

Prevalence rates of pica and rumination behaviors in German children aged 7-14 and their associations with feeding, eating, and general psychopathology: A population-based study

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The authors declare that they have no conflicts of interest.

Abstract

Despite potentially severe medical consequences of pica and rumination disorder (RD), little is known about their prevalence and association with other psychopathology in childhood. As a part of a larger population-based study, 804 youths aged 7–14 years and their parents were asked about their experience of pica and RD behaviors, and associated eating, feeding and general psychopathology. A total of 12.31% and 11.49% of youth reported having engaged in pica or RD behaviors at least once. Recurring pica or RD behaviors had been experienced by 4.98% and 1.49% of the participants. The behaviors showed a significant, but small correlation with one another ($r = .28, p < .01$). Correlations with symptoms of avoidant/restrictive food intake disorder (ARFID) were significant, but small (pica: $r = .18$, RD: $r = .27$, both $p < .01$). Prevalence rates of recurring pica behavior were significantly increased if recurring RD was present (58.33%), and also greater vice versa (17.50%). The prevalence rates for recurrent pica and RD behaviors were also increased in the presence of an ARFID diagnosis (both behaviors 12.0%). However, correlations with restraint, eating, weight, and shape concern were non-significant (all $p > .05$). In addition, RD behavior was positively correlated with emotional and conduct problems ($r = .15$ and $.22$, both $p < .01$) and both behaviors were negatively correlated with prosocial behavior ($r = -.10$ and $-.09$, both $p < .05$). Our findings underscore the clinical significance of pica and RD behaviors. More research is warranted on both disorders, their association and their relation with ARFID, in order to reach a further understanding of their presentation and to ascertain diagnostic validity.

Keywords: pica, rumination disorder, prevalence, children and adolescents, feeding and eating disorder psychopathology, general psychopathology

Background

In 2013, pica and rumination disorders (RD) became diagnoses in the Feeding and Eating Disorder category of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; [1]). With the move from the section of 'Feeding and eating disorders of infancy or early childhood' to the Feeding and Eating Disorder category, these disorders receive increased attention from researchers specializing in eating disorders. While pica is characterized by eating nonfood substances, RD's hallmark features include the regurgitation of food, its subsequent re-chewing, re-swallowing, or spitting out [1, 2]. Both disorders are severely under-researched, resulting in a lack of population-based prevalence rates, limited etiological models, and very few evidence-based treatment approaches [3–6]. Given the potential detrimental physical consequences of both disorders, including gastrointestinal complications (ruptures or obstructions), poisoning, and infection in pica [7-10] and weight loss, tooth decay, and electrolyte imbalances in RD [11], there is a need for better understanding of their prevalence, their associated psychological burden, and comorbidity features.

Pica is now defined as consuming nonfood items that have no nutritional value (before DSM-5: inedible substances) over a period of at least one month. These nonfood items can range from paper or paint chips to faeces [12]. Typical substances consumed by children include earth and clay (geophagy) [4], plaster or paint chips [13, 14], string, hair, cloth, animal faeces, stones, and insects [15]. Notably, DSM-5 limits pica diagnosis to individuals for whom the developmental status of eating a nonnutritive substance is inappropriate. Furthermore, the consumption of nonfood items must not be culturally supported or socially normative. Finally, pica can be diagnosed comorbidly with other mental disorders or medical conditions only if it warrants additional clinical attention due to sufficient severity [1].

According to DSM-5, “the prevalence of pica is unclear” in the general population [1]. Epidemiological studies using DSM-5 criteria are missing. Studies assessing prevalence rates of pica behavior rather than the disorder in youth using other criteria report widely ranging prevalence rates from 1.7% for children in upstate New York counties [14] to 74.4% for children in Zambia [4]. The wide range of prevalence is due to differences in definitional criteria, the partially selective demographic strata of samples, and obstacles for reporting behavior (e.g., shame for the eating behavior vs. regarding it as normal or socially acceptable [6, 16]). There is a lack of studies assessing pica disorder and behavior in European children. However, a meta-analysis of the prevalence rates of pica behavior during pregnancy and postpartum are remarkably low in Europe, Asia, and the Americas in comparison to Africa [17]; a Danish study, for example, described a prevalence rate of pica behavior of 0.02% in pregnant women [18]. Furthermore, studies on the psychosocial consequences of such behavior are missing.

In pica, the focus is on nonnutritive nonfood items; in RD, on the other hand, the behavior around food consumption is central. The core feature of RD is the recurrent and effortless regurgitation of partially digested food at least several times a week over a period of at least one month without a feeling of nausea or the demonstration of involuntary retching or disgust [1]. The food is then usually re-chewed and re-swallowed, or spat out (before DSM-5 only re-chewing was mentioned). An essential point is that regurgitation cannot be attributed to gastrointestinal or other medical conditions (e.g., gastroesophageal reflux). While RD can only be diagnosed comorbidly with another feeding or eating disorder if it also occurs outside the other disorder's course, a comorbid diagnosis with other mental disorders is possible in case the severity is sufficient to warrant additional clinical attention [1].

As in pica, DSM-5 characterizes RD prevalence rates in the community to be inconclusive [1]. This is due to the variability in the use of diagnostic terms (e.g., regurgitation disorder [19] or rumination syndrome [20]) to describe the same presentations, as in pica unclear definitions between behaviors and full syndrome diagnoses, and non-disclosure due to shame [21]. A school-based study conducted in Sri Lanka assessing RD (the disorder not the behavior) based on the ROME III Diagnostic criteria for functional gastrointestinal disorders (i.e., defined as variable combinations of chronic or recurrent gastrointestinal symptoms not otherwise explained by structural or biochemical abnormalities) via questionnaire yielded a prevalence rate of 5.1% in children aged 10–16 years [22]. There are no data with regard to psychosocial consequences, and studies on the prevalence rates of RD and RD behavior are missing in Western European countries. One can only assume that social functioning might be impaired, potentially, at least in part due to the knowledge of social undesirability of behavior.

Thus, as in pica, data on prevalence rates of behaviors and the associated psychological burden are strongly needed in RD, particularly in youth, as the major onset of the disorders is assumed to occur within this timeframe [1]. The present study, therefore, aimed to assess prevalence rates of self-reported pica and RD behaviors in 804 youths aged 7–14 years, participating in a large population-based study. Furthermore, the study's second aim was to analyze associations with other self-reported feeding and eating disorder psychopathology, parent-reported feeding practices as well as self- and parent-reported associated psychological burden (i.e., general psychopathology). We expected the prevalence rates of pica and RD behaviors within the range of the prevalence rates found in the scarce previously reported population-based studies in youth. Furthermore, we expected at least small-sized correlations with other feeding and eating disorder pathology, therewith supporting their categorization in the DSM-5 diagnostic category Feeding and Eating Disorders [1]. Finally, given that a diagnosis in DSM-5 implies the presence of burden or psychosocial impairment, we

expected at least small-sized correlations of both behaviors with psychological burden (i.e., general psychopathology).

Methods

Participants and Recruitment

Data were derived from the “Leipzig Research Center for Civilization Diseases (LIFE)” Child study, a large prospective population-based cohort study that aims to identify the risk factors behind various lifestyle diseases; for example: childhood obesity and its comorbidities (see: [23, 24]). Children were included into the study’s Health Cohort between one and 16 years of age, and the study included different medical and psychological assessments over the course of multiple visits.

Recruitment was performed through advertisement at different institutions, such as university hospitals, local clinics, public health centers, schools, and partner study centers. For inclusion, participants were required to live in the greater area of Leipzig, have sufficient German language skills, and be able to attend at least one on-site assessment. For a detailed description of the design and procedures of the LIFE study see [23, 24].

All parents provided informed written consent. Written informed assent was also obtained from the children if they were ≥ 12 years of age. In case children still participated when they were 18 years old, they additionally approved their previous participation retrospectively. The Ethics Committee of the Medical Faculty of the University of Leipzig, Germany, approved the methodological concept for the conduct of the LIFE study, including the consent procedure (Reg. No. 264-10-19042010), and therefore it has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. As of August 2017, a total of $n = 804$ completed the Eating Disorders in Youth–Questionnaire (see below) and their data underwent the analyses described.

Procedure

As the larger study, from which the data reported here were derived, has a longitudinal design, there were multiple measurements of the single assessments (questionnaires and anthropometric measures). For reasons of consistency and to comply with a cross-sectional focus for this study, we selected the first measurements of each assessment in participant age range 7-14 years.

Measures

Eating Disorders in Youth-Questionnaire (EDY-Q; [25]). The EDY-Q assesses early-onset restrictive eating disturbances in 8–13-year-old children. The questionnaire consists of 14 items (scaled on a seven-point Likert scale ranging from 0 *never true* to 6 *always true*). Ten items cover the symptoms of avoidant/restrictive food intake disorder (ARFID) symptomatology and are summarized to a mean score (ranging from 0 to 6), which has previously shown acceptable internal consistency (Cronbach's $\alpha = .62$; [26]). In addition, an ARFID diagnosis can be approximated (see: [26]). Pica and RD behaviors were assessed by one additional item each (“I like to eat things that are not meant for eating (e.g., sand)” and “I regurgitate food that I have already swallowed.”), and are central to the present study. Having engaged in any pica or RD behavior was defined as an item score ≥ 1 . Recurrent pica or RD behavior is defined as an item score ≥ 4 , mirroring the answer “the behavior is presented at least often.”

Eating Disorder Examination-Questionnaire for Children (ChEDE-Q; [27, 28]). The ChEDE-Q is the child version of the adult self-report instrument for assessing eating disorder psychopathology (EDE-Q; [29, 30]). Of the 28 items, 22 are grouped into the four subscales of Restraint, Eating Concern, Weight Concern, and Shape Concern. The subscales show good to excellent internal consistency ($.78 \leq \text{Cronbach's } \alpha \leq .90$; [31]).

Child Feeding Questionnaire (CFQ; [32]; German version: Hilbert, unpublished manuscript). The CFQ consists of 31 items and assesses the parent's view of child feeding practices as well as perceptions and concerns regarding feeding and weight. The three parental feeding practice subscales Restriction, Pressure to Eat, and Monitoring were used in the present study. Each item is scaled on a five-point Likert scale ranging from 1 to 5, with scale labels depending on the content of the scale: *never to always, markedly underweight to overweight, unconcerned to concerned, or disagree to agree*. The subscale sum scores show acceptable to excellent internal consistency ($.71 \leq \text{Cronbach's } \alpha \leq .91$; [33]).

Strengths and Difficulties Questionnaire (SDQ; [34, 35]). The SDQ measures behavior strengths and difficulties in 4–16-year-old children and adolescents in parent- or self-reports that were both employed in all participants in the present study. The 25 items (scaled on a three-point Likert scale, ranging from 0 *not true* to 2 *certainly true*) are summarized in five subscales: Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, Peer Relationships Problem, and Prosocial Behavior. The subscale sum scores of the self-report version show small to moderate internal consistencies ($.55 \leq \text{Cronbach's } \alpha \leq .77$), the subscale sum scores of the parental version moderate to good internal consistency ($.73 \leq \text{Cronbach's } \alpha \leq .86$; [35]).

Anthropometrics were assessed as objective measurements of weight, height, and circumference of waist, hip, and thigh in cm, and skinfold thickness at the triceps. All the measurements were subsequently standardized. The BMI standard deviation scores (SDS) were derived from weight and height SDS using a

formula developed by Cole [36], based on a British 1990 reference [37, 38]. The formula, $BMI\ SDS = (1.41 \times weight\ SDS) - (0.80 \times height\ SDS) + 0.18$, has been shown to predict BMI SDS scores from weight and height SDS, with very high accuracy [36]. Youth were classified according to the US 2000 CDC Growth Chart [39] as individuals with underweight ($\leq 5^{th}$ BMI percentile, corresponding to -1.64 BMI SDS), normal weight ($< 5^{th}$ and $< 85^{th}$ BMI percentile, thus $-1.64 < BMI\ SDS < 1.04$), overweight ($\geq 85^{th}$ BMI percentile corresponding to $+1.04$ BMI SDS), and obesity ($\geq 95^{th}$ BMI percentile corresponding to $+1.64$ BMI SDS; [40]).

Data Analyses

First, participant demographic and anthropometric characteristics were displayed as *M (SD)* and *range*, or *n (%)*. Prevalence rates of any and recurrent (cut-off scores on EDY-Q items ≥ 1 or 4, respectively) pica and RD behaviors were presented as *n (%)* for the total sample, and separately for sex, age groups (i.e., 7–10 years and 11–14 years of age), weight status (underweight, normal weight, overweight, and obesity), and individuals with an approximated ARFID diagnosis [26]. The group differences in pica and RD behaviors across sociodemographic groups were examined using *t* tests, and for weight status groups using an analysis of variance. In order to assess associations with related constructs, we computed Pearson's *r* correlation coefficients of the severity of pica and RD behaviors with early-onset restrictive eating behavior (mean EDY-Q score on ARFID items), eating disorder psychopathology (mean ChEDE-Q subscale scores: Restraint, Eating, Shape, and Weight Concern; in subsample; $n = 476$), parental feeding practices (mean CFQ subscale scores: Restriction, Pressure to Eat, and Monitoring), anthropometric measurements, and general psychopathology (mean SDQ subscale scores in parent- and self-report: Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, Peer Relationships Problem, and Prosocial Behavior). We calculated effect sizes of the group differences as Cohen's *d* ($d \geq 0.2$ small effect, $d \geq 0.5$ medium effect, $d \geq 0.8$ large effect), and of the correlations as Cohen's *r* ($r \geq 0.1$, small effect; $r \geq 0.3$ medium effect; $r \geq 0.5$, large effect; [36]).

Results

Demographic and Anthropometric Characteristics

Participants' sociodemographic characteristics and anthropometrics are displayed in Table 1. They showed a mean age of 10.49 years. Of the 804 children entering this data analysis, 438 (54.5%) were male and 366 (45.5%) were female. Whereas the majority of participants were classified as normal weight, all indices of participants' anthropometry showed a large range, including all weight groups.

- Insert Table 1 about here -

Prevalence of Pica and Rumination Behaviors

Out of the 804 children, a total of 99 participants (12.31%) reported having engaged in pica and 96 (11.94%) in RD behavior at least once (scores of ≥ 1 on EDY-Q items). A total of 40 participants (4.98%) reported recurrent pica behavior and 12 participants (1.49%) described recurrent RD behavior (scores of ≥ 4 on EDY-Q items). Data on the frequencies of behaviors shown across the sample are depicted in Table 2. The mean scores on the pica ($M = 0.40$, $SD = 1.30$) and the RD items ($M = 0.27$, $SD = 0.89$) in the EDY-Q items were low. In terms of co-occurrence, seven participants (0.87%) engaged in both recurrent behaviors concurrently, which represents a prevalence of 58.33% (7/12) of pica behavior in people with RD behavior and a prevalence of 17.50% (7/40) of RD behavior in people with pica behavior. The frequencies of both behaviors were significantly correlated, however the effect size was small ($r = .28$, $p < .01$).

- Insert Table 2 about here -

Prevalence of Pica and Rumination Behaviors depending on Sex, Age, and Weight Status

As shown in Table 3, the frequency of pica behavior was significantly greater in boys than in girls. In addition, more boys reported recurrent pica behavior. In contrast, the frequency of RD behavior did not significantly differ between sexes, and there was no difference between boys and girls in the number of individuals with recurrent RD behavior.

The frequency of both behaviors was higher in the younger group (≤ 10 years of age) than the older group. No differences in the number of individuals with recurrent pica or RD behaviors were found between the younger and the older age groups.

Children of different weight status did not differ in their frequency of pica or RD behavior nor their prevalence rates of both behaviors. Pica and RD behaviors did not show significant correlations with the participants' weight or BMI SDS nor with circumferences of waist, hip, and thighs ($<.001 \leq r \leq .06$; all $ps > 0.05$). Of note, the skinfold measurement at the triceps showed a significant but very small positive association with RD behavior ($r = .08$, $p = .02$).

- Insert Table 3 about here -

Association of Pica and Rumination Behaviors with Psychopathology and Parental Feeding Practices

In terms of self-reported early-onset restrictive eating disturbances mirroring criteria for ARFID, significant positive, but small correlations were shown with pica and RD behaviors ($r = .19$ and $.27$, respectively,

both $p < .01$). On closer inspection, among those with an approximated ARFID diagnosis ($n = 25$; according to [26]), three individuals reported recurrent pica behavior (12.0%) and three described recurrent RD behavior (12.0%). Notably, two youth with approximated ARFID diagnosis mentioned both recurrent behaviors (8.0%).

A subsample of the participants also completed the ChEDE-Q ($n = 476$). None of its subscales (Restraint, Eating, Shape, and Weight Concern) correlated significantly with pica or RD behaviors ($<.01 \leq r \leq .08$; all $ps > .05$). In the full sample ($N = 804$), no parent-reported feeding practices (CFQ) were associated with pica behavior ($-.01 \leq r \leq .03$; all $ps > .05$), but there were very small positive correlations of RD behavior with Restriction and Pressure to eat (both $r = .07$, both $p < .05$), but not with Monitoring ($r = .04$, $p = 0.34$).

The correlation coefficients of pica and RD behaviors with self- and parent-reported behavioral strengths and difficulties (SDQ) are displayed in Table 3. Pica behavior was significantly negatively associated with self-reported prosocial behavior, with a very small effect size. RD behavior showed a very small significant negative correlation with prosocial behavior, and small positive correlations with conduct and emotional problems. No significant associations were found with the strengths and difficulties based on parent-report.

- Insert Table 4 about here -

Discussion

Given the relative dearth of prevalence data of pica and RD in Europe across all age groups, their relationship with other disorders of the DSM-5 Feeding and Eating Disorders category, and the limited studies on associated psychological burden, the present study's aims were twofold. It, at first, aimed at assessing the prevalence rates of pica and RD behaviors in a German population sample of youth aged 7–14 years. Its second aim was to analyze associations with other feeding and eating disorder psychopathology, parental feeding practices, and general psychopathology.

Whereas several youths indicated that they consumed a nonnutritive substance at least once (12.31%) or performed RD behavior at least once (11.49%), 4.98% and 1.49%, respectively, reported recurrent frequencies of the behaviors. Our rates of recurrent behaviors fell below those assessed by the only study assessing both behaviors using expert interviews based on DSM-5 criteria in the US. This investigator-based rating found a prevalence rate of 7.4% for each behavior in female adolescents and young adults in residential eating disorder care [43]. However, the sample was highly selected and treatment-seeking, and was, on average, eight years older ($M = 18.1$, $SD = 2.7$). Still, while other studies in privileged populations (e.g. the Danish study in pregnant women [18]) showed very low prevalence rates of pica behavior compared to studies, e.g. in African regions

[17], our data indicate an intermediate position despite also investigating the prevalence rate in a privileged population.

With regard to RD behavior, our prevalence rate is lower than the rate that was reported in a recent study in Sri Lanka focusing on children aged 10–16 years, assessing RD based on the ROME III Diagnostic criteria for functional gastrointestinal disorders via a questionnaire (5.1%; [22]). This might, at least in part, be due to our one-item based assessment of the behaviors that did not allow for an investigator-based clarification of definition and presentation.

Pica seemed to be more common in boys than in girls, the effect found was negligible in size though. There was no sex difference with regard to the prevalence rate of RD behavior. This is in line with the school-based study of Rajindrajith and colleagues [22], which showed no difference in the prevalence rates in RD between boys and girls. Small age differences in prevalence rates were found for both disorders, with higher prevalence rates in youths aged 10 and younger. Given the suggested early onset of the disorders [1], this finding is plausible. In addition, youths of different weight status did not differ in frequency or number of individuals with pica or RD behaviors. Furthermore, there was almost no association between the objective measurements of body fat with pica and RD behaviors, except for a very small positive correlation between triceps skinfold thickness and RD behavior. Thus, it seems that RD behaviors do not represent a weight control strategy in most of the youth in our study, which is in contrast to studies with older youth or adult samples in which the behavior represents an attempt to lose weight [16; 44-46].

Associations with other Feeding and Eating Disorders are a relevant research target in order to understand both the accuracy of the disorders' placement in the Feeding and Eating Disorders Category of DSM-5 [1] and their diagnostic validity. Both behaviors do not seem to be particularly related to “classic” eating disorders as no correlation was found with eating disorder pathology (i.e., Restraint Eating, Shape, and Weight Concern as measured with the CheDE-Q). This finding supports the notion that the behaviors/disorders do not share the hallmark feature of weight control/body image disturbance with other eating disorders [1]. On the other side, Delaney and colleagues found a wide range of pica and RD behavior presentations in adolescent and adult individuals in residential care for eating disorders [43]. This is also supported by case reports based on individuals showing pica [47-50] and RD behaviors for weight control [16; 44-46]. Thus, while findings in older individuals highlight the challenge of differential diagnosis of pica and RD behaviors and other eating disorders, our findings do not provide comparable findings in youth. Further studies, particularly in clinical samples, should further investigate this difference. In terms of ARFID symptoms, only small associations with both behaviors were shown, and both behaviors showed only small correlations with one another. Still, the prevalence

rates for the two recurrent behaviors were significantly increased in the presence of the other and so was their presentation given a comorbid approximated, self-report-based ARFID diagnosis. These findings highlight an overlap of these symptoms and a potential difficulty of diagnostic validity among the three problematic behaviors, but mirrors challenges of differential diagnosis with anorexia and bulimia nervosa in older samples [16; 44-50]. Differential diagnosis, however, is highly relevant due to the trumping rules in DSM-5 [1]: Whereas RD can only be diagnosed if occurring also outside the course of ARFID, as it is the case with anorexia and bulimia nervosa, pica can co-occur with ARFID, particularly in those with avoidance of foods due to their sensory characteristics [1]. Further studies need to shed light on these associations and differential diagnoses in clinical samples to inform diagnostic validity of the three problematic behaviors, pica, rumination, and avoidant and restrictive food intake.

Parental feeding practices were associated with RD behavior, even though correlations were very small. In particular, pressure to eat and restriction were related to RD behavior. The relations might be based on parental concerns about nutritional deficiencies as a consequence of spitting out previously digested food and the subsequent attempt to increase control over their offspring's food intake behavior. While studies targeting the interaction in feeding situations of youth with pica and RD behaviors and their parents specifically are missing, one study examined mother-child interactions in infants aged 0-2 years in four groups with different feeding problems, one of them a group with individuals with varied symptom presentations including RD behaviors [51]. It yielded no associations between feeding interaction and the group including individuals with RD behaviors, thus did not support our correlations between RD behaviors and pressure to eat as well as restriction in older children. Follow-up studies involving youth with pica or RD behaviors should focus on parent-child feeding interaction to clarify potentially existing associations. Furthermore, as our and previous studies are cross-sectional, longitudinal studies are needed to further explore the causal direction of the association.

Finally, we found remarkably low associations of pica and RD behaviors with self-reported general psychopathology, i.e., behavior strengths and difficulties. Pica and RD behaviors were negatively correlated with prosocial behavior in their self-report; however, these behaviors showed a correlation size smaller than what is deemed small and were not clinically significant. Studies on clinical samples with diagnoses of pica or RD would need to verify these associations. RD behavior was, furthermore, correlated with self-reported conduct and emotional problems, showing small-sized effects. These findings could either mirror the psychological burden associated with RD behavior or signify a general latent factor causing both problems. Of note, there was no association of either behavior with parent-reported general psychopathology. As previous information on this

association is missing, one can only assume that as the behavior potentially is performed secretly by the youths [12; 52-53], associated psychopathology might be kept from parents as well.

These findings need to be interpreted, acknowledging the limitations and strengths of the present study. Limitations include a sample recruited in and around the city of Leipzig only and characterized by a sociodemographic bias towards families from a higher socio-economic background [23], and therefore potentially not representative of the whole German population at this age. Furthermore, data were mainly based on self- and parent-report. In particular, the assessment of pica and RD behaviors was based on one self-report item each, thus not allowing for an investigator-based clarification of the concepts or the examination of exclusion criteria for the diagnosis of full syndrome disorders (social and cultural acceptance for the behavior in pica, voluntary nature of RD behavior, or other feeding and eating disorder diagnoses in both disorders). However, we might assume that the measure indicates core symptoms of the disorders from the children's viewpoint. Notably, our findings do not deviate much from previous data on the behaviors assessed in expert interviews [43]. Also, the present study did not include measures assessing intellectual disability or developmental difficulties. Future studies should incorporate respective tests in order to provide information with regard to differential diagnostics with intellectual disability or developmental difficulties. Finally, the assessment of pica behavior comprises enquiries on the substance consumed which was not implemented in the present study. Findings from a small-scale online survey analyzing pica behavior in a non-representative sample of German adolescents and adults indicate that about half of the substances individuals consider nonnutritive substances would not qualify as such based on DSM-5 [1] as they possess nutritive value (e.g., uncooked pasta) or do not represent nonfood items (e.g., ice cubes; see [43]). The strengths of the current study include a large population-based sample. Furthermore, the study employed validated questionnaires in the self- and the parent-report for characterization of pica and RD behaviors. Given the limited knowledge on the prevalence rates of pica and RD behaviors and disorders in the general population worldwide, including Europe, the findings from this study provide a preliminary understanding of the significance and the prevalence of the problems in European youth.

The study has both clinical and research implications. For clinicians, the study highlights the fact that pica and RD behaviors might be common in youth. Even though not associated with other psychopathology in our study, the behaviors might have detrimental medical consequences, and therefore should be assessed during intake in clinics and private practices. It further suggests that pica and RD behaviors might be independent of other eating disorder psychopathology in youth; however, overlaps with ARFID should be taken into account. In addition, the increased prevalence rates of one behavior if the respective other is present recommends inquiry on

one behavior in the presence of the other. It further seems significant to directly ask youth that report pica or RD behaviors themselves about their associated psychological burden as this did not seem to be observable for parents (i.e., missing association with parent-reported SDQ scales). The remarkable prevalence rates of the behaviors found in the present population-based study alongside the potential medical consequences of the disorders make the field relevant to explore in research. Future studies should focus on the assessment of prevalence rates of full-syndrome pica and RD including their clinical relevance, their course over adolescence and young adulthood, and diagnostic validity of the syndromes alongside “classic” eating disorders and ARFID.

In summary, this study is the first to provide estimates of prevalence rates of pica and RD behaviors in youth aged 7–14 years based on a population-based sample. Non-negligible rates of recurrent pica and RD behaviors were 5% and 1.5%, respectively, while there were only minimal differences across sex and age groups, with more pica behavior in boys and more of both behaviors in the group younger than 10 years of age, and no group differences in either behavior across different weight status groups. The behaviors were found to be associated with ARFID symptoms and, in the case of RD, with general psychopathology, even though respective correlations were very small. Both behaviors should not be neglected both in research and practice, as they might have detrimental medical consequences.

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Table 1

Age and Anthropometric Measures of Participating Youth (N = 804)

	<i>M (SD)</i>	<i>Range</i>
Age	10.49 (2.01)	7.52–14.45
Weight SDS	0.01 (0.96)	–3.06–2.50
Height SDS	0.17 (1.02)	–3.04–2.93
BMI SDS	0.06 (0.97)	–3.00–3.05
Triceps skinfold SDS	–0.02 (0.99)	–2.71–2.45
Waist circumference SDS	0.02 (0.98)	–3.04–2.60
Hip circumference SDS	0.01 (0.98)	–3.96–2.70
Thigh circumference SDS	0.05 (0.96)	–4.31–2.97
	<i>n (%)</i>	
Underweight	20 (2.49)	
Normal weight	645 (80.22)	
Overweight	72 (8.96)	
Obesity	67 (8.33)	

Note. *M*, mean; *SD*, standard deviation; *SDS*, standard deviation score; *BMI*, body mass index.

Table 2

Pica and Rumination Behavior in the Full Sample (N = 804)

Rating	Pica Behavior <i>n</i> (%)	RD Behavior <i>n</i> (%)
0 – never true	708 (88.06)	705 (87.67)
1	35 (4.35)	36 (4.48)
2	25 (3.11)	9 (1.12)
3	24 (2.99)	14 (1.74)
4	3 (0.37)	5 (0.62)
5	3 (0.37)	5 (0.62)
6 – always true	6 (0.75)	30 (3.73)

Note. The mean scores on the pica item in the EDY-Q was 0.40 (*SD* = 1.30) and on the RD item 0.27 (*SD* = 0.89).

Table 3

Sex, Age, and Weight Status Differences in Pica and RD Behaviors (Means and Standard Deviations) and Prevalence Rates of Recurrent Behaviors

Boys (<i>n</i> = 438)		Girls (<i>n</i> = 366)		χ^2	<i>t</i> (802)	<i>d</i> / Φ^2
<i>M</i> (<i>SD</i>) / <i>n</i> (%)		<i>M</i> (<i>SD</i>) / <i>n</i> (%)		<i>(df</i> = 1; <i>n</i> = 804)		
Recurrent pica behavior						
0.48 (1.44)		0.30 (1.10)			2.03*	0.14
29 (6.62)		11 (3.01)		2.07*		0.08
Recurrent RD behavior						
0.29 (0.91)		0.25 (0.91)			0.57	0.05
9 (2.05)		3 (0.64)		2.07		0.05
Younger group ¹ (<i>n</i> = 355)		Older group (<i>n</i> = 449)		χ^2	<i>t</i> (802)	<i>d</i> / Φ
<i>M</i> (<i>SD</i>) / <i>n</i> (%)		<i>M</i> (<i>SD</i>) / <i>n</i> (%)		<i>(df</i> = 1; <i>n</i> = 804)		
Recurrent pica behavior						
0.50 (1.43)		0.32 (1.18)			1.99*	0.14
22 (6.20)		18 (4.01)		2.01		0.05
Recurrent RD behavior						
0.41 (1.07)		0.17 (0.68)			3.95***	0.14
8 (2.25)		4 (8.91)		2.50		0.06
Underweight	Normal weight	Overweight	Obesity	χ^2	<i>F</i> (3, 800)	<i>p</i> η^2 / $\Phi^{2,3}$
(<i>n</i> = 20)	(<i>n</i> = 645)	(<i>n</i> = 72)	(<i>n</i> = 67)	<i>(df</i> = 3; <i>n</i> = 804)		
<i>M</i> (<i>SD</i>) / <i>n</i> (%)	<i>M</i> (<i>SD</i>) / <i>n</i> (%)	<i>M</i> (<i>SD</i>) / <i>n</i> (%)	<i>M</i> (<i>SD</i>) / <i>n</i> (%)			
Recurrent pica behavior						
0.50 (1.57)	0.39 (1.26)	0.39 (1.40)	0.45 (1.45)		0.08	< .01
2 (10.00)	29 (4.50)	4 (5.56)	5 (7.46)	2.31		0.05
Recurrent RD behavior						
--	0.27 (0.87)	0.37 (1.16)	--		1.05	< .01
0 (0.00)	10 (1.55)	2 (2.78)	0 (0.00)	2.14		0.05

Note. *M*, mean; *SD*, standard deviation; RD, rumination disorder

¹ ≤ 10 years of age; ² η^2 , partial Eta Square (< 0.06 = small effect [42]); ³ Φ , Phi (< 0.30 = small effect [41]);

* *p* < .05; *** *p* < .001

Table 4

Correlations of Pica and RD Behavior with Self- and Parent-reported General Psychopathology (Strength and Difficulties Questionnaire)

	Pica Behavior	RD Behavior
Emotional problems		
Self-report ¹	.072	.216**
Parent-report ²	-.034	-.002
Hyperactivity/inattention		
Self-report	.061	.092
Parent-report	.031	.043
Peer relationship problems		
Self-report	-.010	.055
Parent-report	-.010	.021
Conduct problems		
Self-report	.067	.150**
Parent-report	.067	.018
Prosocial behavior		
Self-report	-.095*	-.093*
Parent-report	-.057	-.004

Note. ¹ $n = 473$; ² $n = 804$; * $p < .05$; ** $p < .01$