The Eating Disorders
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Chapter 28

Nutritional Characteristics and Consequences of Anorexia Nervosa and Bulimia

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INTRODUCTION

Abnormal patterns of behavior relating to food acquisition, selection, preparation, mental preoccupation, and dietary intake in anorexia nervosa and bulimia have been extensively documented in the literature [1-6]. Behavioral patterns may be viewed both as indicators of physiologic state and modes of psychosocial adaptation. Dysfunctional patterns of behavior can promote further deviations that may perpetuate an altered physical state. Anorexia nervosa and bulimia exemplify the latter. The overwhelming fear of fatness [3-8] alters food-related behaviors, which become progressively distorted with the worsening physical condition. A restrained or chaotic consumatory pattern along with the effects of sham eating and malnutrition warp the psychobiologic regulation of appetite and food selection.

The need for establishing differentiated criteria for the food-related behaviors and nutritional characteristics of anorexia nervosa and bulimia is important for early diagnosis and treatment of the disorders. A beginning differentiation and classification of the range of food-related behaviors in anorexia nervosa and bulimia is included in Table 1.

The classification may be useful (1) in assisting the clinician in assessing historical and observational diagnosis; (2) as a guide in confronting the patient with specific maladaptive behaviors, to heighten awareness and motivation toward normalization of the behavior; and (3) to define social and environmental dimensions of human eating behavior that may be tested in animal eating behavior studies and serve as observational models to further our understanding of the effect of external conditions on eating behavior.

HISTORY

Early recognition of abnormal food-related behavior can benefit the treatment and prognosis of anorexia nervosa and bulimia.

The advantage of early diagnosis in the successful treatment, prevention of medical complications, and prognosis of anorexia nervosa was documented by Ryle 50 years ago [9]. He ascertained that anorexia nervosa was frequently unrecognized or treated inappropriately due to misdiagnosis [9]. Yet, the clinical characteristics of amenorrhea, bradycardia, weight loss, changes in temperament, and sustained physical and mental energy, despite the emaciated state, were recognized by Sir William Gull as early as 1868 [10].

Other physical features of the anorexia condition were noted subsequently. The characteristic reduction in basal metabolic rate in anorexia nervosa was first noted by Berkman in 1930 [11]. Damage to tooth enamel due to vomiting was reported by Bargen and Austin in 1937 [12].

Table 28.1 Differentiation and Classification of the Range of Food-Related Behaviors in Anorexia Nervosa and Bulimia

Food Preferences		Physical Experience	
Anorexia Nervosa	**Bulimia**	**Anorexia Nervosa**	**Bulimia**
Restrictive in fat and refined carbohydrate, as well as certain complex carbohydrates (bread and cereals) and protein (red meat).	Polyphagic or carbohydrate specific during a binge, however, when not in a binge-purge cycle specific "binge" foods, such as cereal, cakes, cookies, ice cream, bread, nuts, peanut butter, pasta and chips are restricted.	Cuts food into small pieces. Arranges food on plate.	Normal to large bites of food. May mix foods together.
Consumes most vegetables and specific fruits to control weight gain.	Consumes easily purged foods to control weight gain, such as ice cream, cheese, eggs, vegetables, cereal, milk.	Eats slowly with prolonged chewing time before swallowing. Prefers small containers of food.	Lifting food to mouth is generally more frequent with shortened chewing time before swallowing. Prefers large containers of food during a binge.
Observable increase in the amount of noncaloric condiments used to alter the flavor of food, possibly to make it less appealing (cinnamon, mustard, vinegar).	Craves foods that satisfy taste desires, usually for sweet or salty foods.	Throws away or hides food to avoid consumption.	Dislikes being responsible for food waste and will overeat or hoard food for an isolated binge experience.
Increased desire for diet drinks, coffee and/or tea.	Increased desire for diet drinks, coffee and/or tea. Consumes excess fluid to aid vomiting, attempt to suppress hunger and aid rehydration.	Does not self-induce vomiting to control food intake.*	Vomits to control food absorption by induced vomiting, spontaneous rumination or regurgitation.

*The exception is the anorectic who is also bulimic.

A presentation of case studies by Ryle in 1936 reveals the occurrence of self-induced vomiting in one anorexia nervosa patient and uncontrolled vomiting leading to severe weight loss in another [9]. The concept of vomiting and/or use of laxatives as a means of controlling weight was designated by Russell (1979) as "bulimia nervosa: an ominous variant of anorexia nervosa" [13].

Bliss and Branch (1960) refer to anorexia nervosa as "nervous malnutrition," contending that the behavior changes are primarily a result of the malnourished state [14]. Others oppose this view, considering it as a primary psychopathological disorder [15-20].

DEVELOPMENT IN THE FIELD

Crisp [3,15,21,22] regards anorexia nervosa as the result of a weight phobia that promotes restrictive dieting with the avoidance of carbohydrate foods, generally resulting in a "unique state of carbohydrate starvation."

Crisp [15] analyzed one day's diet of an anorexia patient on three occasions during the course of illness. The analysis compares the total kilocalories and the grams of protein, carbohydrate, and fat consumed on each occasion.

Table 2 presents the percent of total kilocalories from protein, carbohydrate and fat, as calculated from Crisp's data. Table 2 represents a means of assessing and comparing the balance of macronutrients between the three days analyzed during the course of the anorexic condition.

Although the total amount of food decreased regardless of nutrient composition, the relative amounts of protein and fat increased in the period just prior to admission, while the percent of the kilocalories derived from carbohydrate decreased. During the inpatient treatment, the percentages of protein, carbohydrate, and fat represent a nutrient composition considered typical of average diets in developed countries [23]. The diet analyses at both one year and two months before admission indicated a low carbohydrate intake, supporting Crisp's carbohydrate avoidance theory.

In a subsequent controlled study of the diet composition, Crisp [24] again found the anorexia diet to be

Table 28.2 Percent Protein, Carbohydrate and Fat of an Anorexic's Diet on 3 Occasions*

	Calories	% Protein	% Carbohydrate	% Fat
1 yr. prior to admission	1180	22%	25%	50%
2 mo. prior to admission	470	27%	13%	57%
During in-patient treatment	3300-3500	16%	41-45%	41-42%

*adapted from: Crisp, A.H. Anorexia Nervosa "feeding disorder," "nervous malnutrition" or "weight phobia." World Reviews Nutrition and Dietetics, 1970; 12:452-504.

mainly restricted in carbohydrates. The study was based on three experimental groups of patients with anorexia nervosa. Group A consisted of 19 restrictive patients, and groups B and C were, respectively, made up of patients who binge and vomit, infrequently and frequently. Five dietary surveys from"normal" young females were used as the control group.

In looking at the mean daily intake, group A consumed fewer kilocalories than the control group, as expected. During binge periods, kilocalories consumed by groups B and C exceeded the intake of the control groups, as expected. It is of interest that the mean daily kilocalorie consumption during nonbinge periods for Groups B and C was similar in amount to that of the control group. The foregoing contrasts with Fairburn's [25,26] findings that bulimics are usually more restrictive in nonbinge periods, eating less than the average intake of normals.

It is also of interest that the experimental groups in Crisp's study have a relatively high proportion of the total kilocalories coming from fat, especially in groups B and C. This suggests that during nonbinge periods, anorexics with bulimia consume foods contributing significant amounts of fat to the diet. In the author's experience, however, anorexics and bulimics during nonbinge periods commonly have a subjective attitudinal aversion to dietary fats and to any other food they consider to be "fattening," regardless of actual fat content. (See chapters 10,11 in this volume for discussion of palatability and preference studies.)

It is also observed that bulimics' avoidance of food varies, being dependent on whether they have binged on the food in the past. The experience of binging and vomiting on a specific food instills a fear of overeating, which *inhibits consumption* during *nonbinge periods* and *promotes overconsumption* during *binge periods.* Psychobiologic homeostasis regulating variety and constancy of food selection may be interfered with or impaired.

In any diet, a balance of the energy-contributing nutrients (carbohydrate, protein, and fat) is important for two reasons: (1) any macronutrient alone cannot support growth, and (2) a relatively constant calorie intake can be maintained through balancing the proportion of protein, carbohydrate, and fat [27].

An imbalance of the macronutrients in the diet may cause change in physiologic and behavioral response. Animal studies have been performed to show this effect. Rats given a glucogenic pattern of food intake (a mixed diet, with adequate carbohydrate as a percentage of total calories) show a heightened excitability (or tonus) level of CNS, whereas a reduced excitability level results from a gluconeogenic pattern of food intake [27]. An elevated excitability level causes the rats to learn better and makes them more resistant to stress. The inability of eating disorder patients to cope with stress is well documented in the literature [6,28,29], and an imbalance of carbohydrate, protein, and fat in the diet may contribute to these problems.

It was observed by Scott [30] that, given a choice of diet, rats will base their selection on "simple preference" when the choice is between diets containing differing protein concentrations that are balanced, but not abnormally high or low in protein content. However, when given the choice of a diet with an imbalance of amino acids (one containing a limiting amino acid and a surplus of all other amino acids) or an alternative that is protein-free, it was found by Sanahuja and Harper [31] that the rats usually chose the latter.

Various studies suggest that a diet with an imbalance of amino acids does not cause physiological or biochemical defects, as would a protein-free or amino acid-deficient diet. However, an imbalanced protein diet can cause a reduction in food consumption by an appetite-regulating mechanism [32,33].

In eating disorder patients, abnormal eating patterns, avoidance of meat, (1) and attempts to practice vegetarianism [34] may result in a diet that has a poor balance of amino acids. Based on the findings in animal studies, it may be possible that in humans a similar tendency toward a protein-free diet (ie, avoid protein) may result from consuming an imbalanced amino acid diet.

Reference has been made to carbohydrate-specific bingeing in bulimia [22,35] and carbohydrate craving in females with chronic, mild depression [36]. Wurtman et al [37] evaluated carbohydrate craving in obese subjects by the use of three drugs: tryptophan, fenfluramine, and a placebo (lactose). During the baseline period all sub-

jects showed significant preference for carbohydrate food over protein food. Subsequently, fenfluramine was found to significantly decrease carbohydrate snacking in all subjects, while carbohydrate snacking was significantly decreased in three subjects with tryptophan. However, no subjects decreased carbohydrate snacking while taking the placebo.

The researchers concluded that a large quantity of dietary carbohydrate would be required to elevate serotonin neurotransmission and subsequently suppress carbohydrate craving. Increased intake of tryptophan, like carbohydrate, causes an increase in brain serotonin and therefore maybe useful in reducing carbohydrate bingeing. Wurtman et al [37] note that in treatment and diet therapy, the evaluation of a patient's food intake pattern is essential to determine whether the diet is overconsumption of all food or only certain macronutrients.

It is well known that delayed menarche, amenorrhea, and irregular periods are characteristic consequences of anorexia nervosa and bulimia [20,24,25,38,39]. Cause for the disturbed menstrual function has been attributed to a number of factors including psychological factors, reduced caloric intake, inadequate carbohydrate intake, and weight loss with reduced percentage of body fat [2]. A recent study and review has associated increased carotene intake (in the form of salads, vegetables, health diets) and intense exercise as important contributions to oligomenorrhea and amenorrhea in normal-weight women [40].

Frisch [41] compared seven-day food diaries in 13 premenarcheal trained athletes and 11 postmenarcheal trained athletes. The average dietary composition of the premenarcheal group was significantly lower in protein, in the percentage of kilocalories from fat, in total fat, in saturated fat, in calcium, and in total kilocalories than that of the postmenarcheal teammates. Although an eating disorder diagnosis was not applicable to this particular group, the relationship of diet composition to body fat composition and to menarche is of interest. (Vigorous athletic training in the prepubertal years may compromise the capacity of appetite regulatory mechanisms to compensate for both heightened energy expenditure and the beginning demands for skeletal growth and weight gain. A relative anorexia with growth retardation may result.)

Halmi and Falk [2] studied 40 menstruating female and amenorrheic anorexia nervosa patients one year after treatment. Both groups were assessed as to dietary and behavioral factors. The two groups were significantly different in response to variables measuring eating attitudes and behavior. For example, the amenorrheic group was assessed as feeling ill with eating, experiencing the feeling of bloating, fearful of fat, believing their food choices to be more nutritious, having a selective appetite, and having a fear of compulsive eating. The menstruating group was without all of the aforementioned behaviors and dietary attitudes [1].

Dietary attitudes contribute both to food selection and the experience of eating. The Eating Attitudes Test designed by Garner and Garfinkel [1] provides a rating scale for assessment of food related behaviors and attitudes applicable to varying populations of normal and eating disorder subgroups to assess similarities and differences.

Mental food preoccupation, food behavior rituals, interest in cooking for others (especially foods with high caloric density), gazing at recipes and food pictures, thinking about food, and calculating caloric intake have been consistently reported as characteristics of anorexia nervosa [15,17,20,24]. Food thought preoccupation is also characteristic of bulimia [13,26,42]. Bulimics will often plan food binges in advance, during hours of self-seclusion. Johnson and Larson [6] found that bulimics on the average spend 38% of the time thinking about food, food preparation, or eating compared with 14% for the control group. Mental and behavioral preoccupation with food may reflect a primary regulatory disorder further complicated by food restriction, chaotic eating schedule, and in some instances a state of relative starvation.

One major difference between anorexics and bulimics is the level of awareness of the problem. Anorexics will deny their eating habits and defiantly hide their fears of losing control [17,20,24]. Bulimics are aware of their abnormal behavior and may seek help to re-establish a sense of being in control, especially when vomiting ceases to be a successful mechanism for weight control or when vomiting becomes habitual and medically hazardous [28,43].

According to Fairburn [44] bulimics absorb a significant amount of each binge. Absorption and utilization are likely to be influenced by the macro and micro nutrient composition of the diet intake, factors inhibiting absorption (phytates, specific mineral and trace mineral ratios, coffee, tea, antacids, etc), biological availability, tissue depletion, the transport mechanism, extent of purgation, and the degree of emotional instability.

Dietary inadequacies in iron, calcium, zinc, thiamine, and vitamin B-6 are common in young women [45]. An unpublished study [46] of three-day dietary records from 23 bulimic subjects determined thiamine, niacin, calcium, iron and zinc to be less than 100% of the Recommended Dietary Allowance (RDA). Records analyzed from 24 controls found thiamine, iron, and zinc to be below the RDA, but not to the same extent as in the

bulimic group with the exception of iron. The bulimic group consumed a higher percentage of vitamin A and iron, and a smaller percentage of vitamin C, thiamine, riboflavin, niacin, calcium, zinc and protein than the control group [46].

Thiamine is essential in energy metabolism, particularly in carbohydrate metabolism. Ingestion of large amounts of refined carbohydrates during a binge, or negligible amounts of thiamine during a starvation phase could rapidly deplete tissue stores of thiamine. The RDA for thiamine for an adult under normal conditions is 0.5 mg/1,000 kcal consumed [45]. Food sources of thiamine (whole grain cereals, nuts, dried beans and peas, beef, and pork) are usually restricted or consumed during a binge with the anticipation of vomiting the food before absorption.

Animal studies of food selection adaptation in response to thiamine deficiency are to be found in the literature [47]. In response to thiamine-deficient diets, rats will alter their diet composition by increasing total fats and decreasing protein and carbohydrates, a change in energy source that prolongs their survival. A similar shift by anorexics towards fat as an energy source was previously discussed based on findings of Crisp [15,24]. Rats with thiamine deficiency become hyperactive, seemingly related to food-seeking behavior and are observed to increase food hoarding activity [47]. Crisp et al [4] found that about 40% of a group of anorexics will binge and vomit and will also be more likely to hoard and steal food. Underweight patients with restriction and vomiting or normal-weight bulimic patients with high frequency bingeing and vomiting may develop symptoms and signs of peripheral neuropathy in association with malnutrition, high-carbohydrate load, and excess activity suggesting early state thiamine deficiency. A case of Wernicke's encephalopathy associated with anorexia nervosa has been reported [48].

The nutritional consequences of consistent vomiting are generalized malnutrition, fluid and electrolyte imbalance, impaired protein metabolism, and vitamin and mineral depletion [3]. Decreased serum potassium and chloride caused by repeated vomiting episodes will return to normal within 24 to 48 hours after cessation of vomiting and resumption of normal intake [49].

Crisp [24] states that anorexics do not become anemic or deficient in essential vitamins or minerals unless they binge and vomit. Nutrients such as vitamins A, D, E, K, and B_{12} in the liver, essential fatty acids in adipose tissue, amino acids in muscle, and minerals in bones and muscle are provided as needed by reserves stored in the body. Use of these stores is the first stage of nutritional depletion [50]. Plasma concentrations of electrolytes, protein, immunoglobulins, and total calcium, as well as serum B_{12}, folate, and iron are normal in restrictive anorexia [49] but may mask depletion of nutrient reserves. Certain laboratory findings may aid in early identification of deficiencies. For instance, falling C_3 complement and transferrin serum levels may reflect decline in circulating protein, and rising RDW index of the blood count may signify early RBC microcytosis reflecting iron deficiency prior to a decline in hemoglobin or serum iron [48].

It has been proposed that, due to the association of bingeing and vomiting with tension reduction, a subgroup of bulimic patients may have a predisposition to drug or alcohol abuse [52]. Alcohol may be consumed to end a food binge. Many bulimics seem unaware that alcohol is itself a source of calories. Alcohol contributes to poor utilization of vitamins and minerals and would further increase nutritional requirement for thiamine (B_1).

Other B vitamin requirements may be altered by physical stress or dietary imbalance. The need for riboflavin (B_2) may increase as a result of a negative nitrogen balance or a diet where carbohydrate isocalorically replaces fat [53]. B_2 allowances do not need to increase as energy intake increases [45]. Dietary tryptophan contributes significantly to fulfilling the RDA for niacin (B_3), through the conversion of tryptophan to niacin in the body. Inadequate amounts of vitamin B_6 impair this conversion [45]. The requirement for B_6 increases with a high-protein diet. Under acute emotional stress, vitamin C requirement increases to maintain normal plasma levels of vitamin C. Drugs, oral contraceptives, smoking, age, and sex may also alter vitamin C requirement [45]. Carotene, the vitamin A precursor, is often consumed in excessive amounts by eating disorder patients. This is in high concentration in orange fruits and vegetables. Excessive ingestion of carotene-containing foods and possible interference with metabolic enzymatic degradation can cause hypercarotenemia with its characteristic orange discoloration of the skin [21].

Minerals that may be of concern are calcium and zinc. High protein diets and intense physical activity increase calcium requirements. Under normal conditions, about 30% of dietary calcium is absorbed, and if the intake is suddenly reduced, the relative absorption may be insufficient. However, adaptation to lower calcium intake occurs in time [45]. A high intake ratio of phosphorus to calcium may inhibit absorption of calcium. Convenience foods, snack foods, and phosphate-based drinks contribute phosphorus to the diet, especially when diet drinks are taken as the primary fluid.

Zinc may be inadequate due to diet restriction; poor absorption due to chelation with phytates and fiber; geophagia; excess of calcium, magnesium, or copper in the diet; or alcohol intake that increases urinary excretion

Table 28.3 Clinical consequences of nutritional problems common to anorexia nervosa and bulimia

Area of Examination	Anorexia Nervosa	Bulimia
Hair	lack of lustre, thinness, sparseness, easy to pluck	dryness
Face	moon-face, sunken facial features, lanugo hair	naso-labial dysse-bacea, edema face and neck
Lips	angular stomatitis, angular scars, cheilosis	angular stomatitis, angular scars, cheilosis
Tongue	edema, scarlet or raw, atrophic papillae	
Teeth	depressed salivary flow	caries, enamel decalcification enamel erosion
Gums	recession of gum line, bleeding	recession of gum, bleeding
Glands	enlarged thyroid, enlarged parotid	enlarged parotid
Skin	darkening, rough lanugo hair, petechiae, ecchymoses, hypercarotenaemia	warm, clammy, hypercarotenemia
Nails	brittle, ridges	brittle, ridges
Subcutaneous	edema, low % body fat	dependent edema low to high % body fat
Muscular and skeletal systems	depleted lean body mass, atrophy of type 1 & 2 muscle fibers, bone marrow hypoplasia	low to normal lean body mass
Internal Systems		
Gastrointestinal	atrophy, delayed gastric emptying, constipation	esophagitis, esophageal tear, gastric rupture, abdominal distension, constipation
Nervous	peripheral neuropathy symptomatic epilepsy	stupor associated with fluid retention
Cardiovascular	bradycardia, low blood pressure, hypercholesterolemia, pericardial effusion	arrhythmia, temporary abnormal ECG

[55]. Smith et al [56] note that the protein source and amount, the caloric content of the diet, and the individual's energy expenditure all affect the body's zinc requirements. Zinc deficiency may occur in groups of vegetarians or those consuming a high intake of grains, legumes, fruits and vegetables with little or no meat or seafood [56]. The zinc from meat, eggs, and seafood, especially oysters, is more biologically available than that found in whole-grain products [46].

Changes in the concentration of copper, zinc, and magnesium have been observed in association with alterations in neurotransmitter concentrations in certain regions of the brain [57]. Zinc has a role at the receptor level in taste buds [58]. It acts as a cofactor in alkaline phosphate, which is found in highest concentration in taste bud membrane. The bitter quality of taste is affected first and most severely in zinc deficiency, while the sweet taste is affected last and least [58].

Table 3 summarizes the clinical consequences arising from possible nutritional problems common to anorexia and/or bulimia. Not all of the characteristics mentioned are necessarily observed in all patients. Variations in the presenting clinical picture may be due to individual variation and ability to adapt to nutritional stress; the duration of the condition; the nutritional state of the individual before the onset of either condition; the actual diet intake; the use of self-induced vomiting; laxatives, diuretics, regurgitation, excessive exercise or fasting; and the rate of onset and extent of initial weight loss. An acute weight loss puts patients at greater risk than those with a slower chronic loss [49].

The reduced basal metabolic rate characteristic of anorexia nervosa [15,24,59] reflects the body's attempt to conserve energy and minimize or prolong the onset of biochemical lesions and observable anatomical changes [60].

Reduced salivation and disturbed electrolyte balance resulting from dehydration, starvation, vomiting, and antidepressant therapy decrease the buffering effect of saliva on acidic action on tooth enamel [35,61]. Changes

in salivary flow also make the teeth of anorexics susceptible to acid. Typically, the restrictive anorexic may be consuming a large amount of citrus fruit or juices or sucking on hard candies, mints, or chewing gum to alleviate thirst.

The contact with acid or carbohydrate directly on the tooth surface enhances deterioration. Vomiting produces a low pH, and this causes decalcification of the tooth enamel [62]. Hurst et al [35] found tooth erosion to be worse in regurgitators compared with anorexic restrictors. However, the severity and frequency of dental caries was higher in carbohydrate bingers and vomiters [35]. Enlarged salivary and parotid glands are commonly found in bulimics [25]. A slowing down of body functions, a result of starvation, may contribute to delayed stomach emptying, constipation, and stomach distention [20,38]. Dehydration, irregular meals, and laxative abuse also contribute to these common complaints [63].

RESEARCH ISSUES

Extensive comprehensive surveys to evaluate parameters of the nutritional status in anorexia and bulimia have not been documented in the literature. A thorough assessment of vitamin and mineral status and anthropometric and physical data would contribute to the understanding of the metabolic and behavioral changes, as well as the unusual food preference and patterns of intake.

The possibility of specific nutrient deprivation, with respect to body weight, age, sex, and physical energy expenditure should be assessed. Comparison of the nutritional intake during nonbinge periods in eating disorder patients with that of normal subjects may be useful in evaluating the contribution of nutrient deprivation to a binge episode.

Nutritional analysis, based on a three- to seven-day dietary intake record from a sample of eating disorder patients during the course of treatment would be beneficial to menu and diet planning. One of the goals in nutritional rehabilitation is to plan diets that will provide the nutritive requirements, while gradually increasing the amount of food tolerated. Nutritional requirements need to be met with expediency. However, patient sensitivity to eating and physical discomfort from refeeding too quickly creates a meal-planning challenge. An evaluation of nutritional intake, as suggested, may provide a useful basis for planning incremented refeeding schedules that are better tolerated by eating disorder patients.

To understand the factors influencing dietary selection and motivation for change, the following are areas of possible investigation:

1. Comparison of cross-cultural food patterns
2. Composition of macronutrients associated with expansion and changes in food supply
3. Effect of the media's interest in "nutrition" promotion

A person's understanding of what should or should not be eaten is strongly influenced by these factors. In the United States, for example, emphasis on decreasing fat, cholesterol, sugar, and calories and increasing fiber in the diet has been pervasive in the advertising of food and health products over the past 10 to 15 years. Although this emphasis is appropriate for prevention and treatment of obesity and cardiovascular disease, an extreme response to trends in the media and food supply system may contribute to the diet restriction patterns observed with eating disorder patients.

Whether the observed changes in food preference in most eating disorder patients toward spicy foods (with often excessive use of mustard or cinnamon) is due to a taste sensitivity change, secondary to altered zinc availability, or some other factor has not been determined. The use of excessive spices on foods may simply be a mechanism to decrease the desirability of food or limit the appetite. Abnormal food practices on refeeding need to be further assessed in relation to the continuation and treatment of the disordered process.

Further assessment of alterations in body composition in anorexia and bulimia are needed. Bulimics appear to vary widely in the change in body fat resulting from vomiting and laxative abuse. The general lack of reduction in body fat may indicate metabolism of lean tissue during glyconeogenesis and/or shifts in fluid balance reflected by short-term weight fluctuation.

Lindboc et al [64] found type 1 and 2 muscle fiber atrophy in anorexics. The extent to which a restrictive diet effects anatomical change (and thus the body's capacity to tolerate physical exercise) needs to be assessed. This would benefit programs that use physical activity as a motivational tool in therapy. Activity scheduling in conjunction with dietary planning is essential for optimum rehabilitation.

CONCLUSION

The nutritional characteristics of the diet and the food-related patterns of behavior act conjointly to maintain, improve, or worsen psychobiologic integrity. The eating disorders are good examples of the impact that dietary factors have on the consequent physiological and behavioral functioning of the individual.

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