




REVIEW

A scoping review of psychological interventions and outcomes for avoidant and restrictive food intake disorder (ARFID)

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Abstract

Objective: This scoping review identifies and describes psychological interventions for avoidant restrictive food intake disorder (ARFID) and summarizes how outcomes are measured across such interventions.

Method: Five databases (Cochrane, Embase, Medline, PsycInfo, Web of Science) were searched up to December 22, 2022. Studies were included if they reported on psychological interventions for ARFID. Studies were excluded if participants did not have an ARFID diagnosis and if psychological interventions were not delivered or detailed.

Results: Fifty studies met inclusion criteria; almost half were single-case study designs (23 studies) and most studies reported on psychological interventions for children and adolescents with ARFID (42 studies). Behavioral interventions (16 studies), cognitive-behavioral therapy (10 studies), and family therapy (5 studies), or combinations of these therapeutic approaches (19 studies) were delivered to support patients with ARFID. Many studies lacked validated measures, with outcomes most commonly assessed via physical health metrics such as weight.

Discussion: This review provides a comprehensive summary of psychological interventions for ARFID since its introduction to the DSM-5. Across a range of psychological interventions and modalities for ARFID, there were common treatment components such as food exposure, psychoeducation, anxiety management, and family involvement. Currently, studies reporting on psychological interventions for ARFID are characterized by small samples and high levels of heterogeneity, including in how outcomes are measured. Based on reviewed studies, we outline suggestions for clinical practice and future research.

Public Significance: Avoidant restrictive food intake disorder (ARFID) is an eating disorder characterized by avoidance or restriction of food due to fear, sensory sensitivities, and/or a lack of interest in food. We reviewed the literature on psychological interventions for ARFID and the outcomes used to measure change. Several psychological interventions have been developed and applied to patients with ARFID. Outcome measurement varies widely and requires further development and greater consensus.

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Abstracto

Objetivo: Esta revisión de alcance identifica y describe las intervenciones psicológicas para el Trastorno de Evitación y Restricción de la Ingesta de Alimentos (TERIA) y resume cómo se miden los resultados en dichas intervenciones.

Método: Se hicieron búsquedas en cinco bases de datos (Cochrane, Embase, Medline, PsycInfo, Web of Science) hasta el 22 de diciembre de 2022. Se incluyeron los estudios que informaban sobre intervenciones psicológicas para TERIA. Se excluyeron los estudios si los participantes no tenían un diagnóstico de TERIA y si las intervenciones psicológicas no se administraban o detallaban.

Resultados: Cincuenta estudios cumplieron los criterios de inclusión; casi la mitad fueron diseños de estudio de caso único (23 estudios) y la mayoría de los estudios informaron sobre intervenciones psicológicas para niños y adolescentes que padecen TERIA (42 estudios). Se administraron intervenciones conductuales (16 estudios), terapia cognitivo-conductual (10 estudios) y terapia familiar (5 estudios), o combinaciones de estos enfoques terapéuticos (19 estudios) para apoyar a los pacientes con TERIA. Muchos estudios carecían de medidas validadas, y los resultados se evaluaron con mayor frecuencia mediante parámetros de salud física como el peso.

Discusión: Esta revisión proporciona un resumen exhaustivo de las intervenciones psicológicas para el TERIA desde su introducción en el DSM-5. A través de una gama de intervenciones y modalidades psicológicas para el TERIA, hubo componentes de tratamiento comunes como la exposición a los alimentos, la psicoeducación, el manejo de la ansiedad y la participación de la familia. Actualmente, los estudios que informan sobre las intervenciones psicológicas para el TERIA están dominados por muestras pequeñas y altos niveles de heterogeneidad, incluso en la forma en que se miden los resultados. Sobre la base de los estudios revisados, se esbozan sugerencias para la práctica clínica y la investigación futura.

KEYWORDS

ARFID, avoidant restrictive food intake disorder, CBT, eating disorders, family therapy, interventions, outcomes

1 | INTRODUCTION

Avoidant restrictive food intake disorder (ARFID) was introduced to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) 10 years ago (American Psychiatric Association, APA, 2013). More recently, ARFID has also been added to the International Classification of Diseases, eleventh edition (ICD-11) (Claudino et al., 2019; World Health Organisation, 2019).

ARFID is characterized by avoidant and restricted eating behaviors driven by an apparent lack of interest in eating or food, avoidance due to the sensory properties of food, and/or fears that eating will result in aversive consequences such as choking or vomiting (APA, 2013; Thomas, Lawson, et al., 2017). These drivers are not mutually exclusive nor exhaustive (Bourne et al., 2020). The avoidant/restrictive eating may contribute to weight loss, failure to gain weight, nutritional compromise, dependence on nutritional supplements or

enteral feeding, and/or psychosocial problems. To receive a diagnosis of ARFID, the avoidant/restrictive eating should not be attributed to concurrent medical conditions or mental disorders, including other eating disorders, nor be better explained by lack of available food or cultural practices (APA, 2013). ARFID can emerge and/or persist across the life stages (Sharp & Stubbs, 2019).

Individuals with ARFID can experience abdominal pain, reflux, nausea, diarrhoea, or constipation and may experience significant medical consequences including weight loss, low bone mineral density, amenorrhoea, electrolyte imbalances, bradycardia, and heart problems (Feillet et al., 2019; Nakai et al., 2017; Thomas, Lawson, et al., 2017). ARFID also poses significant nutritional risks (Feillet et al., 2019; Fisher et al., 2014) and psychosocial challenges including distress, embarrassment, and avoidance of activities involving food (Fisher et al., 2014; Zickgraf et al., 2019). ARFID is highly comorbid with psychiatric disorders and neurodevelopmental conditions,

including anxiety disorders and autism spectrum disorder (ASD) (Bourne et al., 2022; Farag et al., 2021; Sanchez-Cerezo et al., 2023).

Prevalence estimates of ARFID vary widely depending on population and setting examined. In a systematic review of 30 studies, the estimated prevalence of ARFID in non-clinical child and adolescent samples ranged between 0.3% and 15.5% (Sanchez-Cerezo et al., 2023). This is in line with recent prevalence estimates of ARFID among high school students of 1.98%, similar to the community prevalence of anorexia nervosa (van Buuren et al., 2023). Estimated prevalence rates are typically higher in specialized eating disorder services ranging from 5% to 55.5%, with specialized feeding clinics reporting the highest prevalence rates between 32% and 64% (Sanchez-Cerezo et al., 2023). Overall, ARFID is thought to be common in clinical settings and likely common in the general population too (Micali & Cooper-Vince, 2020; Thomas, Lawson, et al., 2017).

Given the prevalence of ARFID, and its associated physical, nutritional, and psychosocial difficulties, clinicians need to understand how to manage the needs of those with ARFID (Norris et al., 2016). Existing research suggests that behavioral interventions can help to increase dietary volume and variety for young patients with feeding problems (Sharp et al., 2017), typically those under the age of six (Taylor et al., 2019). Cognitive-behavioral therapy (CBT) can also be delivered to support children and young people with ARFID (Howard et al., 2023). Thomas and Eddy (2019) have developed a manualized CBT treatment for ARFID (CBT-AR), applicable to those aged 10 and over, with preliminary evidence for the feasibility and acceptability of CBT-AR across various ARFID presentations (Thomas et al., 2020; Thomas et al., 2021). Similarly, family-based treatment (FBT) has also been adapted for ARFID (FBT-ARFID), using the main principles of the approach (Lock, Robinson, et al., 2019).

Whilst there are some promising developments in psychological interventions for ARFID, at present, there are no evidence-based treatment recommendations to guide care for patients with ARFID (National Institute of Health and Care Excellence, NICE, 2017). The Practice Guideline for the Treatment of Patients with Eating Disorders (APA, 2023) highlighted a lack of clinical trial data due to the relative recency of the ARFID diagnosis and therefore does not make statements relating to the treatment of ARFID. However, the guideline suggests that some principles from the treatment of anorexia nervosa, such as medical stabilization and nutritional rehabilitation, may be required for patients with ARFID (APA, 2023). For all eating disorders, including ARFID, consensus guidelines recommend a form of psycho-behavioral therapy in addition to addressing physical, nutritional, and mental health comorbidities (Hay, 2020; Hay et al., 2014).

Currently, it is difficult to understand how outcomes are being measured during psychological interventions for those with ARFID. There has been some slow progress in the development of psychometric measures for ARFID and its symptomatology (Cooke, 2020). Recent developments include the eating disturbances youth-questionnaire (EDY-Q); a 14-item self-report measure with 12 items based on DSM-5 criteria for ARFID designed for 8–13-year-olds to assess eating disturbances (Hilbert & van Dyck, 2016). For adults, the nine-item ARFID screen (NIAS) has been developed (Zickgraf & Ellis, 2018). The International Consortium for Health Outcomes Measurement (ICHOM) recently completed a review of

patient-reported outcome measures for eating disorders and selected the EDY-Q and NIAS as recommended measures for ARFID (ICHOM, 2022). Additionally, the Pica, ARFID, and Rumination Disorder Interview (PARDI) has been developed as a clinical interview tool to assess ARFID (Bryant-Waugh et al., 2019). Given its length, its use in routine clinical settings may not be practical (Bryant-Waugh et al., 2022). Consequently, the Pica, ARFID, and rumination disorder interview ARFID questionnaire (PARDI-AR-Q), focusing on the psychopathology of ARFID, has been developed as a self- and parent-report questionnaire, with preliminary support for its validity and reliability (Bryant-Waugh et al., 2022).

Existing reviews of the ARFID literature have provided a broad overview of the field (e.g., Bourne et al., 2020). This review aims to update previous reviews, with a focus on describing psychological interventions for ARFID across the lifespan and across clinical settings. Additionally, this review also aims to identify how outcomes are measured in psychological interventions for ARFID. It is hoped that in doing so, this review will support understanding of current clinical practice in the absence of evidence-based practice guidelines and will identify considerations for both clinical practice and further research.

1.1 | Objectives

1. To identify and describe studies reporting on psychological interventions for ARFID, across the lifespan and across clinical settings.
2. To identify and report on how outcomes are measured during psychological interventions for ARFID.

2 | METHOD

This review was pre-registered on the Open Science Framework portal (<https://osf.io/8j4sc/>). Scoping review methodology (Peters et al., 2015) was identified as the most appropriate methodology to identify and summarize existing research into psychological interventions and outcomes for ARFID, due to the broad aims of this review and heterogeneity in studies. The review was conducted according to preferred items for systematic reviews and meta-analyses, extension for scoping reviews (PRISMA-ScR; Tricco et al., 2018), and Joanna Briggs Institute guidelines for scoping reviews (Peters et al., 2020). The methodology was initially developed by one author (Emma Willmott) and refined and reviewed by another author (Tom Jewell) using the participants, context, and context (PCC) framework recommended for scoping reviews (Briggs, 2015).

2.1 | Eligibility criteria

Eligibility criteria are presented in Table 1.

3 | SEARCH STRATEGY

Five databases (Cochrane, Embase, Medline, PsycInfo, Web of Science) were searched. An initial search to better understand the literature in

TABLE 1 Scoping review eligibility criteria.

	Inclusion	Exclusion
Publication type	Studies published in peer-reviewed journals	Review articles, letters, commentaries, opinion or reflection articles, newsletters, poster presentations, or conference abstracts
Language	English language	Non-English language
Study objectives	Studies reporting on psychological interventions for ARFID, across all therapeutic settings, and delivery formats; studies reporting on outcomes of psychological interventions for ARFID	Studies in which no intervention was provided; studies in which interventions were only medical, dietetic, and/or pharmacological in approach; studies in which the psychological intervention was not specified or described
Study design	Any study design including case reports, case studies, randomized controlled trials	
Sample	Participants with a clinical diagnosis of ARFID (e.g., meeting DSM-5 or ICD-11 criteria, and/or following psychiatric or psychological assessment, and/or use of psychometric measure); all ages; any geographical region	No ARFID diagnosis Diagnosis of other eating disorders or other eating disturbances

the field took place in April 2020, with the search terms and strategy being developed in consultation with a subject librarian. In March 2022, terms were refined and tailored to each database through a process of piloting. The final search strategy for each database was constructed by Rachel Dickinson and Kevser Sadikovic under supervision from Emma Willmott and Tom Jewell. Given limited extant research into ARFID, search terms were applied in all/any fields, without applying filters, data restrictions, or limits, nor using Boolean operations. The main search was conducted on May 9, 2022 and a further search was conducted on December 22, 2022. The specific search strategy for each database is available in Appendix A.

3.1 | Selection process

Data selection was conducted in line with PRISMA guidelines (Page et al., 2021). All database searches were imported into Covidence, which was used for the screening and data extraction phases. After completing searches, duplicates were removed, and remaining titles and abstracts were reviewed. Full texts were then screened for eligibility. Text citations and reference lists were also screened for eligibility. See Figure 1 for PRISMA flowchart.

Searches, title, and abstract screening were conducted by Rachel Dickinson, Kevser Sadikovic, and Celine Hall. Disagreements were resolved by Emma Willmott and Tom Jewell. Full text screening was conducted in pairs by Rachel Dickinson/Emma Willmott and Rachel Dickinson/Tom Jewell, with disagreements resolved by a third member of the research team (Emma Willmott or Tom Jewell).

3.2 | Data extraction and synthesis

Data were extracted by Rachel Dickinson and Celine Hall using data extraction templates developed by Emma Willmott and Tom Jewell for the study preregistration, with discrepancies resolved by Emma Willmott and Tom Jewell. Data were synthesized by Nora Trompeter, Emma Willmott, and Tom Jewell based on the main treatment modality, informed by prior

work to categorize psychological interventions by Gartlehner et al. (2015). Interventions were organized into four categories: behavioral therapy, cognitive behavior therapy (CBT), family therapy, and mixed interventions. The decision to categorize interventions in this way was based on several factors, including the different histories of these modalities, the different etiologies in the presentation of ARFID (Mairs & Nicholls, 2016), and the development of ARFID from a feeding to an eating disorder (Sharp & Stubbs, 2019). A risk of bias assessment was not completed, in line with scoping review guidance (Munn et al., 2018; Peters et al., 2020).

4 | RESULTS

4.1 | Study selection and characteristics

Overall, the searches identified 7322 studies, of which 6292 were duplicates, leaving 1030 studies to be screened by title and abstract. Of these, 107 studies were assessed according to the eligibility criteria. Out of these studies, 57 studies were excluded, and 50 studies were deemed eligible for this review. References of excluded studies are presented in Appendix B.

Fifty studies were included; see Table 2 for study and sample characteristics. Most studies were based in North America (USA and Canada) (35 studies), followed by Europe (6 studies), Australia and New Zealand (5 studies), with one study each from Japan, India, Brazil, and Turkey. Studies often had small sample sizes, including 23 single-case reports with one participant.

Most studies focused on child and adolescent populations (42 studies), with a small number of studies reporting on adults only (6 studies) and two studies in which participants included children and adults (Brewerton & D'Agostino, 2017; Makhzoumi et al., 2019). The youngest participant was aged 13 months (Sharp et al., 2016) and the oldest participant was 55 years (Thomas et al., 2021). Almost half of the reviewed studies (24 studies) had mixed-sex samples, 15 studies included only female participants, and 10 studies included only male participants. One study did not report sex (Peterson et al., 2021). Race or ethnicity was reported in 28 studies, with most participants being

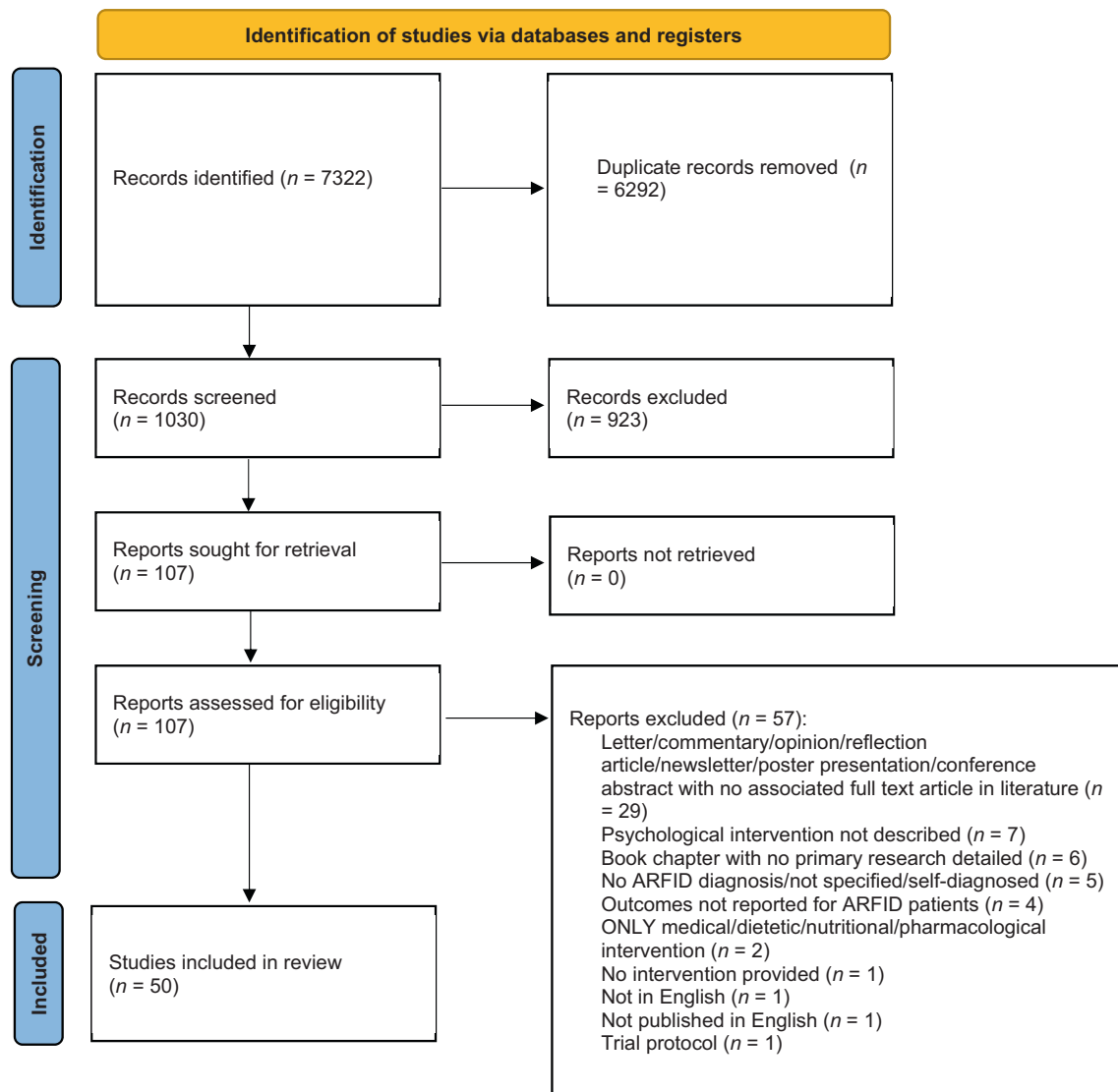


FIGURE 1 Identification of studies via databases and registers. From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Page et al., 2021; 372:n71. doi: 10.1136/bmj.n71.* For more information, visit: <http://www.prisma-statement.org/>.

White (23 studies). Socio-economic status (SES) was reported in six studies, with the majority being from high SES backgrounds (5 studies). Comorbid disorders were reported frequently, including anxiety disorders (19 studies), ASD (16 studies), attention deficit hyperactivity disorder (ADHD) (9 studies), and developmental and/or intellectual disabilities (10 studies). Enteral feeding was reported in 12 studies.

Details of interventions and outcomes are reported in Tables 3–6 for behavioral, cognitive behavioral therapy, family therapy, and mixed interventions, respectively.

4.1.1 | Behavioral interventions

Behavioral interventions for ARFID were reported for 16 studies (seven case studies, five case series, two RCRs, two RCTs). Behavioral interventions were reported for children with ARFID aged 23 months

to 15 years. Interventions were delivered across a variety of formats, including inpatient and day treatment settings, outpatient clinics, telehealth/virtual sessions, and within the home. Interventions were led by therapists of varying disciplines, some with specific behavioral training (e.g., behavioral analyst). Indeed, many of the behavioral interventions were highly specialized and intensive feeding programmes, utilizing applied behavioral analysis (ABA). Few adjunctive treatments were delivered; one study described the use of adjunctive psychiatric medication (Lesser et al., 2022), several studies reported on additional dietetic intervention (e.g., Volkert et al., 2021) and one study reported adjunctive speech therapy (Tomioka et al., 2022).

Common approaches within behavioral interventions were positive and contingent reinforcement. For example, providing praise and rewards (e.g., iPad time, tokens, a preferred activity/food) contingent upon a desired behavior such as bites of food being accepted (e.g., Bloomfield et al., 2019; Taylor et al., 2019). Differential reinforcement was also

TABLE 2 Study characteristics.

First author, year	Country	Study design	N	Sex female (F) male (M) (% female)	Mean age (M) (years), standard deviation (SD), range (R)	Race/ethnicity	Socio-economic status (SES)	Psychiatric and developmental comorbidities	Physical comorbidity
Aloi et al., 2018	Italy	Case study	1	1M	24	NR	NR	NR	Thalassemia carrier
Bąbik et al., 2021	Poland	RCT	6	3F/3M (50% female)	M: NR SD: NR R: 3-4	White (n = 6)	NR	NR	NR
Bergonzini et al., 2022	Italy	Case study	1	1M	15	NR	NR	ASD; Global developmental delay; Intellectual disability; Dyspraxia	Goldenhar syndrome; high-arched palate; malocclusion; rhinophony
Billman et al., 2022	USA	Case series	22	14F/8M (63.64% female)	M: 12.26 SD: NR R: 7-17	White (n = 17) Hispanic/Latino (n = 2) multiracial (n = 2) Asian (n = 1)	NR	None specified	NR
Bloomfield et al., 2019	USA	SCED	1	1M	8	White/non-Hispanic	NR	None specified	NR
Bloomfield et al., 2021	Australia	SCED	1	1F	5	White	NR	ASD	NR
Brewerton & D'Agostino, 2017	USA	RCR	11	8F/3M (72.73% female)	M: 14.4 SD: 4.1 R: 9-19	NR	NR	GAD; OCD; PTSD; separation anxiety; disorder; social anxiety disorder	NR
Brown & Hildebrandt, 2020	USA	Case study	1	1M	12	White	NR	None specified	Food allergies; asthma
Burton et al., 2021	North America	Case study	2	2F (100% female)	M: NR SD: NR R: 6.83-11.42	NR	NR	ASD (n = 2); Separation anxiety (n = 1); Mild intellectual disability (n = 1)	Tuberous sclerosis (n = 1); NGT (n = 1)
Burton Murray et al., 2022	USA	Case study	1	1M	16	NR	NR	None specified	None specified
Bryant-Waugh, 2013	UK	Case study	1	1M	13 years, 4 months	NR	NR	NR	NR
Bryson et al., 2018	USA	Case series	20	14F/6M (70% female)	M: 11.43 SD: 1.55 R: 7-17	White (n = 19) NR (n = 1)	NR	ADHD (n = 3); Anxiety disorder (n = 10); depression (n = 1); OCD (n = 3)	NR
Dahlsgaard & Bodie, 2019	USA	SCED	21	2F/19M (9.52% female)	M: 7.66 SD: 2.02 R: 4-12	White (n = 18) NR (n = 3)	NR	Anxiety disorder (n = 8); OCD or tic disorder (n = 3); ADHD (n = 3)	NR

TABLE 2 (Continued)

First author, year	Country	Study design	N	Sex female (F) male (M) (% female)	Mean age (M) (years), standard deviation (SD), range (R)	Race/ethnicity	Socio-economic status (SES)	Psychiatric and developmental comorbidities	Physical comorbidity
Dhiman et al., 2021	India	Case study	1	1F	25	NR	Lower-middle	NR	NR
Dolman et al., 2021	Canada	Case study	1	1M	11	NR	NR	GAD	Severe anemia; scurvy; GERD; NGT
Dumont et al., 2019	Nether-lands	Case series	11	4F/7M (36.36% female)	M: 13.9 SD: 1.95 R: 10–17	NR	NR	ASD (n = 3); GAD (n = 2); ADD (n = 1)	Enteral feeding (n = 6)
Eckhardt et al., 2019	USA	Case study	1	1F	9	NR	NR	Separation anxiety disorder; specific phobia (choking)	Gluten intolerance (likely coeliac disease)
Fischer et al., 2015	USA	Case study	1	1M	16	NR	NR	Anxiety (not formally diagnosed)	NR
Görmez et al., 2018	Turkey	Case study	1	1F	27	NR	NR	GAD; depression	GERD; gastritis
King et al., 2015	USA	Case study	1	1F	41	NR	NR	Illness anxiety disorder; dysthymia	GERD; tachycardia; uterine fibroids
King et al., 2022	USA	Case study	1	1M	17	Latino	NR	ODD; ASD; Intellectual impairment	NR
Knatz-Peck et al., 2021	USA	SCED	6	5F/1M (83.33% female)	M: 19.92 SD: 1.27 R: NR	White (n = 5) Asian (n = 1)	NR	Mood disorder (n = 2); Anxiety disorder (n = 6); Substance-use disorder (n = 1); Trauma-related disorder (n = 1); Other disorder (n = 1)	NR
Lane-Loney et al., 2022	USA	RCR	81	Fear: (85.7% female) Appetite (60.0% female), Combined poor appetite and selective eating (62.5% female)	Fear: M: 10.89, SD: 2.16, R: NR Appetite: M: 13.11, SD: 2.06, R: NR Combined: M: 11.50, SD: 1.97, R: NR	Fear: 90.5% White Appetite: 86.7% White Combined: 79.2% White	NR	NR	NR
Lenz et al., 2018	USA	Case study	1	1F	8 years, 7 months	White	NR	Not specified	GERD; NGT

(Continues)

TABLE 2 (Continued)

First author, year	Country	Study design	N	Sex female (F) male (M) (% female)	Mean age (M) (years), standard deviation (SD), range (R)	Race/ethnicity	Socio-economic status (SES)	Psychiatric and developmental comorbidities	Physical comorbidity
Lesser et al., 2022	USA	RCR	15	12F/4M (80% female)	M: 11.5 SD: NR R: NR	NR	NR	Anxiety disorders (n = 7); Developmental diagnoses (n = 2)	Gastrointestinal conditions (n = 8); allergies (n = 4), endocrine (n = 2), malignancy (n = 1), 63% enterally fed
Lock, Robinson, et al., 2019	USA	Case series	3	3F (100% female)	M: 7.33 SD: NR R: 3–11	Latina (n = 1) NR (n = 2)	NR	NR	NR
Lock, Sadeh-Sharvit, & L'Insalata, 2019	USA	RCT	28	7F/9M (77.78% female)	Total sample: M: 9.29 SD: 2.36 R: NR Usual care (n = 12)	Total sample: Race: -White (75%), Asian (10.7%), multiracial (14.3%). Ethnicity: Hispanic (7.1%)	Total sample: Depression (14.3%); GAD (28.6%); ADHD (17.9%); ASD (3.6%) Total sample: 67% > \$150,000 household income	NR	NR
Makhzoumi et al., 2019	USA	RCR	27	19F/8M (70.37% female)	M: 18.97 SD: 3.60 R: 11–26	NR	NR	ARFID sample: Anxiety disorder (n = 9) Depression (n = 14)	ARFID sample: Anemia (n = 2); GERD/ vomiting (n = 17); Constipation/ diarrhea (n = 21); Enteral feeding (n = 7)
McMahon et al., 2022	USA	Case series	4	1F/3M (25% female)	M: 4.46 SD: 3.41 R: 1.92–9.33	White (n = 2); Black or African American (n = 2)	NR	ASD (n = 2); Developmental disability (n = 2); Intellectual disability (n = 1)	Cerebral palsy (n = 1); Blindness (n = 1)
Murphy & Zlomke, 2016	USA	Case study	1	1F	6	White	NR	None specified	GERD (Nissen's fundoplication to correct)
Naviaux, 2019	Ireland	Case study	1	1F	12	Irish	NR	NR	Constipation
Ornstein et al., 2017	USA	RCR	32	26F/6M (81.25% female)	M: 11.06 SD: 1.91 R: 7.20–16.86	White (93.8%)	NR	ASD traits (no formal diagnosis)	NR
Peterson et al., 2021	USA	Case series	15	NR	M: NR SD: NR R: 2–7.5	NR	NR	NR	Enteral feeding (n = 12)

TABLE 2 (Continued)

First author, year	Country	Study design	N	Sex female (F) male (M) (% female)	Mean age (M) (years), standard deviation (SD), range (R)	Race/ethnicity	Socio-economic status (SES)	Psychiatric and developmental comorbidities	Physical comorbidity
Phipps et al., 2022	USA	Case series	3	1F/2M (33.33% female)	M: 6.33 SD: NR R: 5-8	White	NR	ASD (n = 2); ADHD (n = 1); Global developmental delay (n = 1)	Hypotonia (n = 1); Dysphagia (n = 1); Short-gut syndrome (n = 1)
Rienecke et al., 2020	USA	Case series	3	1F/2M (33.33% female)	M: 10.67 SD: NR R: 8-14	African American (n = 1), White (n = 2)	NR	ADHD (n = 1); Anxiety disorder (n = 2); Depression (n = 1)	NR
Rosania & Lock, 2020	USA	Case study	1	1F	9	NR	NR	NR	NR
Sharp et al., 2016	USA	RCT	20: iEAT (n = 10) Waitlist control (n = 10)	Total sample: 8F/12M (40% female)	Total sample: M: 3.52 SD: 1.48 R: 1-6	NR	NR	ASD (n = 3)	Enteral feeding (n = 9), GERD (n = 6), failure to thrive (n = 4), cardiac conditions (n = 4), broncho-pulmonary dysplasia (n = 3), food allergy (n = 1)
Shimshoni et al., 2020	USA	SCED	15	2F/13M (13.33% female)	M: 9.14 SD: 2.63 R: 6-14	Ethnicity: Non-Hispanic or Latino (n = 12, 1 missing), NR (n = 2) Race: White (n = 13, 1 missing), multiracial (n = 1)	Median annual household income: \$100,000-\$124,999	Anxiety (n = 5); OCD (n = 5), ADHD (n = 4), ODD (n = 4), Dysthymia (n = 1)	NR
Soffritti et al., 2019	Brazil	Case study	1	1F	20	NR	NR	Down's syndrome and intellectual disability	Enteral feeding
Spettigue et al., 2018	Canada	Case series	6	5F/1M (83.33% female)	M: 12.73 SD: 1.15 R: 10.9-14.4	White (n = 6)	NR	Anxiety (n = 6); anxiety disorder (n = 1); ASD (n = 2); OCD, (n = 1), separation anxiety disorder (n = 3)	NGT (n = 1)
Taylor et al., 2019	Australia	Case study	1	1F	13	NR	NR	NR	NR
Taylor, 2020	New Zealand	Case study	1	1M	5	White	High	ADHD; ASD	Iron deficiency

(Continues)

TABLE 2 (Continued)

First author, year	Country	Study design	N	Sex female (F) male (M) (%) female)	Mean age (M) (years), standard deviation (SD), range (R)	Race/ethnicity	Socio-economic status (SES)	Psychiatric and developmental comorbidities	Physical comorbidity
Taylor, 2021	Australia	Case series	26	4F/22M (15.38% female)	M: 6 SD: NR R: 2-13	White Australian (n = 15) Asian, Arabic, or European (n = 11)	High	ASD (n = 20); developmental delay (n = 20)	Growth impairments (n = 14), constipation (n = 11), nutritional deficiencies (n = 8), genetic/ chromosomal abnormalities (n = 5), eczema (n = 3), Coeliac disease (n = 1), enteral feeding/ dependence on formula (n = 11)
Taylor et al., 2021	Australia	Case study	1	1F	5	Asian Australian	High	ASD	Growth impairment, eczema
Thomas, Brigham, et al., 2017	USA	Case study	1	1F	11	NR	NR	Anxiety; specific phobia (choking)	Anxiety
Thomas et al., 2020	USA	Case series	20	9F/11M (45% female)	M: 13.2 SD: 2.1 R: 10-17	Race: White (n = 18), Asian (n = 1), more than one race (n = 1). Ethnicity: Hispanic (n = 1), non-Hispanic (n = 19)	NR	NR	NR
Thomas et al., 2021	USA	Case series	15	10F/5M (66.67% female)	M: 25.0 SD: 10.1 R: 18-55	Race: White (n = 1), Ethnicity: Hispanic (n = 1), non-Hispanic (n = 14)	NR	Panic disorder (n = 6), GAD (n = 6), OCD (n = 3), social anxiety disorder (n = 2), agoraphobia (n = 1), ADHD (n = 1), ASD (n = 1), ODD (n = 1)	NR
Tomioka et al., 2022	Japan	RCR	4	1F/3M (25% female)	M: 4 SD: NR R: 2-5	NR	NR	ASD (n = 3); Intellectual disability (n = 2)	GERD (n = 3); food allergy (n = 2); congenital heart disease (n = 1); chronic lung disease (n = 1); kidney failure (n = 1); enteral feeding (n = 2)

TABLE 2 (Continued)

First author, year	Country	Study design	N	Sex female (F) male (M) (% female)	Mean age (M) (years), standard deviation (SD), range (R)	Race/ethnicity	Socio-economic status (SES)	Psychiatric and developmental comorbidities	Physical comorbidity
Volkert et al., 2021	USA	Case series	60	10F/50M (16.67% female)	M: 6 SD: 3.25 R: 1.92–15.09	Race: White (n = 35); Black or African American (n = 18); Asian (n = 6); Indian/Alaskan Native (n = 1). Ethnicity: Non-Hispanic Hispanic (n = 57); Hispanic (n = 2); NR (n = 1)	NR	ASD (n = 38); ADHD (n = 4); Anxiety (n = 1); Developmental disabilities (n = 11)	GERD (n = 24); Constipation (n = 23); food allergy (n = 20); failure to thrive (n = 15), prematurity (n = 12), pulmonary problems (n = 12), eosinophilic esophagitis (n = 11)
Wagner et al., 2020	USA	SCED	39 ARFID patient from sample of 98 with EDs	Total sample: 75.5% female	Total sample: M: 13.74 SD: 2.27 R: 7.9–17.7	Total sample: White (n = 81); Hispanic (n = 5); Other (n = 5); Asian (n = 4); Black (n = 3).	NR	NR for ARFID participants specifically	Any anxiety disorder (76.5%), major depressive disorder (46.9%), OCD (16.3%), PTSD (11.2%), ADHD (8.2%), adjustment disorder (6.1%), ASD (5.1%)

Abbreviations: ADHD, attention deficit hyperactivity disorder; ARFID, avoidant restrictive food intake disorder; ASD, autism spectrum disorder; ED, eating disorder; F, female; FBT, family based therapy; GAD, generalized anxiety disorder; GERD, gastroesophageal reflux disease; iEAT, integrated eating aversion treatment manual—parent version; M, male; NGT, nasogastric tube; OCD, obsessive compulsive disorder; ODD, oppositional defiant disorder; PTSD, posttraumatic stress disorder; R, range; RCR, retrospective chart review; SCED, single case experimental design; SCID-IV-5, structured clinical interview for DSM-IV, DSM-5; SD, standard deviation; USA, United States of America.

TABLE 3 Behavioral interventions.

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Bağlık et al., 2021	Positive reinforcement for bite accepted, if a food expelled a fresh bite was presented, mealtime structure and rules implemented (e.g., 3-h breaks between meals). Caregiver training.	Duration: 20 × twice-weekly sessions (20 min) Delivery: Not specified Context: Outpatient, University research programme	BMI z-score; Montreal Children's Hospital (MCH) Feeding scale; Food acceptance (taking bite within 10 s), food consumed (grams); Mealtime behaviors	BMI z-score improved MCH feeding scale score decreased (<46) Increase in food acceptance and grams consumed Decrease in inappropriate mealtime behaviors	NR
Bloomfield et al., 2019	Contingent reinforcement: preferred activity and a bite of preferred food after each bite of non-preferred food. Parent involvement and skills training: didactic instruction, modeling, performance feedback.	Duration: 12 × weekly sessions Delivery: APA-accredited and supervised doctoral student, parents continued during the week Context: Outpatient, teleconsultations	Food consumption (bites); Mealtime behavior questionnaire (MBQ); Brief assessment of mealtime behavior in children (BAMBI); Behavior intervention rating scale (BIRS)	Increased bites consumed (maintained at follow-ups) MBQ scores decreased 23 points (improvements in mealtime behaviors) BAMBI showed no change in scores BIRS demonstrated high levels of intervention acceptability	NR
Bloomfield et al., 2021	Contingent reinforcement: preferred food, tablet use, verbal praise. Reinforcement schedule adapted until portion eaten without reinforcements. Parent involvement and skills training: verbal commands, prompts and praise.	Duration: 11 × weekly sessions (~50-min), 1–4 additional parent-led sessions per week Delivery: Therapist-led (2nd year graduate student), with additional parent-led sessions Context: Outpatient, telehealth	Food consumption, measured by bites of target foods and consumption of non-preferred foods	Ate 3–10 bites of each target food, increased consumption of previously nonpreferred foods.	NR
Dahlsgaard & Bodie, 2019	A group and parent-based intervention involving psychoeducation, differential and contingent reinforcement, exposures (e.g., “food challenges”), improving mealtime hygiene, appetite optimisation, mealtime-limit setting, relapse prevention.	Duration: 6 sessions (90 min), 7th optional session at 3-month follow-up Delivery: Therapist-led with parent “homework” Context: “Picky Eaters” outpatient clinic; a parent-only group-based intervention	Behavioral pediatric feeding assessment scale (BPFAS); Child Eating Behaviors Questionnaire (CEBQ); Enjoyment of food; Parent attendance; Parent satisfaction with treatment	Significant change in BPFAS and CEBQ mean scores pre-post treatment and follow-up significant increases in enjoyment of food Decreases in slow eating High attendance (95% had one parent attend every session) 96% parent responses were rated as “very” or “extremely helpful”	NR

TABLE 3 (Continued)

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Lesser et al., 2022	Goal setting, demand fading, contingent reinforcement - schedule changed across time, environmental considerations.	Duration: 38 days (average admission length). Delivery: MDT, therapist-led (e.g., degree in psychology or behavioral analysis) Context: Inpatient treatment programme	BMI; Percentage of calorie needs; Percentage of caloric intake being met orally; Treatment goals; Treatment completion	Increase in BMI Average percentage of calorie needs consumed increased from 38% to 93%; 100% of calorie needs orally All participants met over 80% of their treatment goals, 11/15 met 100% of treatment goals 3/15 patients were unable to complete their admission.	Psychiatric medication (SSRIs and benzodiazepines) (n = 9)
McMahon et al., 2022	Behavioral feeding intervention: child presented with a utensil of pureed food, presentation repeated until the child opened their mouth with prompts and mouth checks.	Duration: 35–41 days (38.5 days average) Delivery: MDT, therapist-led Context: NR	Food acceptance, measured by new foods and bolus size; Percentage of goals met; Treatment acceptability questionnaire (0–5 Likert scale)	All participants ate an average of 15 new foods with greater bolus size 100% of treatment goals met for 3 families Family treatment acceptability scores ranged from 4.3 to 5	NR
Murphy & Zlomke, 2016	Differential and contingent reinforcement, non-removal of the feeding demand (escape extinction). Parent involvement and training; psychoeducation, teaching parents' skills for differential reinforcement including in vivo coaching, feedback, role-play and problem-solving.	Duration: 18 × sessions (60–90 min), over 6 months Delivery: Therapist-led with monitoring by parent in the form of 7-day food diary every 3 weeks Context: Outpatient	Behavioral pediatric feeding assessment scale (BPFAS); Food acceptance, measured by food diaries; Psychological functioning; Parental confidence; ARFID diagnostic status	BPFAS scores decreased to normal limits/below clinical cut-offs across scales Food acceptance: twice as many foods per week post-intervention Significantly improved psychosocial functioning Increased parental confidence No longer met ARFID criteria	NR
Peterson et al., 2021	Non-removal of feeding demand (food re-presentation), continuous attention, attention extinction, praise for food acceptance and for mouth clean, consideration of foods, utensils, and presentation, caregiver training.	Duration: NR Delivery: Therapist-led by clinicians (unspecified) Context: Day-treatment programme with outpatient follow-up (clinic and telehealth)	Mean percentage of correct techniques; Mealtime behavior; Percentage of goals met	Mean percentage of correct escape, praise and attention was 100% for both clinic and telehealth groups. Inappropriate mealtime behavior increased for 2/3 participants in the telehealth sessions Goals met: 92% (clinic) and 100% (telehealth)	NR

(Continues)

TABLE 3 (Continued)

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Phipps et al., 2022	Differential reinforcement, praise for chewing and swallowing. If food expelled, food was placed back in mouth, if further not eaten food was removed from mouth. Therapist instruction to caregivers.	Duration: intensive day treatment: 8 weeks (20-min sessions), partial-day treatment: 4 h per day, outpatient feeding programme (1 h per week) Delivery: MDT, therapist-led Context: Intensive day-treatment, then partial-day treatment, then outpatient feeding programme (virtual)	Variety of foods; Patient goals	Variety of foods increased at 1-year follow-up. Patient feeding goals met	NR
Sharp et al., 2016	Reinforcement, escape extinction, formalized meal structure. Parent training to support treatment generalization and treatment gains.	Duration: 14 × 40-min meal blocks delivered across 5 consecutive days, follow-up (n = 7) at ~36 days Delivery: MDT Context: Day treatment programme	BMI; Food intake, measured by bite acceptance and volume consumed; Treatment satisfaction	Slight increase in BMI-for-age percentile for treatment group Significant increase in bites accepted pre-post treatment for treatment group (88.9%) versus waitlist (5.6%). Significant decrease in disruptions for treatment group versus waitlist (55.6% vs. 9.2% respectively)	NR
Taylor et al., 2019	Contingent reinforcement (tokens) and differential reinforcement (attention), demand fading, treatment generalization (e.g., to restaurants), Parent involvement and training.	Duration: 9 days, then parents continued introducing new foods for 2 weeks Delivery: Therapist-led, trained doctoral level behavior analyst Context: Outpatient (home setting)	Food consumption, measured by bites and variety of foods; Goal-based outcomes; Caregiver satisfaction and social acceptability	Food consumption increased to 100% of bites consumed variety increased from 7 to 61 foods; 46 foods consumed at 9-month follow-up 100% of client's goals met Caregivers reported high satisfaction and social acceptability	None
Taylor, 2020	Presentation of food with verbal prompts, mouth clean checks, reinforcement (verbal praise, iPad access if mouth clean after 30 s), if bite was not accepted the bite was guided to the side teeth using hand-over-hand and blocking mouth	Duration: 8 h/day for 3 weeks Delivery: Therapist-led by doctoral level behavior analyst Context: Outpatient (home setting)	Number of foods consumed Latency to mouth clean Latency to acceptance Mealtime behaviors	Number of foods increased (3–109) Food consumption increased 100% Latency to mouth clean across all textures was an average of 29.4 s	None

TABLE 3 (Continued)

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
	covering. Intensive caregiver training and generalization.			Latency to acceptance decreased to an average of 3.3 s Decrease in inappropriate mealtime behaviors by 100%	
Taylor, 2021	Intensive caregiver behavioral skills training, consideration of mealtime environment and requirements, feeding skills (e.g., chewing, self-feeding). Generalization to settings (e.g., cafes, restaurants, day care centres and schools).	Duration: Six days per week for 2–4 weeks (average of 11 treatment days). Sessions lasted ~7–8 h per day. Treatment was withdrawn (baseline 2) and re-established when needed (treatment 2). Delivery: Therapist-led Context: Outpatient (home setting)	Food consumption (percentage of bites consumed, number of foods, meals accepted). Mealtime behaviors (e.g., food expulsion, negative vocalizations) Treatment goals	100% bites consumed at treatment 1, consumption decreased at baseline 2, and increased again at treatment 2. Number of foods increased from an average of 6 to 92. At follow-up, a mean of 25 meals were accepted and 99% of foods presented were consumed. Mealtime behaviors reduced at end of treatment Treatment goals 100% met	NR
Taylor et al., 2021	Intensive, individualized, behavior-analytic treatment with parental training to continue at home. Contingent reinforcement (access to preferred items) and differential attention (praise for accepting bite). Non-removal and re-presentation (no escape with inappropriate mealtime behavior and expulsion).	Duration: Intensive treatment for 11 days, parents trained to continue at home Delivery: Doctoral-level behavior analyst Context: Outpatient (home setting)	Food consumption (grams) Food variety (number of foods) Mealtime behaviors Treatment goals	Increased consumption (grams) of solids and liquids in meals Food variety increased from 41 to 116 foods 100% decrease in inappropriate mealtime behaviors 100% of treatment goals met	Daily multi-vitamin
Tomioka et al., 2022	Eight dietary steps (varying caloric percentages and target mealtimes), positive reinforcement, caregiver psychoeducation.	Duration: Inpatient 4–8 weeks; Outpatient 3–5 months. Delivery: MDT Context: Inpatient (n = 2), outpatient (n = 2)	BMI Height and weight Caloric intake percentage Oral or enteral intake Mealtime behaviors	Percentage of ideal BMI was 66%–76% Weight increase: .5–.6 kg Height increase: .8–4 cm 100% oral caloric intake percentage No unfavorable mealtime behaviors	All received speech therapy

(Continues)

TABLE 3 (Continued)

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Volkert et al., 2021	Reinforcement, stimulus fading (introduce new foods and bite persistence procedures), parent training.	Duration: 4 × daily meals (40 min), 5 days per week. Then bi-weekly follow-up sessions with a psychologist. Delivery: MDT Context: Inpatient, then outpatient	BMI/weight change Dietary Reference Intakes (DRIs) Dietary diversity (child's consumption of food groups and items by food groups) Mealtime behaviors, rapid acceptance, mouth clean Treatment goals Caregiver satisfaction (9-item post-treatment questionnaire)	No significant change in BMI or weight DRIs significantly improved Dietary diversity improved by 16 new foods (range 8–22) Significant improvement in mealtime behaviors, rapid acceptance, and mouth clean Treatment goals met = 93% Caregiver satisfaction average score 4.95/5 (80% caregivers completed)	Dietetic support with meal plan and schedule

Abbreviations: ARFID, avoidant restrictive food intake disorder; APA, American Psychological Association; BAMBIC, brief assessment of mealtime behavior in children; BIRS, behavior intervention rating scale; BMI, body mass index; BPFAS, behavioral pediatric feeding assessment scale; CEBQ, child eating behaviors questionnaire; DRI, dietary reference intakes; IEAT, integrated eating aversion treatment; MBQ, mealtime behavioral questionnaire; MCH-feeding scale, montreal children's hospital feeding scale; MDT, multidisciplinary team; NR, not reported; SSRIs, selective serotonin reuptake inhibitors.

common, such as providing attention for a desired behavior and not giving attention for undesirable eating and mealtime behaviors. Several studies involved escape extinction, in which the patient is not allowed to “escape” the feeding demand through re-presenting the food or not removing a spoonful of food (e.g., McMahon et al., 2022; Phipps et al., 2022; Sharp et al., 2016). Working closely with parents was central to behavioral interventions, including didactic instruction, in vivo therapist feedback, modeling, and role-play with parents (e.g., Bloomfield et al., 2019; Taylor et al., 2019). Behavioral interventions also often involved “meal hygiene,” including setting time-limits for meals, limiting grazing, and formal meal structures, and consideration of meal environments.

Regarding outcomes, most studies reported increased food acceptance and food consumption, measured in varying ways, such as the number of (new) foods accepted, grams consumed, bites eaten, or percentage of caloric needs met orally. Studies often reported decreased inappropriate mealtime behaviors, such as improved food acceptance or shorter mealtime durations. Several studies used measures of behavioral and/or feeding changes to determine outcomes (e.g., Bloomfield et al., 2019; Dahlsgaard & Bodie, 2019; Murphy & Zlomke, 2016), including the BAMBIC, BPFAS, CEBQ, MCH feeding scale and MBQ. Caregiver treatment satisfaction and meeting of treatment goals were also commonly measured outcomes (e.g., Lesser et al., 2022; Taylor, 2021; Volkert et al., 2021). Several studies reported increased BMI (Bağik et al., 2021; Sharp et al., 2016; Tomioka et al., 2022), although no difference in BMI was found in Volkert et al. (2021).

4.1.2 | Cognitive behavioral therapy (CBT) interventions

In total, 10 studies reported CBT interventions for ARFID (eight case studies, two case series). CBT interventions were reported for patients with ARFID aged 10–55 years. Interventions were delivered across settings, including inpatient, day treatment, outpatient, and virtual settings. Interventions were led by therapists, some with specific CBT training or under the supervision of CBT-accredited therapists, and some with wider MDT support. Several studies (Thomas et al., 2020; Thomas et al., 2021; Thomas, Brigham, et al., 2017) described the use of a CBT protocol developed specifically for ARFID, CBT-AR (see Thomas & Eddy, 2019), applied to those with ARFID across the lifespan (aged 11–55). CBT interventions ranged in length from 7 weeks (Dolman et al., 2021) to 2 years (Soffritti et al., 2019). For seven studies, psychiatric medication was also administered.

CBT interventions commonly included goal setting, psychoeducation (e.g., nutrition, anxiety, physical sensations), graded exposure to avoided or unfamiliar foods, behavioral experiments, cognitive restructuring, anxiety management (e.g., relaxation and breathing techniques), homework and self-led exposure, and generalization to broader food-related contexts. Parent and family involvement was also common, including specific child–parent sessions (e.g., Dumont et al., 2019) and parents being involved in co-developing plans (e.g., Dolman et al., 2021).

Nine studies reported on growth or BMI, with eight studies reporting increases in weight and/or height and one study reporting

TABLE 4 Cognitive behavioral therapy (CBT) interventions.

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Burton Murray et al., 2022	<p>Stage 1: psychoeducation, self-monitoring, behavior change</p> <p>Stage 2: identifying foods for food exposure</p> <p>Stage 3: food exposure, tackling maintaining mechanisms</p> <p>Stage 4: maintenance and relapse prevention). Parental support.</p>	<p>Duration: 2 × weekly</p> <p>Delivery: Therapist-led with self-led food exposure outside of sessions</p> <p>Context: Outpatient, remote video sessions</p>	<p>Food neophobia scale; Nine-Item ARFID Screen (NIAS); PARDI</p>	<p>Food neophobia scale decreased from 71 mid-treatment, 37 at discharge and 43 at 2-month follow-up</p> <p>NIAS decreased from 15 to 13 mid-treatment, 7 at discharge and 10 at 2-month follow-up</p> <p>Met diagnostic criteria at start and mid-treatment but no longer met criteria at 2-month follow-up</p>	NR
Bryant-Waugh, 2013	<p>Goal setting, psychoeducation, self-monitoring, behavioral experiments and food exposure, cognitive restructuring, anxiety management (e.g., breathing), parental involvement</p>	<p>Duration: NR</p> <p>Delivery: Therapist-led</p> <p>Context: Outpatient</p>	<p>Growth velocity, height; Nutritional intake; Foods added</p>	<p>Growth velocity and height increased</p> <p>Improved nutritional intake (multivitamin, iron supplement, yogurt, smoothies, fries)</p> <p>3 × foods added</p>	NR
Dolman et al., 2021	<p>Food hierarchy (for introducing new foods and emetophobia), daily exposures, rewards, visualization, distraction, positive self-talk, and breathing exercises, parental involvement</p>	<p>Duration: 7 weeks</p> <p>Delivery: MDT, therapist-led with parents co-developing behavior plans and reward systems</p> <p>Context: Inpatient</p>	<p>Weight, height, and BMI; Blood test results; Nutritional adequacy; Foods added; Anxiety and mood; (worksheet ratings of pre- and post-exposure anxiety from 1 to 10); Psychosocial changes</p>	<p>Increase in weight (1–2 kg at 8-week follow-up) and BMI</p> <p>Improved blood results</p> <p>Accepted oral nutritional supplement</p> <p>Foods added: apple juice, apple sauce, yogurt</p> <p>Improved self-reported anxiety and mood</p> <p>Psychosocial improvement (e.g., sitting at the family dinner table, eating at school)</p>	<p>Olanzapine (initially .625 mg nightly)</p> <p>Sertraline (25 mg nightly).</p>
Dumont et al., 2019	<p>Goal setting, psychoeducation, behavioral experiments and food exposures, cognitive restructuring, relaxation techniques, daily communication around achievements, homework, relapse prevention. Parent involvement and weekly child–parent sessions.</p>	<p>Duration: 4-week CBT day treatment, daily individual CBT sessions and daily group sessions. Then 4-week low intensity weekly/biweekly outpatient telephone/video contact</p> <p>Delivery: CBT therapists</p> <p>Context: Day treatment followed by outpatient treatment</p>	<p>Body weight; Reliance on tube/nutritional supplements; Food Neophobia Scale; Food acceptance score; Food Selectivity Composite Score (FSCS); Anxiety (0–100 visual analogue scale) pre and post meal; ARFID diagnostic status (DSM-5)</p>	<p>Weight increased (n = 10)</p> <p>Tubes/nutritional supplements eliminated (n = 6)</p> <p>Food neophobia scores decreased 91% had increased food acceptance and decreased food selectivity</p> <p>Decrease in FSCS</p> <p>Anxiety decreased for most</p> <p>At 3-month follow-up, no longer met ARFID criteria (n = 10)</p>	NR

(Continues)

TABLE 4 (Continued)

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Gómez et al., 2018	Psychoeducation (physical symptoms of anxiety), in vivo exposures, cognitive restructuring, relaxation techniques, homework	Duration: Weekly 40-min CBT sessions for 12 weeks, six monthly follow-ups Delivery: CBT by therapist under supervision of certified CBT therapist, MDT Context: Inpatient general adult psychiatry unit	Weight, BMI; Caloric intake; Hamilton anxiety scale (HARS); Hamilton depression scale (HAM-D); Ratings of pre-meal anxiety	Gained 2 kg in weight, BMI increased Caloric intake increased to 1450 kcal/day 6 months post-discharge HARS decreased from 27 to 4 and HAM-D decreased from 15 to 2 Pre-meal anxiety scores dropped from 9/10 to 3/10	Mirtazapine (increased from 30 to 45 mg) Food supplements
King et al., 2015	Psychoeducation (symptoms of anxiety), systematic desensitization, cognitive restructuring, food fear hierarchy, relaxation training, graded exposure. Family involvement.	Duration: Weekly appointments then monthly outpatient follow-ups with psychiatrist and psychologist Delivery: Therapist-led, MDT Context: Inpatient psychiatry unit, then monthly outpatient follow-ups and weekly psychotherapist sessions in local town	BMI; Caloric intake (% meal consumption); Ratings of pre-meal anxiety (scale 1–10); Subjective self-report	BMI increased to 17.4 kg; 8-months post-discharge increased to 19.4 kg Caloric intake increased to 1650 kcal/day Meal consumption was 70%–100% Pre-meal anxiety scores decreased from 8/10 to 3/10 at the last inpatient session. At 2-months post-discharge, pre-meal anxiety remained below 3/10 Self-reported improvements in cognition, energy, anxiety, and socializing	Lorazepam (1 mg before meals) Paroxetine (40 mg daily)
Soffritti et al., 2019	Psychoeducation for patient and parents, social skills training, desensitization and gradual exposure to food and situational contexts during feeding. Parent training promoted generalization to the domestic and social environment. Patient started by touching food to mouth without swallowing, after 6 months swallowing was resumed.	Duration: Two years of treatment Delivery: Therapist-led, MDT Context: Inpatient and outpatient	BMI; Reliance on enteral nutrition	Maintained a normal BMI of 22 kg/m ² after 2 years After 6 months resuming swallowing the patient was extubated	Fluoxetine (30 mg/day) Quetiapine (50 mg/day via gastrostomy)
Thomas, Brigham, et al., 2017	Individualized cognitive behavioral intervention for ARFID. Food exposure on a fear hierarchy (least likely to cause choking, ending	Duration: NR Delivery: MDT Context: Inpatient and outpatient	Weight and height; Food variety; Psychosocial impact; Self-reported fears	Gained 6.4 kg and grew 8 cm Food variety increased; all solid foods were reintroduced into the diet	Mirtazapine

TABLE 4 (Continued)

First author, year	Psychological intervention	Intervention characteristics	Outcomes measured	Details of outcome	Adjunctive treatments
Thomas et al., 2020	<p>with food that caused the choking incident), tasting chart including point-based reward system. Parental involvement.</p> <p>CBT for ARFID (CBT-AR) (Thomas & Eddy, 2019), delivered in a family-based or individual format, across four stages (a) psychoeducation and early change; (b) treatment planning; (c) addressing maintaining mechanisms; and (d) preventing relapse.</p>	<p>Duration: 20/30 sessions, depending on patient's weight, 50-min sessions, weekly for stages 1–3, and every 2–3 weeks for stage 4.</p> <p>Delivery: Therapist-led</p> <p>Context: Outpatient</p>	<p>Weight and BMI;</p> <p>Menstruation status; Food Neophobia Scale; New foods; State-Trait Anxiety Inventory; Child Depression Inventory 2 (CDI-2); PARDI; Clinical Global Impression Scale (CGI); Satisfaction questionnaire</p>	<p>Diet no longer affected psychosocial functioning</p> <p>1 year after initial assessment, no reported fear of choking</p> <p>Underweight subgroup gained weight and increased on BMI weight percentiles</p> <p>Menstruation post treatment (n = 3/5 females)</p> <p>Food neophobia scores decreased</p> <p>Patients incorporated a mean of 16.7 new foods into their diet</p> <p>Depression and/or anxiety did not significantly change</p> <p>ARFID symptoms improved, and PARDI scores decreased (except for parent-rated PARDI and lack of interest)</p> <p>CGI: "much improved" or "very much improved"</p> <p>Treatment satisfaction was high, though some patients dropped out (n = 3)</p>	<p>Psychiatric medication (n = 8)</p>
Thomas et al., 2021	<p>CBT-AR (Thomas & Eddy, 2019). See Thomas et al., 2020. All patients were offered the individual version of the treatment apart from those who were underweight and living at home (n = 1), who were offered a family-supported version in which the parents attended all sessions.</p>	<p>Duration: 20/30 (depending on patient's weight), 50-min sessions.</p> <p>Delivery: Therapist-led by Doctoral or master's level therapists</p> <p>Context: Outpatient, face-to-face (n = 8), mixed face-to-face and telehealth delivery (n = 5), telehealth delivery (n = 2)</p>	<p>Weight and height; Food Neophobia Scale; State-Trait Anxiety Inventory; Beck Depression Inventory (BDI); Clinical Impairment assessment; Clinical Global Impression Scale (CGI); PARDI; Satisfaction questionnaire</p>	<p>Underweight subgroup gained an average of 11.38 pounds</p> <p>Food neophobia decreased significantly</p> <p>Anxiety and depression did not change</p> <p>Clinical impairment decreased significantly</p> <p>CGI: 80% of patients "much improved" or "very much improved"</p> <p>PARDI scores decreased in places and 47% of patients no longer met the criteria for ARFID</p> <p>93% of patients reported high treatment satisfaction scores</p>	<p>Psychiatric medication (n = 7)</p>

Abbreviations: ARFID, avoidant restrictive food intake disorder; beck depression inventory, BDI; BMI, body mass index; CBT, cognitive behavioral therapy; CBT-AR, cognitive behavioral therapy for ARFID; CDI-2, child depression inventory 2; CGI, clinical global impression scale; DSM-5, diagnostic and statistical manual of mental disorders fifth edition; FSCS, food selectivity composite score; HAM-D, Hamilton depression scale; HARS, Hamilton anxiety scale; MDT, multidisciplinary team; NIAS, nine-item ARFID screen; NR, not reported; PARDI, pica, ARFID, and rumination disorder interview.

TABLE 5 Family therapy interventions.

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Knatz-Peck et al., 2021	Multi-family intervention for young adults and their parents/s. Psychoeducation including temperament and neurobiology; parental involvement; experiential exercises focused on explaining neurobiology and building effective young adult-parent relationships; skills training.	Duration: Five days, 40 h of treatment Delivery: Therapist-led, multi-family format Context: Outpatient	BMI; Eating Disorder Examination Questionnaire (EDE-Q); State-Trait Anxiety Inventory - Trait subscale; Clinical impairment assessment; Client satisfaction questionnaire; ARFID remission	BMI increased EDE-Q did not change significantly for ARFID patients. Trait anxiety reduced for all participants Clinical impairment decreased No patients were in full remission at discharge, but five patients were at follow up	NR
Lock, Robinson, et al., 2019	FBT-ARFID: Phase 1: parents taking control of eating. Phase 2: child taking back control of eating in an age-appropriate way. Use of externalizing, parental empowerment, emphasizing seriousness of ARFID and increasing parental anxiety, family meal.	Duration: Patient 1: 19 sessions lasting 9 months. Patient 2 and 3: 17 sessions lasting 8 months Delivery: Therapist-led Context: Outpatient	Weight and height; PARDI; Eating Disorder Assessment for DSM-5 (EDA-5)	Weight increased ($n = 3$). Reduction in PARDI scores (representing decreased symptoms) for all patients except for Patient 1 who had decreases on the Severity and Fear scales but increases on the Lack of Interest and Sensory scales. No longer met EDA-5 criteria for ARFID ($n = 1$), two continued to meet ARFID criteria.	NR
Lock, Sadeh-Sharvit, & L'Insalata, 2019	FBT-ARFID (see Lock, Robinson, et al., 2019)	Duration: Up to 22 sessions over 6 months. Average ~14 sessions over 4 months. Delivery: Therapist-led: clinical faculty or postdoctoral students Context: Outpatient treatment, specialist ED clinic	Weight; %Estimated Body Weight (EBW); PARDI; Beck Depression Inventory (BDI); Beck Anxiety Inventory (BAI); Child Eating Attitudes Test (ChEAT); Parent versus Avoidant/Restrictive Food Intake Disorder (PvARFID); Strengths and Difficulties Questionnaire (SDQ)	Increased weight Increased %percentage EBW PARDI scores reduced (reflecting improvement) across all subscales BDI decreased BAI decreased ChEAT scores decreased. PvARFID scores increased SDQ Total Difficulties decreased.	None reported for the FBT arm
Rienecke et al., 2020	Family-based partial hospitalization program (PHP). Utilized FBT first session with whole family.	Duration: 5 days per week for 6 h, stepped down to intensive outpatient 3 days per	Weight; BMI; Food variety consumption; Latency to swallow; Children's Depression	Patient 1: gained 4.9 lbs BMI—14.99 (22nd percentile) Reported increased comfort when swallowing	Patient 1: Omeprazole, Miralax; Patient 2: Clonidine, Dextroamphetamine

TABLE 5 (Continued)

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Rosania & Lock, 2020	psychoeducation, parents put in charge of refeeding; gradual exposure to increase bite sizes, volume, and variety of food; parental management of mealtimes including providing small exposures and 'not backing down.'	week for 3 h, overall, 22 days (<i>n</i> = 1), 31 days (<i>n</i> = 1), 19 days (<i>n</i> = 1) Delivery: MDT, therapist-led with parents taking control of the child's eating Context: PHP	Inventory (CDI); Multidimensional Anxiety Scale (MASC)	Latency to swallow decreased from 19–38 s to 5–8 s CDI increased from 4 to 5 MASC decreased from 45 to 24 Patient 2: gained 3.6lbs. BMI—17.5 (35th percentile) Patient 3: gained 14.0 lbs (PHP) and additional 4.4 lbs (IOP) BMI—17.6 and in IOP was 18.2 (18th centile) Increased consumption of food variety CDI decreased from 3 to 1 MASC reduced from 19 to 18	Melatonin
	FBT-ARFID (see Lock, Robinson, et al., 2019)	Duration: 17 sessions across 6 months Delivery: Therapist-led Context: NR	Weight; %Expected Body Weight (%EBW); PARDI; EDA-5	Weight increased from 28 to 31.07 kg %EBW increased from 96.95 to 97.62 PARDI score decreased (severity, sensory and fear) PARDI increased (loss of interest subscale) EDA-5 diagnosis changed from ARFID to OSFED	NR

Abbreviations: ADHD, attention deficit hyperactivity disorder; AN, anorexia nervosa; ARFID, avoidant restrictive food intake disorder; BAI, beck anxiety inventory; BDI, beck depression inventory; BMI, body mass index; BN, bulimia nervosa; CBT, cognitive behavioral therapy; CDI, children's depression inventory; CHEAT, child eating attitudes test; CSQ, client satisfaction questionnaire; EBW, expected body weight; ED, eating disorder; EDE-Q; EDA-5, eating disorder assessment for DSM-5; eating disorder examination questionnaire; FBT, family-based therapy; FBT-ARFID, family based therapy for ARFID; IOP, intensive outpatient program; MASC, multidimensional anxiety scale; NR, not reported; OSFED, other specified feeding or eating disorder; PARDI, Pica, ARFID, and rumination disorder interview; PHP, partial hospitalization program; PVARFID, parent versus avoidant/restrictive food intake disorder; SDQ, strengths and difficulties questionnaire.

TABLE 6 Mixed interventions.

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Aloi et al., 2018	Psychoeducation (e.g., dietetic information, ARFID). Family Therapy: 3 × sessions focusing on family dynamics during mealtimes and how to support patient. CBT: 11 × sessions (cognitive restructuring, behavioral exposures, diary analysis, 2 × relapse prevention sessions)	Duration: 20 sessions across 6 months and 6-month follow-up Delivery: Therapist-led with training in eating disorders, self-monitoring by using a food diary Context: Outpatient ED unit	Health status (blood tests, electrolytes); Eating Disorder Inventory-2 (EDI-2); ORTO-15 (orthorexia measure)	Health status improved EDI-2 scores reduced on the Maturity Fears scale ORTO-15 scores reduced post-treatment but increased at follow-up “Many new foods” introduced	NR
Bergonzini et al., 2022	Inpatient programme: 2 × weekly psychological support, weekly therapeutic groups, and weekly group activities (e.g., drama). Ongoing outpatient psychological support.	Duration: 47 days inpatient stay with ongoing outpatient care Delivery: MDT Context: Inpatient programme and outpatient follow-up	BMI; NIAS; Eating Disorder Youth-Questionnaires (EDY-Q)	BMI increase from 12.7 to 14.75 at discharge and 15.3 at 6 months post-discharge NIAS scores (appetite subscale) decreased 6 months post discharge, scores improved EDY-Q showed improvement among limited intake-related scores and appetite subscale	NR
Billman et al., 2022	PHP and outpatient services post-discharge, using cognitive behavioral and family-centred approach. Treatment included family therapy sessions, individual sessions with the patient, multifamily groups, and patient groups.	Duration: 3–17 weeks, 6 h per day, 5 h per week Delivery: MDT; dietitians, therapists, pediatricians, nurse practitioners, psychiatrist Context: PHP	BMI (%MBMI); Children's Eating Behavior Questionnaire (CEBQ); NIAS	%MBMI increased admission-discharge, increased at 6-month follow-up, but decreased at 12-month follow-up (remained higher than admission). CEBQ scores decreased from admission to discharge, decreased further at 6-month follow-up, increased at 12-month follow-up. NIAS scores decreased at discharge. Increased on picky and appetite subscales at 6-month follow-up. At 12-month follow-up, all decreased again except fear subscale which increased.	NR
Brewerton & D'Agostino, 2017	Structured behavioral programme with meal behavior therapy (three meals and three snacks) modified for patients with ARFID. Patients were also offered other treatment modalities including individual, group and family therapies.	Duration: 6 sessions a day (three meals and three snacks). No duration reported for other treatments offered. Delivery: MDT Context: Inpatient and PHP	Mean BMI and weight change; Clinical Global Impressions (CGI)	Mean weight change 16.4lbs Mean BMI change 3.1 kg/m ² CGI mean scores decreased from 5.3 at admission to 3.2 at discharge.	Olanzapine (n = 9)

TABLE 6 (Continued)

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Brown & Hildebrandt, 2020	Parent-facilitated behavioral treatment for ARFID: FBT principles (e.g., family involvement, family meal session, "grave scene," blame reduction and externalization of the illness). Sessions involved psychoeducation, in vivo food challenges, exposure, reducing parental accommodation.	Duration: Intensive outpatient programme (3 days per week, 3 h per day for 2 weeks) followed by weekly outpatient 50- or 90-min sessions for 12 months. Delivery: MDT, therapist-led and parent-facilitated Context: Intensive outpatient programme, followed by weekly outpatient sessions	Weight, height; Eating behavior (range of foods and context)	Weight remained stable Height: growth of 2 inches Able to tolerate eating a wide variety of foods flexibly across settings by the end of treatment	Sertraline, Clonazepam
Bryson et al., 2018	PHP individualized to each patient, including FBT, behavioral management, and CBT. Reintroduction to foods, exposure and response prevention following fear/exposure hierarchy, individual and group therapy including cognitive restructuring, goal setting, coping skills, and motivation, weekly family therapy.	Duration: 6–8 h per day, 5 days per week. The number of hours decreased as patients improved. Delivery: Therapist-led, MDT Context: PHP	% mBMI; Children's Eating Attitude Test (ChEAT)	% mBMI increased from 84.9% at intake to 94% mBMI at discharge. ChEAT scores decreased from 17.58 at intake to 9.2 at discharge.	Psychiatric medication (unspecified)
Burton et al., 2021	Combination of FBT with the Unified Protocol for Transdiagnostic Treatment for Emotional Disorders in Children and Adolescents: training in cognitive reappraisal, problem-solving and exposure-based paradigms). Treatment included ARFID psychoeducation, FBT sessions to build parental alliance, and a family meal.	Duration: Patient 1: 24× sessions over 8 months (weekly then reduced to fortnightly and three-weekly). 4× individual parent sessions. Patient 2: 29× sessions over ~7 months (weekly or daily) 3× parent sessions Delivery: Therapist-led, MDT Context: Outpatient, in clinic and telehealth sessions	Patient 1: Weight, new foods, oral intake Patient 2: Liquid consumed, NGT reliance	Patient 1: 1–2 new foods a week, oral intake improved, rally took medication. Patient 2: After 1 week of daily sessions, patient able to drink lemonade from a glass, having only been able to drink 30 mL water from a syringe. After 4 weeks NGT was removed, and ate soft foods from all food groups	Patient 1: Fluoxetine Patient 2: Fluoxetine

(Continues)

TABLE 6 (Continued)

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Dhiman et al., 2021	Patient and family psychoeducation, cognitive reattribution, relaxation techniques, addressing fear of hiccups.	Duration: 4 weeks Delivery: Therapist-led, MDT Context: Inpatient	Weight; PARDI; Food acceptance without NGT; Fearful impulses to food	Gained 6 kgs PARDI score reduced from 5/6 to 3/6 Started accepting and swallowing semi-solid food without NGT Reduction in fearful impulses to the sight or smell of food	Lorazepam Olanzapine NGT for iron and vitamin D supplement
Eckhardt et al., 2019	Combination of FBT with the Unified Protocol for Transdiagnostic Treatment for Emotional Disorders in Children and Adolescents (see Burton et al., 2021).	Duration: 29 weekly or biweekly sessions over 10 months Delivery: Therapist-led with homework activities Context: Outpatient	BMI, weight: "Top problems" (ideographic assessment tool)	BMI increased from 41st to 81st percentile Weight increased from 36.7 to 44.7 kg and further increased to 50.4 kg 5-months post treatment "Top problems" decreased for both parent and patient Patient returned to eating nearly all foods in numerous settings	Sertraline increased to 50 mg Hydroxyzine 5 mg 3× daily
Fischer et al., 2015	Behavioral and CBT intervention; reinforcement, relaxation techniques, identification and thought monitoring; Use of positive self-statements and visualization techniques. Parental involvement.	Duration: 11, 50-min sessions (3 behavioral: 8 CBT), and in home concurrent sessions Delivery: Therapist-led in clinic and parent-led for in-home meals Context: Outpatient	Bites consumed; Percentage of food presented that is consumed; Subjective units of distress; Intervention Rating Profile-15 (IRP-15)	Bites consumed increased Improved consumption of previously avoided foods Achieved 100% consumption of required portions Distress ratings gradually decreased	NR
King et al., 2022	Behavioral and CBT intervention; reinforcement (praise, money), cognitive reframing, diaphragmatic breathing. Parent involvement and training sessions.	Duration: 2× parent training sessions. 40× 20 min sessions over 2 months. 1× CBT session Delivery: Psychology doctoral student and a Consultant Certified Behavior Analyst, parent-led sessions at home Context: Outpatient, including telehealth	Food consumption; Rate of problem behavior; "Errors of omission and commission"	Increased consumption of non-preferred foods Increased percentage of food consumption across all food groups was maintained at the 1.5-month follow-up. Lower rates of problem behavior, with zero instances at the 1.5-month follow-up Rates of omission and commission errors decreased as treatment progressed and was 0 at 15-month follow-up	NR
Lane-Loney et al., 2022	Family therapy and individual sessions, and therapeutic group programme. Meal planning and self-monitoring, psychoeducation, contingency management and transfer of control,	Duration: Fear presentation: average 28.52 days Appetite presentation: average 22.93 days Co-primary presentation: average 29.88 days Delivery: Therapist-led, MDT Context: PHP	BMI (%mBMI); Food Acceptance/Fears Survey (FAFS); Children's Eating Attitudes Test (ChEAT) (oral subscale); Revised Children's Manifest Anxiety Scale	%Median-BMI increased for all presentations from intake to discharge Feared foods decreased RCMAS scores decreased except for "appetite" which remained the same at start and discharge CDI scores decreased for all expect "appetite" with the score remaining the same	Psychiatric medications (unspecified)

TABLE 6 (Continued)

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Lenz et al., 2018	<p>exposure therapy, cognitive restructuring, and distress tolerance skills.</p> <p>Family and individual CBT sessions. CBT included goal setting, psychoeducation (ARFID, anxiety), fear hierarchy, in vivo exposures, homework food exposures.</p> <p>Reinforcements (rewards, consequences) around amount and variety of food. Parental involvement and training, including parental self-efficacy.</p> <p>Coping Cat (Kendall & Hedtke, 2006) programme.</p>	<p>Duration: 16 outpatient therapy sessions over 12 weeks, then hospital admission for 6 days, then 6 additional outpatient therapy sessions for 2 months.</p> <p>Delivery: Therapist-led, MDT</p> <p>Context: Outpatient then hospitalization</p>	<p>(RCMAS); Children's Depression Inventory (CDI)</p> <p>Weight, height; Amount and variety of nutritional food intake; Remission of ARFID</p>	<p>ChEAT oral control scores decreased for all Number of foods patients willing to eat increased for all groups</p> <p>Weight remained the same from admission to discharge, at follow-up had increased to 26.5 kg (BMI 52nd percentile)</p> <p>At follow-up height had increased by 2.9 cm</p> <p>Increased variety of foods consumed</p> <p>Self-reported increased confidence to face fears and use coping skills</p> <p>Full remission of ARFID symptoms</p>	<p>Escitalopram (5 mg/5 mL)</p> <p>Hydroxyzine (6 mL, 12 mg total)</p>
Makhzoumi et al., 2019	<p>Patient attended 3 therapeutic groups daily incorporating CBT, FBT and dialectical behavioral therapy (DBT). Topics covered include nutrition, family dynamics, body image, coping skills, anxiety and stress management, cognitive restructuring, exposure and response prevention, communication, and assertiveness training.</p>	<p>Duration: 12 h per day, 7 days per week, moving to 8 hrs per day for 3–4 days per week. Average length of PHP stay: 18.31 days ($SD = 9.30$). Average length of IP stay: 26.14 days ($SD = 18.31$)</p> <p>Delivery: Therapist-led, MDT</p> <p>Context: Inpatient and PHP</p>	BMI at discharge	<p>Average BMI increased from 16.55 ($SD = 1.83$) at admission to 18.92 ($SD = 2.11$) at end of PHP. Mean discharge BMI above 18.5 over an average length of stay of less than 7 weeks.</p>	<p>Meal-based rapid refeeding protocol including nutritional rehabilitation</p>
Naviaux, 2019	<p>Inpatient and PHP programme including FBT and increasing appropriate mealtime behavior, decreasing maladaptive patterns, psychoeducation, meal support.</p>	<p>Duration: psychiatric appointments weekly</p> <p>Delivery: Therapist-led, MDT</p> <p>Context: Three admissions: Inpatient and PHP</p>	BMI, weight, height	<p>BMI increased from 15.1 (6th centile) to 17.2 (33rd centile) on second admission and was 16.2 (17th centile) at the final discharge</p> <p>Weight increased from 39.2 to 45 kg from second admission to discharge. Weight was 42.4 kg at the final review</p> <p>Height did not change</p>	<p>Mirtazapine started after 5 months.</p> <p>Meal plans reviewed weekly by a dietitian.</p>

(Continues)

TABLE 6 (Continued)

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Ornstein et al., 2017	PHP individualized to each patient, including weekly family therapy, daily multifamily therapy, behavioral management, and CBT in individual and group format. Reintroduction to foods, exposure and response prevention fear/food hierarchy, cognitive restructuring, goal setting, coping skills. Weekly expressive art groups.	Duration: 5 days per week for 8.5 h per day, reducing as patients improved. Mean number of weeks in programme was 7. Delivery: Therapist-led, MDT Context: PHP	% mBMI; Children's Eating Attitudes Test (ChEAT); Revised Children's Manifest Anxiety Scale (RCAMS)	% mBMI increased from intake to discharge ChEAT scores decreased across all four subscales from intake to discharge RCMAS scores decreased from intake to discharge	Psychiatric medications; SSRIs ($n = 12$), atypical antipsychotic ($n = 1$), ADHD medication ($n = 4$), other medication ($n = 1$)
Shimshoni et al., 2020	SPACE-ARFID, 7-part manual involving ARFID psychoeducation, creation of food ladders, modification of parental behaviors (e.g. parental accommodation, parent-child interactions/conflict, and parental support), developing individualized plans and reviews, supporting child's exposure to non-preferred foods, relapse prevention	Duration: 12 weekly 60-min session Delivery: Therapist-led, SPACE-ARFID follows a 7-part manual, with optional modules that can be implemented. Context: Outpatient	Mean %EBW ARFID diagnosis NIAS Family Accommodation Scale Anxiety (FASA) Satisfaction questionnaire Feasibility and acceptability (percentage total number of sessions attended)	Mean %EBW increased (not significant) ARFID diagnosis: 57.14% no longer met ARFID diagnostic criteria, 35.71% met criteria for ARFID at a "low-to-moderate interference level," one participant met criteria for ARFID at a high interference level NIAS scores decreased FASA significantly reduced Parents and patients rated the treatment as highly satisfactory Of 15 families that took part, 14 families completed all 12-weekly sessions. One family dropped out after 6 treatment sessions.	NR
Spettigue et al., 2018	Family therapy using FBT principles adapted for ARFID. Psychoeducation (effects of low weight, nutrition), raising anxiety about the seriousness of the problem, lifting guilt/blame, empowering parents; supporting parents to empathize with child whilst being firm on nutrition, focusing on family issues relating to	Duration: varied for each patient Delivery: Therapist-led, MDT Context: Inpatient and outpatient	Weight/height Recovery Individualized treatment goals	Weight goal met ($n = 6$). Height increase ($n = 2$) Complete recovery from ED ($n = 1$) Able to eat all foods, eat at a restaurant and participate in sport ($n = 1$), improvement in hyperactivity, restlessness, irritability, affection, and maturity ($n = 1$), Decreased anxiety, back at school ($n = 1$), Food variety improved	Fluoxetine Olanzapine Cyproheptadine

TABLE 6 (Continued)

First author, year	Psychological intervention	Intervention characteristics	How were outcomes measured?	Details of outcome	Adjunctive treatments
Wagner et al., 2020	food intake. CBT (n = 2): psychoeducation around anxiety and phobias, hierarchy of feared food, graded exposure, relaxation techniques. PHP including weekly family therapy and individual sessions (see Ornstein et al., 2017 for description)	Duration: Weekdays delivery: Therapist-led, MDT Context: PHP	Accommodation and Enabling Scale for Eating Disorder (AESED)	AESED overall score decreased, with no change in "meal ritual" or "turning a blind eye" subscales	Psychiatric medications (unspecified)

Abbreviations: ADHD, attention deficit hyperactivity disorder; AESED, accommodation and enabling scale for eating disorder; AN, anorexia nervosa; ARFID, avoidant restrictive food intake disorder; ASD, autism spectrum disorder; BDA, before, during and after form; BMI, body mass index; CBT, cognitive behavioral therapy; CDI, children's depression inventory; CEBQ, children's eating behavior questionnaire; CGI, clinical global impressions; ChEAT, children's eating attitudes test; DBT, dialectical behavior therapy; ED, eating disorder; EDI-2, eating disorder inventory-2; EDY-Q, eating disorder in youth questionnaire; FAFS, food acceptance/fears survey; FASA, family accommodation scale anxiety-parent scale; FBT, family-based treatment; FF-TAM, the technology acceptance model instrument-fast form; IP, inpatient; IRP-15, intervention rating profile-15; MDT, multidisciplinary team; NGT, nasogastric tube; NIAS, nine-item ARFID screen; PBT-ARFID, parent-facilitated behavioral treatment for youth with ARFID; PHP, partial Hospitalization programme; RCMAS, revised children's manifest anxiety scale; SD, standard deviation; SPACE-ARFID, supportive parenting for anxious childhood emotions adapted for avoidant/restrictive food intake disorder; SSRI, selective serotonin reuptake inhibitors. %mBMI, percentage median body mass index.

weight maintenance (Soffritti et al., 2019). Some studies measured other physical outcomes, such as blood results (e.g., Dolman et al., 2021) or menstruation status (e.g., Thomas et al., 2020). Studies reported increased number of accepted foods (e.g., Dolman et al., 2021; Dumont et al., 2019; Thomas et al., 2020), decreases in food-related fears (e.g., Burton Murray et al., 2022), improved nutritional intake (e.g., Bryant-Waugh, 2013), and decreased food selectivity and sensitivity (e.g., Dumont et al., 2019; Thomas et al., 2020; Thomas et al., 2021). Decreases in anxiety and depression were reported (e.g., Görmez et al., 2018; King et al., 2015), except for Thomas et al. (2021) where no changes were reported. CBT studies measured anxiety and mood in various ways, some using validated measures (e.g., Görmez et al., 2018; Thomas et al., 2020; Thomas et al., 2021), others using visual-analogue scales to rate pre- and post-meal anxiety (e.g., Dumont et al., 2019), and some using subjective self-report (e.g., King et al., 2015). One study reported that participants no longer required enteral feeding (Burton Murray et al., 2022). Several studies reported that participants no longer met criteria for an ARFID diagnosis (e.g., Burton Murray et al., 2022; Thomas et al., 2020; Thomas et al., 2021), some using validated measures, such as the NIAS and PARDI.

4.1.3 | Family therapy interventions

In total, five studies reported family interventions for ARFID (two case series, one case study, one single-case experimental design, and one RCT). All studies focused on those aged 21 and under.

Family interventions for ARFID typically followed phases commonly used in FBT for other eating disorders, such as anorexia nervosa (e.g., full parental control of feeding, then gradually returning control to the adolescent). A specific FBT protocol developed for ARFID (FBT-ARFID) (Lock, Robinson, et al., 2019) was implemented in three out of five family intervention studies reported (Lock, Robinson, et al., 2019; Lock, Sadeh-Sharvit, & L'Insalata, 2019; Rosania & Lock, 2020). Intervention components across family interventions for ARFID often included parental empowerment, parent skills training, psychoeducation, externalization, and the family meal.

Physical outcomes, including weight, height, and BMI were measured across all family-based interventions for ARFID and all studies reported increases on such measurements. In terms of ARFID-specific symptoms, FBT studies showed reduced symptom severity (Lock, Robinson, et al., 2019; Rosania & Lock, 2020), reduced clinical impairment (Knatz-Peck et al., 2021; Lock, Sadeh-Sharvit, & L'Insalata, 2019), and increased food intake (Rosania & Lock, 2020). Three studies reported on ARFID diagnostic status as an outcome, two of which used the EDA-5 to assess this (Lock, Robinson, et al., 2019; Rosania & Lock, 2020). Studies reported decreased anxiety (Knatz-Peck et al., 2021; Lock, Sadeh-Sharvit, & L'Insalata, 2019; Rienecke et al., 2020), decreased depression (Lock, Sadeh-Sharvit, & L'Insalata, 2019; Rienecke et al., 2020), and decreased general psychopathology (Lock, Sadeh-Sharvit, & L'Insalata, 2019).

4.1.4 | Mixed interventions

In total, 19 studies reported interventions for ARFID that combined various therapeutic modalities. These included combinations of CBT and behavioral approaches (Fischer et al., 2015; King et al., 2022), combinations of family therapy and cognitive-behavioral approaches (Aloi et al., 2018; Bryson et al., 2018; Lane-Loney et al., 2022; Spettigue et al., 2018), one which included a coping cat anxiety management programme (Lenz et al., 2018), and one parent programme specifically developed for ARFID (SPACE-ARFID) (Shimshoni et al., 2020) which drew upon CBT techniques alongside family/parenting intervention and support. One study reported a combined behavioral and family therapy approach (Brown & Hildebrandt, 2020). Two studies reported on the use of FBT and the unified protocol for transdiagnostic treatment for emotional disorders in children and adolescents (UP-C) (Burton et al., 2021; Eckhardt et al., 2019). One study reported on a combination of FBT and CBT with DBT (Makhzoumi et al., 2019). Many studies reported a wide range of therapeutic approaches as part of inpatient or partial hospitalization programmes, often tailored to the individual patient (Bergonzini et al., 2022; Billman et al., 2022; Dhiman et al., 2021; Naviaux, 2019; Ornstein et al., 2017).

As with other intervention modalities, outcomes were measured in various ways for mixed modality approaches. Many studies measured physical outcomes, including blood results, BMI, weight, and height. Several studies used validated measures regarding changes in attitudes or behaviors regarding food, such as the children's eating attitude test (ChEAT) and some used validated psychological measures, such as the revised children's manifest anxiety scale (RCAMS) (e.g., Lane-Loney et al., 2022; Ornstein et al., 2017). Two studies used measures of family accommodation (Shimshoni et al., 2020; Wagner et al., 2020).

5 | DISCUSSION

Our review provides a comprehensive overview of psychological interventions for ARFID, and how outcomes have been measured across such interventions, with the aim of supporting clinical practice and highlighting avenues for future research.

Overall, most studies comprised of case reports and case series with small sample sizes. Studies detailed a broad range of psychological interventions applied to those with ARFID with wide variation in how outcomes are measured. The variation in psychological interventions and outcome measures during such interventions may reflect the heterogeneity in ARFID with its various presentations, etiologies, and historical underpinnings (Mairs & Nicholls, 2016; Sharp & Stubbs, 2019).

This review highlights that a range of psychological interventions can be applied to individuals with ARFID across the lifespan and across a range of settings, including outpatient clinics, home settings, virtual appointments, and partial hospitalization and inpatient treatment programmes. Certain psychological interventions were more likely to be employed depending on the age and developmental stage of patients with ARFID. For example, behavioral interventions were typically delivered to those aged 15 and under, family therapy interventions were

applied to those aged 21 and under, and CBT interventions were implemented across the broadest age range for those aged between 10 and 55. The variation in intervention modality across age groups perhaps stems from the history of ARFID and its positioning in the intersection between feeding and eating disorders (Sharp & Stubbs, 2019), necessitating differentiation in its treatment approach across the lifespan.

Behavioral methods, as standalone interventions or as part of CBT, were found to be commonly applied in the treatment of ARFID. Certain behavioral methods were applied to different patient groups. For example, intensive feeding programmes led by behavioral analysts, involving techniques such as escape extinction, were typically aimed at younger children, where such techniques may be more developmentally appropriate and feasible. This differs from behavioral methods within other therapeutic modalities (e.g., CBT), such as behavioral experiments, which were typically applied with older children and adults. This possibly reflects the developmental skills required for CBT (Frankel et al., 2012).

Several manualized approaches for ARFID were used across studies, including CBT-AR (Thomas et al., 2020; Thomas et al., 2021; Thomas, Brigham, et al., 2017) and FBT-ARFID (Lock, Robinson, et al., 2019; Lock, Sadeh-Sharvit, & L'Insalata, 2019; Rosania & Lock, 2020). Whether a manualized approach was used or not, CBT and family-based approaches typically incorporated techniques used in the treatment of other psychiatric conditions or eating disorders. For example, FBT-ARFID typically followed principles and phases of FBT established for other eating disorders, such as anorexia nervosa, adapted to patients' presentations and drivers of ARFID (e.g., Lock, Robinson, et al., 2019). Similarly, CBT interventions for ARFID used common cognitive and behavioral strategies, such as psychoeducation, self-monitoring using diaries, graded exposure, and behavioral experiments. More specifically, CBT strategies focused on reducing maintaining cognitions and behaviors pertinent to ARFID, such as reducing avoidance around foods, increasing exposure to foods, and targeting cognitions underlying the limited diet, such as fear of vomiting or fear of interoceptive sensations (e.g., Dumont et al., 2019; King et al., 2015). CBT was adapted to specific patient-related comorbidities, such as a learning disability (e.g., King et al., 2022).

Of note, the majority of studies used combinations of therapeutic approaches, perhaps reflecting the multidimensional nature of ARFID in which numerous factors typically contribute to its etiology and presentation (Mairs & Nicholls, 2016; Thomas, Lawson, et al., 2017). Relatedly, a substantial number of patients received adjunctive treatments, such as medications, dietetic interventions, or speech therapy, suggesting that additional interventions are often required to support patients with ARFID. Such an approach fits with previous research and consensus guidelines which emphasize a multidisciplinary approach to care, including psychological therapy alongside nutritional and physical health interventions for patients with eating disorders, including those with ARFID (Hay, 2020; Hay et al., 2014; Jewell et al., 2016).

Whilst various psychological modalities have been applied to those with ARFID, it should be noted that there were often commonalities across different psychological interventions. For example, family therapy approaches often included food exposure, and whilst CBT typically focused on the individual, parents or family members were

often involved in such interventions for those across the lifespan. Indeed, almost all studies described caregiver or family involvement in interventions, perhaps suggesting its usefulness in supporting patients with ARFID. As well as the use of direct food exposure and family involvement, commonalities across treatment components included psychoeducation on ARFID, nutrition and/or anxiety, broader anxiety management and strategies, and treatment generalization. This may be indicative of such factors being important therapeutic components within interventions for ARFID patients, regardless of the overall intervention modality adopted.

As well as heterogeneity of both ARFID itself and the psychological interventions employed, there was also large variability in how outcomes were measured during such interventions. Many studies lacked validated outcome measures and, of those employed, very few were in line with recommended measures (ICHOM, 2022). Physical metrics were the most common means to measure outcomes, including weight, height, body mass index (BMI), or percentage median BMI (%mBMI) for children and adolescents, and occasionally blood test results or menstruation status. The use of physical metrics as the most common means to measure outcomes across psychological interventions for ARFID is interesting, given that weight and BMI are not always an indication of severity, risk, or recovery in ARFID (Yule et al., 2021).

A variety of means to determine nutritional and dietetic change were also used across many studies including the number of foods accepted overall, measuring caloric intake, measuring the percentage of a meal consumed in grams, and evaluating whether patients were reliant on supplements or enteral feeding at the end of the intervention. Direct food-related changes were measured in some studies, for example, foods accepted or the number of new foods added into a diet. Some studies measured nutritional change in terms of no longer requiring an oral nutritional supplement (e.g., Dumont et al., 2019), whereas other studies measured nutritional change in terms of being able to successfully introduce an oral nutritional supplement (e.g., Dolman et al., 2021). This emphasizes the importance of outcome measurement being specific to the patient presentation and patient-specific goals, in the context of a highly heterogeneous condition.

Given that this review focused on studies reporting psychological interventions for ARFID, it is perhaps surprising that only eight studies used validated psychometric measures to determine psychological change, such as changes in mood or anxiety. Some studies used visual-analogue scales or the patients' subjective ratings to measure aspects of anxiety relating to food, such as pre- and post-meal anxiety, though many studies did not measure any psychological change. Behavioral change was often measured using questionnaires and scales, including the behavioral pediatric feeding assessment scale (BPFAS) (Crist & Napier-Phillips, 2001), the children's eating behavior questionnaire (CEBQ) (Wardle et al., 2001), and the mealtime behavior questionnaire (MBQ) (Berlin et al., 2010). Unsurprisingly, such measures were used in behavioral interventions or across mixed-modality interventions which included behavioral components. Thirteen studies determined change in ARFID diagnostic status or symptomatology, with some using measures including the NIAS or PARDI, in line

with recommendations (ICHOM, 2022). Whilst promising, the fact that most studies did not directly measure changes in ARFID or its symptomatology may reflect slow progress in the development of specific measures for ARFID (Cooke, 2020) and a lack of agreement upon what outcomes should be measured and how recovery for ARFID is operationalized (Thomas, Lawson, et al., 2017).

5.1 | Implications for practice

This review suggests that a range of psychological interventions can be implemented to support patients with ARFID, across its heterogeneity in presentation and population, and that such interventions can be applied across a range of settings. At present, due to the nature of the evidence-base for ARFID, the absence of practice guidelines, and the scope of this review, we cannot be certain of the relative efficacy of different interventions for those with ARFID. Therefore, at present, we agree with prior suggestions that clinicians will need to be guided by psychological formulation (e.g., Bryant-Waugh et al., 2021) to determine the most suitable intervention approaches and concur that multidisciplinary care is often indicated (e.g., Hay, 2020). From the reviewed studies, considerations when applying psychological interventions for patients with ARFID include the patient's demographics, the presence of any physical or nutritional risks and any psychosocial impact or impairments, patient comorbidities including psychiatric and/or neurodevelopmental conditions, the driving and maintaining factors of ARFID, and the patient and family's priorities and goals.

Clinicians should also measure outcomes during psychological interventions for ARFID and will need to consider how to appropriately measure outcomes to assess meaningful change for patients with ARFID. This review highlights a broad array of approaches to outcome measurement that clinicians can further consider. Clinicians may wish to incorporate the use of validated measures of ARFID and/or broader psychological comorbidities, and to consider whether physical and nutritional changes are useful to measure. Studies included in this review highlight that certain measures are likely more appropriate depending on the intervention modality and patient demographic. For example, the behavioral pediatric feeding assessment scale (BPFAS) (Crist & Napier-Phillips, 2001) would be an appropriate measure of behavioral change during behavioral interventions for pediatric populations. Studies from this review also suggest that patients' goals or outcomes will likely be personalized to the individual with ARFID. For example, the goal or outcome for one patient with ARFID may be to introduce an oral nutritional supplement, whereas for another the goal and desired outcome may be to no longer require an oral nutritional supplement. Clinicians can also measure other outcomes, such as patient/family satisfaction and intervention acceptability.

5.2 | Recommendations for research

Our review highlights several important areas for future research. Firstly, given that ARFID can affect people across the lifespan, adults

are currently underrepresented in research. Further studies are required to better understand the application of psychological interventions for adults with ARFID. This is especially important given that ARFID was introduced to the diagnostic nomenclature to better reflect a life course approach to eating pathologies (Sharp & Stubbs, 2019). Furthermore, research with adults is especially important given that recent data suggests that ARFID presentations in adulthood may differ from those in childhood in terms of both medical and psychiatric profile, with a greater prevalence of female patients and rates of 68% for comorbid anxiety (Nitsch et al., 2023).

Most studies were from Western countries with predominantly White samples. Further studies exploring ARFID in non-Western countries and with patients from a diverse range of cultural and ethnic backgrounds are needed, especially given that ARFID presents across a range of ages, ethnicities, countries, and socio-economic backgrounds (Bourne et al., 2020; Micali & Cooper-Vince, 2020). To build understanding of cultural competencies when delivering psychological interventions for ARFID, studies should include detailed demographic information including race, ethnicity, and socio-economic status.

The ARFID literature at present consists mostly of single-case reports, case series, and retrospective chart reviews. The current evidence-base limits the conclusions that can be drawn regarding the effectiveness of psychological interventions for ARFID. Larger scale studies and randomized controlled trials with adequate statistical power are necessary to establish the efficacy of interventions. The use of validated outcome measures would also support more sound conclusions to be drawn about the effectiveness of interventions for ARFID.

None of the reviewed studies investigated potential treatment mechanisms (mediators). Future research should examine such proposed mechanisms, such as decreased fear of food, to further understand and improve the efficacy of current ARFID treatments. Relatedly, more research is needed to identify cognitive drivers of ARFID which could guide treatment selection and enhance treatment efficacy by targeting distinct cognitions. Additionally, future research should investigate factors associated with treatment success (moderators) to further understand which treatment modality might be most effective for individuals. Studies would also benefit from measuring treatment targets (e.g., anxiety) with repeated measures throughout treatment.

Whilst larger scale studies are required, any future case studies could use single-case experimental designs to better evidence the relationship between the intervention and behavior change and outcomes. Process evaluation studies could be added to trials to understand the process of change from the perspective of patients and carers. Such studies would also illuminate potential common elements across treatment modalities.

Our review highlights important gaps in outcome measurement. There is a need for research to investigate the psychometric properties of measures, including sensitivity to change, with greater research into self-report measures for ARFID (Kambanis & Thomas, 2023). Researchers conducting treatment studies need to employ validated measures where possible and agreed definitions of recovery. Whilst there is a substantial literature on eating disorder recovery from the perspective of individuals with lived experience (de Vos et al., 2017; Wetzler et al., 2020), studies of

recovery meanings in ARFID are absent and needed. Additionally, Delphi studies to develop consensus on the best choice of measures for ARFID and support definitions of recovery criteria, building on the work conducted previously by ICHOM (2022) and Eddy et al. (2019), would help to lead to improvements in outcome measurement.

Finally, future studies and reviews of interventions may need to become narrower in their focus to disentangle what types of psychological interventions are best suited for specific ARFID populations and presentations.

5.3 | Limitations

This review has several limitations. Firstly, the quality of studies included, and their risk of bias, have not been assessed in line with scoping review guidance (Briggs, 2015). By conducting a scoping review, we aimed to provide a broader overview of the literature than would be possible in a meta-analysis due to the considerable variation in design and measures of studies in this field. As the evidence base increases, focused systematic reviews and meta-analyses can be conducted which can include quality assessment.

Second, readers should consider that whilst we organized this review according to four broad categories of psychological interventions, our review highlights that there are often common components across psychological interventions for ARFID. As the evidence base matures, more sophisticated analyses will be possible, such as component meta-analyses to identify core “ingredients” of successful treatments. However, based on this scoping review, conclusions about the most effective interventions for ARFID, or indeed the effective components of such interventions, are not yet possible.

Thirdly, by including studies describing ARFID, we recognize that a vast and well-established body of literature regarding interventions for pediatric feeding disorders have not been included, despite their potential utility for this patient group (Sharp & Stubbs, 2019).

6 | CONCLUSION

This review highlights the growing literature and details a range of psychological interventions for ARFID, since ARFID was added to the diagnostic nomenclature 10 years ago. Behavioral approaches, CBT, family therapy, and combinations of these modalities, are being delivered to support patients with ARFID across the lifespan and different clinical settings.

Given that a range of psychological approaches can be applied for patients with ARFID, our key message for clinicians is that the choice of psychological intervention should be guided by psychological formulation, taking into consideration patients' demographics, physical and/or nutritional risks, the impact on psychosocial functioning, psychiatric and/or neurodevelopmental comorbidities, the driving and maintaining factors of ARFID, and the patient and family's priorities and goals. Similarly, clinicians need to carefully

consider how to measure outcomes during psychological interventions for ARFID, selecting measures that are appropriate to the psychological intervention and modality adopted, the treatment priorities, and patient demographics and goals. Clinicians should consider the use of validated measures of ARFID, as well as broader psychological measures.

For researchers, our review highlights the need to improve understanding of how ARFID treatments work and for whom they are most effective. This requires improved demographic reporting, increased efforts to identify common elements of existing treatments, further research developing outcome measures for ARFID and testing their validity, and consensus building work to select key outcomes. Finally, future studies require improved methodology, including the use of larger sample sizes to enable investigation of moderators and mediators of treatment, and the use of experimental designs.

AUTHOR CONTRIBUTIONS

Emma Willmott: Conceptualization; investigation; methodology; writing – original draft; writing – review and editing; supervision.
Rachel Dickinson: Data curation; investigation; writing – original draft.
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Tom Jewell: Conceptualization; data curation; investigation; methodology; project administration; resources; supervision; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

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DATA AVAILABILITY STATEMENT

Not applicable to this article as no new data were created or analysed in this study.

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SUPPORTING INFORMATION

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