



Severe Malnutrition in a Normal Weight Adolescent Male with Anorexia Nervosa: A Case Study

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Authors' contributions

This work was carried out in collaboration between both authors. Author KMD wrote the first draft of the manuscript and managed the literature searches. Author KC conceived the report, edited and added to each draft. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Due to the significantly greater diagnosed cases in females, direct evaluation of a male presenting with Anorexia nervosa (AN) has infrequently been evaluated in the literature. Further, the typical view of AN often limits the perspective to those who are significantly underweight. Incidence of normal weight adolescents with AN, who are malnourished are increasing in prevalence. As in all patients with ED, a comprehensive, multi-system approach is requisite in the treatment of AN-related malnutrition irrespective of BMI. In a patients, increasing skeletal muscle mass may promote even greater health improvements than simply increasing weight/ fat. Accordingly, resistance training, as a part of a treatment plan, can improve nutrient delivery and utilization, restore weight and mitigate systemic manifestations of malnutrition.

Keywords: Eating disorders; adolescent male; anorexia nervosa; malnutrition; musculoskeletal health.

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1. BACKGROUND

The National Institute of Mental Health estimates that 2.7% of teens, ages 13 to 18, have an eating disorder, [1] but research suggests the actual prevalence may be underestimated [2]. Over 90% of diagnosed cases are in females. There appears to be a bimodal increase in anorexia nervosa (AN), one pre-pubertally and one post-pubertally (average age of onset (combining two modes) 15-19; however most research has been conducted in patients older than 15 years (post-pubertal). To our knowledge, direct evaluation of a male presenting with AN has been published.

Eating disorders (ED) are a group of psychological disorders categorized by disturbances in eating and food behaviors. [3-5] The criteria for a diagnosis of AN was updated in DSM 5, removing the requirement for weight to be less than 85% of expected weight-for-height and the requirement for amenorrhea; however "significantly low" body weight is still a criteria [3,4]. The categorization of Feeding and Eating Conditions not elsewhere classified (FECNEC) is used for the patients who have lost a significant amount of weight but remain at a normal weight, but it is often not considered as "severe" of an ED. For those adolescents who fall into this category, many of whom had a maximum weight was classified as overweight or obese, the time to diagnosis of an overt ED is often much longer than a patient who meets criteria of significantly low body weight [6]. The long-term health implications are highly detrimental, yet only recently emerging as a concern. For example, Whitelaw, et al. found a fivefold increase in cases in which an adolescent with significant weight loss presented into clinic in the absence of an "underweight" classification based on body mass index (BMI) over the 6-year period spanning 2005 to 2011 [7]. A diagnosis of malnutrition would be rare, despite substantial adverse metabolic effects on growth and development. Accordingly, intervention strategies may not be appropriately tailored if implemented at all. Due to the much greater occurrence of ED in females, achieving a fat mass percentage to support reproductive fecundity has typically been the focus. However, in both males and females, particularly during growth and development, when body composition trajectories are highly plastic, optimizing skeletal muscle mass is a priority. Of note, approximately 70% of glucose uptake occurs in skeletal muscle [8]. Thus, beyond the established adverse consequence on bone health in adolescent females with AN, loss of skeletal muscle and function has direct impact

on metabolic health. Inclusion of strategies to preserve, maintain and/or increase skeletal muscle mass are warranted. Due to the well-described contribution to nutrient delivery and utilization, resistance training in conjunction with a nutrition plan is a novel approach to optimize body composition in adolescents with malnutrition [8,9].

2. METHODS

A 13 year-old male adolescent presented in the Adolescent Health Clinic with significant weight loss, 68 pounds (30.9 kg) over 1 year, while growing 2.5 inches (6.35 cm) (arguably encompassing 83 pounds taking expected weight increase with height into account). Patient's weight recorded by his primary care physician (PCP) was 183 pounds (83 kg) and height of 65.5 inches (166.4 cm) (reflecting BMI percentile-for-age at the 99th) in August of 2014. The patient presented to Adolescent Health Clinic in September of 2015, weighing 116 pounds (52.7 kg) at 67.3 inches (170.9 cm) tall. At this time, his BMI-for-age was at the 18th percentile (Fig. 1). Parental consent and patient assent was obtained for to document case prior to publication.

3. CASE PRESENTATION

Upon independent interview with the patient and his parents, the impetus for weight loss was associated with bullying at school because of his weight. Patient stated that after the school's football season, he continued to exercise, running 3 to 4 miles per day. In January, he continued this as school and travel baseball practices began. At the same time, he used a calorie-counting phone application to keep his daily caloric intake below 1000 kcal. After the school year ended, the patient decreased his caloric intake again to less than 500 kcal per day. The patient denies purging, via emesis, diuretics, laxatives, etc. At the time of our initial appointment with the patient, his PCP restricted physical activity and prescribed Prozac. On medical examination, bilateral temporalis wasting with a prominent atrophy at the zygomatic arch was evident in addition to an obvious lack of periorbital adipose tissue. Patient also had significant appendicular muscle wasting, particularly in the deltoid, gluteal and paraspinous musculature and a scaphoid abdomen with prominent iliac crests of note, bilateral mild gynecomastia was observed, plausibly associated with decreased testosterone

aromatization. Patient also presented with pitting edema (+1) bilaterally in the lower extremities. Complaints of cold intolerance, abdominal pain, muscle cramping, constipation, and sinus congestion were also noted. Biochemical analysis indicated a low magnesium (2.4 mg/dL); pyridoxine (vitamin B6; 59.9 ng/mL); glucose (60 mg/dL); blood urea nitrogen (BUN; 20 mg/dL); serum creatinine (0.99 mg/dL); and serum ferritin (306 ng/mL). Other systemic examinations were unremarkable, Celiac panel was negative and abdominal ultrasound and EKG were normal. The Eating Disorder Inventory (EDI) (Fig. 2) showed clinical elevations in Drive for Thinness, Ineffectiveness, and Perfectionism. There were

subclinical elevations in Bulimia, Body Dissatisfaction, and Interpersonal Distrust. The Body Image Scale (BIS) (Fig. 3) illustrated moderate body image distortion. Handgrip strength, assessed via dynamometer indicated 165.5 PSI, which is classified as "Above Average" for sex and age.

3.1 Treatment

The patient was prescribed a 2200 kcal/d nutrition plan consisting of 3 meals, 3 snacks and a supplemental nutrient shake per day. The overall nutritional plan to improve the patient's nutritional status was to start with a manageable

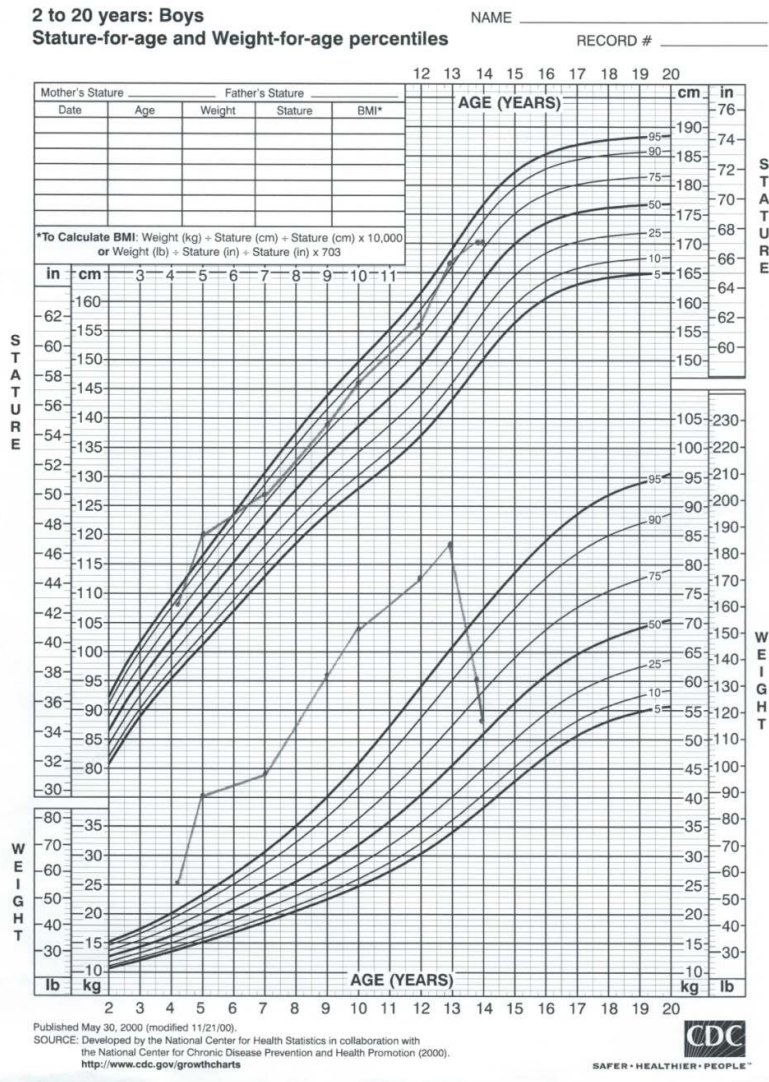


Fig. 1. Patient's growth charts illustrating height-for-age and weight-for-age

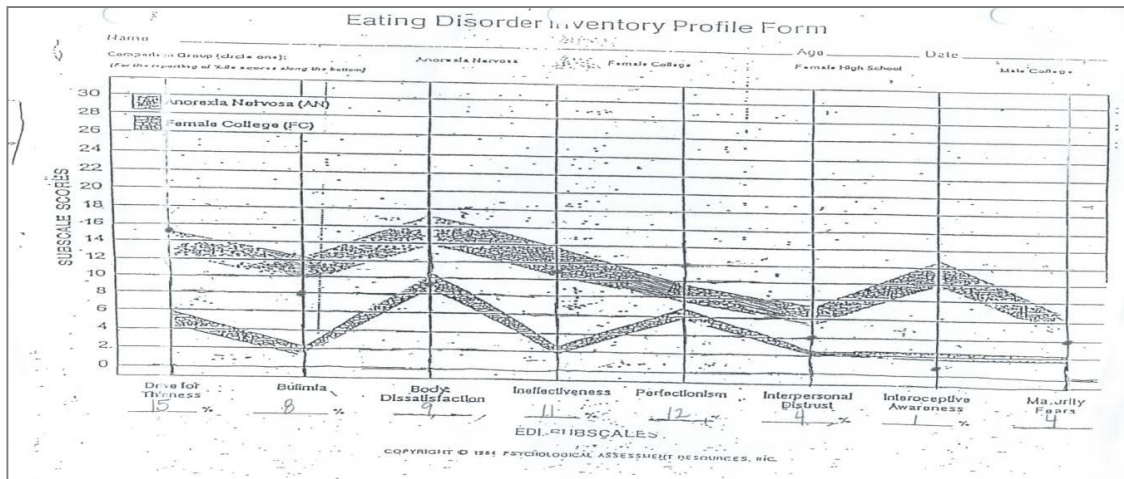


Fig. 2. Eating disorder inventory

food plan and increase the intake as able. The patient was also instructed to continue drinking 60 to 80 fluid ounces of water per day. Patient was also provided with six resistance training exercises using weights. Due to noted muscle wasting, weights no heavier than 10 pounds (4.5 kg) were recommended. Exercises included: bicep curls, chair dips, wall push-ups, bent-over rows, wall sits and bridges. Instruction and demonstration was provided for each as well as recommended sets and reps. As is typical with AN, an inter-disciplinary approach, encouraging the patient's parents to have a psychiatry consultation to assist with psychotropic management of presumed Obsessive Compulsive Disorder and possible anxiety and/or depression was initiated.

3.2 Outcome and Follow-up

Over five weeks of outpatient treatment in the Adolescent Health Clinic, the patient's weight loss continued weekly, but with a decelerated rate per week (e.g. 2.6 pounds between weeks 1 and 2 to 0.2 pounds between weeks 3 and 4). Weight was maintained during weeks six and seven.). At week 7, the patient had a much more positive attitude, adopted resistance training and set a personal goal to be medically cleared for physical activity by baseball try-outs in the spring. On week 8, the patient gained 3.6 pounds (1.6 kg). Of clinical relevance, the patient presented at week 5 with 2 Stage 2 pressure ulcers on his back; one was located on his upper mid-back and the other was located on the right shoulder blade (reflecting points of contact with school backpack), secondary to malnutrition-

related skin and capillary fragility. The patient was instructed to keep the sores lubricated with an over-the-counter ointment and Juven, 1 to 2 times per day to support tissue repair. Upon most recent assessment (9 weeks post-initial assessment) patient's weight was 120.1 pounds (54.6 kg), height was 67.3 in (170.9 cm), BMI percentile-for-age at the 41st, and medical clearance for sports was received. His handgrip strength also improved by 2 PSI.

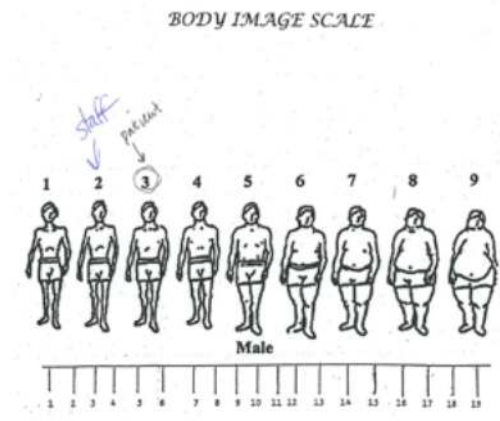


Fig. 3. Body image scale

4. DISCUSSION

Upon investigation of literature encompassing adolescent health and weight, three obvious themes emerge. First, the obesity epidemic far overshadows the rising number of malnourished adolescents in developing countries. Second, recent published cases involving adolescents

with AN include post-pubertal females often focusing on the female athlete triad. Finally, weight restoration/treatment focuses almost exclusively on weight/fat mass gain.

Severe malnutrition resulting from insufficient caloric intake can affect all bodily systems. There is extensive literature describing overlapping manifestations of malnutrition in those that are underweight, as in AN overweight, yet lacking in adolescents that are normal weight, as in FECNEC. Diagnoses encompass cardiovascular, gastrointestinal, endocrine, neurological, renal, integumentary, haematological, and psychiatric manifestations, and often electrolyte disturbances. Indeed greater fat mass via increased dietary and fluid intake attenuates the systemic manifestations initiating overt chronic disease. However, metabolic inefficiency in terms of nutrient delivery and utilization in the context of decreased resting energy expenditure due to muscle wasting limits capacity to fully restore health [10].

Although deficiencies in certain nutrients have long been known to impair healing, supplementation of specific immune modulating nutrients has not consistently yielded improvements in wound healing [11]. Speculatively, increasing nutrients through supplementation does not achieve the critical step involving nutrient delivery. Through the enhanced nutrient delivery of muscle contraction, resistance exercise triggers exercise-induced hormone, auto/paracrine-acting growth factors, mechanical transduction, and intramyocellular second messenger pathways, which have far-reaching systemic effects.

The current knowledge about AN indicates that it is a complex, serious, and often chronic condition that may require a variety of treatment modalities at different stages of illness and recovery. Whereas typical treatment involves a multidisciplinary approach including nutritional rehabilitation, psychological intervention, and pharmacotherapy, the inclusion of resistance training into the treatment plan, allows for optimization of nutrient delivery and utilization. Resistance training is associated with changes at the metabolic level. Resistance training, utilizing negligent amounts of energy, increases the sensitivity of skeletal muscle tissue to amino acids, which increases muscle protein synthesis. This increased anabolic activity can remain for up to 24 hours after single resistance training session [12]. Ultimately, increases in lean mass influence fuel utilization.

5. IMPLICATIONS

A comprehensive, multi-system approach is requisite in the treatment of AN-related malnutrition irrespective of BMI; thus, enhanced awareness by PCPs is requisite. In ED patients, increasing skeletal muscle mass may promote even greater health improvements than simply increasing weight/ fat. Accordingly, resistance training, as a part of a treatment plan, can improve nutrient delivery and utilization, restore weight and mitigate systemic manifestations of malnutrition. In any case of rapid and/or significant weight loss, PCPs should be encouraged to investigate the methods employed for weight loss and examine the adolescent for indicators of malnutrition. It is critical to not rule out an ED diagnosis for a patient despite their sex and previous weight history, as ED patients encompass individuals across all spectrums.

6. CONCLUSION

Timely diagnosis and treatment of an ED diagnosis is critical in all effected individuals. Utilizing a comprehensive, multi-system approach to treat an ED, and the associated malnutrition, should be encouraged to restore individuals to improve nutrient utilization, restore weight, and mitigate systemic manifestations of malnutrition. Consideration of the changing face of AN, including sex, weight, and muscle wasting is imperative to respond to the dynamic health status of adolescents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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