Looking beyond the macros: assessment tools for micronutrient evaluation for optimal nutrition in children with autism

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ABSTRACT

Background: Children with Autism Spectrum Disorder (ASD) are 5 times more likely to have feeding problems than typically developing children.
Objective: To design tools to assist the Registered Dietitian Nutritionist (RDN) in nutrition assessment of the child with ASD who is a selective/picky eater, specifically in evidence-based assessment and treatment of micronutrient deficiencies.
Design: Based on a science literature review, a nutrition assessment tool and 10 algorithms were developed.
Conclusions: The developed tools are to be used by RDNs, dietetic interns, and other clinicians.

INTRODUCTION

- Autism Spectrum Disorders (ASD) include a range of complex development delays and disabilities characterized by challenges with social interaction, speech/non-verbal communication, behavioral inflexibility, repetitive behaviors and restricted interests(1).
  - 1 in 68 children has a diagnosis of autism(2) .
- Secondary to these core diagnostic features, children with ASD are prone to constipation and other gastrointestinal irregularities, long-term usage of medication causing drug-nutrient interaction, meal-time behaviors including selective eating, and higher prevalence of food allergies and elimination diets that put them at nutritional risk(3).
  - Children with ASD are 5 times more likely to have feeding problems than children without ASD(3).
- Nutrition screening beyond anthropometric measurements (height, weight) is important. Children with ASD are found to often consume enough calories to meet gross energy needs reflecting in normal growth,(5) but these measurements give little insight to quality of food and sufficiency of micronutrients.
- Micronutrient deficiencies can cause a variety of health disparities affecting growth and development and physiological functions including but not limited to eyesight, metabolic system and wound healing(4).
- There is not an agreed upon standardized feeding screening tool or standardized evaluation and treatment guidelines for micronutrient deficiencies in this population.

OBJECTIVES

- To conduct a science literature review of selective eating and micronutrient deficiencies in children with Autism Spectrum Disorder (ASD).
- To develop tools for Registered Dietitian Nutritionists (RDNs) and other healthcare providers to identify and treat micronutrient deficiencies in this population according to scientific evidence based practice.

SCIENTIFIC LITERATURE REVIEW

A literature search was conducted using PubMed and Google Scholar.

Screening Tool

- There is not a standardized screening tool to assess the relationship between food selectivity and nutritional adequacy, i.e. how eating behaviors, food selectivity and food refusal impact a child or identify a need for further nutrition assessment(3).
- The Brief Autism Mealtime Behavior Inventory (BAMBI) assesses mealtime behaviors that may put the child at risk for picky/problem eating or inadequate intake. BAMBI does not cover areas beyond mealtime behaviors that may cause nutritional insufficiency.

Micronutrient Deficiency

- Research to date is limited by small sample sizes, assessment of diet based on caregiver report and questionnaires, and use of the Estimated Average Requirement (EAR: based on 50% of the population) to determine deficiency without verification with biochemical assessment.
- Most studies examined a group of children with ASD compared to a group of typically developing children(6,7,8). One study examined children with autism defined as selective eaters vs. typically developing children and children with autism not identified as selective eaters(9).

Study	Inadequate Nutrients (Significant p<0.05)	Dietary Evaluation Method; Comparison Value
Bandini (2010)	Fiber, Vitamin D*, Vitamin E, Calcium*.	FFQ, 3-day food record; EAR or AI
Johnson (2008)	Vitamin K*, Fiber, Iron	FFQ; Dietary Recall Interview; RDA/DRIs
Lockner (2008)	Vitamin A, Vitamin E, Fiber, Calcium	3- day food records; EAR
Zimmer (2012)	Calcium*, Vitamin B12*, Vitamin D*, Vitamin A*	FFQ; EAR
Herndon (2009)	Calcium*, Fiber, Iron, Vitamin E, Vitamin D	3- day food records; DRIs

Table 1: Micronutrients found to most often be consumed in insufficient quantities.
* signifies Significant difference p<0.05, between typically developing control group children and children with ASD. Others listed were found to be in adequate in both typically developing children and children with ASD.

METHODS

Assessment Tool

The following standardized child feeding screening tools were reviewed for content based on context and relevance to nutrition assessment for the picky eater with ASD.

Screening Tool	Description	Measures	Intended Population/Purpose
Brief Autism Mealtime Behavior Inventory (BAMBI)	18 item scale Caregiver Report	Scores mealtime behaviors: limited variety, food refusal, and features of autism	Children with Autism; to measure meal time behaviors
Behavioral Pediatric Feeding Assessment Scale (BPFAS)	35 item standardized caregiver report	Scores child behavior frequency, parents feelings/strategies frequency, and total frequency.	Children with feeding difficulties
Child Feeding Questionnaire	Caregiver Self Report	Scores parental beliefs, attitudes, and practices regarding child feeding	Focus on child obesity proneness
Children's Eating Behavior Questionnaire	35 item Caregiver report about child	8 Categories: food responsiveness, emotional over-eating, enjoyment of food, desire to drink, satiety responsiveness, slowness in eating, emotional under-eating, and food fussiness	Focus on child obesity proneness

Table 2: Standardized child feeding tools reviewed with description of survey, measures, and intended purpose.

The information gathered was combined with clinical experience to create an assessment tool to be used by RDNs to conduct a thorough nutrition assessment of a picky/selective eater.

Algorithms

- Algorithms are increasingly used in clinical evidence-based decision making(10). The step-by-step concept map guides the clinician through the complex intersecting factors that need to be considered.

- Based on the science literature review results on micronutrients that selective eaters are most likely to be deficient in, the following micronutrients were selected to research best practice identification and treatment:
  - **Calcium**
  - **Vitamin D**
  - **Vitamin A**
  - **Vitamin E**
  - **Vitamin B12**
  - **Vitamin K**
  - **Zinc**
  - **Essential Fatty Acids,**
  - **Iron**
  - **Nutrition-related anemias**

- Essential Fatty Acids and Zinc were not highlighted as common risks of deficiency in the ASD population in the literature review. They were added based on clinical experience and lack of evaluation of Zinc and EFA's in several of the studies reviewed.

- A review of food sources, risk factors, signs of clinical deficiency, Recommended Dietary Allowance (RDAs; estimated to meet the needs of 97-98% of the healthy population), toxicity levels and symptoms, recommended biochemical tests for identification, and recommended treatment were reviewed for each micronutrient.

- Sources reviewed were: Mayo Clinic, American Academy of Pediatrics (AAP), Academy of Nutrition and Dietetics (AND), PubMed current literature search, and any organizations with specific relevance to the micronutrient (ex. Vitamin D council and Endocrine Society for Vitamin D).

Review:

After the first draft and revisions, the algorithms were reviewed by two Registered Dietitians with different specialties, a Pediatrician who specializes in children with ASD, and a Pharmacist specialized in pediatrics. The additional editors/reviewers evaluated for accuracy and clarity based on their different professional perspectives.

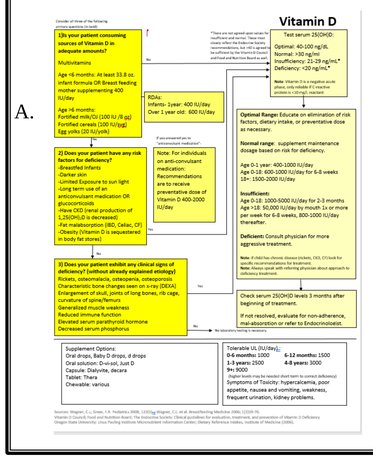
ASSESSMENT TOOL & ALGORITHMS

Assessment Tool

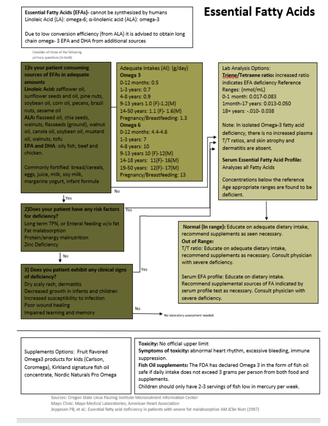
The tool divides assessment questions into 4 categories: behaviors that inhibit intake, food selectivity/picky eating behaviors, food allergies/intolerances, food and drug interactions, and GI difficulties.

Algorithms

A.



B.



Examples of the micronutrient algorithms (A. Vitamin D, B. Essential Fatty Acids). The RDN or other clinician starts their assessment by looking at adequate diet sources, risks of deficiency, and clinical signs of deficiency. Based on those evaluations, they follow the "yes" or "no" arrows to complete evidence based evaluation and treatment.

CONCLUSIONS

- The "Assessment Tool for Picky Eating" is intended for use by the RDN who is new to pediatric special needs population, future MO-LEND Tips4Kids trainees, or for use in training of dietetic interns during pediatric rotations.
- The Micronutrient Algorithms are for reference by RDNs, as well as other clinicians who may have concerns about the adequacy of a child's intake to meet a specific micronutrient need.
- The development of these projects is based on current research and knowledge of micronutrient deficiencies in the pediatric population and specifically children with ASD.
- Recommendations for future research based on this project are the establishment of a common definition of picky/problem eating as well as a standardized screening questionnaire to assess the relationship between picky eating and nutritional adequacy.

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