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► To cite this version:

F. Feillet, A. Bocquet, A. Briend, J.-P. Chouraqui, D. Darmaun, et al.. Nutritional risks of ARFID (avoidant restrictive food intake disorders) and related behavior. Archives de Pédiatrie, 2019, 26 (7), pp.437-441. 10.1016/j.arcped.2019.08.005 . hal-02483794

HAL Id: hal-02483794

<https://hal.science/hal-02483794>

Submitted on 21 Dec 2021

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Nutritional risks of ARFID (avoidant restrictive food intake disorders) and related behavior

Short title: Nutritional risks of ARFID

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Keywords: ARFID, nutrition, deficiency

Conflict of interest:

All of the authors have no conflict of interest to declare.

Abstract

Avoidant/restrictive food intake disorder (ARFID) has recently been added to the DSM V (*Diagnostic and Statistical Manual of Mental Disorders*, 5th edition) as a new class of eating disorders (EDs). ARFID is characterized by a lack of interest in eating or avoiding specific types of foods because of their sensory characteristics. This avoidance results in decreased nutritional intake, eventually causing nutritional deficiencies. In severe cases, ARFID can lead to dependence on oral nutritional supplements, which interferes with psychosocial functioning. The prevalence of ARFID can be as high as 3% in the general population, and it is often associated with gastrointestinal symptoms and mainly appears in children with anxiety disorders. Given the high prevalence of ARFID, a rapid and systematic nutrition survey should be conducted during every pediatric consultation. Its treatment should also be adapted depending on the severity of the nutritional problem and may involve hospitalization with multidisciplinary care (pediatrician, nutritional therapist, dietitian, psychologists, and speech therapists).

1. Introduction

Nutritional assessment is part of the routine examination in pediatric practice and has become more important than ever as children and adolescents increasingly adopt restrictive feeding behaviors that entail risks of severe nutritional deficiencies [1]. Such behavior changes underlie the reason for the latest modification on the classification of eating disorders (EDs) in the latest version of the *Diagnostic and Statistical Manual of*

Mental Disorders (DSM-5) in 2013, which now include pica, rumination disorder, and avoidant/restrictive food intake disorder (ARFID) [2].

Similar restrictive feeding behavior has been described earlier in children with autism spectrum disorders (ASD) [3], but its onset in children and adolescents without ASD seems new. The aim of this paper is to draw attention to ARFID and the nutritional risks induced by this new type of eating disorder.

2. What is ARFID?

ARFID, a new diagnostic category in the latest edition of the DSM, includes previously specific types of diagnosis such as Feeding Disorder of Infancy and Early Childhood and Eating Disorders [4]. It is defined as an eating or feeding disturbance (e.g., apparent lack of interest in eating or food avoidance based on the sensory characteristics of food; concern about aversive consequences of eating) manifested by persistent failure to meet appropriate nutritional and/or energy needs associated with one (or more) of the following criteria:

- Significant weight loss (or failure to achieve expected weight gain or faltering growth in children);
- Significant nutritional deficiency;
- Dependence on oral nutritional supplements or enteral feeding or pronounced interference with psychosocial functioning.

To qualify for ARFID, the disorder must meet several exclusion criteria.

- Food avoidance must not be due to lack of available food or adherence to culturally or religiously sanctioned precepts.

- It does not occur exclusively during the course of anorexia nervosa or bulimia nervosa, and there is no evidence of a disturbance in the way in which one's body weight or shape is experienced [4].
- It is not attributable to a concurrent medical condition or not better explained by another mental disorder. When the eating disturbance occurs in the context of another condition or disorder, the severity of the eating disturbance exceeds that routinely associated with the condition or disorder and warrants additional clinical attention.
- ARFID does not refer to developmentally normal behaviors (e.g., picky eating in toddlers, reduced intake in older adults).

ARFID is now a specific diagnosis in the classification of EDs and from a nutritional standpoint. It is important to screen for restrictive feeding behavior in every child, mainly those with a concomitant disease, particularly autism or other psychiatric diseases [5].

3. Epidemiology of ARFID

Epidemiology studies are scarce for ARFID. Its prevalence ranged from 5% to 14% in tertiary care units of children and adolescent ED programs; it sometimes even reached 22.5% in pediatric day treatment programs [6-9]. In a pediatric gastroenterology clinical sample of 2250 children, Eddy et al. identified 33 cases of confirmed ARFID (1.5%) and 54 cases (2.4%) of possible ARFID with patients carrying one or more ARFID symptoms [10]. In a school-based survey in Switzerland, 3.2% of 1444 children aged 8–13 years self-reported clinical characteristics consistent with ARFID [11]. The high prevalence of ARFID may further be confirmed in the general population by epidemiologic studies,

rendering the screening of ARFID relevant for every child or adolescent seen in clinics. In the few studies looking at patient populations drawn from ED clinical samples, ARFID patients were consistently younger than those with other EDs, more likely to be male (compared to adolescents with anorexia nervosa), with a high rate of comorbid psychiatric and/or medical symptoms[6-9].

4. Determinants of ARFID

Parental pressure to eat, higher disgust sensitivity, and aversive food experiences were associated with general picky eating (PE) behavior [12], which may pave the way to ARFID. In some individuals, food avoidance or restriction may arise from extreme sensitivity to the appearance or sensory characteristics of food, such as color, smell, texture, temperature, or taste. Such behavior has been described as "restrictive eating," "selective eating," "choosy eating," "perseverant eating," "chronic food refusal," and "food neophobia" and may lead to refusals to eat certain foods or even intolerances to the smell of certain foods being eaten by others. Individuals with enhanced sensory food sensitivity associated with ASD may show similar behavior. Food avoidance or restriction may also result from conditioned negative responses associated with aversive experiences, such as repeated vomiting, suffocation or an episode of choking during a traumatic investigative procedure [13].

5. Associated symptoms

5.1 Nutrition and gastroenterology

Associated gastrointestinal symptoms are frequent during ARFID. In a retrospective study, 33 out of 2231 children referred to 19 gastroenterology clinics were diagnosed with ARFID and presented one or more nutritional or gastroenterologic symptoms. Seventeen of 33 (52%) of them suffered from poor weight gain/growth, ten (30%) low weight/underweight, ten (30%) poor appetite, nine (27%) abdominal pain, five (15%) weight loss, five (15%) reflux, three (9%) nausea, three (9%) diarrhea/loose stools, and three (9%) food allergies [10].

5.2 Psychiatric context

Feeding disorders are common features in many psychiatric patients, especially those with anxiety disorders [6, 9], ASD [7], and attention deficit hyperactivity [7]. Other psychiatric symptoms associated with ARFID such as obsessive-compulsive or somatoform disorders, emetophobia (fear of vomiting), food neophobia (fear of new foods), or choking phobia (fear and avoidance of swallowing food, fluids, or pills) have been reported [14]. In a retrospective study of 34 pediatric ARFID patients, almost 50% of these children had generalized anxiety disorders [9]. The treatment of these associated disorders can negatively influence the efficacy of their nutritional management, because a common side effect of the stimulant medication (methylphenidate prescribed for hyperactivity/attention deficit disorder) is decreased appetite [15].

6. Nutritional risks of ARFID

As examples, we report here two teenagers with nutritional deficiency related to abnormal feeding behavior. The first case was a 14-year-old boy who never ate any fruit or drank any fruit juice. He showed mild microcytic anemia (95 g/L [Nl: 130–160 g/L],

MCV: 74 fl [NI: 80–100 fl]) related not to inadequate iron status (which was normal), but to profound vitamin C deficiency (3 $\mu\text{mol/L}$ [NI: 30–60 $\mu\text{mol/L}$]). The second case was a 12-year-old girl who would only eat “white colored foods,” i.e., milk, bread, rice and pasta. She suffered from pronounced vitamin deficiencies: plasma folates: 2 nmol/L [NI: 6–36 nmol/L], plasma cobalamin: 95 pmol/L [N: 156–674 pmol/L], and plasma homocysteine: 45 $\mu\text{mol/L}$ [NI < 10 $\mu\text{mol/L}$]. Both teenagers, referred by their worrying parents for their restrictive feeding patterns, were eventually diagnosed as ARFID despite the absence of clinical symptoms.

The diagnosis of significant nutritional deficiencies in ARFID children is based on dietary history, clinical and biological assessments (e.g., assessment of dietary intake, physical examination, and laboratory testing), and the presence of clinical consequences on physical health. The severity of these consequences is greater than that resulting from anorexia nervosa (e.g., hypothermia, bradycardia, and anemia) [16, 17]. Specific nutritional deficiencies must be screened according to each dietary pattern. The restrictive behavior can induce specific deficiencies related to the nature of the excluded foods. In severe cases, particularly in infants, the consequent malnutrition can even be life-threatening.

The nutritional consequences of ARFID remain poorly described. Most papers reported weight loss [8, 18–20]. Only one paper describes a patient (17 years old) presented with macrocytic anemia. The dietary assessment history revealed that he only ate boiled rice, fried potato chips, chicken nuggets, potato crisps, and sometimes chocolate. This patient presented with a subacute combined degeneration of the spinal cord related to multiple

vitamin deficiencies (A, E, K, D, B₁₂, and folates)[21]. The second case reported here at the beginning of this article was a similar, although less severe case.

7. Autism spectrum disorder and ARFID symptoms

Selective feeding behavior is a well-known feature of ASD [22, 23]. Specific ARFID symptoms in ASD were reported in 2017 [5]. A meta-analysis showed that children with ASD suffered more from feeding problems than their peers as a result of their more frequent food selectivity [24]. Additionally, mealtime behavioral problems, food refusal, and preference for specific textures or smells [25, 26] are described. Approximately 80% of young children with ASD had EDs because of their picky eater behaviors, with 95% of them resisting tasting new foods [27]. A study compared 40 ASD children to 40 healthy controls and found that ASD but not normal children had statistically significant moderate nutritional consequences of their abnormal feeding behavior (i.e., vitamin B₁₂, folate deficiencies) [28]. Other observations such as lower protein, calcium, and phosphorus intakes, as well as lower bone mineral density (BMD) z-scores at the lumbar spine, femoral neck, total hip, and whole body were recently made by Neumeyer et al., who compared 25 ASD children with ARFID to 24 normally developed children. The same study also showed that the lower protein, calcium, and phosphorus intakes in ASD children with ARFID were associated with lower BMD [29].

8. Diagnosis and management

The high prevalence of primary or secondary ARFID (in case of ASD) justifies the necessity of taking a quick dietary survey for children during their visits to the pediatric

clinic. Questions to the parents such as whether the child is regularly drinking milk or consuming dairy products (as a source of protein and calcium), meat, fish or eggs (vitamin B₁₂, iron, zinc, and selenium), vegetables (group B vitamins), fruit (vitamin C), oil or butter (fat soluble vitamins), or starchy foods (energy) are adequate and not overly time-consuming for the pediatrician in charge. These nutritional deficiencies can be diagnosed by biological analysis, which must be adapted to each nutritional deficiency. These analyses are summarized in Table 1. This, together with growth measurement, should identify potential overall or specific malnutrition. The ensuing treatment must then be adapted to the severity and the specifics of the nutritional problems (Figure 1). Hospitalization with multidisciplinary management (pediatrician, nutritional therapist, dietician, psychologists, and speech and occupational therapists) is required for severe malnutrition, which is defined by low nutritional indices (BMI below the 3rd centile for age and sex, weight for height Z-score below -2 SD for sex) and growth faltering at least for weight and associated with height in case of chronic malnutrition associated with clinical signs of malnutrition[30]. Hospitalization is also required when outpatient management fails to normalize the nutritional status. In severe cases, the use of a complete balanced dietary supplement shall be attempted first prior to nasogastric feeding to help restore a proper nutritional status.

Psychological follow-up remains the mainstay treatment for sick children requiring a multidisciplinary approach. It should include a systematic desensitization, a structured nutritional plan with gradual exposure-based therapy, and management of anxiety via techniques such as relaxation techniques [13]. Problematic foods should progressively be

incorporated into the patient's eating pattern. In severe cases of ARFID, drugs such as olanzapine [31] or mirtazapine [32] have been proposed.

9. Progression

ARFID has recently been recognized as a new category of ED and data on its long-term outcome are scarce. One study suggests that this disorder has a favorable outcome if medical care is adequate [33]. Others report that the percentage of patients achieving remission is similar across ARFID and AN, but ARFID patients relied on more enteral nutrition and required longer hospitalizations than AN patients [18]. Failure-to-thrive ARFID patients will have to depend on enteral feeding or oral nutritional supplements to maintain adequate intake. Some patients will need gastrostomy tube feeding or complete dietary supplements in the absence of any underlying organ dysfunction. Certain treatment interventions may lead to patients' inability to participate in normal social activities such as eating with others or to sustain relationships [4].

10. Prevention

The literature shows that parental pressure on their children's food intake negatively impacts the latter's eating behavior which, in turn, correlates with their incidence of picky eating and a below-average body weight. It can contribute both to the dissociation of eating and hunger/satiety cues, and to abnormal eating habits for extrinsic reasons such as emotion [13, 34]. Parents also need to be aware that the pressure they generate is often

more related to their own anxiety than to the nutritional risk for their children [13]. Counseling parents on the deleterious effects of feeding pressure and the verifications of their children's consumption of balanced diets should be part of routine pediatric clinical practice.

11. Conclusion

Eating disorders are commonly encountered in pediatric practice. Restrictive feedings have been observed in ASD for many years. A short dietary screening should be systematically performed as part of the pediatric follow-up to prevent both the nutritional and psychologic consequences of this newly defined disorder. A regular approach in outpatient clinical practice can be sufficient in mild cases, but multidisciplinary management is required in severe cases.

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Table 1: Nutritional consequences of avoided foods

Avoided food	Nutrient deficiency	Primary parameter	Functional consequence
Starchy foods	Carbohydrates	Weight and height	Hypotrophy
Milk, dairy products	Calcium	PTH, alkaline phosphatases, Hypocalciuria *	Rickets
	Total protein	Plasma protein, albumin, prealbumin	Edema
Meat, fish, eggs	Cobalamin	Plasma cobalamin	Hyperhomocysteinemia
	Iron	Plasma ferritin	Microcytic anemia
	Zinc	Plasma zinc	Oxidative stress
	Selenium	Plasma selenium	Oxidative stress
Vegetables	Folates	Plasma folates	Hyperhomocysteinemia
Fruits		Plasma vitamin C	Microcytic anaemia, scurvy
Low fat intake	Vitamin E	Vitamin E/lipids**	Oxidative stress
	Vitamin A	Plasma vitamin A***	Hemeralopia

Legend:

The main functional consequences are cited:

*: Hypocalcemia is a late consequence of low calcium intake and is not the primary biological parameter to assess calcium intake.

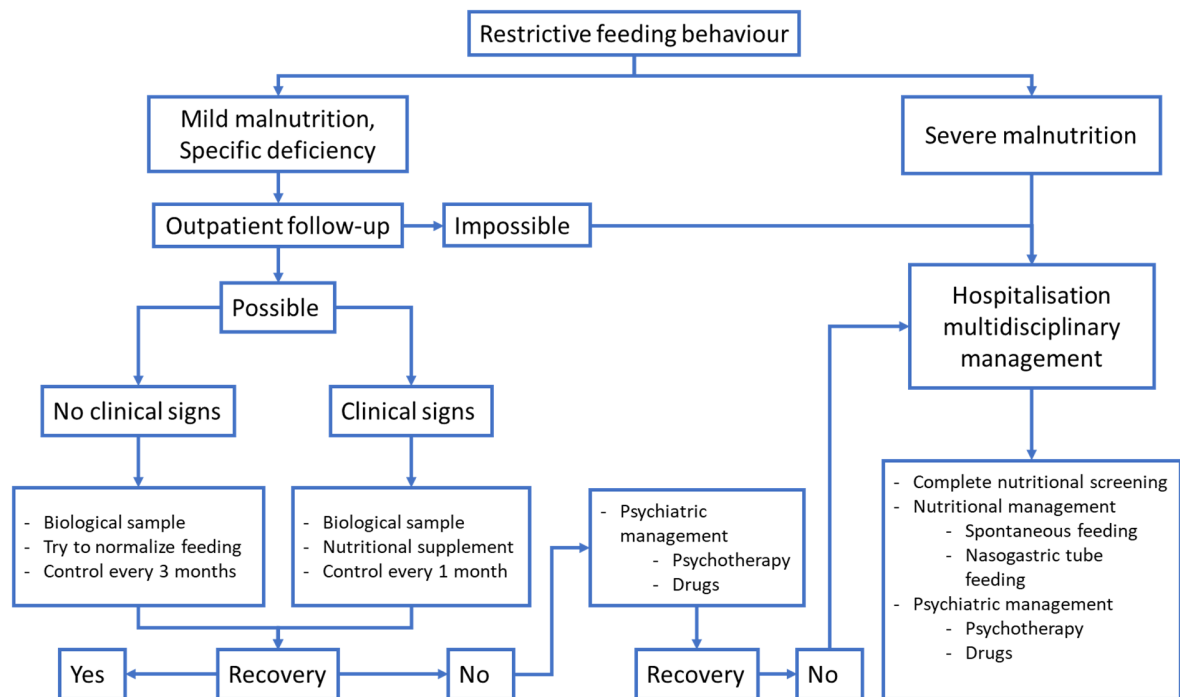
** : Plasma vitamin E depends on the plasma triglyceride levels.

***: Vitamin A deficiency can be avoided by intake of high retinol-containing foods (i.e., yam, pumpkin, carrots, etc.).

Figures:

Figure 1: Management of restrictive feeding behavior in children

Figure 1: Management of restrictive feeding behavior in children.



Severe malnutrition is defined using the criteria of the French Paediatric Society [30].