1 **Manipulating the sensation of feeling fat: The role of alexithymia, interoceptive sensibility and**
2 **perfectionism**

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4 **Aimee E Pink[1,2]*, Claire Williams[1,3], Michelle Lee[1], Hayley A Young[1], Sophie Harrison[1], Amy**
5 **Eldred Davies[1,4], Menna Price[1]**

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7 [1]Department of Psychology, College of Human and Health Sciences, Swansea University, Swansea,
8 SA2 8PP [2]School of Social Sciences, Nanyang Technological University, Singapore, 639818.
9 [3]Elysium Neurological Services, Elysium Healthcare, The Avalon Centre, Swindon, UK. [4]Division of
10 Psychology and Mental Health, School of Health Sciences, University of Manchester, Manchester,
11 M13 9PL.

12 *Correspondence: A.E.Pink@swansea.ac.uk

13 AEP (0000-0003-1516-7922), CW (0000-0002-0791-744X), AED (0000-0003-1741-2661), MP
14 (0000-0002-0025-0881)

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1   **Abstract**

2   **Objective:** Feeling fat reflects difficulties in processing emotions and is an important aspect of body

3   image and eating disorders. The current study aimed to develop a novel social comparison manipulation

4   to induce feeling fat and to explore personality traits that may increase an individual's vulnerability.

5   **Methods:** At time 1, 254 healthy females (24.14 years, BMI = 23.77) completed the feeling fat subscale

6   of the Body Attitudes Questionnaire, as well as self-report measures of alexithymia, interoceptive

7   sensibility, physical appearance comparison and perfectionism online. At time 2, a subset of 107

8   participants (22.39 years, BMI = 23.85) were randomly assigned to a condition: negative social

9   comparison, positive social comparison, negative general, or neutral (as a control). **Results:** At time 1,

10   greater tendency to feel fat was significantly associated with difficulty identifying and describing

11   feelings (alexithymia), poorer interoceptive sensibility, higher socially-prescribed perfectionism, and

12   greater engagement in physical appearance comparisons. At time 2, participants in the negative social

13   comparison condition reported significantly greater increases in feeling fat compared to the control

14   condition, but only when they were also high in alexithymia or socially-prescribed perfectionism.

15   **Discussion:** Current findings provide new insights into the potential mechanisms underpinning feeling

16   fat and highlight how a novel social comparison manipulation can be used to induce the sensation of

17   feeling fat.

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20   **Keywords:** Feeling fat, Alexithymia, Interoception, Perfectionism, Social Comparison

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1. Introduction

Feeling fat is a somatic sensation conceptualised as the expression of over-concern for shape/weight (Fairburn & Beglin, 2008) and the physical sensation of carrying excess weight (Striegel-Moore, McAvay, & Rodin, 1986), despite no relation to actual shape/weight. Whilst body dissatisfaction is linked to cognition (e.g. thinking fat), feeling fat is related to affect and is thought to represent something more than simply being, or thinking of oneself as being, overweight (Tiggemann, 1996). Females report feeling fat more than males (Mehak & Racine, 2019), as do individuals diagnosed with eating disorders, but it is also present in the general population (Cooper, Deepak, Grocutt, & Bailey, 2007; Fairburn & Beglin, 2008). Feeling fat has been identified as a unique aspect of body image and eating behaviours (Linardon et al., 2018; Mehak & Racine, 2020) and prior evidence also suggests that the sensation of feeling fat may be more prevalent and potentially more detrimental than being overweight (Jansen, van de Looij-Jansen, de Wilde, & Brug, 2008).

Consequently, research into feeling fat and its associated factors warrants further attention in both healthy and eating disorder populations. One way we might be able to achieve this, is to develop new methods that allow the sensation of feeling fat to be experimentally manipulated in healthy populations. Here, being able to manipulate the sensation of feeling fat has the advantage that researchers would be able to causally explore potential factors that may moderate one's susceptibility to feeling fat. Thus, facilitating identification of at-risk individuals and in turn, subsequent application of knowledge within eating disorders. However, methods to experimentally manipulate the sensation of feeling fat do not currently exist. Therefore, we drew on existing theory and evidence to develop a new method – a series of social comparison vignettes which utilised evidence suggesting that comparing oneself with familiar peers (social comparison), especially in relation to perceptions of one's body, generates negative mood (e.g. Brown & Tiggemann, 2016; Cohen, Fardouly, Newton-John, & Slater, 2019; Tiggemann & Zaccardo, 2015).

Social comparison theory states that we compare ourselves to others to satisfy our innate drive to obtain accurate evaluations of ourselves (Festinger, 1954), but we have a tendency to compare ourselves to those we perceive as being better than us (upward comparison; Wheeler & Miyake, 1992) which can result in increased body dissatisfaction (Keery, van den Berg, & Thompson, 2004). Checking one's body and comparing one's body to others may also increase an individual's tendency to feel fat, with previous research showing that the tendency to compare one's own weight with the weight of others significantly correlates with feeling fat in females (Striegel-Moore et al., 1986). Furthermore, feeling fat is associated with perfectionism (Striegel-Moore et al., 1986) and in turn, perfectionistic self-presentation (striving to appear perfect to others) is associated increased tendency to compare physical appearances and reduced body esteem (Ko et al., 2019). Therefore, individuals who have a greater

1 tendency to compare their physical appearance and/or have higher levels of perfectionism may have

2 increased vulnerability to feeling fat.

3   However, the sensations of feeling fat can also be generated by several other multifaceted

4 triggers, including clothes being tight and certain foods (Ben-Tovim & Walker, 1991; Fuller-

5 Tyszkiewicz, Skouteris, Watson, & Hill, 2012). Negative mood states and affective distress may also

6 contribute (Ben-Tovim & Walker, 1991; Cooper et al., 2007; McFarlane, Urbszat, & Olmsted, 2011;

7 Mehak & Racine, 2019; Tiggemann, 1996), where feeling fat may occur because of difficulty

8 understanding emotions (Andersen, 2000; Bruch, 1978; Fairburn & Beglin, 2008; Mehak & Racine,

9 2019, 2020). This connection with emotions may help to explain why levels of feeling fat can fluctuate

10 across the day as well as day to day, despite overall body dissatisfaction remaining relatively stable

11 (Fairburn & Beglin, 2008).

12   Subsequently, factors known to affect emotional processing and/or the interpretation of bodily

13 sensations, such as alexithymia and interoception, may therefore underpin the relationship between

14 negative affect and feeling fat, and exacerbate the tendency to feel fat. Alexithymia, a non-clinical

15 personality trait characterised by difficulty identifying and describing emotions and an externally

16 oriented thinking style (Bagby, Parker, & Taylor, 1994; Sifneos, 1973), has previously been associated

17 with feeling fat in individuals with eating disorders (Andersen, 2000). Specifically, Andersen (2000)

18 proposed that individuals with eating disorders voice "*I feel fat*", when they are unsure of the negative

19 emotion they are experiencing. Here, negative emotions may be experienced physically (as feeling fat)

20 because it is easier to deal with (displacement; Bruch, 1978; Harper-Giuffre & MacKenzie, 1992) and

21 allows greater control over emotions. Therefore, individuals who experience difficulty identifying and

22 understanding their emotions (alexithymia) may be at increased vulnerability of feeling fat.

23   Similarly, interoception, the accurate perception of bodily sensations (Craig, 2002), may also

24 influence feeling fat. Although interoception has not been specifically associated with feeling fat,

25 research has shown associations with body image in general (Badoud & Tsakiris, 2017; Todd, Aspell,

26 Barron, & Swami, 2019a, 2019b; Zamariola, Cardini, Mian, Serino, & Tsakiris, 2017). For example,

27 poor interoceptive awareness (conscious representation of internal states) and accuracy (ability to detect

28 internal sensations) has been correlated with greater body dissatisfaction (Badoud and Tsakiris (2017),

29 and multiple facets of interoception (as measured by the Multidimensional Assessment of Interoceptive

30 Awareness (MAIA; Mehling, Acree, Stewart, Silas, & Jones, 2018; Mehling et al., 2012) have been

31 associated with body image across a series of studies (Todd et al., 2019a, 2019b). Specifically, body

32 appreciation, functionality appreciation and body pride, were significantly correlated with all facets of

33 the MAIA, with the ability to trust bodily sensations showing the strongest associations (Todd et al.,

34 2019b). Perfectionism and social comparison also have links with alexithymia and interoception. For

35 instance, alexithymia has been associated with greater body checking behaviours and body

36 dissatisfaction (De Berardis et al., 2007), and deficits in interoceptive awareness have been associated

37 with increased concern about physical appearance (Peat & Muehlenkamp, 2011). Consequently, when

1   individuals high in alexithymic traits engage in social comparisons, they may be vulnerable to

2   interpreting associated negative emotions as feeling fat.

3   On the basis of the aforementioned literature, the overarching aim was to investigate whether

4   the sensation of feeling fat could be manipulated and to predict which individuals were most susceptible

5   in female adults. Firstly, we identified trait correlates of feeling fat – specifically, alexithymia,

6   interoception, perfectionism, and physical appearance comparisons. We predicted that higher tendency

7   to feel fat would be significantly associated with higher levels of alexithymia, perfectionism, and

8   physical appearance comparison, and poorer interoceptive ability. Next, we devised a novel method to

9   manipulate the sensation of feeling fat through the development of a series of social comparison

10   vignettes (negative and positive social comparison, negative general and control). We predicted that

11   participants in a negative social comparison condition would report greater sensations of feeling fat

12   (post-manipulation) compared to a positive social comparison, negative general and control condition.

13   Finally, based on the correlates identified in our cross-sectional analysis, we then examined potential

14   moderators of the effect of our social comparison manipulation on feeling fat (exploratory).

15

16   **2. Method**

17   **2.1. Participants**

18   Eligibility for the study included participants identifying as female, reporting no current or

19   historical diagnosis of depression, anxiety, or eating disorders, and confirming they had good levels of

20   English Language proficiency. All participants completed an online survey (Time 1; T_1) with a subset

21   attending the laboratory (Time 2; T_2). At T_1, 320 accessed the online survey, with a final sample of 254

22   (for exclusions see supplementary materials). Mean age was 24.14 years (n=246, SD=7.7, range =

23   18.21-61.10 years) and BMI was available for 172 participants (M=23.77, SD=4.31, range=16.41-38.6).

24   At T_2, 113 participants attended with six subsequently excluded (see Supplementary Materials Table

25   S1). Mean age at T_2 (n=107) was 22.44 years (n=103, SD=4.00, range=18.46-50.82 years) and BMI

26   was 23.85 (n=103; SD=4.38, range=16.87-38.60).

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28   **2.2. Design and materials**

29   The study was conducted in two parts. T_1 was a series of online questionnaires and T_2 was an

30   independent measures design experiment. Participants were randomly assigned to one of four

31   conditions using Qualtrics: negative social comparison (Neg.SC; n=30); positive social comparison

32   (Pos.SC; n=24); negative general (Neg.Gen.; n=25), or neutral (control; n=28). Feeling fat was

33   measured using a visual analogue scale (VAS) and a change score was calculated by subtracting pre-

34   from post-scores (used as the dependent variable (full description in section 2.2.1.).

35   The novel social comparison vignettes, which were developed for the purpose of this research,

36   were centred around a group of friends going out of food (see Table 1). Presented in English, the

1 negative and positive social comparison vignettes presented the same social eating situation - ordering
2 a tasty but "unhealthy" food (burger). In the Neg.SC, the situation was accompanied by a negative
3 comment and unfavourable social comparisons were made. In contrast, a positive comment and
4 favourable social comparisons were made in the Pos.SC. In each instance, the social comparison
5 referred to the size of the participants and the fit of their clothes to draw attention to their body. The
6 Neg.Gen vignette was included to control for the potential confound that any changes in feeling fat
7 were related to changes in negative emotion more generally, rather than body awareness. This vignette
8 told participants that they were meeting friends for dinner and described how those friends proceeded
9 to ignore the participants and whisper behind their back. Finally, in the control condition everyone had
10 ordered similar foods and the conversation was neutral and food focused. Across all conditions,
11 participants were presented with a free response text box and asked to write a few sentences about how
12 the social situation presented in their respective vignettes would make them feel.
13
14 **2.3. Measures**
15 **2.2.1. Time One (T_1) Measures (Online).**
16   *Demographics:* Age was derived from participants providing their date of birth as part of an
17 anonymised code. Participants self-reported their height and weight, and laboratory measures were also
18 taken for the T_2 subset (using a stadiometer and WW digital scales respectively).
19   *Toronto Alexithymia Scale* (TAS-20; Bagby et al., 1994). The TAS-20 consists of 20-items to
20 assess alexithymia, with a five-point scale (1=*strongly disagree* to 5=*strongly agree*). Summing items
21 creates a total score (T_1: α=.86; T_2: α=.86) in addition to three subscales: difficulty identifying feelings
22 (DIF: T_1: α=.85; T_2: α=.86), difficulty describing feelings (DDF: T_1: α=.83; T_2: α=.82) and externally
23 oriented thinking (EOT: T_1: α=.64; T_2: α=.66). Higher scores indicate higher levels of alexithymia.
24   *Feeling Fat* (FF; Body Attitudes Questionnaire subscale; Ben-Tovim & Walker, 1991). The
25 extent to which individuals experience the sensations of feeling fat is captured across the 14-item FF
26 subscale. Items are rated on a five-point scale (1=*strongly disagree* to 5=*strongly agree*), with raw
27 scores summed to create a total FF score (T_1: α=.93; T_2: α=.93). Higher scores indicate greater sensations
28 of feeling fat.
29   *Multidimensional Assessment of Interoceptive Awareness* (MAIA; Mehling et al., 2012). The
30 MAIA is a 32-item self-report instrument measuring eight dimensions of interoception. Items are
31 answered on a six-point scale (0=*never* to 5=*always*), with higher scores indicating poorer interoceptive
32 abilities. Due to an inputting error, the current scale only had five scale points (1=*never* to 5=*always*),
33 but good internal reliability was found when averaging raw scores to create an overall score of
34 interoceptive sensibility (T_1: α=.87; T_2: α=.88). Eight subscales were also calculated: noticing (T_1:
35 α=.62; T_2: α=.64), not worrying (T_1: α=.63; T_2: α=.69), not distracting (T_1: α=.57; T_2: α=.49), attention
36 regulation (T_1: α=.80; T_2: α=.80), emotional awareness (T_1: α=.83; T_2: α=.81), self-regulation (T_1: α=.80;
37 T_2: α=.81), body listening (T_1: α=.86; T_2: α=.84) and trusting (T_1: α=.85; T_2: α=.84).

1   *Physical Appearance Comparison Scale – Revised* (PACS-R; Schaefer & Thompson, 2014).
2   The PACS-R is an 11-item measure assessing an individual's tendency to engage in physical appearance
3   comparison across a range of situations. Responses are captured on a five-point Likert-type scale
4   (0=*never* to 5=*always*), with higher total scores indicating greater levels of comparison (T_1: α=.96; T_2:
5   α=.96).

6   *Multidimensional Perfectionism Scale (*MPS; Hewitt, Flett, Turnbull-Donovan, & Mikail,
7   1991). The MPS is a 45-item measure which examines three dimensions of perfectionism: self-oriented
8   (MPS-self; 15 items; T_1: α=.89, T_2: α=.89), other-oriented (MPS-other; 15 items; T_1: α=.77; T_2: α=.76)
9   and socially-prescribed (MPS-social; 15 items; T_1: α=.84; T_2: α=.85). Participants select the answer that
10 best describes them on a seven-point scale (1=*strongly disagree* to 7=*strongly agree*). Raw scores are
11 summed to provide a total score, with higher scores reflecting a greater level of perfectionism.
12

13 **2.2.1. Time 2 (T_2) Measures (Laboratory).**
14 *Positive Affect and Negative Affect Scale* (PANAS; Watson, Clark, & Tellegen, 1988). The
15 PANAS has two 10-item subscales to measure positive (PA; pre: α=.85; post: α=.88) and negative (NA;
16 pre: α=.84; post: α=.88) affect. Participants respond on a five-point scale (1=*very slightly or not at all*
17 to 5=*extremely*) to reflect how they are feeling "*right now*". Scores for each subscale are summed (range
18 20-50), with higher scores indicative of greater levels of positive and negative affect.
19 *Visual Analogue Scales* (VAS). VAS were used pre- and post-social comparison manipulation
20 to capture the sensation of feeling fat. Participants were asked to indicate how fat they felt (dependent
21 variable) as well as how aware of bodily sensations, attractive confident, tired, and comfortable
22 (distractor variables) they felt "*right now*" on a scale of 0-100 (*not at all* to *extremely*).

1   Table 1. Instructions and description of social comparison vignettes.

"Take a few minutes to read the scenario and try to imagine yourself as experiencing the scenario. Write in the text box a few sentences on how you might feel or what you might think in this situation."	
Condition	**Vignette description**
Neutral (Control)	You are eating out with a group of close friends. You decide to order a burger and fries. You are very hungry and looking forward to a nice meal. When the food arrives your friends makes a comment, "that looks so tasty. I can't wait for mine!" You look around and you notice your friends all ordered similar meals. The restaurant was quite pleasant and warm, and the décor was colourful. The staff members were polite and very helpful. You dig in and you feel satisfied with the meal.
Negative Social Comparison (Neg.SC)	You are eating out with a group of close friends. You decide to order a burger and fries. You are very hungry and looking forward to a nice meal. When the food arrives your friends makes a comment, "that's really unhealthy, should you really be eating such fatty foods?" You look around and feel everyone's eyes on you. You notice they have ordered salads. Looking around the table you realise you are the biggest person there and your clothes look much tighter. You go bright red and feel embarrassed.
Positive Social Comparison (Pos.SC)	You are eating out with a group of close friends. You decide to order a burger and fries. You are very hungry and looking forward to a nice meal. When the food arrives your friends makes a comment, "you are so lucky you can eat fatty foods and still look amazing!" You look around and everyone is nodding in agreement with her. You feel confident in yourself and happily enjoy the meal with your friends. You can't help but notice how well your clothes fit compared to some of your other friends.
Negative General (Neg.Gen)	You go to meet your friends at the pub. You greet them but no one acknowledges you. You say hello again and two friends turn to look at you and give you an unfriendly look. They go to turn their back on you, whispering something to each other and laughing. You approach them and ask them why they won't speak to you. They whisper something to each other. They get the attention of the rest of the group and tell them it's time to leave. They leave you without explaining why they won't speak to you.

1   **2.4. Procedure**

2   Ethical approval was obtained from the Department of Psychology Research Ethics Committee,

3   College of Human and Health Sciences, Swansea University. Participants were recruited through the

4   Department of Psychology's participant pool (4 credits) and through adverts/flyers (£5). T_1 was

5   completed online using Qualtrics. Participants were presented with an information sheet and consent

6   form before completing the demographic information, TAS-20, FF, MAIA, MPS and PACS-R.

7   Participants also provided their contact information to arrange T_2, which was scheduled at least one

8   week after T_1. During T_2, participants completed the PANAS, as well as the feeling fat VAS and

9   distractor VAS, before being randomly allocated to one of four conditions (see Table 1). Participants

10   were given an undefined amount of time to complete the vignette task before completing the PANAS

11   and feeling fat and distractor VAS for a second time. Participants also had their height and weight

12   measured before being thanked and debriefed. Each session took approximately 30 minutes to complete.

13   Participants also completed a heartbeat counting task (T_2) with results not reported here.

14

15   **2.6. Statistical Analysis**

16   Statistical analysis was conducted using SPSS 25.0. For aim one, Pearson's

17   correlations were conducted between the trait personality measures. Here, we adopted a

18   Bonferroni adjusted alpha level due to multiple comparisons. We grouped variables by

19   construct (i.e. feeling fat, alexithymia, interoception, social comparison, perfectionism and

20   BMI) rather than individual variables to avoid being overly conservative. We used a p-value

21   of .008 (p=.05/6) for our correlational analyses. The correlations were run on all participants

22   from T_1. For aim two, a one-way analysis of covariance (ANCOVA) was conducted to detect

23   any differences in change scores for feeling fat across conditions. BMI was entered as a

24   covariate due to a significant positive correlation with feeling fat. Difference scores were

25   calculated for PA and NA by subtracting T_2 from T_1. To check the social comparison

26   manipulation did not result in changes in mood, two one-way ANOVAs were conducted to

27   test for differences in PA and NA. Moderation analysis (Model 1, PROCESS v3.4.1., Hayes,

28   2018) was then conducted for aim three. Feeling fat change scores were entered as the

29   outcome (y) with condition entered as the predictor variable (x). The Neg.SC was used as the

30   comparator (0), and the remaining conditions assigned as follows: control (1); Pos.SC (2),

31   and Neg.Gen (3). Personality traits (e.g. alexithymia, interoception, social comparison and

32   perfectionism) were entered as a moderator (w) if they were found to significantly correlate

33   with feeling fat during the correlation analyses. BMI was entered as a covariate. Mean, -/+ 1

34   SD were used to test the interactions.

35

36   **3. Results**

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38   **3.1. Correlational Analysis**

39   Descriptive statistics of the trait personality measures and feeling fat for T_1 and T_2 are presented

40   in Table 2, alongside the correlations between all variables at T_1. We found several significant

1   correlations. Specifically, significant positive correlations were found between feeling fat and physical

2   appearance comparisons, socially-prescribed perfectionism, alexithymia total, DIF and DDF scores,

3   and the MAIA subscales 'noticing' and 'not worrying'. Additionally, significant negative correlations

4   were found between feeling fat and the trusting subscale of the MAIA.

Table 2. Summary of correlation analysis and descriptive statistics across all variables.

|	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	19.
1. DIF	-																	
2. DDF	**.62***	-																
3. EOT	**.29***	**.32***	-															
4. TAS-20	**.85***	**.83***	**.65***	-														
5. SO	.07	-.01	-.09	.00	-													
6. OO	.07	.08	.06	.09	**.19***	-												
7. SP	**.32***	**.23***	.07	**.28***	**.45***	**.21***	-											
8. PACS	**.38***	**.27***	.04	**.31***	.06	.11	**.28***	-										
9. FF	**.28***	**.22***	.06	**.25***	.01	.08	**.27***	**.72***	-									
10. T	**-.31***	**-.27***	**-.18***	**-.33***	-.10	.00	**-.20***	**-.39***	**-.41***	-								
11. N	.00	-.11	**-.22***	**-.13**	-.05	-.05	.03	**.20***	**.18***	.12	-							
12. ND	-.05	-.03	-.08	-.07	-.12	**-.12**	**-.15**	.00	-.02	.06	.11	-						
13. NW	**-.24***	-.06	-.06	**-.17***	-.04	-.03	**-.14**	**-.13**	**-.13**	.07	-.08	**-.18***	-					
14. AR	**-.82***	**-.18***	**-.23***	**-.25***	.02	**.13**	-.06	.07	.02	**.28***	**.40***	.06	**.22***	-				
15. EA	.01	**-.18***	**-.29***	**-.18***	.11	-.01	.06	.07	-.02	**.27***	**.46***	.03	-.12	**.39***	-			
16. SR	-.12	-.11	**-.27***	**-.21***	-.07	.08	-.12	-.09	-.09	**.39***	**.25***	.02	.10	**.41***	**.43***	-		
17. BL	.05	-.07	**-.20***	-.08	-.08	-.08	-.09	-.02	-.05	**.34***	**.29***	.06	-.10	**.32***	**.46***	**.50***	-	
18. BMI	-.04	.06	-.03	.00	-.01	.04	.04	**.17**	**.34****	-.07	.10	.12	.11	**.18**	-.15	-.03	.12	-
T_1																		
M	15.84	12.82	18.14	46.80	68.94	56.77	55.94	25.55	44.06	3.18	3.52	2.73	3.08	3.14	3.50	3.07	2.69	23.77+
SD	5.67	4.64	4.44	11.55	14.69	10.87	12.76	11.41	11.91	.95	.73	.73	.82	.68	.86	.88	.98	4.31+
T_2 **Subset**																		
M	15.93	12.92	17.44	46.29	68.08	56.91	56.02	25.51	43.71	3.31	3.64	2.72	3.13	3.20	3.61	3.17	2.70	23.77++
SD	5.60	4.63	4.43	11.55	14.61	10.43	13.15	10.91	11.67	.93	.71	.69	.84	.68	.85	.89	.99	4.31++

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3 DIF = difficulty identifying feelings, DDF = difficulty describing feelings, EOT = externally oriented thinking, TAS-20 = Toronto Alexithymia Scale total
4 scores, SO = self-oriented perfectionism, OO = other-oriented perfectionism, SP = socially-prescribed perfectionism, PACS = Physical Appearance Comparison
5 Scale, FF = feeling fat, T = trusting (MAIA), N = noticing (MAIA), ND = not-distracting (MAIA), NW = not-worrying (MAIA), AR = attention regulation
6 (MAIA), EA = emotional awareness (MAIA), SR = self-regulation (MAIA), BL = body listening (MAIA), BMI = body mass index. **Bold** = $p < .05$, **bold*** = p
7 $< .008$ (Bonferroni adjusted p-value), $^{+}n = 172$, $^{++}n = 104$.
8
9

1

2 **3.2. Social Comparison Manipulation Effects**

3   There was no significant difference in pre- and post-manipulation NA, $F(3,103)=2.20$,

4 $p=.093$, $\eta_p^2=.060$ or PA, $F(3,103)=.65$, $p=.583$, $\eta_p^2=.019$. There was no significant difference in

5 feeling fat change scores across conditions, $F(3,97)=.59$, $p=.624$, $\eta_p^2=.018$ see Figure 1.

6

7

8
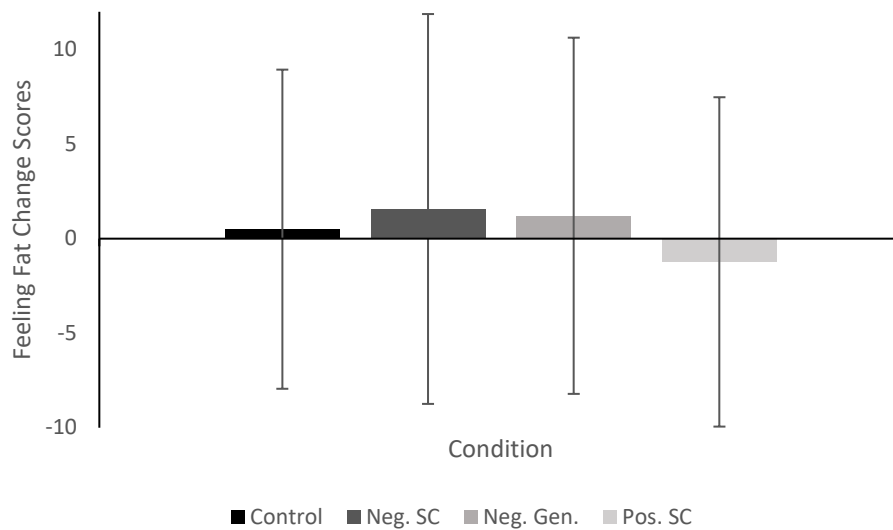
9 Figure 1. Feeling fat difference scores for each condition with error bars representing *SD*. (Gen. =
10 general, SC = social comparison)

11

12

13 **3.3. Personality traits moderating the effect of condition on feeling fat change scores**

14   Given there was no significant difference in feeling fat change scores across conditions, this

15 suggests that individual differences may play a role. In line with our data analysis plan described

16 previously, variables that significantly correlated with feeling fat were then taken forward as

17 moderators. To confirm, these included: socially-prescribed perfectionism, physical appearance

18 comparison, not worrying about, trusting and noticing bodily sensations, DIF, DDF, and total

19 alexithymia scores. Mean, -/+ 1 SD were used to test the interactions. Full moderation analyses for total

20 alexithymia scores, DIF, DDF and socially-prescribed perfectionism are presented in Table 3. In

21 contrast, physical appearance comparison and interoception (not worrying, trusting, and noticing

22 subscales) are not captured in Table 3 as they did not significantly moderate the effect of condition on

23 feeling fat change scores (see Supplementary Materials).

24

25 **3.3.1. Alexithymia**

1   *Total scores:* The overall model was not significant, R^2=.12, $F(8, 93)$=1.53, p=.158, but there

2   was a significant difference in feeling fat change scores between Neg.SC and the control (D_1) and the

3   Pos.SC condition (D_2). In addition, the specific interactions for Neg.SC versus control (D_1 x TAS-20)

4   and Neg.SC versus Pos.SC (D_2 x TAS-20) by TAS-20 scores were significant. Probing these

5   interactions revealed that participants in the Neg. SC condition reported significantly greater changes

6   in feeling fat scores compared to the Pos.SC condition, when they also reported the highest levels of

7   alexithymia, b=-10.69, $t(93)$=-2.71, p=.008 (see Figure 2). The difference between the Neg.SC and

8   control condition, almost reached significance, b=-6.37, $t(93)$ =-1.97, p=.052.

9

10   Table 3. Summary of moderation analysis for alexithymia total scores (TAS-20) DIF, DFF and socially-
11   prescribed perfectionism moderating the effect of condition on feeling fat change scores.

Antecedent		b	SE	t	p	CI
D_1 = Neg.SC v. Control	b_1	22.05	9.83	2.24	.027*	2.52 – 41.58
D_2 = Neg.SC v. Pos.SC	b_2	26.69	10.45	2.55	.012*	5.95 – 47.44
D_3 = Neg.SC v. Neg.Gen	b_3	16.87	11.25	1.50	.137	-5.46 – 39.20
TAS-20	b_4	.42	.15	2.85	.005*	.13 – .71
D_1 x TAS-20	b_5	-.49	.20	-2.42	.018*	-.90 – -.09
D_2 x TAS-20	b_6	-.65	.23	-2.85	.005*	-1.10 – -.20
D_3 x TAS-20	b_7	-.35	.23	-1.51	.134	-.81 – .11
BMI	-	-.03	.21	-.13	.899	-.44 – .38
D_1 = Neg.SC v. Control	b_1	15.21	7.07	2.15	.034*	1.17 – 29.26
D_2 = Neg.SC v. Pos.SC	b_2	12.70	8.10	1.57	.120	-3.38 – 28.78
D_3 = Neg.SC v. Neg.Gen	b_3	8.32	8.01	1.04	.302	-7.58 – 24.22
DIF	b_4	.70	.30	2.34	.022*	.11– 1.30
D_1 x DIF	b_5	-1.02	.42	-2.46	.016*	-1.85 – -.20
D_2 x DIF	b_6	-1.00	.51	-1.97	.052	-2.00 – .01
D_3 x DIF	b_7	-.50	.47	-1.07	.288	-1.42 – .43
BMI	-	-.01	.21	.07	.944	-.40 – .43
D_1 = Neg.SC v. Control	b_1	17.45	6.66	2.62	.010*	2.22 – 30.68
D_2 = Neg.SC v. Pos.SC	b_2	17.94	7.30	2.46	.016*	3.45 – 32.44
D_3 = Neg.SC v. Neg.Gen	b_3	9.44	7.88	1.20	.234	-6.21 – 21.10
DDF	b_4	.92	.31	2.96	.004*	.30 – 1.54
D_1 x DDF	b_5	-1.37	.47	-2.92	.004*	-2.30 – -.44
D_2 x DDF	b_6	-1.59	.55	-2.91	.005*	-2.68 – -.51
D_3 x DDF	b_7	-.62	.56	-1.10	.276	-1.74 – .50
BMI	-	-.07	.20	-.33	.741	-.48 – .34
D_1 = Neg.SC v. Control	b_1	26.29	10.96	2.40	.018*	4.53 – 48.04
D_2 = Neg.SC v. Pos.SC	b_2	13.27	10.59	1.25	.213	-7.76 – 34.30
D_3 = Neg.SC v. Neg.Gen	b_3	22.64	13.92	1.63	.107	-4.99 – 50.28
SP	b_4	.31	.12	2.52	.014*	.07 – .56
D_1 x SP	b_5	-.49	.19	-2.59	.011*	-.86 – -.11
D_2 x SP	b_6	-.29	.20	-1.42	.158	-.69 – .11
D_3 x SP	b_7	-.39	.23	-1.68	.097	-.86 – .07
BMI	-	-.05	.21	-.21	.831	-.46 – -.37

12   Neg.SC=Negative Social Comparison, Pos.Sc=Positive Social Comparison, Neg.Gen=Negative
13   General, TAS-20=Toronto Alexithymia Total Scores, DIF=Difficulty Identifying Feelings,
14   DDF=Difficulty Describing Feelings, SP=socially-prescribed perfectionism.
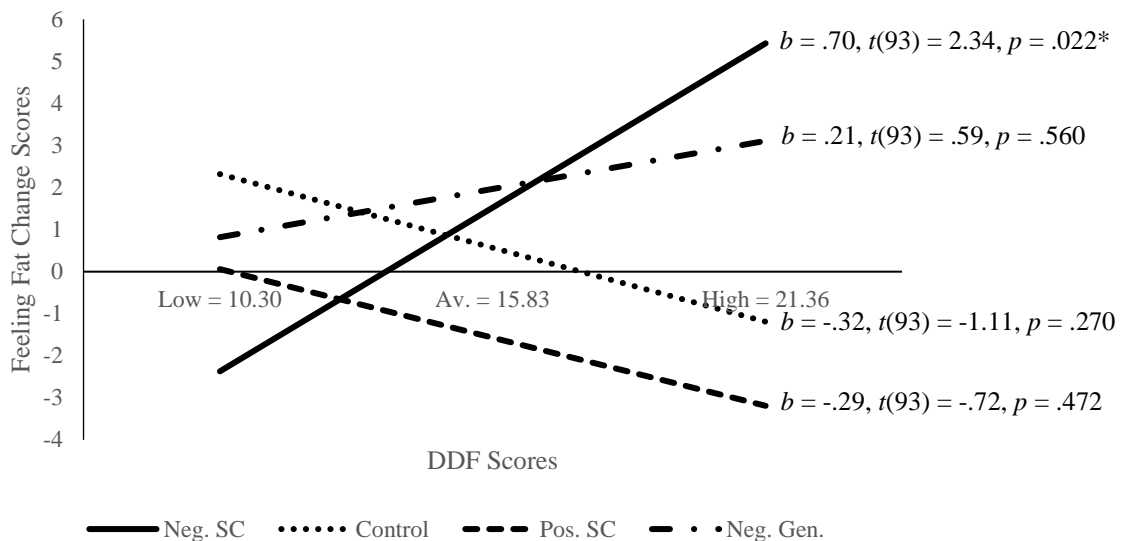
15

1
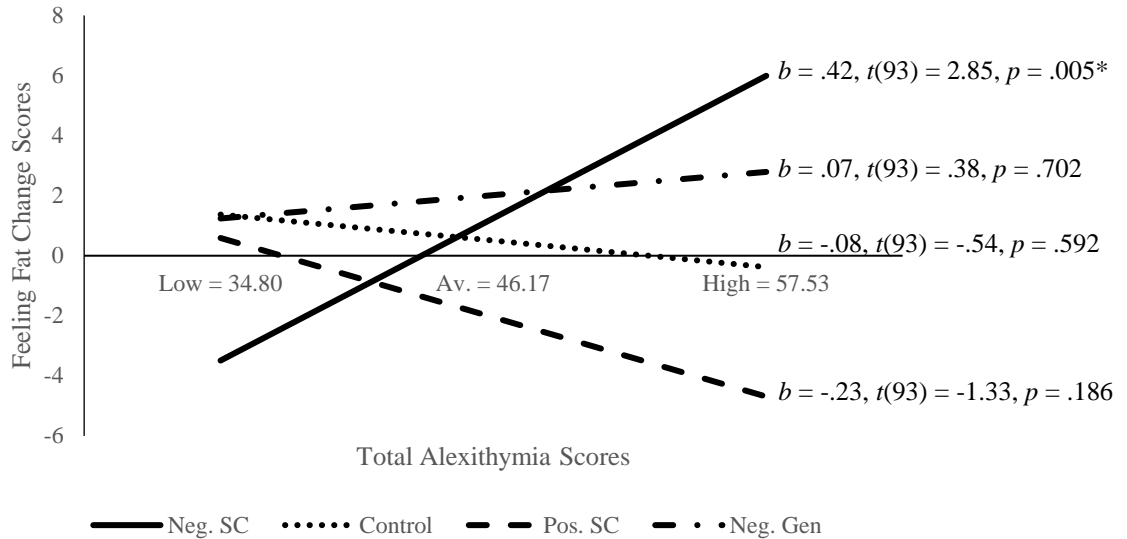
Figure 2. Visual representation for mean +/- 1*SD* alexithymia total scores (TAS-20) scores moderating the
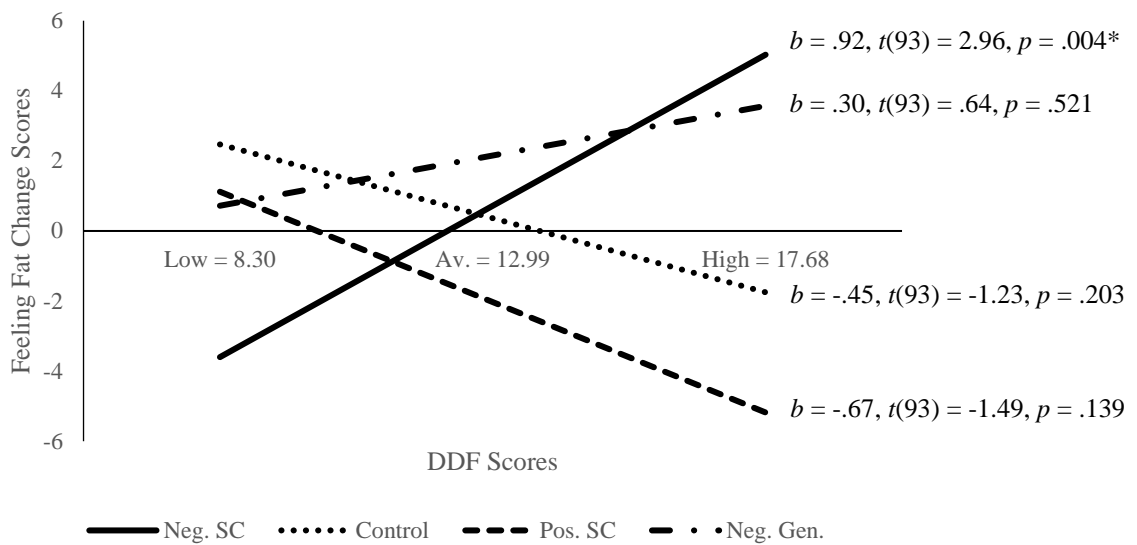effect of condition on feeling fat change scores.

DIF: The overall model, R^2=.09, $F(8,93)$=1.17, p=.324, was not significant. The only
significant difference in feeling fat change scores was between Neg.SC and the control condition (D_1),
and Neg.SC versus control condition by DIF scores (D_1 x DIF) was the only significant interaction.
Probing this interaction revealed that at high DIF scores, participants in the Neg.SC condition reported
significantly greater changes in feeling fat scores compared to the control condition, b=-6.61,
$t(93)$=2.02, p=.046, see Figure 3. There was also a significant difference in feeling fat change scores
between participants in the Neg.SC and Pos.SC conditions, b=-8.62, $t(93)$=-2.12, p=.037, at high DIF
scores. However, this specific interaction (i.e. Neg.SC versus Pos.SC by DIF; D_2 x DIF) was not
significant.

1 *Figure 3.* Visual representation for mean +/- 1*SD* difficulty identifying feelings (DIF) scores moderating the
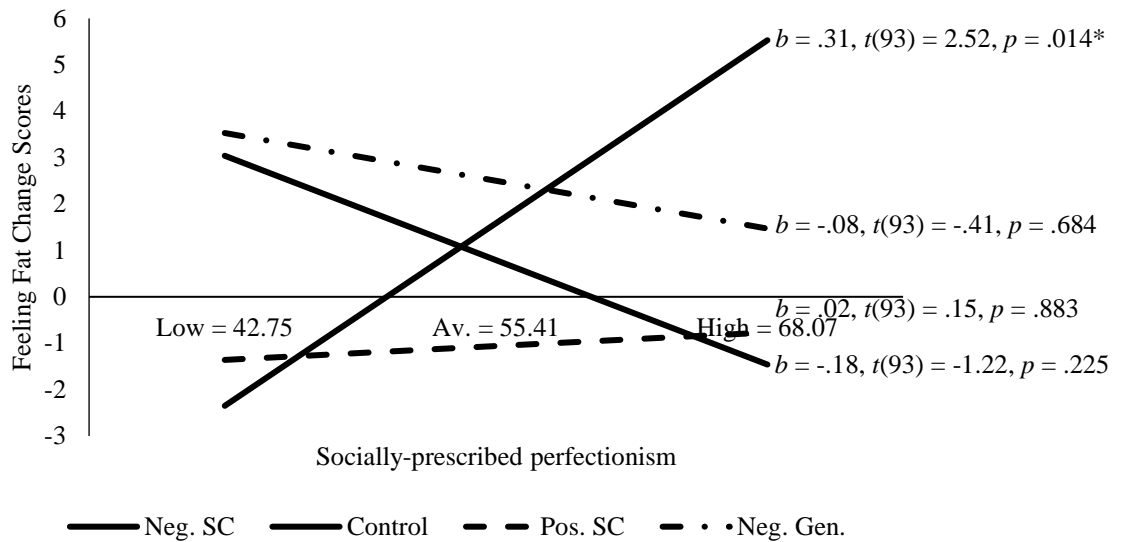2 effect of condition on feeling fat change scores.
3

4 **DDF:** The overall model, R^2=.14, $F(8,93)$=1.87, p=.074, was not significant, but there was a

5 significant difference in feeling fat change scores between Neg.SC and the control condition (D_1) and

6 the Pos.SC condition (D_2). When examining the specific interactions, the Neg.SC versus condition by

7 DDF scores (D_1 x DDF) and Neg.SC versus Pos.SC by DDF scores (D_2 x DDF) were significant.

8 Probing these interactions revealed that at high DDF scores, participants in the Neg.SC condition

9 reported significantly greater changes in feeling fat scores compared to the control condition, b=-6.79,

10 $t(93)$=-2.18, p=.032, and the Pos.SC condition, b=-10.21, $t(93)$=-2.68, p=.009 (see Figure 4).

11

13 *Figure 4.* Visual representation for mean +/- 1*SD* difficulty describing feelings (DDF) scores moderating the
14 effect of condition on feeling fat change scores.
15

16 **3.3.2. Socially-prescribed perfectionism**

17 The overall model was not significant, R^2=.10, $F(8,93)$=1.25, p=.279. The only significant

18 difference in feeling fat change scores was between Neg.SC and the control condition (D_1). Neg.SC

19 versus condition by socially-prescribed scores (D_1 x SP) was the only significant interaction, indicating

20 that at high socially-prescribed perfectionism scores, participants in the Neg.SC condition reported

21 significantly greater changes in feeling fat scores compared to the control condition, b=-7.00, $t(93)$=-

22 2.16, p=.033, see Figure 5.

23

Figure 5. Visual representation for mean +/- 1*SD* socially-prescribed perfectionism scores moderating the effect of condition on feeling fat change scores.

4. Discussion

The current study had three aims. Firstly, we examined the relationships between feeling fat, alexithymia, interoception, perfectionism, and physical appearance comparisons in females. In line with our predictions, a heightened tendency to feel fat was significantly correlated with an increased tendency to compare one's physical appearance with others and the belief that others expect a high level of perfectionism. Feeling fat was also associated with increased difficulty identifying and describing feelings (as well as total alexithymia scores), and trusting, noticing, and not worrying about bodily sensations. Secondly, we tested a novel experimental manipulation to induce the sensation of feeling fat through the use of social comparison vignettes. We found no significant effect of condition on changes in feeling fat. However, when we examined potential moderators of the effect of the manipulation on feeling fat, we found that individuals in the Neg.SC reported a significant increase in feeling fat scores compared to the control condition at both high levels of alexithymia and socially-prescribed perfectionism. This suggests alexithymia and socially-prescribed perfectionism moderated the effect of our social comparison manipulation on feeling fat.

Our correlation analyses are in line with the limited research available in this area (e.g. Mehak & Racine, 2019; Striegel-Moore et al., 1986). Individuals who experience difficulty identifying and describing their emotions may be vulnerable to misinterpreting negative affect (Harper-Giuffre & MacKenzie, 1992), perceiving it instead as a general sensation of feeling fat. This supports clinical findings suggesting that individuals with eating disorders have a tendency to say "*I feel fat*" rather than focusing on how they feel emotionally (Andersen, 2000). Furthermore, a greater tendency to feel fat was associated with a greater likelihood of noticing, worrying about, and not trusting bodily sensations.

17

1 This suggests individuals who feel fat may be at increased vulnerability to detecting negative affect in

2 a physical presentation because they are better at noticing their bodily sensations. However, they also

3 experience greater worry over, and cannot trust, what they are experiencing, which could further

4 exacerbate the tendency to feel fat. These findings complement those previously reported by Brown

5 and colleagues (2020) in their study of individuals with eating disorders.

6   In terms of the social comparison manipulation, feeling fat scores increased following the Neg.

7 SC and Neg.Gen conditions, and decreased in the Pos.SC condition. However, these effects were not

8 significant. This suggests that social comparison may only be a vulnerability factor for certain

9 individuals and other factors may be important. Subsequently, we therefore used moderation analysis

10 to probe the relationships between personality traits and feeling fat further, finding that alexithymia and

11 socially-prescribed perfectionism were significant moderators. At high levels of alexithymia,

12 participants in the Neg.SC condition reported significantly greater changes in feeling fat scores. This

13 suggests that when individuals are unable to process their emotions, such as identifying and describing

14 their emotions to other people (i.e. DIF and DDF), they are at greater risk of feeling fat. This could be

15 because they misinterpret negative sensations as physical sensations, which in turn are expressed as

16 feeling fat (Brown et al., 2020). We also found that at high levels of socially-prescribed perfectionism

17 (e.g. a greater tendency to believe that others expect perfection from you), participants reported

18 significantly greater changes in feeling fat scores in the negative versus no social comparison. Thus,

19 when negative comments on body shape/size are made in a social setting, individuals with high levels

20 of socially-prescribed perfectionism may feel they have let others down by not fulfilling a "perfect"

21 body, feeling fat as a result. Overall, our findings suggest that both alexithymia and socially-prescribed

22 perfectionism may increase a person's vulnerability to feeling fat.

23   It is important to understand the mechanisms underpinning feeling fat and the situations that

24 cause such feelings. Feeling fat is one aspect of body dissatisfaction – with the latter constituting a

25 major risk factor for eating disorders and disordered eating behaviours (Stice, 2002). Therefore, our

26 research has important clinical applications, and our novel manipulation provides researchers with a

27 method of experimentally examining the causal relationships between social comparison and feeling fat

28 further. Additionally, Durkin & Paxton (2002) found that feeling fat scores were the most consistent

29 predictor of changes in body dissatisfaction after viewing images of "thin-deals" in adolescent children.

30 Hence, examining the factors which increase an individual's vulnerability to feeling fat may help to

31 develop interventions to positively support and increase body satisfaction. Current findings highlight

32 the importance of being able to successfully process emotions, indicating that interventions aimed at

33 improving an individual's ability to identify and describe emotions may help reduce the 'default' of

34 feeling fat. Cognitive behavioural therapy (CBT) currently targets the concept of feeling fat and

35 identifying emotions which may trigger such feelings (Andersen, 2000; Fairburn & Beglin, 2008). In

36 addition, our correlational analysis revealed that the tendency to feel fat was significantly associated

37 with a greater tendency to notice bodily sensations, but lower ability to trust and not worry about the

1   sensations being experienced. To our knowledge, no other study has documented this relationship.
2   Consequently, even though both feeling fat and trusting bodily sensations have been individually
3   associated with eating disorders (Brown et al., 2020; Cooper et al., 2007; Fairburn & Beglin, 2008), we
4   show here that the two constructs are also related within a healthy population and are important to
5   consider. Being able to identify individuals who experience high levels of feeling fat and do not trust
6   their bodily sensations is important. Identifying at risk individuals in a timely manner allows for early
7   interventions to be implemented, which could then reduce risk of future eating disorders developing.
8   For example, increasing an individual's ability to accurately identify and interpret bodily sensations
9   would allow individuals to be more in tune with their body and less likely to experience the sensation
10 of feeling fat. Possible interventions include the use of mindfulness and meditation practices (Fischer,
11 Messner, & Pollatos, 2017; Weng, Feldman, Leggio, Napadow, Park, & Price, 2021). Even so, future
12 research should also seek to further elucidate the relationship between the beliefs individual's hold
13 about their bodily sensations and their tendency to feel fat.

14   As with all research, the current study is not without limitations. Firstly, our female sample
15 means that findings cannot be generalised to males. Females were selected because evidence suggests
16 that females have a greater tendency to feel fat (Mehak & Racine, 2019) and to experience body
17 dissatisfaction (Sheldon, 2010). However, feeling fat significantly explains variance in eating pathology
18 above and beyond over-evaluation of shape and weight, and dysphoria in both sexes (Mehak & Racine,
19 2019). Feeling fat has also been associated with lower self-esteem in males (Olivardia, Pope, Iii, &
20 Cohane, 2004). Therefore, even if feeling fat is less prevalent in males, it still warrants investigation.
21 Future research should examine feeling fat in males, as well as in non-binary and transgender
22 individuals. Second, G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) post-hoc calculations reveals
23 there is 55% power to detect differences across conditions in changes to feeling fat scores whilst
24 controlling for BMI. Therefore, a larger study is required to further test and examine the effectiveness
25 of the social comparison manipulation. Third, concerns about factorial validity of the feeling fat
26 subscale of the BAQ have been raised. Fuller-Tyszkiewicz and colleagues (2012) argued that it may be
27 better to conceptualise feeling fat as a bi-dimensional construct consisting of two facets - general and
28 clothing-specific. However, the original factor structure of the BAQ has been replicated many times
29 (e.g. Hartley, Hill, Bailey, Fuller-Tyszkiewicz, & Skouteris, 2018; Mulgrew, Kannis-Dymand, Hughes,
30 Carter, & Kaye, 2019) and the feeling fat subscale demosntrated high levels of internal consistency in
31 the current study. Even so, future studies may wish to re-examine the dimensionality of the FF subscale
32 and conceptualise it differently, although the adoption of the original uni-dimensional model seems
33 appropriate here. Finally, since conceptualising this study, a revised version of the MAIA has been
34 published in an attempt to address reports of sub-optimal levels of internal consistency for two of its
35 subscales - not distracting and not worrying (Mehling et al., 2018). Nevertheless, as the composition
36 and number of items in the trusting subscale is the same across both versions of the scale, adoption of
37 the original versus revised versions of the scale would have no impact on our core findings.

1   In conclusion, we found that changes in feeling fat scores did not significantly differ after a

2 novel social comparison manipulation to induce the sensations of feeling fat. This suggests that making

3 social comparisons to others is not a vulnerability factor for all individuals and that individual

4 differences also play a role. Specifically, we found that females who experience difficulty identifying

5 and describing their emotions, and/or perceive an external pressure from others to be perfect, are more

6 vulnerable to feeling fat when exposed to a negative social comparison (compared to a control and

7 positive social comparison). We also provide support for an important role of interoceptive ability in

8 feeling fat outside of the eating disorder literature. We hope that the novel findings presented here will

9 generate increased attention to the theoretical and clinically important construct of feeling fat.

10

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