



## REVIEW

# Problematic eating behaviours of autistic women—A scoping review

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## Abstract

**Aim:** Eating and feeding behaviours of autistic individuals and related consequences have been mainly investigated in autistic children or in autistic adults with intellectual disabilities. Behaviours such as food selectivity or food neophobia have been shown to persist into adolescence and adulthood and are associated with aversive consequences. However, much less is known about the eating behaviours of autistic adults without intellectual disabilities, especially those of women. By means of a scoping review, we aim to assess the extent of the scientific literature on what is known about the eating behaviours of these women and the possible consequences of such eating behaviour.

**Method:** Medline, Cochrane, PubMed and PsycInfo databases were searched according to Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.

**Results:** Five studies met the eligibility criteria and were included in this review. Autistic women not only reported high levels of eating behaviour frequently seen in autism spectrum disorders (ASD), but also high levels of disordered eating behaviour, similar to that of women with eating disorders.

**Conclusions:** Autistic women seem to exhibit high levels of eating behaviour frequently seen in ASD as well as disordered eating behaviour. Future research needs to shed light on what underlies these problematic eating behaviours, in order to help to adapt current treatment modalities to meet the unique needs of these women.

## KEYWORDS

autism spectrum disorders, eating behaviours, eating disorders, women

**Abbreviations:** ADI-R, autism diagnostic interview revised; ADOS-2, autism diagnostic observation schedule; AN, anorexia nervosa; AQ, autism spectrum quotient; ARFID, avoidant restrictive food intake disorder; ASD, autism spectrum disorder; BED, binge eating disorder; BMI, Body Mass Index; BN, bulimia nervosa; BTSD, best two subscale discriminating score; CRT, Cognitive Remediation Therapy; EAT, eating attitudes test; ED, eating disorders; EDE-Q, eating disorder examination questionnaire; SWEAA, Swedish eating assessment for autism spectrum disorders.

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### Highlights

- This scoping review indicates that autistic women exhibit both eating behaviours frequently seen in autism spectrum disorders (ASD) and disordered eating behaviours, similar to those of women with eating disorders.
- The review also indicates that studies investigating these eating behaviours of autistic women are still very scarce, and those that are available often lack a comprehensive assessment of the ASD diagnosis.
- Future studies are needed to confirm the findings and to further explore how and why autistic women eat the way they eat, in order to help to adapt current treatment modalities to meet the unique needs of these women.

## 1 | INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition that is defined by challenges in social communication and social interactions as well as by the occurrence of restricted and repetitive patterns of behaviour, interests or activities that persist over the whole course of a person's life (American Psychiatric Association, 2013). A suggested 1.4%–1.7% of the general population are autistic (Baron-Cohen et al., 2009; Brugha et al., 2011; Christensen et al., 2018; Fombonne, 2010; Russell et al., 2014). For quite some time, reported male to female ratios are between 12:1 (Eric, 2003) and 4:1 (American Psychiatric Association, 2013) but have recently been found to be closer to 3:1 (Loomes et al., 2017), although exact data are still lacking (Lord et al., 2020). But even with women and girls now more often recognised as being on the autism spectrum, they are still thought to be underrepresented and often remain undetected.

Theories on the aetiology of ASD such as the Extreme Male Brain Theory (Baron-Cohen, 2002) and the Female Protective Model of Neurodevelopmental Disorders (Jacquemont et al., 2014) have attributed genetic factors to be partly responsible for the overrepresentation of autistic males. However, there has been increasing evidence for a particular female phenotype of ASD (Dworzynski et al., 2012; Hull, Petrides & Mandy, 2020; Russell et al., 2011), suggesting that the female expression of ASD differs from the behavioural expression described in current diagnostic criteria. These criteria form the basis of current standard diagnostic instruments for ASD, which have been developed and validated on the basis of predominantly male populations thought to be autistic (Bastiaansen et al., 2011; Gotham et al., 2007; Lord et al., 1994, 2000). Possibly due to a longstanding male bias towards an understanding of what ASD is and how it manifests (Brown & Stokes, 2020; Lai et al., 2015), autistic girls and women frequently require a more severe presentation of their autistic traits to be recognised (i.e., a

more 'male' presentation) (Geelhand et al., 2019; Russell et al., 2011; Rynkiewicz & Łucka, 2018), and are also often overlooked because of the different expression of their autistic traits; Autistic girls and women are thought to use more strategies to compensate for and mask autistic characteristics during social interaction called camouflaging (Hull, Lai, et al., 2020), present with less restrictive and repetitive behaviours (Hull, Petrides & Mandy, 2020; Lai et al., 2015; Supekar & Menon, 2015) and different special interests (Halladay et al., 2015). In addition to these traits, autistic females are more likely to appear to have co-occurring internalising psychiatric problems than their male counterparts such as depression, anxiety, and problems with emotion regulation (Attwood, 2006; Mandy et al., 2012; Oswald et al., 2016), which can cloud the expression of their autistic traits even more.

ASD is associated with significant impairments of an individuals' daily functioning such as having difficulties managing everyday tasks or communicating one's needs, difficulties with social interaction and interpreting other people's behaviour, or processing sensory or cognitive information (Malhi et al., 2017). ASD often co-occurs with a range of physical and psychiatric difficulties, such as gastrointestinal problems (Leader et al., 2021; McElhanon et al., 2014), sleep disturbances (Hare et al., 2006; Morgan et al., 2020), depressive and anxiety disorders (Hollocks et al., 2019; Margari et al., 2019) and problems around eating behaviour (Mari-Bauset et al., 2014; Sharp, Berry, et al., 2013; Spek et al., 2019).

In recent years, there has been a growing interest in the prevalence and origins of eating or feeding problems frequently seen in autistic individuals, with the great majority of studies focussing on autistic children (Leader et al., 2020; Mayes & Zickgraf, 2019). Between 43.6% and 96% of autistic children are reported to have eating or feeding problems (Margari et al., 2020), more than typically developing children (Malhi et al., 2017) or children with other developmental disorders such as Attention Deficit Hyperactivity Disorder (Mayes & Zickgraf, 2019)

or intellectual disability (Crasta et al., 2014; Råstam, 2008). These eating or feeding problems range from being very selective with regards to what they eat or refusing food intake altogether (Bandini et al., 2010), refusing to try out new foods (i.e. food neophobia) (Sun et al., 2013), eating either too much or too little (Geier et al., 2012), exhibiting both emotional over- and under-eating (Wallace et al., 2021) or showing behavioural problems around mealtime (Curtin et al., 2015). In autistic individuals with intellectual disabilities, abnormal eating behaviours such as pica, rumination or regurgitation seem to be more prevalent than in autistic individuals without such disabilities (Brown & Stokes, 2020; Gravestock, 2000).

Eating behaviours frequently seen in autistic individuals have been theorised to be the result of a combination of certain cognitive and behavioural patterns characteristic of ASD: cognitive and behavioural rigidity, restricted interests as well as sensory sensitivities (in this case with regards to the properties of food) are considered to underlie these problems (Christensen et al., 2019; Cooke et al., 2006; Margari et al., 2020; Mari-Bauset et al., 2014). The consequences of these eating behaviours are manifold and have been linked to gastrointestinal problems (Leader et al., 2020), being over- or under-weight (Matheson & Douglas, 2017; Ptomey et al., 2020; Sobanski et al., 1999) and nutrient deficiencies (Zimmer et al., 2012). These eating behaviours have been shown to persist into adolescence and adulthood (Fodstad & Matson, 2008; Lundin Remnélius et al., 2021; Nieminen-von Wendt et al., 2005; Spek et al., 2019), but very little is still known about the eating behaviours and corresponding problems of autistic adults, especially those of women.

Unsurprisingly, autistic men as well as autistic women have been shown to report more eating behaviours frequently seen in ASD compared to controls (Demartini et al., 2021; Spek et al., 2019) and have been described to struggle with being overweight or obese (Ptomey et al., 2020), with some studies reporting a higher prevalence of obesity than in control populations (Croen et al., 2015). Especially autistic women however also seem to struggle with increased eating disturbances associated with 'traditional' ED (henceforth *disordered eating behaviours*), such as a pathological avoidance of certain (fattening) foods (e.g., foods with a high carbohydrate or with a high sugar content) and a desire to be thin, as well as increased bulimic behaviours such as bingeing and purging (Demartini et al., 2021; Karjalainen et al., 2016; Spek et al., 2019), disturbances for which women in general seem to be particularly vulnerable (Micali et al., 2015; Striegel-Moore et al., 2009). Moreover, autistic women have reported more hyperreactivity to sensory information compared to autistic men (Lai

et al., 2015; Spek et al., 2019), which might pose an additional vulnerability to developing problematic eating behaviours (i.e., eating behaviours frequently seen in ASD and/or disordered eating behaviours) because of the various sensory properties of food. However, most studies on problematic eating behaviours of autistic adults either do not provide separate information for men and women (Blomqvist et al., 2015; Demartini et al., 2021; Karjalainen et al., 2016; Karlsson et al., 2013; Nieminen-von Wendt et al., 2005), have included very few female participants (Courty et al., 2013) or have included autistic women with intellectual disability (Lundin Remnélius et al., 2021). To generalise the findings of autistic women with intellectual disabilities to those of autistic women without intellectual disabilities is difficult, since deficits in cognitive functioning might play a bigger role in the development and maintenance of these behaviours in autistic individuals with intellectual disabilities than in autistic individuals without intellectual disabilities (Funayama et al., 2017; Gravestock, 2000; Råstam, 2008). Additionally, in autistic individuals with intellectual disabilities, it is still unclear and difficult to determine which part of the eating or feeding problems is linked to the ASD and which part is linked to the intellectual disability.

The relationship between ASD and problematic eating behaviours in women has mainly been investigated in the literature on ED, where autistic traits have repeatedly been found to be overrepresented in ED populations, especially in women with anorexia nervosa (AN) (Boltri & Sapuppo, 2021; Huke et al., 2013; Westwood & Tchanturia, 2017). Autistic traits have been found to be associated with a more severe clinical presentation of both ED and other psychopathology on admission of patients with ED (Tchanturia et al., 2019). Additionally, patients with ED that are on the autistic spectrum report to not profit from 'traditional' ED treatments that generally concentrate on a desire to lose weight or a negative body image, while not taking sensory sensitivities into account (Kinnaird et al., 2019).

Several previous studies have suggested a shared etiopathology between ASD and ED, as certain behavioural and neurocognitive traits, such as difficulties with emotion recognition and empathic abilities (Kerr-Gaffney, Harrison, et al., 2020; Kerr-Gaffney, Mason, et al., 2020), cognitive inflexibility (Oldershaw et al., 2011; Westwood et al., 2016, 2017) and repetitive and stereotyped behaviour (Pooni et al., 2012), are associated with both ASD and ED. In some ED patients, consequences of the ED, such as being underweight or being in a prolonged starved state, can lead to reduced cognitive flexibility, increased compulsive behaviours, obsessions and rituals around food, mimicking

supposedly autistic traits (Danner, Sanders, et al., 2012; Keys et al., 1950; Tchanturia et al., 2012). It is still not entirely clear whether such similarities persist or get better after nutritional recovery (Miles et al., 2020; Treasure, 2013), making it even more difficult to determine whether these autistic traits are exacerbated by ED psychopathology or in fact warrant a full clinical assessment of ASD (Kinnaird & Tchanturia, 2021). In addition to that, women with AN have been found to show a range of eating behaviours frequently seen in ASD, even after weight gain (Karjalainen et al., 2019).

Still, very little is known about the problematic eating behaviours of autistic women as studies investigating the relationship between autistic traits and problems around eating behaviour oftentimes rely on either self-report measures like the Autism Spectrum Quotient (AQ-50) (Baron-Cohen et al., 2001) or on various versions of semi-structured assessments like the Autism Diagnostic Observation Schedule (ADOS-2) (Lord et al., 2000) to determine the level of autistic traits. While the administration of such measures can be an important first step in the diagnostic process, a full clinical assessment including a thorough investigation of the patient's developmental history is essential to determine whether someone has ASD (National Institute for Health and Care Excellence [NICE], 2021).

The aim of this review is to systematically examine what is currently known about problematic eating behaviours (i.e., eating behaviours frequently seen in ASD and/or disordered eating behaviours) of autistic women as well as their impact on weight. We have opted to concentrate on autistic women without intellectual disabilities, since it is otherwise not possible to determine which part of their eating behaviours are linked to the ASD and which are linked to the intellectual disability. Since both groups would be difficult to compare with regards to problematic eating behaviours, possible results would not be generalisable to both groups.

## 2 | METHOD

### 2.1 | Review methodology

The primary aim of a scoping review is to identify knowledge gaps and to scope a body of literature (Munn et al., 2018). Given the scarcity of studies about autistic women and the diversity of studies on problematic eating behaviours of autistic women in terms of outcome measures, we opted for a scoping review that is in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Moher et al., 2009; Tricco et al., 2018),

with a critical synthesis of the findings instead of a systematic review. A protocol was drafted in accordance with the PRISMA-ScR guidelines (Tricco et al., 2018), which was revised by the research team. The final protocol was not registered beforehand but is available on request from the corresponding author.

### 2.2 | Eligibility criteria

To be included in the review, articles needed to examine or measure any eating related behaviour of women above the age of 18 that have a diagnosis of ASD (e.g. food or eating preferences, eating behaviours frequently seen in ASD, disordered eating behaviours or eating pathology), without intellectual disability. To be as comprehensive as possible with regards to the aim of this scoping review, we also included any studies that examined Body Mass Index (BMI) or weight data in autistic women, in order to investigate whether there is anything known about these eating behaviours and their impact on weight. Another criterion was that the ASD diagnosis had to be obtained or assigned by means of a comprehensive assessment according to DSM-IV or DSM-5 criteria carried out by experienced and trained psychiatrists, psychologists or neurologists (NICE, 2021). Quantitative as well as qualitative studies were eligible for inclusion. Only published and peer-reviewed literature in English, German and Dutch<sup>1</sup> were considered, without any specific date requirements.

### 2.3 | Literature search strategy

The literature search was conducted in February 2022. Eligible studies were identified through searches in four electronic databases: Cochrane, Medline, PsychINFO and PubMed. Given the lack of studies on autistic women above the age of 18, we opted for a very broadly defined search strategy so as to not miss any study that has been done on autistic women and anything possibly relating to their eating behaviours. In consultation with a librarian from Utrecht University and after peer-review from the research team, queries were developed and adapted for each electronic database, using a combination of keywords relevant to women, ASD and eating behaviours. Boolean operators (AND, OR, NOT) were used to combine these keywords to result in a more focussed search. The full queries for all electronic databases can be found in the Supporting Information S1.

- **For Medline:** "exp Feeding Behavior/ OR exp "Feeding and Eating Disorders"/OR exp Food Fussiness/OR exp

Food Preferences/OR exp Food/OR exp Eating/OR exp Meals/OR exp Diet/OR exp Pica/OR exp Rumination Syndrome/OR exp Avoidant Restrictive Food Intake Disorder/OR exp Anorexia/OR exp Bulimia/OR exp Binge-Eating-Disorder/OR exp body weight/OR exp Obesity/OR exp Body Weight/OR exp Body Mass Index/OR eating\*.mp OR feed\*.mp OR food\*.mp OR meal\*.mp OR nutrition\*.mp OR diet\*.mp OR obes\*.mp OR anorexia\*.mp OR bulimia\*.mp OR binge\*.mp OR pica\*.mp OR orthorexia\*.mp OR ARFID\*.mp OR ruminati\*.mp AND exp Women/OR exp Adult/OR exp Female/OR women\*.mp OR woman\*.mp OR female\*.mp OR adult\*.mp AND exp Autism Spectrum Disorder/OR exp Autistic Disorder/OR exp Asperger Syndrome/OR exp Child Development Disorders, Pervasive/OR autistic\*.mp OR asperger\*.mp”

## 2.4 | Study selection

The search strategy yielded a total of 5133 articles, which were exported into EndNote Reference Manager. After duplicates were removed, a total of 3858 records remained: 360 records from Cochrane, 2150 from Medline, 1207 from PsychINFO and 141 from PubMed. To ensure that no article was missed, we additionally scanned reference lists of various review articles retrieved through the database searches (e.g.: Boltri & Sapuppo, 2021; Carpita et al., 2020; Ledford et al., 2018; Nickel et al., 2019) to identify possible articles that were not included by means of the search queries, but no new articles were retrieved this way. We resolved disagreements on study selection and data extraction by consensus. The PRISMA flow diagram of the selection process is presented in Figure 1.

After screening titles and abstracts according to eligibility criteria, a total of 3711 were excluded. The main reasons for exclusion at this point were: studies that included only autistic men or children, articles that did not focus on eating behaviours, studies that did not specify eating behaviours and studies that were in other ways not relevant to review.

A total of 147 full-text articles were then thoroughly examined, of which 142 were excluded for the following reasons: studies of participants with autistic traits instead of having an ASD diagnosis or where it was unclear whether participants qualified for an ASD diagnosis, studies that relied on self-report of the ASD diagnosis instead of a comprehensive assessment including a developmental analysis, studies with insufficient information on how the ASD diagnosis was obtained or assessed,<sup>2</sup> articles without outcome data on eating behaviour or BMI/weight data, studies of autistic participants and intellectual disability (without separate

analyses), studies of autistic men and women without separate analyses for women and correlational relationships between ASD and eating behaviour without separate data of eating behaviour in autistic women. For an overview of reasons for exclusion, please see the lowest box on the right in Figure 1.

## 2.5 | Data charting

After the selection of studies and after the researchers decided conjunctively on how the data was going to be charted, data for the following variables were extracted independently from each study: author(s), year of publication, aim, design, number of participants, gender of participants, percentage of female participants, mean age of participants, BMI, outcome measures of eating related behaviours and key findings. If any information was unclear, the authors of those articles were contacted to clarify.

## 2.6 | Synthesis of results

Studies were grouped by the types of problematic eating behaviour measures as well as by eating related outcomes such as weight and BMI. We summarised the type of study design and population, the measures that were used to examine eating related behaviour or weight and BMI, as well as the broad findings of the study.

## 3 | RESULTS

### 3.1 | Study characteristics

As can be seen in Table 1, a total of five studies assessing problematic eating behaviours or BMI and body composition data of autistic women were identified in the current scientific literature and included in this scoping review. All studies were published within the last 4 years by research groups from the United Kingdom, the Netherlands, Spain, Sweden, and Italy. Four studies, three cross sectional studies and one case study, assessed eating behaviours as measured by self-report questionnaires pertaining to eating behaviours frequently seen in ASD (Karjalainen et al., 2019; Nisticò et al., 2021; Spek et al., 2019) as well as disordered eating behaviours and eating pathology (Dandil et al., 2020; Nisticò et al., 2021). Three of these studies also reported on BMI data (Dandil et al., 2020; Karjalainen et al., 2019; Nisticò et al., 2021). One study, with a cross sectional design, merely assessed BMI data without looking at specific eating behaviours (Garcia-Pastor et al., 2019).

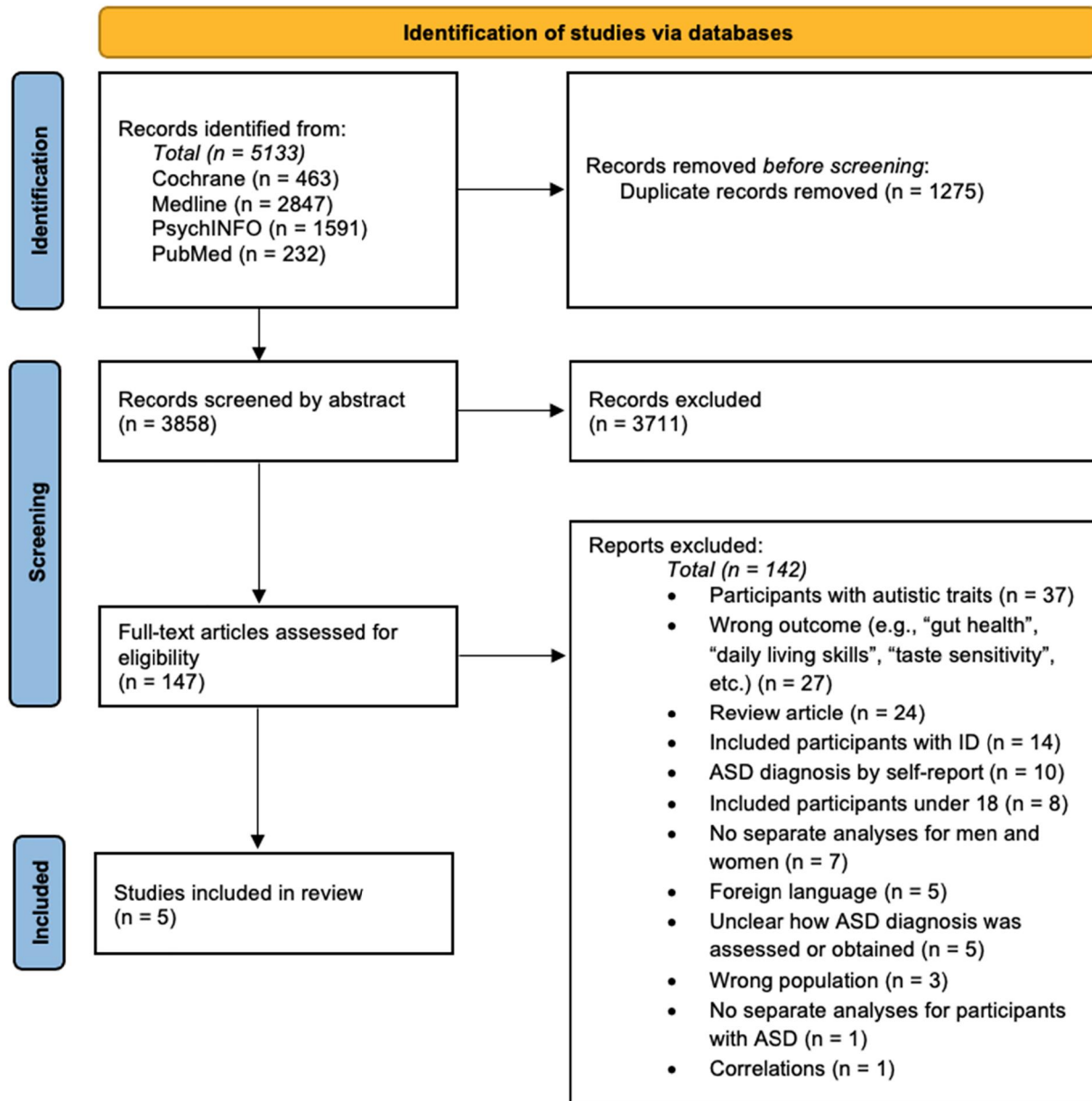


FIGURE 1 Selection process: PRISMA flow diagram

Across all studies, a total of 94 adult women above the age of 18 were included in the studies, with one study including seven participants under the age of 18. All participants were thoroughly assessed and diagnosed according to either DSM-IV or DSM-5 ASD criteria (American Psychiatric Association, 2013) by a psychologist or psychiatrist with regards to their ASD. Four studies also applied a standardised diagnostic instrument such as The Autism Diagnostic Interview-Revised (ADI-R) (Rutter et al., 2003), or ADOS-2 (Lord et al., 2012) to aid in the diagnostic process (Dandil et al., 2020; Garcia-Pastor et al., 2019; Nisticò et al., 2021; Spek et al., 2019). One study additionally ensured that the autistic participants had never received a diagnosis of

EDs (Nisticò et al., 2021), presumably in order to attribute any findings regarding eating behaviours frequently seen in ASD and disordered eating behaviours to the ASD and not to an underlying ED. The case study included a participant with both ASD and a diagnosis of AN (Dandil et al., 2020). The three other studies did not assess whether the autistic participants had a current or a lifetime ED. Four studies also included other psychiatric or control groups: One study included a group of EDs and a control group (Nisticò et al., 2021), another a group of autistic men as well as female and male control groups (Spek et al., 2019), another included two AN groups (current and after 1 year follow-up) as well as a control group (Karjalainen et al., 2019), and another included a

**TABLE 1** Studies examining eating behaviour in autistic women

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
Nisticò et al. (2021)	Comparing ED patients, autistic individuals and CW on measures detecting symptoms of eating disorders and eating disturbances known to be characteristic of ASD	Observational, cross-sectional study	34 women with ED (15 ANR, 7 BN, 12 BED) 34 autistic women 35 CW	ED = 30.82 (13.1) ASD = 37.88 (12.98) CW = 35.66 (12.15)	ASDs were diagnosed by a psychiatrist and psychologist according to DSM-5 criteria and module four of the ADOS-2	BMI EAT-26 SWEAA	<b>BMI (SD)</b> ED = 21.74 (6.85), range: AN (14–18.87), BN (18.8–26.49), BED (19–41.54) ASD = 23.35 (4.98), range: 17.65–35.1 CW = 21.68 (3.26), range: 17.67–31.55 No sig. difference between ASD and ED No sig. difference between ASD and CW <b>EAT-26 total score</b> ED = 21.68 (17.2) ASD = 11.76 (12.383) CW = 3.34 (3.6) ASD < ED ( $p = 0.008$ ) ASD > CW ( $p = 0.008$ ) No sig. effect of BMI <b>EAT-26 subscales</b> <i>Dieting:</i> ED = 11.82 (9.39) ASD = 7.5 (7.88) CW = 2.49 (2.55) ASD > CW ( $p = 0.01$ ) No sig. differences between ASD and ED <i>Bulimia and food preoccupation:</i> ED = 4.88 (4.38) ASD = 2.5 (3.51) CW = 0.29 (0.79) ASD < ED ( $p = 0.013$ ) ASD > CW ( $p = 0.016$ ) <i>Oral control:</i> ED = 4.97 (5.74)

(Continues)

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
							ASD = 1.76 (3.66) CW = 0.57 (1.36) ASD < ED ( $p = 0.01$ ) No sig. differences between ASD and CW Neg. correlation between BMI and subscale oral control
							<b>SWEAA total score</b> ED = 28.65 (14.47) ASD = 31.25 (12.24) CW = 16.6 (6.64) ASD > CW ( $p < 0.001$ ) No sig. differences between ASD and ED No sig. effect of BMI
							<b>SWEAA subscales</b> <i>Perception:</i> ED = 1.09 (0.82) ASD = 1.63 (0.69) CW = 0.83 (0.55) ASD > ED ( $p = 0.004$ ) ASD > CW ( $p < 0.001$ ) <i>Motor control:</i> ED = 0.58 (0.56) ASD = 0.82 (0.057) CW = 0.42 (0.32) ASD > CW ( $p = 0.004$ ) No sig. differences between ASD and ED <i>Purchase of food:</i> ED = 1.95 (0.85) ASD = 2.03 (1.07) CW = 1.49 (0.65)



TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
							ASD > CW ( $p = 0.045$ )
							No sig. differences between ASD and ED
							<i>Eating behaviour:</i>
							ED = 1.52 (0.79)
							ASD = 1.41 (0.75)
							CW = 0.81 (0.43)
							ASD > CW ( $p < 0.001$ )
							No sig. differences between ASD and ED
							<i>Mealtime surroundings:</i>
							ED = 1.52 (0.97)
							ASD = 1.52 (0.79)
							CW = 0.53 (0.42)
							ASD > CW ( $p < 0.001$ )
							No sig. differences between ASD and ED
							<i>Social situation at mealtime:</i>
							ED = 1.21 (0.48)
							ASD = 1.45 (0.55)
							CW = 0.96 (0.38)
							ASD > CW ( $p < 0.001$ )
							No sig. difference between ASD and ED
							<i>Other behaviour associated with disturbed eating behaviour:</i>
							ED = 0.62 (0.55)
							ASD = 0.4 (0.34)
							CW = 0.21 (0.22)
							No sig. differences between ASD and ED
							No sig. differences between ASD and CW
							<i>Hunger/satiety:</i>
							ED = 1.49 (0.9)
							ASD = 1.03 (0.91)

(Continues)

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
							<p>CW = 0.6 (0.53)</p> <p>No sig. differences between ASD and ED</p> <p>No sig. differences between ASD and CW</p> <p><i>Simultaneous capacity:</i></p> <p>ED = 0.68 (1.07)</p> <p>ASD = 1 (1.21)</p> <p>CW = 0.17 (0.45)</p> <p>ASD &gt; CW (<math>p = 0.001</math>)</p> <p>No sig. differences between ASD and ED</p> <p><i>PICA:</i></p> <p>ED = 9.24 (0.7)</p> <p>ASD = 0.15 (0.5)</p> <p>CW = 0 (0)</p> <p>No sig. differences between ASD and ED</p> <p>No sig. differences between ASD and CW</p> <p>No sig. effect of BMI on any subscale</p>
Spek et al. (2019)	To assess eating problems in autistic men (with and without housing support) and autistic women and compare their results to control women and men	Observational, cross-sectional study	53 autistic men (30 without housing support, 23 with housing support) 36 autistic women	Autistic men (with support) = 35.2 (12.7) Autistic men (without support) = 40.7 (12.4)	ASDs were recruited via an outpatient centre and Lister.  <i>Outpatient centre:</i>	SWEAA	<p><b>SWEAA total score</b></p> <p>ASD women = 127.8 (33.9)</p> <p>CW = 99.9 (13.5)</p> <p>ASD men = 115.8 (24.8)</p> <p>ASD women &gt; CW (<math>p &lt; 0.001</math>)</p> <p>No sig. difference between ASD women and ASD men</p> <p><b>SWEAA subscales</b></p>
			30 CM	Autistic women = 38.8 (10.9)	ASDs were all diagnosed by trained psychologist or psychiatrist according to DSM-IV or DSM-5 criteria, by means of a semi-structured interview according to DSM-5 ASD criteria and the ADI-R. (All autistic women came from the outpatient centre)		
			38 CW	CM = 38 (13.2) CW = 34.4 (13.5)			

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
							<p><i>Perception:</i></p> <p>ASD women = 26.4 (8.9)                      CW = 20.6 (4.9)</p> <p>ASD men = 22.5 (6.0)</p> <p>ASD women &gt; CW (<math>p &lt; 0.0001</math>)</p> <p>ASD women &gt; ASD men (<math>p = 0.0036</math>)</p> <p><i>Motor control:</i></p> <p>ASD women = 11.4 (3.7)                      CW = 11.1 (2.6)</p> <p>ASD men = 13.1 (3.8)</p> <p>ASD women &lt; ASD men (<math>p = 0.049</math>)</p> <p>No sig. difference between ASD women and CW</p> <p><i>Purchase of food:</i></p> <p>ASD women = 10.1 (2.9)                      CW = 8.2 (1.9)</p> <p>ASD men = 8.3 (2.9)</p> <p>ASD women &gt; CW (<math>p = 0.0004</math>)</p> <p>ASD women &gt; ASD men (<math>p = 0.014</math>)</p> <p><i>Eating behaviour:</i></p> <p>ASD women = 13.2 (4.8)                      CW = 10.6 (2.7)</p> <p>ASD men = 12.6 (4.7)</p> <p>ASD women &gt; CW (<math>p = 0.0007</math>)</p> <p>No sig. difference between ASD women and ASD men</p> <p><i>Mealtime surroundings:</i></p> <p>ASD women = 24 (10.1)                      CW = 14.6 (3.5)</p> <p>ASD men = 19 (7.6)</p>
					<p><i>Lister:</i></p> <p>ASDs were all diagnosed by a trained psychologist or psychiatrist before coming to Lister, plus they all underwent an additional diagnostic process by a psychiatrist or psychologist. No other standardised instruments were used.</p>		
					<p>Only participants who met DSM-5 criteria of ASD were included in the study</p>		

(Continues)

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
							ASD women > CW ( $p < 0.0001$ )
							No difference between ASD women and ASD men
							<i>Social situation at mealtime:</i>
							ASD women = 24.2 (4.6)
							CW = 19.9 (5.3)
							ASD men = 23.4 (4.8)
							ASD women > CW ( $p < 0.0001$ )
							No difference between ASD women and ASD men
							<i>Other behaviour associated with disturbed eating behaviour:</i>
							ASD women = 10.5 (3.9)
							CW = 8.8 (1.2)
							ASD men = 9.2 (2.8)
							ASD women > CW ( $p = 0.012$ )
							No sig. difference between ASD women and ASD men
							<i>Hunger/satiety:</i>
							ASD women = 4.6 (1.7)
							CW = 3.8 (1.5)
							ASD men = 3.9 (1.8)
							ASD women > CW ( $p = 0.043$ )
							No sig. difference between ASD women and ASD men
							<i>Simultaneous capacity:</i>
							ASD women = 2.4 (1.4)
							CW = 1.2 (0.6)
							ASD men = 2.6 (1.6)
							ASD women > CW ( $p < 0.0001$ )
							No difference between ASD women and ASD men

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
Karjalainen et al. (2019)	To examine the occurrence of eating behaviours frequently seen in ASD among adolescents and young adults with AN	Observational, cross-sectional study	36 females with AN-C (current) 32 females with AN-1 year (AN-C after 1 year follow up) 19 autistic females	AN-C = 19.6 (2.23), range: 15–24 AN-1 year = 20.7 (2.30), range: 16.2–25.1 ASD = 18.5 (3.41), range: 15–24 (7 under 18 years old)	Autistic patients had been thoroughly neuropsychiatrically and neuropsychologically evaluated. ASD diagnoses were assigned on DSM-IV criteria (which were the criteria in place at the time)	BMI SWEAA	<i>Pica:</i> ASD women = 1.0 (0.2) CW = 1 (0) ASD men = 1.1 (0.4) No difference between ASD women and CW No difference between ASD women and ASD men BMI AN-C = 16.1 (0.89), range: 14–17.5 AN-1 year = 18.2 (1.66), range: 16.2–25.1, ( <i>n</i> = 31) ASD = 23.2 (5.49), range: 15.75–36.89 CW = 21.3 (2.18), range: 17.4–26.1 ASD < AN-C ( <i>p</i> < 0.001) <b>SWEAA total score</b> AN-C = 32 (13.8), range: 8–56 AN-1 year = 25.6 (13.4), range: 5–53 ASD = 22.3 (16.0), range: 3–55 CW = 11 (3.65), range: 2–25 ASD > CW ( <i>p</i> < 0.01) ASD < AN-C ( <i>p</i> = 0.013) <b>SWEAA BTSD score</b> AN-C = 28 (18.3), range: 6.25–72.5 AN-1 year = 25 (17.2), range: 3.75–63.75 ASD = 21.8 (15.8), range: 2.5–53.75

(Continues)

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
Dandil et al. (2020)	To provide preliminary evidence to support the efficacy of individual CRT in the treatment of a 21-year-old autistic patient with comorbid AN	Single complex case study	1 autistic female with AN	21 years	Patient was diagnosed with ASD at age 11 in a specialist ASD clinical service. On admission to the inpatient ward, patient completed Module 4 of the ADOS-2, administered by a trained researcher	BMI (calculated before, during and after intervention) EDEQ (calculated before and after CRT intervention)	<p>CW = 8.83 (4.63), range: 1.25–25 ASD &gt; CW (<math>p &lt; 0.001</math>)</p> <p>No sig. difference between ASD and AN-C No correlation between BMI and SWEAA total score or BTSD score</p> <p><b>Variables best discriminating between AN-C and ASD</b> (AN-C scoring higher than ASD on all items)</p> <p>Item C3: Multivariable adjusted OR (95% CI) = 2.18 (1.28–3.74), area under ROC curve = 0.85, <math>p &lt; 0.01</math></p> <p>Item G4: Multivariable adjusted OR (95% CI) = 2.55 (1.12–5.80), area under ROC curve = 0.80, <math>p &lt; 0.05</math></p> <p><b>BMI</b> On admission = 14.1 Time 1 (before CRT) = 13.5 Time 2 (after CRT) = 14.5</p> <p><b>EDE-Q global score</b> Time 1 (before CRT) = 5.1 Time 2 (after CRT) = 4.8</p> <p><b>Complaints before CRT</b></p> <ul style="list-style-type: none"> <li>• Eating difficulties following weight gain from chemotherapy and comfort eating (BMI then 30.1)</li> <li>• Struggling to manage and maintain weight</li> <li>• Overfocus on weight and shape, no target weight but wanting weight to get lower and lower</li> <li>• Restriction of food intake</li> <li>• “Obsessed” with being healthy</li> <li>• Over-exercising, exercising every day</li> <li>• Abusing laxatives (“easy way to eat and not keep the food in my body”)</li> </ul> <p><b>Eating behaviour after CRT</b> Willingness to eat increased during CRT</p>

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
García-Pastor et al. (2019)	To compare body composition and physical activity level between autistic children and adults	Observational, cross-sectional study	Autistic women = 11 Autistic men = 23	Autistic women = 28.36 (5.14) Autistic men = 32.39 (7.27)	All participants had received a clinical diagnosis of ASD from an experienced and recognised psychiatrist or neurologist according to DSM-5 criteria. Individuals met clinical cut-off scores for ASD by either ADOS-2 or ADI-R	BMI Overweight/obesity (%) Body fat (%)	BMI ASD women = 23.65 (4.61) ASD men = 27.18 (4.43)
			Young autistic girls = 7	Young autistic girls = 9.43 (1.90)			Young ASD girls = 19.09 (2.42)
			Young autistic boys = 22	Young autistic boys = 9.41 (1.47)			Young ASD boys = 17.96 (4.70)
			Autistic girls = 4	Autistic girls = 13.75 (0.96)			ASD girls = 24.78 (6.48) ASD boys = 23.20 (5.11) ASD women < ASD men ( $p < 0.05$ )
			Autistic boys = 11	Autistic boys = 15.73 (1.74)			<b>Overweight + obesity (%)</b> ASD women = 36.4% ASD men = 73.9% Young ASD girls = 14.3% Young ASD boys = 13.6% ASD girls = 75% ASD boys = 9.1% ASD women < ASD men ( $p < 0.05$ )
							<b>Obesity (%)</b> ASD women = 9.1% ASD men = 17.4% Young ASD girls = 0% Young ASD boys = 9.1% ASD girls = 25% ASD boys = 9.1%

(Continues)

TABLE 1 (Continued)

Study	Aim	Design	N	Mean age (SD)	ASD assessment	Eating behaviour and related outcomes	Main findings
							<b>Body fat (%)</b> ASD women = 29.59 (7.41) ASD men = 22.12 (7.32) Young ASD girls = 26.18 (2.54) Young ASD boys = 19.55 (8.03) ASD girls = 32.93 (11.69) ASD boys = 18.59 (6.57) ASD women > ASD men ( $p < 0.05$ )

Abbreviations: ADI, autism diagnostic interview; ADOS, autism diagnostic observation schedule; AN, anorexia nervosa; ASD, autism spectrum disorder; BED, binge eating disorder; BMI, body mass index; BN, bulimia nervosa; BTSD, best two subscale discriminating score; CRT, cognitive remediation therapy; CW, control women; EAT, eating attitudes test; ED, eating disorders; EDE-Q, eating disorder examination questionnaire; SWEAA, Swedish eating assessment for autism spectrum disorders.

group of autistic men as well as a group of autistic children and adolescents (Garcia-Pastor et al., 2019).

### 3.2 | Different measures of problematic eating behaviours

A total of three different measures were used in the included studies to examine problematic eating behaviours in autistic women: the Swedish Eating Assessment for Autism Spectrum Disorders (SWEAA) (Karlsson et al., 2013), the Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1994) and the Eating Attitudes Test—26 item (EAT-26) (Garner et al., 1982).

Nisticò et al. (2021) compared eating behaviours frequently seen in ASD and disordered eating behaviours between autistic women, women with EDs (including women with AN, bulimia nervosa [BN] and binge eating disorder [BED]) and control women by means of the SWEAA and the EAT-26. In the study done by Spek et al. (2019), eating behaviours frequently seen in ASD were examined in autistic women and compared to autistic men as well as to a group of control women by means of the SWEAA. Karjalainen et al. (2019) compared the occurrence of eating behaviours frequently seen in ASD across three groups, women with AN (current and after 1 year follow-up), autistic women and control women, also by means of the SWEAA.<sup>3</sup> This is the only study included in this review that also included girls under the age of 18 in the ASD group. The case study of a young autistic woman and comorbid AN by Dandil et al. (2020) investigated the effects of Cognitive Remediation Therapy (CRT) as a feasible treatment for supporting autistic adults with AN, examining disordered eating behaviours by means of the EDE-Q before and after individual CRT.

#### 3.2.1 | SWEAA

The SWEAA is a self-report measure including a total of 65 items across 10 subscales to examine eating problems specifically in adult ASD populations without intellectual difficulties with high reliability and validity (Karlsson et al., 2013). Items are answered on a five point Likert scale from 'never correct' to 'always correct', with higher scores indicating more overall eating behaviour frequently seen in ASD. Authors of papers using the SWEAA seem to apply different scoring methods, with the original paper by Karlsson et al. (2013) using a Likert scale of 1 to 5, and calculating the mean for each subscale, then transforming the mean into a scale from 0 to 100 (0 is the lowest and 100 is the highest possible answer



on all items) by multiplying the obtained mean by 25. Karjalainen et al. (2019) apply the same strategy recommended by the original authors, whereas Nisticò et al. (2021) make use of the same method of calculation, but instead chose for a Likert scale ranging from 0 to 4. Spek et al. (2019) on the other hand apply a different method, by simply adding up the scores per subscale for subscale scores, then adding those up to a total score. Karjalainen et al. (2019) used a self-calculated cut-off score of 12 to measure overall eating behaviour frequently seen in ASD.

### 3.2.2 | EAT-26

The EAT-26 is a standardised self-report measure with 26 items across three subscales to assess symptoms and concerns characteristic of EDs such as AN and BN (Garner et al., 1982). Items are rated on a 6-point Likert scale, ranging from 'always' to 'never', with higher scores indicating more severe eating pathology. Scores range between 0 and 78, with a score of 20 or above warranting a thorough examination whether the individual meets the diagnostic criteria of an ED. The questionnaire has been deemed reliable and valid (Garner et al., 1982; Mintz & O'Halloran, 2000; Rivas et al., 2010) and has been a successful screening tool in the risk assessment of ED in various populations (Garner et al., 1998; Lee et al., 2002; Orbitello et al., 2006).

### 3.2.3 | EDE-Q

The EDE-Q is a highly reliable and valid self-report measure of eating pathology, including disordered eating behaviours and attitudes (Berg et al., 2012; Fairburn & Beglin, 1994), consisting of 22 items across four subscales. Items are rated on a seven point Likert scale ranging from 0 to 6, with higher scores indicating greater eating pathology. Subscores are obtained by adding up the relevant items per subscale and dividing by the total number of items per subscale. The total score is calculated by adding the subscale scores and dividing that by the number of subscales.

### 3.2.4 | Eating behaviours frequently seen in ASD (by means of the SWEAA)

#### *Overall eating behaviour frequently seen in ASD*

When looking at overall eating behaviour frequently seen in ASD (as measured by the SWEAA total score), Karjalainen et al. (2019) found that currently ill women

with AN scored significantly higher than autistic women, thus reporting more overall eating behaviour frequently seen in ASD (here, no comparison was made between autistic women and women with AN after 1 year follow-up). Nisticò et al. (2021) on the other hand did not confirm this finding: both women with EDs and autistic women in this study displayed similar levels of overall eating behaviour frequently seen in ASD. Across all studies included in this review that compared autistic women to control women, autistic women reported significantly more overall eating behaviour frequently seen in ASD than control women (Karjalainen et al., 2019; Nisticò et al., 2021; Spek et al., 2019). Spek et al. (2019), the only study in this review directly comparing autistic women with autistic men, found no differences between the two groups with regards to overall eating behaviour frequently seen in ASD. In Karjalainen et al. (2019), both autistic women as well as both AN groups scored well above the cut-off score of 12 applied in this study showing very high levels of overall eating behaviour frequently seen in ASD. These eating behaviours subsided in women with AN at the one-year follow-up.

#### *Sensory sensitivities*

Autistic women reported significantly more sensitivities regarding the sensory properties of food, such as smell, texture, and taste (as measured by the SWEAA subscale *perception*) compared women with EDs (Nisticò et al., 2021), control women (Nisticò et al., 2021; Spek et al., 2019) and autistic men (Spek et al., 2019).

#### *Motor control problems*

With regards to problems with motor control that can influence eating behaviour (e.g., problems with chewing or drooling, as measured by the SWEAA subscale *motor control*), autistic women reported similar levels of difficulties compared to women with ED (Nisticò et al., 2021). Compared to control women, autistic women reported significantly more difficulties with motor control in Nisticò et al. (2021), but similar levels of difficulties in Spek et al. (2019). In comparison with autistic men on the other hand, autistic women reported less problems with motor control (Spek et al., 2019).

#### *Preferences for brands of food*

Autistic women also reported similar preferences with regards to brands of food (as measured by the SWEAA subscale *purchase of food*) as women with EDs (Nisticò et al., 2021), and significantly more preferences than control women (Nisticò et al., 2021; Spek et al., 2019) and autistic men (Spek et al., 2019). In Karjalainen et al. (2019), women with AN, rather than autistic

women, reported more concerns with regards to control of purchases (as measured by item C3<sup>4</sup> on the SWEAA, one of two SWEAA items best discriminating between the two groups in this study).

#### *Food selectivity*

When looking at selectivities with eating such as a preference for certain food items or difficulties trying out new foods (as measured by the SWEAA subscale *eating behaviour*), autistic women again reported similar levels compared to women with EDs (Nisticó et al., 2021) and autistic men (Spek et al., 2019) and higher levels than control women (Nisticó et al., 2021; Spek et al., 2019).

#### *Routines around mealtimes*

Autistic women reported similar levels of rituals and routines around mealtimes (e.g., where to eat, where the cutlery is placed) (as measured by the SWEAA subscale *mealtimes surroundings*) compared to women with EDs and autistic men, while reporting significantly more rituals and routines than control women (Nisticó et al., 2021; Spek et al., 2019).

#### *Social situations during mealtimes*

With regards to experiencing difficulties adapting one's eating behaviour to other people during the eating situation (e.g., preference for eating alone) (as measured by the SWEAA subscale *social situations at mealtimes*), again, autistic women reported similar difficulties as women with EDs and autistic men, but significantly more difficulties than control women (Nisticó et al., 2021; Spek et al., 2019).

#### *Disordered eating behaviours*

Similar levels of behaviours associated with 'traditional' ED (e.g., vomiting after meals, laxative abuse or restriction of food) (as measured by the SWEAA subscale *other behaviour associated with disturbed eating*) were found in autistic women compared to women with EDs as well as compared to autistic men (Nisticó et al., 2021; Spek et al., 2019). Compared to control women, autistic women reported higher levels of disordered eating behaviours (Spek et al., 2019). In Karjalainen et al. (2019), women with AN, rather than autistic women, reported more dieting behaviour (as measured by item G4<sup>5</sup> on the SWEAA, one of two SWEAA items best discriminating between the two groups in this study).

#### *Recognising hunger or satiety*

Regarding problems recognising one's hunger or satiation (as measured by the SWEAA subscale *hunger/satiety*), autistic women report similar levels of difficulties compared to women with EDs and autistic men (Nisticó

et al., 2021; Spek et al., 2019) and significantly more problems than control women in Spek et al. (2019), but not in Nisticó et al. (2021).

#### *Simultaneous capacity*

When looking at difficulties doing two things at once (e.g., chewing and cutting food) (as measured by the SWEAA subscale *simultaneous capacity*), autistic women report similar levels of difficulties compared to women with EDs and autistic men (Nisticó et al., 2021; Spek et al., 2019), but significantly more difficulties compared to control women (Nisticó et al., 2021; Spek et al., 2019).

#### *Pica*

No differences were found regarding the consumption of non-edible items (e.g., soil or mortar) (as measured by the SWEAA subscale *pica*) between autistic women compared to women with EDs (Nisticó et al., 2021), compared to autistic men (Spek et al., 2019) or control women (Nisticó et al., 2021; Spek et al., 2019).

#### *SWEAA—Best discriminating score*

Apart from investigating overall eating behaviour frequently seen in ASD, as measured by means of the SWEAA total score, Karjalainen et al. (2019) calculated another cut-off score, targeting those subscales (*social situation at mealtimes* and *simultaneous activity*) with items that best discriminate between autistic individuals and a healthy comparison group (i.e., best two subscale discriminating score [BTSD score], based on the means score from these subscales), where a cut-off value of 10 was determined through Stepwise logistic regression analysis. According to this BTSD score, autistic women reported similar levels of difficulties adapting their eating behaviour to other people present during mealtimes as well as having difficulties doing two things at once compared with women currently ill with AN. Here, autistic women scored significantly higher than control women. Autistic women and women with AN (both current and after 1 year follow-up) scored well above the cut-off score on the BTSD score. In women with AN, there was no decrease in these specific eating behaviours (as measured by the BTSD score) at 1 year follow-up.

### 3.2.5 | Disordered eating behaviours and eating pathology (by means of the EAT-26)

#### *Severity of eating pathology*

In Nisticó et al. (2021), autistic women reported significantly less overall disordered eating behaviours (as measured by the EAT-26 total score) and thus less severe eating pathology than women with EDs, but significantly

more than control women. Overall, autistic women scored well below the suggested cut-off score of 20, compared to women with EDs, who did reach the overall cut-off score with regards to severity of eating pathology.

#### *Dieting*

When looking at a pathological avoidance of certain (fattening) foods (e.g., foods with a high carbohydrate or with a high sugar content), a dissatisfaction with one's body size and subsequent desire to be thin (as measured by the EAT-26 subscale *dieting*), autistic women reported similar levels as women with EDs, and with significantly higher levels than control women (Nisticó et al., 2021).

#### *Bulimic behaviours and food preoccupation*

Autistic women displayed significantly fewer bulimic behaviours (e.g., bingeing and purging behaviour) and less preoccupation with food (as measured by the EAT-26 subscale *bulimia and food preoccupation*) compared to women with EDs, but significantly more than control women (Nisticó et al., 2021).

#### *Food restriction*

Autistic women reported significantly less food restriction and acknowledgement of a social pressure to gain weight (as measured by the EAT-26 subscale *oral control*) compared to women with EDs and similar levels as control women (Nisticó et al., 2021).

### 3.2.6 | Disordered eating behaviours and eating pathology (by means of the EDE-Q)

#### *Severity of eating pathology*

In Dandil et al. (2020), the underweight patient (BMI 14.1 kg/m<sup>2</sup> on admission) was described to have developed difficulties with eating difficulties after gaining weight from chemotherapy and engaging in comfort eating in an effort to regulate difficult emotional feelings, which resulted in a BMI of then 30.1 kg/m<sup>2</sup>. The patient subsequently described becoming obsessed with being 'healthy', having an overfocus on her weight and shape, over exercising, abusing laxatives and restricting her food intake. She told the interviewer that she held her being autistic accountable for her fixation and rigidity with regards to engaging in certain exercises every day and the restriction of food. On the global score of the EDE-Q,<sup>6</sup> the patient scored 5.1. To put this into context, the global score from a community sample of women is 1.5 (Fairburn & Beglin, 1994). After 13 CRT sessions, the patient's willingness to eat increased, the global score of the EDE-Q dropped down to 4.8 and her BMI increased from 13.5 kg/m<sup>2</sup> before CRT (but after admission) to

14.5 kg/m<sup>2</sup> after CRT, so still in the very severe range. The authors of this paper concluded that the results of this case study provide preliminary support for the feasibility of individual CRT in supporting autistic adults with comorbid AN to address rigid thinking styles, before proceeding to more complex therapies targeting disordered eating behaviours.

### 3.3 | BMI and body composition of autistic women

The study of Garcia-Pastor et al. (2019) is the only study that provided separate BMI and body composition data of autistic women without intellectual disability, without including any measures of general or problematic eating behaviours. Here, body composition data was compared between autistic men and women as well as between autistic children and adolescents. Autistic men had a significantly higher BMI than autistic women and were more often overweight or obese. Autistic women on the other hand had a significantly higher body fat percentage than autistic men. In Nisticó et al. (2021), BMI was compared between autistic women, women with an ED and control women. Here, no significant differences were found between autistic women and women with an ED, and between autistic women and control women. In Karjalainen et al. (2019), BMI was compared between autistic women and women currently ill with AN, with autistic women having a significantly higher BMI than women currently ill with AN.

## 4 | DISCUSSION

To our knowledge, this is the first scoping review examining the state of knowledge regarding problematic eating behaviours of autistic women without intellectual difficulties. Even though there seems to be a growing interest in the interplay between ASD and problematic eating behaviours, very little is still known about how and why autistic women experience such problems, possibly causing significant impairments in daily life functioning. Across four of the included studies, autistic women demonstrated high levels of problematic eating behaviours typically associated with ASD as well as high levels of disordered eating and eating pathology. This suggests that the eating problems frequently found in autistic girls might persist into adulthood, which gives rise to the assumption that autistic women might be especially vulnerable to develop a range of disordered eating behaviours or already suffer from (undetected) EDs (Margari et al., 2020; Spek et al., 2019).

## 4.1 | Problematic eating behaviours of autistic women

Across the included studies, autistic women reported having eating behaviours frequently seen in ASD such as having problems with sensitivities regarding the sensory properties of food, having rituals and routines around mealtimes, having difficulties adapting one's behaviour to other people present during the eating situation and having preferences with regards to brands of food, which is in line with findings of previous research (Demartini et al., 2021; Karjalainen et al., 2016; Margari et al., 2020; Nieminen-von Wendt et al., 2005). Additionally, they reported disordered eating behaviours, such as pathological avoidance of foods with a high carbohydrate or sugar content, a desire to be thin, a dissatisfaction with their body, as well as bulimic behaviours and a preoccupation with food, all on severity levels similar, though not quite like those of women with EDs.

Specific ASD related characteristics and processes are likely to play a role in the development and maintenance of these behaviours, such as difficulties in sensory processing and engagement in restrictive and repetitive behaviours, though it is not entirely clear which of these characteristics is specifically related to problematic eating behaviours in autistic women. Up to 90% of autistic adults experience difficulties in their sensory processing (Crane et al., 2009; Leekam et al., 2007; Tavassoli et al., 2014; Taylor et al., 2020), with some reporting sensory avoiding behaviours (hyperreactivity) and some reporting sensory seeking behaviours (hyporeactivity) (Crane et al., 2009). These difficulties in sensory processing could subsequently result in the avoidance of certain food items because of their sensory properties (e.g., texture, smell, taste), food selectivity, food neophobia or in contrast to engaging in over-consumption of certain food items because of their sensory properties. Especially autistic women have been suggested to be impacted by difficulties in sensory processing, more so than autistic men (Lai et al., 2011). This is reflected by the findings of studies included in this review, where autistic women reported high levels of sensory sensitivities specifically related to food, more so than autistic men (Spek et al., 2019), women with EDs (Nisticó et al., 2021) and more than control women (Nisticó et al., 2021; Spek et al., 2019). These differences in levels of sensory sensitivities however, as Spek et al. (2019) discovered, did not lead to large discrepancies in the level of overall eating behaviour frequently seen in ASD in autistic women and men they expected, where autistic women were expected to experience more eating behaviours frequently seen in ASD than autistic men. This raises the question whether sensory

sensitivities might play less a role than previously assumed. In view of this, Bitsika and Sharpley (2018) found that rather restrictive and repetitive behaviours, not difficulties in sensory processing, were significant predictors of disordered eating in a sample of high functioning autistic girls. They proposed that the girls' behavioural rigidity and restricted range of interests was more relevant in the development and maintenance of their disordered eating habits than difficulties in sensory processing. And even though restrictive and repetitive behaviours are thought to be more common in autistic men (Wilson et al., 2016), it could be that behaviours such as having preferences for a particular food brand (i.e., behavioural rigidity) or engaging in dieting behaviour (i.e., being busy with food/not eating as a specific and restricted interest) are yet another example of how ASD manifests itself differently in high functioning autistic girls and women than in autistic males (Rynkiewicz et al., 2016; Wallace et al., 2021). It is important to further investigate the roles of sensory sensitivities and restrictive and repetitive behaviours in the development and maintenance of these eating behaviours in autistic women in future research. This in order to try to unravel whether one process is more impactful than the other, or whether a complex interplay of both is at play.

Furthermore, autistic women reported high levels of disordered eating behaviours, such as bingeing and purging, similar to women with EDs, though not quite reaching the same symptom severity. Such behaviours have been linked to difficulties with emotion regulation in the presence of heightened, oftentimes negative, emotional states. Those states are often followed by increased emotional eating (Danner et al., 2012, 2014; Meule et al., 2019), which in turn has been found to trigger bulimic behaviour (Engelberg et al., 2007). Autistic girls and women might be particularly vulnerable for such behaviours, as difficulties with emotion regulation have repeatedly been found in autistic individuals (Cibralic et al., 2019; Mazefsky et al., 2014). Recent studies have corroborated this assumption: Wallace et al. (2021) found emotional eating to be increased in autistic girls along with van't Hof et al. (2020), who discovered that autistic traits at age six in girls of the general population were predictive of increased emotional eating at a later age, an association which was found to not be the case for boys from the general population. Wallace et al. (2021) theorised emotional overeating to be a strategy of self-stimulation in autistic individuals, a repetitive and stereotyped behaviour in order to produce sensory input to cope with negative emotional or cognitive states, such as overstimulation (Zentall & Zentall, 1983) or stress

(LeCompte, 1981). Emotional undereating on the other hand, possibly related to the dieting behaviours or food restriction reported by autistic women, could serve as a way to cope with overstimulation, by avoiding additional sensory information of food (Mayes & Zickgraf, 2019). It is not clear however, when such behaviours result in a symptom severity level comparable to that of individuals with EDs on a measurement like the EAT-26. Items might be interpreted differently by an autistic individual compared to someone with an ED, resulting in a lower score, but symptoms may be equally as severe. Future research is needed to unravel whether there are differences in emotional processing and emotion regulation strategies of autistic women compared to women with an ED, and how that relates to problematic eating behaviours in both.

## 4.2 | Problematic eating behaviours and their physical consequences

When examining the physical consequences of both eating behaviours frequently seen in ASD and disordered eating behaviours displayed by autistic women, results of the included studies indicate that autistic women still had BMIs in the 'normal range', comparable to those of women with a broad range of EDs (Nisticò et al., 2021) but higher than those of currently ill women with AN (Karjalainen et al., 2019). This may suggest that the eating behaviours of autistic women measured with the SWEAA and the EAT-26 do not necessarily result in either over- or under-weight. Emotional eating behaviours however can possibly lead to over- or binge eating, which are associated with a higher BMI or obesity in general (Agüera et al., 2021). The only study who investigated BMI and the body composition of autistic women without intellectual disability (Garcia-Pastor et al., 2019) did not report higher weight or obesity percentages of autistic women compared to the general population (Gallus et al., 2015). Compared to autistic men, autistic women had a lower BMI and a higher body fat percentage, which is also seen in the general population (Gallus et al., 2015; Lutoslawska et al., 2014).

## 4.3 | Eating behaviours of autistic women compared to women with EDs

When comparing the eating behaviours of autistic women to those of women with EDs, it is not only noteworthy that autistic women seem to have similar levels of disordered eating behaviours as women with EDs, but also that women with EDs seem to report

similarly high levels (or even higher) of eating behaviours frequently seen in ASD as autistic women. Some of which persist even after weight gain. Karjalainen et al. (2019) theorise that such eating behaviours in women with AN might overlap with 'traditional' AN behaviours and that symptoms of such behaviours, when already premorbidly present, might constitute as a risk factor for developing an ED (Nielsen et al., 2015; Wentz et al., 2009). It is also possible that these eating behaviours frequently seen in ASD are partly exacerbated by the starved state of AN patients or by other traditional ED symptoms (Karjalainen et al., 2019; Nisticò et al., 2021). The presence of eating behaviours frequently seen in ASD in ED populations also has clinical consequences: The fact that patients with various EDs score high on the SWEAA means that such an instrument has no predictive value of whether ASD is present in the patient. In future studies, it is important to examine how the problematic eating behaviours of autistic women compare to those of women with EDs, in order to get a better understanding of what autistic women need in order to recover from these behaviours.

## 4.4 | Problematic eating behaviours of autistic women with comorbid EDs

Even though very little is evidently known about the eating behaviours of autistic women, there is evidence from the ED field that autistic women with comorbid AN and (suspected) ASD have a more severe presentation at the beginning of treatment and poorer treatment outcomes (Courty et al., 2013; Nielsen et al., 2015; Stewart et al., 2017; Tchanturia et al., 2016, 2019). Autistic women with (suspected) ASD and comorbid AN seem to view both of their conditions as deeply interlinked, which makes it difficult to profit from current treatment modalities as these do not take the autistic traits underlying their ED into account (Kinnaird, Norton, Pimblett, et al., 2019; Kinnaird, Norton, Stewart, et al., 2019).

The case study of Dandil et al. (2020) demonstrates how the combination of eating behaviours frequently seen in ASD and eating pathology can manifest in an autistic woman. The formerly overweight and now severely underweight autistic patient with comorbid AN presents with a history of emotional eating in order to regulate difficult emotions (even before AN was developed), to becoming obsessed with being healthy, over-exercising, hyper focussing on weight and shape and restricting food. This case provides an example of the interplay and interchangeability of specific autistic traits and characteristics and how they relate to problematic

eating behaviours: (1) restrictive and repetitive and behaviours expressed by emotional overeating to self-stimulate in heightened emotional states, by restricting food to partly deal with sensory overload, and by a hyperfixation on becoming 'healthy', and (2) cognitive and behavioural rigidity, expressed by the notion to having to engage in exercises every day. All of which combined, ultimately result in a severe level of eating pathology deeply intertwined with the ASD (Brede et al., 2020).

Recently, a novel clinical pathway for autistic individuals and comorbid AN has been developed, which aims to improve evidence-based treatments offered to these patients (Tchanturia, Dandil, et al., 2020; Tchanturia, Smith, et al., 2020). Most of the studies on the relationship between eating problems and ASD however have not applied comprehensive assessments including developmental analysis to determine the diagnosis of ASD. This is of great importance, as instruments like the ADOS-2 (Lord et al., 2012) or the AQ-50 (Baron-Cohen et al., 2001) alone are not sufficient to detect ASD in patients with EDs, and whose eating problems cannot be linked or attributed to ASD this way.

#### 4.5 | Eating behaviours frequently seen in ASD and avoidant restrictive food intake disorder

The eating behaviours of autistic women described in this review also resemble those of individuals with avoidant restrictive food intake disorder (ARFID). Individuals with ARFID experience restrictive eating behaviours that are not driven by body image disturbances or a fear of gaining weight (American Psychiatric Association, 2013). Patients with ARFID can report a range of reasons that may drive the food restriction, such as a sensory based avoidance of food, a lack of interest in food, or the fear of the aversive consequences of eating. Such a severely restricted diet can result in severe weight loss, nutritional deficiencies, and impact psychosocial functioning (American Psychiatric Association, 2013; Bourne et al., 2022). With research into the prevalence and causes of ARFID still lacking, it is theorised that autistic individuals are at an increased risk to develop ARFID (Bourne et al., 2022; Mayes & Zickgraf, 2019; Sharp, Jaquess, et al., 2013). It is however still unclear what role autistic traits play in the onset and maintenance of ARFID, and how eating behaviours frequently seen in ASD relate to ARFID (Bourne et al., 2022). None of the studies have examined the presence of specific ARFID symptoms in autistic women, which highlights a clear need for further research.

## 5 | CONCLUSION

This review suggests that eating behaviours frequently seen in ASD as well as disordered eating and eating pathology are present in autistic women without intellectual disabilities, however very little research has been done examining either in autistic women. This warrants more research to replicate these findings, to find out more about what these problematic behaviours look like, if they resemble the behaviours of autistic women with intellectual disabilities, how they are different from women who have EDs or feeding disorders such as AN, BN, BED or ARFID, and how to ultimately adapt current treatment modalities that meet the unique needs of these women and help them recover from their eating disturbances.

### CONFLICT OF INTEREST

The author declares that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

### DATA AVAILABILITY STATEMENT

The review protocol following PRISMA guidelines is available upon request from the corresponding author.

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### ENDNOTES

- <sup>1</sup> The first author is of German origin and fluent in all three languages.
- <sup>2</sup> When unclear, we contacted the authors of the relevant articles to elaborate on the diagnostic process of determining the ASD diagnosis described in the study or how the ASD diagnosis was assigned or obtained to be included in this review.
- <sup>3</sup> Apart from SWEAA total scores, Karjalainen et al. (2019) did not report any separate SWEAA subscale scores. Instead, to find independent variables best discriminating between the ASD group and the AN-C group, they identified the most significant univariable and multivariable variables through logistic regression analyses. On all these items, the AN-C group scored higher than the ASD group.
- <sup>4</sup> C3: 'If I buy food with someone else, I want to check what goods are purchased.'
- <sup>5</sup> G4: 'I diet even if other people think I am too thin.'
- <sup>6</sup> Apart from EDE-Q total score, Dandil et al. (2020) did not report any EDE-Q subscale scores.

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## SUPPORTING INFORMATION

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