The Open Journal of Occupational Therapy

Volume 5
Issue 4 *Fall 2017*

Article 3

10-1-2017

# Association between Sensory Processing by Children with High Functioning Autism Spectrum Disorder and their Daily Routines

Tsameret Ricon
*University of Haifa, Israel*, tsricon@gmail.com

Rachel Sorek
*University of Haifa, Israel*, rachelsorek@gmail.com

***See next page for additional authors***

**Credentials Display**
Dr. Tsameret Ricon, OTR; Rachel Sorek, MA, OTR; Professor Batya Engel-Yeger, OTR


DOI: 10.15453/2168-6408.1337

# Association between Sensory Processing by Children with High Functioning Autism Spectrum Disorder and their Daily Routines

**Abstract**

**Background**: Children diagnosed with autism spectrum disorder exhibit persistent deficits in social communication and social interaction accompanied by restricted, repetitive patterns of behavior, interests, or activities. Those with normal intelligence are considered to have high functioning autism spectrum disorder (HFASD).

**Method**: The study participants were 20 children with HFASD aged 5 to 7 years old attending mainstream educational programs and their parents (study group) and 30 typically-developing age-matched children from the same socio-economic background and their parents (control group). Parents from both groups completed the Short Sensory Profile to investigate their children's sensory processing and the presence of Sensory Processing Disorder. Children and parents from both groups were administered the Make My Day (MMD) to obtain information regarding the children's participation and performance in daily activities.

**Results**: The study group had significantly more sensory difficulties, which correlated with restricted daily routines, compared with the control group. SPD significantly predicted the quality and independence of the performance of daily activities by children with HFASD as measured by the MMD.

**Conclusions**: SPD may be a worthwhile therapeutic target for therapists seeking to improve participation in and performance of daily activities, as identified by the MMD, among children with HFASD.

**Keywords**

kindergarten; elementary school; occupational therapy; routine daily activities; autism spectrum disorder; child self-reports

**Complete Author List**

Tsameret Ricon, Rachel Sorek, and Batya Engel Yeger

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that typically manifests during the first 3 years of life. High functioning autism spectrum disorder (HFASD) constitutes the least severe expression of autistic spectrum disorders (American Psychiatric Association [APA], 2013). Children with HFASD have relatively high cognitive and language abilities and are often integrated into the regular school system. Nonetheless, these children usually present with severe difficulties in social communication (Sansosti & Sansosti, 2013; Volkmar & Lord, 2007); behavioral inflexibility; coping with changes; restricted, repetitive, and/or stereotypical behaviors; and sensory processing disorders (Wright & Northcutt, 2005).

Sensory processing refers to the central nervous system's ability to receive, interpret, process, organize, and modulate sensory input in a graded manner appropriate to environmental demands (Dunn, Saiter, & Rinner, 2002; Miller, Anzalone, Lane, Cermak, & Osten, 2007). Individuals with sensory processing disorders (SPD) find it difficult to register and modulate sensory information and to organize sensory input to execute successful adaptive responses to situational demands (Humphry, 2002). SPD is expressed as hyper or hyposensitivity to typically nonaversive stimuli (Miller, Coll, & Schoen, 2007). Individuals with hypersensitivity experience such stimuli as uncomfortable and, consequently, resort to various coping strategies and display extreme emotional responses. Sensory hypersensitivity is associated with anxiety (Engel-Yeger & Dunn, 2011), irritability, and high levels of arousal (Kinnealey & Fuiek, 1999; Pfeiffer, Kinnealey, Reed, & Herzberg, 2005). By contrast, sensory hyposensitivity is associated with low levels of arousal. Both hypo and hypersensitivity may limit a child's adjustment to environmental situations (Pfeiffer et al., 2005) and his or her participation in and performance of activities in various daily contexts, such as personal activities of daily living (PADLs) and domestic or instrumental activities of daily living (IADLs) (Engel-Yeger, 2008; White, Mulligan, Merrill, & Wright, 2007; Yakir-Katz, 2009). SPD can lead to an awareness of personal inefficacy, a lack of control, or dissatisfaction with performance (Mulligan, 1996). Bar-Shalita, Vatine, and Parush (2008) found that parents of children aged 6 to 10 years with SPD reported that their children participate in fewer everyday activities than typical children, which correlates with their level of displeasure in performing them.

It has been reported that 45% to 95% of children with autism have SPD (Baker, Lane, Angley, & Young, 2008; Ben-Sasson et al., 2009), and the prevalence of sensory overreactivity in this population ranges from 56% to 79% (Baranek, David, Poe, Stone, & Watson, 2006; Tomchek & Dunn, 2007). However, children with ASD may display behavioral responses reflecting a low sensory threshold for certain sensory stimuli in parallel with responses reflecting a high threshold for others (Miller, Reisman, McIntosh, & Simon, 2001; Shelly & Bundy, 2012), attesting to the complex nature of the disorder (Miller, 2006).

There is some research discussing how the sensory profiles of children with HFASD impact on their participation and daily life routines.

Hochhauser and Engel-Yeger (2010) examined the impact of SPD on leisure activity participation among children with HFASD. They reported that children with HFASD significantly differed from their typically developing peers with respect to tactile, taste and smell, movement, and auditory sensitivity, and that they more frequently displayed sensory seeking behaviors (i.e., actively seek out powerful sensory stimuli) (Dunn, 1997). Nevertheless, further studies are needed to expand our knowledge on this topic.

**Daily Routines**

Daily routine is defined as a collection of typical daily activities that are observable and repeated at fixed intervals during a typical day (Baum & Christiansen, 2005). Engaging in activities that structure one's daily routine is an integral part of human participation in various occupations (Law, 2002). Age-appropriate, efficient, and satisfying engagement in daily occupations has a significant impact on children's well-being (Clark et al., 1991). However, the literature provides little information regarding the daily routines of young children in general (Keadan-Hardan, 2012) and of children with HFASD in particular.

Children with ASD feel most comfortable when they are provided with the stability afforded through predictable daily routines (Larson, 2006). However, studies have revealed that the families of children with autism, desiring to comply with their children's need for rigid activity patterns, also experience significant constraints on their own daily routines (De Grace, 2004; Dunst, Trivette, Humphries, Raab, & Roper, 2001). Even slight variations in the family environment may bring about confusion, pressure, and anxiety (Groden, Cantela, Prince, & Berryman, 1994) and impair the family's ability to achieve a healthy, balanced daily routine (Rodger & Ziviani, 2006).

Research has indicated that routines, comprised of predictable and repetitive activities, such as dressing, eating, sleeping, and playing, are fertile ground for learning opportunities (Spagnola & Fiese, 2007) and can serve as effective intervention contexts to generate improved child functioning (Dunn, Cox, Foster, Mische-Lawson, & Tanquary, 2012). Therefore, interventions that help structure and adapt a family's routines to the needs of the various members can be effective in improving a child's functioning and participation in daily life activities (Dunn et al., 2012). Considering the high prevalence of SPD among children with ASD, it is likely that their difficulties in processing sensory information may significantly affect both their daily routines and those of their families.

Bagby, Dickie, and Baranek (2012) examined the effect that the sensory experiences of children with ASD have on their families' routines and occupations and revealed that parents find it difficult to share the experience and meaningfulness of family occupations with their child. Furthermore, Ben-Sasson, Soto, Martínez-Pedraza, and Carter (2013) found a relationship between the hyperresponsive behavior patterns of children with autism, disruptions in their families' daily routines, and parental stress. Moreover, Hochhauser and Engel-Yeger (2010) found that the atypical sensory processing patterns of children with HFASD, particularly their hypersensitivity to various stimuli,


DOI: 10.15453/2168-6408.1337

correlated with lower participation intensity and enjoyment from activities and a tendency to perform activities alone and at home. This increases the demands on their parents, who represent their source of social support in after-school activities. In line with the family-centered approach, it is vital that we consider the daily routines of children with HFASD and understand how they relate to the child's unique characteristics and specific needs. The prevalence of SPD among children with ASD and the suggestion that SPD impacts on their participation in daily life activities (Bar-Shalita, Vatine, & Parush, 2008; Hilton, Graver, & LaVesser, 2007; Kay, 2001; Reynolds et al., 2011) as well as their parents' well-being (Bagby, Dickie, & Baranek, 2012) similarly support the need to examine the familial context.

**Children's Self-Reports and Parental Reports**

In general, parents serve as experts and the main source of information regarding their children's abilities and difficulties in everyday life (Keen & Rodger, 2012). However, studies have shown that parental reports on their children's functioning often differ from their children's self-reports (Dunford, Missiuna, Street, & Sibert, 2005). For example, children tend to report a higher level of ability than their parents attribute to them (Missiuna, Pollock, Law, Walter, & Cavey, 2006). In addition, when a child is diagnosed with a disability, such as ASD, it is possible that the parents' report is influenced by a lack of communication between the parents and their child (Bagby et al., 2012), their denial of their child's diagnosis, or that they exaggerate the child's difficulties in order to obtain various services (Rogers, Hepburn, & Wehner, 2003). Thus, it is vital that therapists consider both the parents' and their children's points of view regarding their strengths and limitations (Sturgess, Rodger, & Ozanne, 2002).

Recent developments in the field of autism research reflect an increasing use of self-report tools to investigate the cognitive and behavioral characteristics of individuals in this population (Gillott, Furniss, & Walter, 2001; Zeedyk, Cohen, Eisenhower, & Blacher, 2016). Studies have reported the use of self-reports among children with HFASD, such as in assessing anxiety, participation in leisure activities, and sensory experiences (Hochhauser & Engel-Yeger, 2010; Yamin-Elias, 2013). The reliability of the self-reports of children with autism has been questioned based on their difficulties with self-reflection and expression of emotions (Capps, Yirmiya, & Sigman, 1992); however, useful information may be gained from the differences observed.

There is no well-established and widely accepted tool by which to assess the daily activity routines of children aged 4 to 7 years and to consider the perspectives of both children and their parents. The Make My Day (MMD) (Ricon, Hen, & Keadan-Hardan, 2013) was designed to collect data regarding the activities comprising children's typical daily routines at home and at kindergarten (aged 5 to 6 years) or school (aged 6 to 7 years). It also examines the characteristics of the children's daily routine, such as their activity sequence, their ability to schedule and organize activities, the quality of their performance, and their satisfaction with it. The child version of the MMD is a pictorial

tool that requires relatively little verbal expression and is suitable for use with young children.

The characteristics of children's daily activity routines inform occupational therapists as to their level of functioning and are a vital component of the assessment and intervention processes. The information derived from the MMD can assist in planning an intervention that focuses on improving the daily routine and functioning of children with HFASD and their families. Gaining the perspectives of both children and their parents is in line with the family-centered approach, which emphasizes collaboration between therapists, clients, and their families (Missiuna et al., 2006). Thus, the MMD helps direct intervention to address the specific needs of the child and the family.

Therefore, the aims of the present study were: (a) to examine the sensory profile of children aged 4 to 7 years with HFASD as expressed in daily life scenarios and compare them with those of typically developing children in the same age range; (b) to compare the daily routines of children with HFASD and those of typically developing controls, as reported in the MMD by children and their parents; (c) to examine whether differences exist between the parental and child reports and in each reporting group with respect to the child's daily routines; (d) to examine the relationships between SPD and daily routines among children with HFASD; and (e) to examine the contribution of group membership and sensory processing abilities to the prediction of daily routine characteristics.

We hypothesized that: (a) the study group (children with HFASD) would display more extreme sensory patterns; (b) the daily routines of children with HFASD and of typical controls would differ from each other as reflected in both the children's own reports and those of their parents; (c) the children's reports regarding daily routines would significantly differ from those of their parents in both study groups; (d) significant correlations would be revealed between sensory processing abilities and daily routine characteristics among the children with HFASD; and (e) the presence of SPD would significantly predict the children's daily routine functioning.

## Method

### Participants

The study included 50 children aged 5 to 7 years attending a mainstream educational framework. The study group included 20 children with HFASD and the control group included 30 typically developing children. The groups were matched by age and socioeconomic status. All of the participants were of normal intelligence as reported (for the study group) by competent medical experts (neurologist, developmental psychologist, or psychiatrist) or (for the control group) by their parents. Informed consent was obtained from all of the participants in the study.

Significant differences were found between the groups with respect to gender distribution, residence, and parental education. The participants in the study group met DSM-V criteria, as determined by a developmental psychologist and a psychiatrist or pediatric neurologist. To support the relevance of a past diagnosis of HFASD at the time of the study, the parents of the participants completed *The Childhood Autism Spectrum Test (CAST): Sex Differences* (CAST) (Williams et al.,

2008). Children with additional health conditions who took regular medication or who had visual and/or hearing deficits uncorrected by glasses and/or hearing aids were excluded from the study sample. Table 1 describes the sociodemographic information for each group.

**Table 1**
*Participant Sociodemographic Data*

| | | HFASD group (n = 20) | Typical controls (n = 30) | |
|---|---|---|---|---|
| Gender | Number of boys | 18 | 14 | $\chi 2 = 9.17$* |
| | Number of girls | 2 | 16 | |
| Child's mean age (years) | | 5.53 ± 0.75 | 5.37 ± 0.53 | t = 0.8 |
| Mother's education (years) | | 14.35 ± 2.56 | 16.30 ± 1.34 | t = 3.5** |
| Familial socioeconomic percentile | Low | 40 | 46 | $\chi 2 = 1.11$ |
| | Average | 35 | 40 | |
| | High | 25 | 14 | |

*Note*. *$p \leq 0.05$. **$p \leq 0.01$.

## Instrumentation

**Demographic questionnaire.** The demographic questionnaire was designed for this study to collect information regarding the child and his or her family (i.e., age of child, familial socioeconomic status, course of pregnancy and birth process, general development, child's health status).

***The Childhood Autism Spectrum Test (CAST): Sex Differences.*** The CAST (Williams et al., 2008) is a 37-item parental screening questionnaire designed to identify ASD among children aged 4 to 11 years. It includes 31 items (scored as 0 or 1) that contribute to a child's total score, along with six nonscored questions on the child's general development. Scores of 15 and over are indicative of an autism/communication-social disorder and warrant further investigation. Research has provided initial evidence of the validity and test-retest reliability (r = 0.83, $p = 0.04$) of the CAST (Williams et al., 2005; Williams et al., 2006).

**Short sensory profile (SSP).** The SSP (McIntosh, Miller, Shyu, & Dunn, 1999) is a shortened version of the Sensory Profile (Dunn, 1997), which was designed to assess the behavioral responses of children aged 3 to 10 years to sensory stimuli in various modalities and daily environments. This questionnaire is completed by the child's primary caregiver. The SSP consists of 38 statements divided into seven categories: tactile sensitivity, taste/smell sensitivity, movement sensitivity, underresponsive/seeks sensation, auditory filtering, low energy/weak, and visual/auditory sensitivity. Each statement is scored on a 5-point Likert scale ranging from 1 (*always*) to 5 (*never*). Lower scores represent greater difficultly processing sensory stimuli and more extreme behavioral responses. The scores obtained characterize the child as typical with respect to sensory processing, potentially different, or definitely different. Research (Tomchek & Dunn, 2007) demonstrates the validity of the SSP (α =

0.47-0.91, $p < 0.1$, for the various scale sections). The Hebrew version was also found to be valid, reliable, and suited to the Israeli population (Engel-Yeger, 2010).

**Make My Day.** The MMD (Ricon et al., 2013) is a new 34-item assessment that probes children's perceptions of their daily activities in terms of how many activities they routinely engage in (quantity), the quality of their activity performance (quality), the level of independence they experience during activity performance (independence), and their level of satisfaction with their performance (satisfaction). It consists of a picture-card version for children's self-reports and a parental version comprised of statements that correspond to the children's picture cards, thus enabling a comparison of their responses to the items.

The picture cards depict a typical child performing the various daily activities generally performed by children and are representative of religions and nationalities in the Israeli population. The child is asked to select cards characterizing activities he or she performs over the course of the day (his or her routine, for the quantity domain) categorized according to those performed on rising; and in the morning, afternoon, and evening until sleep. With the guidance of the examiner, the children are asked to indicate their perception of the quality of their performance via a 4-point smiley-Likert scale (1 = *not well*; 4 = *very well*), as well as the level of independence they have in that performance (1 = *independent*; 4 = *requires complete assistance*), and their level of satisfaction with their performance (1 = *not satisfied*; 4 = *very satisfied*). Activities that are repeated during the day (e.g., brushing teeth) are only scored once. Administration requires approximately 20 min. The parents' version is presented in a questionnaire format. The parents are asked to mark each activity as performs/does not perform and to rank activities performed according to performance quality, level of independence, and satisfaction with their child's performance, as described above.

The MMD underwent expert validation by six experienced pediatric occupational therapists. The dimensions of the MMD accord with the Occupational Therapy Practice Framework: Domain and Process (OTPF) (American Occupational Therapy Association, 2002). The MMD covers six of the eight areas of occupation defined by the OTPF, namely, activities of daily living (covered by the BADL dimension of the MMD); instrumental activities of daily living and education (covered by the IADL dimension of the MMD); and play, leisure, and social participation (covered by the PLAY dimension of the MMD). The MMD does not investigate the rest and sleep or the work areas of the OTPF. The specific activities included in the MMD are consistent with Hofferth and Sandberg's study (2001) on the typical daily routine activities performed by young children (aged 0 to 12 years).

Ricon, Hen, and Keadan-Hardan (2013) performed a pilot study investigating the psychometric properties of the MMD among typically developing Arab-Israeli children aged 4 to 7 years and their parents living in central Israel. They found that the internal consistency of the research variables was moderate to very high (Cronbach's $\alpha = 0.66 – 0.96$), given that acceptable

values of Cronbach's alpha range from 0.70 to 0.95 (Tavakol & Dennick, 2011). Their analysis of the concurrent validity between the children's versions of the MMD and the PEGS (Missiuna & Pollock, 2004) for children in the same age range (5 to 7 years) revealed moderate to strong correlations (Pearson's r = .30 – .65). Moderate to strong correlations were also found between the tools' respective parental versions (Pearson's r = .28 – .58). In contrast, significant differences were found between the child and parental reports regarding the quantity and quality of activity performance in the IADL, BADL, and PLAY domains.

**Procedure**

Approval to conduct the study was obtained from the Ethics Committee of the Israeli Ministry of Education and of the Faculty of Social Welfare and Health Sciences at the University of Haifa. Letters of request to participate in the study were sent out to the parents of children with HFASD who were students in special schools for children with communications disorders in the north of Israel. The control group was recruited in a similar manner by the primary researcher from her area of residence. The parents who contacted the researcher and agreed to participate with their child were sent letters providing a more detailed explanation of the study, a consent form, a demographic questionnaire, and the CAST. The researcher then met all of the children and parents who met the inclusion criteria in their homes or schools/kindergarten, as per their preference, where the MMD was administered to the child and the MDD and SSP were completed by the parents.

**Data Analyses**

The results were analyzed using SPSS 21 software. Population characteristics were described by descriptive statistics. T-tests were performed to analyze differences in the total score of the SSP in each group. A multiple analysis of variance (MANOVA) was conducted to find differences in the subscales of the SSP and the MMD between the groups. A separate Chi-square was used to evaluate the differences in percentages of sensory performance level between groups. Paired t-tests were also employed to examine the differences between the children's self-reports and the parental reports on the MMD in each group. Cohen's D test examined the effect sizes of the differences revealed by the paired t-tests. Correlations between sensory processing abilities and daily routine characteristics in each group were examined via Pearson's correlational analysis. A stepwise linear regression was carried out to examine the contribution of the child's sensory profile to predicting the daily routine in the total sample. The significance level for all statistical analyses was set at $p \leq .05$.

## Results

**Between-Groups Comparison of Sensory Profiles**

A t-test for independent samples revealed a significant difference in the total SSP scores between the groups ($t_{(48)} = -4.71$, $p \leq 0.0001$). The control group scored within the typical range (M = 163.4, *SD* = 12.7), whereas the HFASD group scored greater than or equal to two standard deviations above the normal average, which indicates definite impairment (M = 138.25, *SD* = 21.61). The results of the MANOVA revealed a significant difference between the study and control

groups regarding the subsections of the SSP ($F_{(1,48)} = 5.26$, $p \leq 0.0001$), and subsequent analysis demonstrated that the groups differed significantly in all behaviors associated with SPD, with the greatest difference related to auditory filtering (see Table 2).

**Table 2**

*Between-Group Comparison of Mean Scores on the Short Sensory Profile (SSP)*

| SSP Subsections | Control group n = 30 Mean (*SD*) | HFASD group n = 20 Mean (*SD*) | $F_{(1,48)}$ | $Eta^2$ |
|---|---|---|---|---|
| Tactile sensitivity | 30.20(3.20) | 27.40(4.70) | 9.30** | .16 |
| Taste/smell sensitivity | 18.23(2.20) | 15.80(3.27) | 8.52** | .15 |
| Movement sensitivity | 13.30(1.90) | 11.50(2.85) | 5.00** | .14 |
| Underresponsive/ seeks sensation | 29.80(3.71) | 25.20(4.67) | 14.93*** | .23 |
| Auditory filtering | 26.13(2.90) | 21.00(3.32) | 33.32*** | .41 |
| Low energy/weak | 27.70(2.79) | 24.85(5.34) | 6.08** | .11 |
| Visual/auditory sensitivity | 22.30(2.29) | 19.15(4.18) | 10.22** | .17 |

*Note*. *SD* = standard deviation. **$p \leq 0.01$. ***$p \leq 0.0001$.

With respect to the distribution of the children in each SSP performance range, Chi-square analysis showed that a significantly greater number of children with HFASD had atypical sensory processing patterns than children in the control group in all subsections of the SSP, except for taste/smell sensitivity and low energy (see Table 3). Overall, the children with HFASD display more extreme sensory patterns, thus supporting our first hypothesis.

**Table 3**

*Comparison of the Percentage of Children in Each Short Sensory Profile (SSP) Outcome Category in Both Groups*

| | Control Group (n = 30) | | | HFASD Group (n = 20) | | | |
|---|---|---|---|---|---|---|---|
| SSP Subsection | Typical | Probable difference (Potentially Impaired) | Definite difference (Impaired) | Typical | Probable difference (Potentially Impaired) | Definite difference (Impaired) | $\chi^2$ |
| Tactile sensitivity | 75 | 50.0 | 30.0 | 25 | 50.0 | 70.0 | 6.86* |
| Taste/smell sensitivity | 65.9 | 42.9 | 0 | 34.1 | 57.1 | 100 | 4.41 |
| Movement sensitivity | 73.3 | 45.5 | 33.3 | 26.7 | 54.5 | 66.7 | 5.86* |
| Underresponsive/seeks sensation | 82 | 41.7 | 20.0 | 18.0 | 58.3 | 80.0 | 14.06*, |
| Auditory filtering | 81.8 | 22.2 | 12.5 | 18.2 | 77.8 | 87.5 | 19.42*, |
| Low energy/weak | 66.7 | 100 | 33.3 | 33.3 | 0 | 66.7 | 5.55 |
| Visual/auditory sensitivity | 69.2 | 40.0 | 16.7 | 30.8 | 60.0 | 83.3 | 6.91* |
| SSP Total score | 80.6 | 36.4 | 12.5 | 19.4 | 63.6 | 87.5 | 15.59*, |

*Note*. * $p \leq 0.05$. *** $p \leq 0.001$.


DOI: 10.15453/2168-6408.1337

**Children's Daily Routines: Comparing MMD Scores Between and Within Groups**

As presented in Table 4, the children with HFASD reported significantly lower independence in performing activities than the children in the control group. When comparing the parents' reports, the parents of children with HFASD reported significantly lower performance quality, independence, and satisfaction than did the parents of the children in the control group.

**Table 4**

*Differences Between Study Groups Regarding Daily Routines According to Children's and Parents' Responses to the Make My Day (MMD) Domains*

| MMD | Control n = 30 Mean (*SD*) | HFASD n = 20 Mean (*SD*) | $F_{(1,48)}$ | $Eta^2$ |
|---|---|---|---|---|
| **Child responses** | | | | |
| Number of activities | 23.13(3.44) | 23.05(4.22) | 0.06 | .00 |
| Quality of performance | 3.85(0.23) | 3.90(0.12) | 0.51 | .01 |
| Independence | 3.64(0.23) | 3.40(0.35) | 8.65* | .01 |
| Satisfaction with performance | 3.92 (0.11) | 3.90(0.15) | 0.48 | .01 |
| **Parental responses** | | | | |
| Number of activities | 24.67(3.75) | 23.05(3.47) | 2.37 | .05 |
| Quality of performance | 3.63(0.22) | 3.45(0.29) | 6.34* | .01 |
| Independence | 3.60(0.30) | 3.32(0.30) | 10.85** | .02 |
| Satisfaction with performance | 3.76(0.16) | 3.61(0.30) | 5.24* | .01 |

*Note*. *SD* = standard deviation. *$p \leq 0.05$. **$p \leq 0.01$.

Paired within-group t-tests comparing the children's and the parents' reports revealed that children with HFASD reported higher performance quality ($t = 5.80$, $p \leq 0.0001$) and higher satisfaction ($t = 3.90$, $p \leq 0.01$) than their parents. Typical children reported engaging in a significantly lower number of activities ($t = -2.41$, $p \leq 0.01$) than their parents reported for them, and they also reported higher performance quality ($t = 3.98$, $p \leq 0.001$) and higher satisfaction ($t = 4.43$, $p \leq 0.001$) than their parents (see Table 5). The significant differences were found to have medium-high effect size measured by Cohen's D test. Overall, the daily routines of children with HFASD differ significantly from those of typically developing controls as reflected in the parental reports, partially supporting our second hypothesis.

**Table 5**

*Means and Standard Deviations of Child Self-Reports and Parental Reports on the Make My Day (MMD) and a Between-Group Comparison of their Reports*

| MMD | Children's report Mean (*SD*) | Parents' report Mean (*SD*) | Paired t-test | Cohen's D effect |
|---|---|---|---|---|
| **HFASD group (n = 20)** | | | | |
| Number of activities | 23.05(4.22) | 23.05(3.47) | 0.00 | .11 |
| Quality of performance | 3.87(0.12) | 3.45(0.28) | 5.80*** | .84 |
| Independence | 3.40(0.35) | 3.32(0.31) | 0.72 | .01 |
| Satisfaction with performance | 3.90(0.15) | 3.61(0.30) | 3.90** | .77 |
| **Control group (n = 30)** | | | | |
| Number of activities | 23.13(3.44) | 24.67(3.73) | -2.41* | .44 |
| Quality of performance | 3.85(0.19) | 3.63(0.22) | 3.98*** | .73 |
| Independence | 3.64(0.23) | 3.60(0.30) | 0.67 | .12 |
| Satisfaction with performance | 3.92(0.11) | 3.76(0.16) | 4.43*** | .81 |

*Note*. *SD* = standard deviation. *$p \leq 0.05$. **$p \leq 0.01$. ***$p \leq 0.0001$.

**Correlations Between Sensory Processing Abilities and the Characteristics of Children's Daily Routines in the HFASD Group**

The parental reports demonstrated a greater number of significant differences in the MMD scores than the child reports, thus supporting our third hypothesis with respect to the study group. Thus, correlations between the MMD and SSP scores were performed only on the parental reports. The results showed that the children's quality of performance correlated with better ability to process taste/smell stimuli (r = 0.73, $p \leq .01$), while the children's level of independence significantly correlated with better ability to process tactile, vestibular, and visual/auditory stimuli (r = 0.755, $p \leq .01$; r = 0.5, $p \leq .05$; and r = 0.471, $p \leq .05$, respectively). Overall, these results support our fourth hypothesis.

**Predicting Children's Daily Routine Characteristics According to Group Association and Sensory Processing Abilities**

Stepwise linear regression for the child MMD scores yielded one model. This model included group membership as a significant predictor for the level of independence in activity performance, accounting for 15% of the variance. Stepwise linear regression for the parental MMD scores yielded two models. The first model included group membership as a significant predictor for quality of performance accounting for 12% of the variance and the second, which added the total SSP score to this prediction, accounted for an additional 11% of the variance, thus supporting our fifth hypothesis. Finally, the prediction of "satisfaction with performance" yielded one model according to which group membership accounted for 10% of the variance. Overall, it was found that parental satisfaction with their children's performance did not contribute to the prediction of the characteristics of the children's daily routine (see Table 6).


DOI: 10.15453/2168-6408.1337

**Table 6**

*Prediction of Functioning of Children with HFASD in Daily Routines Based on their SSP Scores as Measured by the Make My Day (MMD) Reports of Children and their Parents*

| Variable | | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|---|
| | | **B** | **SEB** | **β** | **B** | **SEB** | **β** |
| **Child reports** | **Independence** | | | | | | |
| | Group | .242 | .08 | .391** | | | |
| | $R^2$ | | 15 | | | | |
| | F for change in | | .8.65* | | | | |
| **Parental reports** | **Quality of performance** | | | | | | |
| | Group | .18 | .72 | .34* | .018 | .86 | .034 |
| | SSP | | | | .006 | .002 | .49** |
| | $R^2$ | | 12 | | | 33 | |
| | F for change in | | 6.34* | | | 7.35** | |
| | **Independence** | | | | | | |
| | Group | .288 | .087 | .429** | .147 | .111 | .219 |
| | SSP | | | | .006 | .003 | .333 |
| | $R^2$ | | 18 | | | 31 | |
| | F for change in | | 0.86** | | | 4.03* | |
| | **Satisfaction with performance** | | | | | | |
| | Group | .15 | 0.67 | .31* | | | |
| | R2 | | 10 | | | | |
| | F for change in | | 5.24* | | | | |

*Note*. *$p \leq 0.05$. **$p \leq 0.01$.

## Discussion

The purpose of this study was to expand our knowledge base regarding the sensory processing abilities and daily routines of children with HFASD. When the sensory profile of children with HFASD as expressed in daily life scenarios is compared with that of their typically developing peers, the children with HFASD display a significantly higher prevalence of SPD. In accordance with previous studies (Dunn, Myles, & Orr, 2002; Liss, Saulnier, Fein, & Kinsbourne, 2006), this study found sensory processing deficits in the various sensory modalities in the study group. Accumulating literature attesting to hyper or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment among children with ASD led to their inclusion in the criteria for the *Diagnostic and Statistical Manual of Mental Disorders* for this population (APA, 2013).

The present study also referred to another important topic that significantly impacts on the daily life of families of children with HFASD. By using the MMD, the present study profiled the daily routines of children with HFASD and compared

them to those of typical controls. The advantage of the MMD is that it provides the perspectives of both parents and children. An examination of the differences between the child and the parental reports within and between groups revealed some notable results. Specifically, whereas children with HFASD reported only that they are less independent in daily routines than did their typical peers, the parents provided a more discerning picture. That is, the parents of the children with HFASD perceived their children as having lower performance quality, independence, and satisfaction with daily routines than the parents of typical controls. It has already been reported that children with developmental disabilities, such as HFASD, are less independent than their typical peers and that their parents tend to assist them more frequently (DeGrace, 2004; Kadlec, Coster, Tickle-Degnen, & Beedgly, 2005). Independence and successful engagement in daily life contribute to the child's apparent competency and perceived self-efficacy (Engel-Yeger & Hanna Kasis, 2010; Kramer & Hinojosa, 1999). This may explain why the parents of children with HFASD perceived their child's performance quality and satisfaction with daily routine performance as lower than the parents of typical peers.

Greater gaps were found between the children and parents from the study group compared with the control group. However, Cohen's D effect values for quality of performance and satisfaction with performance in both groups suggest that these gaps require further attention in future studies to better understand whether the differences are clinically significant and how they are expressed in daily life.

Of interest is that typical children reported significantly higher independence than children with HFASD, yet the difference was small. Moreover, considering that the MMD scale ranges from 1 to 4, both groups reported relatively high independence levels (above 3). This trend was also relevant for the other scales of the MMD. The present study raises two important issues that should be considered during intervention. First, children from both groups reported higher performance ability and satisfaction with their daily activities than did their parents. Rosenberg, Jarus, and Bart (2010) suggested that children are satisfied with their performance even if their social environment perceives their abilities differently. This should be considered a strength that may be used during intervention to elevate the children's motivation and involvement in the process. Second, while previous reports found that children with HFASD perform fewer activities than their typical peers (Hilton, Crouch, & Israel, 2008; LaVesser & Berg, 2011; Solish, Perry, & Minnes, 2010), this study did not find such a difference. This may result from the fact that in Israel, children with a formal ASD diagnosis in this age group receive intensive treatment that includes exposure to a large number of activities, many of which are funded by compulsory National Insurance and compulsory sick funds (Schipper, Tayar, Alonim, Naimer, 2006). However, the present study highlighted other aspects of daily performance that are rarely discussed in the literature, such as the quality of performance of daily routine activities based on the perspectives of both children and their parents. This highlights the importance of referring not only


DOI: 10.15453/2168-6408.1337

to the quantity, but also to the quality of activities performed in daily life by children with HFASD.

Overall, the reports of parents via the MMD seemed more discerning than the children's reports. This may be due to their different priorities (McGavin, 1998; Pollock & Stewart, 1998). Nevertheless, in line with the client-centered approach (Law & Mills, 1998; Missiuna, 1998) and other studies highlighting the importance of referring to the child's own voice (Gillott et al., 2001; Hochhauser & Engel-Yeger, 2010), clinicians should include the self-reports of children with HFASD in the evaluation process. By understanding what aspects of performance are more meaningful for parents and children, analyzing the similarities and differences in their respective reports, and focusing intervention on their specific challenges in a real-life context, therapists may enhance their clients' involvement in therapy and improve its outcomes.

Findings revealed that SPD across more than one sensory modality significantly correlated with specific aspects of daily routines. These findings are supported by Shelly and Bundy (2012), who found that SPD among children with autism may negatively impact on their performance of daily routine activities, such as showering and eating, and by Bar-Shalita et al. (2008), who reported that SPD severity correlated with the quality of activity performance. In the present study, the more effectively children could process gustatory and olfactory stimuli, the better the quality of their daily activity performance. Hochhauser and Engel-Yeger (2010) found that difficulties in processing of taste/smell correlated with lower intensity of participation and less enjoyment in activities. The authors cited studies in which parents described how their children avoided situations that involved intense odors, such as recreational activities and mealtimes (Leekam, Nieto, Libby, Wing, & Gould, 2007; Rogers et al., 2003). In accordance with their findings, these authors suggest that clinicians should consider the impact of sensory processing difficulties of less well-studied modalities, such as these, on the performance of children with HFASD, since avoidance and restricted participation may limit the child's opportunities to learn and acquire skills.

The present study also found that better modulation of tactile, vestibular, and visual/auditory input correlated with greater independence when performing routine daily activities. Hochhauser and Engel-Yeger (2010) found significant relationships between somatosensory dysmodulation and the participation patterns of children with HFASD. For example, vestibular sensitivity correlated with more activities performed in the secure environment of their home. It may be suggested that somatosensory stimuli, together with visual/auditory information, enable adequate visual-spatial processing and visual-kinesthetic integration to contribute to the child's sense of motor and emotional control (Fong, Tsang, & Ng, 2012; Miller, Polatajko, Missiuna, Mandich, & Macnab, 2001), thus increasing their sense of independence. These results were supported by the regression analysis from the current study, according to which the ability to process sensory inputs significantly predicted performance quality and independence.

In summary, the unique sensory processing patterns that children with HFASD frequently experience may be related not only to the amount of activities they perform but also to the qualitative aspects of their daily routine performance. Although the parents' reports seem to be more discerning than those of the children, it is important to include both parents' and children's perspectives in intervention.

**Limitations**

The present study has some limitations. The sample size was relatively small, there was a significantly different distribution of the genders between the groups, the study focused on a specific age group, and it drew on a limited geographic area, all of which may limit the generalizability of the main findings. Future studies should use a larger sample size to improve generalizability. Doing so would also enable groups of boys and girls to be examined separately, which is desirable because of known sex-specific differences in the expression of ASD (Williams et al., 2008; Werling & Geschwind, 2013) that may translate to differences at the levels of participation and functioning. The current study excluded children with an additional diagnosis, yet the prevalence of neurological and psychological comorbidities among children with ASD is high, as high as 93% with respect to ASD and ADHD during childhood (Kantzer et al., in press), and therefore it would be valuable to include them in future research.

**Conclusions**

Understanding how the sensory processing vulnerability of children with HFASD impacts their performance and participation with respect to the type of activity, performance quality, independence, and satisfaction, can better enable clinicians to optimize intervention by focusing on children's specific skills, interests, and needs. This may be achieved, for example, by creating environmental adaptations matching their sensory profile and by consulting with parents and increasing their awareness of their child's unique sensory characteristics.

Moreover, the parents' reports may enhance their awareness of their child's performance limitations and strengths, and exposure to the child's point of view may deepen their knowledge of their child's interests and needs. By directing intervention to practical aspects of their real life familial context, clinicians may reduce the parents' perceived burden in attempting to meet their child's demands and enhance their engagement in positive social and emotional family experiences (DeGrace, 2004). By providing children with an opportunity to report, clinicians can be informed not only of children's limitations but also of factors that may motivate or satisfy them. This approach may increase the child's involvement in therapy and willingness to cooperate with it, thus improving intervention outcomes and child/family well-being.

**References**

American Occupational Therapy Association. (2002). Occupational therapy practice framework: Domain and process. *American Journal of Occupational Therapy*, *56*(6), 609-639. https://doi.org/10.5014/ajot.56.6.609

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, D.C.: Author.

Bagby, M. S., Dickie, V. A., & Baranek, G. T. (2012). How sensory experiences of children with and without autism affect family occupations. *American Journal*

*of Occupational Therapy*, *66*(1), 78-86. https://doi.org/10.5014/ajot.2012.000604

Baker, A. E., Lane, A., Angley, M. T., & Young, R. L. (2008). The relationship between sensory processing patterns and behavioural responsiveness in autistic disorder: A pilot study. *Journal of Autism and Developmental Disorders*, *38*(5), 867-875. http://dx.doi.org/10.1007/s10803-007-0459-0

Baranek, G. T., David, F. J., Poe, M. D., Stone, W. L., & Watson, L. R. (2006). Sensory Experiences Questionnaire: Discriminating sensory features in young children with autism, developmental delays, and typical development. *Journal of Child Psychology and Psychiatry*, *47*(6), 591-601. http://dx.doi.org/10.1111/j.1469-7610.2005.01546.x

Bar-Shalita, T., Vatine, J. J., & Parush, S. (2008). Sensory modulation disorder: A risk factor for participation in daily life activities. *Developmental Medicine and Child Neurology*, *50*, 932-937. http://dx.doi.org/10.1111/j.1469-8749.2008.03095.x

Baum, C. M., & Christiansen, C. H. (2005). Person-environment-occupation-performance: An occupation-based framework for practice. In C. Christiansen, C. M. Baum, & J. Bass-Haugen (Eds.), *Occupational therapy: Performance, participation, and well-being* (pp. 242-267). Thorofare, NJ: Slack.

Ben-Sasson, A., Hen, L., Fluss, R., Cermak, S. A., Engel-Yeger, B., & Gal, E. (2009). A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*(1), 1-11. http://dx.doi.org/10.1007/s10803-008-0593-3

Ben-Sasson, A., Soto, T. W., Martínez-Pedraza, F., & Carter, A. S. (2013). Early sensory over-responsivity in toddlers with autism spectrum disorders as predictor of family impairment and parenting stress. *Journal of Child Psychology and Psychiatry*, *54*(8), 846-53. http://doi.org/10.1111/jcpp.12035

Capps, L., Yirmiya, N., & Sigman, M. (1992). Understanding of simple and complex emotions in non-retarded children with autism. *Journal of Child Psychology and Psychiatry*, *33*, 1169-1182. http://dx.doi.org/10.1111/j.1469-7610.1992.tb00936.x

Clark, F. A., Parham, D., Carlson, M. E., Frank, G., Jackson, J., Pierce, D., . . . Zemke, R. (1991). Occupational science: Academic innovation in the service of occupational therapy's future. *American Journal of Occupational Therapy*, *45*(4), 300-310. https://doi.org/10.5014/ajot.45.4.300

DeGrace, B. W. (2004). The everyday occupation of families with children with autism. *American Journal of Occupational Therapy*, *58*(5), 543-550. http://dx.doi.org/10.5014/ajot.58.5.543

Dunford, C., Missiuna, C., Street, E., & Sibert, J. (2005). Children's perception of the impact of developmental coordination disorder on activities of daily living. *British Journal of Occupational Therapy*, *68*(5), 207-214. https://doi.org/10.1177/030802260506800504

Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. *Infants and Young Children*, *9*(4), 23-35. https://doi.org/10.1097/00001163-199704000-00005

Dunn, W., Cox, J., Foster, L., Mische-Lawson, L., & Tanquary, J. (2012). Impact of a contextual intervention on child participation and parent competence among children with autism spectrum disorder: A pretest-posttest repeated-measures design. *American Journal of Occupational Therapy*, *66*, 520-528. http://dx.doi.org/10.5014/ajot.2012.004119

Dunn, W., Myles, B. S., & Orr, S. (2002). Sensory processing issues associated with Asperger syndrome. A preliminary investigation. *American Journal of Occupational Therapy*, *56*(1), 97-102. https://doi.org/10.5014/ajot.56.1.97

Dunn, W., Saiter, J., & Rinner, L. (2002). Asperger syndrome and sensory processing: A conceptual model and guidance for intervention planning. *Focus on Autism and Other Developmental Disabilities*, *17*(3), 172-185. http://dx.doi.org/10.1177/10883576020170030701

Dunst, C. J., Trivette, C. M., Humphries, T., Raab, M., & Roper, N. (2001). Contrasting approaches to natural learning environment interventions. *Infants and Young Children*, *14*(2), 48-63. https://doi.org/10.1097/00001163-200114020-00007

Engel-Yeger, B. (2008). Sensory processing patterns and daily activity preferences of Israeli children. *Canadian Journal of Occupational Therapy*, *75*(4), 220-229. https://doi.org/10.1177/000841741007700207

Engel-Yeger, B. (2010). The applicability of the Short Sensory Profile for screening sensory processing disorders among Israeli children. *International Journal of Rehabilitation Research*, *33*(4), 311-318. http://dx.doi.org/10.1097/MRR.0b013e32833abe59

Engel-Yeger, B., & Dunn, W. (2011). The relationship between sensory processing difficulties and anxiety level of healthy adults. *The British Journal of Occupational Therapy*, *74*(5), 210-216. http://dx.doi.org/10.4276/030802211X13046730116407

Engel-Yeger, B., & Hanna Kasis, A. (2010). The relationship between developmental coordination disorders, child's self-efficacy and preference to participate in leisure activities. *Child: Care, Health &*

*Development*, *36*(5), 670-677. http://dx.doi.org/10.1111/j.1365-2214.2010.01073.x

Fong, S. S., Tsang, W. W., & Ng, G. Y. (2012). Taekwondo training improves sensory organization and balance control in children with developmental coordination disorder: a randomized controlled trial. *Research in Developmental Disabilities*, *33*(1), 85-95. http://dx.doi.org/10.1016/j.ridd.2011.08.023

Gillott, A., Furniss, F., & Walter, A. (2001). Anxiety in high-functioning children with autism. *Autism*, 5, 277-286. https://doi.org/10.1177/1362361301005003005

Groden, J., Cantela, J., Prince, S., & Berryman, J. (1994). The impact of stress and anxiety on individuals with autism and developmental disabilities. In E. Schopler & G. B. Mesibov (Eds.), *Behavioural issues in autism*. New York, NY: Plenum.

Hilton, C. L., Crouch, M. C., & Israel, H. (2008). Out-of-school participation patterns in children with high functioning autism spectrum disorders. *American Journal of Occupational Therapy*, *62*(5), 554-563. https://doi.org/10.5014/ajot.62.5.554

Hilton, C., Graver, K., & LaVesser, P. (2007). Relationship between social competence and sensory processing in children with high functioning autism spectrum disorders. *Research in Autism Spectrum Disorders*, *1*, 164-173. http://dx.doi.org/10.1016/j.rasd.2006.10.002

Hochhauser, M., & Engel-Yeger, B. (2010). Sensory processing abilities and their relation to participation in leisure activities among children with high-functioning autism spectrum disorder (HFASD). *Research in Autism Spectrum Disorders*, *4*(4), 746-754. http://dx.doi.org/10.1016/j.rasd.2010.01.015

Hofferth, S. L., & Sandberg, J. F. (2001). How American children spend their time. *Journal of Marriage and Family*, *63*(2), 295-308. http://dx.doi.org/10.1111/j.1741-3737.2001.00295.x

Humphry, R. (2002) Young children's occupations: Explicating the dynamics of developmental processes. *American Journal of Occupational Therapy*, *56*(2), 171-179. https://doi.org/10.5014/ajot.56.2.171

Kadlec, M. B., Coster, W., Tickle-Degnen, L., & Beeghly, M. (2005). Qualities of caregiver–child interaction during daily activities of children born very low birth weight with and without white matter disorder. *American Journal of Occupational Therapy*, *59*(1), 57-66. https://doi.org/10.5014/ajot.59.1.57

Kantzer, A-K., Fernell, E., Westerlund, J., Hagberg, B., Gillberg, C., & Miniscalco, C. (in press). Young children who screen positive for autism: Stability, change and "comorbidity" over two years. *Research in Developmental Disabilities*.

Kay, S. F. (2001). *The relationship between sensory processing and self-care for children with autism ages two to four*. (Doctoral dissertation). Nova Southeastern University, Fort Lauderdale, FL.

Keadan-Hardan, A. (2012). *Establishment of the reliability and validity of Make My Day for the assessment of activities comprising the daily routine of 4-7 year-old children*. (Master's thesis). Haifa University, Israel.

Keen, D., & Rodger, S. (2012). *Working with parents of a newly diagnosed child with an autism spectrum disorder: A guide for professionals*. Philadelphia, PA: Kingsley Publishers.

Kinnealey, M., & Fuiek, M. (1999). The relationship between sensory defensiveness, anxiety, depression and perception of pain in adults. *Occupational Therapy International*, *6*(3), 195-206. https://doi.org/10.1002/oti.97

Kramer, P., & Hinojosa, J. (1999). *Frames of reference for pediatric occupational therapy* (2nd ed., pp. 9-27). Philadelphia, PA: Lippincott, Williams & Wilkins.

Larson, E. (2006). Caregiving and autism: How does children's propensity for reutilization influence participation in family activities? *Occupational Therapy Journal of Research*, *26*(2)**,** 69-79. https://doi.org/10.1177/153944920602600205

LaVesser, P., & Berg, C. (2011) Participation patterns in preschool children with an autism spectrum disorder. *Occupational Therapy Journal of Research*, *31*(1), 33-39. http://dx.doi.org/10.3928/15394492-20100823-01

Law, M. (2002). Participation in the occupations of everyday life. *American Journal of Occupational Therapy*, *56*(6), 640-649.

Law, M., & Mills, J. (1998). *Client-centered occupational therapy.* Thorofare, NJ: Slack Leekam, S. R., Nieto, C., Libby, S. J., Wing, L., & Gould, J. (2007). Describing the sensory abnormalities of children and adults with autism. *Journal of Autism and Developmental Disorders*, *37*, 894–910. http://dx.doi.org/10.1007/s10803-006-0218-7

Liss, M., Saulnier, C., Fein, D., & Kinsbourne, M. (2006). Sensory and attention abnormalities in autistic spectrum disorders. *Autism*, *10*(2), 155-172. http://dx.doi.org/10.1177/1362361306062021

McGavin, C. (1998). Planning rehabilitation: A comparison of issues for parents and adolescents. *Physical & Occupational Therapy in Pediatrics*, *18*(1), 69-82. http://dx.doi.org/10.1080/J006v18n01_05

McIntosh, D. N., Miller, L. J., Shyu, V., & Dunn, W. (1999). *The Sensory Profile: Examiner's manual.* San Antonio: The Psychological Corporation.

Miller, L. J. (2006). *Sensational kids: Hope and help for children with sensory processing disorder*. New York: G. P. Putnam's Sons.

Miller, L. J., Anzalone, M. E., Lane, S. J., Cermak, S. A., & Osten, E. T. (2007). Concept evolution in sensory integration: A proposed nosology for diagnosis. *American Journal of Occupational Therapy*, *61*(2), 135. https://doi.org/10.5014/ajot.61.2.135

Miller, L. J., Coll, J. R., & Schoen, S. A. (2007). A randomized controlled pilot study of the effectiveness of occupational therapy for children with sensory modulation disorder. *American Journal of Occupational Therapy*, *61*(2), 228-238. https://doi.org/10.5014/ajot.61.2.228

Miller, L. T., Polatajko, H. J., Missiuna, C., Mandich, A. D., Macnab, J. J. (2001). A pilot trial of a cognitive treatment for children with developmental coordination disorder. *Human Movement Science*, *20*(1-2), 183-210. http://dx.doi.org/10.1016/S0167-9457(01)00034-3

Miller, L. J., Reisman, J., McIntosh, D. N., & Simon, J. (2001). An ecological model of sensory modulation: Performance of children with fragile X syndrome, autistic disorder, attention-deficit/hyperactivity disorder, and sensory modulation dysfunction. In S. Roley, E. Blanche, & R. Schaaf (Eds.), *Understanding the nature of sensory integration with diverse populations* (pp. 57-88). San Antonio, TX: Therapy Skill Builders.

Missiuna, C. (1998). Development of 'All About Me', a scale that measures children's perceived motor competence. *Occupational Therapy Journal of Research*, *18*, 85-108. http://dx.doi.org/10.1177/153944929801800202

Missiuna, C., & Pollock, N. (2004). *Perceived Efficacy and Goal Setting* System *(PEGS)*, Manual. San Antonio, TX: Psychological Corporation.

Missiuna, C., Pollock, N., Law, M., Walter, S., & Cavey, N. (2006). Examination of the Perceived Efficacy and Goal Setting System (PEGS) with children with disabilities, their parents, and teachers. *American Journal of Occupational Therapy*, *6*(2), 204-214. https://doi.org/10.5014/ajot.60.2.204

Mulligan, S. (1996). An analysis of score patterns of children with attention disorders on the Sensory Integration and Praxis tests. *American Journal of Occupational Therapy*, *50*, 647-654. https://doi.org/10.5014/ajot.50.8.647

Pfeiffer, B., Kinnealey, M., Reed, C., & Herzberg, G. (2005). Sensory modulation and affective disorders in children and adolescents with Asperger's disorder. *American Journal of Occupational Therapy*, *59*(3), 335-345. https://doi.org/10.5014/ajot.59.3.335

Pollock, N., & Stewart, D. (1998). Occupational performance needs of school-aged children with physical disabilities in the community. *Physical & Occupational Therapy in Pediatrics*, *18*(1), 55-68. https://doi.org/10.1080/j006v18n01_04

Reynolds, S., Bendixen, R., Lawrence, M., Lane, T., Lane, S., & Lane, J. (2011). A pilot study examining activity participation, sensory responsiveness, and competence in children with high functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *41*(11), 1496-1506. http://dx.doi.org/10.1007/s10803-010-1173-x

Ricon, T., Hen, L., Keadan-Hardan, A. (2013). Establishing reliability and validity for "Make My Day" - A new tool for assessing young Arab-Israeli children's typical daily activities. *Occupational Therapy International*, *20*(4), 173-184. https://doi.org/10.1002/oti.1350

Rodger, R., & Ziviani, J. (2006). *Occupational therapy with children: Understanding children's occupations and enabling participation*. Oxford, UK: Blackwell.

Rogers, S., Hepburn, S., & Wehner, E. (2003). Parent reports of sensory symptoms in toddlers with autism and those with other developmental disorders. *Journal of Autism and Developmental Disorders*, *33*(6), 631-642. http://dx.doi.org/10.1023/B:JADD.0000006000.38991.a7

Rosenberg, L., Jarus, T., & Bart, O. (2010). Development and initial validation of the Children Participation Questionnaire (CPQ). *Disability and Rehabilitation*, *32*(20), 1633-1644. https://doi.org/10.3109/09638281003611086

Sansosti, F. J., & Sansosti, J. M. (2013). Effective school-based service delivery for students with autism spectrum disorders: Where we are and where we need to go. *Psychology in the Schools*, *50*(3), 229-244. http://dx.doi.org/10.1002/pits.21669

Schipper, B., Tayar, D., Alonim, H. B., Naimer, S. A., (2006). A model of autism treatment: Using early intensive and sequential multidisciplinary intervention. *Israeli family practice*, *132*(16).

Shelly, L., & Bundy, A. C. (2012). *Kids can be kids: A childhood occupations approach*. Philadelphia: F.A. Davis. http://dx.doi.org/10.3109/07380577.2013.775541

Solish, A. Perry, A., & Minnes, P. (2010). Participation of children with and without disabilities in social, recreational and leisure activities. *Journal of Applied Research in Intellectual Disabilities*, 23, 226-236. http://dx.doi.org/10.1111/j.1468-3148.2009.00525.x

Spagnola, M., & Fiese, B. H. (2007). Family routines and rituals: A context for development in the lives of

young children. *Infants and Young Children*, *20*, 284-299.

Sturgess, J., Rodger, S., & Ozanne, A. (2002). A review of the use of self-report assessment with young children. *British Journal of Occupational Therapy*, *65*(3), 108-116.

Tomchek, S. D., & Dunn, W. (2007). Sensory processing in children with and without autism: A comprehensive study using the Short Sensory Profile. *American Journal of Occupational Therapy*, *61*, 190-200. http://dx.doi.org/10.5014/ajot.61.2.190

Volkmar, F., & Lord, C. (2007). *Diagnosis and definition of autism and other pervasive developmental disorders in autism and pervasive developmental disorders* (2nd ed.). New York: Cambridge University Press.

Werling, M., & Geschwind, D. H. (2007). Understanding sex bias in autism spectrum disorder. *Proceedings of the National Academy of Sciences*, *110*(13), 4868-5869. https://doi.org/10.1073/pnas.1301602110

White, B. P., Mulligan, S., Merrill, K., & Wright, J. (2007). An examination of the relationships between motor and process skills and scores on the sensory profile. *American Journal of Occupational Therapy*, *61*(2), 154-160. https://doi.org/10.5014/ajot.61.2.154

Williams, J., Allison, C., Scott, F., Stott, C., Bolton, P., Baron-Cohen, S., & Brayne, C. (2006). The Childhood Asperger Syndrome Test (CAST): Test–retest reliability. *Autism*, *10*(4), 415-427. http://dx.doi.org/10.1177/1362361306066612

Williams, J., Allison, C., Scott, F., Stott, C., Bolton, P., Baron-Cohen, S., & Brayne, C. (2008). The Childhood Autism Spectrum Test (CAST): Sex differences. *Journal of Autism Developmental Disorders*, *38*(9), 1731-1739. https://doi.org/10.1007/s10803-008-0558-6

Williams, J., Scott, F., Stott, C., Allison, C., Bolton, P., Baron-Cohen, S., & Brayne, C. (2005). The CAST (Childhood Asperger Syndrome Test): Test accuracy. *Autism*, *9*(1), 45-68. https://doi.org/10.1177/1362361305049029

Wright, C. & Northcutt C., (2005). ZERO TO THREE: Diagnostic classification of mental health and developmental disorders of infancy and early childhood: Revised edition (DC:0-3R). Washington.

Yakir-Katz, N. (2009). *Comparing models of participation and preference for leisure activities between children with sensory modulation disorder and typical children according to the reports of the children and their parents.* (Master's thesis). Haifa University, Israel.

Yamin-Elias, L. (2013). *Sensory experience of children with HFASD compared with that of typical children based on reports by parents and children.* (Master's thesis). Haifa University, Israel.

Zeedyk, S. M., Cohen, S. R., Eisenhower, A., & Blacher, J. (2016). Perceived social competence and loneliness among young children with ASD: Child, parent and teacher reports. *Journal of Autism and Developmental Disorders*, *46*(2), 436-449. http://dx.doi.org/10.1007/s10803-015-2575-6