Investigating the Psychosocial Outcomes of Picky Eating Beyond Childhood

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Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signatur 

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Overview

Picky eating can persist into adolescence and adulthood for some individuals and can be associated with undesirable psychosocial factors. Investigating associations with these factors may inform the development of effective prevention and intervention strategies and further research. Part One is a systematic review of the psychosocial correlates of picky eating beyond childhood. A range of psychosocial correlates were identified including eating disorder behaviours, mental health factors and identity-related difficulties. Picky eating behaviours may be associated with undesirable psychosocial outcomes, particularly mental health correlates. The results were more varied for eating disorder behaviours and identity-related difficulties. The review highlights the need for further research with methodological improvements to draw more robust conclusions.

Part Two presents empirical research into the psychosocial outcomes of picky eating in adolescence. To date, most of the evidence on correlates of picky eating focuses on either children or adult populations. There is some evidence that adolescents with PE habits experience social challenges and criticism from peers. Contrary to expectation, persistent picky eating was not associated with lower school engagement and enjoyment, friendship quality and higher bullying experiences. Other factors such as child sex, health conditions, household income and an autism diagnosis were found to have a greater influence on these associations. Efforts should be made to increase the generalisability of results and capture the difference in influence between transient PE, persistent PE, and ARFID on psychosocial outcomes.

Part Three presents a critical appraisal of the systematic review and empirical paper. Reflections on the research process for each part were considered including reflections on the

choice of topic, the challenges present in the literature, methodological issues and potential clinical implications.

Impact Statement

This thesis provides valuable insights that can be disseminated to individuals with picky eating (PE), their families, and healthcare professionals (HCPs). Our findings offer potential clinical implications and highlight the need for further research.

In terms of dissemination, the findings of the systematic review shed light on the psychosocial correlates of PE beyond childhood. By sharing this information with individuals and families affected by PE, they can gain a better understanding of the potential psychosocial correlates associated with their PE behaviours. This knowledge empowers them to seek appropriate support and interventions that address the specific challenges related to PE, such as social eating anxiety, depression, anxiety symptoms, psychological distress, quality of life/impairment, and identity-related difficulties. Furthermore, HCPs can benefit from this knowledge by incorporating the identified psychosocial correlates into their assessments and interventions. By recognising the potential impact of PE on individuals' mental well-being and quality of life, HCPs can provide tailored support and guidance to improve outcomes for their patients. This may involve developing individualised assessments that capture the unique needs and challenges of each individual with PE and considering a broader range of psychosocial factors in treatment planning.

Our findings from the empirical research suggested that individuals with either transient or persistent PE may not face a substantial risk of lower school engagement and enjoyment, lower friendship quality, or higher bullying experiences. Although further research is needed to confirm these findings, these results can potentially provide reassurance to parents and caregivers. They may alleviate concerns and anxieties regarding the potential negative impact of

their adolescent's PE behaviours on their psychosocial well-being. By highlighting that the association between PE and these outcomes is not substantial, our study contributes to a more nuanced understanding of the potential effects of PE on adolescents' psychosocial functioning.

We also found that factors other than persistent PE may have a stronger influence on friendship quality, school engagement and enjoyment and bullying experiences in adolescence. This highlights the importance of considering multiple factors in clinical assessments and interventions, including child sex, recent health conditions, household income and the presence of a recorded autism diagnosis. By addressing these factors alongside PE status, HCPs can provide comprehensive support that takes into account the various influences on psychosocial outcomes.

The analysis conducted in the empirical research highlights the advantages of longitudinal research in exploring the long-term implications of PE. By examining data from the Growing Up in Scotland cohort, we were able to investigate the association between persistent PE in childhood and negative psychosocial outcomes in adolescence. This longitudinal approach provides valuable insights into the trajectory of PE and its potential impact on individuals' school engagement, enjoyment, friendship quality and bullying experiences over time.

Given the results of the systematic review and empirical research, further research should focus on using clear definitions and precise measures of PE and psychosocial outcomes and using these measures to explore a range of psychosocial outcomes potentially related to PE. These include the factors in our systematic review and the outcomes used in our empirical paper. Further research is also needed to investigate the difference in influence between transient PE, persistent PE, and ARFID on psychosocial outcomes. Overall, efforts should be made to increase

the generalisability of the results and replicate the findings of our study. By addressing these limitations, future research can generate more robust and generalisable results that further our understanding of the impact of PE on individuals' psychosocial well-being.

Clinicians may consider incorporating comprehensive assessments of PE that encompass all aspects of its definition, including food neophobia, meal variety, and sensory sensitivity. Additionally, the presence of ARFID should be taken into account during assessments to gain a more accurate understanding of an individual's PE patterns and tailor appropriate interventions and support.

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Part 1: Literature Review

Psychosocial Correlates of Picky Eating in Adolescents and Adults: a Systematic Review

Abstract

Background. For some, picky eating behaviours do not resolve in childhood and can persist into adolescence and adulthood. PE beyond childhood can have negative associations with psychosocial factors. This review aims to synthesise the psychosocial correlates of PE beyond childhood and investigate the differences between PE with and without ARFID on psychosocial correlates.

Methods. Two databases were used to conduct the literature search. Peer-reviewed studies in English that investigated the psychosocial correlate(s) of picky eating with or without ARFID in individuals aged 10 and above were included. Correlates were categorised into three categories: eating disorder behaviours, mental health factors and identity-related difficulties. 17 studies, which examined 8 psychosocial correlates, were identified from the searches.

Results. Overall, the reviewed studies suggested a positive association between picky eating and undesirable psychosocial outcomes such as social eating anxiety, depression, anxiety symptoms, psychological distress, quality of life/impairment and identity-related difficulties. The results were more varied for eating disorder behaviours and OCD symptoms.

Conclusion. This review highlights the importance of investigating psychosocial correlates of PE beyond childhood as well as the need for further research to provide more robust results. Further research should focus on longitudinal designs, establish a gold standard definition and measure of picky eating, and take into consideration the difference between PE with and without ARFID.

Psychosocial Correlates of Picky Eating in Adolescents and Adults: a Systematic Review

Introduction

Although definitions vary, picky eating (PE) is usually described as eating a limited range of foods and avoiding or rejecting foods based on their sensory properties (Dovey et al., 2008). This includes avoidance of new or unfamiliar foods, also known as food neophobia (FN), avoidance of foods that are strongly disliked as well as a reliance on preferred foods that vary only slightly in their preparation and/or presentation (Dovey et al., 2008; Taylor et al., 2015; Wildes et al., 2012; Zickgraf & Schepps, 2016). PE and FN are common behaviours in childhood and can be part of typical development (Dovey et al., 2008). The prevalence rates of these behaviours are highest around the age of two, ranging between 14% and 50% (Dubois et al., 2007; Carruth et al., 2004). Research shows that these behaviours coincide with a stage in development when individuals may reject most foods, specifically unfamiliar ones. These behaviours are believed to have been evolutionarily adaptive, as they helped prevent individuals from consuming toxic substances (Birch & Fisher, 1998; Dovey et al., 2019). The prevalence of PE behaviours tends to decline with age, ranging between 7% and 27% in later childhood (Mascola et al., 2010). However, studies have observed that in a minority of children, PE behaviours do not resolve in middle childhood and can persist into later childhood, adolescence, and adulthood (Cardona Cano et al., 2016; Mascola et al., 2010).

In some cases, PE can be a pattern of restrictive eating that can lead to a diagnosis of avoidant/restrictive food intake disorder (ARFID). ARFID is classified as an eating and feeding

disorder in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). It is characterised by restrictive eating patterns that are unrelated to concerns about weight or body shape, resulting in weight loss, nutritional deficiencies, reliance on nutritional supplements, and/or impaired psychosocial functioning (American Psychiatric Association, 2013). According to the DSM-5, three patterns of restrictive eating can lead to ARFID, namely, (i) PE from high sensory sensitivity to food, (ii) a lack of appetite or interest in food and/or (iii) a fear of aversive consequences associated with food such as choking or vomiting (American Psychiatric Association & DSM-5 Task Force, 2013). These three presentations are not mutually exclusive which means that individuals can present with one or more restrictive patterns (Thomas et al., 2017). One study found that over half of their sample presented with more than one restrictive pattern of eating and that the sensory sensitivity subtype associated with PE was the most common one that co-occurred with the other subtypes. In fact, between 62% and 80% of the sample reported at least one characteristic consistent with the sensory sensitivity subtype (Reilly et al., 2019).

It is important to acknowledge that PE and ARFID are distinct terms; nonetheless, there has been a suggestion that PE might represent a subclinical manifestation of certain ARFID presentations (Kauer et al., 2015). In recent years, ARFID has received increased attention in the literature by investigating it as a disorder on its own and its relationship with PE. Researchers have distinguished ARFID from PE by its persistence and severity, and the associated presence of significant nutritional and psychosocial impairment. Research has shown that 33% of adults in a general population sample self-identified as picky eaters with only 9% of self-identified picky eaters endorsing symptoms of ARFID according to the DSM-5 (Zickgraf et al., 2016). Therefore,

it is important to investigate and compare the psychosocial correlates associated with both PE with and without ARFID in adults. It will shed light on whether these conditions have similar impacts on individuals or if there are substantial differences in their effects.

The research on PE, both in children and adults, has been limited, partly due to the lack of consistent definitions and measurement methods of PE. There is no universal consensus when it comes to defining PE, although most definitions incorporate the restriction of familiar foods, FN, and sensitivity to the sensory properties of foods (Dovey et al., 2008). A related issue is that the terms PE and FN are frequently used interchangeably in the literature along with ‘selective eating’ (Van Tine et al., 2017), ‘faddy eating’ (Thompson et al., 2015), ‘choosy eating’, and ‘fussy eating’ (Carter Leno et al., 2022). This review will use the term ‘picky eating’ to simplify matters.

In addition, some researchers consider PE to be part of the range of "feeding difficulties," with PE being the most prevalent type at one end and severe feeding disorders such as ARFID at the other end (McCormick and Markowitz, 2013). Conversely, Kerzner et al. (2015) argue that PE has distinct characteristics that set it apart from feeding disorders. This disagreement can lead to variations in the definition and measurement of both ARFID and PE, which can affect the consistency and comparability of research results.

In this review, we acknowledge that there is not sufficient evidence yet for either perspective as there might be some cases where PE and ARFID are in the range of feeding difficulties, particularly when ARFID is sensory-driven. However, we also recognise that other cases of ARFID are either only partly sensory-driven or have distinct, non-sensory causes, which aligns with the argument that PE and ARFID, in many cases, have distinct characteristics. In this

review, we further differentiate PE from 'traditional' eating disorder (ED) behaviours such as restriction, binge eating, and purging associated with concerns around shape and weight. These behaviours map onto diagnoses of EDs such as anorexia nervosa, bulimia nervosa and binge eating disorder (APA, 2013).

Due to the multiple measures available to assess PE, it has been increasingly challenging for researchers to compare findings across different studies (Taylor et al., 2015; Ellis et al., 2017). Previous studies have mainly relied on self-report or parent-report methods, or short subscales, which mainly focus on FN and limited food variety (Zickgraf & Schepps, 2016; Wildes et al., 2012; Hunot et al., 2016). However, these approaches may not capture all important aspects of PE behaviours and attitudes, such as sensory processing difficulties, mealtime behaviour and impact on psychosocial functioning (Dovet et al., 2008; Mascola et al., 2010). Recent efforts have led to the creation of a multidimensional measure of adult PE, which considered rigid food preferences, aversions to specific tastes, and mealtime avoidance, common among individuals with PE (Ellis et al., 2017). While these developments are promising, more work is needed to fully operationalise the concept and measures of PE to improve the comparability of research findings and better understand the relationship between PE, health, and psychosocial outcomes.

Using a variety of methods to measure PE is likely to contribute to inconsistent and unclear findings regarding the impact of PE on eating behaviours, physical, and mental health. Looking at eating behaviours, studies have shown that PE in childhood can impact children's nutritional intake and dietary quality by consuming a limited range of foods, less protein and vegetables and more sweets (Jacobi et al., 2003; Volger et al., 2013). Although some studies

have found that these behaviours negatively impact children's growth and development (Cardone Cano et al., 2016; Dubois et al., 2007), other studies have found that the nutritional impact of PE can be minimal (Brown et al., 2018).

Other studies have explored PE in childhood and the subsequent development of ED behaviours and found inconsistent results. One study reported that PE in childhood increased the risk of developing an ED, such as anorexia nervosa, in adolescents and adulthood (Marchi & Cohen, 1990) whereas other studies found no associations between PE in childhood and the development of EDs later in life (Van Tine et al., 2017; Kotler et al., 2001). However, Marchi and colleagues (1990) used an atypical definition of PE by conceptualising it as a combination of poor appetite, mealtime conflicts, and stomach pain. These inconsistent results can most likely be attributed to the absence of a clear definition and measurement tool for PE.

In terms of physical health, some studies reported that PE in childhood may be protective against being overweight and obese (Antoniou et al., 2016; Taylor et al., 2019) which was confirmed in a meta-analysis in individuals up to 18 years old (Brown et al., 2016).

Moreover, research in PE in childhood has focused on anxiety, depression, and social anxiety as mental health correlates. Studies have shown that childhood PE is associated with symptoms of anxiety and depression (Zucker et al., 2015; Mascola et al., 2010). However, more recent studies have reported that these findings may not persist when controlling for other restrictive eating behaviours (Zickgraf & Ellis, 2018). Another study suggested that some children with PE may encounter challenges in their relationships with their peers as a result of being teased about their dietary habits (Bryant-Waugh, 2013).

Although there is more evidence for the correlates of PE during childhood, less is known about PE beyond childhood. Just as in childhood, there is also variability in the measures of PE beyond childhood, with self-report measures being the most used. Some studies have used single-question self-identification of being a picky eater (Pesch et al., 2020; Folta et al., 2020; Fox et al., 2018; Thompson et al., 2015) whereas others have used multiple questions to assess PE (Kauer et al., 2015; Wildes et al., 2012). There are limitations to self-report measures of PE such as they may increase response bias and rely on individuals' memories, behaviours and feelings. Individuals might also want to answer the questionnaires in ways they think is acceptable to other people, also called social desirability (Rosenman et al, 2011). They might also not complete the questionnaires for different reasons such as lack of time, attention or boredom. Moreover, single-item questionnaires may be problematic when measuring PE as they may not be able to capture all aspects of PE at once such as meal variety and sensory sensitivity for example. However, the development of the Adult Picky Eating Questionnaire (APEQ) has been viewed as a step forward in the measurement of PE in adulthood due to its ability to capture four facets of PE behaviours and attitudes such as meal disengagement, meal presentation, food variety and taste aversion (Ellis et al., 2017). The APEQ was used as a measure of adult PE in several studies (Barnhart et al., 2021; Dial et al., 2021) and has the potential to help researchers compare more accurately and reliably the correlates of PE across adult populations.

Researchers have investigated similar PE correlates in adulthood as were previously studied in childhood, including eating behaviours and mental health correlates. Several observations found a negative correlation between adult PE and fruit and vegetable consumption

and food variety (Ellis et al., 2018; Zickgraf & Schepps, 2016). These results indicate that PE in childhood and adulthood may have similar dietary patterns.

Moreover, other studies examined psychosocial correlates of PE beyond childhood such as ED behaviours, depression, anxiety and social anxiety symptoms, quality of life, clinical impairment, and identity-related difficulties (Dial et al., 2021; Barnhart et al., 2021; He et al., 2020; Ellis et al., 2018; Herle et al., 2020; Pesch et al., 2020). Some studies found a positive association between PE in childhood and ED symptoms in adolescence and adulthood (Herle et al., 2020) whereas others found no associations (Van Tine et al., 2017; Pesch et al., 2020). In addition, PE beyond childhood was associated with higher levels of impairment, distress, obsessive-compulsive disorder (OCD), and depression symptoms compared to individuals who do not identify as picky eaters (He et al., 2020; Ellis et al., 2018). However, other studies found no associations between adult PE and negative psychosocial correlates such as impairment (Wildes et al., 2012).

In some studies, adult PE was associated with higher levels of social eating anxiety whereas other studies reported that for many individuals PE did not have a major impact on their social lives (Dial et al., 2021; Wildes et al., 2012; Barnhart et al., 2021; Ellis et al., 2018; Folta et al., 2020). Mixed results were also found when investigating identity-related difficulties. Some studies found that several individuals who identified as picky eaters reported avoiding social situations that involved eating with others due to criticism or feeling embarrassed. However, other adults have shown to not internalise the PE identity as much and may be less impacted by it (Blake & Bisogni, 2003; Thompson et al., 2015).

There are currently no robust theories or well-established explanations for the mechanisms that elucidate the relationship between PE and the psychosocial correlates mentioned above. The mechanisms remain largely unexplored in the literature. However, potential explanations have been proposed. For EDs, it is plausible that PE may increase the risk of their development due to chronic food restriction and anxiety around food choices. PE may also trigger self-consciousness and apprehension during social meals which may be linked to social eating anxiety.

Different studies offer varied perspectives on the relationship between anxiety and PE. For instance, McDermott et al. (2008) suggest that anxiety might serve as a predictor of PE, whereas Bryant Waugh (2013) posits that it could function as a maintaining factor. In contrast, Wildes et al. (2012) propose that anxiety may result from PE, particularly due to the social repercussions of a highly restricted diet. Additionally, the interplay between anxiety and PE may be subject to moderation by other factors. For example, Green and Ben Sassoon (2010) propose a bidirectional relationship where anxiety can either precede or result from sensory sensitivity, a factor implicated in PE. Meanwhile, Harris et al. (2019) suggest that the association between PE and anxiety may be mediated by feelings of disgust.

The link between OCD and PE is multifaceted. OCD is characterized by a reliance on rituals, routines, and a need for control, factors that have been suggested as potential mechanisms underlying PE in autistic children (Sharp et al., 2013). Alternatively, the connection between OCD and PE may be rooted in anxiety, given that OCD was formerly classified as an anxiety disorder (Stein et al., 2010) and anxiety symptoms often co-occur with OCD (Stein et al., 2010).

It is possible that the desire for control and adherence to routines exhibited by picky eaters serve as coping strategies to manage anxiety. In some cases, PE may manifest as a symptom of OCD.

Sensory sensitivity presents a plausible explanation for the link between depression and PE. Some suggest that alterations in sensory perception associated with depression (Fitzgerald, 2013) may increase the likelihood of PE. Additionally, the social isolation that PE adults may experience due to their restricted eating habits could partially account for the connection between PE and depression. Loneliness, a common outcome of social isolation, has been consistently linked to depression in previous research (e.g., Cacioppo et al., 2010; Heinrich & Gullone, 2006). These experiences related to PE may lead to psychological distress and a lower quality of life in different domains of life.

More recent studies have separated adult PE and ARFID when looking at their correlates beyond childhood and found that individuals who reported PE and ARFID symptoms endorsed higher distress symptoms than PE without ARFID (Zickgraf et al., 2017).

The literature shows that PE beyond childhood can have negative associations with overall health, mental health, and well-being. However, limitations in the literature include variability in PE measurement and definitions, in psychosocial correlates measurement and in how researchers view ARFID and its relationship to PE. Other methodological limitations also include limited sample sizes, the absence of control groups, and a lack of longitudinal investigations. Therefore, there is a need to better understand the nature of the literature on associations between PE and psychosocial factors beyond childhood. Moreover, it is important to review the conditions under which PE and/or ARFID are associated with certain psychosocial

factors. Researchers also need to understand the factors that might influence the outcomes of PE in specific populations. For instance, some studies typically focused on general adolescents and adult populations whereas others focused on specific populations, such as individuals with autism spectrum disorder (hereafter, autism). The rates of PE in autism are extremely high (Ledford & Gast, 2006). Autism is also associated with an increased risk for eating disorders like ARFID (Lai et al., 2019). While research on the occurrence of eating disorders in individuals with autism is limited, self-report studies conducted online indicated that there is a twofold increased likelihood of experiencing eating disorders among autistic individuals compared to those who are neurotypical (Sedgewick et al., 2021).

Therefore, the purpose of this systematic review is to examine and synthesise the available literature on the psychosocial correlates of PE beyond childhood.

The specific aims of this review are to:

1. Identify the psychosocial correlates associated with PE beyond childhood to understand the current state of knowledge in this area.
2. Investigate the differences between PE with and without ARFID on psychosocial correlates.
3. Evaluate the methodological features and quality of the available research on the psychosocial correlates of PE in adolescence and adulthood.
4. Identify the limitations and gaps in the existing literature on the psychosocial correlates of PE beyond childhood.

The results of this systematic review will be of value to healthcare professionals, educators, and researchers who work with adolescents and adults who struggle with PE. It can provide them with a comprehensive understanding of the current state of research on this topic and will contribute to developing more effective interventions and treatments for these individuals. This review will also provide researchers with useful guidance for future study design. Additionally, the findings of this review will be useful for families and caregivers of adolescents and adults who struggle with these behaviours, as it will enhance their understanding of the factors associated with PE and the potential outcomes associated with it. This will enable them to support their loved ones more effectively.

Methods

Study Selection Criteria

To construct the research question and determine the study's inclusion and exclusion criteria, the PICO (population, intervention, comparison, outcomes) framework (Table 1) was used. According to the World Health Organisation, adolescence is a phase between ages 10 and 19, representing the transition between childhood and adulthood (World Health Organisation, 2022). Therefore, studies that met the following criteria were included: (1) presented an analysis of at least one psychosocial correlate of PE behaviour in individuals aged 10 and above, (2) were published in English in a peer-reviewed publication and, (3) included PE and/or PE with ARFID presentations. There were no limitations on study design or publication dates.

As mentioned above, there is evidence that the sensory sensitivity ARFID subtype associated with PE is the most prevalent subtype and that the three presentations of ARFID are not mutually exclusive (Thomas et al., 2017). By including individuals diagnosed with ARFID, we minimise the exclusion of valuable information and will provide a more comprehensive understanding of the correlates of PE in different populations. We will explore similarities and differences between PE and ARFID, thereby contributing to attempts to clarify the nature of the relationship between these two concepts.

In the review process, articles that fulfilled any of the following criteria were excluded: (1) not written in English; (2) not subjected to peer review (e.g., dissertation or conference proceeding); (3) were either a case study or review paper; (4) focused solely on children under 10 years old; and (5) reported a study that only evaluated individuals with significant long-term physical health conditions. This exclusion was set due to the possibility of developing PE from physical conditions and/or outcomes being influenced by those physical health conditions.

Table 1

Criteria used to define the research question for the systematic review.

Criteria	Description
Population	Individuals aged >10 years old with picky eating, fussy eating, choosy eating, faddy eating, food neophobia, food fussiness, or selective eating. Including individuals diagnosed with autism spectrum disorder, or ARFID and excluding significant long-term health conditions.
Intervention	All studies examining a psychosocial correlate of picky eating.
Comparison	Not applicable.
Outcome(s)	Psychosocial correlates such as eating disorder behaviours, social eating anxiety, depression and anxiety symptoms, psychosocial impairment, distress, OCD symptoms and identity-related difficulties.

Search Strategy

The search strategy involved searching two databases (PsychInfo and Medline) and including a combination of keywords from the following two groups:

1. Fussy eat* OR Picky eat* OR food neophobia OR food fuss* OR selective eat* OR food select* OR Food phobia OR Food refusal OR ARFID OR avoidant-restrictive food intake disorder OR Avoidant restrictive food intake disorder OR Faddy eat* OR choosy eat* OR Food aversion OR Food variety OR Food avoidance in the title, or abstract, or key concepts.

2. Adolescen* OR teen* OR preteen* OR youth* OR young adult* OR adult* OR preadolescen* OR early adult* OR student* in the title or abstract.

The results were limited to the English language and peer-reviewed journals. Duplicates were removed. Articles were then screened by title and abstract by one author (T.A.). Discussions about study eligibility were scheduled with the co-author (W.M.). T.A. conducted a full-text evaluation of potentially relevant articles that were retrieved. The search was concluded on December 17, 2022.

Data Extraction

To collect methodological and outcome variables information from each study, two data extraction forms were used. The first form (see Appendix A) collected the following: author(s), publication year, country of study, study design, measurement tool(s) for assessing PE, the psychosocial correlates of interest, sample size, sample and age of subjects, and data analyses. The second form (see Appendix B) gathered data regarding the nature of the associations between PE and various psychosocial factors included in the reviewed studies. The data extraction process was completed by one author (T.A.), with dilemmas discussed and resolved via discussion with the second author (W.M.).

Table 2

Basic characteristics of the studies examining correlates of PE beyond childhood

Study number and reference	Country	Study design	Measure of picky eating	Psychosocial correlates measured	Sample size	Sample, age (years)	Data analyses
1. Carter Leno et al. (2022)	England	Longitudinal	3 parent-reported questions	ED behaviours	8982	Adolescents, 14	Structural equation model
2. Dial et al. (2021)	USA	Cross-sectional	Self-identification and APEQ	Identity-related difficulties, social anxiety, QOL, distress	488	Undergraduate students, 18-25	Correlations and independent t-tests and conventional content analysis
3. Barnhart et al. (2021)	USA	Cross-sectional	APEQ	Depression, anxiety, ED behaviours, social anxiety, OCD symptoms	509	Undergraduate students, 18-25	Correlations
4. Pesch et al. (2020)	USA	Retrospective	Retrospective self-identification	ED behaviours	2275	Teens and young adults, 25	Logistic regression

5. He et al. (2020)	China	Cross-sectional	AEBQ	Distress, QOL, ED behaviours	1068	Undergraduate students, 17-24	Multinominal logistic regression
6. Ellis et al. (2018)	USA	Cross-sectional	APEQ	Social eating anxiety, depression, QOL, ED behaviours	1339	Adults, 40	ANCOVA
7. Kauer et al. (2015)	USA	Cross-sectional	Questions related to PE		271	Adults, above 18	ANOVA
8. Wildes et al. (2012)	USA, Canada, Australia, UK	Cross-sectional	4 questions related to PE	OCD, depression, ED behaviours	6895	Adults, above 18	Chi square tests
9. Ellis et al. (2017)	USA	Cross-sectional	APEQ subscales	Eating disorders symptoms, impairment, OCD symptoms	1663	Adults, above 18	Multiple regression analyses
10. Herle et al. (2020)	England	Longitudinal	Parent-reported questions		4760	Adolescents, 16	Multivariable logistic regression
11. Van Tine et al. (2017)	USA	Longitudinal	Parent-reported questions at ages 2 and 11. Self-identification at 23	Social eating anxiety, depression, anxiety, QOL, ED behaviours	61	Adults, 23	Binary logistic regression
12. Maiz & Balluerka (2017)	Spain, Chile	Cross-sectional	Child FNS (Spanish version)	Eating disorder behaviours	831	Adolescents, 12-16	ANOVA and MANCOVA
13. Schnettler et al. (2017)	USA	Cross-sectional	FNS (Spanish version)	Eating disorder behaviours, impairment	371	University students, 20	Pearson's correlations
14. Zickgraf et al. (2017)	USA, Across different countries	Cross-sectional	Self-identification, ARFID symptom	Anxiety, identity-related difficulties, QOL	406, 20, 13	Adults, above 18	ANOVA, In-depth interviews, IPA

15.Folta et al. (2020)	UK	Qualitative	questionnaire		26	Young adults, 18-24	
16.Fox et al. (2018)		Qualitative	Self-identification			Adults, 18-67	Thematic analysis
17.Thompson et al. (2015)		Qualitative	Self-identification	QOL, ED behaviours, distress, OCD symptoms		Adults	
			Self-identification	Social anxiety, anxiety			
				Social anxiety and identity-related difficulties			
				Social eating anxiety			

Abbreviations: APEQ, Adult Picky Eating Questionnaire; AEBQ, Adult Eating Behaviour Questionnaire; FNS, Food Neophobia Scale; ED, eating disorders; QOL, quality of life; ARFID, Avoidance Restrictive Food Intake Disorder.

Study Quality Assessment

The Mixed Method Appraisal Tool (MMAT) was used to assess the quality of the included studies (see Appendix C). To use the MMAT, two screening questions need to be answered for each study (1. Are there clear research questions? 2. Do the collected data allow us to address the research questions?). If the answers were “yes” then the appraisal of each study using the appropriate category of studies was done. When using the MMAT, there is no overall

score from the ratings, however, by looking closely at each criterion rating, the quality of the included studies can be considered (Hong et al., 2018).

Due to resource constraints, a second coder was not available to ensure the reliability of the appraisal of studies using the MMAT. However, the MMAT guidelines were followed consistently to minimise the potential for bias.

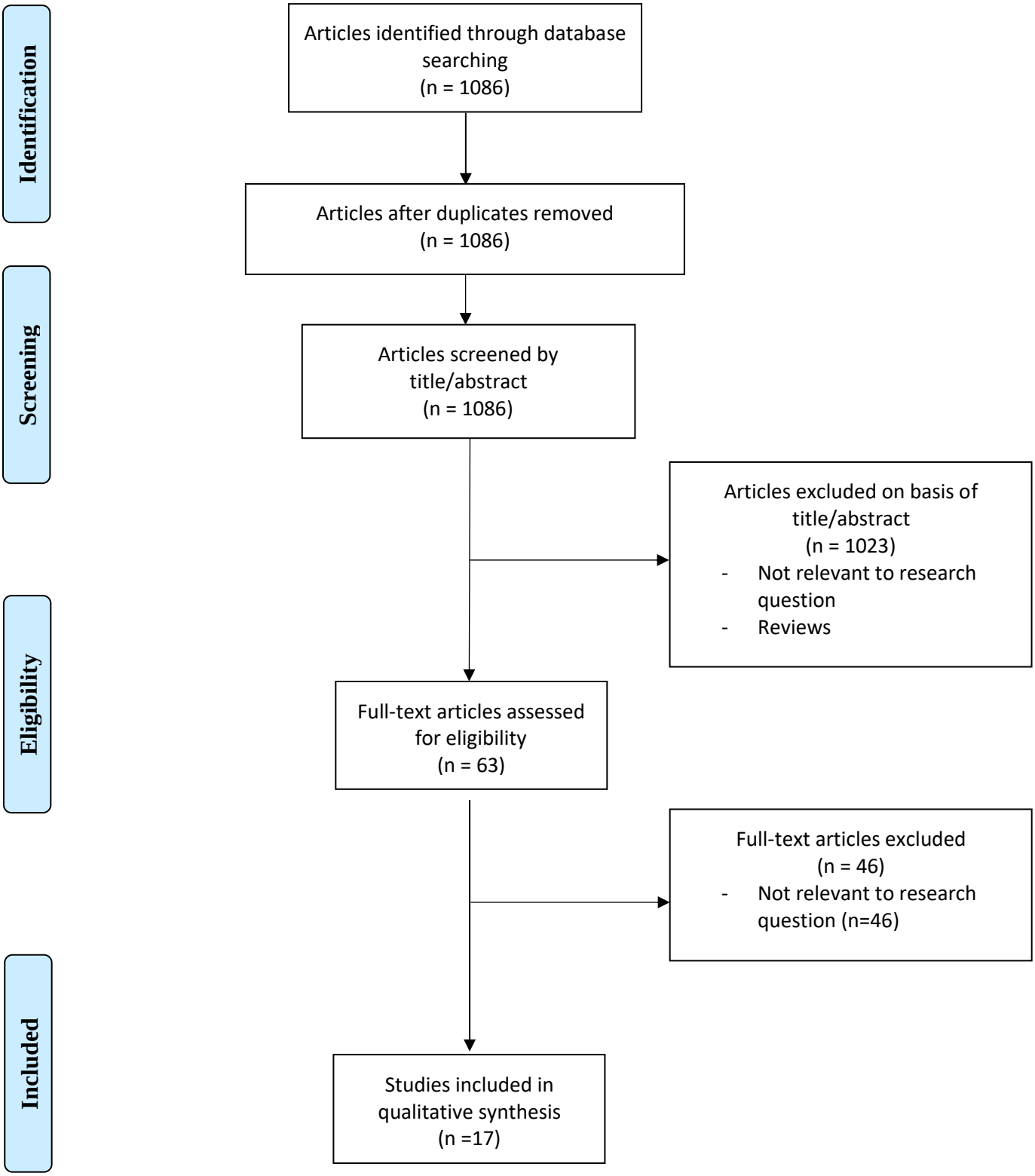
Results

Study Selection

The study selection process and reasons for exclusion are presented in Figure 1. Initially, 1086 articles were identified through keyword searches, and after a title/abstract screening, 1023 were excluded. The remaining 63 articles were assessed against the study selection criteria by reviewing the full text. Ultimately, 17 articles were found to meet the inclusion criteria and were included in the review.

Figure 1

Study selection flowchart



Basic Characteristics of the Included Studies

Appendix A summarises the basic characteristics of the 17 articles included in the review. Almost all studies (n=16) were published from 2015 onward. In terms of study location, four were conducted in Europe (Studies 1,10 and 17 in the UK and Study 12 in Spain); nine were conducted in the United States (2-4,6,7,9,11,14,15); one study in China (study 5), one study in Chile (study 13) and two studies across multiple countries (8, 16). In terms of study design, 10 studies were cross-sectional (2,3,5-9, 12-14); three were longitudinal (1,10,11), one was retrospective (4) and three were qualitative (15-17). PE was measured at several time points in childhood in the longitudinal and retrospective studies whereas it was measured in adolescence and/or adulthood in cross-sectional and qualitative studies. The sample sizes ranged from small-scale qualitative investigations (n=13) to a large longitudinal cohort (n=8982). Four studies had a sample size of <100 participants (11,15-17); six studies had a sample size of 100-999 (2,3,7,12-14); and 7 studies has a sample size of >1000 (1,4-6,8-10). In terms of the sample, three studies only included adolescents (1,10,12); five studies only included young adults (2,3,5,13,15); eight studies included a more general adult population (6-9, 11,14,16,17) and one study included both adolescents and young adults (study 4).

Of the 17 studies included in the review, 13 examined PE (i.e., food fussiness, choosy eating, faddy eating, and selective eating); two examined FN on its own (12,13), one examined PE, FN and ARFID (study 14), and one examined PE and ARFID (study 5). A variety of methods were used to assess PE and FN. Four studies used self-identification of being a picky eater (studies 4,15-17). Other studies used existing questionnaires, including the Adult Picky Eating Questionnaire (3,6,9; Ellis et al., 2017); the Food Neophobia Scale (12,13; Maiz et al.,

2016) and the Adult Eating Behaviour Questionnaire (He et al., 2019; Hunot et al., 2016) paired with the nine-item ARFID questionnaire (study 5; Zickgraf & Ellis, 2018). Two studies used both self-identification and questionnaires (2,14). Two studies relied on parent-report of PE behaviours (studies 1,10). One study used both parent-report and self-report (11). Two studies used study-specific questions (7,8).

Of the 17 studies, four operationalised PE using latent class or profile analyses. Ellis et al. (2018) used the adult version of the Child Eating Behaviour Questionnaire (CEBQ) to assess food approach and avoidance traits (Wardle et al., 2001). They categorised individuals into four profiles that differed in food approach and avoidance traits: picky, moderate, approaching, and joyful eaters. He et al. (2020) used the Adult Eating Behaviour Questionnaire (AEBQ) to assess appetitive traits (Hunot et al., 2016). They reported four profiles as well: picky, severe picky, approaching and moderate eaters. Using latent class analysis, Wildes et al. (2012) found four classes based on PE, FN, and a disordered eating assessment. These classes were picky, comorbid (picky and disordered eating), disordered eating and low pathology. Zickgraf et al. (2016) divided participants into four categories based on PE, ARFID and a disordered eating assessment. They reported four profiles: picky eating, disordered eating, picky eating with ARFID and typical eating. For synthesis purposes, the term ‘profiles’ will be used consistently in this study when referencing these studies.

Psychosocial Correlates of PE Behaviours

Appendix B reports the nature of the associations between adult PE and psychosocial correlates in the identified papers. A total of eight correlates classified into three categories (i.e., ED behaviours, mental health correlates and identity-related difficulties) were identified.

Eating Disorder (ED) behaviours

11 studies investigated the association between PE and ED behaviours such as restriction, binge eating, and purging associated with concerns around shape and weight.

Of the 11, seven studies were cross-sectional. Overall, the results were mixed, with most of them finding mixed results, negative associations or none between PE and ED behaviours whereas a few studies found positive associations. However, when positive associations were found, the results were attributed to some but not all facets of PE behaviours (according to the four facets of PE created by Ellis et al. 2018) or were moderated by other psychosocial factors.

Three different measures of ED symptoms were used across the seven cross-sectional studies: the Eating Disorder Diagnostic Scale (EDDS; Stice et al., 2000) used in three studies, the Eating Attitude Test-26 (EAT-26; Garner et al., 1982) used in three studies, and the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn et al., 2008) used in one study. The EDDS and EDE-Q assess a range of ED symptoms and behaviours such as dietary restraint, binge eating, purging, and overvaluation of weight and shape, whereas the EAT-26 assesses attitudes and behaviours related to eating and weight and screens for symptoms of EDs such as dieting, fear of weight gain, and body dissatisfaction (Schaefer et al., 2019).

Of the three using the EDDS, one study reported a negative association between PE and the development of ED symptoms whereas two studies found some overlap between PE and ED patterns. Ellis et al. (2018) categorised individuals into four eating profiles using latent profile analysis (approaching, joyful, moderate and picky). They found that the picky eater profile was associated with significantly fewer traditional ED behaviours such as binging, purging, and restrictive behaviours related to shape and weight concerns compared to the approaching profile. The picky eater profile also exhibited similar levels of these behaviours as the moderate and joyful eaters (Ellis et al., 2018). These findings support the argument that PE and ED behaviours are distinct eating patterns.

The two other studies found some overlap between PE and ED patterns. Using latent class analysis, Wildes et al. (2012) found that the largest class included individuals with both PE and disordered eating patterns followed by individuals who only endorse PE behaviours, individuals who have low levels of PE and disordered eating patterns and individuals who only endorse disordered eating patterns. They found that individuals in the comorbid (PE and disordered eating symptoms) or disordered eating profiles were more likely to meet the criteria for an ED diagnosis compared to individuals in the PE profile (Wildes et al., 2012). Therefore, while this study supports the argument that adult PE can be comorbid with ED symptoms, there is a large proportion of individuals who only reported PE behaviours and were less likely to meet ED diagnostic criteria. The third study reported that only two facets of PE; the Meal Presentation and Meal Disengagement subscales, were significant predictors of ED symptoms (Ellis et al., 2017). This means that individuals who had rigid food preferences in terms of their preparation

and presentation and those who tend to avoid mealtimes were more likely to report ED symptoms.

Using the EDE-Q, Barnhart et al. (2021) found that PE was more strongly associated with disordered eating, specifically eating concerns, when inflexible eating, anxiety and stress were higher. However, there were no effects between PE and negative psychological correlates in relation to other ED behaviours such as binge eating, dietary restraint, or overall eating pathology (Barnhart et al., 2021).

Of the three studies using the EAT-26, two studies reported some overlap between PE and ED symptoms, whereas one study did not. He et al. (2020) reported that participants with picky and severe PE profiles had significantly higher scores on self-reported ED symptoms than non-picky eaters. Moreover, He and colleagues found that, relative to the PE profile, participants with a severe PE profile reported greater self-reported ED symptoms. Kauer et al. (2015) found that although PE scores were higher on ED symptoms than non-picky eaters, they were well below the clinical cut-off for an ED diagnosis. However, Zickgraf and colleagues (2017) reported that picky eaters did not significantly differ from either typical eaters or picky eaters with ARFID on measures of ED behaviours. Although participants with ARFID scored higher on ED symptoms compared to typical eaters and picky eaters, the difference was not significant (Zickgraf et al., 2017).

Of the 11 studies looking at the relationship between PE and ED behaviours, four were longitudinal, with three using prospective data and one using retrospective reports of PE. In these studies, PE was assessed and measured at different time points during childhood. Two studies

measured PE and ED behaviours using the same measures: parent-reported questions for PE and study-specific questions for ED behaviours (Carter Leno et al., 2022; Herle et al., 2020). The two other studies used similar measures but differed in their assessment questions (Van Tine et al., 2017; Pesch et al., 2020).

The results were mixed across the longitudinal studies but overall, they tend to find that childhood PE did not predict ED behaviours in adolescence or adulthood and when associations are found, the effects are small. Carter Leno et al. (2022) found a small but significant association between autistic traits at age 7 and binge eating behaviours at age 14 mediated by the effect of PE. No associations were found for restriction and purging behaviours (Carter Leno et al., 2022). Another study found that children with transient or persistent PE had a 2% risk increase for anorexia nervosa at age 16 compared to children with no PE behaviours (Herle et al., 2020). Compared to the two previous studies, the third prospective study found no differences between picky and non-picky eaters regarding ED behaviours at age 23 (Van Tine et al., 2017). Similarly, the retrospective study found no associations between PE in childhood and ED behaviours such as restriction, binge eating or purging as a young adult (Pesch et al., 2020).

Mental Health Correlates

Social Eating Anxiety.

Of the 17 studies, eight studies investigated the association between PE and social anxiety, particularly social eating anxiety. Social eating anxiety is a type of social anxiety disorder that involves intense fear, nervousness, or discomfort associated with eating in front of others or in social situations that involve food. Individuals with social eating anxiety may feel

self-conscious, embarrassed, or judged when eating around others, and may avoid social situations that involve food altogether (Levinson & Rodebaugh, 2016).

Of the eight studies, five were cross-sectional and three were qualitative. Of the five cross-sectional studies, two examined social anxiety using the Social Phobia Scale (SPS, Mattick & Clarke, 1998) and the remaining three used a social eating anxiety questionnaire developed by Wildes and colleagues (2012).

Across the five cross-sectional studies, individuals who were considered picky eaters reported higher levels of social eating anxiety compared to non-picky eaters (Dial et al., 2021; Wildes et al., 2012; Barnhart et al., 2021; Ellis et al., 2018). Particularly, one study found that three out of the four facets of adult PE; meal presentation, meal disengagement and low food variety were significant predictors of social eating anxiety (Ellis et al., 2017). The results were consistent across these five studies regardless of the measure of social eating anxiety used.

Overall, the results of the qualitative studies complemented the cross-sectional ones except for one study that did not identify social eating anxiety symptoms in individuals with PE as a common experience. Fox and colleagues (2018) found that many participants reported social eating anxiety and impairment in their social functioning beyond childhood, where it was not present earlier in their lives. Thompson et al. (2015) reported that individuals with PE habits found it challenging and isolating to participate in social eating occasions. Consequently, they frequently consumed meals alone or needed their meals adjusted or replaced to take part in social eating activities with their loved ones and peers (Thompson et al., 2015). However, the third qualitative study examining autistic young adults found that although food availability at social

events was a concern expressed by some participants, it did not deter them from attending. Participants believed that it did not significantly affect their lives because they had developed coping mechanisms to deal with these situations. Such strategies included avoiding disliked foods, reviewing the menu in advance, focusing on preferred foods, eating beforehand, carrying snacks, consuming just enough disliked foods to stave off hunger, and sometimes going hungry. Additionally, young people did focus on strangers' reactions, and they expected that strangers would not focus on them either. Instead of feeling ashamed, participants felt a sense of accomplishment for learning how to manage their eating difficulties (Folta et al., 2020).

Depression.

Of the 17 studies, four cross-sectional studies examined the association between depression symptoms and PE in adults over the age of 18. Measures of depression were different across the studies using questionnaires such as the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995), the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2021) and Beck Depression Inventory (BDI; Beck et al., 1987).

Overall, the results suggested a positive association between adult PE and depression symptoms. One study stated that participants in the PE profile scored higher on the PHQ-9 compared to other eating profiles (Ellis et al., 2018). Another study found that the number of picky eaters surpassing the clinical threshold for mild depression was considerably greater compared to non-picky eaters (Kauer et al., 2015). They also found that being a picky eater significantly predicted higher scores on the BDI while accounting for age (Kauer et al., 2015). Although a third study found an association between PE and depression symptoms, it was only

significant for the Meal Disengagement facet of PE. This means that individuals who tend to not be involved or avoid mealtimes were more likely to endorse depression symptoms (Ellis et al., 2017).

However, one study, using the DASS, examined the relationship between PE, disordered eating, and depression. They found that symptoms of depression did not interact with higher PE in relation to disordered eating symptoms (Barnhart et al., 2021). This means that depression symptoms did not influence the relationship between PE and disordered eating.

Psychological Distress.

Four cross-sectional studies examined the relationship between PE and psychological distress in adults over the age of 18. Overall, studies found a positive association between PE and psychological distress.

One study reported that PE behaviour was positively associated with overall distress and situational distress (Dial et al., 2021). Barnhart and colleagues (2021) found that PE was associated with higher distress levels. Similarly, He and colleagues (2020) categorised individuals into four profiles (PE, severe PE, moderate eating and approaching eating) and found that participants in the PE and severe PE profiles scored higher on psychological distress relative to the other eating profiles. Interestingly, they also found that participants in the severe PE profile had significantly higher scores on psychological distress than those in the PE profile (He et al., 2020). Similarly, Zickgraf and colleagues (2017) found that individuals who reported PE and ARFID symptoms had higher scores on the distress measure compared to individuals who reported PE without ARFID (Zickgraf et al., 2017).

Anxiety.

Of the 17 studies, three cross-sectional and one qualitative study examined the relationship between PE and anxiety. Overall, they tend to find positive associations between PE and anxiety.

Ellis and colleagues (2017) found that two of the four facets of PE, the Meal Presentation and Meal Disengagement subscales significantly predicted anxiety sensitivity in adults. This indicates that individuals with inflexible food preferences and those who avoid mealtimes were more likely to report a fear of arousal-related sensations (Ellis et al., 2017). Barnhart and colleagues (2021) reported that higher anxiety and stress symptoms strengthened the relationship between PE and disordered eating symptoms. Another study examining FN in adolescents found that it was positively related to trait anxiety. Trait anxiety was significantly higher in the FN profile compared to the non-FN adolescents (Maiz & Balluerka, 2017). A qualitative study reported that some participants reported feeling anxious around food they did not consider "safe" (Fox et al., 2018).

Quality of life (QOL) and Psychosocial Impairment.

Of the 17 studies in this review, seven cross-sectional and one qualitative study examined the association between PE and QOL, particularly eating-related QOL in adults. Four of the cross-sectional studies used the Clinical Impairment Assessment questionnaire (CIA; Bohn et al., 2008) and the remaining three used different QOL questionnaires. Most studies found that individuals with PE profiles reported lower scores on QOL due to their PE behaviours.

One study reported that two facets of PE, the Meal Presentation and Meal Disengagement subscales significantly predicted eating-related QOL (Ellis et al., 2017). Another study found that PE behaviour was negatively correlated with QOL (Dial et al., 2021). Similarly, Schnettler et al. (2017) reported that FN was negatively correlated with satisfaction with life and satisfaction with food-related life scores. He et al. (2020) reported that individuals in the PE and severe PE profiles scored lower on satisfaction with food-related life relative to the other eating profiles. Also, participants in the severe PE profile had significantly lower scores on satisfaction with food-related life than those in the PE profile (He et al., 2020). Similarly, Zickgraf and colleagues (2017) found that individuals who reported PE with ARFID scored significantly higher than individuals who reported PE without ARFID on measures of eating-related QOL. However, compared to typical eaters, picky eaters scored higher on the QOL impairment measure (Zickgraf et al., 2017). Ellis and colleagues (2018) found that individuals in the PE profile showed higher impairment scores compared to individuals in the moderate eater profile. Nevertheless, this impairment was mainly associated with extreme scores on food approach and avoidance traits (Ellis et al., 2018).

Interestingly, Wildes and colleagues (2012) found that impairment was lowest in the PE profile compared to the comorbid (PE and disordered eating symptoms) and disordered eating profiles (Wildes et al., 2012).

OCD Symptoms.

Of the 17 studies, four examined the association between PE and OCD symptoms using different measures to assess OCD. The results varied across the studies. One study found that

symptoms of OCD did not interact with higher PE in relation to eating concerns. This means that OCD symptoms did not influence the relationship between PE and disordered eating symptoms (Barnhart et al., 2021). Zickgraf et al (2017) reported that participants with PE and ARFID symptoms reported higher OCD symptoms compared to PE without ARFID. They suggested that in the absence of ARFID symptoms, PE did not appear to be associated with significant impairment (Zickgraf et al., 2017). A third study reported that individuals in the PE profile had higher rates of OCD symptoms compared to those in the low pathology profile. Nevertheless, OCD scores were highest in other profiles such as the comorbid (PE and disordered eating) and disordered eating profiles (Wildes et al., 2012).

However, Kauer et al (2015) reported a large and significant difference between the PE profile and the non-PE profile in their scores on the OCD measure. They found that PE status significantly predicted the score on the OCD measure when controlling for age (Kauer et al., 2015).

Identity-related Difficulties

Of 17 studies, three investigated the association between PE and identity-related difficulties. The results varied across the studies. One study found that PE behaviour was positively correlated with the internalization of PE bias, the identification with PE as part of one's identity, and the significance of PE in shaping one's sense of self (Dial et al., 2021). Another study found that adolescents in the FN group scored lower on the family dimension of self-concept and physical self-concept compared to peers in the non-FN group (Maiz & Balluerka, 2017). Thompson et al. (2015) found that while some people associated their PE

behaviours with a sense of ‘otherness’, and shame, others perceived their PE identity as positive. The identity was not considered troublesome and did not hinder their ability to appreciate eating (Thompson et al., 2015).

Discussion

PE and FN are commonly observed in childhood, but there is a lack of research on the psychosocial correlates of these behaviours beyond childhood. This systematic review aimed to identify the psychosocial correlates associated with PE beyond childhood, investigate the differences between PE with and without ARFID on these correlates and evaluate the available research. This review classified psychosocial correlates into three groups: ED behaviours, mental health correlates (including social eating anxiety, depression, anxiety, OCD symptoms, psychological distress, quality of life/psychosocial impairment), and identity-related difficulties.

Overall, the reviewed studies suggested a positive association between PE and undesirable psychosocial outcomes such as social eating anxiety, depression, anxiety symptoms, psychological distress, quality of life/impairment and identity-related difficulties. The results were more varied for ED behaviours and OCD symptoms.

Studies examining the association between PE and ED behaviours in adulthood have produced mixed findings. One study found a negative association (Ellis et al., 2018), suggesting that individuals who exhibit PE behaviours may maintain a low weight which makes them less likely to develop weight and shape concerns associated with EDs. Another study found no association, indicating that there may be no direct relationship between the two constructs (Zickgraf et al., 2017). However, five studies found some degree of overlap between PE and ED

behaviours in adulthood (Wildes et al., 2012; Ellis et al., 2017; Barnhart et al., 2021; He et al., 2020; Kauer et al., 2015). It is important to consider the four facets of PE defined in the APEQ (Ellis et al., 2017) that contribute to this overlap, as some studies found associations with some but not all PE facets, such as meal presentation and meal disengagement. It is also worth noting that the overlap between PE and ED behaviours in adults did not necessarily indicate a clinical diagnosis of an ED, suggesting that PE can be a distinct eating pattern separate from the pathology of EDs. These results highlight the complexity of the relationship and suggest that PE can exist both as a distinct eating pattern and co-occur with ED behaviours in certain cases.

One possible explanation for these inconsistencies is that cross-sectional studies may not adequately capture the temporal relationship between PE and ED behaviours. For instance, when positive associations were found, we did not know whether PE preceded or followed ED behaviours. Another factor that may contribute to the inconsistency in findings is the definition and measurement of PE and ED behaviours. Different studies used different criteria and instruments to assess these constructs, which may affect the prevalence and severity of these behaviours in the sample. Moreover, due to the lack of clear diagnostic criteria for ARFID and overlapping symptomatology with PE, certain studies might have inadvertently included individuals with ARFID within their PE profiles. Including individuals with ARFID in PE profiles raises interesting considerations in the literature as researchers have reported different cases where adolescents presented with both sensory-driven ARFID and traditional ED symptoms, suggesting an overlap between ARFID and EDs behaviours (Becker et al., 2020). They hypothesised that a combination of factors, including shared characteristics between both constructs, may contribute to the development of EDs in individuals with ARFID (Becker et al.,

2020). For instance, individuals with ARFID who have heightened sensory sensitivity may react with disgust to some foods, which could potentially generalise to body shape concerns during an important transition like adolescence (Thomas et al., 2020). Additionally, individuals with ARFID may demonstrate a cognitive thinking style characterised by rigidity and detailed processing, contributing to a lack of dietary flexibility. This cognitive style is also implicated in the pathogenesis of Anorexia Nervosa (Becker et al., 2018).

It is also important to note that some studies grouped individuals into different profiles, including a picky eater profile, and compared the profiles on different measures, including ED behaviours. Therefore, the results were likely to be influenced by the profiles they were compared to. For example, one study compared picky eaters to a comorbid profile (PE and disordered eating) and a disordered eating profile (Wildes et al., 2012) whereas another study compared picky eaters to severe picky eating, approaching and moderate eating profiles (He et al., 2020).

While some cross-sectional studies have found positive associations between PE and ED behaviours, longitudinal studies suggest that PE may not be a significant risk factor for the development of EDs in most cases and when positive associations were found, the effects were small. One study found that children with transient or persistent PE had a 2% risk increase for anorexia nervosa at age 16 compared to children with no PE (Herle et al., 2020). However, there is a lack of clarity about the underlying mechanisms of this association. One potential explanation is that rigidity around food, as measured in PE, may be associated with ED patterns, or may mediate the relationship between PE and ED behaviours. Rigidity may serve as an

overlapping symptom between PE and anorexia nervosa which might explain why PE increased the risk of developing anorexia nervosa in adolescence. Individuals who experience aversion to a wide range of foods may be more susceptible to developing anorexia nervosa behaviours in response to distress, compared to those with a natural affinity for food. Therefore, further research is needed to investigate the potential role of PE as a risk factor for EDs.

There are several possible reasons why prospective studies have found weak associations between PE and ED behaviours. One possible explanation is that PE and ED behaviours are distinct constructs with different underlying mechanisms. PE is commonly defined by FN, sensory sensitivity, and limited food variety, whereas EDs involve more intricate psychosocial and cultural factors (Jacobi et al., 2008). The development of an ED is likely influenced by a combination of risk factors beyond PE alone, such as genetic predisposition, environmental factors, body image concerns, perfectionism, low self-esteem, and societal pressures (Jacobi et al., 2004). These factors may interact with PE tendencies, but the relationship is not strong enough to lead to a significant risk increase for most individuals. Moreover, as mentioned above, the level of severity and persistence of PE and the inclusion of ARFID may influence the association with EDs. Future research could explore these nuances and examine the effects of different categories of PE and ARFID on EDs to better understand the potential risk factors and mechanisms involved. Another potential explanation for the lack of strong associations is that the time lag between the assessment of PE and the onset of EDs is too long to capture the dynamic and complex relationships between these behaviours. Longitudinal studies also used different cut-offs or criteria to define ED symptoms or relied on self-reported measures that are subject to biases and inaccuracies. Therefore, longitudinal studies, with clearer and consistent definitions of

PE, ARFID and ED behaviours, are needed to explore the underlying mechanisms between childhood PE and ED behaviours in adolescence.

Overall, studies tend to find positive associations between PE beyond childhood and mental health correlates such as social eating anxiety, depression, anxiety symptoms, psychological distress, and QOL/psychosocial impairment. However, there were some unexpected findings for associations with mental health correlates.

While cross-sectional studies tend to find a positive association between PE and social eating anxiety, one qualitative study offered different insights. In this study, some autistic individuals with PE expressed concerns about PE in social situations, whereas others did not and had already developed strategies to cope with these situations (Folta et al., 2020). One possible explanation is that many autistic individuals have been developing general coping strategies since childhood and may be successful in implementing them when it comes to PE-related anxiety. However, these findings only represent a small number of people in the autistic population, and the results cannot be generalised to the broader autistic community or general populations. Further studies are needed to explore associations between PE and psychosocial factors in general and specific populations to understand whether certain populations are more vulnerable to encountering adverse psychosocial effects.

Moreover, while cross-sectional studies mainly found PE to be positively associated with identity-related difficulties, one qualitative study found that for some individuals, PE was a significant part of their identity and affected them negatively whereas for others it was not

problematic (Thompson et al., 2015). This study highlights that although individuals with PE may have common dietary preferences, the way they perceive their identity may vary.

These findings underscore the importance of considering individual experiences and perspectives when examining the relationship between PE and psychosocial factors such as social eating anxiety and identity-related difficulties. They suggest that the impact of PE on social anxiety and identity is not uniform across all individuals with PE habits. Factors such as personal coping strategies, social support networks, self-perception, and contextual influences may contribute to the diverse experiences and perceptions of individuals with PE tendencies. Future research could delve further into understanding the factors that differentiate those who perceive PE as a significant part of their identity and experience related difficulties such as social eating anxiety from those who do not. Exploring the underlying mechanisms and contextual factors that shape the relationship between PE and social anxiety and identity-related difficulties would provide a more comprehensive understanding of the diverse experiences within the PE spectrum as well as tailored prevention and intervention strategies for individuals navigating the complexities of PE, social anxiety, and identity-related difficulties.

The results for OCD symptoms were varied. Overall, studies did not find positive associations between OCD symptoms and PE behaviours, except when PE and ARFID co-occurred or when OCD symptoms were compared to low pathology profiles. However, in comparison to other profiles, individuals with PE exhibited the lowest levels of OCD symptoms. This suggests less of an overlap between OCD symptoms and PE behaviour however, a

diagnosis of ARFID might be more strongly correlated with OCD symptoms. Further research should investigate the relationship between PE, PE with ARFID and OCD symptoms. Interestingly, one study found a significant association between PE and OCD in adults (Kauer et al., 2015). It may be the case, for instance, that PE is a behavioural expression of heightened OCD traits found in the PE subsample. In other words, the rigid and ritualistic behaviours associated with OCD may manifest as selective eating habits in individuals with PE. Another explanation is that PE and OCD symptoms may share underlying risk factors, such as behavioural or cognitive rigidity, which could contribute to the co-occurrence of these conditions. However, the directionality of this relationship needs to be established. Further investigation is necessary to determine the causal relationship and underlying mechanisms between PE and OCD.

Overall, PE was positively associated with psychological distress and negatively associated with QOL and impairment. However, one study reported that participants with ARFID reported higher distress and impairment levels compared to both typical eaters and picky eaters without ARFID, and similar levels to those in the disordered eating profile (Zickgraf et al., 2017). These results suggest that PE may not be associated with high levels of impairment unless it co-occurred with symptoms of ARFID. Interestingly, none of the other reviewed studies examined the differences between PE and PE with ARFID in terms of their associations with psychosocial correlates. However, as mentioned above, individuals with ARFID may have been included in the broader PE profiles in some of the reviewed studies, which could have influenced the findings. It should be noted that during the data collection of most studies, ARFID was a

relatively new clinical concept that was not differentiated from other forms of PE. Moreover, one study included a severe PE profile but did not specifically identify this profile as individuals with ARFID (He et al., 2020). Therefore, it is not possible to draw conclusive assumptions about whether the associations with correlates in the severe PE profile could be similar to those observed in individuals with ARFID. Further research is needed to establish the strength of the relationship between PE, PE with ARFID and impairment.

The literature on ARFID, although limited, found consistent associations with undesirable psychosocial correlates. Studies found that children and adolescents with ARFID were more likely to present with symptoms of generalised anxiety disorder (Norris et al., 2014) and OCD (Herpertz-Dahlmann, 2017). They may also exhibit ED behaviours such as restrictive eating patterns, fear of weight gain and body dissatisfaction (Strandjord et al., 2015; Fischer et al., 2014). Other findings indicate that in a sample of children and adolescents with full and subthreshold ARFID, the severity in the sensory-driven ARFID subtype was associated with an increased likelihood of current and future development of neurodevelopmental, disruptive and conduct disorders as well as anxiety, OCD and trauma-related disorders (Kambanis et al., 2020). The severity of the sensory sensitivity profile was also linked with co-occurring depressive and bipolar-related disorders (Kambanis et al., 2020). These results align with a study that found higher rates of depressive and anxiety symptoms among individuals with ARFID compared to the general population (Zickgraf et al., 2019). These results underscore the significant implications associated with the ARFID profile linked to PE. Therefore, further research is

needed to clarify whether the psychosocial correlates associated with ARFID are distinct from those associated with PE.

One strength of this review was that it ensured that relevant studies were included by using appropriate search terms and multiple databases, therefore reducing the risk of publication bias and providing a comprehensive overview of the topic. In addition, there were clearly defined inclusion criteria to select the studies. The criteria included participants with ARFID to minimise the exclusion of valuable information. Moreover, although we looked at PE specifically, we did not omit synonym terms used in the literature such as food neophobia, fussy eating, and selective eating among others. Another strength is the use of the MMAT to critically appraise the studies and identify any potential biases or limitations that could influence the findings.

However, most of the studies on PE in adolescence and adulthood were cross-sectional and thus did not provide results on PE outcomes in the long term. Inferences of causality could not be made. Upon reflection on our results, it is plausible that for example, rigid food rules that manifest from ED behaviours or OCD traits lead to PE behaviour. The directionality of relationships between PE and psychosocial correlates should be further explored. Moreover, although we included adolescents in this review, only three out of 17 studies investigated this age group. It would be interesting to look at associations between childhood PE and psychosocial factors at two time points beyond childhood, both in adolescence and adulthood. Longitudinal studies are needed to establish the directionality of the relationship between PE and psychosocial factors as well as the strengths of these associations in adolescence and adulthood.

Other limitations include only reviewing papers published in English. We might have excluded valuable research done in different countries and cultures. This is an important consideration as PE might be defined in a different way across food cultures which might affect associations with psychosocial correlates. Moreover, dissertations, conference proceedings and case studies were excluded to facilitate the systematic search however, we might have missed some research by doing so. Also, due to time and resource constraints only two databases (PsycInfo and Medline) were used to do the systematic search and an independent rater was not available to ensure the reliability of the appraisal of studies using the MMAT. Furthermore, definitions of PE, methods used to assess PE and psychosocial correlates and study designs varied between the 17 studies, which made synthesis complex.

Research implications and clinical recommendations

In summary, the reviewed studies suggest a positive association between PE and psychosocial correlates, particularly mental health correlates. However, some gaps in the literature were identified. Further research is needed to establish a clear definition and assessment method of PE to be able to consistently compare psychosocial correlates across studies and decrease the complexity and confusion of research in the field. Further research is also needed to establish causality and understand the mechanisms underlying these associations. The relationships between PE and ED patterns and PE and OCD symptoms require further investigation. Longitudinal studies are necessary to explore the directionality of these relationships and to determine whether PE is a risk factor for disordered eating or whether these behaviours are part of a larger pattern of rigid or avoidant behaviours. Additionally, the

differences between PE and PE with ARFID on ED behaviours, mental health correlates and identity-related difficulties are still unknown. Further research needs to be conducted to assess different associations between PE, PE with ARFID and psychosocial correlates.

Since the presentation of PE may differ between individuals, one clinical recommendation would be to conduct individualised assessments of PE, ARFID symptoms and the broader range of psychosocial factors. These assessments should be conducted at multiple time points, starting from a young age and involving parents or caregivers, to gain a comprehensive understanding of the individual's specific needs. By tailoring interventions based on these assessments, healthcare professionals can address the underlying issues in the context of PE and determine whether they are related. Continuing these assessments over time is crucial as the severity of PE and its correlates can vary. By maintaining regular evaluations, clinicians can track the progress and identify any changes in symptoms, psychosocial factors, or overall treatment needs. This ongoing assessment approach allows for timely adjustments to the intervention strategies and ensures that the individual receives appropriate support throughout their development.

Furthermore, it is important to address the underlying issues associated with PE. This may involve exploring the individual's relationship with food, sensory sensitivities, anxiety, social factors, and other relevant psychosocial aspects. By understanding the unique challenges and factors contributing to PE, clinicians can develop targeted interventions that focus on promoting healthy eating behaviours, addressing emotional well-being, and improving the overall quality of life.

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Part 2: Empirical Paper

Investigating the Psychosocial Outcomes of Childhood Picky Eating in Adolescence: A Longitudinal Study

Abstract

Aim. This study aimed to explore whether persistent picky eating in childhood is associated with negative psychosocial outcomes in adolescence such as lower school engagement and enjoyment and friendship quality.

Methods. Using data from the Growing Up in Scotland longitudinal research survey, PE was assessed by 3 parent-report questions spread across three time points. Participants who had complete data on the three PE questions were included (n= 2930). To increase validity,

exploratory factor analysis was conducted on our outcome scales measuring school engagement and enjoyment, and friendship quality. We used hierarchical multiple linear regressions to investigate the associations between transient and persistent PE and friendship quality and school engagement and enjoyment, adjusting for potential confounders.

Results. Neither transient nor persistent picky eating in childhood was associated with poorer friendship quality and lower school engagement and enjoyment in adolescence. Being female and having recent health conditions were associated with friendship quality whereas household income was associated with school engagement and enjoyment.

Conclusion. These findings highlight the fact that factors other than PE status may have a stronger influence on friendship quality and school engagement and enjoyment in adolescence. However, efforts should be made to increase the generalisability of results and capture the difference in influence between transient PE, persistent PE, and ARFID on psychosocial outcomes. Adolescents who are exposed to PE and other factors associated with negative psychosocial outcomes may benefit from individualised assessments and interventions.

Investigating the Psychosocial Outcomes of Childhood Picky Eating in Adolescence: A Longitudinal Study

Introduction

The definition of picky eating (PE) lacks universal consensus, but it is often described as a pattern of behaviour characterised by a limited acceptance of food variety and the avoidance or rejection of certain foods based on their sensory properties (Dovey et al., 2008). This includes

behaviours such as avoiding new or unfamiliar foods, also known as food neophobia (FN), avoiding strongly disliked foods, and relying on a narrow range of preferred foods that vary slightly in their preparation and/or presentation (Dovey et al., 2008; Taylor et al., 2015; Wildes et al., 2012; Zickgraf & Schepps, 2016). From this point forward, the term 'PE' will be used as an inclusive construct to encompass all variations of selective eating behaviours mentioned in the definition, including but not limited to FN and other synonymous terms such as selective, choosy, and faddy eating.

PE and FN are common behaviours in childhood and can be part of typical development (Dovey et al., 2008). PE typically resolves without significant intervention from healthcare professionals (Taylor et al, 2015). However, for some children, it persists into later childhood and adolescence and can often negatively impact family relationships (Goh & Jacob, 2012; Taylor et al., 2015). As argued in Part One of this thesis, the literature suggests that when PE persists, it may lead to longer-term health and development issues. In some cases, PE can potentially develop into a set of symptoms and impairments that warrant a diagnosis of avoidant/restrictive food intake disorder (ARFID; Cardona Cano et al., 2015). According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5; American Psychological Association, 2013), ARFID is characterised by restrictive eating patterns that are not driven by weight or shape concerns. These patterns can result in weight loss, nutritional deficiencies, reliance on nutritional supplements, and/or impaired psychosocial functioning (American Psychological Association, 2013).

Some studies have explored the prevalence and patterns of PE throughout childhood. However, the absence of a universally recognised definition of PE among researchers and the

absence of an established and validated method for identifying PE make it challenging to compare study results effectively. The prevalence estimates for PE range from 6 to 50% in different studies (Taylor et al., 2015). This wide range is likely to reflect differences in definitions of PE, assessment methods, and study designs but may also be partly due to social and/or cultural factors as well as the age of the participants.

There is more consensus regarding the association between PE prevalence and the age of the child. A general population cohort study looked at the trajectories of PE during childhood, at 1.5, 3 and 6 years old. Researchers found that PE peaked at the age of 3 with a prevalence of 27.6% which declined to 13.2% at the age of 6 (Cardona Cano et al., 2015). Another longitudinal study examined the course of PE until age 10 (Bourne et al., in press). They defined transient picky eaters as children who are picky at ages 2 and/or 5 but not picky at age 10 and persistent picky eaters as children who are picky at ages 2 and/or 5 and still picky at age 10. They found that 23.3% of children were identified as transient picky eaters and 3.7% as persistent picky eaters (Bourne et al., in press). These findings support the view that PE is common in early childhood (3 to 6 years) and that it is a transient phase of normal development for most children. The findings also show that there are some children whose picky eating behaviours do not resolve naturally (Cardona Cano et al, 2015; Carruth et al, 2004; Marchi & Cohen, 1990). Therefore, it is useful to identify factors that predict different trajectories of PE, to identify who may be at risk of persistent PE.

To date, there has been some investigation of family and child factors which predict PE. In this section, we discuss the risk factors of PE to provide context for our selection of confounding variables used in our study (See Confounders in Methods). Feeding difficulties in

the child's first year and late introduction of lumpy foods at weaning were identified as risk factors for being a picky eater at 3 years old (Taylor & Emmett, 2019). Moreover, being picky at 15 months old predicted being a picky eater at 3 years old, especially if the mother had concerns about her child's PE behaviours (Taylor & Emmett, 2019). One systematic review identified several potential correlates of PE in young children such as certain feeding practices (Cole et al., 2017). They found that pressure to eat from parents was positively associated with PE whereas providing a child with a variety of healthy foods and allowing them to make their own food choices were found to be negatively associated with PE. This study also reported that children with a heightened awareness of sensory stimuli were more likely to be picky eaters (Cole et al., 2017). Cardona Cano and colleagues defined persistent PE as being picky at ages 1.5, 3 and 6. They identified that being male, having a lower birth weight, having a non-Western maternal ethnicity, and having low parental income were risk factors for persistent PE (Cardona Cano et al, 2015). However, measuring persistent PE at age 6 may be considered relatively early. To identify persistent PE, it would be beneficial to measure it at a later time point, ideally as children become adolescents. According to the World Health Organisation, adolescence starts at age 10 (World Health Organisation, 2022).

Bourne et al. (in press) defined transient PE as being picky at 2 and/or 5 years old and persistent PE as being picky at 2 and/or 5 years old as well as at 10 years old. This longitudinal study looked specifically at factors that predict different trajectories of PE. They found that children born to young mothers, those from minority ethnic backgrounds, those born later than their due date and those with feeding concerns between 0-3 months were at an increased risk of experiencing transient PE. They also found that males, children from lower-income families,

those whose mothers smoked during pregnancy and those born with medical intervention had an increased risk of persistent PE. Moreover, being diagnosed with autism spectrum disorder (hereafter, autism) and reporting feeding problems at 9-12 months were also associated with a greater risk of persistent PE (Bourne et al., in press).

Correlates and Outcomes of PE

It is important to note that most studies that investigate psychosocial associations with PE are cross-sectional in nature. Therefore, when referring to these studies, the term 'correlates' will be used instead of 'outcomes' to reflect the fact that these studies cannot establish causality, or even directly predict the future well-being and functioning of children with PE. Cross-sectional correlates refer to factors that are associated with PE behaviours at a single point in time, while future correlates/outcomes refer to the potential consequences of PE behaviours that may manifest over time.

Although there is a greater body of literature on the correlates of PE in childhood compared to adolescents and adults, there is inconsistent evidence on the correlates of PE across all age groups. This may be attributed to variations in the definitions and measures of PE, and differences in feeding practices and cultural factors (Taylor & Emmett, 2018). Other factors that may differ across development and potentially explain the inconsistent evidence across age groups include individual nutritional needs, autonomy and control over food choices, peer and family dynamics and media influence.

In the literature on PE in childhood, it is hypothesised that PE could lead to reduced food intake and variety, both of which are usually included in the definition of PE. The evidence for these associations is inconsistent, however, studies have consistently reported that children who

are picky eaters have a lower intake of fruits and vegetables (Jacobi et al., 2003; Volger et al., 2013; Taylor & Emmett, 2018).

For some children, PE can be associated with a higher risk of being underweight and having poor growth during adolescence (Cardone Cano et al., 2016; Dubois et al., 2007). Investigations of PE in childhood and the subsequent development of disordered eating behaviours have found inconsistent results. Some studies reported that PE in childhood increases the risk of developing an eating disorder, such as anorexia nervosa, in adolescence and adulthood (Marchi & Cohen, 1990; Herle et al., 2020) whereas other studies have found no associations between PE in childhood and the development of eating disorders later in life (Van Tine et al., 2017; Kotler et al., 2001; Pesch et al., 2020).

Moreover, while some research found an association between PE and being overweight in childhood (Taylor & Emmett, 2018), other studies found that PE in childhood may be protective against being overweight and obese (Antoniou et al., 2016; Taylor et al., 2019) which was confirmed in a meta-analysis in individuals up to 18 years old (Brown et al., 2016).

As mentioned in Part One of this thesis, investigations into PE during childhood have also focused on mental health correlates such as anxiety, depression, and social anxiety symptoms. Studies have found that depression and anxiety symptoms are linked to PE during childhood (Zucker et al., 2015; Mascola et al., 2010). However, more recent research has suggested that these results may not be consistent when controlling for other types of restrictive eating behaviours (Zickgraf & Ellis, 2018). Additionally, a separate study has indicated that some children who experience PE may face difficulties in their relationships with peers due to ridicule over their eating habits (Bryant-Waugh, 2013). Building upon these findings, exploring

these associations in an older age group could provide insights into the potential continuity or changes in the psychosocial factors associated with PE as individuals transition from childhood to adolescence and adulthood.

Researchers have examined associations between PE and various dietary and psychosocial factors in adulthood, as previously studied in childhood. Studies have found a negative correlation between PE and the consumption of fruits and vegetables as well as variety in diet (Ellis et al., 2018; Zickgraf & Schepps, 2016), suggesting that PE in adulthood and childhood may share similar dietary patterns.

Furthermore, research has explored psychosocial factors associated with PE beyond childhood, such as eating disorders symptoms, depression, anxiety, and social anxiety symptoms, quality of life, clinical impairment, and identity-related difficulties (Dial et al., 2021; Barnhart et al., 2021; He et al., 2020; Ellis et al., 2018; Herle et al., 2020; Pesch et al., 2020). PE in adulthood was linked to higher levels of impairment, distress, anxiety, and depression symptoms compared to individuals with no PE (He et al., 2020; Ellis et al., 2018). However, other studies found no associations between PE in adulthood and negative psychosocial factors such as impairment (Wildes et al., 2012).

PE has also been linked to social eating anxiety in adulthood, but the results are mixed. While some studies found that adults with PE reported more social anxiety symptoms than non-picky eaters (Dial et al., 2021; Wildes et al., 2012; Barnhart et al., 2021; Ellis et al., 2018), one study found that autistic young adults did not report that their PE had a negative effect on their engagement in social interactions (Folta et al., 2020).

The results are also inconsistent for associations between PE and identity-related difficulties in adults. While some individuals associated their PE behaviours with ‘otherness’ and low self-esteem, others did not strongly identify with the PE label and may not be as affected by it (Dial et al., 2021; Thompson et al., 2015).

Recent studies have distinguished between adult PE and ARFID when exploring their associations with psychosocial factors beyond childhood. The researchers recruited a sample of adults who self-identified as picky eaters and then screened them for the presence of ARFID using the DSM-5 criteria. Participants who did not meet these criteria were categorised as picky eaters whereas participants who did were categorised as picky eaters with ARFID. They found that individuals reporting both PE and ARFID symptoms experience higher levels of distress than those who only reported PE (Zickgraf et al., 2017).

The findings above suggest that there are links between PE and psychosocial factors in both childhood and adulthood. However**,** one area that has received limited attention in the literature is the link between PE and psychosocial outcomes in adolescence. Adolescents with PE habits may experience poorer mental health outcomes, such as higher levels of anxiety and depression (Emond et al., 2015; van der Horst et al., 2018). Adults with PE may find it anxiety-provoking to eat at a restaurant or explain their PE to others (Thompson et al., 2015). Drawing from these findings, adolescents with PE may feel anxious about food-related events in social settings such as school, which can contribute to a reduced sense of school enjoyment. Individuals with PE can eat less or not at all outside of the home which can include the school setting and food-related events such as lunch breaks, school events, or peer gatherings (Dial et al., 2021;

Thompson et al., 2015). This may lead to feelings of isolation and exclusion thus lower school engagement and enjoyment. Adults with PE may feel a sense of being different from other people (Thompson et al., 2015). This may also be the case for adolescents which further contributes to isolation and exclusion thus lower school engagement and enjoyment. Challenges in food-related events may be associated with limited participation in social interactions which may lead to lower friendship quality (Dial et al., 2021). Anxiety and depression can be associated with social withdrawal which leads to reduced social interactions, and potentially to lower friendship quality (Rubin & Burgess, 2001). Adolescents who persistently avoid certain foods may also experience social exclusion or criticism from peers and teachers, which could contribute to experiences of being bullied (Hartman et al., 2010). Some adolescents reported that their PE has made them 'less acceptable' to their peers and as a result, were bullied by them (Zohar, 2022). Adolescents with PE behaviours may be perceived negatively by others, who may view it as a sign of being different and difficult with their food choices which may lead to social stigmatisation and teasing from others.

There is also small but growing attention on the impact of ARFID on adolescents. Nicely et al. (2014) found that a diagnosis of ARFID was associated with lower food intake thus leading to a smaller stature. This may lead to bullying from peers and poor mental health outcomes, therefore, lower quality friendships and school engagement and enjoyment (Nicely et al., 2014). Another case study reported similar effects that were experienced by a 15-year-old boy with ARFID. These included bullying from peers due to his small stature and not being allowed to eat his preferred foods with others which led to further social isolation (Davis & Stone, 2020).

Adolescence is a critical developmental stage marked by rapid physical, cognitive, and emotional changes and a time when individuals are particularly susceptible to the influence of social and environmental factors (Viner et al., 2012). Research has consistently shown that teenagers who have close friendships during adolescence tend to experience better mental health outcomes in young adulthood (Bagwell et al., 2005; Buhrmester & Furman, 1986; Sullivan, 1953). While high-quality friendships in adolescence are associated with enhanced well-being (Demir & Urberg, 2004; Raboteg-Saric & Sakic, 2014), low-quality friendships are associated with symptoms of anxiety and depression (Demir & Urberg, 2004; Raboteg-Saric & Sakic, 2014). Moreover, school engagement is strongly and consistently associated with both health-promoting and risky behaviours (Carter et al., 2007). Specifically, adolescents with higher levels of school engagement were significantly less likely to report behaviours such as smoking, excessively drinking alcohol, drug use, violent behaviour, and depression symptoms (Carter et a., 2007). In contrast, they reported taking care of their health with better nutrition, exercise, and safe sex practices (Carter et al., 2007). A retrospective study found that higher school engagement was associated with higher adult educational achievement and occupation level (Abbott-Chapman et al., 2013). Research has also found that bullying at school may have an impact on both adolescence and adulthood (Wolke & Lereya, 2015). Experiences of bullying were found to be associated with adolescents' mental health such as anxiety, depression, suicidality and sleeping problems. Bullying was also found to have negative effects on health, occupational and social factors in adulthood such as anxiety, suicidality, a lower income, and a reduced social support network (Wolke & Lereya, 2015)

As such, investigating friendship quality, school engagement and enjoyment and bullying experiences is important due to: (i) them being plausible adolescent sequelae of persistent PE and (ii) their influence on overall well-being and development. These outcomes are important not only in their own right, but also because they have been linked to a range of negative life-course outcomes, including lower educational attainment, reduced job prospects, and increased risk of mental health problems (Masten et al., 2005; Kessler et al., 2010; Piquero et al., 2012). It is therefore important to assess these outcomes during adolescence, as they provide insights into the social, academic, and emotional well-being of adolescents who were persistent picky eaters in childhood and shape their pathway to adulthood and multiple life-course problems.

The literature suggests that PE beyond childhood is a behaviour that may be negatively associated with overall health, mental health, and well-being. The mixed findings in the literature make it difficult to draw robust conclusions regarding PE associations with psychosocial factors**.** To date, most of the studies on correlates and outcomes of PE focus on either children or adult populations, do not differentiate between transient and persistent PE, are cross-sectional in nature and have mainly examined the physical health outcomes of being a picky eater, such as nutrient deficiencies and impaired growth (Dovey et al., 2008; Mascola et al., 2010; Dubois et al., 2016). While these findings are certainly important, they do not provide a comprehensive picture of the impact that PE can have on the development and well-being of young people as they transition from childhood to adulthood.

Therefore, by identifying whether there are forms of PE associated with poor psychosocial outcomes at an older age, researchers will be able to create specific targets for

prevention and intervention that aim to improve mental health, school engagement and well-being for the young person as well as useful guidance for parents and caregivers.

In the Growing Up in Scotland dataset that we used in this study, there were no validated scales representing our three outcomes of interest (school engagement and enjoyment, friendship quality and bullying experiences), however, participants were asked to answer questions related to these constructs. The first aim of the study was to conduct an exploratory factor analysis to derive scales from individual questions related to our outcomes of interest (see Methods for details).

The second aim of the study was to explore whether being a persistent picky eater in childhood was associated with negative psychosocial outcomes in adolescence such as lower school engagement and enjoyment, lower friendship quality and higher bullying experiences. We hypothesised that being a persistent picky eater in childhood would be associated with lower school engagement and enjoyment and friendship quality and higher bullying experiences compared to transient picky eaters and those without PE. We also hypothesised that being a transient PE would not be associated with these negative psychosocial outcomes.

Methods

Sample

Participants included in this study are from the Growing up in Scotland (GUS) birth cohort 1 (BC1) which is a cohort of families with children born between June 2004 and May 2005. GUS is a national longitudinal research study, tracking the lives of children and their

families from birth, throughout childhood and adolescence. The study aims to provide new information on different topics relevant to children and their families such as development, well-being, social factors, and behaviours. The families are selected at random from Child Benefit records provided by HM Revenue and Customs. Families from every Local Authority area in Scotland receive a letter inviting them to take part in the study and it is entirely voluntary.

Specifically, BC1 is a nationally representative sample where data was collected annually starting when children were 10 months old (n = 5217) until 6 years old and then biennially. Participants were between 13 and 14 years old at the most recent data collection wave.

Using the same cohort as Bourne and colleagues' (in press), PE was measured using the same methodology. PE was assessed by three parent-report questions spread across three time points (one question when children were 2 years old, one when they were 5 years old and one when they were 10 years old, see Measures for details).

To address the first aim of the study, we used a sample of n = 5101. Similarly to Bourne et al.'s sample (in press), this sample included participants whose main respondent was the birth mother as several variables in the study were related to pregnancy and birth, and therefore, were most reliably taken from those who had given birth to the study child. The sample also included children who were going to school at age 13 as several outcome and confounding variables relied on this data (n = 5101). To address the second aim of the study, analyses were conducted on participants who had complete data for the three PE questions (n = 2930).

The data collection process initially underwent medical ethical review by the Scotland 'A' MREC committee (application reference: 04/M RE 1 0/59). From sweep 1 to sweep 8, subsequent annual sweeps were reviewed through substantial amendments submitted to the same

committee. Sweeps 9 and 10 underwent ethical review by the NatCen Research Ethics Committee, a non-profit social research organization that conducts research on behalf of government bodies and delivers the survey. Further details on the GUS cohort are available on their website (Growing Up in Scotland, n.d).

Measures

Picky Eating

Since there is no universally accepted definition or measure of PE (Taylor et al., 2015), transient and persistent PE were defined based on how Bourne et al. (in press) operationalised them. Parent-report data from Sweeps 2, 5 and 8 were used to assign children to one of three mutually exclusive categories of picky eating: (i) no picky eating; (ii) transient picky eaters and (iii) persistent picky eaters.

At ages 2 (sweep 2) and 5 (sweep 5), parents were asked to describe the variety of foods their child generally eats. The response options were "(1) Eat most things, (2) Eat a reasonable variety of things, or (3) is she/he a fussy eater?" A similar question was previously used to assess PE by Mascola et al. (2010). At age 10 (sweep 8), the question used to assess PE at sweeps 2 and 5 was not asked. To capture persistent PE, a question based on the reliance on preferred foods and FN elements in PE definition was used instead. It also draws on the definition of PE posited by Dubois et al. (2007). Parents were asked if the child is served different food from adults at main meals. The response options were "(1) Never, (2) Occasionally, (3) Quite often, or (4) Mostly".

Children were defined as transient picky eaters if they were considered picky at either sweep 2 or 5 (or both), but not at sweep 8 (If the parents answered (3) on questions 1 and/or 2 and (1) on question 3). Persistent picky eaters were those who were fussy at either sweep 2 or 5 (or both) and at sweep 8 (If the parents answered (3) on questions 1 and/or 2 and (4) on question 3. All remaining children were defined as unexposed (no picky eating).

Outcomes

We sought to measure friendship quality, bullying experiences and school engagement and enjoyment as outcomes. These constructs were not assessed using standardised measures in the GUS dataset. However, a series of questions were asked of young people that map onto these outcomes of interest, collected via self-report interviews at age 13 (sweep 10; see Appendix G for details). To ensure the validity and accuracy of our measurements, we conducted an exploratory factor analysis (EFA) to derive scales from these self-report interview questions that we aimed would map onto our outcome constructs of interest, namely school engagement and enjoyment, friendship quality and bullying experiences (see Data Analysis for details).

Confounders

We define confounders as factors which could be related to both PE and the outcomes. These included child sex, child ethnicity, household income and maternal education level as socioeconomic status (SES) indicators (Rashid et al., 2020), the presence of an autism diagnosis, the presence of long-standing health conditions, the presence of recent health conditions and feeding challenges between 9-12 months (Bourne et al., in press). We also included pre-natal and

perinatal factors that were found to be associated with PE such as smoking during pregnancy and the type of delivery (vaginal or with medical intervention; Bourne et al., in press). Pregnancy and birth-related factors were included as confounders as they are broad spectrum risks which tend to be considered in studies relating to childhood eating behaviours (and generally, for most studies relating to childhood development). There are also studies that investigate the relationship between smoking during pregnancy and the development of PE as a child (Cardona Cano et al., 2015; Dubois et al., 2007; Taylor et al., 2015), as well as medical intervention/complications during delivery and the development of PE (Hafstad et al., 2013).

A measure of autism was aggregated at ages 5, 10 and 13 (sweeps 5, 8 and 10 respectively). Mothers were asked 'Has child additional support needs?' and if so, required to select from a list, with 'Autistic Disorder' as one option. Children whose mothers replied "yes" to this question at least once across the three sweeps were noted as having autism, providing that there were no contradictory responses thereafter. If mothers said "yes" and then "no" at a later sweep, autism was not recorded.

A measure of the total number of previous long-term health conditions was created at age 13 (sweep 10). Mothers were asked 'Does the child still have previous illness?'. This question was asked multiple times accounting for up to four illnesses recorded in the past sweep. Based on the responses to this question, a categorical measure was calculated to determine the total number of long-standing conditions that the child had experienced. Three categories were created; one to represent children who did not have previous illnesses, one for children who still had one and one for children who had two or more.

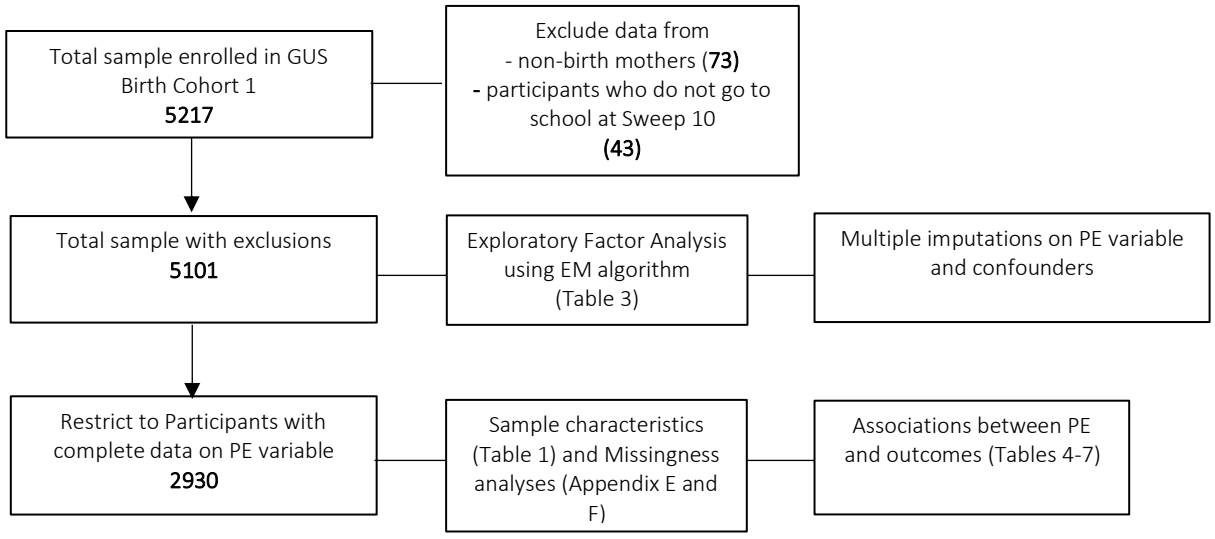
Similar to the measure for previous illnesses, a measure was created for the total number of new illnesses at age 13 (sweep 10). The data were categorised into three groups: none, one new illness, and two or more new illnesses. The question asked to capture this information was "Does the child have a new illness?".

Data analysis

All statistical analyses were completed using Stata release 17 (See Figure 1).

Figure 1

Flow chart of study participation and data analyses



Sample analysis

Sample characteristics were calculated using a sample of participants with complete data on the PE variables (n=2930). Sample characteristics were also calculated for individuals who have missing data on the PE variable. To determine whether they were any significant differences between those who have complete (n=2930) and missing data (n=2171) on the PE variable, odds ratios were calculated for binary and categorical variables (sociodemographic variables) and t-tests for continuous variables (questionnaire scales).

Exploratory Factor Analysis (EFA)

We investigated the factorial structure of our three outcome variables using a sample of 5101 participants (total sample excluding non-birth mothers and those who were not going to school). Adolescents were asked to respond to each of the 17 items listed in Appendix G using a 4 or 5-point Likert scale. We predicted that the 17 items would map onto three factors representing our outcome constructs of interest, namely school engagement and enjoyment, friendship quality, and bullying experiences.

The percentage of missing values for the 17 items ranged between 53-57 %. While there is some variation in the recommended cut-off for acceptable missingness, some guidelines suggest a threshold of 5% as the maximum limit (Schafer, 1999). Others suggest that 15-20% is common and that there are benefits of handling missing data when missingness is above 10% (Enders, 2003; Dong & Peng, 2013). Missing data may introduce bias and reduce the generalisability of the results (Rubin, 2004; Schafer, 1997). It may also lead to reduced information thus reducing statistical power (Peng et al., 2006).

To be able to conduct the EFA while handling missing data, the literature suggested an approach using maximum likelihood with the expectation-maximization (EM) algorithm. (Truxillo, 2005; Graham 2009; Weaver & Maxwell, 2014). This method allowed us to estimate the covariance matrix, which captures the relationship between variables and is a crucial component in conducting the EFA. The EM algorithm uses the available information in the observed data to estimate the covariance matrix and impute the missing values. It iteratively refines its estimates until it converges to a solution that maximises the likelihood of the complete data (Truxillo, 2005; Graham 2009; Weaver & Maxwell, 2014).

This covariance matrix was then used to conduct the EFA. An orthogonal varimax rotation was applied to clarify the factor structure and determine the number of latent factors present in the data (Kaiser, 1958). The number of factors was determined by an examination of factor eigenvalues. Factors were retained if they had an eigenvalue above 1 (Watkins, 2018). Any items that did not load at .40 or higher or cross-loaded on multiple factors (i.e., loaded ≥.40 onto more than one factor) were removed one by one through an iterative process, and the model was re-estimated (Guadagnoli and Velicer, 1988; Table 2). Uniqueness in Table 2 is the variance that is ‘unique’ to the item and not shared with other items thus the greater the ‘uniqueness’, the lower the relevance of the item in the factor model (Kim et al., 1978).

To evaluate the goodness-of-fit of the scales, we used the likelihood ratio (LR) tests which compare the independent model to the saturated model. The independent model assumes that there is no relationship or structure among the observed variables, while the saturated model represents a model where each observed variable is perfectly predicted by the latent factors. The chi-square test comparing the independent model to the saturated model assesses whether there is

a significant difference in fit between these two extremes (Hamilton, 2013).

Multiple Imputations and Hierarchical Linear Regressions

In our main analyses, we imputed missing data on our predictor and confounding variables, using multiple imputations by chained equations, imputing 50 data sets on the assumption that the data were missing at random (see Sensitivity Analyses below). Imputation models included all variables in the analyses as well as scores on the Strengths and Difficulties Questionnaire (Goodman et al., 1998), hypothesised to be associated with our outcomes, for more precision (Bryant et al., 2020).

Following the multiple imputations, we restricted the analyses to those with complete PE data. Three outcome variables were then generated, one representing a summed score of six individual questions that loaded onto our friendship quality factor in the EFA, one representing a summed score of five individual questions that loaded onto the school engagement and enjoyment factor and one representing a summed score of the four items that loaded onto the bullying experiences factor.

To investigate the association between transient and persistent PE and the three outcomes, namely friendship quality, school engagement and enjoyment and bullying experiences, we used hierarchical linear regressions. We first ran univariable models for our three outcomes. Subsequently, we ran multivariate models in blocks adjusting for potential confounders. The purpose of using this type of regression was to assess the unique contribution of each set of predictors to the prediction of the outcome variables. For instance, we started by adding demographic variables in three steps starting with child sex, child ethnicity, and SES

indexed by household income and maternal education level. We then added the presence of an autism diagnosis followed by the presence of long-standing health conditions and recent health conditions. We then introduced feeding challenges between 9-12 months. The last step was adding pregnancy-related factors such as smoking during pregnancy and the type of delivery.

Due to multiple testing, type I error rate increases which means there is a higher probability of finding significant predictors that are not, in reality, related to the outcome. To adjust for multiple testing, an alpha level of <.01 was considered significant in the univariable and multivariable linear regressions instead of applying the Bonferroni correction. The Bonferroni correction effectively reduces family-wise error by dividing the significance level alpha with the number of tests that are being run simultaneously (Perrett et al., 2006). However, this method is very conservative. The literature suggests that if there are many tests, the adjusted alpha from the Bonferroni correction can be smaller than required which increases the type II error rate (a higher probability of not finding significant associations when they are present; Perrett et al., 2006; Groenwold et al., 2021; Lee & Lee, 2018). To be less conservative without compromising statistical power, a more lenient alpha level of <.01 was considered significant.

Sensitivity Analyses

It is recommended to conduct sensitivity analyses after handling missing data in the main analyses to assess the robustness of results that are based on imputation (Sterne et al., 2009). We ran the EFA and univariable and multivariable linear regressions on a sample with complete data on all variables including PE status, outcome variables and confounding variables with the inclusion of non-birth mothers (n = 1795).

Results

Sample characteristics

5217 participants enrolled in GUS BC1. Following the removal of data from participants who were non-birth mothers (n = 73) and participants who did not go to school (n = 43), the total sample number was 5101. Of the 5101, 2930 (57.4%) had complete data on all PE variables and were included in our main regression analyses sample (Figure 1). Of these 2930 participants, 1489 (50.8%) were male and 2831 (96.7%) were white. Most mothers completed a bachelor's degree or any higher level of education (73.2%). Moreover, 1.9% of the participants were identified as having received an autism diagnosis (Table 1). In our sample, 687 (23.5%) children were identified as transient picky eaters and 109 (3.7%) as persistent picky eaters (Appendix D).

Table 1

Sample characteristics (participants with data on Picky Eating variable; n = 2930)

	n (%)*	Not picky	Transient picky	Persistent picky
Child sex				
Male	1489 (50.8%)	1064 (49.9%)	361 (52.6%)	64 (58.7%)
Female	1441 (49.2%)	1070 (50.1%)	326 (47.4%)	45 (41.3%)
Child ethnicity				
White	2831 (96.7%)	2074 (97.2%)	654 (95.3%)	103 (94.5%)
Other ethnic background	98 (3.3%)	60 (2.8%)	32 (4.7%)	6 (5.5%)
Mother's highest education level				
School with qualification	618 (21.2%)	418 (19.7%)	174 (25.5%)	26 (24.3%)
Degree or Higher	2135 (73.2 %)	1605 (75.5%)	460 (67.5%)	70 (65.4%)
No qualifications	162 (5.6%)	103 (4.8%)	48 (7.0%)	11 (10.3%)
Household income**				
Up to £11,999	69 (3.2%)	38 (2.4%)	24 (4.9%)	7 (9.5%)
£12,000 - £22,999	292 (13.6%)	194 (12.3%)	80 (16.3%)	18 (24.3%)

£23,000 - £31,999	250 (11.6%)	175 (11.1%)	63 (12.8%)	12 (16.2%)
£32,000 - £49,999	506 (23.6%)	378 (23.9%)	118 (24.0%)	10 (13.5%
£50,000 - £73,999	533 (24.8%)	414 (26.2%)	104 (21.1%)	15 (20.3%)
£74,000 or more	497 (23.1%)	382 (24.2%)	103 (20.1%)	12 (16.2%)
Smoking pregnancy				6
No	2382 (81.7%)	1778 (83.8%)	535 (78.1%)	9 (63.9%)
Yes (occasionally/always)	534 (18.3%)	345 (16.2%)	150 (21.9%)	39 (36.1%)
Type of delivery	1735 (59.6%)	1267 (59.9%)	412 (60.1%)	56 (51.4%)
Vaginal delivery				
With medical intervention	1176 (40.4%)	850 (40.1%)	273 (39.9%)	53 (48.6%)
How many previous illnesses does child still have?				
None	1892 (79.5%)	1411 (80.1%)	418 (76.0%)	63 (73.3%)
1	363 (15.3%)	250 (14.3%)	99 (18.0%)	14 (16.3%)
2+	124 (5.2%)	82 (4.7%)	33 (6.0%)	9 (10.5%)
How many new illnesses does child have?				
None	2083 (87.6%)	1540 (88.3%)	472 (85.8%)	71 (82.6%)
1	261 (10.9%)	183 (10.5%)	67 (12.2%)	11 (12.8%)
2+	35 (1.5%)	20 (1.2%)	11 (2.0%)	4 (4.7%)
Feeding problems 9-12 months				
Not a problem	2531 (86.4%)	1908 (89.4%)	536 (78.0%)	87 (79.8%)
A problem (a bit or big)	399 (13.6%)	226 (10.6%)	151 (22.0%)	22 (20.2%)

Does child have additional needs?				
(Autism)				
No				
Yes	2875 (98.1%)	2096 (98.2%)	676 (98.4%)	103 (94.5%)
	55 (1.9%)	38 (1.8%)	11 (1.6%)	6 (5.5%)

*Note. * n varies across variables due to missing data.*
***We display this categorical variable to present clear sample characteristics. A continuous variable is used in the regression analyses.*

Data Completeness Analysis

Appendix E shows a comparison of sample characteristics for participants with complete (n=2930, 57.4%) and missing data (n=2171, 42.6%) on the PE variable.

Participants with missing data were more likely to come from non-white-British ethnic backgrounds (OR: 1.78, 95%CI: 1.36-2.33) compared to participants with complete data. They were also more likely to have two or more previous health conditions (OR: 1.23, 95%CI: 0.65-2.35) and have one recent health condition (OR: 1.26, 95%CI: 0.84-1.91) compared to participants with complete data. Moreover, participants' mothers with missing data were more likely to have no educational qualification (OR:1.65, 95%CI: 1.32-2.06) and were more likely to smoke during pregnancy (OR: 2.08, 95%CI: 1.82-2.37) compared to participants' mothers with complete data.

There were no significant differences between participants with complete and missing data on the PE variable for any of the individual variables that were used to create the friendship quality, school engagement and enjoyment and bullying experiences variables (Appendix F).

Exploratory Factor Analysis

The EFA was conducted to examine the factor structure and assess the factor loadings of the original 17-item pool. Table 2 presents the factor loadings, uniqueness values, and the reason for item removal.

Initially, three factors were identified with three eigenvalues above 1.0. Factor 1 represented friendship quality (Items 7-12), Factor 2 represented school engagement and enjoyment (Items 1-6) and Factor 3 consisted of items related to experiences of bullying (Items 13-17). Items with low factor loadings (<.40) were removed from the analysis. There were no items with high cross-loadings across multiple factors (see Table 2 for details). Following the removal of items 6 and 17, the model was re-estimated.

In the final model, an examination of eigenvalues indicated that a three-factor solution provided the most acceptable fit, with three eigenvalues above 1.0. The EFA revealed a 15-item, three-factor solution with six items loadings onto factor 1, five items onto factor 2 and four items onto factor 3 (Table 3).

For the unrotated solution, factor 1 had an eigenvalue of 4.43, factor 2 had an eigenvalue of 1.84 and factor 3 had a value of 1.43. The proportion of variance explained by Factor 1, representing friendship quality, was 0.58 (i.e., 58% of the total variance). Factor 2, representing school engagement and enjoyment, explained a proportion of 0.24. Factor 3, representing bullying experiences, explained a proportion of 0.19. Factor loadings ranged from .44 to .82, indicating strong associations between the variables and the extracted factors.

The likelihood ratio (LR) tests were conducted to evaluate the goodness of fit. There was a significant difference in the test comparing the independent model to the saturated model $\chi 2(136) = 10{,}000$, $p<.005$. This suggests that the observed variables are related to each other through latent factors. There was also a significant difference in the test comparing the three-factor model to the saturated model $\chi 2(88) = 819.73$, $p<.005$. This suggests that the three-factor solution captures the underlying structure of the data better than the saturated model, indicating that the observed variables are more adequately represented by the three identified factors.

Table 2

Original item pool, three-factor EFA loadings, uniqueness and item removal

Item	Factor 1	Factor 2	Factor 3	Uniqueness	Reason for removal
1. I enjoy learning at school	.12	**.78**	.01	.39	
2.I look forward to going to school	.15	**.73**	.05	.45	
3. I hate school	.08	**.66**	.14	.50	
4. My teachers treat me fairly	.09	**.44**	.15	.78	
5. How often do you try your best at school?	.18	**.47**	.07	.74	
6. How often do you misbehave or cause trouble in class?	-.01	.36	.09	.86	Loading <.4
7. My friends listen to what I have to say	**.65**	.11	.22	.50	
8. Can count on my friends to help me	**.78**	.12	.17	.35	

when I have a problem					
9. I talk to my friends when I am having a problem	**.82**	.12	.01	.32	
10. If my friends know something is bothering me, they ask me about it	**.75**	.09	.09	.43	
11. I share my thoughts and feelings with my friends	**.78**	.15	.02	.36	
12. My friends pay attention to me	**.69**	.13	.24	.45	
13. How often do other young people pick on you by calling you names or making fun of you Bullying in a way that you don't like?	.12	.10	**.69**	.50	
14. How often do other young people pick on you by leaving you out of games and chats?	.22	.06	**.59**	.60	
15. How often do other young people pick on you by shoving, pushing, hitting or picking a fight with you?	.10	.08	**.64**	.68	
16. How often do other young people pick on you by sending messages or posting things about you online that you don't like?	.06	.11	**.60**	.63	
17. How often do you pick on others? (e.g. by calling them names, making fun of them, leaving them	.02	.12	**.39**	.83	Loading <.4

out of games and chats, shoving, pushing, hitting, or picking a fight with them, or sending messages or posting things about them online that you know they won't like)'.

Table 3

Final three-factor solution, factor loadings and uniqueness

Item	Factor 1 (Friendship quality)	Factor 2 (School engagement and enjoyment)	Factor 3 (Bullying experiences)	Uniqueness
1. I enjoy learning at school		.78		.38
2.I look forward to going to school		.75		.42
3. I hate school		.67		.53
4. My teachers treat me fairly		.42		.79
5. How often do you try your best at school?		.46		.76
6. My friends listen to what I have to say	.64			.51
7. Can count on my friends to help me when I have a problem	.78			.34
8. I talk to my friends when I am having a problem	.82			.30
9. If my friends know something is bothering me, they ask me about it	.74			.42

10. I share my thoughts and feelings with my friends	.79			.35
11. My friends pay attention to me	.68			.45
12. How often do other young people pick on you by calling you names or making fun of you Bullying in a way that you don't like?			.69	.49
13. How often do other young people pick on you by leaving you out of games and chats?			.61	.58
14. How often do other young people pick on you by shoving, pushing, hitting or picking a fight with you?			.61	.60
15. How often do other young people pick on you by sending messages or posting things about you online that you don't like?			.58	.65
Eigenvalue	4.37	1.67	1.34	
% of variance	47%	29%	24%	

Note. Blanks represent loadings <.40.

Outcomes of Picky Eating

Results for the univariable and multivariable regressions models are presented in Tables 4, 5, 6 and 7.

Friendship Quality

Univariable Models. Being female was significantly associated with higher friendship quality ($\beta = 1.89$, $p < .005$), suggesting that girls tended to report better friendship quality compared to boys. Having an autism diagnosis, two or more long-standing health conditions and two or more new health conditions were significantly associated with lower friendship quality ($\beta = -1.81$, $p < .005$; $\beta = -1.2$, $p < .005$; $\beta = -2.06$, $p < .005$, respectively).

However, other factors such as PE status, ethnicity, maternal education level, household income, feeding problems at 9-12 months, smoking during pregnancy, and delivery type did not show significant associations with friendship quality (Table 4).

Multivariable Models of Friendship Quality. Results are presented in Table 6.

PE and Demographic Factors. Compared to individuals with no PE, there was no evidence that transient and persistent PE in childhood significantly predicted higher friendship quality in adolescence. However, compared to males, being female was found to have a significant association with higher friendship quality in adolescence ($\beta = 1.89$, $t = 10.7$, $p < .005$). There was no evidence that being from an ethnic minority significantly predicted friendship quality at age 13.

SES. Adding SES to the model, there was no evidence that a higher household income or having a mother who remained in education after school significantly predicted friendship quality in adolescence. Being female was retained as a significant predictor.

Autism Diagnosis and Health Conditions. Adding the presence of an autism diagnosis and long-standing health conditions to the model showed that there was no evidence that these factors predicted friendship quality at age 13. However, compared to having no recent health

conditions, having one or two or more recent conditions was found to have significant negative associations with friendship quality (β = -.77, t = -2.80, p = .005; β = -1.90, t = -2.65, p = .008). Being female was also retained as a significant predictor.

Feeding Challenges. The addition of feeding challenges between 9-12 months to the model showed no evidence that adolescents who had a feeding problem significantly predicted friendship quality in adolescence.

Pregnancy-related Factors. In the last model, there was no evidence that adolescents whose mothers smoked and who were born with medical intervention significantly predicted friendship quality. Being female and having one or multiple recent health conditions were retained as significant predictors of friendship quality.

School Engagement and Enjoyment

Univariable models. Compared to adolescents whose mothers only have a school qualification, there was evidence that adolescents whose mothers obtained a higher degree showed significantly higher school engagement and enjoyment (β = .34, t = 3.39, p = .001). Results also show that a higher household income was significantly associated with higher levels of school engagement and enjoyment (β = .27, t = 6.73, p < .005). Having an autism diagnosis was significantly associated with lower school engagement and enjoyment (β = -.82, t = -2.78, p = .005). Having two or more new health conditions was significantly associated with lower school engagement and enjoyment (β = -2.06, p < .005). Compared to those whose mothers did not smoke during pregnancy, adolescents whose mothers did smoke predicted lower school engagement and enjoyment at age 13 (β = -38, p < .005). Compared to vaginal delivery, there

was evidence that adolescents who were born with medical intervention significantly predicted higher school engagement and enjoyment ($\beta = .21$, $t = 2.67$, $p < .008$; Table 4).

However, other factors such as PE status, child sex, ethnicity, having long-standing previous, feeding problems at 9-12 months, and delivery type did not show significant associations with school engagement and enjoyment.

Multivariable Models for School Engagement and Enjoyment. Results are presented in Table 6.

PE and Demographic Factors. Compared to individuals with no PE, there was no evidence that transient or persistent PE in childhood significantly predicted school engagement and enjoyment in adolescence. There was also no significant evidence that being female or being from an ethnic minority were associated with school engagement and enjoyment in adolescence when controlling for PE status.

SES. Moving on to SES, having a higher household income emerged as a significant predictor of higher school engagement and enjoyment ($\beta = .24$, $t = 5.69$, $p < .005$). However, compared to children whose mothers only had a school qualification, there was no evidence that children whose mothers had no qualifications or those who remained in education after school significantly predicted friendship quality in adolescence.

Autism Diagnosis and Health Conditions. Adding the presence of an autism diagnosis and long-standing and recent health conditions to the model showed that there was no evidence that an autism diagnosis or long-standing and recent health conditions significantly predicted

school engagement and enjoyment at age 13. Household income was retained as a significant predictor.

Feeding Challenges. The addition of feeding challenges between 9-12 months to the model showed no evidence that adolescents who had a feeding problem at 9-12 months significantly predicted school engagement and enjoyment in adolescence. Household income was retained as a significant predictor.

Pregnancy-related Factors. In the last model, there was no evidence that adolescents whose mothers smoked and who were born with medical intervention significantly predicted school engagement and enjoyment in adolescence. Household income was retained as the only significant predictor of school engagement and enjoyment.

Bullying experiences

Univariable models. Having a recorded autism diagnosis, two or more long-standing health conditions and a mother who smoked during pregnancy were significantly and negatively associated with bullying experiences, indicating higher experiences of bullying ($\beta = -1.48$, $p < .005$; $\beta = -.84$, $p < .001$; $\beta = -.44$, $p = .005$, respectively).

However, other factors such as PE status, sex, ethnicity, maternal education level, household income, having recent health conditions, feeding problems at 9-12 months, and delivery type did not show significant associations with bullying experiences (Table 5).

Multivariable Models of Bullying Experiences. Results are presented in Table 7.

PE and Demographic Factors. Compared to individuals with no PE, there was no evidence that transient and persistent PE in childhood significantly predicted higher bullying experiences in adolescence. There was no evidence that being female or from an ethnic minority significantly predicted bullying experiences at age 13.

SES. Adding SES to the model, there was no evidence that a higher household income or having a mother who remained in education after school significantly predicted bullying experiences in adolescence.

Autism Diagnosis and Health Conditions. There was evidence that having a recorded autism diagnosis significantly predicted higher bullying experiences (β =-1.51, $p<.005$). There was no evidence that having long-standing and recent health conditions significantly predicted bullying experiences at age 13.

Feeding Challenges. The addition of feeding challenges between 9-12 months to the model showed no evidence that adolescents who had a feeding problem significantly predicted bullying experiences in adolescence. The association between an autism diagnosis and bullying was retained and a new association emerged. There was evidence that having two or more long-standing health conditions significantly predicted higher bullying experiences at age 13 (β =-.68, p=.01).

Pregnancy-related Factors. In the last model, there was no evidence that adolescents who were born with medical intervention significantly predicted bullying experiences. Adolescents whose mothers smoked during pregnancy predicted higher bullying experiences at age 13 (β =-.43, p=.009). Having an autism diagnosis and multiple long-standing health conditions were retained as significant predictors of bullying experiences in adolescence.

Table 4

Univariable linear regression results for the association between picky eating status and friendship quality and school engagement and enjoyment using imputed data (n = 2930)

Univariable models

	Friendship Quality			**School Engagement and Enjoyment**		
	β (SE)	t	*p*-value	β (SE)	t	*p*-value
Picky eating status						
No Picky eating						
Transient	.06 (.21)	.29	.77	-.19 (.09)	-1.98	.05
Persistent	-.63 (.48)	-1.31	.19	-.32 (.21)	-1.47	.14
Child sex						
Male						
Female	1.89 (.18)	10.7	**<.005***	.15 (.08)	1.94	.05
Child ethnicity						
White						

Other ethnic background	-.03 (.47)	-.06	.95	-.28 (.21)	1.35	.18
Highest education level						
School						
Post-school	-.36 (.23)	-1.53	.13	.34 (.10)	3.39	**.001***
No qualifications	-.11 (.48)	-.23	.82	-.18 (.21)	-.87	.39
Household Income (Std)	.11 (.09)	1.12	.26	.27 (.04)	6.73	**<.005***
Autism diagnosis						
No	-1.81 (6.7)	-2.69	**<.005***	-.82 (.29)	-2.78	**.005***
Yes						
Number of long-standing health conditions						
None	-.08 (.26)	-.31	.76	-.13 (.11)	-1.22	.22
1	-1.2 (.41)	-2.85	**<.005***	-.19 (.18)	-1.07	.28
2+						
Number of new heath conditions						
None	-.49 (.29)	-1.68	.09	-.13 (.13)	-.99	.32
1	-2.06 (.74)	-2.78	**.005***	-.89 (.32)	-2.79	**.005***
2+						
Problems feedings 9-12 months						
No						

Yes (a bit or big)	-.49 (.26)	-1.88	.06	.07 (.11)	.59	.56
Smoking during pregnancy						
No	-.21 (.25)	-.88	.38	-.38 (.11)	-3.54	**<.005***
Yes (occ/always)						
Delivery Type						
Vaginal delivery	-.28 (.18)	-1.51	.13	.21 (.08)	2.67	**.008***
With medical intervention						

*Note. *p <.01 is significant.*

Table 5

Univariable linear regression results for the association between picky eating status and bullying experiences using imputed data (n = 2930)

Univariable models

	Bullying Experiences		
	β (SE)	t	*p*-value
Picky eating status			
No Picky eating			
Transient	-.08 (.14)	-.59	.56
Persistent	-.13 (.31)	-.42	.67
Child sex			
Male			
Female	-.11 (.11)	-1.02	.31
Child ethnicity			
White			

Other ethnic background	.53 (.30	1.76	.08
Highest education level			
School			
Post-school	.07 (.15)	.51	.61
No qualifications	-.13 (.31)	-.44	.66
Household Income (Std)	.09 (.06)	1.47	.14
Autism diagnosis			
No			
Yes	-1.48 (.42)	-3.50	**<.005***
Number of long-standing health conditions			
None	-.03 (.16)	-.18	.86
1	-.84 (.26)	-3.23	**.001***
2+			
Number of new heath conditions			
None	-.14 (.18)	-.77	.44
1	-1.10 (.47)	-2.32	.02
2+			
Problems feedings 9-12 months			
No			

Yes (a bit or big)	-.38 (.16)	-2.29	.02
Smoking during pregnancy			
No	-.44 (.16)	-2.80	**.005***
Yes (occ/always)			
Delivery Type			
Vaginal delivery			
With medical intervention	-.02 (.12)	.21	.83

Note. p<.01 is significant.*

Table 6

Hierarchical multiple linear regression results for the association between picky eating status and friendship quality and school engagement and enjoyment using imputed data (n = 2930)

	Multivariable models					
	Friendship Quality			**School Engagement and Enjoyment**		
	β (SE)	t	*p*-value	β (SE)	t	*p*-value
Step 1						
Picky eating status						
No Picky eating						
Transient	.06 (.21)	.29	.77	-.19 (.09)	-1.95	.05
Persistent	-.63 (.48)	-1.31	.19	-.31 (.21)	-1.43	.15
Child sex						
Male						
Female	1.89 (.18)	10.7	**<.005***	.15 (.08)	1.88	.06

Step 2						
Picky eating status						
No Picky eating						
Transient	.06 (.21)	.30	.77	-.19 (.09)	-2.03	.04
Persistent	-.63 (.48)	-1.31	.19	-.31 (.21)	-1.46	.14
Child sex						
Male						
Female	1.89 (.18)	10.7	**<.005***	.15 (.08)	1.88	.06
Child ethnicity						
White						
Other ethnic background	-.05 (.46)	-.10	.92	.30 (.21)	1.48	.14
Step 3						
Picky eating status						
No Picky eating						
Transient	.05 (.21)	.24	.81	-.12 (.09)	-1.34	.18
Persistent	-.63 (.48)	-1.31	.19	-.21 (.21)	-1.01	.31
Child sex						
Male						
Female	1.90 (.18)	10.8	**<.005***	.15 (.08)	1.90	.06

Child ethnicity						
White						
Other ethnic background	-.01 (.46)	.03	.98	.38 (.20)	1.85	.06
Highest education level						
School						
Post-school	-.55 (.24)	-2.32	.02	.16 (.10)	1.59	.11
No qualifications	-.06 (.47)	-.13	.89	-.06 (.21)	-.29	.77
Household Income (Std)	.18 (.10)	1.84	.07	.24 (.04)	5.69	**<.005***
Step 4						
Picky eating status						
No Picky eating						
Transient	.04 (.21)	.20	.84	-.13 (.09)	-1.39	.16
Persistent	-.61 (.48)	-1.27	.21	-.20 (.21)	-.96	.34
Child sex						
Male						
Female	1.90 (.18)	10.6	**<.005***	.13 (.08)	1.72	.09
Child ethnicity						
White						
Other ethnic background	.02 (.46)	.04	.97	.38 (.20)	1.87	.06

Highest education level						
School						
Post-school	-.56 (.24)	-2.37	.02	.16 (.10)	1.53	.12
No qualifications	-.08 (.47)	-.16	.87	-.06 (.21)	-.33	.74
Household Income (Std)	.17 (.10)	1.76	.08	.24 (.04)	5.60	**<.005***
Autism diagnosis						
No						
Yes	-1.24 (.66)	-1.88	.06	-.67 (.29)	-2.31	.02
Step 5						
Picky eating status						
No Picky eating						
Transient	.08 (.22)	.40	.70	-.12 (.09)	-1.27	.20
Persistent	-.43 (.49)	-.88	.38	-.18 (.21)	-.87	.38
Child sex						
Male						
Female	1.88 (.17)	10.9	**<.005***	.14 (.08)	1.78	.08
Child ethnicity						
White						
Other ethnic background	.004 (.43)	-.01	.99	.38 (.21)	1.85	.07

Highest education level						
School						
Post-school	-.50 (.23)	-2.22	.03	.16 (.10)	1.59	.11
No qualifications	-.09 (.43)	-.21	.84	-.06 (.21)	-.28	.78
Household Income (Std)	.18 (.10)	1.90	.06	.23 (.04)	5.44	**<.005***
Autism diagnosis						
No						
Yes	-.98 (.64)	-1.53	.13	-.53 (.30)	-1.78	.08
Number of long-standing health conditions						
None	.11 (.24)	.45	.66	-.09 (.11)	-.85	.39
1	-.72 (.40)	-1.81	.07	-.06 (.18)	-.33	.74
2+						
Number of new heath conditions						
None	-.77 (.28)	-2.80	**.005**	-.10 (.13)	-.80	.42
1	-1.90 (.72)	-2.65	**.008****	-.58 (.32)	-1.82	.07
2+						
Step 6						
Picky eating status						
No Picky eating						

Transient						
Persistent	.13 (.21) -.46 (.48)	.62 -.97	.53 .33	-.13 (.09) -.19 (.21)	-1.34 -.90	.18 .37
Child sex						
Male						
Female	1.92 (.18)	10.83	**<.005***	.14 (.08)	1.76	.08
Child ethnicity						
White						
Other ethnic background	.02 (.47)	.05	.96	.37 (.21)	1.79	.07
Highest education level						
School						
Post-school	-.53 (.24)	-2.26	.02	.16 (.10)	1.56	.12
No qualifications	-.03 (.47)	-.08	.94	-.06 (.21)	-.28	.78
Household Income (Std)	.15 (.10)	1.57	.12	.23 (.04)	5.43	**<.005***
Autism diagnosis						
No	-.67 (.68)	-.99	.32	-.53 (.30)	-1.78	.08
Yes						
Number of long-standing health conditions						
None	.12 (.25)	.50	.62	-.09 (.11)	-.86	.39

1	-.68 (.41)	-1.66	.10	-.07 (.18)	-.38	.70
2+						
Number of new heath conditions						
None	-.71 (.29)	-2.44	.02	-.11 (.13)	-.83	.41
1	-1.98 (.74)	-2.69	**.007****	-.59 (.32)	-1.83	.07
2+						
Problems feedings 9-12 months						
No						
Yes (a bit or big)	-.48 (.26)	-1.84	.07	.07 (.11)	.62	.54
Step 7						
Picky eating status						
No Picky eating						
Transient	.15 (.21)	.69	.50	-.13 (.09)	-1.35	.18
Persistent	-.38 (.48)	-.80	.43	-.19 (.21)	-.91	.36
Child sex						
Male						
Female	1.92 (.18)	10.81	**<.005***	.14 (.08)	1.85	.06
Child ethnicity						
White						
Other ethnic background	.01 (.47)	.02	.98	.35 (.21)	1.70	.09

Highest education level						
School						
Post-school	-.56 (.24)	-2.36	.02	.14 (.10)	1.34	.18
No qualifications	.03 (.47)	.06	.95	-.06 (.21)	-.29	.77
Household Income (Std)	.15 (.10)	1.49	.14	.21 (.04)	4.72	**<.005***
Autism diagnosis						
No	-.69 (.68)	-1.02	.31	-.55 (.30)	-1.82	.07
Yes						
Number of long-standing health conditions						
None	.13 (.25)	.54	.59	-.09 (.11)	-.85	.39
1	-.68 (.41)	-1.66	.10	-.07 (.18)	-.37	.71
2+						
Number of new heath conditions						
None	-.71 (.29)	-2.45	**.01***	-.12 (.13)	-.94	.35
1	-1.99 (.74)	-2.71	**.007****	-.59 (.32)	-1.85	.07
2+						
Problems feedings 9-12 months						
No	-.49 (.26)	-1.88	.06	.06 (.11)	.51	.61

Yes (a bit or big)						
Smoking during pregnancy						
No	-.33 (.25)	-1.31	.19	-.19 (.11)	-1.66	.10
Yes (occ/always)						
Delivery Type						
Vaginal delivery	-.23 (.18)	-1.28	.20	.15 (.08)	1.84	.07
With medical intervention						

*Note. *p <.01 is significant.*

Table 7

Hierarchical multiple linear regression results for the association between picky eating status and bullying experiences using imputed data (n = 2930)

	Bullying experiences		
	β (SE)	t	*p*-value
Step 1			
Picky eating status			
No Picky eating			
Transient	-.08 (.14)	-.61	.54
Persistent	-.14 (.31)	-.44	.66
Child sex			
Male			
Female	-.12 (.11)	-1.04	.30
Step 2			
Picky eating			

status			
No Picky eating			
Transient	-.10 (.14)	-.71	.48
Persistent	-.15 (.31)	-.48	.63
Child sex			
Male			
Female	-.12 (.11)	-1.05	.30
Child ethnicity			
White			
Other ethnic background	.54 (.30)	1.81	.07
Step 3			
Picky eating			
status			
No Picky eating			
Transient	-.08 (.14)	-.56	.58
Persistent	-.11 (.31)	-.37	.71
Child sex			
Male			
Female	-.12 (.11)	-1.03	.30
Child ethnicity			
White			
Other ethnic background	.57 (.30)	1.90	.06
Highest education level			

School			
Post-school	.02 (.15)	.11	.91
No qualifications	-.11 (.31)	-.36	.72
Household Income (Std)	.08 (.06)	1.29	.20
Step 4			
Picky eating			
status			
No Picky eating			
Transient	-.09 (.14)	-.63	.53
Persistent	-.09 (.31)	-.29	.77
Child sex			
Male			
Female	-.15 (.11)	-1.31	.19
Child ethnicity			
White			
Other ethnic background	.58 (.30)	1.93	.05
Highest education level			
School			
Post-school	.002 (.15)	.02	.99
No qualifications	-.13 (.31)	-.42	.68
Household Income (Std)	.07 (.06)	1.14	.25
Autism diagnosis			

No			
Yes	-1.51 (.43)	-3.54	**<.005***
Step 5			
Picky eating			
status			
No Picky eating			
Transient	-.07 (.13)	-.49	.63
Persistent	-.004 (.31)	-.01	.99
Child sex			
Male			
Female	-.16 (.11)	-1.45	**.**15
Child ethnicity			
White			
Other ethnic background	.67 (.28)	2.42	.02
Highest education level			
School			
Post-school	-.02 (.14)	-.18	.86
No qualifications	-.11 (.28)	-.39	.70
Household Income (Std)	.09 (.06)	1.55	.12
Autism diagnosis			
No			
Yes	-1.42 (.41)	-3.44	**.001**
Number of long-standing health conditions			
None			

1	.04 (.16)	.30	.76
2+	-.59 (.25)	-2.33	.02
Number of new heath conditions			
None			
1	-.18 (.18)	-1.00	.32
2+	-.77 (.48)	-1.64	.10
Step 6			
Picky eating			
status			
No Picky eating			
Transient			
Persistent	-.03 (.14)	-.23	.82
	.006 (.31)	.02	.98
Child sex			
Male			
Female	-.15 (.181	-1.30	.19
Child ethnicity			
White			
Other ethnic background	.58 (.30)	1.92	.06
Highest education level			
School			
Post-school			
No qualifications	.02 (15)	.13	.89
	-.13 (.31)	-.42	.68
Household Income (Std)	.06 (.06)	1.02	.31

Autism diagnosis			
No			
Yes	-1.22 (.44)	-2.78	**.006***
Number of long-standing health conditions			
None			
1	.004 (.16)	.03	.98
2+	-.68 (.27)	-2.55	**.01***
Number of new heath conditions			
None			
1	-.06 (.19)	-.35	.72
2+	-.72 (.48)	-2.49	.14
Problems feedings 9-12 months			
No			
Yes (a bit or big)	-.34 (.17)	-2.06	.04
Step 7			
Picky eating status			
No Picky eating			
Transient	-.02 (.14)	-.17	.87
Persistent	.06 (.31)	.19	.85
Child sex			
Male			
Female	-.14 (.11)	-1.36	.21

Child ethnicity			
White			
Other ethnic background	.55 (.30)	1.82	.07
Highest education level			
School			
Post-school	-.02 (.15)	-.13	.90
No qualifications	-.09 (.31)	-.28	.78
Household Income (Std)	.03 (.07)	.55	.59
Autism diagnosis			
No			
Yes	-1.24 (.44)	-2.84	**.005***
Number of long-standing health conditions			
None			
1	.01 (.16)	.08	.93
2+	-.67 (.26)	-2.54	**.01***
Number of new heath conditions			
None			
1	-.08 (.19)	-.45	.66
2+	-.73 (.48)	-1.52	.13
Problems feedings 9-12 months			
No			
Yes (a bit or big)	-.37 (.17)	-2.19	.03
Smoking during pregnancy			
No	-.43 (.16)	-2.62	**.009***

Yes (occ/always)			
Delivery Type			
Vaginal delivery			
With medical intervention	-.005 (.12)	-.05	.96

Note. p<.01 is significant.*

Sensitivity analyses

An EFA was conducted using complete case analyses and retaining non-birth mothers (participants with complete data on all outcome and exposure variables; n = 1795). The results were similar to those of our main analyses using imputed data, strengthening a three-factor solution structure (Appendix H).

We ran univariable and multivariable hierarchical linear regression models using the same sample (Appendices I, J, K, L). For friendship quality as the outcome, the results of the hierarchical multiple linear regressions differed on some variables. In our main analyses, being female was significantly associated with higher friendship quality whereas having one or two and more recent health conditions was significantly associated with lower friendship quality. When complete cases were used in the analysis, associations between being female (β =1.87, t = 9.56, p < .005) and having two or more recent health conditions (β =-2.11, t = -2.757, p = .01) and friendship quality were retained whereas the association between having one recent health condition and lower friendship quality became non-significant. The sensitivity analysis also revealed a significant association between adolescents whose mothers obtained a higher degree and lower friendship quality (β =-.70, t = -2.71, p = .007).

In the sensitivity analyses, no significant associations were found between having a recorded autism diagnosis and bullying experiences which were significant in the main analysis. Having a mother who smoked during pregnancy was the only factor that was associated with higher bullying experiences in the sensitivity analysis.

For school engagement and enjoyment, the multiple linear regression results were similar to those of our main analyses using imputed data.

Discussion

This study had two main aims. The first aim was to conduct an exploratory factor analysis to derive outcome scales for school engagement, friendship quality, and bullying experiences. The second aim focused on investigating whether being a persistent picky eater in childhood was associated with negative psychosocial outcomes in adolescence such as lower school engagement and enjoyment, lower friendship quality and higher bullying experiences. We also hypothesised that transient PE was not associated with lower school engagement and enjoyment, lower friendship quality and higher bullying experiences.

Main Findings

The EFA revealed three factors which aligned with the expected structure of the constructs under investigation. The EFA identified six items representing friendship quality, five items representing school engagement and enjoyment and four factors representing bullying experiences. This step was crucial in establishing valid measures for these constructs, allowing us to investigate associations with PE status and other confounding variables.

In line with our hypothesis, the results revealed that there were no significant associations between transient PE and friendship quality, school engagement and enjoyment or bullying experiences in adolescence. This finding is in line with the literature, which suggests that transient PE may be considered within the realm of normal development or functioning, therefore not having a strong influence on psychosocial outcomes later in life (Cardona Cano et al., 2015).

Friendship Quality

We predicted that adolescents with persistent PE habits may experience challenges in food-related situations which can be associated with lower engagement in social interactions thus affecting friendship quality (Dial et al., 2021). Contrary to our hypothesis, we found that there were no significant associations between persistent PE in childhood and friendship quality in adolescence. While some findings align with our hypothesis (Thompson et al., 2015; Dial et al, 2021), other studies found that for some individuals, their PE habits did not significantly impact their social interactions (Dial et al., 2021). Some individuals did not report lower engagement in social interactions due to their PE. Young adults mentioned being able to pick the restaurant when going out with friends (Dial et al, 2021). Others reported not letting their identity as a picky eater stop them from eating outside the home with others (Thompson et al., 2015). Moreover, one study that investigated PE in autistic young adults found that as they grew older, peers became more accepting of their PE behaviours, and they developed strategies to manage social situations (Folta et al., 2020). One possible explanation for the lack of association between persistent PE and friendship quality in our study is that adolescents with persistent PE may have supportive friends; friends who are accepting, empathetic, and accommodating of their dietary preferences or restrictions. It is also plausible that these adolescents have developed coping mechanisms to manage social situations involving food. These reasons help mitigate the potential negative impact of persistent PE on friendship quality.

It is also important to consider that other factors may also contribute to the quality of friendships among adolescents. Other studies have argued that difficulties in forming high-

quality relationships may not solely arise from PE behaviours but could be influenced by other factors, such as family dynamics or comorbid conditions like autism, depression, or social anxiety, which can impact social interactions (Cermak et al., 2010; Kauer et al., 2015; Wildes et al., 2012; Goh & Jacob, 2012; Dial et al., 2021).

Our study found that being female was associated with having higher friendship quality in adolescence whereas having one or two or more recent health conditions was associated with lower friendship quality. These findings are in line with previous research (Way & Greene, 2006; Davis, 2019; Taylor et al., 2008; McCarroll et al., 2009) and suggest that these two factors may be more influential in shaping the quality of adolescent friendships compared to being a persistent picky eater.

In fact, during childhood and adolescence, research suggests that girls generally report higher levels of intimacy, self-disclosure, and affection in their friendships compared to boys (Buhrmester & Furman, 1987; Lempers & Clark- Lempers, 1993; Sharabany, Gershoni & Hofman, 1981). Moreover, studies have identified a disparity in self-reported friendship quality between boys and girls during early adolescence (Way & Greene, 2006). One study observed that girls' self-reported friendship quality showed a more rapid improvement than that of boys between the ages of 13 and 16, which could explain our findings (Davis, 2019).

Additionally, the literature supports the association between one or more health conditions and lower friendship quality. Health conditions affect different aspects of one's life which includes adolescents’ social interactions. Adolescents with chronic health conditions have reported difficulties in forming and maintaining friendships which are associated with lower friendship quality and higher levels of social anxiety (Taylor et al., 2008; McCarroll et al., 2009).

School Engagement and Enjoyment

We predicted that anxiety around food-related events at school and criticism from peers and teachers may lead to feelings of isolation and exclusion thus affecting school engagement and enjoyment (Hartman et al., 2010). Contrary to our hypothesis, we found that there were no significant associations between persistent PE in childhood and school engagement and enjoyment in adolescence. Previous research has found that some individuals with PE reported that their peers were accommodating and non-judgmental of their eating practices (Folta et al, 2020). Others may feel that although strangers do not understand their PE behaviour, their support network including family, friends and teachers were accommodating and accepting (Fox et al., 2018). It is possible that some individuals with PE benefit from a supportive school environment that promotes inclusion and implements anti-bullying policies, leading to adaptations and acceptance of their eating preferences. In our study, adolescents with persistent PE may have an accommodating support network and environment which is a potential explanation of the lack of associations found.

It is also important to consider that other factors may also contribute to school engagement and enjoyment among adolescents. Our study found that household income was the only variable associated with higher levels of school engagement and enjoyment in adolescence. Other studies have argued that school enjoyment may be influenced by both in-school and out-of-school factors such as values, motivations and expectations held by family and teachers (Meyer & Turner, 2002; Jennings, 2003). Moreover, receiving social support from teachers, peers and family, and SES were strongly and positively related to school engagement (Appleton et al., 2008; Fernández-Lasarte et al., 2019; Diogo et al., 2018; Fredricks et al., 2016).

Interestingly, while school engagement was found to be influenced by SES, school enjoyment was not (Fullarton, 2002; Willms, 2003; Appleton et al., 2008; Gorard & Huat See, 2010; Olana & Tefera 2022). Separating engagement and enjoyment as distinct outcome measures could provide a more nuanced understanding of how different factors influence these aspects of the school experience.

Bullying Experiences

We predicted that experiencing feelings of not being understood or accepted by their peers due to their PE behaviour, as well as being perceived negatively by others due to their food choices may contribute to an increased likelihood of bullying (Zohar, 2022). Contrary to our hypothesis, we found that there were no significant associations between persistent PE in childhood and bullying experiences in adolescence. Previous research has shown that some individuals with PE reported teasing from their peers however, it was perceived as a joke and a form of acceptance (Folta et al., 2020). As previously mentioned, having an accepting support network and environment reduces the likelihood of bullying experiences at school which may explain the lack of associations found in our study. However, case studies have found associations between ARFID and bullying experiences in adolescents due to their PE behaviours and smaller stature (Bryant-Waugh, 2013; Davis & Stone, 2020). Since we did not capture ARFID, one potential explanation could be that more severe cases such as ARFID may be associated with an increased likelihood of bullying experiences whereas persistent PE may not be. Further studies could consider including a specific assessment of ARFID and comparing the experiences of individuals with ARFID to those with persistent PE.

Other factors may have an influence on bullying experiences in adolescence such as poor friendship quality (Moore et al., 2018), belonging to a minority group (Peguero & Williams, 2013, and poor school and family support (Hong & Espelage, 2012). Our study found that having a recorded diagnosis of autism, living with two or more recent health conditions, and having a mother who smoked during pregnancy were related to higher bullying experiences in adolescence. Our findings are in line with previous research suggesting that children and adolescents who have an autism diagnosis or are living with chronic conditions are at a high risk of being bullied (Humphrey & Hebron, 2014; Pittet et al., 2010). However, it is worth noting that the relationship between smoking during pregnancy and bullying experiences has not been extensively explored in previous studies. Smoking during pregnancy has been consistently linked to externalizing problems in adolescents, such as conduct disorders, criminal conviction, and drug misuse (D'Onofrio et al., 2008). Therefore, further research is needed to better understand and strengthen the links between smoking during pregnancy and bullying experiences.

Overall, it is important to recognise that not all individuals perceive their PE as entirely negative (Thompson et al., 2015; Fox et al., 2020; Blake & Bisogni, 2003). This finding suggests that individual perspectives on PE and its perceived severity can vary among adolescents, which may have affected the strength of the relationship between PE and negative psychosocial outcomes. For example, there might be a significant difference in friendship quality if PE was severe enough to not be able to eat anything outside the home compared to an individual who might have a few preferred items.

Most previous studies did not differentiate transient PE from persistent PE or ARFID when investigating the potential associations between PE and psychosocial outcomes.

Consequently, some studies may have categorised individuals with transient PE, persistent PE, and ARFID collectively as PE, leading to inconsistent findings regarding the associations between PE and psychosocial outcomes (Thompson et al., 2015; Fox et al., 2020). In previous studies, it could be that associations were found, such as positioning themselves as 'other' or being socially isolated, when individuals were managing ARFID (Bryant-Waugh, 2013). We were also not able to capture the full spectrum of PE severity including the presence of ARFID. Further studies need to investigate the outcomes of transient PE, persistent PE and ARFID in general adolescent populations to better understand the impact of PE severity on the individual.

In our study, we assessed persistent PE based on its persistence until age 10, a lack of variety in children's diets at ages 2 and 5 and reliance on preferred foods by eating different meals than their family members. According to our definition of PE, the element of avoiding and rejecting food based on their sensory properties was not captured in our PE measure, which may also explain the lack of significant associations between persistent PE and psychosocial outcomes. Due to being restricted by data availability, a critical component of PE that could be associated with our psychosocial outcomes may have been overlooked. Future research should aim to incorporate a PE measure that captures all aspects of PE including the sensory aspect as well as a measure of ARFID to provide a more comprehensive understanding of their associations with psychosocial outcomes in adolescence.

Sensitivity Analyses Findings

The results using complete case analyses differed from those using imputed data for friendship quality. In the sensitivity analysis, being female remained significantly associated

with higher friendship quality and having two and more recent health conditions remained significantly associated with lower friendship quality. The association between having one recent health condition and lower friendship quality became non-significant whereas a significant association between adolescents whose mothers obtained a higher degree and lower friendship quality emerged. Moreover, the association between having an autism diagnosis and recent health conditions and bullying experiences became non-significant. The association between smoking during pregnancy and bullying was the only one retained in complete case analyses.

It is important to consider that the sensitivity analysis was conducted with a smaller sample size due to missing data. This reduction in sample size may have affected the statistical power of the analysis, increasing type II error rate and potentially leading to differences in the results. The emergence of a significant association between adolescents whose mothers obtained a higher degree and lower friendship quality in the sensitivity analysis could be influenced by this reduced statistical power. These differences highlight the importance of understanding the impact of specific variables and the potential bias introduced by missing data.

A potential explanation could be related to social dynamics and expectations. It is possible that higher levels of maternal education may result in different parenting styles or expectations, which could influence adolescents' social interactions and friendships (Cui et al., 2002; Engels et al., 2001). Further research is needed to explore the underlying mechanisms and contextual factors that contribute to this association.

However, it is important to note that this finding is not in line with existing literature which suggests that higher maternal education which reflects the influence of broader socioeconomic factors, such as access to resources, social networks, and opportunities, is associated with positive psychosocial outcomes, healthy development, and well-being for children (Perper et al.,

2010). A potential explanation as to why we found a significant negative association could be due to our sample. Participants with missing data were found to have mothers who had significantly lower levels of education compared to participants with complete data. This may have introduced sample bias and affected the generalisability of our findings. Further research is needed to explore this association and enhance the generalisability of studies.

For school engagement and enjoyment, the findings using complete case analyses were similar to those using imputed data, suggesting that the missing data may not have heavily influenced the relationship between PE, school engagement and enjoyment and confounding variables. In other words, the significant associations between being female and friendship quality, having two or more health conditions and friendship quality, household income and school engagement and enjoyment, and having a mother who smoked during pregnancy and bullying experiences seem to be the most robust.

Strengths and Limitations

This study has several strengths. First, it stands out as one of the first to examine PE psychosocial outcomes specifically in a general adolescent population. The study also used a longitudinal dataset with a large sample size, which enables the assessment of the same cohort of participants over an extended period. In terms of data analysis, we considered several approaches to strengthen the robustness of the results such as conducting an EFA on our outcome scales, running missingness analyses, handling missing data for the EFA and the linear regressions as well as conducting sensitivity analyses on complete cases to strengthen the results of the main analyses using imputed data. This study also considered a wide range of confounding variables, allowing for a more comprehensive understanding of the associations between PE and

psychosocial outcomes by drawing on previous research that has identified factors associated with PE.

There were also limitations to consider. The generalisability of the findings may be limited due to the sample composition and the nature of missing data. The study exclusively sampled children born in Scotland, predominantly from white families (97%), which may restrict the applicability of the results to other populations. Moreover, missingness analyses revealed that participants with missing data differed in certain characteristics, such as ethnicity and maternal education level. This suggests that the sample may not be fully representative of the general population which also reduces the generalisability of results.

Moreover, the assessment of PE was based on parent reports, which may not fully capture the child's own experience. As mentioned above, due to being restricted by the data provided in the GUS study and the lack of a universal consensus on PE definition and measurement, it is difficult to accurately classify participants' eating behaviours. Despite using questions that were used in previous studies to assess PE, the question asked at age 10 was different from the one asked at ages 2 and 5 and the overall measure did not capture the element of sensory sensitivity that we included in our definition. This could have resulted in the misclassification of some individuals and potentially underestimating the prevalence of PE. Further studies should aim to provide a clear definition of PE which would result in more precise measures, and classification of individuals thus providing more accurate results. Further studies should also capture the difference between transient PE, persistent PE and ARFID to aid with their classification.

Conclusions

In conclusion, this study did not find evidence of an association between transient or persistent PE and lower school engagement and enjoyment, lower friendship quality and higher bullying experiences in adolescence. Other factors such as child sex, living with recent health conditions, having a recorded autism diagnosis and household income were found to have a stronger influence on these outcomes. The results suggest that individuals with persistent PE may not face a substantial risk of experiencing negative psychosocial outcomes in the areas of school engagement and enjoyment, friendship quality, and bullying experiences. These findings can provide some reassurance to parents and adolescents with PE behaviours. However, it is important to note that further research is needed to enhance our knowledge and provide more comprehensive insights into the potential effects of PE on adolescents' psychosocial well-being.

Implications for Clinical Practice and Future Research

The findings highlight the need for further research to better understand the impact of PE severity on psychosocial outcomes in adolescence. To do that, efforts should be made to increase the generalisability of results, use clear definitions and precise measures of PE and psychosocial outcomes, as well as capturing the difference in influence between transient PE, persistent PE, and ARFID on psychosocial outcomes.

The current literature highlights that the impact of PE may vary among individuals with some finding it more challenging than others. Given the research gaps, it is recommended to develop individualised assessments and interventions in adolescence to prevent further negative outcomes in later stages of life. Clinicians should consider incorporating a comprehensive assessment of PE that encompasses all aspects of its definition, including FN, meal variety and sensory sensitivity. Clinicians should also consider the presence of ARFID in their assessments.

This would provide a more accurate understanding of the individual's PE patterns and help tailor appropriate interventions and support.

Given that other factors may have a stronger influence on friendship quality and school engagement and enjoyment in adolescence, clinicians should consider addressing these factors alongside patients' PE status. This may involve providing support and resources to individuals from disadvantaged backgrounds and implementing strategies to promote positive social interactions and engagement in school settings.

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Part 3: Critical Appraisal

Critical appraisal

Systematic Review

Choice of Topic

My motivation for conducting this review stems from my passion for the fields of eating behaviours and mental health, which I cultivated during my undergraduate studies in Nutrition and Psychology. The intersection between eating behaviours and mental well-being has always fascinated me. In my prior research experiences, I explored the effectiveness of Cognitive Remediation Therapy on Anorexia Nervosa and investigated the role of appetitive traits in the development of "traditional" eating disorder behaviours such as Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder.

When the opportunity to delve into the topic of adult picky eating (PE) arose, I was immediately drawn to it for multiple reasons. Firstly, I identified as a picky eater when I was younger, and it impacted my life, particularly in terms of social interactions and identity formation. Although I do not identify myself as a picky eater anymore, I recognised the importance of exploring PE's developmental trajectory and the subsequent impact on individuals. I was particularly interested in understanding the relationship between PE and mental health outcomes during adolescence and adulthood as these are stages where we become more aware of our thoughts, behaviours, feelings, and environment. Investigating which groups of individuals struggle the most with their PE behaviours and discerning the differences between those who do and do not struggle was a focal point for me. I firmly believe that with a better understanding of the impact of PE, healthcare professionals, parents, and the individuals themselves can normalise and manage it in a manner that is tailored to their specific needs.

The second driving factor behind my choice of topic was the opportunity to investigate PE and its connection to Avoidant/Restrictive Food Intake disorder (ARFID), a relatively recent disorder added to the DSM-5. ARFID can be considered the underdog of the eating and feeding disorder category due to its relatively low awareness compared to 'traditional' eating disorders. It may not receive as much attention in research, media, or public discourse as anorexia nervosa or bulimia nervosa. This lack of awareness and understanding can contribute to challenges in diagnosis, access to appropriate treatment, and support for individuals with ARFID. However, in recent years, there has been growing recognition of ARFID and efforts to raise awareness, research, and support for it.

Previously, PE behaviours were often categorised under the umbrella term of Eating Disorder Not Otherwise Specified (EDNOS), making it challenging to identify and treat. This lack of specificity made it difficult for eating disorder services to provide targeted treatment pathways for EDNOS. However, with the recognition and inclusion of ARFID, specialised feeding disorder clinics now offer tailored treatment for individuals with this condition. Despite being an emerging field, there is still much research to be undertaken. Overall, being able to contribute to the growing literature on PE and ARFID beyond childhood is incredibly rewarding and meaningful. This research has the potential to enhance our understanding of the psychosocial correlates of these conditions, provide insights into their underlying mechanisms, and ultimately inform clinical practice.

Upon further reflection, it became more apparent that our research is relevant and significant for informing clinical practice and research implications. By studying the psychosocial correlates of PE beyond childhood, we aimed to help researchers and families understand how PE affects various aspects of a person's life, such as mental health, social

functioning, and quality of life. Moreover, identifying psychosocial factors associated with PE beyond childhood can inform the development of effective and tailored treatment and intervention strategies. Additionally, since PE is mainly investigated in children, we also gained insights into the continuity and stability of PE behaviours across the lifespan, contributing to a more comprehensive understanding of this phenomenon.

Literature and synthesis

When I reviewed the literature, I discovered that most of the studies exploring the psychosocial correlates of PE focused on childhood, with fewer studies conducted during adolescence and adulthood. There was a substantial gap in the literature on PE during adolescence with many studies on PE beyond childhood focusing predominantly on adults, leaving a significant void that needs to be addressed in future research.

What also struck me is the lack of a clear definition of PE, therefore, creating a range of measurement methods in an attempt to capture this behaviour. Moreover, there are several PE synonyms used in the literature which also contributed to the lack of consensus on definitions and measurement methods. What made it increasingly confusing during synthesis was not only the variety of PE measures but the variety of psychosocial measures as well. One of the challenges that arose from this variability was that it complicated the synthesis of the literature and hindered drawing firm conclusions on the topic and its psychosocial correlates.

Furthermore, I realised that most of the literature consisted of cross-sectional studies, with only a few investigating prospective associations. This limited the ability to make causal inferences and draw definitive conclusions about the longitudinal impact of PE and its psychosocial outcomes.

I observed that the initial study examining the psychosocial correlates of PE in adults was conducted in 2012 (Wildes et al., 2012), and subsequent studies frequently referenced this foundational work. Interestingly, most of the literature on PE beyond childhood was published after 2015, a few years after the inclusion of ARFID in the DSM-5. However, it was intriguing to note that only a limited number of studies examined the distinctions between PE and ARFID, as well as their divergent psychosocial impacts on individuals. Understanding the differences in severity between an ARFID diagnosis and PE is an area that requires further exploration, particularly in terms of their respective impacts on individuals' well-being and functioning.

Furthermore, the lack of separate investigations into PE and PE with ARFID has resulted in varying perspectives among researchers regarding their placement on the spectrum of eating and feeding disorders. Some researchers propose that PE falls within the broader category of "feeding difficulties," encompassing a range of behaviours, with PE representing the most prevalent type at one end and more severe feeding disorders like ARFID at the other end (McCormick and Markowitz, 2013). Conversely, other researchers, such as Kerzner et al. (2015), argue that PE exhibits distinct characteristics that differentiate it from other feeding disorders. These contrasting viewpoints highlight the ongoing debate regarding the classification and relationship between PE and ARFID within the spectrum of eating and feeding disorders. It underscores the need for further research to delineate the boundaries and unique features of each condition, enabling a clearer understanding of their respective positions on the spectrum.

One of the other challenges was to decide whether to include studies that investigated the psychosocial correlates of ARFID on its own or ARFID only when it co-occurs alongside PE. After doing some research and multiple discussions with my supervisor, we decided it might be

beneficial to include individuals with PE co-occurring with ARFID in this review as the sensory sensitivity ARFID subtype associated with PE is the most prevalent subtype and the three presentations of ARFID are not mutually exclusive (Thomas et al., 2017). However, I noticed that very few studies accounted for PE co-occurring with ARFID in their research, often treating it as a mere point of discussion rather than an integral part of the investigation.

On a positive note, I came across a few longitudinal studies that provided valuable insights. Additionally, I was pleased to discover efforts aimed at developing a dedicated measure for adult PE, which has the potential to revolutionise research in the field (Ellis et al. 2018**).**

Implications for my research

Conducting a thorough review of the strengths and weaknesses present in the existing literature using the MMAT was instrumental in informing my research process (Hong et al., 2018). What became clearer from the review were the different areas that needed improvement and further research. This included conducting further research on adolescent and adult populations. The review highlighted the need to agree on the definition and assessment methods of PE to be able to compare psychosocial correlates across studies and decrease the complexity and confusion of research in the field. Moreover, longitudinal studies are needed to explore the directionality of these relationships. Further research should also aim to differentiate between PE and PE with ARFID when investigating their psychosocial correlates.

I aimed to try to build on the reviewed studies' strengths, address their limitations when possible, and acknowledge when it was not feasible due to different constraints.

Some of the limitations of past research that we were able to address in the empirical piece of work was focusing specifically on an adolescent population, using a longitudinal design and

examining specific psychosocial correlates related to school, friendships, and bullying, as these factors are particularly influential during this developmental stage. We acknowledge that although we clearly defined PE in our introduction, we were not able to measure all its aspects in our study. Due to data availability constraints, we were not able to differentiate between PE and PE with ARFID (see details below).

Empirical Paper

Topic

When my supervisor Dr Will Mandy and I met initially, he introduced me to Laura Bourne, a PhD candidate who has also been investigating PE. As part of her research, Laura previously used the Growing up in Scotland (GUS) cohort to investigate risk factors of transient and persistent PE (Bourne et al, in press). To be able to do that, she created a measure of PE using the available data on GUS. From this measure, she placed individuals into three categories (no PE, transient PE, and persistent PE).

Given the findings of the systematic review, there is limited literature on the psychosocial outcomes of PE in adolescence. After multiple discussions with Will and Laura, we decided that using the GUS data to investigate prospective associations between PE and psychosocial factors in adolescence might be the most appropriate approach. We decided that Laura would explore physical and mental health outcomes of PE (depression, anxiety symptoms and weight) whereas I would focus on psychosocial factors such as school engagement and enjoyment, friendship quality and bullying experiences using the PE measure she previously created.

Adolescence is a critical developmental stage, a time when individuals are particularly susceptible to the influence of social and environmental factors (Viner et al., 2012). The rationale

behind our choice of outcomes stemmed from exploring the literature**.** We found that during adolescence friendship quality, school engagement and enjoyment and bullying experiences are important psychosocial factors to investigate as they are associated with adolescents' overall well-being and development (Bagwell et al., 2005). These outcomes hold significance not only in their regard but also due to their association with various negative life-course consequences such as lower educational attainment, diminished job prospects, and an elevated risk of mental health problems (Masten et al., 2005; Kessler et al., 2010; Piquero et al., 2012).

Therefore, identifying whether there are forms of PE associated with poor psychosocial outcomes at an older age may inform clinical practice and future research. Researchers will be able to create specific targets for prevention and intervention that aim to improve mental health, school engagement and well-being for the young person as well as useful guidance for parents and caregivers.

It would have been interesting to explore the influence of PE on other outcomes mentioned in the review such as eating disorder behaviours, other mental health factors such as social anxiety or OCD symptoms and identity-related challenges. However, due to data constraints, we were not able to do so. Further research should aim at exploring these outcomes in adolescence in relation to PE status.

Design and Measures

In the process of developing empirical research studies, there are inherent compromises between the ideal approach that maximises validity and the practical constraints within the scope of the research project. We conducted a secondary analysis using the GUS data. Although this type of design has its advantages such as saving time spent on data collecting and the ability to

investigate hypotheses and associations on a large scale (Boslaugh, 2007), it also has drawbacks. Since we did not collect the data, I was not familiar with the dataset and the different information that was collected. The GUS data allows for the exploration of various research questions and topics relevant to children and their families such as development, well-being, social factors, and behaviours. With this type of design, we were constrained by the data that was collected and thus had to adjust our measures and the type of data analysis used (Boslaugh, 2007).

A prospective cohort design is a suitable design if the study aims to look at prospective associations between multiple exposures and outcomes that cannot be randomised in a clinical trial for ethical and/or practical issues (Euser et al, 2009). It is the case in our study as we cannot control a person's PE status, making the prospective cohort design suitable for our study. However, one disadvantage of a cohort design is that we cannot always rule out the possibility of confounding variables or reverse causation. In our study, potential confounding variables were identified according to past literature and were included in the analysis according to availability in the dataset.

The GUS dataset used different questionnaires to collect data which can have multiple limitations. Our PE variable was derived from three parent-report questions whereas our outcomes were self-report questionnaires at age 13. The parent-report questions may not take into consideration the individual's personal experiences whereas the self-report questionnaires may increase response bias and rely on individuals' memories, behaviours and feelings. Individuals might also want to answer the questionnaires in ways they think is acceptable to other people, also called social desirability (Rosenman et al, 2011). They might also not complete the questionnaires for different reasons such as lack of time, attention or boredom.

To measure PE status, I used the measure Laura created in her previous study that was based on previous literature. However, due to data constraints, we were only able to measure certain aspects of PE such as meal variety and meal presentation and did not capture the element of sensory sensitivity which may have resulted in the misclassification of some individuals.

In the GUS dataset, some questionnaires have been previously validated however the questionnaires we used for our outcomes were not. Therefore, we considered several approaches to strengthen the robustness of the results and address these limitations such as conducting an exploratory factor analysis (EFA) on our outcomes using imputed data and unimputed data and, running missingness analyses.

Moreover, the generalisability of the findings may be limited due to the sample composition and the nature of missing data. The study exclusively sampled children born in Scotland, predominantly from white families (97%), which may restrict the applicability of the results to other populations. Moreover, missingness analyses revealed that participants with missing data differed in certain characteristics, such as ethnicity and maternal education level. This suggests that the sample may not be fully representative of the general population which reduces the generalisability of results.

Data Analysis

During the course of my research journey, I encountered various challenges and dilemmas in data analysis that required careful consideration and decision-making. After discussions with Will and Laura, we felt it was important for me to align with Laura and use the same statistical software, Stata, for data analysis. Although this posed a significant challenge for me as I had no prior experience with Stata, I recognised the benefits of consistency in our

analysis, especially since Laura had used Stata when developing the PE measure. Consequently, I dedicated time and effort to learning Stata from scratch, ensuring that I could effectively analyse the data.

As the analysis progressed, additional dilemmas emerged. I re-coded certain variables several times to ensure their suitability for analysis. Furthermore, preparing for an EFA presented its own set of challenges, particularly in handling missing data. These issues required thoughtful consideration and consultation with statistics experts as we could not run multiple imputations with the EFA. We had to use an expectation-maximization algorithm instead to handle the missing data (Truxillo, 2005; Graham 2009; Weaver & Maxwell, 2014). One strength of this study is that we were able to derive scales related to our outcomes of interest, namely school engagement and enjoyment, friendship quality and bullying experiences.

Following the EFA, I had multiple discussions with Stata experts to prepare for the linear regressions. One crucial decision involved choosing between using factor scores derived from the EFA or using a summed score of the individual variables that loaded onto different factors as outcome variables. Additionally, careful consideration was given to the imputation of missing data on predictor, outcome, and confounding variables. Since we used multiple imputations, it was best to use a summed score of the individual variables as our outcomes. That way, the creation of the outcome variables can also be easily replicated.

Moreover, we ran multiple tests when conducting linear regressions which increased the type I error rate meaning that the probability of finding significant predictors that were not significant increased. We contemplated using the Bonferroni correction to adjust for multiple testing. However, this method is very conservative and reduces statistical power (Perrett et al.,

2006). We decided to use a more lenient alpha (>.01) that would account for multiple testing without compromising power.

Another strength of this study was that we conducted sensitivity analyses on complete cases. We ran the EFA and linear regression on complete cases to strengthen the results of the main analyses using imputed data. Although we may have lost power, it is recommended to do so, especially after imputations (Sterne et al., 2009).

Potential Clinical Implications

The systematic review highlighted several limitations in the PE literature that stem from studies in children and extend to the limited number of studies on adolescents and adults. This includes the lack of agreement on the definition and assessment methods of PE to be able to compare psychosocial correlates across studies. The results of associations between PE and some psychosocial correlates varied more than others such as eating disorder behaviours, OCD symptoms and identity-related difficulties. Another limitation in the literature was the lack of studies with more robust results looking at these associations. Finally, the lack of studies differentiating between transient PE, persistent PE and ARFID as well as studies examining their separate influence on psychosocial factors.

In light of these limitations and their clinical implications, our study aimed to address some of these gaps by examining an adolescent population using a longitudinal dataset. However, it is important to note that certain limitations, such as the lack of consensus on definition and assessment methods, remained unaddressed.

Our study's findings and limitations as well as unaddressed limitations in the literature may inform clinical practice and future research. Our findings suggested that individuals with

either transient or persistent PE may not face a substantial risk of lower school engagement and enjoyment, lower friendship quality, or higher bullying experiences. Although further research is needed to confirm these findings, these results can potentially provide reassurance to parents and caregivers. They may alleviate concerns and anxieties regarding the potential negative impact of their adolescent's PE behaviours on their psychosocial well-being. By highlighting that the association between PE and these outcomes is not substantial, our study contributes to a more nuanced understanding of the potential effects of PE on adolescents' psychosocial functioning.

To expand our understanding, further research should focus on using clear definitions and precise measures of PE and psychosocial outcomes and using these measures to explore a range of psychosocial outcomes potentially related to PE. These include the factors in our systematic review and the outcomes used in our empirical paper. Further research is also needed to investigate the difference in influence between transient PE, persistent PE, and ARFID on psychosocial outcomes. Overall, efforts should be made to increase the generalisability of the results and replicate the findings of our study.

Given the identified limitations in the literature, it is recommended that during assessments, clinicians should aim to measure PE through all aspects of its definition, including food neophobia, meal variety, and sensory sensitivity. Furthermore, clinicians may consider assessing the presence of ARFID to gain a more accurate understanding of individuals' PE patterns and severity. Alongside assessing the severity of eating behaviours, clinicians should aim to assess undesirable associations with psychosocial factors as these may vary greatly between individuals. Therefore, by differentiating between transient PE, persistent PE and ARFID, and individual challenges related to their eating behaviours, clinicians will be able to create tailored interventions and support.

We also found that other factors may exert a stronger influence on friendship quality, school engagement and enjoyment and bullying experiences in adolescence, thus clinicians should also aim to address these factors alongside patients' PE status. This may involve providing support and resources to individuals from disadvantaged backgrounds and implementing strategies to promote positive social interactions and school engagement.

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Appendices

Appendix A: Psychosocial Correlates of PE and FN beyond childhood

Appendix B: MMAT appraisals of each study

Appendix C: Prevalence of transient and persistent picky eaters (participants with data on all three outcome variables; n = 2930)

Appendix D: Comparison of sample characteristics for participants with complete data (n=2930) and those with missing data on the PE variable (n= 2171) among the total sample of GUS Children with birth mother as the main respondent

Appendix E: Comparison of questionnaire items using t-tests for participants with complete data (n=2930) and those with missing data on the PE variable (n= 2171) among the total sample of GUS Children with birth mother as the main respondent

Appendix F: Individual questions and response options used in the EFA

Appendix G: Final three-factor solution, factor loadings and uniqueness using complete case analysis (n=1795)

Appendix H: Univariable linear regression model results for the association between picky eating status and friendship quality and school engagement and enjoyment using complete case analysis (n =1795)

Appendix I: Univariable linear regression model results for the association between picky eating status and bullying experiences using complete case analysis (n =1795)

Appendix J: Hierarchical multiple linear regression model results for the association between picky eating status and friendship quality and school engagement and enjoyment using complete case analysis (n =1795)

Appendix K: Hierarchical multiple linear regression model results for the association between picky eating status and bullying experiences using complete case analysis (n =1795)

Appendix A

Psychosocial Correlates of PE and FN beyond childhood

Psychosocial correlate	Associations with PE or FN			
	Positive	Negative	None	Mixed
ED behaviours	He et al. (2020); Kauer et al. (2015)	Ellis et al. (2018)	Zickgraf et al. (2017); Van Tine et al. (2017); Pesch et al. (2020)	Wildes et al. (2012); Ellis et al. (2017); Barnhart et al. (2021); Cartner-Leno et al. (2022); Herle et al. (2020)
Social anxiety	Dial et al. (2021); Wildes et al. (2012); Barnhart et al. (2021); Ellis et al. (2018); Ellis et al. (2017)		Folta et al. (2020)	Thompson et al. (2015), Fox et al. (2018), Barnhart et al. (2021)
Depression	Ellis et al. (2018); Kauer et al. (2015)			Ellis et al. (2017)
Anxiety	Barnhart et al. (2021); Fox et al. (2018); Maiz & Balluerka (2017)			Ellis et al. (2017);

Psychological distress	Dial et al. (2021); He et al. (2020); Barnhart et al. (2021)		Zickgraf et al. (2017)
QOL/impairment		Dial et al. (2021); Schnettler et al. (2017); He et al. (2020); Zickgraf et al. (2017); Ellis et al. (2018);	Ellis et al. (2017); Wildes et al. (2012)
OCD	Kauer et al. (2015)		Zickgraf et al. (2017); Wildes et al. (2012);
Identity-related difficulties	Dial et al. (2021); Maiz & Balluerka (2017)		Thompson et al. (2015)

Appendix B

MMAT appraisals of each study

	Study number and reference				
	1. Carter Leno et al. (2022)	**2. Dial et al. (2021)**	**3. Barnhart et al. (2021)**	**4. Pesch et al. (2020)**	**5. He et al. (2020)**
Screening questions					
1. Are there clear research questions?					
Yes	X	X	X	X	X
No					
Can't tell/comment					
2. Do the collected data allow to address the research questions?					
Yes	X	X	X	X	X
No					
Can't tell/comment					
For quantitative non-randomised studies					

1. Are the participants representative of the target population?				
Yes	X	X	X	X
No				
Don't know/comment	X There was limited information on how the sample was selected and whether it was representative of the target population			
2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
Yes	X		X	X
No				
Can't tell/comment	X The self-report questionnaires used were not described in detail, and there was no information on their validity or reliability	X The self-report questionnaires used were not described in detail, and there was no information on their validity or reliability		

3. Are there complete outcome data?					
Yes			X		
No				X High attrition rate	
Can't tell/comment	X	X no mention of how missing data were handled			X
4. Are the confounders accounted for in the design and analysis?					
Yes					
No					
Can't tell/comment	X There may have been some unmeasured confounding variables	X	X There may have been some unmeasured confounding variables	X There may have been some unmeasured confounding variables	X There may have been some unmeasured confounding variables
5. During the study period, is the intervention administered (or exposure occurred) as intended?					
Yes	X	X	X	X	X
No					
Can't tell/comment					

Study number and reference (continued)

	6. Ellis et al. (2018)	7. Kauer et al. (2015)	8. Wildes et al. (2012)	9. Ellis et al. (2017)	10. Herle et al. (2020)
Screening questions					
1. Are there clear research questions?					
Yes	X	X	X	X	X
No					
Can't tell/comment					
2. Do the collected data allow to address the research questions?					
Yes	X	X	X	X	X
No					
Can't tell/comment					
For quantitative non-randomised studies					
1. Are the participants representative of the target population?					
Yes	X	X	X	X	X
No					
Don't know/comment					
2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?					
Yes	X	X			X
No			X the survey used may not accurately capture all aspects of PE	X the survey used may not accurately capture all aspects of PE	
Can't tell/comment					
3. Are there complete outcome data?					

Yes					
No					
Can't tell/comment	X	X	X	X	X
4. Are the confounders accounted for in the design and analysis?					
Yes					
No					
Can't tell/comment	X There may have been some unmeasured confounding variables	X There may have been some unmeasured confounding variables	X There may have been some unmeasured confounding variables	X	X There may have been some unmeasured confounding variables
5. During the study period, is the intervention administered (or exposure occurred) as intended?					
Yes	X	X	X	X	X
No					
Can't tell/comment					

	11. Van Tine et al. (2017)	12. Maiz & Balluerka (2018)	13. Schnetller et al. (2017)	14. Zickgraf et al. (2017)
Screening questions				
1. Are there clear research questions?				
Yes	X	X	X	X
No				
Can't tell/comment				
2. Do the collected data allow to address the research questions?				
Yes	X	X	X	X
No				
Can't tell/comment				
For quantitative non-randomised studies				
1. Are the participants representative of the target population?				
Yes			X	X
No	X Small sample size			
Don't know/comment		X Unclear how participants were recruited		
2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
Yes	X	X	X	X
No				
Can't tell/comment				

3. Are there complete outcome data?				
Yes				
No				
Can't tell/comment	X	X	X	X
4. Are the confounders accounted for in the design and analysis?				
Yes				
No				
Can't tell/comment	X There may have been some unmeasured confounding variables	X There may have been some unmeasured confounding variables	X	X
5. During the study period, is the intervention administered (or exposure occurred) as intended?				
Yes	X	X	X	X
No				
Can't tell/comment				

	15. Folta et al. (2020)	16. Fox et al. (2018)	17. Thompson et al. (2015)
Screening questions			
1. Are there clear research questions?			
Yes	X	X	X
No			
Can't tell/comment			
2. Do the collected data allow to address the research questions?			
Yes	X	X	X
No			
Can't tell/comment			
For qualitative studies			
1. Is the sampling strategy relevant to address the research question?			
Yes	X	X	
No			
Don't know/comment			X
2. Is the sample representative of the target population?			
Yes	X		X
No			
Can't tell/comment		X the lack of demographic information on the participants makes it difficult to determine the representativeness of the sample.	
3. Are the measurements appropriate?			
Yes	X		X
No			

Can't tell/comment		X	
4. Is the risk of nonresponse bias low?			
Yes			
No			
Can't tell/comment	X	X	X
5. Is the statistical analysis appropriate to answer the research question?			
Yes	X	X	X
No			
Can't tell/comment			

Appendix C

Prevalence of transient and persistent picky eaters (participants with data on all three outcome variables; n = 2930)

	Count	Percent
Not picky (control)	2134	72.8
Transient picky	687	23.5
Persistent picky	109	3.7
Total	2930	100.0

Appendix D

Comparison of sample characteristics for participants with complete data (n=2930) and those with missing data on the PE variable (n= 2171) among the total sample of GUS Children with birth mother as the main respondent

	Complete PE data n (%)*	**Missing PE data n (%)**	**Odds Ratio (95% CI)**
Total	2930 (57.4%)	2171 (42.6%)	
Child sex			
Male	1489 (50.8%)	1132 (52.1%)	0.95 (0.85-1.06)
Female	1441 (49.2%)	1039 (47.9%)	
Child ethnicity			
White	2831 (96.7%)	2043 (94.2%)	**1.78 (1.36-2.33)**
Other ethnic background	98 (3.3%)	126 (5.8%)	
Mother's highest education level			

School with qualification	618 (21.2%)	672 (31.5%)	
Degree or Higher	2135 (73.2 %)	1171 (54.9%)	0.50 (0.44-0.57)
No qualifications	162 (5.6%)	291 (13.7%)	**1.65 (1.32-2.06)**
Household income			
Up to £11,999	69 (3.2%)	14 (7.3%)	
£12,000 - £22,999	292 (13.6%)	35 (18.2%)	0.59 (0.30-1.15)
£23,000 - £31,999	250 (11.6%)	28 (14.6%)	0.03 (0.009-0.18)
£32,000 - £49,999	506 (23.6%)	39 (20.3%)	0.38 (0.20-0.73)
£50,000 - £73,999	533 (24.8%)	44 (22.3%)	0.40 (0.21-0.78)
£74,000 or more	497 (23.1%)	32 (16.7%)	0.32 (0.16-0.62)
Smoking pregnancy			
No			
Yes	2382 (81.7%)	1466 (68.2%)	
(occasionally/always)	534 (18.3%)	683 (31.8%)	**2.08 (1.82-2.37)**
Type of delivery			
Vaginal delivery	1735 (59.6%)	1398 (64.8%)	

With medical intervention	1176 (40.4%)	760 (35.2%)	0.80 (0.71-0.90)
How many previous illnesses does child still have?			
None	1892 (79.5%)	181 (84.6%)	
1	363 (15.3%)	22 (10.3%)	0.63 (0.40-1.0)
2+	93 (3.9%)	11 (5.1%)	**1.23 (0.65-2.35)**
How many new illnesses does child have?			
None	2083 (87.6%)	183 (85.5%)	
1	261 (10.9%)	29 (13.5%)	**1.26 (0.84-1.91)**
2+	31 (1.3%)	2 (0.9%)	0.73 (0.17-3.01)
Feeding problems 9-12 months			
Not a problem	2531 (86.4%)	1878 (86.5%)	
A problem (a bit or big)	399 (13.6%)	293 (13.5%)	0.99 (0.84-1.16)

Does child have additional needs? (ASD)			
No	2875 (98.1%)	918 (99.1%)	0.45 (0.22-0.96)
Yes	55 (1.9%)	8 (0.9%)	

Appendix E

Comparison of questionnaire items using t-tests for participants with complete data (n=2930) and those with missing data on the PE variable (n= 2171) among the total sample of GUS Children with birth mother as the main respondent

		Complete PE data n (%)*	Missing PE data n (%)	t-test t(df), p
School engagement and enjoyment	1. I enjoy learning at school	2930 (46.9%)	2711 (53.1%)	t(2388)=0.04, p=0.96
	1. I look forward to going to school	2931 (46.9%)	2710 (53.1%)	t(2389)=0.69, p=0.49
	2. I hate school	2931 (46.9%)	2710 (53.1%)	t(2389)=0.89, p=0.38
	3. My teachers treat me fairly	2931 (46.9%)	2710 (53.1%)	t(2389)=0.13, p=0.89
	4. How often do you try your best at school?	2931 (46.9%)	2710 (53.1%)	t(2389)=0.71, p=0.48

	5. How often do you misbehave or cause trouble in class?	2161 (42.4%)	2940 (57.6%)	t(2159)=1.76, p=0.08
Friendship quality	1. My friends listen to what I have to say	2738 (46.6%)	2723 (53.4%)	t(2376)=-1.35, p=0.18
	2. I can count on my friends to help me when I have a problem	2738 (46.6%)	2723 (53.4%)	t(2376)=-1.56, p=0.12
	3. I talk to my friends when I am having a problem	2738 (46.6%)	2723 (53.4%)	t(2376)=-0.29, p=0.77
	4. If my friends know something is bothering me, they ask me about it	2738 (46.6%)	2723 (53.4%)	t(2376)=0.74, p=0.46
	5. I share my thoughts and feelings with my friends	2738 (46.6%)	2723 (53.4%)	t(2376)=0.29, p=0.77
	6. My friends pay attention to me	2738 (46.6%)	2723 (53.4%)	t(2376)=0.10, p=0.92
Bullying experiences	1. How often do other young people pick on you by calling you names or making fun of you Bullying in a way that you don’t like?	2738 (46.6%)	2723 (53.4%)	t(2376)=-1.02, p=0.31
	2. How often do other young people pick on you by leaving you out of games and chats?	2737 (46.6%)	2724 (53.4%)	t(2375)=-0.72, p=0.47
	3. How often do other young people pick on you by shoving, pushing, hitting or picking a fight with you?	2738 (46.6%)	2723 (53.4%)	t(2376)=-1.08, p=0.28

	4. How often do other young people pick on you by sending messages or posting things about you online that you don't like?	2736 (46.6%)	2725 (53.4%)	t(2374)=1.36, p=0.17
	5. How often do you pick on others? (e.g. by calling them names, making fun of them, leaving them out of games and chats, shoving, pushing, hitting, or picking a fight with them, or sending messages or posting things about them online that you know they won't like)'.	2736 (46.6%)	2725 (53.4%)	t(2374)=1.43, p=0.15

Appendix F

Individual questions and response options used in the EFA

Outcomes	Questions	Response options
School engagement and enjoyment	6. I enjoy learning at school 7. I look forward to going to school 8. I hate school 9. My teachers treat me fairly 10. How often do you try your best at school? 11. How often do you misbehave or cause trouble in class?	1. Never 2. Sometimes 3. Often 4. Always
Friendship quality	1. My friends listen to what I have to say 2. I can count on my friends to help me when I have a problem 3. I talk to my friends when I am having a problem 4. If my friends know something is bothering me, they ask me about it 5. I share my thoughts and feelings with my friends 6. My friends pay attention to me	1. Never true 2. Sometimes true 3. Often true 4. Always true

Bullying experiences	1. How often do other young people pick on you by calling you names or making fun of you Bullying in a way that you don't like? 2. How often do other young people pick on you by leaving you out of games and chats? 3. How often do other young people pick on you by shoving, pushing, hitting or picking a fight with you? 4. How often do other young people pick on you by sending messages or posting things about you online that you don't like? 5. How often do you pick on others? (e.g. by calling them names, making fun of them, leaving them out of games and chats, shoving, pushing, hitting, or picking a fight with them, or sending messages or posting things about them online that you know they won't like)'.	1. Most days 2. About once a week 3. About once a month 4. Every few months 5. Never

Appendix G

Final three-factor solution, factor loadings and uniqueness using complete case analysis (n=1795)

Item	Factor 1 (Friendship quality)	Factor 2 (School engagement and enjoyment)	Factor 3 (Bullying experiences)	Uniqueness
1. I enjoy learning at school		.74		.44
2.I look forward to going to school		.71		.47
3. I hate school		.65		.55
4.My teachers treat me fairly		.44		.78
5.How often do you try your best at school?		.46		.76
6. My friends listen to what I have to say	.66			.49
7. Can count on my friends to help me when I have a problem	.77			.34
8. I talk to my friends when I am having a problem	.80			.34
9. If my friends know something is bothering me, they ask me about it	.74			.44
10. I share my thoughts and feelings with my friends	.77			.38
11. My friends pay attention to me	.70			.43
12. How often do other young people pick on you by calling you names or making fun of you Bullying in a way that you don't like?			.65	.55
13. How often do other young people pick on you by leaving you out of games and chats?			.59	.60

14. How often do other young people pick on you by shoving, pushing, hitting or picking a fight with you?			.62	.59
15. How often do other young people pick on you by sending messages or posting things about you online that you don't like?			.59	.64
Eigenvalue	4.36	1.56	1.25	
% of variance	68%	24%	19%	

Note. Blanks represent loadings <.
4.

Appendix H

Univariable linear regression model results for the association between picky eating status and friendship quality and school engagement and enjoyment using complete case analysis (n =1795)

Univariable models

	Friendship Quality			**School engagement and enjoyment**		
	β (SE)	t	*p*-value	β (SE)	t	*p*-value
Picky eating status						
No Picky eating						
Transient	.11 (.24)	.50	.61	-.19 (.10)	-1.86	.06
Persistent	-.39 (.57)	-.69	.49	-.27 (.25)	-1.07	.28
Child sex						
Male						
Female	1.81 (.19)	9.3	**<.005***	.19 (.09)	12.20	.03
Child ethnicity						
White						
	-.26 (.58)	-.45	.66	.16 (.25)	.62	.54

Other ethnic background						
Highest education level						
School						
Post-school	-.356 (.25)	-2.20	.03	.33 (.11)	2.98	**.003***
No qualifications	-.99 (.54)	-1.76	.09	-.24 (.24)	-1.01	.31
Household Income (Std)	.09 (.10)	.93	.35	.31 (.04)	7.09	**<.005***
Autism diagnosis						
No						
Yes	-1.35 (.79)	-1.71	**.**09	-.71(.35)	-2.05	.04
Number of long-standing health conditions						
None						
1	-.13 (.28)	-.46	.64	-.15 (.12)	-1.19	.23
2+	-.74 (.46)	-1.59	.11	-.14 (.21)	-.07	.49
Number of new heath conditions						
None						
1	-.48 (.32)	-1.49	.13	-.16 (.14)	-1.11	.27
2+	-2.04 (.82)	-2.50	**.01***	-.76 (.36)	-2.10	.04
Problems feedings 9-12 months						
No						
Yes (a bit or big)	-.24 (.29)	-.84	.40	.05 (.13)	.41	.68
Smoking during pregnancy						
No						
Yes (occ/always)	-.27 (.28)	-.98	.33	-.48 (.12)	-3.95	**<.005***
Delivery Type						
Vaginal delivery						
With medical intervention	-.25 (.20)	-1.21	.22	.21 (.09)	2.36	.02

*Note. *p <.01 is significant.*

Appendix I

Univariable linear regression model results for the association between picky eating status and bullying experiences using complete case analysis (n =1795)

	Univariable models		
	Bullying experiences		
	β (SE)	t	*p*-value
Picky eating status			
No Picky eating			
Transient	-.23 (.15)	-1.54	.12
Persistent	-.12 (.36)	-.33	.74
Child sex			
Male			
Female	-.20 (.12)	-1.62	.11
Child ethnicity			

White			
Other ethnic background	.48 (.36)	1.35	.18
Highest education level			
School	.09 (.16)	.59	.56
Post-school	-.03 (.34)	-.08	.94
No qualifications			
Household Income (Std)	.10 (.06)	1.62	.11
Autism diagnosis			
No			
Yes	-1.18 (.49)	-2.41	.02
Number of long-standing health conditions			
None			
1	-.15 (.167	-.86	.39
2+	-.61 (.29)	-2.10	.04
Number of new heath conditions			
None	-.03 (.20)	-.16	.87
1	-1.18 (.52)	-2.29	.02
2+			
Problems feedings 9-12 months			
No	-.39 (.18)	-2.14	.03
Yes (a bit or big)			
Smoking during pregnancy			
No			
Yes (occ/always)	-.46 (.17)	-2.67	**.008***
Delivery Type			
Vaginal delivery			
With medical intervention	-.01(.13)	.08	.94

Note. p<.01 is significant.*

Appendix J

Hierarchical multiple linear regression model results for the association between picky eating status and friendship quality and school engagement and enjoyment using complete case analysis (n =1795)

Multivariable models

	Friendship Quality			School engagement and enjoyment		
	β (SE)	t	*p*-value	β (SE)	t	*p*-value
Step 1						
Picky eating status						
No Picky eating	.15 (.23)	.64	.52	-.19 (.10)	-1.84	.07
Transient	-.38 (.56)	-.68	.50	-.27 (.25)	-1.07	.29
Persistent						
Child sex						
Male						
Female	1.81 (.19)	9.3	**<.005***	.19 (.09)	2.18	**.**03
Step 2						
Picky eating						

status						
No Picky eating	.15 (.23)	.65	.51	-.19 (.10)	-1.85	.06
Transient	-.36 (.56)	-.65	.52	-.27 (.25)	-1.09	.28
Persistent						
Child sex						
Male						
Female	1.81 (.19)	9.31	**<.005***	.19 (.09)	2.17	.03
Child ethnicity						
White						
Other ethnic background	-.34 (.56)	-.60	.55	.17 (.25)	.66	.51
Step 3						
Picky eating						
status						
No Picky eating	.14 (.23)	.62	.54	-.13 (.10)	-1.23	.22
Transient	-.32 (.56)	-.58	.56	-.18 (.25)	-.74	.46
Persistent						
Child sex						
Male						
Female	1.82 (.19)	9.39	**<.005***	.18 (.09)	2.15	.03
Child ethnicity						
White						
	-.25 (.56)	-.44	.66	.24 (.25)	.95	.34

Other ethnic background						
Highest education level						
School						
Post-school	-.69 (.26)	-2.69	**.007***	.14 (.11)	1.23	.22
No qualifications	-.91 (.54)	1.69	.09	-.06 (.24)	-.27	.78
Household Income (Std)	.14 (.10)	1.35	.18	.28 (.05)	6.14	**<.005***
Step 4						
Picky eating status						
No Picky eating	.14 (.23)	.62	.54	-.13 (.10)	-1.23	.22
Transient	-.31 (.56)	-.55	.58	-.17 (.25)	-.70	.48
Persistent						
Child sex						
Male						
Female	1.81 (.19)	9.30	**<.005***	.18 (.09)	2.06	.04
Child ethnicity						
White						
Other ethnic background	.25 (.56)	.44	.66	.24 (.25)	.95	.34
Highest education level						
School						
Post-school	-.70 (.26)	-2.73	**.006***	.13 (.11)	1.18	.24

No qualifications	-.093 (.54)	-1.73	.08	-.07 (.24)	-.33	.75
Household Income (Std)	.13 (.10)	1.27	.20	.28 (.05)	6.04	**<.005***
Autism diagnosis						
No	-.97 (.77)	-1.26	.21	-.49 (.34)	-1.43	.15
Yes						
Step 5						
Picky eating status						
No Picky eating						
Transient	.18 (.23)	.80	.42	-.12 (.10)	-1.11	.27
Persistent	-.21 (.56)	-.37	.71	-.15 (.25)	-.61	.54
Child sex						
Male						
Female	1.87 (.19)	9.55	**<.005***	.19 (.09)	2.18	.03
Child ethnicity						
White						
Other ethnic background	-.35 (.56)	-.62	.54	.23 (.25)	.91	.37
Highest education level						
School						
Post-school	-.68 (.26)	-2.67	**.008***	.14 (.11)	1.23	.22
No qualifications	-.85 (.54)	-1.58	.12	-.06 (.24)	-.24	.81

Household Income (Std)	.11 (.10)	1.10	.27	.27 (.05)	5.92	**<.005***
Autism diagnosis						
No						
Yes	-.39 (.80)	-.48	.63	-.36 (.36)	-1.01	.31
Number of long-standing health conditions						
None	.02 (.27)	.06	.95	-.10 (.12)	-.79	.41
1	-.41 (.46)	-.90	.37	-.03 (.20)	-.18	.85
2+						
Number of new heath conditions						
None	-.78 (.32)	-2.46	**.01***	-.15 (.14)	-1.05	.30
1	-2.1 (.82)	-2.56	**.01***	-.46 (.36)	-1.25	.21
2+						
Step 6						
Picky eating status						
No Picky eating						
Transient	.22 (.24)	.92	.36	-.12 (.10)	-1.18	.24
Persistent	-.17 (.56)	-.31	.75	-.16 (.25)	-.65	.52
Child sex						
Male						
Female	1.87 (.19)	9.57	**<.005***	.19 (.09)	2.16	.03

Child ethnicity						
White						
Other ethnic background	-.32 (.57)	-.56	.57	.22 (.25)	.87	.38
Highest education level						
School						
Post-school	-.68 (.26)	-2.64	**.008***	.14 (.11)	1.21	.22
No qualifications	-.85 (.54)	-1.59	.11	-.06 (.24)	-.23	.81
Household Income (Std)	.11 (.10)	1.11	.27	.27 (.05)	5.91	**<.005***
Autism diagnosis						
No						
Yes	-.38 (.80)	-.47	.63	-.36 (.36)	-1.02	.31
Number of long-standing health conditions						
None	.02 (.27)	.08	.94	-.10 (.12)	-.80	.42
1	-.38 (.46)	-.83	.41	-.05 (.20)	-.22	.82
2+						
Number of new heath conditions						
None	-.77 (.32)	-2.41	.02	-.15 (.14)	-1.08	.28
1	-2.08 (.82)	-2.54	**.01**	-.46 (.36)	-1.27	.21
2+						

Problems feedings 9-12 months						
No						
Yes (a bit or big)	-.25 (.29)	-.88	.38	.07 (.13)	.56	.58
Step 7						
Picky eating status						
No Picky eating						
Transient	.23 (.24)	.98	.33	-.12 (.10)	-1.17	.24
Persistent	-.09 (.56)	-.17	.87	-.15 (.25)	-.61	.54
Child sex						
Male						
Female	1.87 (.19)	9.56	**<.005***	.19 (.09)	2.23	.03
Child ethnicity						
White						
Other ethnic background	-.32 (.57)	-.57	.57	.19 (.25)	.78	.44
Highest education level						
School						
Post-school	-.70 (.26)	-2.71	**.007***	.11 (.11)	.94	.35
No qualifications	-.78 (.54)	-1.44	.15	-.03 (.24)	-.15	.88
Household Income (Std)	.11 (.11)	1.03	.30	.25 (.05)	5.20	**<.005***

Autism diagnosis						
No						
Yes	-.39 (.80)	-.49	.63	-.36 (.36)	-1.01	.31
Number of long-standing health conditions						
None	.03 (.27)	.12	.90	-.10 (.12)	-.79	.43
1	-.39 (.46)	-.85	.40	-.05 (.20)	-.24	.81
2+						
Number of new heath conditions						
None	-.78 (.32)	-2.43	.02	-.17 (.14)	-1.20	.23
1	-2.11 (.82)	-2.57	**.01***	-.48 (.36)	-1.32	.19
2+						
Problems feedings 9-12 months						
No						
Yes (a bit or big)	-.27 (.29)	-.93	.35	.06 (.13)	.47	.64
Smoking during pregnancy						
No						
Yes (occ/always)	-.35 (.28)	-1.27	.20	-.28 (.12)	-2.28	.02
Delivery Type						
Vaginal delivery	-.20 (.20)	-1.00	.32	.13 (.09)	1.43	.15

With medical intervention

*Note. *p <.01 is significant.*

Appendix K

Hierarchical multiple linear regression model results for the association between picky eating status and bullying experiences using complete case analysis (n =1795)

	Bullying experiences		
	β (SE)	t	*p*-value
Step 1			
Picky eating status			
No Picky eating			
Transient	-.23 (.15)	-1.56	.12
Persistent	-.12 (.35)	-.33	.74
Child sex			
Male			
Female	-.20 (.12)	-1.64	.10
Step 2			

Picky eating			
status			
No Picky eating			
Transient	-.24 (.15)	-1.60	.11
Persistent	-.14 (.36)	-.40	.69
Child sex			
Male			
Female	-.20 (.12)	-1.66	.09
Child ethnicity			
White			
Other ethnic background	.541(.36)	1.43	.15
Step 3			
Picky eating			
status			
No Picky eating			
Transient	-.22 (.15)	-1.46	.14
Persistent	-.11 (.36)	-.32	.75
Child sex			
Male			
Female	-.21 (.12)	-1.67	.09
Child ethnicity			
White			
Other ethnic background	.53 (.36)	1.49	.14
Highest education level			

School			
Post-school No qualifications	.02 (.16) .03 (.34)	.11 .10	.91 .92
Household Income (Std)	.09 (.67)	1.46	.14
Step 4			
Picky eating			
status			
No Picky eating			
Transient	-.22 (.15)	-1.46	.14
Persistent	-.09 (.36)	-.26	.79
Child sex			
Male			
Female	-.22 (.12)	-1.80	.07
Child ethnicity			
White			
Other ethnic background	.54 (.36)	1.49	.14
Highest education level			
School			
Post-school No qualifications	.005 (.16) .01 (.34)	.03 .03	.97 .97
Household Income (Std)	.09 (.07)	1.32	.19
Autism diagnosis			
No			
Yes	-1.18 (.49)	-2.40	**.02**

Step 5			
Picky eating status			
No Picky eating			
Transient	-.20 (.15)	-1.32	.19
Persistent	-.05 (.36)	-.14	.89
Child sex			
Male			
Female	-.23 (.12)	-1.87	.06
Child ethnicity			
White			
Other ethnic background	.50 (.36)	1.40	.16
Highest education level			
School			
Post-school	.02 (.16)	.12	.91
No qualifications	.02 (.34)	.07	.94
Household Income (Std)	.79 (.07)	1.18	.24
Autism diagnosis			
No			
Yes	-.88 (.51)	-1.73	.08
Number of long-standing health conditions			
None			
1	.12 (.18)	-.69	.49
2+	-.53 (.29)	-1.81	.07

Number of new heath conditions			
None			
1	.04 (.20)	.21	.83
2+	-.84(.53)	-1.58	.11
Step 6			
Picky eating			
status			
No Picky eating			
Transient	-.16 (.15)	-1.06	.29
Persistent	-.01 (.36)	-.03	.98
Child sex			
Male			
Female	-.23 (.12)	-1.81	.07
Child ethnicity			
White			
Other ethnic background	.54 (.36)	1.51	.13
Highest education level			
School			
Post-school			
No qualifications	.03 (16)	.18	.86
Household Income (Std)	.02 (.34)	.05	.96
	.08 (.07)	1.20	.23
Autism diagnosis			
No			
Yes	-.87 (.51)	-1.71	.09
Number of long-standing health conditions			

None			
1			
2+	-.11 (.18)	-.65	.52
	-.49 (.279	-1.67	.10
Number of new heath conditions			
None			
1	.06 (.20)	.30	.76
2+	-.82 (.53)	-1.54	.12
Problems feedings 9-12 months			
No			
Yes (a bit or big)	-.33 (.18)	-1.78	.08
Step 7			
Picky eating			
status			
No Picky eating			
Transient	-.15 (.15)	-.99	.32
Persistent	.05 (.35)	.14	.89
Child sex			
Male			
Female	-.22 (.12)	-1.79	.07
Child ethnicity			
White			
Other ethnic background	.52 (.36)	1.45	.14
Highest education level			
School			
Post-school			
No qualifications	-.008 (.16)	-.05	.96
	.08 (.34)	.23	.82

Household Income (Std)	.06 (.07)	.81	.42
Autism diagnosis			
No			
Yes	-.88 (.51)	-1.72	.09
Number of long-standing health conditions			
None			
1			
2+	-.10 (.17)	-.60	.55
	-.50 (.29)	-1.70	.09
Number of new heath conditions			
None			
1	.04 (.20)	.22	.82
2+	-.84 (.53)	-1.59	**.**11
Problems feedings 9-12 months			
No			
Yes (a bit or big)			
	-.35 (.18)	-1.89	.06
Smoking during pregnancy			
No			
Yes (occ/always)			
	-.44 (.168	-2.46	**.01***
Delivery Type			
Vaginal delivery			
With medical intervention	-.03 (.13)	-.27	.79

*Note. *p <.01 is significant.*