

Food selectivity and autism: A systematic review

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Abstract

BACKGROUND

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that manifests in the first years of life, with a complex pathogenesis influenced by biological, genetic and epigenetic factors. Many children with ASD display marked food selectivity, often restricting themselves to a narrow range of foods. The problems associated with feeding children with ASD can vary widely, from mild cases that pose no immediate health risks, to more severe situations with a risk of malnutrition or, conversely, overeating. This scoping review aims to provide an in-depth overview of the frequency, nature and factors related to food selectivity in children with autism.

AIM

To comprehensively review the literature on food selectivity in ASD.

METHODS

A systematic review of the literature was conducted using the PubMed, Web of Science and EBSCO databases, to identify articles published in English from 2014 until 2024. Studies on a sample diagnosed with ASD and food selectivity were included. The selected databases were chosen for their broad coverage of the scientific literature. These databases represent reliable sources of high-quality articles, ensuring a comprehensive and up-to-date search.

RESULTS

We evaluated 222 studies on food selectivity in autism, from which duplicates were removed and unrelated titles were filtered out. Finally, 9 articles were included in the review. Five articles provide a general overview of the phenomenon, analysing its nature and factors. Two studies delve into sensory sensitivity, in particular the impact of food textures, tastes and smells. Finally, two studies focus on problem behaviour during mealtimes.

CONCLUSION

Children with ASD have greater food selectivity than the neurotypical population. The diet should contain a greater variety of fruit, vegetables, yoghurt, while reducing the consumption of rice and pasta.

Key Words: Food selectivity; Autism; Development; Autism spectrum disorder; Children

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Core Tip: This scoping review explored food selectivity in autism spectrum disorder. Two main themes emerged: Eating behaviour (*e.g.*, food refusal) during meals and sensory processing, in particular the smell, texture, taste, colour and temperature of food. Children with autism spectrum disorder have greater food selectivity than children with typical development and this makes them nutritionally vulnerable.

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INTRODUCTION

Autism spectrum disorder (ASD) is a neuro-developmental disorder with onset in early childhood with a complex pathogenesis, linked to biological, genetic and epigenetic factors[1,2]. The term ‘spectrum’ refers to the heterogeneity in the clinical manifestation and severity of ASD symptoms[3]. It is a condition characterised by difficulties in social interactions, both verbal and non-verbal communication, stereotyped behaviour and narrow interests[4]. The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), groups the first two elements into a single social and communicative domain and narrow interests and repetitive behaviour[5]. In the child’s first year of life, a number of alarm bells can already be observed in order to identify typical or atypical development, such as, for example, a sociable smile or avoidance of a direct gaze. ASD can also be classified into three levels of severity: Level 1 (mild autism), level 2 (requires substantial support) and level 3 (the most severe form of autism)[6]. In the early understanding of autism, specific difficulties in executive functions are also present. In reality, the executive functions in autism are diverse and show individual variations, but no impairment or impairment is present compared to individuals with typical development[7].

International epidemiological studies have reported a widespread increase in the prevalence of ASD[8]. Approximately 1 in 100 children worldwide has an ASD[9]. Furthermore, although estimates indicate that men are more frequently diagnosed with autism than women, recent evidence suggests a tendency for under-diagnosis of autism in women[10], who have a more internalised autism syndrome, rather than a lower prevalence than men[11]. Many children with an ASD may display a strong selectivity towards food, often limiting themselves to an extremely small number of accepted foods, sometimes as few as five or less. Feeding difficulties are commonly reported in early childhood when, during mealtimes, young children venture to explore food through their senses, gradually acquiring greater self-awareness through the sensory experiences of taste, touch and smell[12].

However, inappropriate feeding practices may entail risks, including a slowdown in the child’s growth[13,14]. Problems related to food intake in children can manifest themselves in a wide range of facets, ranging from mild cases where the behaviour does not pose an immediate health risk, to more serious situations where there is a serious risk of malnutrition or, conversely, of exceeding the recommended intake[15]. In the DSM-5, nutrition and eating disorders are grouped into a single diagnostic category and are characterised by a persistent eating disorder or eating-related behaviour that results in impaired food consumption or intake and significantly impairs physical health or psychosocial functioning[3]. Adopting restrictive child feeding practices can have counterproductive effects, in particular, the imposition of food restrictions can lead to undesirable results. In fact, restrictive feeding practices tend to increase children’s preferences for restricted foods[16]. This means that, instead of promoting a balance in the diet, restrictions may feed an overwhelming desire for foods considered ‘forbidden’[2]. Conversely, excessive eating with loss of control or elimination and/or compensatory behaviour can impair physical health and lead to altered nutritional status[17]. Also, persistent avoidance/restriction of food intake resulting in significant nutritional deficiency; Avoidant/restrictive food intake disorder is a new diagnosis in the DSM-5[18].

Children with ASD have significantly more feeding problems and eat a narrower range of foods than children with typical development[19]. Their eating habits tend to involve food aversion or rejection behaviours or preferences for some types of food over others. Several factors are involved in food selectivity in ASD, such as texture, taste, colour, *etc.* And, in some cases, it is possible to identify physiological factors that are the cause of some eating problems and difficulties, such as sensory sensitivity. In fact, ASD is also often associated with sensory processing difficulties, including hypersensitivity or hyposensitivity to sensory stimuli in the environment, so it is possible that tactile sensitivity may contribute to some of the feeding problems[20].

Some studies have also observed high rates of gastrointestinal disorders in ASDs compared to typically developing children[21,22]. The severity of intestinal symptoms appears to be strongly correlated with the severity of ASD symptoms, anxiety and the gut microbiome[23]. The most common gastrointestinal symptoms were abdominal pain and constipation, and gastroesophageal reflux was the most common condition found as a factor most associated with food refusal[24,25]. However, the aetiology of gastrointestinal disorders in children with ASD remains unclear. If left untreated, food selectivity may continue into adulthood, leading to social and nutritional deficits[26]. Thus, several factors contribute to feeding difficulties and require targeted interventions by various specialised professionals[27]. It is of particular importance to monitor nutritional status in individuals with ASD from birth, either by monitoring the increase in body mass index, or by using nutritional tools, such as food diaries compiled by parents, and periodically checked by paediatricians[28].

Various nutritional approaches are included in dietary approaches for ASD, including gluten-free and casein-free diets, ketogenic diets, gut syndrome and psychology and specific carbohydrate diets[29]. The most commonly used nutritional supplements include probiotics, polyunsaturated fatty acids and dietary supplements such as vitamins A, C, B6 and B12, as well as minerals such as magnesium and folate[30]. Despite the existing literature on food selectivity in children with ASD, little has been studied regarding its impact during family meals. Some studies have shown that destructive behaviours during these times are more common in children with ASD and are a source of parental concern[31,32]. Food selectivity is one of the most widespread conditions among autistic subjects. Through this scoping review, we aim to provide a comprehensive overview of the frequency and nature of food selectivity and related factors during mealtimes in autism. The aim of this scoping review was to study the literature dealing with the relationship between autism and food selectivity.

MATERIALS AND METHODS

Three electronic databases were used for the search. The scientific articles reviewed were within a 10-year research range (2014-2024) on autism and food selectivity. PubMed, EBSCO and Web of Science were used. The research team judged it appropriate to search these three databases. The selected databases were chosen for their broad coverage of the scientific literature. These databases represent reliable sources of high-quality articles, ensuring a comprehensive and up-to-date search.

Identify the research question

The study begins with a general description of the subject matter and possible complications. Our aim was to investigate the current scientific literature on the prevalence and nature of food selectivity in individuals with ASD compared to the neurotypical population.

Identify relevant studies

In order for useful studies to emerge for the study questions posed, the following keywords were used: “food selectivity and autism”, “food choices and autism”, “food selection and autism”. The selection criteria were English language and publication between 2014 and 2024. The selected time window, from 2014 to 2024, ensures that the data reflect the most current scientific and clinical developments and avoids including studies that are not relevant for today’s context.

Study selection

During the initial search, 142 articles were identified from PubMed, 32 from EBSCO and 48 articles from Web of Science, from which duplicates were removed, and unrelated titles were filtered out. After applying the inclusion and exclusion criteria, 13 articles were selected. Of these, 4 articles were excluded as they did not present specific objectives or experience with autism and food selectivity. After reviewing the titles of all articles, those that were clearly not relevant (such as those that did not deal with autism specifically) were discarded. During the research work, the main focus was on analysing articles that sampled children with a diagnosis of ASD with food selectivity. Subsequently, the articles were read in their entirety, paying more attention to methodology. Finally, 9 articles were suitable for full-text review. This systematic process ensured a comprehensive and rigorous literature review. The flow chart of the study selection is shown in **Figure 1**. **Figure 1** demonstrates the PRISMA 2009 flowchart diagram depicting the process of selecting studies for the review.

The inclusion criteria were as followed: Studies on a sample diagnosed with ASD and food selectivity. It was decided to include studies conducted on samples of individuals with a diagnosis of ASD and food selectivity to ensure that the results are relevant to understanding the possible interaction between these two conditions. The exclusion criteria were as followed: Laboratory studies often take place in controlled environments that may not reflect real-world conditions and dynamics. Parental studies are often based on subjective perspectives or unrepresentative samples that may limit the validity and general applicability of the results.

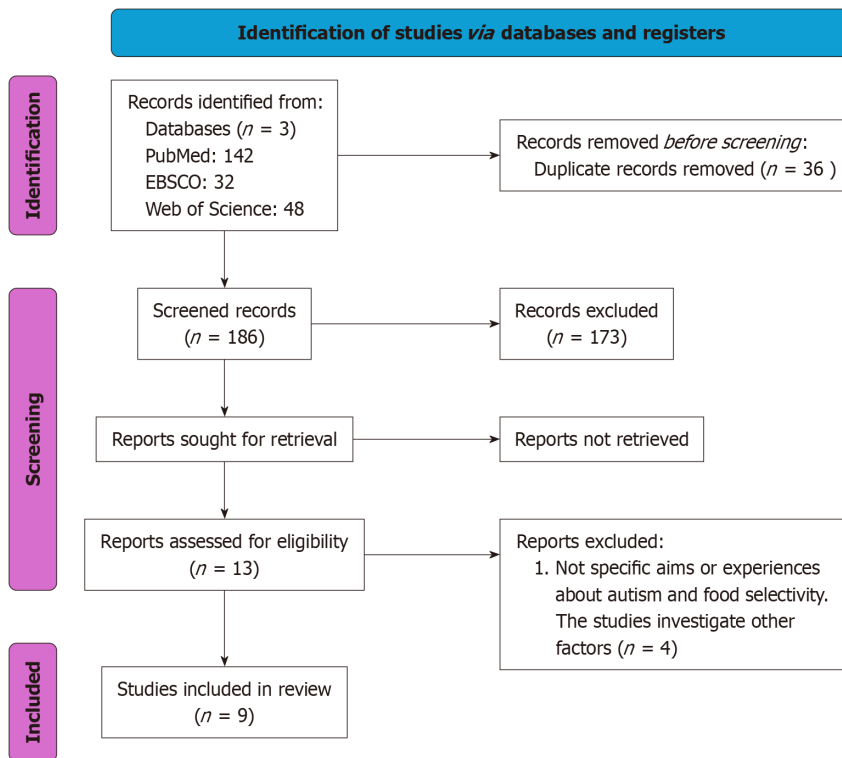


Figure 1 PRISMA diagram of the steps in the record review and selection process.

Chart the data

The fourth step concerns the organisation of the data from the identified articles. Microsoft Excel was used in this step. The data collected are as follows: Authors, year of publication, title, purpose, research setting, country of affiliation of the first researcher’s university, research methods, interventions, participant demographics, important findings and limitations.

Collate, summarize, and report results

Finally, the following actions were carried out: The results were organised into themes, the focus was on the results according to their applicability to the research objectives, with particular emphasis on the type of intervention. The most important information was: Sample size, participants, procedures and results. Within the results space there is a comprehensive account of all data.

RESULTS

In this review, 9 articles were identified that met the inclusion criteria. Specifically, 5 articles provide a general overview of the phenomenon, analysing the nature and factors of food selectivity in ASD. Another 2 studies delved into sensory sensitivity, which is common in autism, focusing on how different food textures, tastes and smells may impact food selectivity. Finally, 2 studies dealt with problematic mealtime behaviour.

Food selectivity

In five selected studies, the authors’ aim was to determine the nature and prevalence of food selectivity in individuals with ASD compared to the neurotypical population. Table 1 summarises the main characteristics of the included studies. The children who took part in these studies had a diagnosis of ASD. The diagnosis was confirmed on the basis of the DSM-5 and International Classification of Diseases-10 criteria (study 1), on the basis of the DSM-5 criteria (study 2) and on the basis of the autism behaviour checklist (study 5)[30]. In contrast, in study 3, the authors assessed ASD symptoms rather than clinically diagnosed ASD. For children aged 1.5, 3 and 6 years, by means of the DSM-oriented subscale ‘pervasive developmental problems’ and for children aged 10 to 14 years, the authors had parents complete the child behaviour checklist/6-18 and examined its correlation with the short form of the social responsiveness scale[30-34]. Overall, the studies showed that traits of food selectivity are common in individuals with ASD. Studies have found that the texture, appearance and presentation of food (colour, taste and smell) are among the main characteristics influencing food choices in children with autism. In another study, the authors found significant correlations between autism scores and the consumption of certain foods. Specifically, autism scores increased with the intake of certain foods, including rice, pasta and other cereals, and decreased with higher consumption of fruit and vegetables. Furthermore, this limited consumption of foods by children with autism decreased with age.

Table 1 Characteristics of included studies - food selectivity

Study	Number and age	Objective	Measures	Specific findings
1	219 participants, 115 of whom were diagnosed with autism and 92 without	Determining the prevalence and nature of food selectivity traits in individuals with ASD compared to the neurotypical population	The personal history form; children’s eating behaviour inventory; the food preference inventory; the Gilliam autism rating scale	Food selectivity traits are more common in individuals with ASD than in the neurotypical population
2	74 parents and/or caregivers; 72 children	Analysing the eating patterns of pre-school and school-age children with ASD	Online questionnaire	97.67% of ASD children show food selectivity
3	Participants (n = 4930)	Examine the two-way association between ASD symptoms and eating problems during the child’s development and whether this differs according to the child’s gender	Child behaviour checklist	ASD symptoms and eating problems may represent a set of highly stable traits from early childhood to adolescence and associations did not differ according to the child’s gender
4	375 children	Assessing food preferences in children diagnosed with ASD compared to controls	Food frequency questionnaire	Food selectivity is higher in children with ASD than in children with typical development
5	46 children with ASD	Investigating predisposing factors of eating disorders and the effects of food consumed on autism scores	Brief autism mealtime behaviour inventory; autism behaviour checklist; food frequency questionnaire	Food selectivity was observed in 84.8% of children

ASD: Autism spectrum disorder.

Sensory processing

Autism is often associated with sensory processing difficulties, *i.e.*, hypersensitivity or hyposensitivity to sensory stimuli in the environment. This means that even moderate stimuli may be perceived as overly intense or, conversely, they may have difficulty perceiving stimuli or reacting to them[35]. In 2 studies included in the review, the authors paid attention to food selectivity and its possible correlation with atypicality of sensory processes, the results are shown in Table 2. The children who took part in these studies had a diagnosis of ASD. The diagnosis of ASD was confirmed by the autism diagnostic observation schedule in the first study and by the autism diagnostic interview-revised in the second study[36, 37]. Overall, both studies confirm that children with ASD have sensory processing difficulties and that these have a negative impact on eating. In fact, the results emphasise precisely the correlation between food selectivity and the sensory domain. Children with ASD have a higher sensory sensitivity than children with typical development. The results show that there is no significant difference in nutritional status between these two groups but only dietary differences in the intake of certain foods. In particular, children with ASD tend to refuse food more and have a more restricted food repertoire, with less variety of fruit and vegetables than typically developing children.

Problematic mealtime behaviour

Two studies that looked at dietary intake and behavioural problems during mealtimes in children with ASD were included in the review (Table 3). The 2 selected studies were conducted in different countries: Spain (n = 1) and India (n = 1)[38,39]. One of the included studies is a cross-sectional, observational case-control study and the other a pilot study. All children who participated in the interventions described in the included articles were diagnosed with ASD using the diagnostic criteria of the DSM-5 in the first study and using the Indian autism assessment scale in the second[3,30,40]. The results showed inadequate food intake, food selectivity and eating problems such as food rejection, limited variety and disruptive behaviour in children with ASD. Furthermore, the data also showed a prevalence of underweight and obesity in children with ASD compared to neurotypical children. The research revealed a number of issues related to food intake in children with ASD. One study used the children’s eating behaviour inventory questionnaire to assess children’s eating behaviour and found that some children showed: A lack of satiety, food reactivity, and food pleasure. In addition, they showed a lower consumption of fruit and vegetables than the neurotypical children, which negatively influenced their micronutrient intake, which was significantly lower. Interestingly, although some children with ASD were overweight or obese, others were undernourished and showed an inadequate intake of vitamins and minerals.

DISCUSSION

This scoping review found that children diagnosed with ASD have a higher incidence of feeding problems and food selectivity than the neurotypical population, and these findings are consistent with what is found in the literature[16,41, 42]. In children with ASD, food selectivity can lead to significant nutritional deficiencies. From the results, we found a higher consumption of cereals such as pasta and rice and a lower consumption of fruit and vegetables, affecting both macronutrient and micronutrient sources. Sharp *et al*[43] in their study provided a detailed description of the food variety in ASD, which showed that the most frequently omitted food group was vegetables and fruit, resulting in a higher risk of

Table 2 Characteristics of included studies - sensory processing

Study	Number and age	Objective	Measures	Specific findings
1	Children with ASD (<i>n</i> = 53); children without ASD (<i>n</i> = 58)	Assessing the relationship between oral sensory processing and food selectivity in children with ASD	Food frequency questionnaire; the vineland adaptive behaviour scales; differential abilities scale; sensory profile (questionnaire); the subscale: Oral sensory over-sensitivity	Children with ASD had more atypical sensory processing than children without ASD and refused more food than those with typical oral sensory sensitivity
2	65 children with ASD and 30 with typical development	Analysing dietary intake, nutritional status and sensory profile in children with and without ASD	The SAYCARE study food frequency questionnaire; the Spanish version of the Short Sensory Profile; for anthropometric measurements of weight and height: Standardised by Frisancho and the World Health Organisation	Children with ASD had a higher sensory sensitivity, a lower intake of dairy products and a higher intake of cereal and protein foods than children with typical sensory performance with ASD

ASD: Autism spectrum disorder.

Table 3 Characteristics of included studies - problematic mealtime behaviour

Study	Number and age	Objective	Measures	Specific findings
1	44 children (<i>n</i> = 55 with ASD; <i>n</i> = 91 with neurotypical children)	Assessing body composition, nutritional status through food selectivity, degree of inappropriate intake and mealtime behaviour in ASD children compared to neurotypical children	Brief assessment of mealtime behaviour in children; food frequency questionnaire; seventy-two-hour food diary; body composition and anthropometric measurements	Children with ASD showed high food selectivity, more low weight and obese children and more disturbed eating behaviour than children with neurotypical development
2	45 boys and 8 girls	Assessing the dietary patterns, food intake and behavioural problems during mealtimes of children with ASD	Indian scale for assessment of autism; standard anthropometric techniques (World Health Organisation); food frequency questionnaire; children's eating behaviour inventory	Children with ASD are at risk of developing micronutrient deficiencies. Children present with: lack of satiety, lack of responsiveness to food and lack of enjoyment of food

ASD: Autism spectrum disorder.

nutritional inadequacies.

It is also clear from the review that there are two main themes relating to food selectivity in children with autism. Autism is often associated with sensory processing difficulties, *i.e.*, hypersensitivity or hyposensitivity to sensory stimuli in the environment. Autism is often associated with sensory processing difficulties, *i.e.*, hypersensitivity or hyposensitivity to sensory stimuli in the environment. This means that even moderate stimuli may be perceived as overly intense or they may have difficulty perceiving stimuli and reacting to them. In 2 studies it is shown that food selectivity is related to sensory processing and in particular to odour, texture, taste, colour and temperature of food. Our results are consistent with those of other studies showing that children with ASD have greater sensory sensitivity than children with typical development[18,44,45]. These sensory processing difficulties also have an impact on children's eating behaviour at mealtimes. In two studies, it was found that atypical mealtime behaviour is common in children with ASD and how these behaviours contribute to defining food selectivity. Problem behaviours such as food refusal, limited variety of food and disruptive behaviour (*e.g.*, demanding parents' attention in order to eat) were found. Food selectivity can be considered the manifestation of altered sensory response and behavioural rigidity, and an expression of altered brain networks. In this regard, several studies have shown the importance of taking sensory processing aspects into account. This information, in fact, may be crucial in structuring intervention protocols and, as a result, is significantly more effective. It is therefore possible to conclude that food selectivity in children with ASD can be improved by including strategies that take into account the presence of sensory processing[46-49].

The results revealed several problems related to food intake in children with ASD, including disruptive eating behaviour, reduced responsiveness to satiety, poor responsiveness to food and a lack of pleasure in eating. It has been shown that children with ASD show worse behaviour during mealtimes. The study by Murphy *et al*[50] examined the factors that contribute to problem eating behaviour in children. Problematic eating behaviour appears to emerge from a complex interaction of biological, social and psychological factors. In particular, the eating behaviour of parents had a greater impact than the disruptive behaviour of children. This scoping review has certain limitations. The main limitation is the insufficient number of studies dealing with the relationship between nutrition and autism, especially when compared to the high percentage of autistic individuals with eating disorders. Furthermore, existing studies lack depth and detail, thus limiting the comprehensive understanding of the problem. The research results show the need for further investigation into food selectivity in individuals with ASD.

CONCLUSION

Research shows that children with ASD have a higher food selectivity and this makes them nutritionally vulnerable, with a risk of adequate nutritional deficiencies. Food selectivity is a multifactorial problem that affects different aspects of these individuals' lives. Eating behaviour can also have consequences for the family of the child with autism, affecting the family's meal routine. This may result in meals becoming too focused on the child's sensory needs, limiting opportunities for sharing with the family. Therefore, it is of particular importance that treatment plans are customised according to the specific characteristics and sensory needs of the child. The treatment should involve a multidisciplinary team composed of neuropsychiatrists, psychologists, nutritionists, speech therapists and, finally, also the child's family members, providing them with support in dealing with the various dietary challenges. This approach aims to improve both the variety of foods consumed and the nutritional intake, while also optimising sensory processing, thereby also reducing behavioural problems during mealtimes. There are numerous strategies that can be adopted, for example some may include modifying the texture and sensory characteristics of foods.

Chung *et al*[49] conducted a study to improve the sensory experience of children with ASD from eating fruit and vegetables. They transformed the fruit and vegetables into snacks to evaluate the effects of the transformation on the children. The results of their study show how physical changes in food can improve sensory processing in children with ASD and promote acceptance. In conclusion, the diet should include a greater variety of fruit, vegetables, pulses, yoghurt and other cereals, and reduce the consumption of rice and pasta, to improve the health and well-being of children. It is recommended that children with ASD do not skip meals and use appropriate utensils at the table. Furthermore, it is important to create a calm eating environment, eating together without distractions such as television, phones or tablets, to try to foster a positive relationship with food. To better understand and address food selectivity in autism, it is necessary to explore innovative research directions and develop theoretical models that can guide future studies. One promising avenue is the in-depth analysis of the neurobiological and behavioural mechanisms that influence food selectivity. Understanding how sensory experiences influence food choices could facilitate personalised interventions to promote a more varied and balanced diet. In parallel, the adoption of a multidisciplinary approach, integrating psychology, nutrition and neuroscience, can contribute to improving the dietary variety, general well-being and quality of life of people with autism.

FOOTNOTES

Author contributions: Ferrara R, Iovino L, Ricci L, Avallone A, Latina R, and Ricci P contributed to the manuscript; Ferrara R conceptualized the study and coordinated the research activities; Avallone A contributed to data analysis, literature review; Iovino L contributed to data collection, methodology section; Roberto L contributed to manuscript editing, proofreading reviewed and supervised the manuscript.

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