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Original Article

Sensory profile in infants and toddlers with behavioral insomnia and/or feeding disorders

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ABSTRACT

Background: Sleep and feeding difficulties are two common disorders in early childhood. It has been shown that feeding difficulties are more common among children with sleep disorders and vice versa. Since a child's characteristics play a substantial role in these two conditions, we aimed to investigate the sensory profile of infants and toddlers with behavioral insomnia (BI) or feeding disorders (FDs) in comparison with healthy age-matched controls.

Methods: Children aged 7–36 months with BI or FD were recruited from the sleep and feeding disorders clinics. Healthy controls were recruited from well-baby clinics. Parents completed a questionnaire which included demographics and socioeconomic status, as well as a sensory profile evaluation using the Infant/Toddler Sensory Profile (ITSP).

Results: Twenty-five children with BI, 28 with FDs and 32 controls were recruited. Oral processing scores were significantly lower in both BI and FD groups vs the controls ($p = 0.015$ and 0.001, respectively). Auditory processing scores were lower in the FD group vs the controls ($p = 0.028$). The scores of three out of the four ITSP sensory quadrants (Low Registration, Sensory Sensitivity, and Sensation Avoiding) were significantly lower in the FD group vs the controls ($p = 0.027$, 0.025, and 0.001, respectively), and in one quadrant (Sensation Avoiding) in the BI group vs the controls ($p = 0.037$).

Conclusions: There were considerable differences in sensory processing, as reported by parents between children with BI and those with FDs compared to healthy controls, most often in the direction of the 'hypersensitive' profile. These differences may underlie the development and partially explain the coexistence of the two disorders. Sensory profile may be a target of intervention as part of the management of sleep and feeding disorders in early childhood.

1. Introduction

Behavioral insomnia (BI) of childhood is a prevalent condition, affecting 10–30% of children aged 6–36 months [1]. The clinical manifestations consist of difficulty in falling or staying asleep or both. These difficulties usually reflect certain established patterns of interaction between parent and child at times of sleep transition [1,2]. Interaction between caregiver characteristics, child characteristics, and parent–child interaction factors substantially contribute to this disorder [1,2]. If left untreated, bedtime problems, and night awakenings can negatively impact the daytime functioning and behavior of both the child and the entire family. BI can lead to increased irritability, temper tantrums, impaired emotion regulation and behavior problems on the part of the child. It can also shorten parental sleep, leading to increased sleepiness, negative mood and decreased daytime functioning on the part of the parents [3].

Feeding difficulties are common in pediatric practice and encompass a spectrum ranging from children with physiological difficulties in ingesting food, through picky eaters to full-fledged infantile feeding disorders. They may include inappropriate/disruptive mealtime behaviors, food refusal, self-feeding inadequacy, excessive mealtime duration, and food selectivity [4–7]. The prevalence of problematic eating and feeding behaviors is 25%

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in infants and young children [4–7]. Problematic eating and feeding behaviors are sources of concern for parents and, if prolonged, can lead to weight loss or failure to gain weight and cause cognitive and developmental delay [8–10]. Feeding disorders (FDs) in healthy children are linked to a variety of causes, ranging from environmental disruption, parental incompetence, the child's temperament, and psychological factors. It has been shown that certain characteristics of the infant combined with certain vulnerabilities in the parent lead to negative responses and conflicts in their interactions [11].

We recently discovered that feeding and eating difficulties are more prevalent among children with BI of childhood, and that sleep problems are more frequent in children with FDs [12]. We also observed that maternal characteristics, such as knowledge/attitude/perceptions about sleep and feeding, are different in these two disorders in comparison with controls [13]. A child's characteristics might play a substantial role in these two common conditions, leading to the development of sleep difficulties, feeding difficulties or both in early childhood. The child's characteristics may affect parent–child daily interactions including bedtime and mealtime interactions. Sensory profile is one of the child's characteristics, often reported by parents and caregivers.

Sensory processing is the ability to integrate information received from the body's basic sensory systems and to form appropriate and efficient behavioral responses. Impaired sensory processing may result in various functional problems and affect daily routines. The Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC 0–3) [14] defines three types of regulation disorders of sensory processing in infants: hypersensitive (corresponding to 'sensory over-responsivity'), hyposensitive (corresponding to 'sensory under-responsivity') and Sensory Seeking. Sensory difficulties may underlie/mediate the development of both sleep and feeding disorders. It is possible that the child's early sensory characteristics may affect daily parent–child interactions, including those at bedtime and mealtimes. Indeed, sensory processing impairments have been found in school-aged children with sleep difficulties [15] as well as in children with feeding disorders [16,17].

The aim of the present study was to investigate the sensory profile of children with BI and children with FDs in comparison with healthy controls. Our hypothesis was that sensory processing difficulties are more common in children with sleep disorders and in those with FDs compared to children without such difficulties.

2. Methods

Children 7–36 months of age who were diagnosed as having BI based on the International Classification of Sleep Disorders criteria [1] were recruited from the Pediatric Sleep Center at Dana Children's Hospital. Infants and toddlers who were diagnosed as having FDs based on Chatoor criteria [6] were recruited from the Clinic of Feeding Disorders at Dana Children's Hospital. In addition, children in the same age group who attended the well-baby clinics in metropolitan Tel Aviv for routine periodic medical examinations were recruited and served as controls. Children with chronic medical conditions, congenital abnormalities or developmental delay were excluded from the study.

Parents of all the participating children completed a questionnaire which included demographics and socioeconomic status, as well as a sensory profile evaluation. In addition, all participants completed the Brief Infant Sleep Questionnaire (BISQ) which is a validated sleep questionnaire for screening of sleep problems [18] and the Behavioral Pediatrics Feeding Assessment Scale (BPFAS) for screening of FDs [5]. These questionnaires were used in our previous publications [12,13].

The sensory profile was assessed using the Infant/Toddler Sensory Profile (ITSP), which is a validated tool for measuring sensory processing [19,20]. The ITSP is a 48-item caregiver questionnaire that measures sensory processing abilities as reflected in daily experiences among children aged 7–36 months. The caregiver's responses are summarized according to standardized scoring procedures and then interpreted in terms of the impact that a child's sensory processing abilities may have on the lives of the child and the family. Parents rate the frequency of the child's behaviors on a five-point scale from one (almost always) to five (almost never).

The total frequency of behaviors is calculated for each sensory modulation section: auditory, visual, vestibular, tactile, and oral sensory (these are the ITSP sensory section scores). The scores are then grouped based on the Dunn's Model of Sensory Processing [19,20] into four quadrant scores (ITSP sensory quadrant scores): Low Registration (high sensory thresholds with passive responding strategies), Sensation Seeking (high sensory thresholds with active responding strategies), Sensory Sensitivity (low sensory thresholds with passive responding strategies), and Sensation Avoiding (low sensory thresholds with active responding strategies). In addition, a Low Sensory Threshold score is calculated by summing the Sensory Sensitivity and Sensation Avoiding quadrant scores. Lower scores on the ITSP indicate a higher frequency of response.

The study was approved by the Institutional Review Board at the Tel Aviv Medical Center, and informed consent was obtained from all parents. The trial was posted on www.clinicaltrials.gov (NCT02040688).

Statistical analyses were performed with SPSS (version 22.0; SPPS Inc., Chicago, IL). Comparisons of variables according to group assignment (BI, FD, and control) were performed with independent *t*-tests or analysis of variance (ANOVA) followed by post-hoc comparisons, with *p* values adjusted for unequal variances when appropriate (Levene's test for equality of variances), or χ^2 analyses with Fisher's Exact Test (dichotomous outcomes). Comparisons of variables that were not normally distributed were performed with the Wilcoxon Mann–Whitney non-parametric test. All reported *p* values are two-tailed, with statistical significance set at <0.05. Effect Sizes (ESs) were calculated by Cohen's d (delta) for means and standard deviations and by d (Probit Method) for Dichotomous Proportions/Percentages.

3. Results

Between January 2012 and December 2015, 85 infants and toddlers were recruited: 25 with BI, 28 with FDs and 32 controls. The characteristics of the children in the three groups are presented in Table 1. A family history of sensory integration disorder was reported in three cases (one from the FD group and two from the control group).

Table 1
Characteristics of children with insomnia of childhood, feeding disorders, and controls.

Variable	Behavioral insomnia ($N = 25$)	Feeding disorders ($N = 28$)	Controls ($N = 32$)	*p*
Age (years)	1.18 ± 0.55	1.31 ± 0.66	1.45 ± 0.74	0.32
Gender (male %)	68	71	47	0.11
Maternal age (years)	34.7 ± 4.6	33.3 ± 4.6	34.3 ± 4.3	0.53
Paternal age (years)	37.6 ± 5.5	37.3 ± 7.1	36.6 ± 4.5	0.81
Maternal education (years)	16.2 ± 3.0	14.6 ± 2.7	16.0 ± 2.4	0.08
Paternal education (years)	15.7 ± 2.9	14.8 ± 2.7	16.2 ± 3.2	0.21
Gestational age (weeks)	38.4 ± 1.8	39.5 ± 1.3	38.7 ± 2.2	0.08
Birth weight (kg)	3.10 ± 0.51	3.17 ± 0.43	3.15 ± 0.43	0.86
Number of children	1.76 ± 0.83	2.04 ± 1.26	1.58 ± 0.67	0.19
Birth order	1.88 ± 0.97	1.75 ± 0.92	1.53 ± 0.76	0.32