HHS Public Access

Author manuscript

*Eat Behav*. Author manuscript; available in PMC 2016 December 01.

Published in final edited form as:

*Eat Behav*. 2015 December ; 19: 28–32. doi:10.1016/j.eatbeh.2015.06.005.

# Abnormal eating behavior in video-recorded meals in anorexia nervosa

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## Abstract

**Objective—**Eating behavior during meals in anorexia nervosa (AN) has long been noted to be abnormal, but little research has been done carefully characterizing these behaviors. These eating behaviors have been considered pathological, but are not well understood. The current study sought to quantify ingestive and non-ingestive behaviors during a laboratory lunch meal, compare them to the behaviors of healthy controls (HC), and examine their relationships with caloric intake and anxiety during the meal.

**Method—**A standardized lunch meal was video-recorded for 26 individuals with AN and 10 HC. Duration, frequency, and latency of 16 mealtime behaviors were coded using computer software. Caloric intake, dietary energy density (DEDS), and anxiety were also measured.

**Results—**Nine mealtime behaviors were identified that distinguished AN from HC: staring at food, tearing food, nibbling/picking, dissecting food, napkin use, inappropriate utensil use, hand fidgeting, eating latency, and nibbling/picking latency. Among AN, a subset of these behaviors were related to caloric intake and anxiety.

**Discussion—**These data demonstrate that the mealtime behaviors of patients with AN and HC differ significantly, and some of these behaviors may be associated with food intake and anxiety. These mealtime behaviors may be important treatment targets to improve eating behavior in individuals with AN.

### Keywords

anorexia nervosa; eating disorders; anxiety; food intake; eating behavior; video assessment

## 1. INTRODUCTION

The eating behavior of individuals with Anorexia Nervosa (AN) is aberrant in a number of ways. Individuals with AN engage in extreme dietary restriction by avoiding consumption of

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high fat foods and by restricting their overall caloric intake to maintain low weight (Affenito, Dohm, Crawford, Daniels, & Striegel-Moore, 2002; Walsh, 2011). One emerging line of research has examined the relationship between dietary patterns in AN toward the end of inpatient treatment and outcomes one year after discharge. In these studies, patients with AN who had been weight-restored provided food records for the four days prior to discharge (Schebendach et al., 2011; Schebendach, Mayer, Devlin, Attia, & Walsh, 2012). Those with poor outcomes at one year follow-up had significantly lower diet variety scores (the cumulative number of foods and beverages consumed), dietary energy density scores (DEDS, kcal/gram), and fraction of calories deriving from fat intake. These studies indicate that specific facets of dietary intake in AN have implications for the longer term course of the illness, and further exploration is warranted.

In addition, it has long been clinically noted that AN is characterized by abnormal mealtime behaviors. In fact, many examples of these aberrant mealtime behaviors have been enumerated in the Yale Brown Cornell-Eating Disorder Severity Scale (YBC-EDS; (Sunday, Halmi, & Einhorn, 1995)), a semi-structured interview measuring the presence of ritualistic eating disordered behaviors in the past month. The YBC-EDS conceptualizes many of these behaviors, such as excessively cutting or tearing foods, as rituals analogous to those found in Obsessive-Compulsive Disorder (OCD). Rituals in AN may be in the service of managing anxiety around eating (Steinglass et al., 2011).

Despite the common clinical observation that patients with AN frequently exhibit abnormal eating behaviors, there are few objective data available regarding these mealtime behaviors. Wilson and colleagues (Wilson, Touyz, Dunn, & Beumont, 1989) developed a rating scale to measure aberrant mealtime behaviors in AN and compare them to those of healthy controls. This scale measured frequency and intensity of behaviors using Likert scales rated after the entire meal had been viewed. While potentially useful for charting clinical progress, this scale does not quantify behavior and the ratings are completed retrospectively at the end of the meal. Sunday and Halmi (Sunday & Halmi, 1996) also conducted a study examining the mealtime patterns of individuals with AN. This study did quantify the number of times a participant paused between bites, but other common mealtime behaviors were not assessed. Tappe and colleagues (Tappe, Gerberg, Shide, Andersen, & Rolls, 1998) completed a comprehensive assessment and quantification of video-recorded mealtime behaviors in AN and compared them to healthy controls though the use of computer coding software. Results demonstrated that patients with AN spent more time during meals engaged in behaviors related to food arrangement and preparation. This study is the single report of objective measurement of mealtime behavior; however, the study design did not allow for exploration of the relationship between these mealtime behaviors and caloric intake. With improvements in digital technology, we can now better and more accurately assess a range of mealtime behaviors, thus allowing us to better characterize the role mealtime behaviors might play in eating pathology.

Our first aim was to develop, validate, and pilot an approach for assessing ingestive and non-ingestive mealtime behaviors of individuals with AN using a videotaped assessment of a lunch meal. Successful implementation of this assessment approach would then allow us to pursue a second aim, which was to identify behaviors that distinguish patients from their

healthy peers, and explore the relationships between these behaviors and anxiety and caloric intake. We hypothesized that (1) patients with AN would be distinguishable from healthy controls based upon the pattern of mealtime behaviors measured, (2) among patients, frequency and duration of meal-time behaviors would be related to caloric intake, and (3), among patients, frequency and duration of meal-time behaviors would be related to anxiety.

## 2. METHOD

### 2.1 Participants

**2.1.1 Patients with anorexia nervosa—**Participants were individuals between the ages of 16 and 45 years who met DSM 5 criteria for AN at the time of hospital admission (American Psychiatric Association, 2013). Participants with AN were receiving standard inpatient behaviorally-based treatment for AN at the New York State Psychiatric Institute (NYSPI; (Attia & Walsh, 2009)), where they had achieved partial weight restoration to near normal weight (body mass index (BMI) ≥18.5 kg/m$^2$). Patients with AN were enrolled in a randomized controlled trial (RCT) comparing two psychotherapeutic approaches (Exposure and Response Prevention for AN vs. Cognitive Remediation Therapy) which began once patients had achieved weight restoration to 80% of ideal body weight. On average, patients with AN had been in the hospital for 4.9 ± 2.5 weeks (range: 1.3 to 11.1 weeks) before study procedures began. The laboratory meal in the present study served as a baseline assessment prior to randomization in the psychotherapy study. Patients were excluded if they had OCD, or a different Axis I disorder requiring immediate clinical intervention, or acute suicidality (see Steinglass et al 2014 for details (Steinglass et al., 2014)).

**2.1.2 Healthy Controls—**Ten age-matched, normal weight female healthy controls (HC) were recruited via advertisement to participate. HC were included if they had no current or past psychiatric illness, including any history of an eating disorder, and had a BMI in the normal range (18–25 kg/m$^2$). Additional exclusion criteria for HC were the presence of significant medical illness, current use of psychotropic medication, or current food allergies or food restrictions incompatible with foods to be consumed during the laboratory lunch meal (described below). Psychiatric diagnoses were assessed by the Structured Clinical Interview for DSM-IV and the Eating Disorder Examination (Cooper & Fairburn, 1987; First, Spitzer, Gibbon, & Williams, 2007).

All participants provided written informed consent in accordance with the New York State Psychiatric Institute Institutional Review Board (Clinical Trials Registry: NCT00627341).

### 2.2 Study Design

Patients with AN participated in a videotaped laboratory lunch meal as a baseline assessment before beginning treatment in the RCT. Separately, a group of healthy controls were recruited to participate in a videotaped meal, following the same procedures. All participants consented to being videotaped during this meal.

**2.2.1 Laboratory Meal—**All participants received a standardized breakfast (300 kcal) at 8 am with nothing to eat or drink between breakfast and the study meal, 4 hours later

(Steinglass et al., 2012). The lunch meal was comprised of a large turkey and cheese sandwich (600 kcal), a squeeze bottle of mayonnaise, a bowl of potato chips (455 kcal), and a small bottle of water (8 oz). Participants were instructed that this was their lunch for the day, that they should eat a self-determined "appropriate amount," and to press the bell when they were done. Thus, meal length and amount were variable and determined by the participant. All meals were video-recorded (Sony Handycam DCR-SR62). Intake was calculated by measuring the weight of the food (Acculab 7200 balance) before and after the meal and calculating calories consumed based on kilocalories per gram weight of the foods. Diet energy density (DEDS) was calculated as caloric intake (in kilocalories) divided by the total weight (in grams) of food and beverages consumed.

**2.2.2 Meal coding—**Video-recordings of the meals were viewed by three independent raters and the ingestive and non-ingestive mealtime behaviors of the study participants were coded using Stopwatch+(Center for Behavioral Neuroscience) computer software which allows for the simultaneous monitoring of the frequency, latency, and duration of up to 16 behavior categories. The sixteen behavior categories examined in this study were: eating, drinking, arranging/inspecting, staring at food, body checking, nibbling, dissecting, blotting, cutting, odd food combinations, putting down utensils between bites, inappropriate utensil use, napkin use, tearing food, rocking, and hand fidgeting (description of behaviors available in Supplementary Materials; coding manual available upon request). A subset of these behaviors was coded only for frequency, others were coded for frequency and duration, and others were also coded for latency (i.e., time elapsed before the first appearance of the behavior; see Table 1). Co-occurring behaviors were coded simultaneously. For example, if a participant was eating the sandwich and also using a fork to bring the sandwich pieces to her mouth, both "eating" and "inappropriate utensil use" categories were coded.

To establish interrater reliability, a subset of meals (15%, chosen at random) was coded separately by all three independent raters and intraclass correlation coefficients (ICC) were calculated. Guidelines that suggest that ICC's ≤ 0.70 are considered poor, 0.70-0.79 are considered adequate, 0.80-0.89 are considered good, and ≥ 0.90 are considered excellent, were used in the current study (Hunsley & Mash, 2008).

**2.2.3 Psychological Assessment—**Presence of ritualistic eating disordered behaviors was assessed at baseline using the Yale Brown Cornell Eating Disorder Severity Scale (YBC-EDS), a semi-structured interview (Sunday et al., 1995). Eating-related anxiety was measured with the State Trait Anxiety Inventory, state version (STAI-S) immediately prior to each laboratory meal (Spielberger, 1983). Participants in the current study were asked to provide Subjective Units of Distress (SUDs) ratings at three-minute intervals throughout the meal, on a scale from zero to 10, where zero indicated a lack of distress, and 10 indicated extreme distress (Beidel, Turner, Jacob, & Cooley, 1989).

**2.2.4 Statistical Analysis—**First, the frequency, duration, and latency of mealtime behaviors were compared between patients and HC's using two sample t-tests or Wilcoxon rank tests (a non-parametric test) when variables did not pass the Shapiro-Wilk test for normality. Next, summary variables measuring total mealtime behavior frequency and total mealtime behavior duration were created. The total behavior frequency variable was

computed by summing the frequencies of staring at food, arranging/inspecting, body checking, nibbling/picking, dissecting, cutting, inappropriate utensil use, napkin use, and tearing variables. A total behavior duration variable was computed by summing the durations of staring at food, arranging/inspecting, body checking, cutting, and napkin use variables. Associations between these two summary variables and total meal length were examined using Pearson's correlation. Finally, we explored the relationships between mealtime behaviors, measures of anxiety (STAI-S, mean SUDS, YBC-Total), and caloric intake (caloric intake and DEDS) with a series of linear regressions adjusting for meal length. To examine the association between multiple mealtime behaviors while reducing the number of variables being examined and addressing collinearity between variables, we examined this association only for mealtime behavior measurements that most clearly distinguished patients from controls when the standardized partial correlation (controlling for meal length) between the mealtime behavior and patient/HC group indicator was 0.30 or greater, which corresponds to a medium correlation (Cohen, 2013). Thus, rather than relying on statistical significance, we examined effect sizes which indicated relationships worthy of further exploration. In each multiple linear regression, measures of anxiety or intake were the outcome variables, one of the selected mealtime behaviors and the total length of meal were included as covariates.

## 3. RESULTS

Thirty patients with AN completed the baseline lunch meal. Videotapes were available for 26 individuals with AN (4 meals were lost due to video camera malfunctions) and 10 HC. Clinical and demographic characteristics are presented in Table 1. There was no significant difference in the caloric intake of the entire meal between AN and HC; however, caloric intake per minute was significantly lower in AN compared to HC. Furthermore, the dietary energy density score (DEDS) for the meal was significantly lower among AN than HC (see Table 1).

### 3.1 Interrater Reliability

Interrater reliability ranged from adequate to excellent for the majority of mealtime coded behaviors ($r$= 0.72-0.99) except for rocking frequency ($r$= 0.42), rocking duration ($r$=0.63), hand fidgeting duration ($r$= 0.57), and frequency of putting utensils down between bites ($r$= 0.54). As a result, these four variables were not included in further analyses. Blotting and odd food combination variables were not observed during any meal recordings and thus were also not considered in further analyses.

### 3.2 Meal-time behaviors of Healthy Controls and Patients with AN

Mean duration, frequency, and latency of behaviors for AN and HC are shown in Table 2. Pearson correlations between meal length and Total Behavior Frequency and Total Behavior Duration were $r$= 0.630 ($p$<.001) and $r$= 0.489 ($p$=.002), respectively, such that increased meal length was associated with greater frequency and duration of meal time behaviors for the total sample. Meal length was also significantly positively correlated with caloric intake ($r$=0.442, $p$=.007) (i.e. greater meal length was associated with greater caloric intake). Thus

length of meal is a potential confounding variable and was adjusted for in all further analyses.

Given the small sample size and multiple comparisons, we had low power to detect statistically significant effects. Because this study was intended to be hypothesis-generating and exploratory, we therefore examined and reported effect sizes rather than statistical significance for all further analyses. The behaviors that most clearly differentiated AN from HC based upon a medium effect size with at least a medium partial correlation (0.3 or greater), were latency to: 1) nibbling/picking, and 2) eating, as well as frequency of: 1) staring at food, 2) tearing food, 3) nibbling/picking, 4) dissecting, 5) napkin use, 6) inappropriate utensil use, and 7) hand fidgeting. Specifically, patients with AN exhibited greater frequencies of staring at food, tearing food, nibbling/picking, dissecting, and inappropriate utensil use, and lower frequencies of napkin use and hand fidgeting than HC. Patients with AN also had longer eating latency and shorter nibbling/picking latency than HC.

### 3.3 Association between Mealtime Behaviors, Energy Intake, and Anxiety

Exploratory analyses, controlling for meal length, were conducted (described above) examining the associations between meal time behaviors, intake, and psychological measures in the sample of patients with AN. The exploratory nature of these analyses, the small sample size, and the number of comparisons examined precludes discussion of statistical significance; however, we present relationships worth further exploration based upon effect size measured by the magnitude of association between variables and their confidence intervals and consider them to be hypothesis-generating.

**3.3.1 Energy Intake—**As shown in Table 3, using a pre-defined threshold of partial correlation of >0.3, several behaviors were found to have a negative association with caloric intake: eating latency, and frequencies of nibbling/picking, staring at food, tearing food, inappropriate utensil use, and dissecting. In each case, a greater amount of the aberrant behavior was associated with a decrease in caloric intake. Another measure of eating, the DEDS, was strongly associated with eating latency and frequency of staring at food, such that a greater delay in eating and greater frequency of staring at food was associated with decreased DEDS in the foods consumed.

**3.3.2 Anxiety—**There were no strong associations between patients' pre-meal anxiety (STAI-S), and the nine meal time behaviors most strongly differentiating patients from controls (see Table 3). Patients' mean level of anxiety during the meal, (SUDS), had strong associations with the frequencies of nibbling/picking, tearing, and inappropriate utensil use (see Table 3). Similar relationships were found between these behaviors and the YBC-EDS. In each case, greater frequency of the mealtime behavior was associated with heightened anxiety. Additionally, greater frequencies of hand fidgeting and napkin use were associated with lower SUDS during the meal and lower YBC-EDS score. Notably, HC's displayed more hand fidgeting and napkin use than AN.

## 4. DISCUSSION

In this study, 26 AN showed greater frequencies of specific disordered eating behaviors during a meal: namely, dissecting, inappropriate utensil use, nibbling, staring at food, and tearing food. Patients also displayed greater latency to eating, and shorter latency to nibbling (controls did not typically engage in nibbling behavior), and lower frequencies of napkin use and hand fidgeting than controls. Contrary to our expectation, frequency of cutting, arranging or inspecting food did not differentiate AN from HC. Thus, our coding system of mealtime behaviors was able to reliably distinguish individuals with and without AN and demonstrated that the presence and frequency of several notable behaviors, long thought to be pathological, were more common in AN.

The assessment of mealtime behaviors in AN is an understudied area. Our results are in concordance with a similar study conducted by Tappe and colleagues (Tappe et al., 1998), which demonstrated that patients with AN displayed more food preparation, food manipulation, and food moving behaviors during a fixed-calorie lunch meal than controls. In the current study, patients and controls did not differ significantly with regards to meal length or mean caloric intake, although the food consumed by patients was of a significantly lower energy density than that consumed by controls, and patients ate fewer calories per minute than controls.

Among patients with AN, greater frequencies of dissecting, inappropriate utensil use, nibbling, staring at food in the absence of eating, and tearing food were related to decreased caloric intake, when controlling for meal length. Additionally, the longer patients delayed the initiation of eating at the start of the meal (eating latency), the less they ate over the course of the meal. Greater frequency of staring at food and initial delay in eating were also both related to eating foods of a lower energy density during the meal. These results are similar to those of Sunday and Halmi (Sunday & Halmi, 1996), who found that slower eating marked by many bouts of pausing for at least 30 consecutive seconds was associated with lower caloric intake during a multi-item breakfast meal among a subsample of patients with AN-restricting subtype. The importance of eating behavior in maintaining weight gained during inpatient treatment points to the identification of specific meal-time behaviors that may be associated with intake and energy density during treatment. The present findings suggest that several meal-time behaviors are associated with decreased intake and energy density and therefore are worthy of further exploration as behavioral treatment targets. Of note, in the absence of evidence that many of our notable effects differ statistically, there is a need to replicate this research with a larger sample where statistical significance can be more thoroughly examined.

While the current study was not designed to address *how* particular meal-time behaviors result in decreased caloric intake and lower dietary energy density, the relationships between mealtime behaviors and intake seen here suggest two categories: 1) avoidance strategies (staring at food, eating latency), and 2) ritual behaviors (inappropriate utensil use, dissecting, tearing, and nibbling food). Based in these findings, we can make several hypotheses. Avoidance strategies, such as staring at food, may serve to reduce dietary intake simply because they reduce the amount of time an individual is eating. Ritualistic behaviors,

such as tearing and nibbling foods, may slow down the process of eating and result in smaller individual bites of food, resulting in decreased intake. Of note, ritual behaviors, but not avoidance strategies, were associated with heightened anxiety during the meal. This information may help to refine interventions for individuals with AN (Steinglass et al., 2011).

There were notable differences in the way that mealtime behaviors related to different components of anxiety. *Pre*-meal anxiety was not associated with the presence of mealtime behavior; however, anxiety ratings obtained *during* the meal were associated with tearing food, nibbling and picking, and inappropriate utensil use. These findings may be related to the instructions given to participants for this meal. Participants were able to decide how much of the meal to eat and the length of the meal. Therefore, participants reporting intense pre-meal anxiety had the option of responding to this anxiety by eating very little and ending the meal very quickly, thus evincing few mealtime behaviors. In fact, in the current sample of patients with AN, pre-meal anxiety was negatively associated with caloric intake ($r = -.437$, $p = .012$), in concordance with other research (Steinglass et al., 2010). Anxiety ratings *during* the meal were associated with mealtime behaviors. In OCD, rituals are enacted as ineffective attempts to reduce anxiety, and it is possible that these mealtime behaviors may function as similar attempts to reduce anxiety during the meal. Similarly, YBC-EDS, which is a baseline measure indicating the presence of ritualistic eating disordered behaviors, was also associated with tearing, nibbling and picking, and inappropriate utensil use. Interestingly, frequency of both hand fidgeting and napkin use (behaviors that were more frequent among HC) were associated with lower levels of anxiety during the meal.

In this study design, participants could end the meal at their discretion. Therefore the relationship between mealtime behaviors and anxiety is difficult to parse, as low anxiety could potentially be related to the knowledge that one could end the meal at any time, or to a genuine lack of fear of eating. To better understand these relationships between anxiety and mealtime behaviors, future studies should include a meal of fixed length and a prescribed caloric amount.

Additionally, we cannot determine whether the associations found between mealtime behaviors, intake, energy density, and anxiety, may be dependent upon the particular meal available to participants. As described above, this meal was comprised of a turkey sub sandwich, potato chips, mayonnaise, and water, and therefore several aberrant behaviors that have been observed clinically (e.g., odd mixtures and combinations of foods, blotting, etc.) were not likely to occur during this type of homogenous meal. As such, to determine whether different eating behaviors emerge and show different associations with intake, future studies should include a standardized multi-item buffet meal offering a wider range of foods.

Hypotheses generated regarding the functions of these behaviors deserve further exploration and these findings point to the importance of considering these behaviors as targets for behaviorally-based treatment. There would also be value in conducting longitudinal studies to explore potential relationships between these mealtime behaviors, treatment outcome, and

prognosis, and in identifying whether individual patient differences may contribute to the presence and persistence of abnormal eating behaviors.

The results of this study support the clinical observation that the eating behavior of patients with anorexia nervosa differs from healthy peers. Furthermore, these aberrant mealtime behaviors are associated with the decreased caloric intake and dietary energy density that is a salient problem for individuals with anorexia nervosa and merit exploration as targets for treatment.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgements

The authors thank Ann Marie Albano, Ph.D. for her contributions to this project. Funding for this study was provided by NIMH grants R01MH08273602 (Steinglass) and T32-MH096679-01A1 (Attia/Gianini).

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**Table 1**

Demographic variables of patients with AN and healthy controls.

| | Healthy Controls (*n*=10) | Patients with AN (*n*=26) | *ρ* | *p* value |
|---|---|---|---|---|
| Age (years) | 27.6 ±5.2 | 27.8 ±8.3 | 218 | .698[§] |
| BMI (kg/m$^2$) | 20.7 ±1.1 | 19.1 ±0.6 | 321 | <.001[§] |
| YBC-EDS Total Score | 0 ±0 | 18.2 ±6.4 | 55 | <.001[§] |
| Pre-Meal STAI-S | 22.3 ±3.8 | 54.5 ±13.5 | 60 | <.001[§] |
| Mean SUDS | 0.34 ±.67 | 5.14 ±2.54 | 60 | <.001[§] |
| | | | *t* | |
| Length of Meal (min) | 13.2 ±4.3 | 15.6 ±5.8 | 1.19 | .242 |
| Intake (kcal) | 553.0 ±146.4 | 420.5 ±279.6 | −1.18 | .246 |
| Rate of Eating (kcal/min) | 44.0 ±11.6 | 26.6 ±17.5 | −2.91 | .006 |
| DEDS (kcal/g) | 1.2 ±.2 | 0.9 ±.4 | −2.04 | .048 |

**Note.**BMI= Body Mass Index; DEDS= Dietary Energy Density Score; STAI-S= State Trait Anxiety Inventory, State version; SUDS= Subject Units of Distress; W= Wilcoxon Statistic; YBC-EDS= Yale Brown Cornell- Eating Disorder Severity Scale.

[§]*p* value from Wilcoxon test for variables that did not pass Shapiro-Wilk test for normality

*Eat Behav*. Author manuscript; available in PMC 2016 December 01.

**Table 2**

Frequency and duration of mealtime behaviors in patients with AN and healthy controls.

| | Healthy Controls (*n*=10) | Patients with AN (*n*=26) | Standardized difference[€] | *p* value |
|---|---|---|---|---|
| **Behavior Latency (sec)** | | | | |
| Drinking | 120.2 ±118.1 | 172.5 ±356.4 | −.009 | .496[§] |
| Eating | 38.9 ±15.8 | 69.5 ±63.3 | −.295 | .206[§] |
| Nibbling/Picking | 649.3 ±384.2 | 199.4 ±188.7 | .653 | .002[§] |
| **Behavior Frequency** | | | | |
| Arranging/Inspecting | 9.8 ±5.7 | 16.3 ±10.7 | −.167 | .080[§] |
| Body Checking | 0.5 ±1.6 | 0.2 ±.6 | .147 | .974[§] |
| Cutting | 1.2 ±1.1 | 10.5 ±13.3 | −.270 | .031[§] |
| Dissecting | 1.5 ±2.0 | 5.6 ±5.7 | −.307 | .016[§] |
| Drinking | 6.5 ±3.5 | 6.2 ±3.0 | .054 | .764 |
| Eating | 6.9 ±3.3 | 10.0 ±6.3 | −.143 | .170[§] |
| Hand Fidgeting | 18.0 ±16.2 | 9.9 ±8.7 | .371 | .142[§] |
| Inappropriate Utensil Use | 0 ±0 | 15.2 ±20.5 | −.295 | .003[§] |
| Napkin Use | 8.9 ±7.1 | 5.6 ±5.7 | .306 | .164[§] |
| Nibbling/Picking | 1.4 ±1.9 | 24.0 ±25.4 | −.328 | <.001[§] |
| Staring at Food | 0.1 ±.3 | 1.4 ±2.3 | −.370 | .084[§] |
| Tearing | 1.6 ±1.6 | 16.3 ±18.1 | −.335 | .266[§] |
| **Behavior Duration (sec)** | | | | |
| Arranging/Inspecting | 67.5 ±40.0 | 160.2 ±138.0 | −.236 | .050[§] |
| Body Checking | 0.9 ±2.8 | 2.0 ±9.7 | −.088 | .949[§] |
| Cutting | 4.7 ±3.4 | 29.3 ±36.1 | −.274 | .009[§] |

| | Healthy Controls (*n*=10) | Patients with AN (*n*=26) | Standardized difference€ | *p* value |
|---|---|---|---|---|
| Drinking | 28.5 ±15.7 | 25.4 ±16.6 | .075 | .507§ |
| Eating | 673.1 ±237.2 | 737.2 ±357.0 | .107 | .025 |
| Napkin Use | 87.4 ±131.6 | 46.1 ±102.1 | .195 | .257§ |
| Staring at Food | 4.4 ±13.8 | 15.8 ±37.6 | −.227 | .156§ |

**Note.**

§ *p* value from Wilcoxon test for variables that did not pass Shapiro-Wilk test for normality

€ Standardized difference (measure of effect size) between patients and healthy controls adjusted for meal length

**Table 3**

Relationships between Intake, DEDS, YBC-Total, STAI-S, Mean SUDS, and mealtime behaviors among patients with AN, controlling for meal length.

| | Intake (kcal) | DEDS (kcal/g) | YBC-Total | STAI-S | Mean SUDS |
|---|---|---|---|---|---|
| | SC [95% CI] | SC [95% CI] | SC [95% CI] | SC [95% CI] | SC [95% CI] |
| **Behavior Latency (sec)** | | | | | |
| Eating | **−.340[−.69,.01]** | **−.413 [−.77,−.05]** | .050 [−.36,.46] | .167 [−.27,.59] | .253 [−.14,.65] |
| Nibbling/Picking | −.134[−.50,.23] | −.133[−.52,.25] | .311 [−.07,.69] | .161 [−.26,.58] | .118 [−.27,.51] |
| **Behavior Frequency** | | | | | |
| Dissecting | **−.317 [−.67,.03]** | −.172 [−.56,.22] | −.101 [−.51,.30] | .015 [−.41,.44] | −.133 [−.53,.27] |
| Hand Fidgeting | .218 [−.17,.60] | .057 [−.36,.47] | **−.388 [−.79,.01]** | −.261 [−.70,.18] | **−.414 [−.81,.02]** |
| Inappropriate Utensil Use | **−.331 [−.71,.04]** | −.210 [−.62,.20] | **.473 [.09,.85]** | .266 [−.18,.70] | **.417 [.02,.81]** |
| Napkin Use | .086 [−.31,.48] | .068 [−.35,.48] | −.198 [−.62,.22] | −.221 [−.66,.23] | **−.354 [−.75,.04]** |
| Nibbling/Picking | **−.527 [−.93,−.13]** | −.180 [−.66,.30] | **.574 [.14,1.00]** | .400 [−.11,.89] | **.468 [.02,.92]** |
| Staring at Food | **−.404 [−.78,−.03]** | **−.436 [.83,−.04]** | .145 [−.29,.59] | .225 [−.24,.68] | .216 [−.22,.65] |
| Tearing | **−.332 [−.70,.03]** | −.123 [−.53,.29] | **.491 [.12,.86]** | .328 [−.11,.75] | **.477 [.11,.85]** |

**Note.** Bold type indicates values considered strong associations with an absolute value of partial correlation ≥ 0.3. CI= Confidence Interval; DEDS= Dietary Energy Density Score; STAI-S= State Trait Anxiety Inventory, State version; SC= Standardized Coefficient; SUDS= Subject Units of Distress; YBC-EDS= Yale Brown Cornell- Eating Disorder Severity Scale.