# "I feel full with shame": A qualitative perspective on gastric interoceptive sensibility

L. Stafford,1 A. C. Pike,1 C. E.J. Preston,1.

1 Department of Psychology, University of York, York, United Kingdom, YO10 5DD

Corresponding author: Lucy Stafford, Department of Psychology, University of York, York, United Kingdom, Y010 5DD, lucy.stafford@york.ac.uk

# Abstract

Background: “Am I hungry? Did I overeat at lunch?” Gastric interoception - the sensing, interpretation, and regulation of signals from the gastrointestinal system - is central to daily behavior and homeostasis. Dysfunctional gastric interoception has been proposed as a maintenance factor in both eating disorders and gastrointestinal symptoms. However, no qualitative research has explored how individuals across these groups, and the general population, subjectively experience gastrointestinal signals, known as gastric interoceptive sensibility. This study aimed to investigate how gastric sensations are sensed, interpreted, and regulated among individuals with eating disorders, gastric disorders, and those without such diagnoses, focusing on identifying shared experiences. Methods: Fifteen semi-structured focus groups (n = 96) were conducted. Transcripts underwent hybrid deductive and inductive thematic analysis. Findings: Four key themes were identified. In “Sensations in the Interoceptive Body”, participants described hunger and fullness as physically aversive or reported an absence of cues related to satiation. “Perceiving the Interoceptive Body” captured the noticing, interpreting, attending to, and reacting to sensations of hunger, satiation, and fullness. In “Affective Experiences of the Interoceptive Body”, participants discussed how these sensations influenced emotional states positively, negatively, or not at all. “Responding to the Interoceptive Body” described participants strategies relating to relief-seeking, compensation, acceptance, distraction, and body checking in response to gastric sensations. Discussion: These findings shed light on the nuanced components of gastric interoceptive sensibility and suggest that individuals vary in how they experience and manage gastric signals. This work may inform interoceptive exposure therapies targeting maladaptive interpretations and regulation strategies in eating and gastrointestinal symptoms.

# Introduction

The physiological state of the body is primarily perceived via interoception: *the sensing, interpretation, and regulation of signals from any biological system that maintains homeostasis* [(Chen et al., 2021)](https://paperpile.com/c/wCfYCG/hhrW). Interoception is theorised to be important to our wellbeing because sensing and interpreting bodily sensations motivates (mal)adaptive regulation strategies [(Bonaz et al., 2021)](https://paperpile.com/c/wCfYCG/CdEDo). For instance, reduced sensing of and/or problematic interpretation of thirst can mean we fail to sufficiently hydrate ourselves.

The gastrointestinal system is arguably one of the most important biological systems for maintaining homeostasis; noticing a rumbling stomach and interpreting this as hunger means we can replenish our energy levels for essential functions [(Murciano et al., 1994)](https://paperpile.com/c/wCfYCG/82GSq). This type of eating, guided by internal signals rather than external rules or restrictions, is often referred to as intuitive eating or internally regulated eating [(Palascha et al., 2021; Tylka, 2006)](https://paperpile.com/c/wCfYCG/kTZp%2BxfqC). It has been associated with improved psychological and physical outcomes, including lower disordered eating and positive body image [(Linardon, 2021; Tylka & Kroon Van Diest, 2013)](https://paperpile.com/c/wCfYCG/ZQBx%2B8UvT). However, our understanding of how individuals subjectively sense, interpret, and respond to internal gastric cues, and how this varies across populations, remains limited, as no qualitative investigations have yet explored gastric interoceptive sensibility in line with the current definition of interoception [(Chen et al., 2021)](https://paperpile.com/c/wCfYCG/hhrW). For example, in their focus groups, neither Murray and Vickers [(2009)](https://paperpile.com/c/wCfYCG/HeUbJ/?noauthor=1) nor Duerlund et al., [(2019)](https://paperpile.com/c/wCfYCG/dD58I/?noauthor=1) provided insight on how people may regulate such signals, excluding a key part of the interoceptive framework [(Chen et al., 2021)](https://paperpile.com/c/wCfYCG/hhrW). Duerlund et al., [(2019)](https://paperpile.com/c/wCfYCG/dD58I/?noauthor=1) also did not ask participants about how they experience hunger,instead focusing on *post-ingestive* experiences. Thislimits our understanding of how it is sensed, interpreted, and regulated. Further, neither study focused on sensations exclusively within the gastrointestinal system, such as the stomach. Both considered how the body felt generally, such as how it could feel shaky when hungry [(M. Murray & Vickers, 2009)](https://paperpile.com/c/wCfYCG/HeUbJ) and energised with typical satiety [(Duerlund et al., 2019)](https://paperpile.com/c/wCfYCG/dD58I). This confounds gastric interoception with domain-(/body-)-general interoception.

Additionally, neither Murray and Vickers [(2009)](https://paperpile.com/c/wCfYCG/HeUbJ/?noauthor=1) nor Duerlund et al., [(2019)](https://paperpile.com/c/wCfYCG/dD58I/?noauthor=1) considered how gastric interoceptive sensibility may be experienced in clinical populations in which gastric interoception has been implicated, like those with eating disorders (EDs) [(Forney et al., 2023)](https://paperpile.com/c/wCfYCG/X0OlC) or gastric disorders (GDs) [(Fournier et al., 2020)](https://paperpile.com/c/wCfYCG/ZKuD). For example, symptoms of irritable bowel syndrome are believed to be triggered by problematic interpretation of gastric sensations [(Tillisch et al., 2011)](https://paperpile.com/c/wCfYCG/hChEf). Suspecting that gastric sensations, even those not immediately threatening (e.g. a rumbling stomach), signal the onset of symptoms is believed to increase anxiety, and in turn perpetuate symptoms via activation of the ‘fight or flight’ autonomic nervous system [(Labus et al., 2007)](https://paperpile.com/c/wCfYCG/WC0x0). Further, in the domain of EDs, practices like restriction and purging have been theorised to relieve aversive interpretations of gastrointestinal sensations (e.g. “Bloating means I am greedy”). This makes disordered eating behaviours highly reinforcing and implicates gastric interoception as a maintenance factor for such behaviours [(Cusack et al., 2022; Schaumberg et al., 2021)](https://paperpile.com/c/wCfYCG/8Dk4Z%2BvGeCr).

Further, there is clinical overlap between EDs and GDs. Eating disorder populations frequently report symptoms such as bloating, nausea, or early satiety [(Sato & Fukudo, 2015)](https://paperpile.com/c/wCfYCG/qgBCt), and may go on to develop gastrointestinal disorders [(Almeida et al., 2024)](https://paperpile.com/c/wCfYCG/IvhQ). Conversely, individuals with gastric disorders often report disordered eating behaviours, including food avoidance and restrictive intake patterns, in attempts to manage or prevent symptoms [(Satherley et al., 2015)](https://paperpile.com/c/wCfYCG/VVyht). These bidirectional links suggest disruptions in gastric interoception may be a shared underlying mechanism across conditions. However, the precise nature of these interoceptive experiences, how individuals feel, interpret, and respond to gastric sensations, may differ between diagnostic groups in clinically relevant ways.

In sum, despite its clinical relevance, gastric interoceptive sensibility remains an under-researched area. This study sought to explore broad themes in gastric interoceptive sensibility that may be common across individuals and to examine whether and how these differences generalise within specific groups, namely those with eating disorders and gastric disorders, where this domain of interoception is particularly pertinent. Understanding both the shared and distinct features of gastric interoceptive sensibility across ED, GD, and non-disordered populations, as considered in the analysis employed in this manuscript, can inform more tailored and transdiagnostic treatment approaches. This includes interoceptive exposure therapies, whereby people are encouraged to tolerate uncomfortable internal signals without catastrophizing or engaging in disordered eating behaviours [(Boswell et al., 2015, 2019)](https://paperpile.com/c/wCfYCG/HgcU0%2BrLXtl). Therefore, our research question was: *What common themes characterize the experiences of gastric interoceptive sensibility among individuals with EDs, GDs, and those with neither condition, and how do the contents of these themes differ across groups?* Further, we aimed to do so using the currently accepted definition of interoception as a guiding principle for the focus groups: *the sensing, interpretation, and regulation of signals from any biological system involved in maintaining bodily homeostasis* [*(Chen et al., 2021)*](https://paperpile.com/c/wCfYCG/hhrW).

#  Methods

The study utilised a focus group methodology and thematic analysis approach and is reported according to SRQR guidelines [(O’Brien et al., 2014)](https://paperpile.com/c/wCfYCG/oS9hu).

# 2.1 Ethical considerations

Ethical approval was obtained from the Department of Psychology Research Ethics Committee at the University of York in April 2023 and November 2023 (ref numbers: 23012 & 202417). However, we did not have approval to collect special health data such as diagnosis, duration of illness, medication, or surgeries due to concerns that this could potentially identify people who took part in the focus groups. The University of York Data Protection team informed us of how to prepare the focus group transcripts for data sharing.

# 2.2 Design

Pre-registered online (focus groups 1-4, 6-9, 11-14 (inclusive); <https://osf.io/ngxjt>) and in-person (<https://osf.io/atywn>; focus groups 5, 10, and 15) focus groups were conducted. In-person focus groups were used to improve the trustworthiness of the online data after some concerns about the use of artificial intelligence (see *3.2 Trustworthiness of online focus group data*). Differences between the online and in-person focus groups are detailed in *2.6 Procedure.*

The focus groups were semi-structured with a topic guide (Supplementary Materials). When designing the topic guide, we considered how gastric sensations may be sensed, interpreted, and regulated to ensure we were considering the current definition of interoception [(Chen et al., 2021)](https://paperpile.com/c/wCfYCG/hhrW). Participants were categorised into a focus group according to population, so that each focus group was made up of exclusively ED, GD *or* ND participants.

# 2.3 Measures

Participants could choose to provide their age, weight, height, highest educational level, ethnic origin, and gender identity. This information was collected to contextualise qualitative findings.

The Gastrointestinal Quality of Life Index (GQLI) [(Eypasch et al., 1995)](https://paperpile.com/c/wCfYCG/S7rA3) and The Eating Disorder Examination Questionnaire-6 (EDEQ-6) [(Fairburn, 2008)](https://paperpile.com/c/wCfYCG/SiQGK) questionnaires were used to gauge GD and ED severity and validate the division into groups of this self-diagnosing sample. Information on these scales can be found in the Supplementary Materials.

# 2.4 Participants

Participants were eligible to take part if they were: aged 18+, located in the UK, fluent in English, identified as having an ED, identified as having a GD, or identified as having no current or historic ED or GD. Self-identifying was defined as having a current diagnosis or thinking you have an ED or GD. We allowed for a self-identifying sample given the substantial waiting times for medical attention and diagnosis in the UK [(Baraitser & Brook, 2021)](https://paperpile.com/c/wCfYCG/0BbCQ) making formal diagnoses difficult to attain. Further, there are systematic biases of who gets a diagnosis for an ED [(Thapliyal et al., 2018)](https://paperpile.com/c/wCfYCG/xGwCZ) or GD [(Sempere et al., 2023)](https://paperpile.com/c/wCfYCG/hIPFP), excluding certain populations from research. Therefore, proof of formal diagnosis was not requested. Exclusion criteria involved having been involuntarily committed to in- or outpatient ED treatment in the last 6 months. This was a protective measure.

The minimum number of focus groups needed to reach ‘meaning’ saturation, whereby the identified themes are judged as being fully understood when no further insight comes from additional data collection, was estimated as 5 [(Hennink et al., 2019)](https://paperpile.com/c/wCfYCG/CjkxP). Therefore, 5 focus groups per population (15 total; 12 online, 3 in-person) were conducted. 3-12 people (mean=6.4) attended each focus group. This range was broad because of discrepancies between the number of participants who confirmed their attendance and then attended. Focus groups with people who identified as having both disorders were not held, as there were insufficient participants who self-reported symptoms of both disorders to fill a focus group.

Participants volunteered to participate in a focus group by completing an online screening expression-of-interest survey on Qualtrics (Provo, UT). Online (May-June 2023, inclusive) and in-person (November-December 2023, inclusive) focus group participants were recruited via social media, UK-based ED and GD charities, university campus posters, and SONA (a participant pool management system for universities).

1022 people accessed the expression-of-interest survey to take part in an *online* focus group (see Figure 1). 489 of these provided an email address to be invited to an online focus group, of whom 78 took part in an *online* focus group. 111 people accessed the expression-of-interest survey to take part in an *in-person* focus group: 44 provided an email address, and 18 took part in an *in-person* focus group. Participants were invited to a focus group via email based on their availability. The expression-of-interest survey data from those who did not attend a focus group are not included in this manuscript. Together, the online and in-person focus groups recruited a total of 96 participants (GD n=35, ED n=37, ND n=24). Of the 96 participants included in a focus group, 74 (GD n=20, ED n=30, ND n=24) provided some demographic details. Table 1 provides a summary of participant’s demographic characteristics. Participants were invited to a focus group via email based on their availability.

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**Figure 1:**

*Summary of sampling procedure*

N= number of participants.

|  |  |  |  |
| --- | --- | --- | --- |
|  | ED n=30 | GD n=20 | ND n=24 |
| Age in years (mean) | 25.88 (SD=6.93; range=18.00-42.00)Undisclosed n=6 | 26.81(SD=7.30; range=20.00-48.00)Undisclosed=4 | 22.75 (SD=4.66; range=18-39)Undisclosed=0 |
| BMI (mean) | 20.96(SD=3.74; range=13.59-29.18Undisclosed n=7 | 24.79(SD=4.96) range=18.60-32.32)Undisclosed n=8 | 22.75 (SD=4.66; range=17.26-38.10)Undisclosed n=4 |
| University undergraduate degree or higher (%)  | 72Undisclosed n=6 | 46Undisclosed n=5 | 20Undisclosed n=4 |
| White ethnic origin (%) | 60Undisclosed n=6 | 46Undisclosed n=5 | 55Undisclosed n=4 |
| Gender identity  | Female n=18Male n=7Undisclosed n=5 | Female n=9Male n=4Non-binary n=2Undisclosed n=5 | Female n=18Male n=1Non-binary n=1Undisclosed n=3 |
| EDE-Q 6 Global score (mean) | 3.08(SD=1.04; range=0.68-4.99Undisclosed n=9 | NA | NA |
| GQLI Global score (mean) | NA | 83.06(SD=17.03, range=53-106Undisclosed n=3 | NA |

**Table 1:**

*Focus group participant demographic characteristics by population*

Undisclosed refers to people who chose not to answer the question, EDE-Q 6 refers to the Eating Disorder Examination Questionnaire version 6, GQLI refers to the Gastrointestinal Quality of Life Index. For brevity and confidentiality purposes we have reported the percentages of respondents categorised within the majority group for ethnicity and education.

# 2.6 Procedure

Participants accessed the expression-of-interest survey via Qualtrics (Provo, UT), completed a bot check reCAPTCHA question, and answered exclusion criteria questions. If they answered no to all exclusion criteria questions, they were asked to provide informed consent. They then created a unique identifier code made up of the last 2 letters of their first name, the last 2 digits of their mobile phone number, the last two letters of the street they live on, and the last two digits of their birth year so their questionnaire responses could be linked to the focus group they attended. They then provided demographic details. Participants then categorised themselves as an ED, GD, both disorders, or ND participant. If ND, they were redirected to the email address collection survey. ED participants answered the EDEQ-6. GD participants answered the GQLI. These participants were then redirected to the email address collection survey.

The email address collection survey, hosted by Qualtrics (Provo, UT), asked participants for an email address so they could be invited to a focus group, and selected dates and times they were available. Then they were given access to the debrief document which detailed the aims of this project and a list of resources if they needed further support.

The procedure for the online focus groups has been published in Stafford et al., [(2024)](https://paperpile.com/c/wCfYCG/50ho9/?noauthor=1) and can be found in the Supplementary Materials. For the in-person focus groups, a moderator collected participants' unique identifier codes so the demographic details of focus group attendees could be considered. A facilitator asked questions from the topic guide (see Supplementary Materials), with deviations and follow-up questions asked when appropriate. We focused on the interoceptive states of hunger, satiation, and fullness as they are associated with sensations in the gastrointestinal system and an example definition of satiation and fullness (in Supplementary Materials) were given to participants to provide clarity on these states. Participants were reimbursed £10 and for any travel. They were also handed a debrief document, and were asked if we still had their consent to share anonymised transcripts on an open data platform. No participants objected.

# 3. Analysis

# 3.1 Expression-of-interest survey data

One-sample t-tests comparing total scores on the Eating Disorder Examination Questionnaire-6 (EDE-Q 6) and Gastrointestinal Quality of Life Index (GQLI) to community norms (those without an ED or GD) were conducted to validate the recruitment of self-diagnosing ED and GD participants. Of the 30 ED participants who provided some demographic details, 9 were excluded from this analysis due to not completing the EDE-Q 6. Of the 20 GD participants who gave some demographic details, 3 were excluded from this analysis for not completing the GQLI. The final total sample size included in the t-test analyses was ED n=21 and GD n=17. Figure 1 summarises the sampling procedure.

# 3.2 Trustworthiness of online focus group data

Due to concerns that people in online focus groups who answered questions using the Zoom chat box feature could be using generative artificial intelligence (Stafford et al., 2024), we analysed the trustworthiness of our online data obtained from said chat boxes. This process can be seen in Supplementary Materials. As a result, 9 people (GD, n=2, ED n=7) of our online participants were excluded from the qualitative data analysis.

# 3.3 Focus group data analysis

Focus group audio recordings were transformed into transcripts using the transcription feature in Microsoft Word and corrected where appropriate. The transcripts were analysed on NVivo using a hybrid inductive and deductive thematic analysis framework (Fereday & Muir-Cochrane, 2006). This framework was used for transparency concerning the predefined codes searched for in the transcripts and true emergent codes. Themes were developed to assess similarities between the three groups, and then group-level differences were examined within the themes. This approach allowed for a cohesive thematic structure and for clinically meaningful distinctions between groups to be highlighted.

Step 1 of the analysis involved the development of a deductive codebook based on previous literature and questionnaire measures. Step 2 involved testing the applicability of the codebook to a test transcript per population with three independent coders. Each coder independently highlighted which parts of the transcripts fit which codes, thus providing evidence that the code was applicable to the test data. The extracts from the transcript under each code were then compared across the coders, with changes to the codebook labels, definitions, and descriptions made as needed. Codes were removed from the codebook if they had not been evidenced in the test transcripts. Removal had to be agreed by all three coders. Changes were made iteratively until all three coders independently approved the coding. The three independent coders agreed to the final version of the codebook. Step 3 was summarising participant responses to the topic guide questions. Step 4 involved deductive coding by searching the transcripts for the codes in the codebook. Step 5 involved inductive coding: the identification of emergent codes that were not included in the codebook. In the sixth and final step, similar codes were identified and collapsed into a theme.

# 4. Findings

# 4.1 Expression-of-interest survey data

To check the validity of using self-identifying ED participants, a one-sample t-test on the EDEQ-6 global score was performed against the community average (1.63) [(Carey et al., 2019)](https://paperpile.com/c/wCfYCG/NV1wV). The data met the requirement of being normally distributed according to the Shapiro–Wilk test (p=0.371). The ED sample reported significantly more eating difficulties (Mean=3.08 , Standard deviation =1.04) than the community average (t(20) = 6.36, p < .001, d = 1.39).

To check the validity of using self-identifying GD participants, a one-sample t-test on the GQLI global score was performed against the community average (125.8) [(Eypasch et al., 1995)](https://paperpile.com/c/wCfYCG/S7rA3). The data met the normal distribution requirement according to the Shapiro–Wilk test (p=0.245). The GD sample reported a significantly lower gastrointestinal quality of life (Mean=83.06 , Standard deviation=17.03) than the community average (t(16) = -10.35, p<.001, d = -2.51 ).

# 4.2 Focus group data

Deductive and inductive thematic analysis revealed 4 superordinate themes *across* ED, GD, and ND participants*.* The following results section is a narrative synthesis of the themes across ED, GD, and ND participants. Evidence for these themes are provided with quotes. The quotes came from a mixture of the online and in-person focus groups, suggesting commonality in responses from the two types of focus groups. See figure 2 for a summary of themes and sub themes.

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**Figure 2:**

*Visualisation of themes*

# 4.2.1 Theme 1

# Sensations in the Interoceptive Body: Aversive Experiences of Hunger and Fullness Amidst the Absence of Satiation Cues

Within theme 1, participants described internal eating cues as physical experiences. While hunger and fullness were typically experienced as overtly uncomfortable, satiation was described as more elusive. This theme captures how participants made sense of these interoceptive signals, highlighting the internal body as both a site of aversion and uncertainty in the regulation of eating.

Across ED, GD, and ND groups, participants described hunger as an unpleasant gastric sensation, often characterised by pain or nausea. For instance, one ND participant shared, *“I'll be really hungry and there will be a physical pain”* (Focus group 15, ND), while a GD participant described it as *“borderline pain… it's like irritation”* (Focus group 4, GD). An ED participant similarly noted, *“I feel a little sick from the hunger”* (Focus group 6, ED). These descriptions suggest that hunger was experienced as an uncomfortable, aversive physical state.

In addition to hunger, some GD and ND participants also described satiation as a source of gastrointestinal discomfort. Satiation was sometimes associated with bloating, even when only small amounts of food were consumed. As one ND participant explained, *“Even if I haven't overeaten, it's just something small that I've eaten, I feel bloated”* (Focus group 12, ND), while another from the GD group shared, *“Even after eating just to satisfaction…I get abdominal bloating”* (Focus group 2, GD). These accounts suggest that interoceptive cues associated with satiation may also be interpreted as unpleasant bodily states, potentially complicating the internal regulation processes involved in meal cessation.

Fullness was also consistently framed as an aversive gastric experience across all participant groups. It was described as *“intense pressure”* (Focus group 10, ED), *“heavy food in my stomach”* (Focus group 11, ND), and *“like a golf ball... it just expands and expands... and it's very uncomfortable”* (Focus group 5, GD). These quotes indicate that fullness was often experienced as physically intrusive or overwhelming.

In contrast to the discomfort associated with hunger, fullness, and, at times, satiation, some participants described satiation as a lack of sensation altogether. For these individuals, satiation was experienced as a neutral gastrointestinal state, defined more by the absence of discomfort than by the presence of a new or emerging sensation. One ND participant characterised satiation as *“a weird feeling of neutrality,”* elaborating that *“there's nothing really going on… there's no more pangs of hunger and there's no uncomfortable feeling”* (Focus group 11, ND). Similarly, an ED participant explained, *“It’s not so much what’s there, but… the absence of the sensations that are related to feeling uncomfortable. It’s more the absence of those that are recognised rather than new ones”* (Focus group 8, ED). A GD participant summarised this, stating, *“Actually, I don’t feel anything”* (Focus group 1, GD).

These accounts suggest that satiation, for many individuals, is recognised not through the emergence of a clear bodily cue, but the absence of an internal signal. This contrasts with the aversive experiences associated with hunger and fullness. Paradoxically, although satiation is positioned in intuitive eating models as a reliable internal signal for meal termination, its ambiguous nature may make it difficult to detect or trust. This discrepancy raises questions about the applicability of appetite-based self-regulation approaches for individuals whose interoceptive experiences are marked by uncertainty or silence.

# 4.2.2 Theme 2

# Perceiving the Interoceptive Body: Noticing, Interpreting, Attending to, and Reacting to Hunger, Satiation, and Fullness

The perception and interpretation of gastrointestinal signals by participants is discussed In theme 2. Whilst for most, hunger and fullness were generally experienced with clarity, satiation was more difficult to discern. This theme explores how participants navigate the complexities of detecting and making sense of these internal cues, revealing variability in the attention afforded to interoceptive cues and the influence of external factors on eating behaviours.

Within the ED, GD, and ND groups, participants reflected on their ability to detect and interpret internal sensations related to hunger, satiation, and fullness. Hunger emerged as the most consistently identified and actionable cue, particularly among GD and ND participants. These individuals described hunger as a clear, stomach-based sensation that directly influenced their eating behaviour. For example, one ND participant explained, “*I normally wake up feeling hungry… stomach rumbles. Gets to about six o’clock at dinner time, I’m hungry”* (Focus group 12, ND), while a GD participant shared, *“Actually my stomach tells me…I’m hungry and that I have to eat now”* (Focus group 3, GD). In contrast, some ED participants reported an inability to detect hunger even during recovery, *“Even in the first year after I started to recover, I just didn't get any hunger signals at all”* (Focus group 10, ED). Across groups, however, difficulties in *interpreting* stomach sensations were also noted. Some participants struggled to correctly identify whether sensations indicated hunger or were attributed to other states, such as anxiety or general discomfort, *“I can mistake anxiety as feeling hungry”* (Focus group 10, ED), *“I don't even consider I could just be hungry”* (Focus group 4, GD), and *“I find it difficult to know when I'm hungry or not”* (Focus group 14, ND). These accounts highlight the challenges of accurately decoding gastrointestinal signals.

Similar patterns were evident in participants’ experiences of satiation. While GD and ND participants generally described being able to recognise satiation, often through subtle shifts in comfort or the absence of hunger, ED participants expressed more ambiguity. A GD participant explained, *“It’s like I’ve eaten just what I needed to eat”* (Focus group 1, GD), and an ND participant characterised it as *“a few steps down from that over-full feeling”* (Focus group 11, ND). In contrast, an ED participant said, *“Satiated, it’s the same thing [as fullness], like I don’t always notice it”* (Focus group 10, ED), suggesting that satiation lacked a clear or distinguishable signal. This difficulty was echoed in the broader challenge ED participants faced in determining when/whether they had eaten enough *“I don't know… I fight with myself a bit”* (Focus group 5, ED). ND and GD participants, however, appeared to associate satiation with positive or manageable sensations: *“Just knowing you don't need to eat anymore, but it's not too uncomfortable”* (Focus group 11, ND), and *“It's nice to know that you've enjoyed a meal and it’s filled you up”* (Focus group 1, GD). These distinctions suggest that while satiation is detectable for some, others may experience it as ambiguous, overlapping with or indistinguishable from fullness.

Fullness was more consistently recognised across all groups but was typically described in aversive terms. ED, GD, and ND participants often portrayed fullness as an overwhelming or contaminating physical state. For example, one ED participant noted, *“...You can really feel the presence [of food] in your body like in the centre of your torso”* (Focus group 10, ED), while a GD participant described it as *“...so incredibly tight… it's quite intense”* (Focus group 4, GD), and an ND participant remarked, *“It's like a really heavy, sort of tight…sensation… just really pressurised”* (Focus group 11, ND). Fullness was also understood in relation to portion size and speed of eating, with some participants stating that rapid consumption contributed to feeling excessively full, *“If I eat my food really quick… by the time it hits you, you're suddenly feeling too full”* (Focus group 8, ED). However, some ND participants reported that their awareness seemed to skip directly to discomfort or nausea, without necessarily connecting it to fullness, *“Instead of experiencing kind of fullness… I tend to just jump straight to nausea”* (Focus group 12, ND).

Participants also described how their attention was directed toward, or away from, interoceptive cues. GD participants reported actively attending to hunger cues, *“I pay attention to cues like hunger”* (Focus group 4, GD). In contrast, ED and ND participants often described a more passive or reactive stance, with hunger triggering food-related thoughts or behaviours, *“When I am hungry I forget about everything. I just want to eat”* (Focus group 7, ED), and *“It’s almost like a kind of one-track mind thing… [food] thoughts, getting a takeaway…”* (Focus group 11, ND). While stomach sensations of satiation were described as allowing individuals to reorient to other tasks or *“carry on”* with their day, *“I can just carry on with my day compared to if I was feeling full”* (Focus group 13, ND), fullness, by contrast, appeared to dominate participants’ attention. This was described as an overpowering experience that interfered with functioning or generated preoccupation with food or bodily discomfort: *“I think I feel just kind of gross… I can't ignore the sensation of being full”* (Focus group 9, ED), *“Whenever I have this sensation [of fullness]... I have to take some time…before I'm able to get on with what I’m doing”* (Focus group 3, GD), and *“I'm not thinking about the food [when satiated] like I would be if I was uncomfortably full”* (Focus group 11, ND).

Despite these attentional responses, participants did not always act on their internal cues. Some ED and ND participants reported delaying or ignoring hunger signals in favour of external structure, such as time of day or completing tasks: *“I usually ignore them because I have a very one-track mind when I'm doing something”* (Focus group 11, ND), and *“I ignore…whatever my stomach is telling me until it's kind of time to eat”* (Focus group 6, ED). In contrast, a GD participant said they usually responded to hunger unless busy, *“Most of the time, I will eat. But if I’m really busy… I will wait”* (Focus group 1, GD). Cues of satiation and fullness were more frequently described as motivating behaviours across groups. Participants indicated that satiation helped them regulate intake before reaching fullness, *“Sometimes I can just eat until I'm not completely full… I definitely can do that”* (Focus group 8, ED), *“I’ve had enough now”* (Focus group 15, GD), and *“I can register when I feel full, before it gets to a point of feeling uncomfortable”* (Focus group 12, ND). Similarly, fullness was described as a decisive cue to stop eating, *“I just cannot eat anymore”* (Focus group 6, ED), *“You just don’t want to stomach anything else”* (Focus group 3, GD), and *“I don’t want to eat again”* (Focus group 15, ND).

These findings indicate that whilst hunger is often experienced as an obvious bodily signal, and fullness as a disruptive state, satiation lacked the same clarity. For many participants, especially those with EDs, satiation was either difficult to detect or conflated with fullness, lacking a distinct or salient bodily cue. This interpretive ambiguity, combined with the tendency to either ignore or override internal signals in favour of external structures, again complicates the assumption that interoceptive cues *alone* can reliably guide eating behaviour.

# 4.2.3 Theme 3

# Affective Experiences of the Interoceptive Body: An Emotional Spectrum across Hunger, Satiation, and Fullness

In theme 3, participants described gastrointestinal sensations as intertwined with emotional experiences. While hunger and satiation were sometimes associated with positive or neutral feelings, fullness was consistently linked to negative emotions such as shame, regret, and guilt. This theme captures how bodily signals are not purely physiological cues but affectively-charged sensations that influence participants’ relationships with their bodies and eating behaviours.

Satiation was linked to feeling satisfied by ND and GD participants, who described feeling *“whole again”* (Focus group 1, GD) or *“content”* (Focus group 12, ND) after eating enough to remove discomfort without reaching fullness. For some ED and ND participants, eating to fullness could also elicit a sense of pride, particularly when reframed as a sign of nourishment or accomplishment, *“Some days it makes me feel quite proud that I've filled my body”* (Focus group 9, ED).

However, these emotional responses were not uniformly positive. Hunger was often experienced as emotionally distressing across ED, ND, and GD groups, sometimes linked to confusion about how to interpret bodily signals or internal conflict between physical needs and mental resistance. As one ED participant recalled, *“I've had panic attacks from literally just the physical sensations of being hungry”* (Focus group 10, ED), while others described hunger as triggering irritability, sadness, or frustration: *“I'm hungry…and I do get quite angry…more easily irritable.”* (Focus group 11, ND), *“Hunger can sometimes bring about feelings of frustration for me.”* (Focus group 4, GD), *“Sad, and teary…sort of like I want to eat this, but like then my brain is telling me, no don't (eat) as well.”* (Focus group 9, ED), and *“I think it makes me feel quite overwhelmed…it's a lot of, okay well do I acknowledge this (hunger)?”* (Focus group 10, ED).

Satiation, too, could provoke negative emotions, particularly when it left participants feeling unfulfilled or physically uncomfortable. Some described bloating as undermining the sense of having eaten “enough,” or reported emotional dissatisfaction when satiation meant eating less than desired, *“I don't feel satisfied, (I’m) not eating as much as I would have loved to”* (Focus group 8, ED). In contrast, some ND and ED participants reported neutral responses to satiation, describing it as emotionally uneventful or balanced, *“It's just kind of a happy medium of just carrying on”* (Focus group 11, ND). Notably, no GD participants described satiation in these terms.

Fullness was most consistently associated with negative emotional responses across all groups. ED, GD, and ND participants described feelings of shame, regret, disgust, or embarrassment in response to fullness sensations or perceived overeating. For example, one ED participant shared, *“I feel full with shame”* (Focus group 8, ED), while another described the aftermath of eating as *“filled with regret”* (Focus group 13, ND). Fullness was often framed not just as a physical sensation but as a trigger for self-critical and distressing emotional reactions.

These accounts highlight how gastrointestinal cues are not solely physiological signals, but also affectively-charged sensations that can shape how people relate to eating and their bodies. While hunger and satiation were occasionally framed in positive or neutral terms, fullness consistently emerged as an emotionally fraught state. This variability complicates assumptions that internal sensations naturally inform adaptive eating, pointing instead to the emotional and cultural meanings and interpretations that can mediate the relationship between bodily signals and eating behaviour.

# 4.2.4 Theme 4

# Responding to the Interoceptive Body: Relief‑Seeking, Compensating, and Acceptance to Cope with Hunger and Fullness

Participants described a variety of strategies used to cope with the physical and emotional impact of gastrointestinal sensations in theme four. These strategies reflected attempts to both alleviate bodily discomfort and regulate the affective responses associated with hunger and fullness. Some participants sought immediate relief through practical means, such as drinking water, resting, or using medication, while others engaged in emotionally driven behaviours, including body-checking, distraction, or compensatory actions like food restriction or exercise. Particularly among individuals with ED experiences, these behaviours were often motivated by feelings of guilt, shame, or a need for control. In contrast, some participants described efforts to tolerate or accept these sensations, signalling more adaptive or neutral responses.

Participants across groups described a range of strategies used to manage or respond to the physical and emotional impact of hunger. One common theme was to search for relief from bodily sensations. ED, GD, and ND participants shared ways they tried to ease the discomfort of hunger, such as drinking water, eating high-volume meals, or relying on safe foods that wouldn’t aggravate gastrointestinal symptoms. For example, one ND participant explained, *“I'll just drink water or something. If I'm not in a situation that's easy enough, I guess, to relieve them (sensations of hunger)”* (Focus group 11, ND), while others mentioned *“bulking”* up the meals, trying to figure out *“what can I have for the highest volume?”* (Focus group 7, ED) or preparing snacks that wouldn’t *“trigger my stomach [symptoms]”* (Focus group 5, GD).

Similar efforts were made to manage the unpleasant aftermath of fullness. Participants across ED, GD, and ND groups described using medication, rest, or movement to soothe the body. *“I feel really bad and then have to take Rennies…that usually sort of helps me feel better,”* one ED participant noted (Focus group 8, ED), while others shared, *“When I just sit down and relax a little bit, I feel better”* (Focus group 2, GD) or *“I just sort of feel like I need to go for a walk”* (Focus group 11, ND).

Alongside these relief-seeking strategies, some ND and ED participants described compensatory behaviours in response to fullness, often driven by guilt or anxiety. These included planning to restrict future intake or engage in physical activity, *“Tomorrow I’ll go on a 10km run…to compensate for what I’ve done”* (Focus group 12, ND), and *“Anytime I get the feeling of being full, I tend to skip meals”* (Focus group 9, ED).

However, others described efforts to accept sensations of fullness without resorting to compensatory actions. Across ED, ND, and GD groups, participants reflected on a shift toward tolerating fullness, sitting with discomfort, and waiting for it to pass, or a sense of hopelessness. One participant explained, *“Now I just kind of sit with it, and try to learn, it is what it is”* (Focus group 14, ND), while others echoed*, “There’s nothing that I can possibly do about it, I just allow it to get by”* (Focus group 8, ED), and *“It’s a matter of just waiting it out”* (Focus group 5, GD).

Participants also described using distraction as a means of coping with fullness, particularly when accompanied by negative emotions or physical pain. This included deliberately shifting attention away from bodily discomfort or guilt, *“It is quite gastrically painful so it's just like trying to distract myself from guilt”* (Focus group 10, ED). Distraction sometimes involved passive strategies like sitting quietly (Focus group 5, GD), while ED participants additionally reported changing into loose-fitting clothes to avoid heightened body awareness, *“I’ll need to change clothes right after I eat…just like really oversized, I just don’t wanna see anything”* (Focus group 10, ED).

Another common strategy was body-checking during moments of hunger or fullness. ND participants reported checking their reflection when hungry and perceiving themselves as *“a lot thinner”* (Focus group 11, ND). GD participants described seeking reassurance that their body had not changed after eating to fullness, *“I look for something to reassure me that I look fine and like myself”* (Focus group 2, GD). ED participants similarly checked their bodies during episodes of fullness, particularly when experiencing emotional distress, *“I'll change my clothes or check my body in the mirror”* (Focus group 10, ED).

These accounts suggest that people often respond to hunger and fullness not only by managing physical discomfort, but also through compensatory behaviours aimed at controlling or making sense of these sensations. For many, especially those with ED experiences, sensations like fullness could provoke shame or distress, leading to actions like body-checking or dietary restriction. Yet, there were also signs of adaptive coping, with some participants choosing to tolerate or accept these feelings rather than react to them.

# 5. Discussion

In this study, we investigated gastric interoceptive sensibility in three different populations: those with eating disorders, gastric disorders, and neither disorder, across both online and in-person focus groups. The four themes discussed above highlight commonalities in which gastric sensations are experienced, attended to, emotionally loaded, and acted upon, along with group-specific differences.

Reduced interoceptive sensing is a consistent feature in ED populations [(Klabunde et al., 2013)](https://paperpile.com/c/wCfYCG/fZveV), and the Competition of Cues Hypothesis [(Pennebaker, 2012)](https://paperpile.com/c/wCfYCG/xs15Y) offers one explanation: namely, that internal signals like hunger are overlooked when attention is dominated by external concerns, such as body image [(Cash & Deagle, 1997)](https://paperpile.com/c/wCfYCG/JPhVN). In comparison, ND participants reported being more attuned to hunger than fullness, possibly because hunger is tied to immediate survival, while fullness signals are more abstract and linked to longer-term consequences like weight gain. Taken together, these patterns underscore how attentional focus, whether inward or outward, might shape the accessibility of gastrointestinal sensations.

Despite well-documented gastrointestinal symptoms among individuals with EDs [(M. J. Cooper et al., 2007; Wiklund et al., 2021)](https://paperpile.com/c/wCfYCG/3H07l%2BRv6wG), participants with EDs in the current study did not describe bloating as part of satiation. One possible explanation is the presence of binge eating tendencies in some individuals, as this has been linked to difficulty experiencing distinct gastric satiety [(Eli, 2015, p. 366; Ortmann et al., 2024)](https://paperpile.com/c/wCfYCG/Hz0gX%2BHBrw/?locator=366,). This may contribute to confusion between the concepts of satiety and fullness, an ambiguity explicitly raised by at least one ED participant. This finding points to altered or disrupted interoceptive processing as a key factor in how bodily sensations are interpreted in EDs.

Nevertheless, participants across all groups, including ED, GD, and ND participants, described difficulty recognising hunger-related sensations, with some misinterpreting these as emotional states. This confusion, particularly evident among ED participants, may reflect the embodied nature of emotional experiences in the gut [(Nummenmaa et al., 2014)](https://paperpile.com/c/wCfYCG/uB1tI) and the role of alexithymia (difficulties describing and identifying one’s own emotions) which is common in EDs and linked to impaired interoception [(Brewer et al., 2016; Westwood et al., 2017)](https://paperpile.com/c/wCfYCG/AsfKZ%2BO8iyP). Despite this, all participants clearly identified extreme fullness, likely because of its intense, localised sensation in contrast to the more diffuse nature of hunger [(M. Murray & Vickers, 2009; Stevenson et al., 2023)](https://paperpile.com/c/wCfYCG/HeUbJ%2BNaXJH). These findings suggest that the recognisability of internal cues may vary based on both intensity and emotional clarity.

The emotional meaning attached to gastrointestinal sensations diverged markedly across groups. Interoceptive appraisal or evaluation , ascribing meaning with respect to the self [(Herbert, 2020; Savage & Garfinkel, 2025)](https://paperpile.com/c/wCfYCG/fYLtm%2BzbdB), was a key determinant of whether sensations like hunger or fullness were experienced as threatening or benign. For ND participants, hunger was sometimes seen as enhancing mood, but for ED and GD participants, it often triggered anxiety. In EDs, this may relate to fears of bingeing or weight gain [(Ralph-Nearman et al., 2024)](https://paperpile.com/c/wCfYCG/PUQyk), while in GDs, anxiety likely stems from concerns about symptom flare-ups [(Di Giorgio et al., 2023)](https://paperpile.com/c/wCfYCG/4mL4n). Interestingly, one ED participant reported pride in feeling full, suggesting possible therapeutic progress and the influence of cognitive-behavioural interventions aimed at emotional reframing [(Waller & Beard, 2024)](https://paperpile.com/c/wCfYCG/T42KQ). These observations highlight how the appraisal of bodily states, not just the states themselves, shapes emotional responses.

Fullness was overwhelmingly associated with guilt across all groups, though this guilt took different forms. For ND and GD participants, guilt was generally situational and not self-directed. In contrast, ED participants described feelings of disgust and worthlessness following fullness, reflecting deep-seated beliefs linking self-worth to eating behaviour [(Bardone‐Cone et al., 2020)](https://paperpile.com/c/wCfYCG/gu1Fe). This pattern mirrors earlier findings where individuals with EDs interpret bodily sensations as moral or personal failings [(M. J. Cooper et al., 2007)](https://paperpile.com/c/wCfYCG/3H07l). However, some ED participants expressed emotional neutrality toward satiation, possibly due to a lack of perceptible interoceptive cues post-eating, which would limit emotional interpretation [(Seth, 2013)](https://paperpile.com/c/wCfYCG/T7t9p). This suggests that both the presence and interpretation of internal cues are critical in determining affective outcomes.

Across all groups, participants described behavioural strategies to relieve hunger or fullness, but the methods varied by context and clinical status. ED participants used strategies such as "volume eating", consuming large amounts of low-calorie food to simulate fullness without increasing calorie intake [(Benton & Young, 2017)](https://paperpile.com/c/wCfYCG/HNYHE). GD participants managed hunger by carrying snacks to avoid symptom exacerbation, a strategy aligned with clinical recommendations for frequent, small meals [(Friedenberg & Parkman, 2006)](https://paperpile.com/c/wCfYCG/SnC3y). After eating, ND participants often exercised, potentially reflecting societal pressure to 'burn off' food [(Churruca et al., 2017)](https://paperpile.com/c/wCfYCG/tvNlV), while GD participants preferred rest, treating fullness more like a symptom requiring recovery [(Quadt et al., 2018)](https://paperpile.com/c/wCfYCG/wJpPc). These coping behaviours illuminate how physiological cues are shaped by both medical and cultural narratives.

Differences in emotional regulation were particularly evident in how participants coped with fullness. GD participants used distraction to manage physical discomfort, while ED participants focused on alleviating guilt and negative self-evaluations. This suggests that the distress experienced in EDs may be less about the bodily sensation itself and more about its emotional interpretation [(M. Cooper et al., 2021; Mensinger et al., 2025; Merwin et al., 2010; Myers & Crowther, 2008)](https://paperpile.com/c/wCfYCG/ZtqRe%2BvyGz4%2BqQRf2%2BqWgS). Body-checking behaviours also revealed distinct motivations: GD participants sought reassurance that their body remained unchanged, whereas ED participants engaged in checking as a reaction to emotional turmoil triggered by fullness. These behaviours reinforce the idea that interoceptive signals are not only physical experiences but also emotionally and cognitively constructed events.

In sum, these findings underscore the central role of interoceptive evaluation in shaping how gastrointestinal sensations are experienced emotionally and behaviourally. While certain patterns, like guilt after fullness, appeared across groups, the meaning attached to these experiences diverged depending on clinical status. These differences point to the importance of therapeutic strategies that target not just bodily awareness but also the emotional interpretations layered onto those sensations.

# 5.1 Implications

The current study may have implications for the way gastric interoceptive sensibility is assessed. Our findings align with the view of Desmendt et al., [(2022)](https://paperpile.com/c/wCfYCG/EkNH4/?noauthor=1), Mehling et al., [(2016)](https://paperpile.com/c/wCfYCG/Bjw2f/?noauthor=1), Todd et al., [(2022)](https://paperpile.com/c/wCfYCG/680DX/?noauthor=1), and Vig et al., [(2022)](https://paperpile.com/c/wCfYCG/ctzcN/?noauthor=1) who suggest there may be multiple facets of interoceptive sensibility, or self reported “experiences and beliefs about (our) interoceptive sensations” [(Suksasilp & Garfinkel, 2022](https://paperpile.com/c/wCfYCG/xh9kf), p. 5). How we physically and emotionally (interoceptive evaluation or appraisal) experience interoceptive signals, our perception of these signals, and how we respond to them could be considered distinct factors within the umbrella of interoceptive sensibility.

Problematic interpretations of gastric interoceptive signals have been identified as a key maintenance factor in ED [(Cusack et al., 2022; Schaumberg et al., 2021; Velkoff et al., 2024)](https://paperpile.com/c/wCfYCG/8Dk4Z%2BvGeCr%2BOA6hw) and irritable bowel syndrome [(Labus et al., 2007)](https://paperpile.com/c/wCfYCG/WC0x0). Interoceptive exposure therapy for gastric sensations has been shown to reduce anxiety around visceral sensations in irritable bowel syndrome [(Craske et al., 2011)](https://paperpile.com/c/wCfYCG/p35Tw) and EDs [(Boswell et al., 2019)](https://paperpile.com/c/wCfYCG/rLXtl). However, current interoceptive exposure therapy focuses on patients being able to simply *tolerate* gastric sensations without engaging in disordered eating behaviours (e.g. purging) or becoming anxious or catastrophizing (and in turn, leading to worsened gastrointestinal symptoms). The current study provides additional insight to suggest that it may be important to teach ED participants to reappraise gastric sensations more positively, rather than just tolerate them. More specifically, changing the negative emotions in relation to themselves brought up by gastric sensations of fullness, like shame, disgust, worthlessness, and worries about their body changing, into feelings of appreciation, like found in the ND participants, could be a specific target for therapy. Similarly, having people with irritable bowel syndrome reappraise gastric sensations to *not* be symptoms of their illness may mean they do not become anxious or catastrophize in the first place and therefore not perpetuate symptoms [(Labus et al., 2007)](https://paperpile.com/c/wCfYCG/WC0x0).

Furthermore, while the current study is primarily situated within the interoception literature, our findings also have relevance for research on intuitive eating and internally regulated eating. These frameworks emphasise responding to internal cues of hunger and ending eating in response to comfortable fullness, rather than relying on external rules or emotional cues [(Palascha et al., 2021; Tylka, 2006)](https://paperpile.com/c/wCfYCG/kTZp%2BxfqC). Participants' accounts in the current study may help explain why some individuals struggle to adopt these eating styles. For instance, difficulties in sensing or interpreting gastrointestinal cues, confusing them with emotional states such as anxiety, experiencing negative affect in response to internal sensations, or responding to them in maladaptive ways may all serve as barriers. These interoceptive disruptions are commonly observed in eating disorder populations [(Bernatova & Svetlak, 2017; Jenkinson et al., 2018; Pollatos et al., 2016)](https://paperpile.com/c/wCfYCG/zJsF%2BPYXZ%2BuMXP) and may undermine the ability to eat intuitively or regulate eating internally. As such, the current findings extend beyond interoception to inform broader discussions about the factors that may support or hinder engagement with internally regulated eating behaviours, particularly in the context of eating disorder prevention and recovery.

# 5.2 Limitations

Limitations of the current study include not collecting the diagnosis participants identified as having, for both ED and GD participants. ED diagnoses can be differentiated by engagement in restriction, purging, and binge eating, which can also be associated with differences in gastric experiences. Restriction is often accompanied by early satiety and discomfort and nausea (induced by delayed gastric emptying; [(Westmoreland et al., 2016)](https://paperpile.com/c/wCfYCG/g7RyE), whereas binge eaters struggle to detect satiety (Eli 2015; Ortmann et al. 2024) but report being sensitive to hunger [(Poovey & Rancourt, 2024)](https://paperpile.com/c/wCfYCG/YP4UM). Purging has also been related to greater difficulty detecting satiety [(van Dyck et al., 2021)](https://paperpile.com/c/wCfYCG/w6bCd). Over-recruitment of one of these subtypes may have skewed our findings and limit the applicability of the current study. Future research may consider conducting separate focus groups with participants who binge, purge, or restrict to look for qualitative differences between these populations.

We were also not aware of the duration of illness for the ED or GD sample, and if the GD sample had undergone any surgery or were taking medication. Although not collected to comply with ethical approval, this could also be considered a weakness of the research. Chronic anorexia nervosa comes with significant physiological changes, like slowed gastric emptying caused by gastroparesis [(Bluemel et al., 2017)](https://paperpile.com/c/wCfYCG/HjaTK). This is associated with early satiety whereby people report feeling full after eating very little [(Parkman et al., 2017)](https://paperpile.com/c/wCfYCG/pDs5G). If duration of illness was collected, this could have explained an ED participant's experience of finding satiation to produce the same sensation as extreme fullness. Further, loss of appetite is present in people who have and have not undergone gastrointestinal surgery. People with a colostomy report problems with appetite loss [(Silva et al., 2003)](https://paperpile.com/c/wCfYCG/xTjfa), but this is also a common manifestation of a gastrointestinal disorder itself. Therefore, it is unclear if the GD participant found it hard to know if they were hungry due to their disorder, due to surgical intervention, or both.

Another limitation is the recruitment of self-identifying ED and GD populations. We did not ask for formal proof of diagnosis so we could honour the lived experience of those who experience disordered eating and gastrointestinal symptoms, including those waiting for an assessment or diagnosis and individuals from groups that are less likely to receive an ED [(Thapliyal et al., 2018)](https://paperpile.com/c/wCfYCG/xGwCZ) or GD [(Sempere et al., 2023)](https://paperpile.com/c/wCfYCG/hIPFP) diagnosis. However, this means it may be that our ED and GD sample represent subclinical disorder symptoms in the general population. Nevertheless, we did collect responses to the EDEQ and GQLI, and these samples were found on average to have significantly greater eating difficulties, and lower quality of life due to gastrointestinal symptoms, respectively, than community norms (i.e those without an ED or GD).

Importantly, we only used relevant screening questionnaires to confirm the presence of symptoms in specific disorder groups, rather than also confirming the absence of symptoms - i.e. we did not screen for gastric symptoms in the ED and ND groups, or ED symptoms in the GD and ND groups. This raises the possibility of people with comorbid EDs and GDs taking part in an ED or GD-only focus group. People with EDs often report gastrointestinal complaints [(Forney et al., 2023; H. B. Murray et al., 2021; Spillebout et al., 2019)](https://paperpile.com/c/wCfYCG/X0OlC%2BE5IN7%2Bhvtea) and disordered eating practices are common in those with GDs [(Peters et al., 2022)](https://paperpile.com/c/wCfYCG/W3K7a). Indeed, in focus group 10, an ED participant admitted having *“comorbid gastrointestinal issues”*. It is surprising that the participant quoted did not identify in the expression-of-interest survey as someone with an ED and GD, however it could be that their gastrointestinal symptoms are interpreted as being a *consequence* of their ED, and hence identified themselves as an ED participant. Nevertheless, having a GD was not part of the exclusion criteria for taking part in an ED focus group, and neither was having an ED to take part in a GD group. Therefore, there is the possibility that our ‘separate’ groups are not fully independent, but we do not know to what extent.

Relatedly, it is possible that subthreshold or undiagnosed gastric disorders or eating pathology are present outside of the groups focused on those symptoms. More specifically, some participant comments referencing compensatory behaviours (e.g., exercising to offset food intake) raise the possibility of the inclusion of individuals with unacknowledged eating pathology in our non-disorder group. However, such behaviours may also reflect culturally normative dieting practices rather than clinical symptomatology. In the UK, where this study was conducted, thinness is culturally idealised [(Ozbek et al., 2023)](https://paperpile.com/c/wCfYCG/HxTZ), and compensatory behaviours, such as ‘burning off’ food are widely normalised and socially endorsed [(Kaklamanou & Armitage, 2012)](https://paperpile.com/c/wCfYCG/OqHE). Thus, these comments may reflect the influence of dominant sociocultural norms rather than evidence of undiagnosed EDs. Nevertheless, the absence of structured screening remains a weakness of the current study. Future research would benefit from incorporating an eating pathology screening measures to more clearly delineate participants with no current or subthreshold eating pathology, thereby strengthening the validity of between-group comparisons within the themes.

There is an unequal split of gender identity in our sample. This study recruited a mostly female sample. This may have happened organically due to a female bias for irritable bowel syndrome [(Kim & Kim, 2018)](https://paperpile.com/c/wCfYCG/qvb3C) - the most commonly occurring GD [(Chey et al., 2015)](https://paperpile.com/c/wCfYCG/K8ako) - and EDs [(Coelho et al., 2021)](https://paperpile.com/c/wCfYCG/BTIkS). However, this means a lack of insight into the male and gender diverse experience of gastric interoception. Recent research has found gender diverse samples experience increased distress even for pleasant interoceptive experiences, like focusing on the movement of their chest with their breath, due to the gender dysphoria it can cause [(Tilley et al., 2022)](https://paperpile.com/c/wCfYCG/oL29h). However, due to a lack of representation in our sample, we do not know if sensations that originate in more gender neutral body locations, such as the stomach, would also motivate distress due to gender dysphoria. Future research may consider investigating this in order to make body-focused therapies suitable for gender diverse populations.

There was also a large range of BMIs included in this study (13.6 in the ED group to 38.1 in the ND group). Increases in BMI are correlated with reduced interoceptive sensing [(Robinson et al., 2021)](https://paperpile.com/c/wCfYCG/1Om61), and so it is possible the comments from participants in *theme 4* reflect this*.* However, for ethical and logistical reasons, we cannot connect individual speakers to their demographic details, such as their BMI. Further research may consider stratifying focus groups based on body weight classifications to see if there are qualitative differences in their responses which could support current quantitative findings [(Robinson et al., 2021)](https://paperpile.com/c/wCfYCG/1Om61).

A further limitation regards the use of online focus groups. We had some concerns that participants may have been responding to questions by copying and pasting the responses from large language models like ChatGPT. Therefore, we conducted a separate analysis to check for this, the results of which are reported in this manuscript and Stafford et al., [(2024)](https://paperpile.com/c/wCfYCG/50ho9/?noauthor=1). This meant we excluded 9 participants (GD, n=2, ED n=7) from the qualitative analysis, 9% of our sample. However, just because participants were potentially using a large language model does not necessarily mean they were being untruthful about their experiences. They may have used it to help them verbalise their thoughts and feelings, especially if English was not their first language [(Shahriar & Hayawi, 2023)](https://paperpile.com/c/wCfYCG/LJqsb). Our ED population, the group involving the majority of our potential large language model responders, may have been using it due to difficulties with verbalising their emotions due to alexithymia [(Westwood et al., 2017)](https://paperpile.com/c/wCfYCG/O8iyP) and experiences more generally due to malnutrition [(Gibson et al., 2021)](https://paperpile.com/c/wCfYCG/KKxAl). Therefore, it is possible that by excluding responses from these participants, we missed additional insight.

Nevertheless, there is the possibility that some large language model generated responses were not picked up by our analysis in Stafford et al., [(2024)](https://paperpile.com/c/wCfYCG/50ho9/?noauthor=1). This is because the only speakers that were excluded were those providing responses that were equal to or above 10% in similarity to the response ChatGPT produced for the same question. However, the responses from excluded participants also shared some qualitative similarities *not* found in the responses included in the findings section of this paper. This included features such as starting a sentence with two contradictory, independent clauses, using American spelling, providing multiple points of view in their answers, and including cautionary disclaimers in their answers (see [(Stafford et al., 2024)](https://paperpile.com/c/wCfYCG/50ho9) for examples).

# 6. Conclusions

Using the currently accepted definition of interoception [(Chen et al., 2021)](https://paperpile.com/c/wCfYCG/hhrW) as a guiding framework, this study uncovered four main themes of gastric interoceptive sensibility. These were 1) Sensations in the interoceptive body, 2) Perceiving the interoceptive body, 3) Affective experience of the interoceptive body, and 4) Responding to the interoceptive body. These findings may be informative in considering if *interoceptive sensibility* encompasses several distinct factors in the subjective experience of interoceptive signals. They may also be useful for further developing interoceptive exposure therapies to address problematic interpretations of gastric sensations posited to be core maintenance factors for EDs and gastrointestinal symptoms.

**Funding**

The author(s) disclose receipt of the following financial support for the research, authorship, and/or publication of this article: ESRC PhD scholarship ES/P000746/1.

**Data**

Please see anonymised transcripts: https://osf.io/wqt6f/files/osfstorage

**Author contributions: CREDiT**

Conceptualization- L.S., A.C.P., C. E. J.P. Data curation- L.S. Formal analysis- L.S, A.C.P, C.E.J.P. Supervision- A.C.P, C. E. J. P. Writing – original draft- L.S. Writing- editing- L.S., A.C.P., C. E. J.P.

**Acknowledgements**

We wish to thank the participants who took part in this project and the following organisations for their help with participant recruitment: GUTs UK, Bowel Research UK, Bladder and Bowel Foundation, SEED Eating Disorder Services, Eating Disorder Association Northern Ireland, and SupportED Scotland.

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