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REVIEW

Cognitive Behavioral and Cognitive Remediation Strategies for Managing Co-Occurring Anorexia Nervosa and Elevated Autism Spectrum Traits

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Abstract: Anorexia nervosa (AN) is a potentially severe eating disorder whose core characteristics include energy intake restriction leading to low body weight. Autism spectrum disorder (ASD) is a developmental disorder characterized by deficits in social interaction and communication as well as repetitive, stereotyped behavior and interests. Both high ASD traits and diagnosed ASD are over-represented among individuals with AN, and AN and ASD appear to share certain neurocognitive features. These features are associated with the severity of eating disorder symptoms and prolongation of AN. Thus, individuals with AN and high ASD traits or ASD may benefit less from traditional treatment when compared to those with low ASD traits. No previous reviews have summarized what is known about treatment adaptations for individuals with AN and high ASD traits or ASD. The purpose of this narrative review was to investigate the feasibility of cognitive remediation therapy (CRT), cognitive remediation and emotional skill training (CREST), and cognitive behavioral therapy (CBT), and give an overview of treatment modifications for individuals with AN and co-occurring ASD or high ASD traits. We found nine studies that fulfilled our inclusion criteria. The combined results suggest that individuals with AN and high ASD traits or ASD benefit less from CRT, CREST, and CBT than those with AN and low ASD traits. However, CRT and CREST administered in individual format may be associated with improved cognitive flexibility, motivation for change, and decreased alexithymia among adults with AN and high ASD traits or ASD. Individuals with comorbid AN and ASD themselves highlight the importance of treatment adaptations that take the characteristics of ASD into account. In the future, controlled studies of the treatment strategies for individuals with AN and ASD/high ASD traits are needed in order to improve the outcome of individuals with this challenging comorbidity.

Keywords: anorexia nervosa, feeding and eating disorders, autism spectrum disorder, treatment, cognitive remediation, cognitive behavioral therapy

Introduction

Anorexia nervosa (AN) is an eating disorder whose core characteristics include restriction of energy intake leading to low body weight, intense fear of gaining weight, or persistent behavior that interferes with weight gain and a disturbance in the way in which one's body weight/shape is experienced.[1] Autism spectrum disorder (ASD) is a developmental disorder characterized by deficits in social interaction and communication as well as repetitive, stereotyped behavior and interests.[1] Elevated ASD traits are overrepresented among individuals with AN.[2–7] Many studies report that elevated ASD traits occur both before and after acute AN[3,8–11] and thus these traits are unlikely to occur only because of consequences of starvation or other acute illness-related process. Furthermore, a subgroup of individuals with AN fulfills the diagnostic criteria of ASD.[2–7] Studies that have actively screened for ASD among individuals with current AN have reported its prevalence to be between 10% and 30% in female patients with AN.[3–5,12] In registry-based studies, the

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prevalence of ASD among females with AN has been reported to be between 1.3% and 2.5%, while the corresponding prevalence of ASD among the control females has been reported to be 0.6%.[8,9] In these studies, individuals with AN also have a highly elevated risk of receiving a later diagnosis of ASD, and the risk is higher for male than for female individuals.[13,14]

AN and ASD appear to share certain neurocognitive features, that is, difficulties in social cognition, cognitive inflexibility, weak central coherence, and atypical sensory processing.[15–19] Difficulties in social cognition include challenges in emotion recognition, poor theory of mind, low empathy, and difficulties in interpersonal relationships.[8,18,20,21] Individuals with AN and ASD have been described having developed disturbed eating behavior as a response to social challenges.[22,23] Cognitive flexibility refers to the ability to shift between tasks and adapt to changing rules and situations. Challenges in cognitive flexibility may result in the rigid behavior typical to AN and ASD and contribute to the development of rigid eating pattern including the urge to count and monitor calories and weight.[17,22,23] Weak central coherence, in turn, refers to increased attention to detail and challenges in global integration and processing information in its context.[24] This may be involved in attentional bias towards food and body.[25] Sensory processing atypicality may manifest as sensory sensitivity and sensory avoidance, for example, sensitivity for some food textures or tastes, which may underlie some eating disturbances.[16] These ASD-related neurocognitive features have been reported to be associated with the severity of eating disorder symptoms among acutely ill individuals with AN.[9,16] These traits are also suggested to contribute to the development and prolongation of AN.[23,26–28] Some studies have not found an association between ASD traits and treatment outcome of AN,[29,30] but several other studies report that treatment outcome is poorer among individuals with AN and ASD or elevated ASD traits when compared to those with low ASD traits.[7,31–33] It has been suggested that neurocognitive features of ASD may contribute to the lack of treatment response to traditional treatments among individuals with co-occurring AN and ASD or high ASD traits.[22,23] To summarize, ASD-related neurocognitive characteristics may predispose to disordered eating behavior, and AN in individuals with high ASD traits or ASD is likely to differ from AN in individuals with low ASD traits. Individuals with this comorbidity also appear to benefit less from the current treatment methods for AN, when compared to individuals with AN and low ASD traits. Recent studies have indeed highlighted the need for developing tailored treatments for individuals with AN and ASD or high ASD traits.

Cognitive remediation therapy (CRT) is a treatment method that could benefit individuals with AN and co-occurring ASD. CRT includes training in neurocognitive skills, for example, cognitive flexibility and central coherence, which, among other things, facilitates functioning in daily life.[34–36] CRT can also include training of emotional skills (cognitive remediation and emotional skill training, CREST), targeted at social and emotional difficulties.[37] Besides CRT and CREST, it has been suggested that also cognitive behavioral therapy (CBT) could be modified in ways that take high ASD traits into account. The underlying assumption in CBT is that one can learn to identify and alter dysfunctional thinking, emotional responses, and behaviors.[38] Enhanced forms of CBT (CBT -E), targeting biased body image and over evaluation of shape and weight and their control, is commonly used in the treatment of AN.[39] However, among individuals with AN and ASD, the ASD traits such as the effect of sensory sensitivity on disordered eating might be beneficial to consider one of the treatment target of CBT.[16] Further, other adaptations in treatment target and settings that take into account the effects of ASD traits, would also be beneficial for individuals with AN and ASD. However, no previous reviews have summarized literature regarding treatment adaptations for individuals with AN and co-occurring ASD. The purpose of this narrative review was to investigate the feasibility of CRT, CREST, and CBT and give an overview of treatment modifications for individuals with AN and co-occurring ASD. CBT, CREST, and CBT were selected for this review, because CBT is one of the most commonly used treatments for both AN and ASD and their psychiatric co-morbidities and, as outlined above, CRT and CREST target some of the central common features of AN and ASD.[40,41]

Methodology

In order to include all relevant studies in this narrative review, a systematic search was conducted. To be included in the review, the studies were required to 1) be published in English and in a peer-reviewed journal, and 2) be original research articles that included participants with diagnosed AN and diagnosed ASD or high ASD traits, and 3) to investigate treatment in some of the following areas: CRT, CREST, CBT, or treatment adaptations. High ASD traits were defined as

ASD traits above the cut-off for high ASD traits/ASD in the questionnaire or observation-based measurement method. We set no limitations for study designs. Case studies and qualitative studies were also included as only a few quantitative studies focusing on treatment for co-occurring AN and ASD or high ASD traits emerged in searches. A systematic search in the Ovid Medline, Ovid PsycINFO, and the PubMed databases was conducted using the following terms: "eating disorders" or "feeding and eating disorders" or "anorexia nervosa" and "autism spectrum disorder" and "treatment" or "cognitive behavioral therapy" or "cognitive remediation" or "therapy". All searches were conducted on January 19th, 2022. The literature search resulted in 575 articles. After the removal of duplicates, 374 articles were screened for title and abstract. A total of 331 articles were excluded, and the remaining 43 articles were screened based on full text, leading to the exclusion of another 34 articles. The final sample consisted of 9 articles. Two authors (E.S. and M.Å.) independently screened the resulting articles for their appropriateness for inclusion. See Figure 1 for the Flow chart.

Results

Four of the articles focused on CRT, including one case study. One study focused on CREST. We found one qualitative study in which participants' experiences of CBT were included as one interview theme. In addition, we found four studies that investigated treatment adaptations. Of these, one was a case study focusing on a family-based intervention, one focused on sensory issues, and two studies used qualitative interviews and focused on treatment adaptations. See Table 1 for a summary of the included studies.

CRT, CREST, and CBT

Two of the four studies[34,37,42,43] investigated individual CRT and one investigated group CRT among individuals with AN and high ASD traits. One was a case study that described CRT in females with AN and diagnosed ASD.[44] All four studies focused on CRT for cognitive flexibility and central coherence. One study found no improvement after group

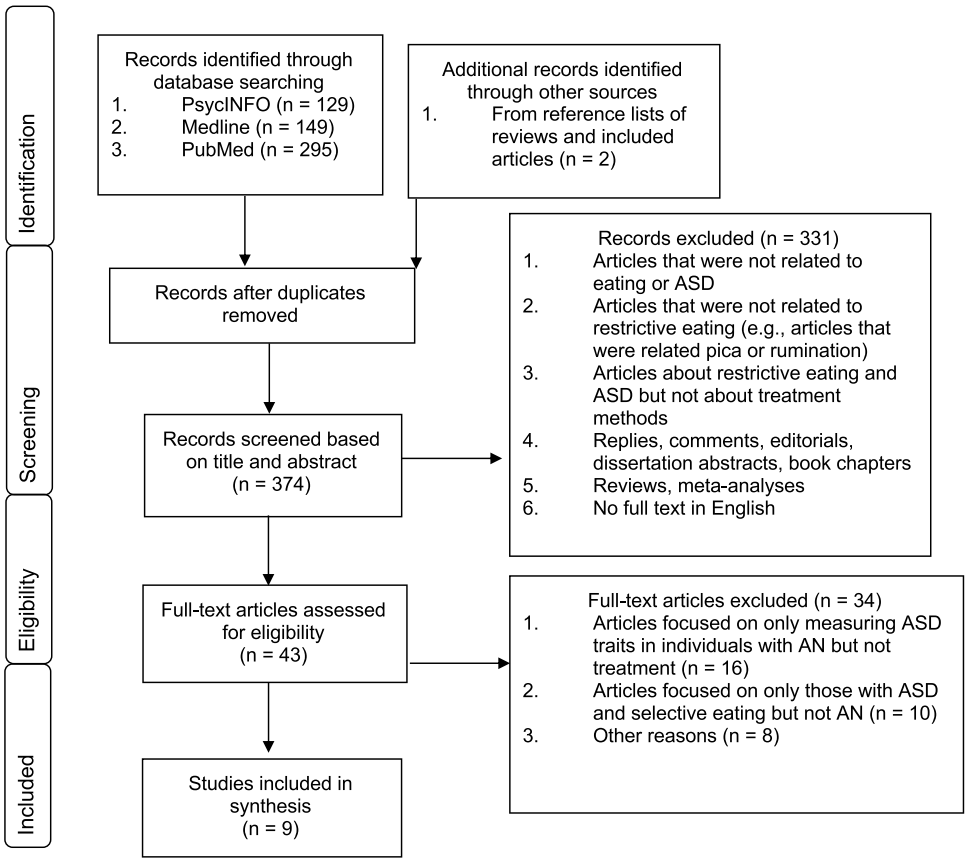

Figure 1 Study selection process.

Table 1 Characteristics and Main Results of the Included Studies

Study	Participants with AN				Treatment or Study Setting	Measures	Main Findings	
	Individuals with High ASD Traits or Diagnosed ASD (n)	Controls with Low ASD Traits (n)	Sex	Age			Measured with Performance-Based Test	Measured with Self-Report or Clinical Follow-Up
Adamson et al., 2018[37]	21 with ASD traits (measured with AQ-10)	44	All females	18–63 years, mean age 25.5 year	Individual CREST (8 sessions)	Three self-report questionnaires focusing social anhedonia, alexithymia, and MR (subscales: ability to change, importance to change).	N/A	Ability to change increased (time $F(1,37) = 11.27$, $p < 0.01$; time x ASD $F(1,27) = 0.02$, $p = 0.88$) and alexithymia (time $F(1,47) = 6.84$, $p = 0.01$; time x ASD $F(1,34) = 0.10$, $p = 0.75$) improved. Importance of change (time $F(1,42) = 0.04$, $p = 0.84$; time x ASD $F(1,32) = 1.00$, $p = 0.32$) or social anhedonia did not improve time ($F(1,46) = 0.79$, $p = 0.38$; time x ASD $F(1,33) = 2.99$, $p = 0.09$). There was no interaction between ASD traits and any of the measured outcome.
	21 with ASD traits (measured with AQ-10)	45	All females	18–53 years, mean age 25.8 years	Group CREST (5 sessions)	Three self-report questionnaires focusing social anhedonia, alexithymia, and motivation.	N/A	Ability to change increased (time $F(1,48) = 4.57$, $p = 0.04$; time x ASD $F(1,34) = 2.08$, $p = 0.16$). Social anhedonia ($F(1,51) = 0.87$, $p = 0.36$; time x ASD $F(1,36) = 0.27$, $p = 0.61$), alexithymia ($F(1,48) = 1.67$ $p = 0.20$; time x ASD $F(1,34) = 0.85$, $p = 0.36$), or importance to change ($F(1,49) = 2.81$, $p = 0.10$; time x ASD $F(1,35) = 0.68$, $p = 0.42$). did not improve. There was no interaction between ASD traits and any of the measured outcome.
Babb et al., 2021[45]	15 individuals with diagnosed ASD	0	All females	23–58 years, mean age 32.60 years	Retrospective interview about treatment experiences.	Qualitative interview	N/A	Participants described that they had had difficulties in CBT because they viewed they did not have the skills needed for benefiting from CBT. Participants described that they perceived group therapy as challenging due to their social difficulties.

Dandil et al., 2020a[44]	25 individuals with high ASD traits (measured with AQ-10)	35	All females	Mean age 23.9 years	Individual CRT (8–10 sessions)	Two performance-based test (ROCF, The Brixton Test)	Among individuals with high ASD traits, cognitive flexibility improved ($t(24) = 5.3$, $p < 0.001$) but central coherence did not ($t(23) = -1.9$, $p = 0.06$). Among individuals with low ASD traits, cognitive flexibility improved ($t(35) = 6.74$, $p < 0.001$) but central coherence did not ($t(34) = -1.44$, $p > 0.05$).	N/A
Dandil et al., 2020b[34]	1 individual with diagnosed ASD	0	Female	21 years old	Individual CRT (13 sessions)	Three self-report questionnaires (DFlex, EDE-Q, MR), two performance based-test (ROCF, The Brixton Test)	No improvement in cognitive flexibility or central coherence.	Improvement of eating disorder symptoms, cognitive flexibility, central coherence, and ability to change.

(*Continued*)

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Table 1 (Continued).

Study	Participants with AN				Treatment or Study Setting	Measures	Main Findings	
	Individuals with High ASD Traits or Diagnosed ASD (n)	Controls with Low ASD Traits (n)	Sex	Age			Measured with Performance-Based Test	Measured with Self-Report or Clinical Follow-Up
Giombini et al., 2022[42]	18 individuals with high ASD traits (measured with SRS-2)	62	75 females, 5 males	10–18, mean age 14.49 year	Individual CRT	Four self-report questionnaires (DFlex, EDE-Q, MR (subscales: ability to change, importance to change), RCADS), three performance based-test (ROCF, The Brixton Test, WCST)	Cognitive flexibility improved, but in WCST, follow-up analysis showed that only older age group with low ASD traits showed improvement (time: $F(2,152) = 6.76$, $p < 0.002$, $n^2_p = 0.082$; time x treatment group x ASD: ($F(2,152) = 3.45$, $p = 0.034$, $n^2_p = 0.043$), and in Brixton, group with low ASD traits showed greater improvement that group with high ASD traits (time: $F(2,152) = 32.00$, $p < 0.000$, $n^2_p = 0.296$; time x treatment group x ASD: ($F(2,152) = 4.00$, $p < 0.020$, $n^2_p = 0.050$). Central coherence was improved; there was no significant difference between high or low ASD trait groups (time: $F(2,158) = 6.874$, $p < 0.001$, $n^2_p = 0.08$).	No improvement DFlex, MR (ability to change and importance of change). Eating disorder symptoms improved ($p < 0.000$) and there was no interaction between ASD traits and eating disorder symptoms improvement.

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Kinnaird et al., 2019[22]	9 individuals with diagnosed ASD, 4 with high ASD traits (measured with AQ-10 and ADOS)	0	11 females, 2 non-binary	Mean age 28.46 years	A retrospective interview about treatment experiences	Qualitative interview	N/A	Participants described that treatment should be adapted to individuals with AN and ASD. and that it is important to recognize the role of underlying ASD traits in AN.
Tchanturia et al., 2016[43]	14 individuals with high ASD traits (measured by AQ-10 or ADOS)	21	All females	Mean age 26.2 years	Group CRT (6 sessions)	Two self-report questionnaires (DFLex, MR (subscales ability to change and importance to change)	N/A	Among the group with high ASD traits, there was no improvement in any of the measured areas (cognitive rigidity: d = 0.0, p = 0.905; attention to detail d = 0.1, p = 0.702; importance to change: d = 0.2, p = 0.427; ability to change: d = 0.2, p =0.389). Among the group with low ASD traits, cognitive flexibility and ability to change improved significantly, while central coherence and importance to change did not (cognitive rigidity: d = 0.5, p = 0.007; attention to detail d = 0.4, p = 0.053; importance to change: d = 0.1, p = 0.450; ability to change: d = 0.5, p =0.004).
Tchanturia et al., 2021[46]	7 individuals with high ASD traits (measured by AQ-10)	16	All females	18–60 years, mean age 28.2 years	One workshop focused on sensory processing	A self-report questionnaire before and after workshop (focusing on sensory wellbeing) and after workshops also a self-report qualitative feedback questionnaire	N/A	Among individuals with high ASD traits, sensory confidence was increased (d = 1.07, p = 0.039), whereas sensory awareness and strategies to enhance sensory wellbeing did not improve (d = 0.86, p = 0.066; d =0.64, p = 0.131, respectively). Among individuals with low ASD traits, sensory confidence (d = 1.55, p = 0.001), sensory awareness (d = 1.04, p = 0.004), and strategies to enhance sensory wellbeing increased (d = 1.62, p = 0.001).
Treasure et al., 2019[47]	1 individual with ASD traits defined by clinical history	0	Female	17 years old	MANTRA with a special focus on social difficulties	Clinical follow-up	N/A	Symptoms of eating disorder and social difficulties improved to some degree.

Abbreviations: ADOS, autism diagnostic observation schedule; AN, anorexia nervosa; ASD, autism spectrum disorder; AQ-10, Autism Spectrum Quotient 10; CBT, cognitive behavioral therapy; CREST, cognitive remediation and emotional skills training; CRT, cognitive remediation therapy; DFlex, Detail and Flexibility Questionnaire; EDE-Q, Eating Disorder Examination Questionnaire; MANTRA, Maudsley anorexia nervosa treatment for adults; MR, motivational ruler; RCADS, The revised child anxiety and depression scale; ROCF, The rey–osterrieth Complex Figure; SRS-2, Social responsiveness scale −2.

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CRT among adults with high ASD traits whereas among those with low ASD traits cognitive flexibility improved.[43] Other study found improvement in cognitive flexibility in performance-based tests after individual CRT among adolescent participants with high and low ASD traits, but the improvement was more subtle among individuals with high ASD traits when compared to those with low ASD traits (Wisconsin card sorting task: combined results of both group including individuals with low and high ASD traits).[42] Further, one study found improvement in cognitive flexibility measured with a performance-based test after individual CRT among adults with high and low ASD traits.[44] One of the studies with adolescent participants who received individual CRT found improvement in central coherence both among those with high and low ASD traits,[42] whereas other studies found no improvement in central coherence.[43,44] Further, in the case study with adult women with AN and ASD, self-reported cognitive flexibility and central coherence were improved after CRT, but in the performance-based test, no improvement was observed.[34]

We found one study which investigated CREST.[37] The study included two groups of adult participants; one group received individual CREST, while the another group received group CREST.[37] The authors reported that CREST in both individual and group formats was associated with participants' increased self-reported motivation for change, and that this improvement was seen among both those with high and low ASD traits. Further, individual CREST, but not group CREST, was associated with decreased alexithymia among both individuals with high and low ASD traits.

We found no studies that applied CBT for individuals with AN and high ASD traits or ASD. However, one qualitative study included individuals with AN and diagnosed ASD, who were interviewed concerning their experiences in treatment that included CBT.[45] Participants described experiencing difficulties in CBT because they felt that they lacked some basic skills, such as ability to generalize and transfer learned things to real-life situations, necessary for benefitting from this treatment. Furthermore, they had experienced group situations challenging due to their experienced social challenges.

To conclude, individuals with AN and high ASD traits or ASD may benefit less from CRT, CREST, and CBT than those with AN and low ASD traits. However, this very limited body of evidence suggests that CRT and CREST administered in individual format may be associated with improved cognitive flexibility, central coherence, and motivation for change, and decreased alexithymia among adults with AN and high ASD traits or ASD.

Treatment Adaptations

We found two studies that applied treatment adaptations for individuals with AN and high ASD traits or ASD. In one study, women with AN and low or high ASD traits participated in a workshop focusing on sensory processing.[46] The workshop included psychoeducation about sensory processing and group discussion about sensory experiences. Further, participants made their own sensory item, for example, scented hand cream. The authors reported that confidence in managing sensory wellbeing was increased among both groups, that is, in those with high and low ASD traits. However, among those with low ASD traits, sensory wellbeing, and sensory awareness also increased, suggesting that those with low ASD traits benefited more from the workshop. Another study was a case study including individuals with AN and high ASD traits who underwent Maudsley anorexia nervosa treatment for adults (MANTRA), with treatment adaptations targeted specifically for ASD-related difficulties.[47] In this study, inflexibility, social difficulties, and social isolation were considered as important underlying factors for anorexia nervosa, and treatment was targeted specifically for these. As a result, assessed only with a qualitative clinical follow-up, flexibility was reported to increase and some improvement in social difficulties was also noted.

Two qualitative studies examined how individuals with AN with high ASD traits or diagnosed ASD experienced treatment.[22,45] In both studies, participants described the experience of being misunderstood in treatment due to their ASD-related traits and behavior. They reported, for example, that they were considered resistant, uncooperative, and difficult because of their slow progress, social difficulties, or inability to eat certain foods due to their of atypical sensory processing. Further, they described that their social challenges made it difficult for them to engage in treatment and create a satisfying relationship with health-care professionals. They suggested adaptations to the treatment of AN in order to take ASD traits into account. These were suggested to include adaptations to the communication style and treatment environment, offering more flexible and individualized approaches, considering the possibility that ASD traits may underlie AN symptoms; and increasing the awareness of the specific manifestation of AN among those with ASD.[22,45] To conclude, studies suggest that individuals with AN and high ASD traits or ASD appear to benefit less from CRT, CREST,

and CBT compared to those with low ASD traits. In addition, individuals with comorbid AN and ASD themselves highlight the importance of treatment adaptations that take the ASD traits underlying AN into account.

Discussion

The purpose of this narrative review was to evaluate how individuals with AN and ASD or high ASD traits respond to CRT, CREST, or CBT, and to investigate what kinds of treatment modifications might be beneficial for them. The combined results suggest that individual CRT and CREST may improve cognitive flexibility, central coherence, and motivation in individuals with AN and ASD traits, but the improvement was more subtle than among those with AN and low ASD traits. Individuals with AN and ASD also report that they encounter difficulties in treatment related to their ASD traits, and that they wish for more flexible and individualized treatment approaches, as well as a greater understanding of ASD traits underlining their AN symptoms. Our findings suggest that adaptations to the treatments appear to benefit individuals with AN and ASD or high ASD traits. However, given the small number of studies, these results should be considered with caution.

Social difficulties are widespread and generalized among those with AN and ASD.[15] In individuals with AN and co-occurring ASD, social difficulties may underlie eating disorder behaviors and cause struggling both in treatment settings and in peer relationships. Group situations may be difficult for these individuals, and therefore, as the results of the previous study suggest, CREST in its individual form may be effective and enable flexible approaches for each individual's specific difficulties.[37,45] On the other hand, these individuals may also benefit from practicing social interaction, such as structured group conversations.[45] As a part of their treatment, individuals with AN and ASD may also benefit from additional support to engage in age-appropriate peer relationships, because their social network may be limited, and, making new friends may be difficult for them.[48] Further, when working with families, it is worth keeping in mind a relatively high heritability of ASD,[49] which tend to manifest as difficulties in social communication and interaction among biological relatives, such as parents.[47] In family-based treatment settings, the whole family may thus require extra support.[47,48]

In the context of cognitive inflexibility, there is some evidence that individual CRT may improve cognitive rigidity among individuals with AN and high ASD traits or co-occurring ASD.[44] Among individuals with AN and ASD traits or ASD, cognitive rigidity usually precedes AN, but during acute AN, it may be emphasized even further.[17,19] Cognitive inflexibility has also been shown to be associated with acute eating disorder symptoms.[9] Individuals with AN and ASD describe that their rigidity and inflexibility have contributed to development of rigid routines around eating and also made it difficult to change eating habits during treatment.[22] Cognitive inflexibility could therefore be an important factor contributing for poorer treatment outcomes among individuals with AN and ASD or high ASD traits. These findings suggest that cognitive inflexibility would be an important treatment target, and since individual CRT seems to improve cognitive inflexibility, it could be a promising addition to other treatments.

We found only one study focusing on sensory processing.[46] In this study, participants received psychoeducation and discussed their experiences of sensory processing in workshops, which they experienced beneficial, but no planned modifications to their treatment were made. Among individuals with ASD, selective eating based on sensory processing atypicality is very common even in the absence of a co-occurring clinical eating disorder.[50] Therefore, it is likely that in individuals with both AN and ASD, selective eating has occurred to some degree even before the onset of a clinical eating disorder. Among individuals with both AN and ASD, it may therefore be essential to clarify what kind of food they ate before the onset of AN, because it is likely that they have always avoided certain textures or tastes.[48] It has also been suggested that foods offered in the treatment would be bland, mild, and of soft texture; and that predictability of the served food would be valued by not varying menus that much, and providing photographs of foods beforehand.[51] Modifications of served food for those with ASD and prominent sensory processing atypicalities may be of importance, because without such modifications these individuals may not be able to engage in treatment. However, after the individual has achieved some degree of weight restoration and is committed to treatment, it is also important to widen the accepted food repertoire.[48] In the context of ASD, numerous strategies have been developed to treat selective eating and some of these treatment strategies may also be beneficial for individuals with AN and ASD. In addition, it is likely that among those with ASD, some overlap exists between AN and avoidant/restrictive food intake disorder (ARFID), in

which atypical sensory processing is one of the main factors underlying the eating disturbance. Thus, CBT that has been developed for ARFID and includes particular treatment strategies for eating disturbances based on sensory avoidance may also be beneficial for some individuals with AN and ASD.[52,53] See Table 2 for a summary of treatment adaptations.

Limitations

The main limitations of this review include overall low number of studies and relatively small samples, high heterogeneity of study designs, and low number (five) of controlled studies. The outcomes of treatment were measured with different methods across studies and therefore the results of the studies may not be directly comparable. Also, in five of the studies, the treatment outcome was assessed only with self-report measures. Further, most of the participants in the studies did not have a formal ASD diagnosis but only high ASD traits measured with self-report, most often by the Autism Quotient −10 (AQ-10). Participants were mostly women. Because it has been shown that sex and gender differences affect the presentation of ASD,[54] the results may not be generalizable to males or non-binary individuals.

Conclusions

The limited body of evidence covered in this review suggests that individually provided forms of CRT and CREST appear to be associated with improved social skills, cognitive flexibility, and central coherence in individuals with AN and ASD or ASD traits. Among these individuals, atypical sensory processing should be considered in feeding and nutritional treatment and provide appropriate modifications. In the future, large controlled studies of the treatment strategies for individuals with AN and ASD/high ASD traits are needed in order to improve the outcome of individuals with this challenging comorbidity.

Table 2 Treatment Adaptations for Individuals with Anorexia Nervosa and Autism Spectrum

ASD Characteristics in Individuals with AN	Possible Treatment Modifications
Difficulties in social cognition and emotion processing	• Individual CREST may improve motivation and alexithymia • Group therapy may be challenging because of social difficulties, and extra support for participating in group therapy may be needed. Structured group discussion may however improve social communication skills • Extra support for engaging in age-appropriate peer relationships • In family-based treatment, the whole family may benefit from extra support for emotion regulation and emotion identification • Modifications for communication style may be helpful
Cognitive inflexibility and rigidity	• Individual CRT may improve cognitive flexibility • Due to more severe neurocognitive difficulties, the required length of treatment may be longer • More understanding for cognitive inflexibility as an inherent trait • Extra support before and during CBT in order to train skills that make it possible to benefit from CBT, eg, ability to transfer learned things to real-life situations, ability to generalize learned things
Atypical sensory processing	• Psychoeducation about sensory processing • CBT developed for ARFID including s systematic desensitization for different tastes, smells, and textures • Specifying the types of food which the individual has eaten and/or has not eaten before AN in order to define whether they have always avoided certain textures or tastes • Modifications of nutrition plan, eg, striving to offer food that is bland, mild, and of soft texture • Increasing the predictability of the offered food by not varying menus too much and providing photographs of the foods beforehand • Modifications for treatment environment in order to decrease the sensory load

Abbreviations: AN, anorexia nervosa; ARFID, avoidant/restrictive food intake disorder; ASD, autism spectrum disorder; CBT, cognitive behavioral therapy; CREST, cognitive remediation and emotional skills training; CRT, cognitive remediation therapy.

Disclosure

Professor Anu Raevuori reports equity ownership in Meru Health Inc., outside the submitted work. The authors have no other conflicts of interest to declare in this work.

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