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# Longitudinal Development of Portion Size Estimation in Patients With Anorexia Nervosa Receiving Inpatient Treatment—Evidence From Laboratory and Real-Life Data

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## ABSTRACT

**Background:** Food intake is highly aversive for patients with anorexia nervosa (AN), and fear of weight gain is closely linked to altered eating behaviours, including reduced portion sizes. This study investigated how portion size estimation develops longitudinally in patients with AN during inpatient treatment. We hypothesised that patients with AN would overestimate portion sizes compared to healthy controls, with overestimation being most pronounced at treatment onset and decreasing over the course of treatment.

**Methods:** 29 patients with AN were assessed three times during real-life mealtimes in an inpatient setting and in a laboratory-based task: shortly after inpatient admission, in the middle of treatment, and shortly before discharge. 19 healthy control participants were assessed cross-sectionally. The laboratory task was performed twice, asking participants one time to select a portion they would be ready to eat completely and a second time selecting an adequate portion for a hypothetical other person of their age and gender.

**Results:** Patients with AN overestimated portion sizes as compared to control participants at baseline, both in the laboratory and under real-life circumstances. Patients chose larger portions for a hypothetical healthy person. As treatment progressed, patients chose larger portions they would be ready to eat in the laboratory task, while they continued to perceive the real-life lunch portions as large, indicating that they did not adapt to usual portion sizes and continued to overestimate.

**Discussion:** Portion size estimation in patients with AN differed depending on whether the task was implemented under laboratory or real-life conditions, supporting the need for method combinations. A better understanding of mechanisms underlying portion size estimation is needed to advance mealtime support and other treatment approaches for AN.

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**Highlights**

- We investigated how portion size estimation develops longitudinally in patients with anorexia nervosa (AN) during inpatient treatment under real-life conditions and in a laboratory task.
- Patients with AN overestimated portion sizes in both tasks as compared to control participants at baseline.
- As treatment progressed, patients chose larger portions in the laboratory task, but they continued to perceive the real-life lunch portions as large.
- Our findngs can help to advance mealtime support and other nutritional treatment approaches for AN.

## 1 | Introduction

Food intake and mealtimes are often experienced as aversive, extremely stressful, and frightening by patients with anorexia nervosa (AN) (Komarova et al. 2024; Lloyd et al. 2021). Fear of food has been endorsed as their leading 'core fear' by patients with AN, which is putatively closely intertwined with fear of gaining weight as another core psychopathology (Brown and Levinson 2022). Consequently, intensive mealtime anxiety was associated with reduced food and caloric intake in affected patients (Lloyd et al. 2021).

A key objective in the treatment of patients with AN is to increase energy intake to promote and restore body weight (Hilbert et al. 2017). This is critical due to the severe short- and long-term physical risks associated with low body weight, which can lead to life-threatening conditions (Zipfel et al. 2015). Current guidelines recommend a weight gain of up to 1.4 kg per week in adults, and as much as 2 kg per week in adolescents (Hilbert et al. 2017). Energy intake is influenced by two primary factors: portion size (Zlatevska et al. 2014) and the energy density of foods (kcal/g) (Klos et al. 2023). However, due to the fear of weight gain, patients with AN often reduce portion sizes and/or choose foods with lower energy density (Lloyd et al. 2021). In some cases, these behaviours are further exacerbated by compensatory purging mechanisms (Zipfel et al. 2015). Consequently, addressing dietary habits and eating behaviours constitutes a critical component of AN treatment (Hilbert et al. 2017).

Within inpatient programs for eating disorders (ED), meal support interventions play an important role (Ellis et al. 2024). These interventions are usually provided by a trained clinician in a group setting (Ellis et al. 2024) and mostly follow a stepwise approach, which gradually increases flexibility and patient autonomy by starting with closer supervision, passing to unsupervised meals with other patients towards the end of treatment (Komarova et al. 2024). Mealtime support covers both, practical issues, such as setting the table, as well as interpersonal support, which includes education, encouragement, and emotional support of patients around food intake (Ellis et al. 2024).

Nevertheless, the primary goal of planned mealtime supervision for patients with AN is to support the consumption of appropriately portioned meals with normal or increased energy density, as these are predetermined to meet nutritional and therapeutic objectives. However, both research and clinical practice related to portion size face several challenges: First, a portion is typically defined as the amount of food served or consumed by an individual during a meal (Almiron-Roig et al. 2018). Although there are general dietary intake recommendations (World Health Organization 2023), the concept of an 'adequate' portion for a specific individual remains vague. Portion sizes for single meals, meal components, or snacks vary widely, influenced by individual characteristics, environmental conditions, and cultural norms (Almiron-Roig et al. 2018; Papagiannaki and Kerr 2024). For example, in healthy populations, the perception of an adequate portion size has been shown to be influenced by factors such as sex and age, reflecting not only differences in energy requirements, but also variations in hunger levels, pre-meal planning mindset and specific eating patterns, such as restrictive eating (Brunstrom et al. 2008; Duszka et al. 2022; Veit et al. 2020). Interestingly, Body Mass Index (BMI), at least within the normal-weight and overweight ranges, was not consistently associated with portion size estimation (Brunstrom et al. 2008; Dörsam et al. 2020; Duszka et al. 2022). Additionally, environmental factors, such as increased serving sizes in supermarkets and restaurants, may further shape individual portion standards (Almiron-Roig et al. 2018; Papagiannaki and Kerr 2024; Zlatevska et al. 2014).

Given these challenges, it appears unsurprising that limited evidence exists on how patients with AN actually estimate portion size. To date, only a few studies have investigated this question using food pictures, food videos, mixed reality or single real food items (candies) under laboratory conditions (Dörsam et al. 2020; Gutheil et al. 2025; Pasi et al. 2022). The available evidence suggests a tendency among patients with AN to overestimate portion sizes, meaning they are more likely to perceive a given portion as larger compared to control participants (Dörsam et al. 2020; Gutheil et al. 2025; Pasi et al. 2022).

To better understand the mechanisms underlying altered portion size estimations in patients with AN, some studies involved control conditions to rule out that overestimation was due to perceptional difficulties in patients with AN (Dörsam et al. 2020). From a theoretical perspective, portion size estimations can be seen as single component within a more complex multi-step decision-making process. In line with this, recent accounts to AN disease models suggest that aberrant food valuation might play a central role in maladaptive food choices and restrictive eating (Lloyd et al. 2024). Complementing this perspective, another view emphasises the role of excessive cognitive control in AN, putatively overriding food-related reward signals and motivational behaviour, thereby influencing portion size selection (Schmidt et al. 2025). This aligns with previous findings demonstrating the powerful role of cognition on portion size selection in healthy participants (Hege et al. 2018; Veit et al. 2020).

Notably, none of the previous studies in AN included actual food ingestion, meaning that portion ratings remained theoretical. Two studies used an additional 'intent-to-eat instruction' in which patients with AN were asked to imagine they would later eat the presented portion (Milos et al. 2013; Pasi et al. 2022), and this resulted in increased overestimation in one of these studies



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(Milos et al. 2013), but not in the other (Pasi et al. 2022). Moreover, the cross-sectional design of existing studies prevents conclusions about potential changes in portion size estimation over the course of treatment in AN.

The present study aimed at investigating how portion size estimation develops longitudinally in patients with AN during inpatient treatment. To enhance ecological validity, we combined two methodological approaches for assessing portion size estimation: a laboratory-based task relying on pictorial stimuli and an assessment during real-life mealtimes. In patients, we assessed portion size estimation three times: shortly after treatment uptake, in the middle of treatment, and shortly before treatment termination, which is also after terminating mealtime supervision. We also assessed cross-sectional data in a healthy control group. In the laboratory task, we additionally asked participants to estimate an adequate portion for a healthy person of their age.

We hypothesised that, consistent with previous findings, patients with AN would overestimate portion sizes as compared to control participants. We expected to observe this overestimation in both the laboratory task and the real-life condition. However, we expected the patients to choose larger portions for a hypothetical healthy person. Related to longitudinal changes, we expected that portion size overestimation would be most pronounced at the beginning of treatment and would decrease as treatment progressed, for both methodological approaches.

## 2 | Methods

### 2.1 | Study Design and Participants

We report data from a longitudinal study with three measurement periods for patients with AN. Patients were assessed shortly after inpatient admission, in the middle of treatment and shortly before discharge. A group of healthy control participants was assessed cross-sectionally.

Adult patients with AN were consecutively invited for study participation at admission to inpatient treatment at the University Hospital Tübingen. In order to be enrolled, they had to fulfill a diagnosis of a full-syndrome or atypical AN according to ICD-10 (World Health Organization 2004).

A convenience sample of healthy female control participants was recruited from the general population via e-mail and social media announcements, flyers, and posters. Exclusion criteria comprised an active or past ED, which was screened based on the Eating Disorder Examination Questionnaire (EDE-Q) (Hilbert et al. 2016), a severe somatic or mental disease, and professional nutritional knowledge.

### 2.2 | Self-Report Measures

#### *2.2.1 | Eating Disorder Examination-Questionnaire (EDE-Q)*

The German Version of the Eating Disorder Examination-Questionnaire (EDE-Q) was used to assess ED symptom severity (Hilbert et al. 2016). The EDE-Q comprises four subscales (*Restraint, Eating Concern, Weight Concern and Shape Concern*) which assess ED psychopathology in the last 28 days on 7-point Likert-scales. Higher scores indicate higher symptom burden. There are additional diagnostic items.

#### *2.2.2 | Patient Health Questionnaire-(PHQ-D)*

The German version of the Patient Health Questionnaire (PHQ-D) was used to assess severity of symptoms of depression and anxiety (Löwe et al. 2001). The items of the PHQ-D are rated on a 4-point Likert-scale, with higher scores indicating higher symptom burden.

Hunger and appetite were assessed using a 100 mm Visual Analogue Scale (VAS), asking about how much hunger/appetite the person currently feels (0 = not at all; 100 = very much).

### 2.3 | Portion Size Estimation

Under the laboratory condition, we utilised a computerised standardized portion size task that had been previously established and employed in healthy populations with different body weight (Hege et al. 2018; Veit et al. 2020). This task includes standardized stimulus material from a database (Brunstrom and Rogers 2009) depicting ten meals (and not the food served at lunch in the real-life assessment). For each meal, ten pictures depict different portion sizes ranging from 100 kcal going in 100 kcal-steps to 1000 kcal. In order to avoid anchor effects, some trials started with the smallest portion, some with the largest, and some with the medium portion size. Participants could click through the portions of each meal in each direction as long as needed.

The laboratory portion size estimation was performed twice, for two scenarios that were randomized in order. In scenario one, patients were asked to select the portion of each meal that they would be ready to eat completely as a main course during a meal. In scenario two, patients were asked to select the portion of each meal that they would consider adequate for a hypothetical other person of their age and sex as a main course.

In the real-life assessment, portion size estimation was embedded around lunchtime, either as part of mealtime supervision, or for patients in later treatment stages, as part of lunch with other patients at the ward. Healthy controls completed the real-life assessment in the same hospital dining environment and at the same mealtime as the patient group and received the same lunch meals; assessments were conducted after the patients had finished their meals and left the dining area. Meals were embedded within the routine inpatient treatment programme and followed standardized ward procedures regarding meal schedules, meal routines, and therapeutic support. However, meal plans could differ at treatment entry depending on individual clinical requirements and illness severity. Participants evaluated the main entrée only; desserts were not included in the rating in order to maximise comparability with the laboratory task, which likewise focused exclusively on main meal portions. Across the repeating hospital menu cycle, main entrées had a mean portion size of 465 ± 58 g and provided 518 ± 113 kcal, with a mean macronutrient composition of 18 ± 10 g fat, 62 ± 19 g carbohydrates, and 25 ± 8 g protein. Desserts were standardized and contributed approximately 130–220 kcal, with lower-energy desserts paired with more energy-dense main entrées and vice



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versa. Consequently, total lunch meals typically provided approximately 600–750 kcal. Meal composition followed standard nutritional treatment guidelines and was designed to provide a balanced macronutrient distribution and adequate protein intake. Representative examples of lunch meals, including approximate energy and macronutrient content, are provided in Table S1. After lunch, patients estimated the size of their meal portion using a 100 mm VAS, anchored by 'very small' and 'very large'. A marker at 50 mm indicates a normal portion size, with values below this threshold indicating the estimation of a smaller portion and values above indicating the estimation of a larger portion. Portion size estimation was not conducted before the meal to avoid adding extra stress to the patient's eating experience. Portion size estimation was assessed over 3 days during the specified measurement periods, with at least three assessments required for calculation of the mean value. The mean value across assessments was calculated for subsequent analysis to reduce the influence of day-to-day variation.

### 2.4 | Procedures

Patients with AN were invited to take part in the study at admission to inpatient treatment. Self-report measures are part of the diagnostic assessment of inpatient treatment and were filled in upon admission and upon treatment termination. Body Mass Index (BMI) of patients is based on objectively measured height and regular weighing at the ward within treatment procedures. Real-life portion size estimation was implemented within mealtime support and nutritional therapy and was therefore assessed several times weekly. For the present data analysis, data from three assessment points were taken as the arithmetic mean of measurements of the single week. Data is reported for the time shortly after admission and before discharge, as well as a measurement point after leaving supervised mealtime support, which is mostly towards the middle of the stay, but can also be later depending on individual treatment course. Importantly, these assessment points represented clinically meaningful treatment stages rather than fixed calendar time points. Consequently, not all patients contributed data to every stage, as progression through treatment stages depended on individual clinical course and treatment requirements. The laboratory portion size estimation took place right after lunch at three measurement points. Hunger and appetite were assessed before performing the task; these factors were reassessed after task termination. Participants were additionally asked for their subjective priorities during portion size estimation, choosing between getting full, eating healthy, and enjoying the meal.

### 2.5 | Ethics

This study was approved by the ethics committee of the Medical Faculty at the University Tübingen (083/2020BO). All study participants provided written informed consent.

### 2.6 | Statistical Analysis

We used independent *t*-tests to investigate group differences in continuous variables considering participant characteristics at baseline (T0). Repeated measure analysis of variance was used to investigate longitudinal changes in continuous data in the patient sample (e.g., in BMI or portion size estimation). As the laboratory task had two conditions with portion size estimation for oneself and a hypothetical other person, we used a two-way analysis of variance to analyse group differences at T0. We calculated Pearson correlations to investigate putative relationships between two continuous variables.

Beyond hypothesis testing, we performed exploratory correlational analyses on putative associations between real-life and laboratory portion size estimation on the one hand and clinical variables such as BMI and eating disorder pathology on the other hand at various time points.

Significance level was set at $\alpha = 0.05$. Statistical analyses were performed using SPSS version 28.0 by IBM.

## 3 | Results

### 3.1 | Participants

We report data from patients who provided complete assessments for at least one approach, that is, either laboratory or real-life data. For 75% of the sample, we have complete data points for both laboratory and real-life data. Based on this, the study sample consists of 29 patients ($n = 2$ males) with AN and 19 healthy control participants. Three of the patients had the diagnosis of an atypical AN. The average inpatient stay was 9.2 ± 3.1 weeks.

Table 1 provides an overview on basic demographic and clinical data of the study sample. AN and HC participants were comparable in age ($p > 0.05$), however, AN patients had a significantly lower BMI ($p < 0.001$) and scored significantly higher in terms of eating disorder pathology ($p < 0.001$). The patients significantly increased their BMI throughout inpatient treatment, with an average weight gain of 1.6 BMI points and a BMI of 17.4 ± 2.2 kg/m$^2$ at discharge ($n = 27$; F (1,26) = 47.995; $p < 0.001$).

**TABLE 1** | Demographic and clinical characteristics of the study sample.

| | HC | AN |
|---|---|---|
| *N* | 19 | 29 |
| Age (yrs) | 27.0 ± 3.2 | 30.9 ± 13.7 |
| BMI (kg/m$^2$)[a] | 21.6 ± 1.5 | 15.7 ± 2.6 |
| EDE-Q restraint[a] | 1.5 ± 1.3[b] | 3.3 ± 2.1 |
| EDE-Q eating concern[a] | 0.2 ± 0.2 | 3.1 ± 1.8 |
| EDE-Q weight concern[a] | 1.0 ± 0.6 | 3.6 ± 1.6 |
| EDE-Q shape concern[a] | 1.3 ± 0.8 | 4.0 ± 1.5 |
| EDE-Q total score[a] | 1.0 ± 0.6 | 3.5 ± 1.6 |
| Hunger (mm on a 100 mm VAS) | 7.8 ± 16.2 | 14.6 ± 23.4 |
| Appetite (mm on a 100 mm VAS) | 12.8 ± 21.2 | 15.8 ± 23.6 |

*Note:* Data is reported as mean ± standard deviation.
Abbreviations: AN = patients with anorexia nervosa; BMI = Body Mass Index; EDE = Eating Disorder Examination-Questionnaire; EDE-Q = Eating Disorder Examination Questionnaire; HC = healthy control participants; PHQ = Patient Health Questionnaire; T0 = baseline/at inpatient admission for AN patients; T1 = around the middle of the inpatient stay; T2 = at discharge.
[a]Variable differs between groups at T0.
[b]EDE-Q data available for $n = 18$ HC and $n = 26$ AN participants.



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### 3.2 | Portion Size Estimation

In the real-life setting, there was a significant group effect at T0 with patients with AN endorsing the lunch portion as significantly larger as compared to healthy controls ($t$ (46) = −2170; $p = 0.035$). There was no time effect in portion size estimation in the patient group across the three assessment points ($F$ (2,20) = 1415; $p > 0.05$), indicating that portion size estimation in the real-life setting did not change longitudinally. As Figure 1 depicts, portion size estimation rather increases descriptively towards the end of treatment.

In the laboratory setting, there was a significant interaction effect at T0, indicating that patients with AN endorsed the lunch portion as significantly larger as compared to healthy controls, but only if they applied this to themselves ($F$ (1,48) = 19,471; $p < 0.001$), while there was no group difference in portion size estimation for a hypothetical other person ($p > 0.05$). There was a significant time effect in portion size estimation in the patient group across the three assessment points for estimating the portion size for themselves ($F$ (2,24) = 18,86; $p < 0.001$), indicating that patients tended to choose larger portions at T1 and T2. However, the portion size estimation for a hypothetical other person remained longitudinally stable ($p > 0.05$). Figure 2 displays main findings of the laboratory task.

The survey after completing the laboratory task revealed that at baseline, subjective priorities when choosing the portion size majorly differed between patients with AN and healthy control participants: While getting full was the top priority for healthy participants when choosing a portion for themeslves (endorsed by 94,7%) and another person (100%) and by patients with AN when choosing for another person (96.6%), this was much less of a priority when patients chose for themselves (37,9%). The second priority for both groups was enjoying the meal, and the third was eating healthy, with slightly higher endorsement of this priority by patients with AN.

### 3.3 | Exploratory Analyses

In the laboratory task, healthy controls performed significantly more iterations before choosing a portion size (154.8 ± 89.2 total clicks) as patients (114.6 ± 57.6 total clicks). Patients significantly reduced the total number of iterations through the depicted portions from T0 to T2 ($F$ (2,24) = 4512; $p = 0.016$) and ended with 82.5 ± 38.5 total clicks at T2.

We found nearly no correlations between baseline portion size estimation in the real-life setting and clinical variables, except for a medium size positive association between EDE-Q shape concern and real-life portion size estimation at baseline ($r = 0.399$; $p = 0.04$), indicating that individuals with higher shape concern endorsed the portion as larger. However, at baseline, there were consistent medium size correlations between average kcal of portions chosen by patients in the laboratory task and most EDE-Q outcomes (EDE-Q eating concern: $n = 26$; $r = -0.648$; $p < 0.001$; EDE-Q weight concern: $n = 26$; $r = -0.521$; $p = 0.006$; EDE-Q shape concern: $n = 26$; $r = -0.548$; $p = 0.004$; EDE-Q sum score: $n = 26$; $r = -0.598$; $p = 0.001$) as well as a medium size correlation with BMI at admission ($r = 0.507$; $p = < 0.001$). Overall, this indicates that patients reporting more severe ED pathology consistently chose smaller portions at baseline. Portion size estimation at baseline was not associated with weight gain at discharge.

## 4 | Discussion

The present study investigated portion size estimation in inpatients with AN during real-life mealtimes and in a laboratory-based task at three time periods during treatment and compared

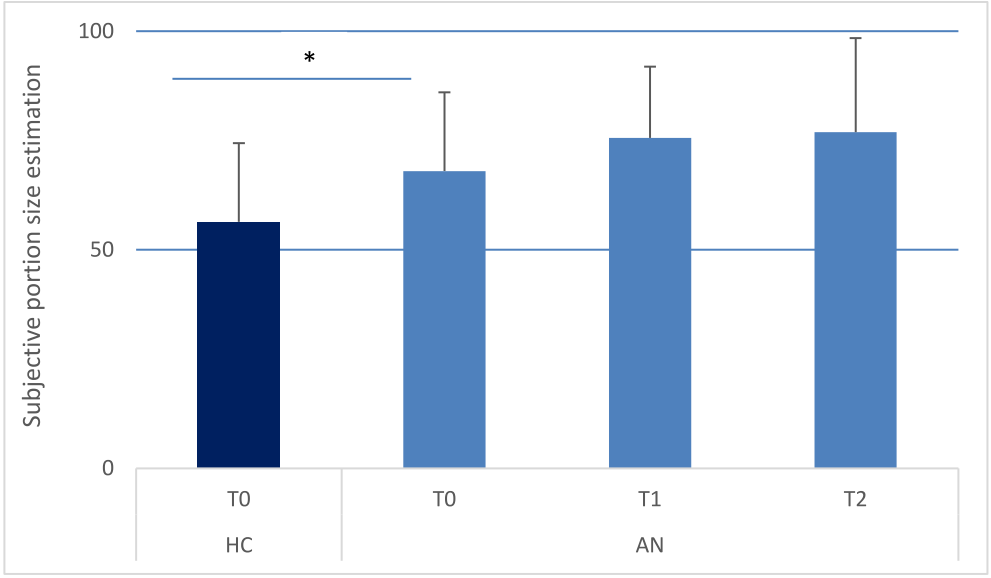



**FIGURE 1** | Portion size estimation in the real-life setting in patients with AN as compared to the control group (HC) $M \pm SD$. T0 = baseline/at inpatient admission for AN patients; T1 = around the middle of the inpatient stay; T2 = at discharge. Longitudinal data was available for $n = 20$ patients. Y-achsis values represent a 100 mm VAS, anchored by 'very small' (0) and 'very large' (100) while a marker at 50 mm indicates a normal portion size. Values < 50 indicate the estimation of a smaller portion and values < 50 mm indicate the estimation of a larger portion. *$p < 0.05$.



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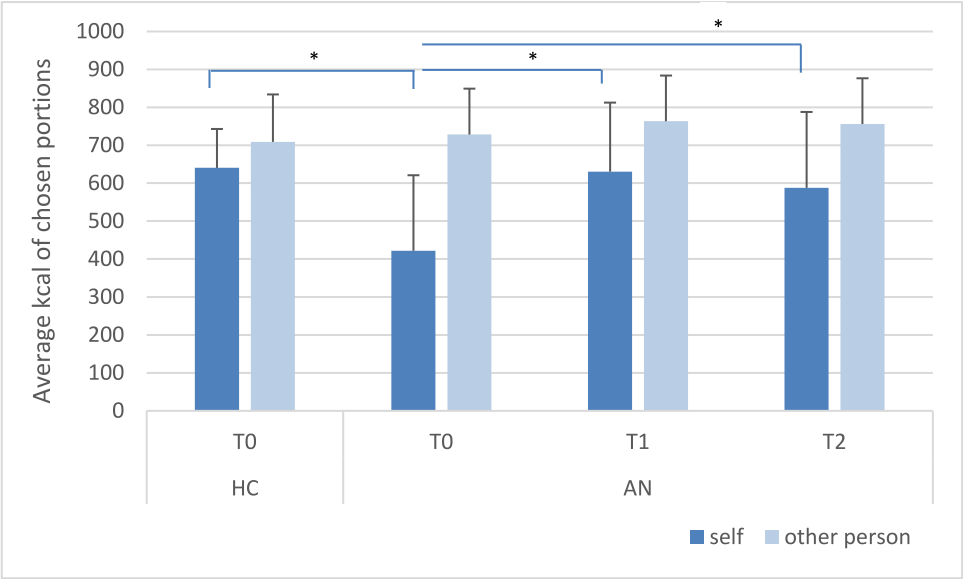



**FIGURE 2** | Portion size estimation in the laboratory task in patients with AN as compared tot he control group (HC) $M \pm$ SD. T0 = baseline/at inpatient admission for AN patients; T1 = around the middle of the inpatient stay; T2 = at discharge. Longitudinal data was available for $n = 24$ patients. *$p < 0.05$.

it to data from a healthy control group. We were able to replicate previous findings showing an overestimation of portion size in patients with AN as compared to control participants at baseline, which is shortly after inpatient admission. Overestimation occurred both in the laboratory and under real-life circumstances. We were also able to confirm our hypothesis that patients will choose larger portions for a hypothetical healthy person. However, we were only partly able to confirm our third hypothesis: As treatment progressed, patients chose larger portions they would be ready to eat in the laboratory task, while ratings in the real-life assessment remained largely stable over time. This may indicate that adaptation to usual portion sizes develops more slowly in real-life eating situations, although this interpretation should be considered in light of the lower degree of standardisation of the real-life assessment.

First of all, findings of the laboratory task show that portion size estimation in AN patients diverges depending on whether the portion is chosen for oneself or a hypothetical other person, which supports the view that patients with AN generally have preserved knowledge of socially normative portioning. This makes it less likely that endorsing small food amounts for themselves in patients with AN is primarily attributable to a lack of knowledge or distorted perceptions (Dörsam et al. 2020; Pasi et al. 2022). Self-report data from the laboratory task suggests that patients with AN primarily differ from healthy participants in their priorities when choosing a portion, predominantly neglecting homoeostatic criteria ('getting full'), and this might be in line with recent accounts on aberrant food valuation, maladaptive food choices and restrictive eating in anorexia nervosa (Lloyd et al. 2024; Schmidt et al. 2025). Exploratory analyses of task performance also indicate that patients needed fewer iterations to choose a portion which could be understood as putative differences to healthy individuals in how portion size decisions are approached (e.g., degree of exploration vs. early commitment).

Laboratory portion size estimation was closely related to ED symptom burden in patients. Overall, patients reporting higher ED symptom burden chose smaller portions at baseline, indicating that portion size estimation might indeed be closely tied to the core pathology of AN (Brown and Levinson 2022) and that it might be a simple indicator of illness severity at the beginning of treatment. However, importantly, baseline portion size estimation was not associated with weight gain during inpatient care, indicating that it is not a predictor for overall treatment outcome, which also reflects that AN is a complex, multi-faceted disorder (Schmidt et al. 2025; Zipfel et al. 2015).

A key finding is the dissociation between the changes in portion size estimation under laboratory versus under real-life circumstances in patients with AN. While in the real-life setting, patients consistently endorsed the portion as large over time, portion size estimation in the laboratory task was 'recalibrated' towards the end of treatment, with patients choosing larger portions as compared to baseline. This dissociation might have different reasons: While the laboratory task poses a hypothetical question about which portion a person chooses, without requiring to eat this amount, the real-life situation includes real ingestion of the food, which is closely tied to the ED core pathology of the patients. Hence, both tasks might capture different facets of portion size estimation and choice. While the 'hypothetical' laboratory task likely stronger reflects changes in cognitive appraisal and decision-making about food portions, the real-life task involves eating the food and may therefore be more sensitive to ongoing anxiety, aversive bodily responses, and fear of weight gain.

Our sample description shows that the patient group investigated is representative of severely ill adult patients receiving inpatient treatment due to very low BMI, with often long-standing and persistent symptoms. Hence, mealtime situations might still be associated with anxiety (Lloyd et al. 2021) in the



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patient group, even towards the end of treatment. Therapeutic work around food intake and fear of weight gain are central topics in ED treatment (Hilbert et al. 2017), and initial positive changes in patients might be expressed in the laboratory task, in which most patients endorsed larger portions at the two follow-up measurements. Hence, while treatment-related cognitive changes might be reflected in laboratory outcomes, real-life changes around meal intake might just take longer to unfold, especially in a group of severely ill patients.

### 4.1 | Strengths and Limitations

To the best of our knowledge, this is one of the few studies investigating portion size estimation in patients with AN, which is clinically highly relevant but rarely empirically investigated. By combining two methodological approaches, we enhanced ecological validity and demonstrated that portion size estimation differs depending on whether the task was implemented under laboratory conditions or during real-life food intake. Limitations comprise that, for 25% of the recruited sample, data from both methodological approaches were not available. Moreover, due to practical reasons associated with treatment progress, we were not able to fully harmonise measurement time periods, especially the second measurement point after leaving supervised mealtime support can differ between patients depending on treatment progress. Importantly, these assessment points represented clinically meaningful treatment stages rather than fixed calendar time points. Consequently, not all patients contributed data to every stage, as progression through treatment stages depended on individual clinical course and treatment requirements. In addition, at baseline, some participants received reduced meal portions due to routine treatment procedures, which limits comparability of VAS ratings across time periods. Nevertheless, mealtimes were conducted within a highly structured clinical environment with standardized meal schedules, meal procedures, and therapeutic support. Therefore, variability primarily resulted from routine clinical procedures and individual treatment requirements rather than from uncontrolled assessment conditions. In addition, minor adjustments of caloric prescriptions could occur during the early phase of nutritional rehabilitation and may have contributed to variability in real-life portion size ratings.

Because portion evaluations tend to be anchored to the stimulus presented and do not scale linearly with actual portion size (Tversky and Kahneman 1974), such baseline differences cannot be meaningfully adjusted and are not further reported. Importantly, using the full portion as reference or inverting the ratio would merely shift baseline ratings upward or downward, respectively, without altering the overall pattern of findings—rendering such computations essentially arbitrary. Finally, it is also noteworthy that slightly different facets of portion size estimation have been assessed in both methodological approaches: while the real-life task rather assessed as how large patients have experienced the lunch portion, the laboratory task assessed which hypothetical portion they would have chosen between different options. As the healthy control group was screened using the EDE-Q rather than a diagnostic interview, undetected current or past eating-disorder pathology in the control group cannot be fully excluded.

### 4.2 | Perspectives

Our findings have important methodological and clinical implications, as we have shown that portion size estimation in patients with AN develops differently longitudinally, depending on whether the situation is experimental or 'real-life'. The sole reliance on experimental outcomes assessing portion size estimation could lead to biased conclusions, as behaviour under laboratory conditions does not necessarily translate to the real mealtime situation and eating behaviour. This underlines the need for method combinations and a better understanding of how different approaches add information to a more complex 'bigger' picture. From a clinical point of view, the unchanged portion size endorsement of patients with AN during inpatient treatment calls for attention towards underlying mechanisms, such as fear of food, which again is closely tied to fear of weight gain (Brown and Levinson 2022) and is expressed in various forms of illness behaviour, including during mealtime situations. Recently, different workgroups have adopted frameworks from anxiety treatment, such as exposure approaches to tackle fear of food in AN (Levinson et al. 2025; Natali et al. 2024). As our work has focused on adult patients with AN, it is also necessary to gain more insight into portions size estimation in newly diagnosed and adolescent populations. While a recent pilot study found that also adolescent patients with AN systematically choose smaller portions, it remains unclear how this is changed during treatment and how persistent this preference might be (Gutheil et al. 2025). With a specific focus on meal portions, exposure to different portion sizes in patients with AN might contribute to recalibrating portion size estimation over treatment course. Mixed or virtual reality set-ups might be helpful tools to support this approach as they provide immersive, yet highly controlled stimulus presentation and environments (Behrens et al. 2025; Gutheil et al. 2025). As earlier work in the field has outlined, more empirical evidence about portion size estimation and selection in patients with EDs is urgently needed in order to inform meal support interventions and advance treatment frameworks (Ellis et al. 2024).

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#### Conflicts of Interest

The authors declare no conflicts of interest.

#### Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## Supporting Information

Additional supporting information can be found online in the Supporting Information section.

**Table S1:** Representative examples of lunch meals served during the inpatient assessment.



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