides information on hypo-responsiveness (Hypo), hyper-responsiveness (Hyper), and sensory seeking behaviors using novel sensory toys, orientation stimuli, and habituation stimuli. SPA Hypo and Hyper scores were used in this analysis. Scores for these sensory patterns are derived from mean item scores following transformation of each item score to a scale of 5 points. The SPA is reported to have strong inter-rater reliability calculated using intra-class correlations and good convergent validity with the Sensory Experiences Questionnaire (Baranek et al., 2013).

Parental language input

To analyze parental language input, the audio from both the play and mealtime portions of the parent-child interaction protocol was transcribed and analyzed. Parental language input was analyzed in three categories: QUANTITY of input, QUALITY of input, and PRAGMATIC FUNCTIONS (see Table 2). QUANTITY of language was defined as the amount of language used with two corresponding variables: utterances per minute and words per minute. QUALITY of language referred to the richness of the parent language in terms of

Table 2. Independent and Dependent Variables

	Variable	Definition/Measurement	Target Area
Independent Variables			
	Play Context	5-min free play with parent	Language during play
	Snack Context	5-min snack with parent	Language during mealtimes
	Child Language	MSEL Expressive & Receptive Language subtests	Child expressive/ receptive language
	Child Cognition	MSEL Visual Reception subtest	Child cognitive skills
	Child Motor Skills	MSEL Fine Motor subtest	Child fine motor skills
	Child Sensory Processing	SPA Hyper and Hypo categories	Child sensory processing patterns
Dependent Variables			
	Utterances per Minute	Number of independent utterances the parent produces per minute as an indicator of the amount of language input	Quantity of input
	Words per Minute	The average number of words the parent produces per minute as a measure of the rate of language input	Quantity of input
	Proportion of Nouns	Proportion of total nouns used compared to total words used to determine relative use	Quality of input
	Proportion of Verbs	Proportion of total verbs used compared to total words used to determine relative use	Quality of input
	Proportion of Adjectives	Proportion of total adjectives used compared to total words used to determine relative use	Quality of input
	Mean Length of Utterance	The average length, in morphemes, of the parent's utterance as an indicator of linguistic complexity of input	Quality of input

Table 2. *(Continued)*

	Variable	Definition/Measurement	Target Area
	Type-Token Ratio	The number of unique words divided by the number of total words as a measure of lexical diversity	Quality of input
	Different Words per Minute	The number of unique words the parent used per minute as a measure of lexical diversity	Quality of input
	Proportion of Affective Utterances	Proportion of codable utterances coded as affective in nature	Pragmatic function of input
	Proportion of Directive Utterances	Proportion of codable utterances coded as directive in nature	Pragmatic function of input
	Proportion of Question Utterances	Proportion of codable utterances coded as questions in nature	Pragmatic function of input
	Proportion of Descriptive Utterances	Proportion of codable utterances coded as descriptive in nature	Pragmatic function of input

Note. MSEL: Mullen Scales of Early Learning. SPA: Sensory Processing Assessment.

complexity, vocabulary, and semantics. Finally, PRAGMATIC CATEGORIES of language were coded to reflect the functions of the language parents used (see Table 2 and Appendix 1). Pragmatics fell under three main categories: Affective utterances, Information utterances, and Other. Affective utterances included several subcategories; however, because of the relatively low incidence of utterances in each subcategory, these were grouped for analysis. Under the main category of Information utterances, directives, questions, and descriptive utterances were all examined individually as we felt these would be more explanatory with separate analyses. The Other category was excluded due to non-normality, described below.

For transcription, authors KT, EC, and JA first established a transcription codebook based on Systematic Analysis of Language Transcription (SALT) software transcription conventions (SALT, 2019). Transcriptions captured only parent-child interactions, beginning when the RA closed the door (leaving the parent and child in the room alone) and stopping anytime the door was open. RAs rarely interrupted the interaction; among the 76 play samples, only one instance of researcher disruption occurred, and among the 76 mealtime samples, there were 11 interruptions with a mean length of 14.1 seconds (range 5-23 seconds). These occurred to alert parents to the end of the five-minute period as well as to offer additional resources (such as offering tissues to a child with a runny nose) or clarification on instructions.

The complete transcription process can be seen in Figure 1. Research assistants for transcription were speech-language pathology undergraduate students. During the training phase, most errors were inaccurate use of SALT conventions rather than inaccurate

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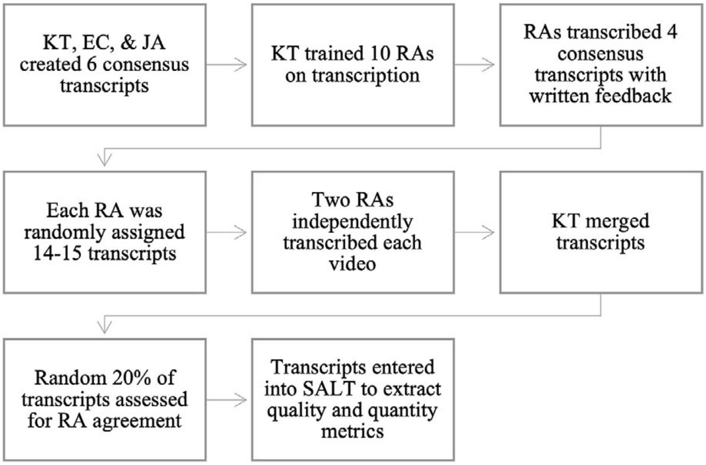

Figure 1. Flow diagram of the transcription process. RA = Research Assistant. SALT = Systematic Analysis of Language Transcription software. KT = First author. EC = Second author. JA = Third author.

transcriptions of parent language. Each sample was transcribed by two different RAs and then merged by one author (KT) who created all final transcripts to improve consistency. Discrepancies in parental language transcriptions were reviewed by KT who listened to the audio of each discrepancy at least three times before determining the finalized transcription. Agreement from a random sample of 20% of transcripts was calculated by taking the number of words that were transcribed identically by each RA and dividing it by the maximum words that were transcribed between the two RAs for each line. For example, if RA A transcribed "He went to bed" and RA B transcribed "He went bed", a total of 4 words would be used for a denominator and 3 words for the numerator for an agreement of 75%. Then, the average agreement for the entire play and entire mealtime transcripts were calculated. For the random sample of 20%, the average agreement between transcribers was 78%.

Pragmatic functions were analyzed by first establishing a codebook based on de Falco et al. (2011) (see Appendix 1 for definitions). To establish a final coding handbook, the first three authors (hereafter referred to as the coders) coded transcripts independently based on the then-current version of the coding handbook. Then, point-to-point reliability was calculated as the total lines in agreement divided by the total number of lines. Agreement on a line required all three coders to use the same code. Following independent coding and reliability calculation, the three coders met to review any discrepancies. The three coders jointly coded and discussed transcripts until 80% reliability was reached for three consecutive transcripts. Then, using the finalized codebook, each coder coded three transcripts independently each week, with one of the three being coded by all three coders. This third transcript was assessed for reliability and the three coders met regularly to review any discrepancies. After initial calibration, all remaining reliability transcripts met or exceeded 80% point-to-point reliability.

Each segment of the parent-child interaction was intended to be five minutes in length. At times, mealtime videos were longer than play videos to allow extra time if the child was still eating. To address this, mealtime videos were transcribed for a maximum of six minutes, and all metrics are reported as proportions relative to time or as means. Additionally, a paired t-test revealed no significant difference between the length of the play and mealtime videos (p = .79).

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Data analysis

Data were analyzed using SPSS v.26. Alpha was set at 0.05 for statistical significance, and standard deviations were reported as measures of precision across analyses. All statistical p-values among ANOVAs and MANOVAs were corrected for multiple comparisons using the False Discovery Rate method (Benjamini & Hochberg, 1995). Bivariate Pearson correlations were not adjusted for multiple comparisons as the number of tests would result in loss of effects. Therefore, results and discussion focus on correlation magnitude rather than the significance of p-values. Prior to running analyses, outliers were determined using box plots. Outliers were checked and confirmed for accurate entry and were retained as valid measurements. Additionally, histograms were reviewed for normality. Ultimately, the 'Other' coding category was the only category which did not meet the requirements for statistical analysis, as there were too few examples across transcripts, resulting in highly skewed data. Thus, this category was not included in analyses. Data met the requirements for MANOVA. Since there were minimal missing outcome data, no adjustments were made. In terms of demographic differences, the EL-A and LL-A groups differed on parent education; however, given the notable number of parents who did not report education level, this was ultimately not controlled for in analysis and is considered a limitation.

The study aims were addressed as follows:

For Aim 1, comparing parental language during play and mealtime, we ran repeated measures ANOVAs, pairing each language metric during play and mealtime across all participants. We ran one analysis for parent language quantity and quality and a separate analysis for pragmatic functions.

For Aim 2, comparing parental language in EL-A and LL-A groups, we ran a one-way multivariate analysis of variance (MANOVA) to determine group differences across parental language variables. The first model used all quantity, quality, and semantic categories variables as dependent variables. The second model used all pragmatic categories as dependent variables. The independent variable was the likelihood of autism group (EL-A or LL-A). We first ran a MANOVA for play followed by a separate MANOVA for mealtime.

For Aim 3, exploring the relationship between child assessment scores and parental language input characteristics, we computed bivariate Pearson correlations with the null hypothesis of no relationship between the child's MSEL scores (expressive language, receptive language, fine motor skills, or visual reception) or SPA scores with each parent language metric. Child scores on the MSEL and SPA were examined as one group inclusive of children at EL-A and LL-A. Correlation magnitudes were examined and defined such that magnitudes of ±0.2 or less were considered very small effects, between ±0.2 and ±0.3 small effects, between ±0.3 and ±0.5 medium effects, and greater than ±0.5 large effects (Cohen, 1988). Full correlation tables are available in Appendices 2 – 5.

Sample demographics

Our sample included 43 toddlers at EL-A (56.6%) and 33 at LL-A (43.4%). Demographic information is reported in Table 1. The average adjusted age of toddler participants inclusive of both groups was 14.14 months and 68.4% were male. The reported race for the majority of toddlers was White (80.3%).

Table 3. Children with Developmental Scores Below the Average Range (less than 40) on the MSEL

	EL-A		LL-A		
	Percentage	N	Percentage	N	p-value
Expressive Language	65.12	28	24.24	8	<.001
Receptive Language	67.44	29	39.40	13	.01
Visual Reception	23.26	10	6.06	2	.02
Fine Motor	27.91	12	6.06	2	.06

Note. EL-A: elevated likelihood of autism. LL-A: lower likelihood of autism. MSEL: Mullen Scales of Early Learning.

Only one parent interacted with the child for the entirety of the parent-child interaction segment. Across both groups, primarily mothers participated (n=64; 84.21%). Fathers accounted for 10 of the parents (13.15%); one grandmother and one grandfather participated. The education level of the parent participating with the child was most commonly a college degree or higher in both the LL-A and EL-A group (93.94% in LL-A group, 55.81% in EL-A group); the difference between groups was significant (p= .003). It should also be noted that fewer parents reported these data in the EL-A group (see Table 1).

The LL-A and EL-A groups were also compared on the basis of toddlers' MSEL scores. There was a significant difference between the two groups in terms of expressive language ($p \leq .001$), receptive language ($p=.01$), and visual reception ($p=.02$): the LL-A group had higher scores, indicative of more advanced skills in these domains. The LL-A group also had nonsignificantly higher scores in fine motor skills ($p=.06$). It is important to note that while the LL-A group had higher MSEL scores on average, not all toddlers in the LL-A group had scores within the average range (see Table 3). Similarly, some toddlers in the EL-A group had average MSEL scores.

Results

Aim 1 – Parental language input in play versus mealtime

The purpose of this aim was to determine if parental language differs between play and mealtime, regardless of autism likelihood status. Parental language inclusive of the entire sample was analyzed. In terms of parental language quantity and quality, the play and mealtime contexts differed [$F(8, 68) = 5.401$, $p < .001$; Wilk's L = 0.611, partial $h^2 = 0.389$], with significantly more words per minute and a higher proportion of verbs in play. Conversely, there was a significantly higher proportion of adjectives in mealtime. No other quantity or quality metrics were significantly different between contexts.

In terms of parental language pragmatic functions, there was an overall significant difference between play and mealtime contexts [$F(4, 72) = 8.10$, $p < .001$, Wilk's L = 0.690, partial $h^2 = 0.310$]. For individual functions, a significantly greater proportion of directives was given in play, and significantly greater proportions of questions were asked and descriptions were provided in mealtime. There was also a non-significant but greater proportion of affective utterances in play.

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Aim 2 – Parental language input among EL-A and LL-A groups in play and mealtime

The purpose of this aim was to determine if parental language input during play or mealtime differed between toddlers at EL-A and LL-A. All models were run with receptive language, expressive language, and visual reception included as covariates. During play, the quantity and quality of parental language input were not significantly different based on group [$F(8, 63) = 1.654$, p = .128; Wilk's L = 0.826, partial $h^2 = 0.174$]. Similarly, during mealtime, parental language quantity and quality were not significantly different based on group [$F(8,63) = 1.252$, p =.128; Wilk's L = .863, partial $h^2 = .137$]. Toddler expressive language, receptive language, and visual reception scores did not significantly contribute to either model.

When examining parental language pragmatic functions, there was a significant group difference during play [$F(4, 67) = 3.552$, p = .011; Wilk's L = .825, partial $h^2 = .175$]. When individual pragmatic functions were investigated and adjusted for multiple comparisons, no significant differences between groups remained. No significant group difference in parent pragmatic language was found during mealtime [$F(4,67) = 1.314$, p =.274; Wilk's L = .927, partial $h^2 = 0.073$]. Toddler expressive language, receptive language, and visual reception scores did not significantly contribute to either model.

Aim 3 – Associations between child skills and parental language input in play and mealtime

The purpose of this aim was to explore the relationship between child variables and parental language input, regardless of toddlers' likelihood status, during play and mealtime. Correlations included independent variables (child MSEL and SPA scores) and dependent variables (parental language input metrics).

Toddler language

There was a small correlation (r = -.25) between toddler MSEL expressive language T-scores and parents' proportion of verbs in mealtime (i.e., higher expressive language skills were associated with lower proportions of verbs). The other correlations between toddler MSEL expressive language T-scores and parental language variables were very small (see Table 4). There were small correlations between toddler MSEL receptive language T-scores and several parental language variables. In play, parents' number of words per minute was positively associated with toddler receptive language skills (r = .23). In mealtime, parents' proportion of descriptions was positively associated with toddler receptive language skills (r = .27). There was also a small negative association between toddler receptive language and the proportion of verbs during play (r = -.26) and mealtime (r = -.22), such that parents of toddlers with higher receptive language skills demonstrated a lower proportion of verbs (see Table 4).

Toddler fine motor

There were no strong correlations between toddler MSEL fine motor T-scores and any parental language variables during play; however, there were small associations with several parental language variables during mealtime. There was a small negative relationship between toddler fine motor score and utterances per minute (r = -.25), words per

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Table 4. Child Language Scores (MSEL) Correlated with Parental Language by Context

Variable	Context	Expressive Language		Receptive Language	
		r	p value	r	value
Proportion of Nouns					
	Play	–.04	.72	.03	.78
	Mealtime	.18	.11	.05	.67
Proportion of Verbs					
	Play	–.15	.19	–.26*	.02
	Mealtime	–.25*	.03	–.22*	.06
Proportion of Adjectives					
	Play	.09	.45	.03	.80
	Mealtime	.14	.24	–.04	.75
MLU					
	Play	.02	.90	.12	.31
	Mealtime	–.02	.85	.12	.32
TTR					
	Play	.03	.79	.10	.37
	Mealtime	–.01	.91	.01	.91
Utterances per Minute					
	Play	.04	.73	–.08	.47
	Mealtime	–.06	.61	.06	.62
Words per Minute					
	Play	.07	.56	.23*	.05
	Mealtime	–.04	.76	.12	.30
Different Words per Minute					
	Play	.04	.71	–.08	.51
	Mealtime	–.04	.73	.13	.26
Affective					
	Play	.08	.50	.18	.12
	Mealtime	.08	.49	.14	.22
Directive					
	Play	–.09	.44	–.16	.16
	Mealtime	–.19	.10	–.19	.11
Descriptive					
	Play	.00	.97	–.04	.76
	Mealtime	.17	.14	.27*	.02

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Table 4. *(Continued)*

Variable	Context	Expressive Language		Receptive Language	
		r	p value	r	value
Questions					
	Play	.03	.78	.05	.65
	Mealtime	.01	.92	–.13	.26

Note. * small effect size; ** medium effect size; *** large effect size

minute (*r* = -.20), and number of different words per minute (*r* = -.27) during mealtime. That is, parents of toddlers with higher fine motor scores produced fewer utterances, words, and different words per minute (see Table 5).

Toddler nonverbal cognition

There were only very small correlations between toddler MSEL visual reception/nonverbal cognition T-scores and parent language variables during play. There were small negative correlations between toddler MSEL visual reception/nonverbal cognition T-scores and utterances per minute (*r* = -.20) and different words per minute (*r* = -.23) during mealtime (see Table 6).

Toddler sensory reactivity

In terms of toddler sensory reactivity, there were only very small correlations between SPA hyperresponsiveness and all parental language variables during play. One small negative relationship between hyperresponsiveness and parental language was found during mealtime: parents of toddlers with more hyperresponsiveness demonstrated a lower proportion of descriptions (*r* = -.24). Conversely, toddler's SPA hyporesponsiveness was correlated with multiple parent language variables. In play, there was a small negative correlation between toddler hyporesponsiveness and parental mean length of utterance (MLU) (*r* = -.28), type token ratio (TTR) (*r* = -.21), proportion of questions asked (*r* = -.28), and proportion of descriptions (*r* = -.20). That is, parents of toddlers who demonstrated more difficulties orienting to sensory stimuli asked fewer questions, used fewer descriptives, had lower mean lengths of utterance, and had lower TTR. There was also a small positive correlation between toddler SPA hyporesponsiveness and parental use of directives (*r* = .21). In mealtime, there were small negative correlations between toddler hyporesponsiveness scores and MLU (*r* = -.20), TTR (*r* = -.26), proportion of verbs used (*r* = -.29), and proportion of questions parents asked (*r* = -.20). There was also a medium positive correlation between toddler SPA hyporesponsiveness and the proportion of directives parents used (*r* = .35). These findings indicate that parents of toddlers demonstrating more hyporesponsiveness produced a lower MLU, fewer verbs, fewer questions, and fewer unique words during mealtime, but more directives (see Table 7).

Table 5. Fine Motor Scores (MSEL) Correlated with Parental Language by Context

Variabl	Context	r	p value
Proportion of Nouns			
	Play	–.08	.48
	Mealtime	.13	.25
Proportion of Verbs			
	Play	.01	.91
	Mealtime	–.09	.45
Proportion of Adjectives			
	Play	.08	.48
	Mealtime	–.01	.90
MLU			
	Play	.11	.36
	Mealtime	–.03	.81
TTR			
	Play	.09	.47
	Mealtime	–.02	.86
Utterances per Minute			
	Play	–.05	.65
	Mealtime	–.25*	.03
Words per Minute			
	Play	–.17	.15
	Mealtime	–.20*	.09
Different Words per Minute			
	Play	–.05	.69
	Mealtime	–.27*	.02
Affective			
	Play	–.08	.49
	Mealtime	–.07	.54
Directive			
	Play	–.01	.95
	Mealtime	–.03	.80
Descriptive			
	Play	–.12	.31
	Mealtime	–.00	.99

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Table 5. *(Continued)*

Variabl	Context	r	p value
Questions			
	Play	.13	.26
	Mealtime	.12	.33

Note. * small effect size; ** medium effect size; *** large effect size

Discussion

This study examined the quality, quantity, and pragmatic functions of parental language input during play and mealtime in toddlers at LL-A and EL-A. The context of the interaction – play or mealtime – significantly impacted parental language input: parents demonstrated different language patterns in terms of quantity, quality, and pragmatic functions. Pragmatic functions during play overall differed by the toddler's likelihood of autism, and some metrics of parental language were associated with toddler developmental skills, particularly fine motor skills and sensory hyporesponsiveness.

Aim 1: Contexts – play versus mealtime

Our results provide initial support for an effect of context on the quality, quantity, and pragmatic functions of parental language input. Within play, we found that parents used more directives and verbs as well as a greater quantity of language overall – a statistically significant higher number of words and a clinically significant higher number of utterances per minute and different words per minute – compared to during mealtime. We hypothesize that during play, parents may make joint attention bids and guide toddlers on how to interact with a toy, resulting in more directives that included verbs. This is consistent with previous studies showing that play involves more prompting by parents to produce actions and that mothers use more verbs than nouns during play (Goldfield, 2000). A higher proportion of verbs fits naturally with an increase in directives, which involve verbs to direct action.

Our finding that parents provide more overall language input in play versus mealtime is supported by existing research on children with developmental delays (Ferm et al., 2005; Harding et al., 2013). However, previous studies on typically developing infants have not reported differences in parental language between mealtime and play (Zimmerman et al., 2019). Given that our sample was inclusive of toddlers with developmental delays in both the EL-A and LL-A subgroups (see Table 3 in Method section), our study, coupled with others, supports the hypothesis that mealtimes elicit less parental language input in developmentally delayed young children. In addition, during mealtime, parents used more adjectives, descriptions, and questions. This is consistent with work by Harding et al. (2013) who reported that parents of the youngest nonverbal children in their mealtime study made more comments and asked more questions about the child's enjoyment of the meal such as "mm", "yum", and "Is it nice?" Our population was similar, with most toddlers demonstrating limited verbal language, and we found similar patterns in that parents discussed their toddlers' enjoyment of the food using adjectives like yummy, good, delicious, tasty, and favorite. Furthermore, parents also described characteristics of food using adjectives like sticky, cold, little, salty, and sweet. Similar to the Harding et al. (2013) findings, parents in our study used these adjectives in questions such

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Table 6. Child Cognition Scores (MSEL) Correlated with Parental Language by Context

Variable	Context	r	p value
Proportion of Nouns			
	Play	–.16	.17
	Mealtime	.03	.78
Proportion of Verbs			
	Play	–.13	.28
	Mealtime	–.18	.12
Proportion of Adjectives			
	Play	.11	.33
	Mealtime	.04	.71
MLU			
	Play	.00	.97
	Mealtime	–.01	.93
TTR			
	Play	.06	.59
	Mealtime	.00	.99
Utterances per Minute			
	Play	–.14	.25
	Mealtime	–.20*	.09
Words per Minute			
	Play	–.06	.62
	Mealtime	–.14	.22
Different Words per Minute			
	Play	–.14	.23
	Mealtime	–.23*	.05
Affective			
	Play	–.12	.33
	Mealtime	.03	.83
Directive			
	Play	–.10	.41
	Mealtime	–.19	.11
Descriptive			
	Play	–.01	.97
	Mealtime	–.04	.74

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Table 6. *(Continued)*

Variable	Context	r	p value
Questions			
	Play	.10	.40
	Mealtime	.19	.10

Note. * small effect size; ** medium effect size; *** large effect size

Table 7. Child Sensory Reactivity Scores (SPA) Correlated with Parental Language by Context

		Hyper		Hypo	
Variable	Context	r	p value	r	value
Proportion of Nouns					
	Play	–.01	.97	–.01	.92
	Mealtime	–.19	.10	.05	.67
Proportion of Verbs					
	Play	.06	.59	.11	.33
	Mealtime	–.01	.93	.29*	.01
Proportion of Adjectives					
	Play	–.16	.16	.06	.63
	Mealtime	.06	.61	–.17	.14
MLU					
	Play	.01	.95	–.28*	.02
	Mealtime	–.09	.43	–.20*	.08
TTR					
	Play	–.03	.80	–.21*	.07
	Mealtime	.12	.30	–.26*	.02
Utterances per Minute					
	Play	–.06	.64	–.00	.98
	Mealtime	.13	.26	.13	.26
Words per Minute					
	Play	.01	.90	–.11	.36
	Mealtime	.07	.56	.06	.62
Different Words per Minute					
	Play	.05	.66	–.02	.86
	Mealtime	.04	.72	.02	.89

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Table 7. *(Continued)*

Variable	Context	Hyper		Hypo	
		r	p value	r	value
Affective					
	Play	–.03	.79	.19	.10
	Mealtime	.18	.13	–.00	.97
Directive					
	Play	.01	.94	.21*	.07
	Mealtime	–.01	.94	.35**	.002
Descriptive					
	Play	–.10	.40	–.20*	.09
	Mealtime	–.24*	.04	–.08	.51
Questions					
	Play	.07	.57	–.28*	.02
	Mealtime	.06	.61	–.20*	.09

Note. * small effect size; ** medium effect size; *** large effect size

as "Is it yummy?" and in descriptions like "It's cold." In play, parents were less likely to describe characteristics of items such as toys or ask about the toddler's enjoyment of them.

Notably, there were no significant differences in MLU, TTR, or proportion of nouns used between play and mealtime. There is little existing research comparing these measures in play versus mealtime in young children. However, our results are consistent with those of Zimmerman et al. (2019), who reported no significant differences in maternal noun percentage or TTR between solid food feeding and play for typically developing infants.

Overall, different contexts elicited different types and amounts of language from parents. During play, parents directed actions with verbs and used more overall language. During mealtime, parents offered more descriptions, used more adjectives, and asked more questions. These findings suggest that for toddlers in this age range and with emerging verbal skills, play contexts may provide a rich environment for overall language learning opportunities while mealtime contexts may facilitate more interpersonal opportunities through the increased use of questions (and thus opportunities to respond) and discussion of food characteristics.

Aim 2: Likelihood of autism

We found that the only differences in parental language input based on toddlers' autism likelihood status (EL-A v LL-A) existed in overall pragmatic language categories during play; however, no single function category drove the group differences. This suggests individual variation, and given that the child variables (receptive and expressive language and visual reception) were not significant in the model, parents of toddlers at varying likelihood of autism may vary their language in response to specific child characteristics,

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like joint attention or intentional communication, rather than their toddler's 'likelihood status' given the wide spectrum of characteristics among toddlers with autism or at EL-A. Additionally, quantity and quality of language input were not significantly different between groups. Previous studies have shown similar amounts of parental language input across children at different levels of familial likelihood of autism (Campbell et al., 2015; Swanson et al., 2018) and with and without language delays (Vigil et al., 2005). Specifically, a study of parental language input at 12, 18, and 24 months across toddlers at high vs. low familial likelihood of autism found no differences in parental language input during play when controlling for toddler communication at 12 months (Choi et al., 2020), which is consistent with our findings of parental language quantity and quality with a similar age group. Finally, because a number of toddlers at LL-A in our sample demonstrated developmental delays, a comparison of parental language of toddlers with EL-A and toddlers without developmental delays might yield different findings. Note, however, that we covaried for toddler receptive and expressive language and visual reception skills in our analyses, thereby statistically controlling for these common developmental differences between toddlers at EL-A and those at LL-A. Future studies may examine toddlers at EL-A, toddlers at LL-A but with developmental delays, and toddlers with neurotypical development, to elucidate how parental language input may differ among these three groups.

Aim 3: Child characteristics

Using a transactional framework in our understanding of caregiver-toddler interactions, we expected to find evidence for associations between parental language input and toddler characteristics. While our findings suggested that parental language input did differ in relation to varying levels of toddler characteristics, we found limited evidence suggesting an impact of toddler expressive language or cognitive skills on parental language in this sample, as previous studies have found (e.g., Fusaroli et al., 2019). Instead, we found that the levels of receptive language, fine motor ability, and sensory hyporesponsiveness among toddlers (11-16 months) were associated with differences in parental language input within and across contexts.

Toddler language skills

There is some evidence that parents of children with autism slightly older than in our sample (age 2-5 years) modify their speech based on the language skills of their child (Fusaroli et al., 2019), but many studies do not differentiate between child expressive and receptive language. We found different effects among these on parental language input. Toddler expressive language scores were not meaningfully correlated with any parental language variables other than parental use of verbs during mealtime. Expressive language may have been less impactful in our study because most toddlers in the study were preverbal, which may have resulted in less variation in MSEL Expressive Language scores. However, it should be noted that the MSEL includes items related to overall expressive language (e.g., babbling, gestures) and not expressive vocabulary alone. Future studies may explore other measures of expressive language and vocabulary to more fully understand the relationship between expressive language growth and parental language input.

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In contrast, toddler receptive language was meaningfully associated with several parental language variables. For example, parents of toddlers with higher receptive language skills used a lower proportion of verbs in their language during play and during mealtime, more words per minute during play, and more descriptives during mealtime. These findings suggest that parents of toddlers with varying receptive language levels may alter their language input, particularly their usage of verbs and descriptions, based on their toddler's strengths or difficulties with receptive language, but further research is needed. Additionally, future studies should expound upon the characteristics of verbs and other content words used by parents in relation to differences in receptive language; for instance, it may be that the lower proportion of verbs or greater use of descriptions may reflect differences in types of content words provided to toddlers (e.g., action vs. stative verbs).

Toddler fine motor skills

Parents of toddlers with lower fine motor scores produced more utterances per minute, words per minute, and different words per minute during mealtime. We were unable to find previous studies directly examining child fine motor skills in relation to parent language. One might hypothesize that toddlers with lower fine motor skills may be less adept at self-feeding and therefore elicit more language input from parents for encouragement and instruction, in contrast to toddlers with stronger fine motor skills. However, we did not find evidence for this possibility in our analysis of parent pragmatic function use in mealtime. In fact, there were only very small correlations between toddlers' fine motor skills and parent pragmatic functions. An alternative explanation is that parents who support their toddler's fine motor skills may be more at eye level and able to monitor the toddler's face and reactions. In this way, they may be more tuned to the toddler's nonverbal cues and provide more responsiveness, in contrast to parents who are not as actively engaged in helping their toddler feed. Given the paucity of research on this subject, further study is recommended to elucidate the significance of this finding.

Toddler sensory reactivity

Toddler sensory hyperresponsiveness and sensory seeking were only meaningfully correlated with parental use of descriptives during mealtime. In contrast, toddler sensory hyporesponsiveness was meaningfully correlated with numerous parental language metrics across both contexts. Hyporesponsiveness is not uncommon in young children at EL-A and children with developmental delays and has been linked to child communication patterns and parental responsiveness (Baranek et al., 2013; Feldman et al., 2021; Kinard et al., 2017; Watson et al., 2011). Specifically, hyporesponsiveness is associated with later outcomes such as poorer joint attention (Baranek et al., 2013) and social communication (Feldman et al., 2021; Watson et al., 2011). These patterns may impact their parents' responsiveness and language. For example, Kinard et al. (2017) found that parents of young children at EL-A with high hyporesponsiveness made fewer comments and directives and used more physical play actions during play. Our results are generally consistent with this finding, demonstrating that parents asked fewer questions and gave fewer descriptions to toddlers with higher levels of hyporesponsiveness. In contrast, Harrop et al. (2018) found that in an older sample of children with autism aged 6-8 years, parents used more prompting and redirection in an effort to direct children with

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high hyporesponsiveness to events around them. This is consistent with our finding that parents of children with higher hyporesponsiveness used more directives in both play and mealtime, but differs from findings of Kinard et al. (2017). The disparate finding in directives may reflect the contexts in which the studies were conducted, or differing trajectories of parent responses over time. Future research may examine this trajectory and how parent responses might impact child joint attention and language skills across child development.

Interestingly, we also found that parents of toddlers with more sensory hyporesponsiveness used less complex language, but not a lower quantity of language. This contrasts with Kinard et al. (2017) who reported parents of infants at EL-A with higher hyporesponsivity talked less during play and may reflect the different context and length of language samples used between the two studies. The lower complexity of language evidenced in our study may reflect previous findings that child hyporesponsiveness is linked to lower child language skills (Feldman et al., 2021). Parents of children who are more hyporesponsive may have fewer cues from their child to respond to, so their language input may be less rich with simpler utterances to adjust their language to perceived child language levels. These findings could have significant implications for how parents are coached to better engage their child's attention as well as identify and respond to their child's communication attempts in language interventions.

Overall, our study suggests that parental language input to toddlers at EL-A and LL-A during play is primarily associated with toddlers' receptive language skills and levels of sensory hyporesponsiveness. Parents used more words per minute and fewer verbs with toddlers with high receptive language and produced a lower MLU and TTR as well as fewer questions and more directives with toddlers with higher hyporesponsiveness. Toddler fine motor skills were primarily associated with parental language during mealtime. Specifically, parents used fewer utterances, word per minute, and different words per minute with toddlers with high fine motor skills. The varying associations of parent language with these toddler variables indicate that the underlying mechanisms producing these differences are more complex than simple associations with the toddler's global development. The results of this study suggest that the relationship between parental language input and children's developmental characteristics differs across contexts which tap various aspects of children's skills and/or parents' priorities.

Future directions

Our findings that parental language in play and mealtime differs support the need for further research into parental language input across other frequently occurring routines, like bath time or dressing, as well as varying play and mealtime routines, such as outdoor versus indoor play, or mealtime at different times of day or with different family members. Our study is one of the first to include child fine motor skills when considering parental language and found a relationship between child fine motor skills and parental language. Future studies on parental language input should include child fine motor skills in their transactional models. Similarly, given the frequency of sensory processing differences among children with autism, sensory responsiveness should be included in future studies of parental language. In particular, elucidating the mechanism by which sensory hyporesponsiveness impacts parental language would be beneficial for improving intervention and social responsiveness for this population. The impact of child receptive language on parental language input yielded mixed findings and should be addressed in future studies.

This study lacked a comparison group with neurotypical development, and future studies would benefit from such a group in addition to those included in the present study to observe how parental language across contexts may differ among EL-A, developmentally delayed, and neurotypical children. Sibling pairs may also yield more informative findings about how the same parents change their language based on the child's skills.

Limitations

While this study presents important findings on parental language input to young children, there were several limitations. First, our sample consisted of primarily White, non-Hispanic/Latino toddlers with at least one parent with a college education and a family income more than $60,000, and therefore results may not generalize to more diverse populations. Parental education level was significantly different between the LL-A and EL-A group but was not controlled for in analyses due to the significant number of parents who did not report education level in the EL-A group, which may have affected our findings as parental education could impact parental language. The play and mealtime interactions in this study occurred in a laboratory setting in which the parents knew they were being audio/videotaped, which may have altered their interactions, although prior work has reported similar parental responsiveness in the home and laboratory environments in typically developing children (Madigan et al., 2019). Additionally, given the constraints of the secondary data analysis – only five-minute segments of play and mealtime were available for analysis which may have impacted the ability to detect indivudal differences – longer recording times may improve this ability (e.g., Anderson et al., 2021). With advancing technologies there are increased opportunities to compare extended play and mealtime language samples in the home environment, which should be explored in future work. Additionally, we used a single, adapted, frequency-based coding schema in this study. Other researchers have found that in a task-based situation (building block constructions from a book), global coding schemes were better able to detect qualitative aspects of parent-child interaction among children with autism (Bontinck et al., 2018). Given that mealtime is a relatively novel coding context, future studies should examine the appropriateness of multiple coding schemas for detecting different aspects of parent-child interactions and language. Existing research has found that parental language has greater impact as the child ages, which may explain our mixed and null findings given our narrow age range (11 to 16-months). Future research may include wider age groups to examine how the influence of parent language during both play and mealtime varies with age. This was a cross-sectional study, and future studies using longitudinal designs may provide better insights into potential causal relationships by examining how parental language input and child language skills change over time.

Conclusions

This study aimed to better understand characteristics of parental language input during play and mealtime and to explore associations with toddler characteristics. Our findings provide further support for a transactional relationship between parental language input and toddlers' developmental skills and expands previous research by exploring differences across contexts. We found evidence for an effect of context on the quantity, quality, and pragmatic functions of parental language input to toddlers. We found that pragmatic functions were the only aspect of parental language input that differed across toddlers' autism likelihood status during play, with post hoc results suggesting that this difference varied at the dyad level rather than differences in the use of any particular pragmatic function. Finally, we found that toddlers' fine motor skills, receptive language skills, and sensory hyporesponsiveness were associated with differences in parental language input that varied across context. Future research examining parental language input across developmental trajectories should consider pragmatic functions in addition to quantity and quality of language as well as how the assessment context might impact research findings.

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Competing interest. Authors Baranek and Watson were involved in the development of the First Years Inventory (FYI), a screening tool to identify elevated likelihood of autism in infants 6–16 months. Author Baranek developed the Sensory Processing Assessment (SPA), an assessment of sensory features in infants and children 6 months to 9 years. Both the FYI and SPA are freely available, so there are no financial benefits associated with the use of these measures.

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