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Spectrum of Feeding Problems and Gastrointestinal Symptoms in Children with Autism Spectrum Disorders: A Scoping Review

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ABSTRACT

Introduction: Managing feeding problems and gastrointestinal (GI) symptoms in children with Autism Spectrum Disorders (ASD) is a challenging process for professionals and parents especially if they become persistent and longstanding. The aim of the study was to assess the evidence on feeding problems and GI symptoms among primary school children with ASD. **Methods:** A scoping review using electronic journal databases, published reports and other types of publication in the last 10 years was conducted. Key terms were defined in the searches and a scoping review framework was used to chart the evidence on feeding problems and GI symptoms in children with ASD. Eighty three articles met the inclusion criteria and 50 articles were used in the review. **Results**: There is emerging literature reporting consistently on a wide spectrum of feeding problems and GI symptoms among children with ASD. In addition, there is little published literature reporting or investigating the impact of these problems in children with ASD which include financial, social and stress impact on parents, children and their families. This review indicates that many school-aged children with ASD can experience several types of feeding problems and GI symptoms. **Conclusion**: It is important for professionals working in the community or public health, and educational settings to be able to identify these issues at an early stage, so that professionals could support parents with appropriate information and advice. A specific tool is needed to assess feeding problems and GI symptoms in children with ASD.

Key words: Autism Spectrum Disorders, feeding problems, gastrointestinal symptoms

INTRODUCTION

Autism Spectrum Disorders (ASD) are common lifelong neuro developmental disorders that are increasingly recognised and diagnosed in early childhood population (National Initiative for Autism, Screening, Assessment (NIASA), 2003; Baird *et al.*, 2006; Yates & Le Couteur, 2009; Bagnall, 2012). The characteristics of children with ASD include impairments across three main areas: social communication, social interaction, and repetitive stereotyped behaviours. Other characteristics include language

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impairment, cognitive impairment, sensory impairment, and rigidity in behaviour and thinking (Yates & Le Couteur, 2009; Bagnall, 2012). It is also increasingly recognised that children with ASD often have additional medical, developmental and mental health problems such as sleep disorders, feeding problems, gastrointestinal (GI) symptoms, learning disabilities, anxiety and emotional lability (NIASA, 2003; Baird *et al.*, 2006). Many of these problems can also be experienced by typically developing children and children with other disabilities.

However, managing feeding problems in young children with ASD can be very challenging for both families and the professionals working to support them, as feeding problems are complex compared to other group of children with neuro-disabilities. Feeding problems are more likely to involve a combination of several factors such as ASD characteristics, child's individual functioning and parental feeding practices (Field, Garland & Williams, 2003; Valicenti McDermott *et al.*, 2008). There are also reports that for some children with ASD, feeding problems may overlap or perhaps interact with additional gastrointestinal symptoms, and possibly with some ASD characteristics such as behavioural rigidity and sensory difficulties (Lukens & Linscheid, 2008; Kerwin, Eicher & Gelsinger, 2005; Valicenti-McDermott *et al.*, 2008). In addition, studies on parents of young children with ASD (aged 4-11 years) have consistently reported higher rates of stress among the parents of children with ASD compared to the rates reported by parents of children with other disabilities (Hastings & Johnson, 2001; Davis & Carter, 2008; Williams, Hendy & Knecht, 2008). High cost and time needed to manage their child's behaviour and implement the range of specific interventions or therapies may contribute to the stress and burden experienced by these parents or carers. This review explores the spectrum of feeding problems and GI symptoms in young children with ASD and the impact of these problems on family life.

METHODS

A scoping review was conducted on feeding problems and GI symptoms in primary school aged children with ASD. In this study, scoping review was found to be useful to map evidence on feeding problems and GI symptoms in a systematic way. The scoping review was performed to determine the extent and nature of research on feeding problems and GI symptoms among children with ASD, and also to identify gaps in existing literature.

The flow of identification of evidence, screening and charting process through the different phases of the scoping review was based on the scoping review framework by Arksey & O' Malley (2005). The stages of the scoping review framework (York Framework) include 'identifying the research questions/ objectives', 'identifying relevant studies', 'study selection', 'charting the data', and 'collating, summarising and reporting the results'. The specific objectives of the scoping review were to (1) identify relevant studies on feeding problems and GI symptoms based on the inclusion criteria; and (2) describe different types of feeding problems and GI symptoms in children with ASD including the rates of these problems.

A comprehensive literature search was conducted using electronic databases of Medline Embase/Ovid, ISI Web knowledge and Scopus; websites such as the Research Autism.net, the Autism Research Institute (ARI) and the Database of Children of Autism Living in the North East England (Daslne); relevant peer reviewed journals including the *Journal of Development and Disabilities (JADD), Autism, Development Disabilities, Paediatric, Human Nutrition and Dietetics* and *Research in Autism Spectrum*

Disorders, and bibliographic search using reports, research summaries, newsletters, reference lists from selected journal articles. Manual searching of evidence was also conducted to identify grey literature such as abstracts or full articles in the scientific ASD conference programme book, National Institute for Health and Clinical Excellence (NICE) Guidelines and unpublished student thesis at local universities in the United Kingdom (UK). Consultation with the experts in ASD field in the UK and USA (Lukens & Linscheid, 2008; Valicenti-McDermott *et al.*, 2008; Kerwin *et al.*, 2005) was also conducted by the authors through email and personal calls in order to retrieve more evidence. Inclusion criteria for the search were articles in English language published from 1992 to 2012 and related to children with ASD below 18 years. All types of studies were included in the search strategy. Foreign language articles were excluded due to the cost and time that would be required to translate these documents. No exclusion criteria were defined in the searches based on study design or publication type. Three main key terms used in the search of articles were (i)Autism Spectrum Disorders (ASD) or autism or autistic disorder or atypical autism or pervasive developmental disorder not otherwise specified (PDD-NOS) or Asperger syndrome; (ii) feeding problems or feeding difficulties or eating problems or feeding disorders or eating disorders or selective eating or food sensory problems or food texture or food pattern or food refusal or mealtime behaviour or pica; and (iii) gastrointestinal symptoms or gut problems or bowel problems or constipation or diarrhoea or abdominal pain or nausea. Endnote software and Microsoft Excel programmes were used to manage the records via searching, keeping track of articles, checking the duplication of records and sorting reference lists.

The study selection was based on the objectives of the study and focused on documents related to feeding problem and GI symptoms of children with ASD. The search strategy identified a large number of studies which were not relevant in answering the specific objectives. The researchers screened the titles and retrieved the relevant abstracts on feeding problems and GI symptoms. Irrelevant documents were eliminated and abstracts that did not capture fully the scope of the study were also excluded. Based on the eligible abstracts, copies of full articles were retrieved. The full articles were then checked by the researchers and were then read by the researchers in order to select the final full articles for the review.

General and specific information about the studies were charted which include author(s), year of publication, objectives or aims of the study, country or study location, study population, sample characteristics, design, sample size including comparison group instruments and findings that were relevant to the objectives of the review. The characteristics of the results from the selected articles from various authors were described based on the design, types and outcomes of each study. Research gaps were also identified in order to make useful recommendations on future research in this area.

RESULTS

Results of the search strategy and process of selecting the articles based on the York Framework are shown in Figure 1. Eighty three articles (dated from 1998 – 2012) were assessed based on the study eligibility criteria. However, a few articles were irrelevant in terms of answering the objectives (e.g. articles on validation study, behavioural, and diet intervention such as gluten free casein free diet) and were excluded. Only fifty articles were selected and used in the scoping review which included relevant articles on feeding problems, GI symptoms and the impact of these problems on family life. There

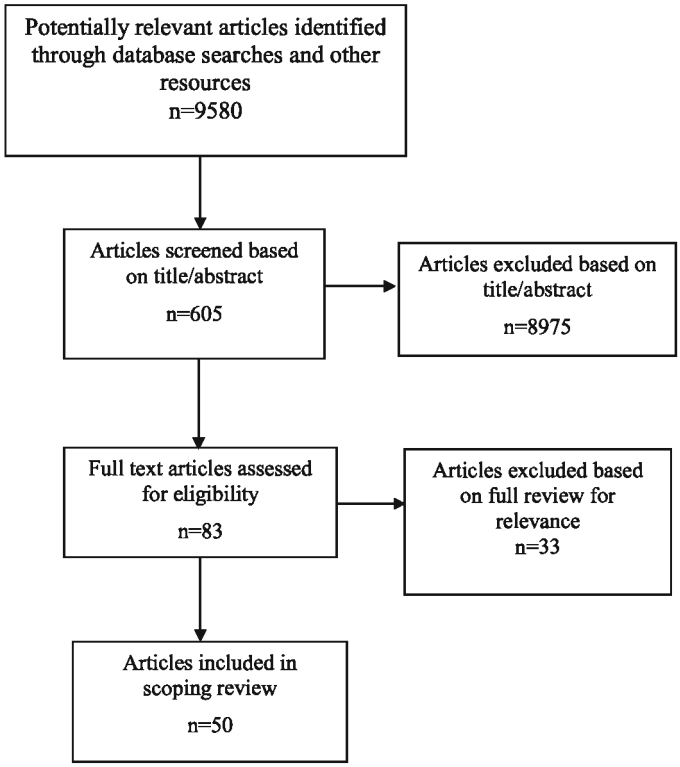

Figure 1. Results of search strategy and process of selecting articles (based on framework by Arksey & O'Malley 2005)

is an emerging literature highlighting the rates and different types of feeding problems and GI symptoms among young children with ASD. The majority of the studies identified during the review were observational (cross sectional, case control) in nature. They were conducted in a range of different settings and treatment programme from child general population community samples, educational/schools samples to clinic settings such as dietary treatment programmes.

Sample size ranged from 17 to 349 participants of children with ASD ages ranged from 2 years to 18 years. Several studies used children without ASD or typically developing children or children with other disabilities as comparison groups (Field *et al.*, 2003; Schreck, Williams & Smith, 2004; Schreck & Williams, 2006; Martins, Young & Robson, 2008; Johnson *et al.*, 2008; Bandini *et al.*, 2010; Smith *et al.*, 2009; Black, Kaye & Jick, 2002; Sandhu *et al.*, 2009; Afzal *et al.*, 2003). The most common methods for collecting information about feeding problems and GI symptoms were parental self-report questionnaires. Some studies used direct interviews, clinical reports from multidisciplinary feeding programme, direct observation methods or audit of referrals (Field *et al.*, 2003; Kerwin *et al.*, 2005; Ahearn *et al.*, 2001; Cornish, 1998; Afzal *et al.*, 2003; Black *et al.*, 2002). The majority of the studies developed their own non-validated parent self-report questionnaires to report the rates and types of feeding problems and GI symptoms.

Findings of several studies about feeding problems and GI symptoms are shown in Table 1 and Table 2. Field *et al.*

(2003) reported rates of feeding problems in children with ASD and children with disabilities (under 12 years old) to be as high as 40% to 80%. This rate is higher than the rates reported in typically developing children (usually in the order of 25% to 45 %) (Nicholls & Bryant-Waugh, 2009; Cermak, Curtin & Bandini, 2010). There are likely to be many factors influencing this increase in severity and intensity of the feeding problems and eating habits of young children. These factors include the child's level of increased physical activities, exposure to other lifestyle and environmental factors (home, schools, family, and/or siblings) compared with the experiences of infants or toddlers (Fox & Joughin, 2002; Nicholls & Bryant-Waugh, 2009). Similar patterns of increasing levels of severity and intensity have also been identified among primary school children with ASD. Matson & Fodstad (2009) reported rates of feeding problems among school children with ASD (aged 3 to 16 years) of 59% compared to atypically and typically developing children (Rate: 1-28%).

The results reported in the articles included in this review indicate that many primary school aged children with ASD can experience several types of feeding problems such as food selectivity, food refusal, food sensitivity, difficult mealtime behaviour, food cravings, food dislikes, food neophobia and pica (Cornish, 1998; Matson & Bamburg, 1999; Ahearn et al., 2001; Cornish, 2002; Schreck *et al.*, 2004; Kerwin *et al.*, 2005; Schreck & Williams, 2006; Johnson *et al.*, 2008; Lockner *et al.*, 2008 Collins *et al.*, 2003; Lukens & Linscheid, 2008; Martins *et al.*, 2008; Valicenti-McDermott et al., 2008; Herndon et al., 2009; Jyonouchi, 2009; Matson & Fodstad, 2009; Matson *et al.* 2009; Nicholls & Bryant-Waugh, 2009; Bandini *et al.*, 2010; Cermak *et al.*, 2010; Provost *et al.*, 2010). Further, there are some studies that report a range of different types of food selectivity by type, texture, brand, appearance and presentation (Cornish, 1998; Cornish, 2002; Field *et al.*, 2003; Schreck *et al.*, 2004). Some children also had food refusal, dysphagia and gastroesophaegal reflux (GOR) similar to children with Cerebral Palsy and Down Syndrome (Field *et al.*, 2003). In addition, there are reports that for some children with ASD, the feeding problems may overlap or perhaps interact with additional GI symptoms, and possibly also with some ASD characteristics such as behavioural rigidity and sensory difficulties (Lukens & Linscheid, 2008; Kerwin *et al.*, 2005; Valicenti-McDermott *et al.*, 2008). The results of the studies have shown that feeding problems in children with ASD are more intense, can take many forms and are distinct compared with typically developing children and other children with neuro-disabilities.

Turning to gastrointestinal symptoms (GI) in children with ASD, again several studies have reported a wide range of symptoms in young children with ASD aged from 2 years to 18 years. In summary, the reported symptoms include constipation, chronic abdominal pain, gaseousness, reflux, vomiting and diarrhoea (Heyman *et al.*, 1999; Horvath *et al.*, 1999; Lightdale, Siegal & Heyman, 2001; Black *et al.*, 2002; Afzal *et al.*, 2003; Kuddo and Nelson, 2003; Molloy and Manning-Courtney, 2003; Goldberg, 2004; Pallanti *et al.*, 2005; Valicenti-McDermott *et al.*, 2006; Levy *et al.*, 2007; Valicenti-McDermott *et al.*, 2008; Nikolov *et al.*, 2009; Smith *et al.*, 2009; Sandhu *et al.*, 2009). However, there is little consistency in the findings with rates of GI symptoms among children with ASD (under 18 years old) ranging from 9% to 90% compared with typically developing children (up to 30%). There are likely to be several reasons for these inconsistent findings.

Several different methodologies have been used to identify GI symptoms. Some studies used abdominal radiograph data from a general practice database, (Black *et al.*, 2002; Afzal *et al.*, 2003) and

Table 1. Feeding problems in children with Autism Spectrum Disorders (ASD)

Study	Purpose	Participants characteristics (diagnosis and age)	Comparison group and sample size	Recruitment Procedure /methods	Results (Types of feeding problems and rate)
William *et al.* (2000)	To investigate eating habits of children with Autism and PDD-NOS	100 Autism and PDD-NOS Age range: 22 months to 10 years	None	Community sample -The Autism project Questionnaires: self-report (NVQ*)	Two thirds of parents reported food refusal and difficult mealtime behaviours
Ahearn *et al.* (2001)	To identify categories of feeding problems in children with ASD	21 Autism; 9 PDD-NOS 3-14 years	None	Direct observation and data collection for education and diet treatment programme	Food selectivity by type or texture:57% Low to moderate food acceptance (food refusal): 87%
Cornish (2002)	To determine the effects of selective diet on food choices	37 ASD Age range: 3 years to 16 years	None	Clinical sample Questionnaires: self-report (NVQ*)	Food selectivity: 89% 32% to 50% of children had nutrient deficiency
Field *et al.* (2003)	To describe feeding problems in a clinical sample	26 ASD 1 month - 12 years	349 Children with Down Syndrome and Cerebral Palsy	Clinical sample Audit of clinical reports of children from a feeding programme	Food selectivity by type: 62%, by texture: 31% Children with ASD also had food refusal, dysphagia and gastro oesophageal reflux (GOR)
Kerwin *et al.* (2005)	To examine potential relationship among parental reports of feeding problems, GI symptoms and behavioural problems in children with ASD	89 ASD (Autism, Asperger's Syndrome, PDD-NOS) 30 months - 18 years	None	Community sample Questionnaires: self-report (NVQ*)	Strong food dislikes, food selectivity, aggressiveness during meal time : 50-75% (Self-injurious behaviours: head banging, ear hitting, eye pressuring, spitting foods) Pica: 20%

NVQ* = Non Validated Questionnaire; VQ***=Validated Questionnaire

Table 1. Continued

Study	Purpose	Participants characteristics (diagnosis and age)	Comparison group and sample size	Recruitment Procedure /methods	Results (Types of feeding problems and rate)
Schreck & Williams (2006)	To determine the types of feeding problems, food preference and the relationship to family eating preference	138 ASD (Autism, Asperger's Syndrome, PDD-NOS) 4 years to 12 years	238 typically developing children	Community sample Questionnaires :self- report The CEBI** (VQ***)	Food refusal ;57%, Restricted variety: 72%, Specific utensil requirements=14%, oral motor problems =23%
Martins *et al.* (2008)	To assess feeding problems and eating behaviours in children with ASD, typically developing children with ASD siblings and typically developing children with siblings who did not have disability	58 ASD 2 years -12 years	31 Typically developing children with ASD siblings 31 Typically developing children with siblings who did not have disability	Questionnaires: self-report (NVQ*)	50% of children with ASD refused to eat fruits and vegetables compared to other group, relationship between mother's eating behaviour and child's eating behaviour Food selectivity, food neophobia among children with ASD compared to other group. Parents of children with ASD had negative perceptions of the child's dietary intake.
Herndon *et al.* (2009)	To evaluate nutritional intake of children with ASD	46 ASD 3 years -8 years	31 typically developing children	Children recruited from hospitals, clinics and schools 3-days food diary	64% of children with ASD had limited consumption of foods Children with ASD ate less dairy products than typically developing children
Provost *et al.* (2010)	To determine specific food preferences in children with ASD	24 ASD 3years -6 years	24, typically developing children	Questionnaires (self-report) (NVQ*)	Food sensitivity or specific food preferences: 95% Food preference based on food colours (33%), food packaging (25%), food textures (71%), food temperatures (46%)

NVQ* = Non Validated Questionnaire , VQ***=Validated Questionnaire; CEBI**=The Children's Eating Behaviour Inventory

Table 2. Gastrointestinal symptoms in children with Autism Spectrum Disorders (ASD)

Study	Purpose	Participants characteristics (diagnosis and age)	Comparison group and sample size	Recruitment Procedure /methods	Results (Types of G symptoms and rate)
Horvath *et al.* (1999)	To evaluate the structure of function of the GI tract in children with ASD	36 ASD (Autism and PDD-NOS) Age: 2.5 years	None	Clinical sample Clinical investigations (e.g. gastrointestinal endoscopy, histology)	Abdominal pain : 69%, n=25 Chronic diarrhoea: 58%, n=21 Bloating:58%, n=21
Black *et al.* (2002)	To identify rate of GI symptoms	96 ASD mean age: 4 years Matched for age, gender and index date (date of first recorded diagnosis of ASD)	449 children without ASD	Computer recorded data from UK General Practices Database Clinical interview	GI symptoms (diarrhoea, pain) in children with ASD: 9%, similar across both groups
Afzal *et al.* (2003)	To investigate the diagnosis of severe constipation in children with ASD and without ASD	103 ASD (core Autism and Asperger's Syndrome) Age: <18 years	29 children without ASD	Clinical sample Abdominal radiographs Children with ASD referred to paediatric gastroenterology service Retrospective study	36% children with ASD had moderate or severe constipation with acquired mega rectum 61% of children with ASD received gluten free and casein free diet, casein free or gluten free
Molloy & Manning-Courtney (2003)	To identify patterns of GI symptoms	137 ASD 2 - 8 years	None	Community sample Questionnaires (NVQ*)	24% (n=33) children with ASD had at least one GI symptom, chronic diarrhoea (n=17), constipation (n=12), vomiting (n=9), abdominal pain (n=3)
Valicenti-McDermott et al (2006)	To compare prevalence of GI symptoms in children with ASD, typically developing children and children with developmental disabilities	50 ASD 1 year-18 years	50 typically developing children 50 children with developmental disabilities	Clinical sample (paediatric programmes, clinics, private practices) Structured interviews	70% GI symptoms in children with ASD, 28% in typically developing children, 42% other developmental disabilities Food selectivity: 60% in children with ASD, 22% typically developing children, 36% other developmental disabilities

NVQ* = Non Validated Questionnaire

Table 2. Continued

Study	Purpose	Participants characteristics (diagnosis and age)	Comparison group and sample size	Recruitment Procedure /methods	Results (Types of G symptoms and rate)
Valicenti-McDermott et al. (2008)	To compare GI symptoms in children with ASD with language regression and without language regression	100 ASD children with and without language regression Age: 1 year- 18 years	Children without language regression 100 ASD	Clinical sample self- report Questionnaires (NVQ*)	68% children with language regression experienced one or more GI symptoms (abdominal pain, constipation and diarrhoea at least once per week) Food selectivity: 62%
Smith *et al.* (2009)	To investigate GI symptoms in children with ASD and children in mainstream school	Mean age: 51 ASD (ASD, childhood autism, atypical autism, Asperger's Syndrome) Mean age :9.7 years (SD 3.7), Mainstream children, Mean Age:10.0 years (SD 3.2), Special school children Mean Age: 12.6 years (SD 3.5)	112 typically developing children 35 Children with learning disabilities and other developmental disabilities	Clinical sample self-report Questionnaires (NVQ*)	Constipation: 25% Diarrhoea:27% Flatulance rate: 24% Rates are similar across all groups, no significant difference between groups Parents of children with ASD are more concerned about GI symptoms
Nikolov *et al.* (2009)	To evaluate GI symptoms in ASD (PDD-NOS and Asperger's Syndrome)	ASD (PDD-NOS Asperger syndrome) Boys=145, girls=27 Age range: 5 years -17 years	None	Clinical sample (Children enrolled in a randomised clinical trial) Structured Interview using screening questionnaires (NVQ*)	23% children had GI symptoms (moderate or severe)- constipation and diarrhoea
Sandhu *et al.* (2009)	To investigate whether children with ASD have bowel symptoms consistent with underlying enterocolitis	78 ASD Age: up to 42 months (stool patterns recorded at 4 weeks and 6, 18, 30 and 42 months of age	78 typically developing children	Avon Longitudinal Study of Parents and Children (ALSPAC) Community sample Questionnaires (Information on stool patterns)	50% diarrhoea in children with ASD, prevalence increased with age compared to typically developing children No major differences in stool colour and consistency

others included children recruited from a clinical sample (Levy *et al.*,2007; Valicenti-McDermott *et al.*, 2008; Nikolov *et al.*, 2009) or a longitudinal study (Sandhu et al., 2009). The majority of the studies used questionnaires (self-report or interviews), and diagnostic criteria to identify a range of GI symptoms in children with ASD. Valicenti-McDermott *et al* (2006) in a cross sectional study reported that 70% children with ASD (below 18 years old; mean age: 7.6 years) had experienced one or more GI symptoms compared with typically developing children (28%) and other children with developmental disabilities (42%). In addition, children who had GI symptoms also had food selectivity problems (Valicenti- McDermott *et al.*, 2006; Valicenti Mc-Dermott *et al.*, 2008). Similarly, Kerwin *et al* (2005) also has reported that in a community sample of children with PDD-NOS investigated for abdominal pain, constipation and diarrhoea were also described as suffering from feeding problems. These studies (Valicenti-McDermott *et al.*, 2006; Valicenti-McDermott *et al.*, 2008; Kerwin *et al.*, 2005) suggested that primary school children with ASD are likely to have a combination of feeding problems and GI symptoms and perhaps there may be a relationship between the two sets of problems and/ or other impairments. Further, Nikolov *et al.* (2009) reported that children with ASD (aged 5-17 years) with GI symptoms showed greater symptom of anxiety, irritability and had severe behavioural problems (such as tantrum, aggressive behaviour and self-injurious behaviour). These findings have shown that it is important to consider these behavioural problems as part of the identification of GI symptoms.

Feeding problems and GI symptoms are likely to have a financial and psychosocial impact on both affected children and their families, and may also have an additional financial burden. Parents of primary school children with ASD (4-11 years) have reported that they felt more isolated and that eating out as a family, going out and socialising were particularly difficult (Cornish, 1998; Williams, Dalrymple & Neal, 2000; Kerwin *et al.*, 2005). To date, the evidence (albeit limited) does indicate that feeding problems and GI symptoms hve increased among primary school children particularly between aged 4-11 years old. Some authors recommend that feeding problems and/or GI symptoms and other medical conditions should be identified before they become entrenched (Kerwin *et al.*, 2005; Cermak *et al.*, 2010; Myers & Johnson, 2007). Indeed, some studies report that feeding problems and GI symptoms among children with ASD aged 4-11 years old are often persistent and longstanding (Field *et al.*, 2003; Kerwin *et al.*, 2005; Valicenti-McDermott *et al.*, 2008). Therefore, persistent problems may have other impacts for the children, their families and friends.

DISCUSSION

There is emerging literature reporting consistently on feeding problems and gastrointestinal symptoms among children with ASD. Based on the published evidence, feeding problems and GI symptoms among young children with ASD are regularly reported but the rates of the problems vary between studies. Findings from this scoping review show that feeding problems and GI symptoms in school children with ASD are complex compared to other groups of children with neurodisabilities. These factors are more likely to involve a complex combination of child ASD characteristics, individual functioning and family factors (Field *et al.*, 2003; Valicenti Mc-Dermott *et al.*, 2006; Lukens & Linscheid, 2008; Cermak *et al.*, 2010; Seiverling, Williams & Sturmey, 2010), such as the patterns of any sensory issues, problems with rigidity and coping with change that may particularly impact on the focus, intensify, number and

probably other aspects of feeding or rigidity behaviours, such as the introduction of new foods, changes in mealtime activities, challenging mealtime behaviours and how the child and family cope with GI symptoms. Therefore, the identification of feeding problems and GI symptoms in children with ASD seems likely to be challenging for both professionals and parents. Further, children with ASD are likely to have additional and co-morbid problems such as communication difficulties, developmental delay, physical health problems, behavioural problems which may affect how the child and parents cope with any feeding problems and GI symptoms (Cermak *et al.*, 2010; Lockner, Crowe & Skipper, 2008; Dunn *et al.*, 2001; Levin & Carr, 2001). In addition, parental feeding practices, levels of parental anxiety/ other mental health disorders and perceptions about their child's feeding problems or GI symptoms may also influence the identified rates or types of feeding problems and GI symptoms among young children with ASD (Field *et al.*, 2003; Martins *et al.*, 2008; Smith *et al.*, 2009; Kerwin *et al.*, 2005).

From all of this evidence, there is a need for more detailed and systematic investigation of the feeding problems and GI symptoms. A specific tool such as a structured questionnaire might be needed for the systematic collection of data about feeding problems and GI symptoms of children with ASD. This would be a valuable tool for both clinical/community practice and for further systematic research in these complex areas of child development. A structured questionnaire with good reliability and validity when used in community services would be a valuable measure for professionals working directly with families and for ASD researchers.

CONCLUSION

The findings based on this scoping review suggest that, first, there is a wide spectrum of feeding problems and GI symptoms in children with ASD. These problems seem to contribute to the financial impact, social impact and stress to children with ASD and their families. Professionals who are supporting primary school children with ASD and their families when investigating the presence of possible feeding problems and GI symptoms should also identify and consider the impact of these problems on the individuals concerned and the family as a whole. This impact issue needs to be explored and further research in this area is warranted.

Second, further research and systematic investigation are required to understand the complex interactions between feeding problems and GI symptoms in primary school children with ASD, and the impact of these problems on family life. It is important to appreciate that the complexity of the core features of ASD are also likely to contribute to the challenges in the identification and management of feeding problems or GI symptoms. Thus, for children with ASD, there may well be many additional factors contributing to the aetiology of their feeding problems and GI symptoms compared to typically developing children.

Lastly, structured assessments and comprehensive treatment approaches involving a multidisciplinary team at different settings in the community are needed to cater these problems. Health professionals who are working with families would be able to identify and investigate these problems in a systematic way so that appropriate support and treatment can be planned for the child. Once these problems have been recognised, it would then be possible for parents and professionals to access appropriate advice.

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Conflict of Interest

The authors declare that they have no competing interests.

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