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Eating Behavior in Anorexia Nervosa: Before and After Treatment

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Abstract

Objective—The purpose of this study was to assess eating behavior in patients with anorexia nervosa before and after weight normalization and healthy controls using a standardized, multiple-item lunch meal paradigm.

Method—Eighteen patients were studied shortly after inpatient admission and again after gaining to a BMI ≥ 19.5 kg m^{-2}. Fifteen healthy controls were studied twice, ~2–3 months apart.

Results—When underweight, patients with AN consumed fewer total calories (364 ± 208 kcal) and a lower percentage of calories from fat (18% ± 10%) compared to controls (775 ± 228 kcal, $p = 0.001$; 38% ± 7%, $p = 0.001$). After weight normalization, despite a modest increase in total calories (364 ± 208 kcal vs. 516 ± 273 kcal, $p = 0.04$) and in percent of calories from fat (18% ± 10% vs. 23% ± 9%, $p = 0.04$), patients continued to consume fewer total calories and a reduced percent of calories from fat compared to controls (758 ± 346 kcal, $p = 0.03$; 38% ± 18%, $p = 0.004$).

Discussion—Patients with AN, even after acute treatment, consume fewer total calories and fewer calories from fat, compared to healthy controls. The reduced overall intake and persistent avoidance of fat may contribute to relapse, and therefore are potential therapeutic targets.

Keywords

anorexia nervosa; eating behavior

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The authors' responsibilities were as follows: Study concept and design: LESM, JS, BTW; Data acquisition: LESM, JS, LPB; Data analysis and interpretation: LESM, JS, LPB, RMS, BTW; Manuscript preparation: LESM, JS, LPB, RMS, BTW. All authors take responsibility for the integrity of the data and accuracy of the data analysis.

Introduction

Anorexia nervosa (AN) is a psychiatric illness characterized by low weight, intense fear of gaining weight, and fear of fat. As core symptoms of this illness, these fears lead to significant dietary restriction and weight loss. Laboratory eating behavior paradigms have consistently demonstrated that patients with eating disorders engage in pathological eating behavior in the laboratory setting,[1] suggesting such methods can be used successfully to investigate clinical assumptions. However, most published studies have examined patients with AN while acutely-ill and underweight.[2–4]

Using a single-item meal, Sysko et al.[5] described that patients with AN consumed fewer calories when underweight compared to controls. Despite weight gain to greater than 90% of ideal body weight (IBW), intake did not significantly increase, and remained reduced relative to healthy controls. An acknowledged limitation of the study was the use of a single-item, strawberry-yogurt shake as a proxy for a ‘‘meal.’’

The current study used a multiple-item meal paradigm to assess eating behavior before and after weight normalization in patients hospitalized for the treatment of AN and in healthy controls.

Method

This study was approved by the New York State Psychiatric Institute (NYSPI)/Columbia University Department of Psychiatry Institutional Review Board. All participants provided informed consent prior to entry into the study.

Participants were 25 patients (23 women, 2 men) meeting DSM-IV[6] criteria for AN except amenorrhea and 20 healthy controls of similar age, gender and BMI of weight-restored patients. All participants were free from medications, except acetaminophen and ibuprofen, for a minimum of 2 weeks prior to initial testing.

Patients with AN were admitted for treatment to the inpatient Eating Disorder Service at the NYSPI/Columbia University Medical Center. Treatment consisted of a structured behavioral program aimed at normalizing weight and eating patterns.[7] Patients were weighed regularly and expected to gain at least 1 kg per week. Caloric prescription began at 1,800 kcal per day, and was increased by ~400 kcal day^{-1} every other day until reaching a prescription of 3,000 kcal in food and 720 kcal in nutritional supplement (Ensure or Ensure Plus; Ross Nutritional, Columbus, OH). Additional calories in the form of liquid nutritional supplement were added, if necessary. The weight gain phase continued until patients reached 90% IBW.[8]

Individuals with AN were studied within the first two weeks of hospitalization, prior to the initiation of formal weight gain, and again after achieving at least 90% IBW. Healthy controls were also studied twice, ~2-3 months apart, similar to the interval between the patients’ studies.

On the morning of testing (~8 am), participants ate a standardized breakfast of ~300 kcal, and then had nothing to eat or drink until the test lunch (~1 pm). The laboratory lunch meal consisted of 25 food items placed on a table: grilled chicken, fried chicken, macaroni and cheese, tuna fish, pickles, french fries, salad, chocolate sandwich cookies, chocolate bar, ice cream, donuts, popcorn, fruit salad, whole wheat and white bread slices, butter, mustard, mayonnaise, ketchup, Italian salad dressing, salt, pepper, iced tea, bottled water, and diet cola. Participants were instructed: ‘‘This is your lunch for the day. Eat as much or as little as you would like.’’ They were alone in the room during the meal, observed via a one-way, closed circuit TV. Participants had up to 60 min to eat their meal and were asked to indicate when they were done with the meal by ringing a bell on the table. Immediately post-meal, while still seated at the table, participants were asked to estimate total calories consumed.

Gram weight and kcal were calculated for all food consumed, as well as macronutrient composition of the meal including grams of carbohydrate (CHO), protein (PRO) and fat (FAT). Diet Energy Density Score, defined as intake (kcal) divided by weight (g) of food and beverage consumed was calculated.[9] Diet Variety Score, defined as the cumulative number of different caloric foods and beverages was calculated.[9]

A repeated measures general linear model was used to examine differences in caloric intake within and between groups, as well as a group by meal interaction. Independent t tests were conducted to determine between-group differences, and paired t tests were conducted to examine change within groups. Significance was set at $p < 0.05$.

Results

Of the 25 patients, 5 completed only the baseline lunch meal as they requested discharge prior to fully normalizing weight, and of the 20 controls, 5 did not return for the second test meal. In neither the patient nor control group was there a significant difference in BMI or intake at the baseline meal between those who completed one or two meals. Two patients (binge-eating/purging subtype) were observed to and reported objective binge-eating (1,410, 3,195 kcal) during the baseline meal study, and their data were excluded from analysis. Thus complete data from 18 patients with AN and 15 controls were available for analysis. Demographic and meal study data results are presented in **Table 1**. Ten patients were restricting subtype, and 8 were binge-eating/purging subtype.

Repeated measures analysis revealed significant between group intake differences ($F = 15.93$, $p < 0.001$), and was suggestive of a meal by status interaction ($F = 3.551$, $p < 0.07$).

At the baseline meal, total caloric intake, diet energy density score and diet variety score were lower in patients with AN compared to healthy controls (**Table 1**). Percent of calories from CHO and PRO were significantly higher and percent of calories consumed as FAT were significantly lower in patients compared to controls (**Fig. 1**).

At the second test meal (i.e., after treatment to restore weight to at least 90% IBW), caloric intake, but not energy density or diet variety score, significantly increased in the patient group. No significant changes in intake or meal composition were observed in the healthy controls.

At the second test meal, although BMI was not significantly different between patients and controls, patients ate less than controls. Specifically, as a percentage of total calories consumed, weight-restored patients consumed less FAT, more CHO, and similar PRO compared to controls.

At both meals, patients significantly overestimated and controls significantly underestimated the actual number of calories consumed (**Table 1**). The mean over- or under-estimation of caloric intake did not change from meal one to meal two in either group.

There were no significant differences on any eating behavior measure between the restricting and binge-eating/purging subtypes (data not shown).

Discussion

In the current study, patients with AN, even following acute treatment and restoration of normal body weight, consume fewer total calories and fewer calories from fat, compared to healthy controls. While intake increases with weight restoration, it remains significantly reduced relative to controls.

This study is consistent with the results of Sysko et al.[5] of reduced intake of strawberry yogurt shake in patients with AN compared to controls before and after acute treatment, and extends their finding to a multiple-item, buffet meal. In contrast to the Sysko study, patients with AN in this study were able to modestly increase intake with weight gain. In both studies, however, intake failed to fully normalize.

Other dietary features—macronutrient intake, energy density, and diet variety—also differed between patients and controls. Lower diet energy density scores may reflect both behavioral avoidance of dietary fat, as patients at low weight and after weight restoration consumed fewer grams of fat, and increased consumption of non-nutritive beverages (e.g., water, diet soda). Our findings of avoidance of dietary fat and reduced energy density while underweight are consistent with clinical observation and with previous studies of observed intake,[2–4] and extend the findings to recently weight-restored individuals. Persistence of this dietary pattern may contribute to difficulty maintaining weight.[9]

As part of the inpatient treatment protocol, patients are prescribed ~4,000 kcal per day in the form of three meals (~900 kcal each) plus one snack (~300 kcal) daily, plus a minimum of 720 kcal of liquid supplement, and patients are expected to eat 100% of their meals. The macronutrient distribution of the hospital diet is 55–60% carbohydrate, 15–20% protein, and ~30% fat. By the time of the second laboratory meal assessment, patients had been regularly and successfully completing these meals for many weeks in the context of the structured, behavioral protocol. It is of note—and potential concern—that in the temporary absence of such structure, caloric intake is reduced and behavioral avoidance of dietary fat is manifest.

Relapse is a significant problem in the treatment of AN. Upwards of 50% of patients relapse in the year following inpatient hospitalization.[10] Predicting who will relapse is challenging. In a large, multi-site relapse prevention trial,[11] multiple psychological factors, including depression, anxiety, eating, shape and weight related concerns, and commitment to exercise,

were examined as potential predictors of failure to maintain normal weight for 6 months following hospital discharge.[12] Only BMI at randomization and the rapidity of weight loss within the first 4 weeks following discharge were significant predictors. In a related study, Schebendach et al.[9] found that reduced diet energy density and diet variety in recently weight-restored patients prior to hospital discharge were associated with poor outcome in the year following discharge. In sum, as weight loss must be related to inadequate food intake relative to energy expenditure, these data strongly suggest that persistent disturbances in eating behavior are a crucial element in vulnerability to relapse and may be a specific target for intervention.

Patients with AN often appear very knowledgeable about the nutritional and caloric content of foods. Our study confirms that patients with AN overestimate their caloric intake.[2] Repeatedly overestimating intake could predispose patients to relapse, as it could contribute to patients' erroneously concluding they have met their caloric prescription.

Strengths of the current study include the multiple-item (as opposed to single item) meal paradigm. This design allowed for presentation of high and low calorie (e.g., fried chicken and grilled chicken) or more vs. less ''healthy'' (e.g., whole wheat vs. white bread) food options so as to elicit patient preference. All participants were studied twice to control for the effect of time and novelty of the buffet presentation. The absence of significant change in the intake and content of the controls' meals suggests substantial test-retest reliability.

Inherent in the meal study design, however, are also limitations that must be acknowledged. The laboratory meal is not a ''real world'' setting, and the buffet presentation is not typical for an average meal. More food was available to the participant than was expected to be consumed, which may have increased both patient and control anxiety. Knowing they were being watched via closed-circuit television might have had an impact on intake. Even with the ''lunch meal'' instruction, two patients binge ate during the session. Despite these limitations, this paradigm appears to be a potentially valuable method of assessing behavioral disturbances critical to the development and maintenance of AN.

Conclusion

Patients with AN consume fewer calories and avoid dietary fat when compared to healthy controls, both before and after weight restoration. The reduced overall intake and persistent behavioral avoidance of fat may contribute to the risk of relapse, and therefore is a potential target for treatment intervention.

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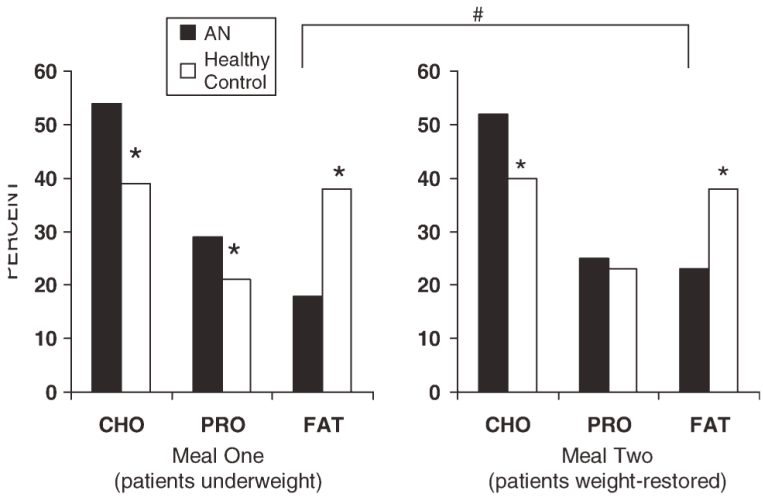

FIGURE 1.

Mean percent of calories from carbohydrate (CHO), protein (PRO) and fat (FAT) ingested by patients with AN and healthy controls at each laboratory meal.

* Compared to healthy individuals, patients with AN consumed a greater percent of calories from CHO ($p < 0.018$) and lower percent of calories from FAT ($p < 0.004$) at both meals and a greater percent of calories from PRO ($p < 0.03$) when underweight.

After normalization of weight, patients significantly ($p < 0.04$) increased the percentage of FAT calories consumed, but FAT intake remained significantly ($p < 0.004$) reduced compared to healthy individuals.

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TABLE 1

Demographic and ingestive behavior data from the laboratory multiple-item meal assessment before and after weight normalization in patients with AN compared to healthy controls studied twice

	Patients						Controls							
	Meal 1 (Low Weight)		Meal 2 (90%IBW)				Meal 1		Meal 2				Meal 1- Meal 1 Comparison	Meal 2- Meal 2 Comparison
	N = 18				Paired *t* Test		*N* = 15				Paired *t* Test			
	Mean	SD	Mean	SD	*p*<		Mean	SD	Mean	SD	*p*<		*p*<	*p* <
Age (yrs)	27 ±	8					26 ±	4					0.502	
Duration of illness (yrs)	10.5	8												
Body mass index (kg m^{-2})	15.5 ±	2.12	20.2 ±	0.68	0.01		20.62 ±	0.79	20.55 ±	0.91	0.52		0.001	0.23
Calories consumed (kcal)	364 ±	208	516 ±	273	0.04		775 ±	228	758 ±	346	0.77		0.001	0.03
Diet energy density score (kcal g^{-1})	0.49 ±	0.34	0.6 ±	0.29	0.21		0.92 ±	0.33	0.95 ±	0.37	0.51		0.001	0.005
Diet variety score	5.39 ±	1.82	5.83 ±	2.48	0.38		7.87 ±	2.45	8 ±	2.95	0.83		0.002	0.03
Difference between calories estimated and actual calories consumed during the meal	153 ±	281	133 ±	151	0.90		−99 ±	203	−95 ±	302	0.95		0.001	0.001