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The psychosocial experience of feeling overweight promotes increased snack food consumption in women but not men

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ABSTRACT

Self-identification of being overweight has been associated with overeating and weight gain in observational studies, irrespective of whether the individual in question is objectively overweight. The aims of the present studies were to examine whether experimentally manipulating the psychosocial experience of feeling overweight impacted on snack food consumption and to identify mechanisms explaining this effect. In Study 1, to manipulate the psychosocial experience of feeling overweight, 120 women wore an obese body suit or control clothing in public or private settings, before consuming snack foods. Wearing the obese body suit resulted in an increase in snack food consumption and this effect was not moderated by whether participants wore the obese body suit in public or in private. In Study 2, we aimed to replicate the effect of the obese body suit on snack food consumption and also examined whether the effect of the body suit on eating behaviour was moderated by participant sex (n = 150; 80 women). Women who wore the obese body suit ate significantly more than women who wore the control clothing, but this effect was not observed in men. Across both studies we examined a number of potential mechanisms that could explain the effect that wearing the obese body suit had on snack food consumption, but did not find supporting evidence. The psychosocial experience of feeling overweight may lead to increased snack food consumption in women, but the psychological mechanism explaining this effect is unclear.

1. Introduction

Weight stigma is defined as the social devaluation of people who are perceived as carrying excess weight (Tomiyama, 2014). Weight stigma is pervasive and has been documented in both institutional (e.g. organisational culture of negative attitudes) and interpersonal (e.g. name calling) settings (Puhl, Andreyeva, & Brownell, 2008) in occupational, educational, healthcare and personal contexts (Puhl & Brownell, 2006; Puhl & Heuer, 2009). Weight stigma is also evident in the mass media (Greenberg, Eastin, Hofschire, Lachlan, & Brownell, 2003; Heuer, McClure, & Puhl, 2011; Patterson & Hilton, 2013).

Pervasive weight stigma is likely to make identifying as being overweight or obese an unpleasant experience. For example, regardless of objective weight, individuals who self-perceive their weight status as being overweight experience increased levels of psychological distress compared to those who do not (Atlantis & Ball, 2008). Furthermore, self-identification of overweight (as opposed to normal weight) has been shown to be associated with stress-induced overeating and weight gain in three large scale studies of UK and US participants (Robinson, Hunger, & Daly, 2015). The association between self-identification of overweight and weight gain occurred whether personal perception of overweight was accurate or inaccurate (Robinson et al., 2015). This and other studies (Duong & Roberts, 2014; Sutin & Terracciano, 2015) suggest that the psychosocial experience of self-identifying as being overweight is associated with worse weight management. Yet, an important caveat of these studies is that they are observational in nature, so the causal influence that self-identifying as being overweight has on behaviour cannot be inferred.

Manipulating the psychosocial experience of self-identifying as being overweight or obese and examining its effect on behaviour is therefore required to understand the causal role that identifying as being overweight has on weight related behaviours. In a novel study, researchers examined the effects of experimentally manipulating apparent weight status in order to examine how the psychosocial experience of feeling overweight impacted on eating behaviour (Incollingo Rodriguez, Heldreth, & Tomiyama, 2016). Participants wore an obese body suit or control clothing and performed a task that required them to walk around a busy University campus, before being given access to calorie dense snack foods and sugar sweetened beverages. Those who wore the obese body suit experienced greater

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negative affect, ate more of calorie dense snack foods and drank more of a sugar sweetened beverage than participants who wore control clothing (Incollingo Rodriguez et al., 2016). This study suggests that the psychosocial experience of feeling overweight can result in increased calorie consumption.

Heightened concerns about appearance or fear of negative appraisal could explain why identifying as overweight could impact on eating behaviour. Individuals with overweight and obesity are likely to experience weight-based social identity threat (Major & O'Brien, 2005; Shapiro & Neuberg, 2007) a psychological state in which an individual is worried about others making negative judgements about them because of their weight (Hunger, Major, Blodorn, & Miller, 2015). Major, Hunger, Bunyan, and Miller (2013) found that after reading a weight stigmatising article, women who self-identified as being overweight ate more than women who were exposed to a neutral article. However, a weight stigmatising article, relative to a neutral one, did not lead to increased calorie consumption in women who self-identified as being of healthy weight (Major et al., 2013). Likewise Inzlicht and Kang (2010) found that women consumed more of a calorie dense snack food when they were given no strategies to cope with social identity threat than when they were given techniques aimed at reappraising threats. These studies suggest that the experience of feeling overweight or obese could increase fear of negative evaluation and this could in turn lead to increased consumption.

Negative affect could explain the link between the experience of feeling overweight and eating behaviour (Tomiyama, 2014). Due to high levels of weight stigma (Puhl & Heuer, 2009), identifying as overweight or obese is associated with reduced self-acceptance (Carr & Friedman, 2005) and could increase negative affect. Self-identification of overweight has been associated with increased depressive symptoms (Roberts & Duong, 2013) and there is a wealth of literature which suggests that negative affect can result in increased calorie consumption (Agras & Telch, 1998; Jansen et al., 2008; Schotte, Cools, & McNally, 1990). For example, Chua, Touyz, and Hill (2004) experimentally manipulated affect by having participants watch either a sad or neutral film and examined the effect this had on chocolate consumption. Participants who watched the sad film experienced greater negative affect and consumed significantly more chocolate than participants who watched a neutral film (Chua et al., 2004).

Finally, another factor that could explain the link between the psychosocial experience of overweight and eating behaviour is stereotype consistent behaviour. There is some evidence that identifying as a member of a stigmatised group can lead people to act in a way that is consistent with the stereotypes held about that group (Ku, Wang, & Galinsky, 2010). For example, when asked to take on the perspective of an elderly individual people walked more slowly (Ku et al., 2010). As a common stereotype about individuals with obesity is that they overeat (Brochu & Esses, 2011) it is possible that implicitly or explicitly self-identifying as being overweight may result in individuals overeating because of stereotype consistent behaviour.

Across two experimental studies we aimed to replicate the effect that experimentally manipulating the experience of feeling overweight has on snack food consumption (Incollingo Rodriguez et al., 2016) and examine the psychological mechanisms explaining why the psychosocial experience of feeling overweight promotes overeating. In Study 1, we experimentally manipulated the experience of feeling overweight by assigning female participants to wear either a body suit that made them appear obese, or control clothing. Moreover, to examine the explanation that feeling overweight may affect snack food consumption due to heightened fear of negative appraisal from others (Major & O'Brien, 2005; Shapiro & Neuberg, 2007) we manipulated whether participants wore the obese body suit in private or public settings before they were provided with snack foods. We hypothesised that participants who wore the obese body suit would eat significantly more than participants who wore the control clothing. We also hypothesised that this effect would be stronger for participants who completed a task in a public setting, as they would experience greater anticipated stigma and more concerns about their appearance than those in the control condition. We also examined whether changes in affect, self-presentation concerns or the extent to which an individual implicitly associated with feeling overweight mediated the effect of the obese body suit on snack food consumption. In Study 2, we examined whether gender moderated the effect of the obese body suit on snack food consumption and examined a number of other potential mechanisms. We also examined whether psychological 'trait' factors which have been shown to affect consumption in previous studies such as body satisfaction (Cash, Skinner, Rotter, & Bandura, 2012), dietary restraint (Schotte et al., 1990) or emotional regulation (Evers, Stok, & de Ridder, 2010) moderated the effect of the obese body suit on snack food consumption.

2. Study 1

2.1. Method

2.1.1. Participants

One hundred and twenty-three women were recruited; 3 participants withdrew during the study. Participants were recruited predominantly through a research participation system, in which undergraduate first year psychology students participate in experiments in return for course credit. Participants were also recruited through campus advertisements in return for a small monetary reimbursement. The advertisements stated that participants were being invited to take part in a short study examining the effect of physical characteristics on time and taste perception. The eligibility criteria for participation were: women aged 18 or over with no history of food allergies or eating disorders. We asked participants to refrain from eating for 2 h before the study in an attempt to ensure baseline hunger was balanced across groups. The final sample had an age range of 18–46 years (M = 19.97, SD = 3.77). The sample's mean Body Mass Index (BMI) was 22.40 (SD = 2.90, Range = 16.59–30.62), calculated from objectively measured weight/height^2. We aimed to recruit 120 participants so that we would have 30 participants per cell of the experiment and this provided us with sufficient power (power = 80%, p = .05) to detect the previously reported main effect of the obese body suit on snack food consumption (Incollingo Rodriguez et al., 2016) and a medium to large sized interaction between the clothing condition and setting.

2.1.2. Measures

Affect: Affect was measured with 6 questions asking participants to rate how happy, sad, stressed, irritated, relaxed and angry they felt on a 100 point visual analogue scale (VAS) with anchors of 'not at all' and 'extremely'. Items relating to negative affect (sad, stressed, irritated and angry; Cronbach's alpha = .814) were averaged to provide a negative affect score and positive items were averaged (happy and relaxed; Cronbach's alpha = .614) to calculate a positive affect score.

Hunger: Baseline hunger was measured on a 100 point VAS with anchors of 'not at all' and 'extremely'.

Implicit Association Task (IAT): We included an IAT in order to examine whether wearing the obese body suit resulted in participants implicitly viewing themselves as being overweight. The IAT task used in this study was adapted from a previous study (Kawakami et al., 2014) and included 8 words pertaining to 'self' (e.g. I, myself), 'others' (e.g. them, theirs), 'overweight' (e.g. fat, chubby) and 'not overweight' (e.g. thin, skinny). The underlying premise of the IAT task is that an individual will be faster at pairing concepts that are conceptually associated than concepts that are unrelated (Greenwald, Nosek, & Banaji, 2003). For example, if a person associated the self with being overweight, they would be faster to pair self and overweight words than self and slim words. Participants took part in 2 practice blocks of 8 trials where they simply had to sort 'self' and 'others' or 'overweight' and 'not overweight' words to the left and right. Participants then engaged in a further two practice blocks of 16 trials where 'self' and 'overweight'

Fig. 1. Clothing women wore in the obese body suit (top) and control (bottom) conditions in Studies 1 and 2.

words were sorted to the left hand side of the screen and 'other' and 'not overweight' words were sorted to the right hand side of the screen. Thereafter participants took part in a 64 trial critical block where the set up was the same. Following the critical block, 'self' and 'not overweight' words were paired on the left hand side of the screen and 'others' and 'overweight' were sorted to the right hand side of the screen. Participants completed two practice blocks of 16 trials before they completed the 64 trial critical block. The order of blocks was counterbalanced across participants. If the participant made a correct response, a blank screen was presented for 400 ms before the next trial. If the participant made an incorrect response, a red X was displayed for 400 ms before another blank screen was presented for 400 ms before the next trial. D scores were computed using the improved algorithm outlined in Greenwald et al. (2003). Trials in which participants made errors were eliminated and replaced with the block mean latency plus a penalty of 600 ms.

Self-Presentation Concerns: A self-presentation concerns questionnaire was based on a previous study (Incollingo Rodriguez et al., 2016). Participants were asked to respond to 5 questions that asked about their experience whilst wearing the study clothing (e.g. "I felt like people were making negative judgements about me" and "I felt rejected") on a 5 point Likert scale with responses from "strongly disagree" to "strongly agree" (Cronbach's alpha = .877). As in Incollingo Rodriguez et al. (2016), the items were averaged to produce a single score.

Trait Body Satisfaction[1]: The 7 item body satisfaction scale was used to measure trait body satisfaction (Slade, Dewey, Newton, Brodie, & Kiemle, 1990). Participants were asked to rate how satisfied they were with specific body parts (e.g. arms) on a 7 point Likert scale, ranging from "very dissatisfied" to "very satisfied" (Cronbach's alpha = .650).

Trait Dietary Restraint: Dietary restraint was assessed using the English version of the Dutch Eating Behaviour Questionnaire (DEBQ) (Van Strien, Bergers, & Defares, 1986). The dietary restraint scale consists of ten items (e.g. "Do you try to eat less at mealtimes than you would like to eat?"), which are scored on a five point scale from "never" to "very often" (Cronbach's alpha = .916).

[1] In order to improve statistical power for the moderation analyses, body satisfaction and dietary restraint scores were merged across Studies 1 and 2 and the pertaining analyses are reported in the additional analyses section.

Bogus Taste Test: Participants were provided with two bowls containing 151 g of chocolate digestive biscuits and 151 g of Maryland cookies, along with a taste perception questionnaire. They were told that they could eat as much or as little from the two bowls as they liked but that they would need to try at least a piece of each cookie in order to complete the questionnaire. The taste perception questionnaire asked participants to compare the two cookies on a series of sensory properties (e.g. "which cookie was crunchiest"). This rating task was included to distract participants from the study aims. Participants were left with the food for 10 min. The bowls were weighed before and after participants completed the taste perception task and snack food consumption was recorded. The bogus taste test has been validated as a measure of food consumption (Robinson et al., 2017).

2.1.3. Procedure

Upon arrival, the researcher verbally checked with participants that they had no allergies and that they had not eaten for 2 h prior to the study. In order to disguise the true research aims, participants were told that the study was concerned with how physical appearance impacted on perception. After giving informed consent, participants completed baseline affect and hunger measures. Participants were randomly allocated (via an online random number generator) to one of four conditions (obese body suit public, obese body suit private, control public, control private). Participants in the obese body suit conditions were asked to wear a body prosthetic designed to make them appear obese with standard clothing over the top. Whereas participants in the control clothing conditions were shown the standard clothing (identical to that worn in the obese body suit condition) and were asked to select a clothing size that would fit best over their own clothes from the range available (UK size 8–18) (see Fig. 1). Participants changed and were then positioned in front of a full length mirror whilst the obese body suit/clothing was adjusted by the researcher. To further distract participants from the study aims, all participants were then told about a fictitious condition in which participants were asked to wear facial prosthetics. Because the body suit weighed approximately 1 kg, participants were also asked to wear a backpack; in the obese body suit condition this was empty and in the control condition the bag contained a 1 kg weight.

Participants were told that their first task was to identify pieces of coloured paper hidden in the laboratory or around the building in

which the laboratory was based. Participants in the public condition were then given a route to follow which involved walking around a busy university building. The participants in the private condition completed the same task in an empty lab. Participants were then asked to record the number of pieces of paper they noticed and made judgements about how long they felt the task lasted (in order to strengthen the cover story). Participants then completed the affect measures. After this, participants completed the bogus taste test. Participants were then asked to complete the IAT before the measures of body dissatisfaction, dietary restraint and self-presentation concerns. Finally, participants were asked to estimate how many people they saw when wearing the study clothing, as a manipulation check of the public vs. private manipulation. Participants were then asked to guess the aims of the study, they removed the study clothing, their height and weight was measured by the researcher and they were debriefed.

2.2. Analysis

We planned a 2 × 2 between subjects ANOVA with study clothing (obese body suit, control clothing) and setting (public, private) as the independent variables and snack food consumption (g) as the dependent variable. Bonferroni corrected t tests comparing snack food consumption between the obese body suit and control conditions in public and private settings seperately were planned in case of a significant interaction between study clothing and setting. Two sensitivity analyses were planned where the primary analysis was re-examined when participants who were identified as outliers on snack food consumption or participants who guessed the aims were removed. Outliers were determined using a decision criterion of 0.003 [determined by $1 - \alpha/(2n)$ (Cousineau, 2011)], resulting in any participants with a z score of $= > 2.807$ being classed as outliers. In order to determine which participants had guessed the aims, two independent researchers coded participant responses. In order to be excluded participants had to explicitly link the study clothing with how much they ate during the taste test. Cases of disagreement were reconciled by a third researcher.

We also planned a series of secondary analyses to examine whether negative affect, positive affect, self-presentation concerns and the extent to which participants associated with being overweight (measured by the IAT) mediated the effect of clothing condition on snack food consumption. Two 2 × 2 between subjects ANOVAs were planned to examine the effect of the clothing and task setting on self-presentation concerns and IAT scores. As negative and positive affect were measured pre and post clothing manipulation, two mixed 2 × 2 × 2 ANOVAs were planned with clothing and setting as the between subjects variables and time point of measurement (pre and post study clothing) as the within subjects factor. We next planned to conduct correlational (Pearson's r) analysis to examine whether any of our potential mediators were associated with snack food consumption. If they were, we planned to conduct bootstrapped PROCESS mediation analyses (Hayes, 2013) in order to examine whether negative affect, positive affect, self-presentation concerns and/or IAT scores mediated the relationship between wearing the obese body suit and increased snack food consumption.

2.3. Results

See Table 1 for participant characteristics according to condition.

2.3.1. The effect of the obese body suit and setting on food consumption

There was a significant main effect of study clothing on snack food consumption [F (1, 116) = 4.87, p = .029, η_p^2 = 0.04], whereby participants ate more when wearing the obese body suit than when wearing the control clothing. Setting did not significantly impact on consumption [F (1, 116) = 0.54, p = .464, η_p^2 = 0.01] and the interaction between clothing and setting was not significant [F (1, 116) = 0.89, p = .347, η_p^2 = 0.01]. The pattern of results remained the same when controlling for participant BMI.[2] See Table 2 for condition means and standard deviations.

Table 1
Participant characteristics according to condition (M ± SD).

	Obese Body Suit		Control Clothing	
	Public	Private	Public	Private
Age (years)	20.73 (5.45)	19.43 (2.46)	19.50 (2.53)	20.20 (3.88)
BMI	23.32 (3.14)	22.44 (2.72)	22.52 (2.67)	21.31 (2.78)
Baseline Negative Affect[a]	11.46 (11.65)	13.98 (13.36)	13.44 (18.34)	13.05 (12.61)
Baseline Positive Affect[a]	62.87 (15.57)	56.47 (16.35)	62.50 (19.55)	58.05 (20.08)
Baseline Hunger[a]	46.77 (25.71)	40.17 (25.23)	51.17 (20.85)	43.60 (21.99)

[a] Negative affect, positive affect and hunger were measured on 100 point VAS where 1 represented “not at all” and 100 represented “extremely”.

Table 2
Snack food consumption (g) per condition. Values are M (± SD).

	Obese Body Suit (N = 60)		Control Clothing (N = 60)	
	Public (N = 30)	Private (N = 30)	Public (N = 30)	Private (N = 30)
Snack Food Consumption (grams)	45.79 (29.97)	38.64 (22.64)	32.38 (19.61)	33.26 (19.55)

2.3.2. Sensitivity analyses

Sensitivity analyses were conducted in which we repeated the main analysis when participants who guessed the aims or were outliers in terms of their consumption were excluded. The pattern of results was consistent, whereby participants in the body suit conditions tended to eat more than those in the control conditions. However, the main effect of study clothing did not reach statistical significance in these analyses with fewer participants. Please see the supplementary materials for detailed results.

2.3.3. Change in negative affect

In order to examine whether wearing the obese body suit resulted in greater negative affect a 2 × 2 × 2 mixed measures ANOVA was conducted; there was a significant interaction between clothing condition and time point [F (1, 116) = 9.82, p = .002, η_p^2 = 0.08], whereby there was no significant difference in negative affect at baseline between the obese body suit (M = 12.72, SD = 12.49) and control (M = 13.25, SD = 15.60) conditions [t (118) = −0.21, p = .999, d = 0.03], but participants who wore the obese body suit (M = 16.28, SD = 11.67) exhibited significantly greater negative affect than control participants (M = 11.06, SD = 10.69) post task [t (118) = 2.56, p = .024, d = 0.51]. The interactions between setting and time point [F (1, 116) = 1.56, p = .214, η_p^2 = 0.01] and time point, setting and clothing condition [F (1, 116) = 0.18, p = .670, η_p^2 < 0.01] were not significant.

2.3.4. Change in positive affect

A 2 × 2 × 2 mixed measures ANOVA showed that there was a significant interaction between clothing condition and time point [F (1,

[2] The results remained consistent when controlling for BMI, whereby participants ate more when wearing the obese body suit than when wearing the control clothing (p = .030). Setting did not affect consumption (p = .455) and the interaction between clothing and setting (p = .352) was not significant.

116) = 11.62, p = .001, η_p^2 = 0.09], whereby there was no significant difference in positive affect at baseline between the obese body suit (M = 59.67, SD = 16.15) and control (M = 60.28, SD = 19.78) conditions [t (118) = −0.19, p = .999, d = 0.03], but participants who wore the obese body suit (M = 47.26, SD = 18.17) exhibited significantly less positive affect than control participants (M = 58.77, SD = 20.14) post task [t (118) = −3.29, p = .002, d = 0.60]. The interactions between setting and time point [F (1, 116) = 0.73, p = .394, η_p^2 = 0.01] and time point, setting and clothing condition [F (1, 116) = 1.12, p = .292, η_p^2 = 0.01] were not significant.

2.3.5. Self-presentation concerns

A 2 × 2 ANOVA showed that there was a significant main effect of clothing on self-presentation concerns [F (1, 118) = 17.95, p < .001, η_p^2 = 0.13], whereby participants who wore the obese body suit (M = 3.15, SD = 0.85) reported greater self-presentation concerns than participants who wore the control clothing (M = 2.53, SD = 0.95). Furthermore there was a significant main effect of setting [F (1, 118) = 29.32, p < .001, η_p^2 = 0.20], whereby those who completed a task in public (M = 3.24, SD = 0.77) reported greater self-presentation concerns than those who completed the same task in private (M = 2.44, SD = 0.95). There was no significant interaction between setting and clothing condition on self-presentation concerns [F (1, 118) = 1.55, p = .215, η_p^2 = 0.01].

2.3.6. IAT

No participants had more than 10% of errors or latencies below 300 ms so no participants were excluded. A 2 × 2 ANOVA showed that the main effects of clothing [F (1, 118) = 0.39, p = .532, η_p^2 < 0.01] and setting [F (1, 118) = 0.08, p = .780, η_p^2 < 0.01] and the interaction between clothing and setting [F (1, 118) = 0.08, p = .780, η_p^2 < 0.01] were not significant.

2.3.7. Mediation analysis

As the clothing condition did not affect the IAT scores, the conditions for examining implicit perception of overweight as a mediator were not met. The clothing condition significantly affected negative affect, positive affect and self-presentation concerns. As such, we examined whether these factors were associated with snack food consumption in order to determine whether the conditions for mediation were met. Neither self-presentation concerns [r (120) = 0.04, p = .672], negative affect change (e.g. post task negative affect minus baseline negative affect) [r (120) = 0.14, p = .143] nor positive affect change [r (120) = 0.02, p = .872] were associated with snack food consumption. Thus, the conditions for tests of formal mediation were not met.

2.4. Conclusion

Wearing an obese body suit resulted in women consuming significantly more snack food than those who wore the control clothing, and this effect was not moderated by whether the obese body suit was worn in private or public. These findings support those of a previous study (Incollingo Rodriguez et al., 2016) and suggest that the psychosocial experience of feeling overweight can lead young women to increase their snack food consumption. Whilst wearing the obese body suit resulted in reduced positive affect, greater negative affect and greater self-presentation concerns, these variables did not mediate the relationship between clothing condition and snack food consumption. Furthermore, we expected participants in the obese body suit condition to implicitly associate themselves with being overweight more than those in the control condition, but we did not find evidence in support of this. It is possible that the body suit manipulation was not strong enough to change implicit beliefs about the self, but could have changed explicit perception of weight; a hypothesis we tested in Study 2.

3. Study 2

Study 1 focused on an exclusively female sample and it is possible that there may be gender differences in responses to wearing the obese body suit. There are greater pressures to be thin among women than men (Spitzer, Henderson, & Zivian, 1999) and women with overweight and obesity face greater stigmatization than men with overweight and obesity (Puhl et al., 2008; Roehling & Pichler, 2017). One study examined the differential effects of gender on weight-related social identity threat (Blodorn, Major, Hunger, & Miller, 2016). Participants with overweight or obesity were asked to record either an audiotaped (weight not seen) or a videotaped (weight seen) dating video. Women who believed their weight would be seen were more likely to experience higher rejection expectations, anxiety and self-consciousness and lower self-esteem than women who believed their weight would not be seen. However, in men, rejection expectations, anxiety, self-esteem and self-consciousness did not differ between conditions when weight was seen or unseen (Blodorn et al., 2016). This suggests that gender could moderate how an individual responds to the experience of feeling overweight. For example, women may be more likely to overeat than men in response to feeling overweight, because of increased negative affect, heightened rejection expectations, or concerns over negative appraisal. As such, Study 2 examined whether gender moderated the effect of the obese body suit on consumption. Furthermore, as the potential mediators examined in Study 1 did not explain the increase in snack food consumption in participants who wore the obese body suit, Study 2 examined some of these mediators in more detail. Affect was measured in Study 1 using a short form measure, so in Study 2 a more comprehensive measure was used (Watson & Clark, 1988). Similarly, given that in Study 1 we found no evidence that the obese body suit resulted in participants implicitly associating themselves as being 'overweight', in Study 2 we examined whether the obese body suit resulted in participants explicitly identifying as being overweight.

Other possible mechanisms were also examined. Self-control is a factor that could explain the association between the psychosocial experience of feeling overweight and increased snack food consumption. Study 1 demonstrated that individuals who wore the obese body suit were more likely to feel rejected, and experiencing rejection can decrease self-control (Baumeister, Dewall, Ciarocco, & Twenge, 2005). Previous research suggests that being in a state of weight-based social identity threat is cognitively demanding and can lead to decreases in self-control (Major, Eliezer, & Rieck, 2012) which could reduce the likelihood of resisting tempting foods. As such, Study 2 examined whether two measures of self-control (inhibitory control and effortful self-control) mediated the relationship between wearing the obese body suit and snack food consumption.

Negative body image, low self-esteem and/or body anxiety could also mediate the relationship between the experience of feeling overweight and eating behaviour. A meta-analysis showed that perceived overweight was a better predictor of body dissatisfaction and low self-esteem than actual overweight (Miller & Downey, 1999). In turn, low self-esteem (Ackard, Neumark-Sztainer, Story, & Perry, 2003; Martyn-Nemeth, Penckofer, Gulanick, Velsor-Friedrich, & Bryant, 2009), appearance related anxiety (Haase & Prapavessis, 2017; Tiggemann, Kuring, Tiggemann, & Kuring, 2004) and having higher body satisfaction concerns (Matos, Aranha, Faria, Ferreira, & Teresa, 2002) are associated with maladaptive eating behaviours. Thus, in Study 2 we examined whether state self-esteem or body anxiety mediated the effect of the obese body suit on consumption. Finally, given that a minority of participants appeared to be aware of the study aims in Study 1, in Study 2 we attempted to make the cover story more convincing by leading participants to believe that the bogus taste test was randomly allocated from a series of other tasks. We presumed that if participants thought that the eating task was one option in a range of other tasks they would be less likely to become aware of the study aims.

We hypothesised that women who wore the obese body suit would

Fig. 2. Clothing men wore in the obese body suit (top) and control (bottom) conditions in Study 2.

eat more than women who wore the control clothing, but that this effect may be smaller in men as women may be more reactive to anticipated weight stigma than men (Blodorn et al., 2016). We also examined whether self-control, body concerns, self-esteem, affect and the extent to which participants felt overweight explained the effect of the obese body suit on snack food consumption.

3.1. Method

3.1.1. Participants

One hundred and fifty participants (80 women and 70 men) took part in a laboratory study. Participants were recruited as in Study 1 with the same inclusion criteria and were given the same instructions. The sample had an age range of 18–30 years (M = 20.13, SD = 2.56) and a mean BMI of 23.32 (SD = 3.37, Range = 16.84–34.26) calculated from objectively measured weight/height^2. A power calculation was used to determine sample size in order to be powered to detect medium sized main and interaction effects (based on the effect sizes in Incollingo Rodriguez et al., 2016 and Study 1) at 80% power. We recruited slightly above the required sample size to account for having to exclude any participants.

3.1.2. Measures

Effortful Self-Control; Participants were asked to clasp a piece of paper in between the clamp of a handgrip and were instructed to hold the handgrip for as long as they could. Participants were timed until their grip loosened enough for the paper to fall. The hand grip task has been used as a measure of effortful self-control as the person completing the task must override their impulse to loosen their grip to reduce the muscular ache experienced when clamping the handgrip shut (Vohs, Baumeister, & Ciarocco, 2005).

Inhibitory Control; Two Stroop tasks were used in this study, both containing the words “blue”, “yellow”, “red” and “green” each repeated 20 times in coloured ink incongruent to the word written. In the Stroop task, the participant is asked to read the ink colour rather than the word that is written. The semantic meaning of words holds more value than the colour of the words so the participant has to override their instinct to read the word meaning rather than the ink colour. The Stroop task is a widely used measure of inhibitory control (Inzlicht & Gutsell, 2007).

Body Anxiety; The Physical Appearance State Anxiety Scale (PASTAS) (Reed & Thompson, 1991) was used to examine body anxiety. The scale consists of 16 body parts (e.g. thighs) and asks participants to rate how anxious, tense or nervous they feel about that body part right now on a scale of “not at all” to “exceptionally so” on a 5 point Likert scale (Cronbach's alpha = .879).

State Self Esteem; The appearance subscale of the State Self Esteem Scale (Heatherton & Polivy, 1991) consists of six questions which examine an individual's physical self-esteem (e.g. “I am pleased with my appearance right now”) and is scored on a 5 point Likert scale where 1 represents “not at all” and 5 represents “extremely” (Cronbach's alpha = .868).

Affect; The Positive and Negative Affect Scale (PANAS) (Watson & Clark, 1988) consists of 10 positively (Cronbach's alpha = .896) and 10 negatively (Cronbach's alpha = .744) valanced emotions and participants are asked to indicate the extent to which they feel each emotion on a 5 point Likert scale of “very slightly or not at all” to “extremely”.

Emotional Regulation; The Emotional Regulation Questionnaire (Gross & John, 2003) is a 10 item questionnaire which measures ability to suppress emotional responses (expressive suppression; Cronbach's alpha = .742) and reappraise situations to think of them in a more positive way (cognitive reappraisal; Cronbach's alpha = .839). The questionnaire is scored on a 7 point Likert scale (strongly disagree - strongly agree).

Explicit Perception of Overweight; Participants responded to three questions (Cronbach's alpha = .909) that asked if they felt larger than usual, heavier than usual and overweight during the study on a 7 point Likert scale (strongly disagree – strongly agree). Participant responses on the three items were averaged.

For Trait Dietary Restraint (Cronbach's alpha = .910), *Body Satisfaction* (Cronbach's alpha = .730), *Self-Presentation Concerns* (Cronbach's alpha = .897) *and Taste Test;* the same measures were used as in Study 1.

3.1.3. Procedure

Participants gave informed consent before completing baseline measures of trait dietary restraint, body satisfaction, emotional regulation, affect, effortful self-control and inhibitory control. Participants were then asked to wear the clothing as in Study 1 (see Figs. 1 and 2). Participants then selected their first 'random task'. Participants were asked to select a slip of paper from a box containing five slips in order to determine which task they would complete. In reality all of the slips were identical. Participants then completed the same public task as in Study 1. Participants returned to the lab and filled in a short questionnaire asking how many pieces of paper they noticed and how long they thought the task took in order to strengthen the cover story. Participants then completed the measures of affect, self-esteem, body anxiety, effortful self-control and inhibitory control. Participants were next asked to select their second "random task", though in actuality all participants selected the taste test. They were left alone for 10 min and asked to complete the same taste perception questions as in Study 1. Finally, to further bolster the cover story participants were asked to complete a time perception questionnaire before being asked to guess the aims of the study, completing the measures of self-presentation concern and the explicit perception of overweight measure. Participants then removed the study clothing. Height and weight were measured and participants were debriefed.

3.2. Analysis

A 2 × 2 between subjects ANOVA was planned with gender (man or woman) and clothing (obese body suit or control) as the IVs and snack food consumption (grams) as the dependent variable. Bonferroni corrected *t* tests comparing snack food consumption between the obese body suit and control conditions for men and women seperately were planned in the case of a significant interaction between clothing and gender. Sensitivity analyses were also planned whereby participants who were outliers (Z score over 2.807 determined in the same way as in Study 1) on snack food consumption and those who guessed the aims (determined by the same process as Study 1) were excluded and the primary analysis was repeated. The same approach was used as in Study 1 for examining possible mediators.

3.3. Results

See Table 3 for participant characteristics according to condition.

3.3.1. The effect of clothing and gender on snack food consumption

There was a significant main effect of gender on snack food consumption [F (1, 146) = 12.61, p = .001, η_p^2 = 0.08], whereby men ate more than women. The main effect of clothing was not significant [F (1, 146) = 0.41, p = .522, η_p^2 < 0.01], but there was a significant interaction between gender and clothing [F (1, 146) = 4.05, p = .046, η_p^2 = 0.03]. Bonferroni corrected t-tests showed that women who wore the obese body suit consumed significantly more than women in the control clothing [t (78) = 2.46, p = .032, d = 0.55]. However, there was not a significant difference between men in the obese body suit and control condition for snack food consumption [t (68) = −0.78, p = .872, d = 0.19]. The pattern of results remained the same when controlling for participant BMI.[3] See Table 4 for condition means.

Table 3
Participant characteristics in study 2 (M ± SD).

	Obese Body Suit		Control Clothing	
	Men	Women	Men	Women
Age (years)	21.75 (3.07)	19.28 (1.81)	20.21 (2.52)	19.48 (2.09)
BMI	23.48 (3.57)	22.79 (3.58)	24.01 (2.97)	23.12 (3.28)
Negative Affect[a]	14.11 (4.10)	12.08 (1.72)	13.53 (3.93)	13.48 (4.08)
Positive Affect[a]	28.06 (8.69)	27.63 (6.68)	26.59 (7.91)	27.10 (7.30)
Hunger[b]	2.86 (1.22)	2.63 (1.41)	3.32 (1.20)	2.83 (1.11)

[a] Negative affect and positive affect are the sums of 10 negatively and 10 positively valenced emotions measured on a 7 point Likert scale where participants indicated the extent that they currently felt the target emotion (1 represented "very slightly or not at all" and 7 represented "extremely").

[b] Hunger was measured on a 7 point Likert scale where 1 represented "very slightly or not at all" and 7 represented "extremely".

Table 4
Snack food consumption (g) per condition (M ± SD).

	Obese Body Suit (N = 76)		Control Clothing (N = 74)	
	Men (N = 36)	Women (N = 40)	Men (N = 34)	Women (N = 40)
Snack Food Consumption (grams)	48.72 (30.12)	42.30 (24.62)	54.44 (30.90)	31.23 (14.34)

3.3.2. Sensitivity analyses

Sensitivity analyses were conducted in which the main analysis was repeated when participants who guessed the aims or were outliers in terms of their consumption were excluded. The pattern of results was consistent and women in the obese body suit condition tended to eat more than women in the control condition but there was no effect on consumption in men. The difference in snack food consumption between the obese body suit and control conditions in women reached statistical significance when aim guessers were excluded but not when outliers were excluded. Please see the supplementary materials for detailed results.

3.3.3. Body anxiety

A 2 × 2 ANOVA showed that there was a significant main effect of gender on body anxiety scores [F (1, 146) = 21.54, p < .001, η_p^2 = 0.13], whereby women (M = 35.59, SD = 9.87) had higher body anxiety than men (M = 29.24, SD = 9.85). Clothing also had a significant effect on body anxiety [F (1, 146) = 49.70, p < .001, η_p^2 = 0.25], whereby participants who wore the obese body suit (M = 37.41, SD = 9.55) felt more anxious about their bodies than controls (M = 27.72, SD = 8.71). There was no significant interaction between clothing condition and gender [F (1, 146) = 1.16, p = .283, η_p^2 = 0.01].

3.3.4. Self-esteem

A 2 × 2 ANOVA showed that there was a significant main effect of gender on self-esteem scores [F (1, 146) = 7.89, p = .006, η_p^2 = 0.05], whereby women (M = 14.13, SD = 4.83) had lower self-esteem than men (M = 16.10, SD = 5.44). Clothing also had a significant effect on self-esteem [F (1, 146) = 43.76, p < .001, η_p^2 = 0.23], whereby participants who wore the obese body suit (M = 12.71, SD = 5.26) reported having lower self-esteem than those who wore the control clothing (M = 17.45, SD = 3.91). The interaction was also significant [F (1, 146) = 4.25, p = .041, η_p^2 = 0.03], where self-esteem was lower in the obese body suit condition (Men M = 13.00, SD = 5.32, Women M = 12.45, SD = 5.25) than in the control clothing condition (Men M = 19.38, SD = 3.21, Women M = 15.80, SD = 3.73) for both men [t (68) = −6.04, p < .001, d = 1.45] and women [t (78) = −3.29, p = .004, d = 0.74], although this effect was larger in men.

[3] The results remained consistent when controlling for BMI, whereby men ate more than women overall (p = .001) and the main effect of clothing on consumption was not significant (p = .471). The interaction between clothing and gender remained significant (p = .048), whereby women in the body suit condition ate more than women in the control condition but there was no difference in consumption between men who wore the obese body suit or the control clothing.

3.3.5. Self-presentation concerns

A 2 × 2 ANOVA showed that clothing had a significant effect on self-presentation concerns [F (1, 146) = 19.50, p < .001, η_p^2 = 0.12], whereby participants who wore the obese body suit (M = 3.50, SD = 0.80) felt more self-presentation concern than controls (M = 2.89, SD = 0.93). The main effect of gender [F (1, 146) = 1.99, p = .160, η_p^2 = 0.01] and the interaction of gender and clothing on self presentation concerns were not significant [F (1, 146) = 1.88, p = .172, η_p^2 = 0.01].

3.3.6. Explicit perception of overweight

There was a significant main effect of gender on perceived overweight [F (1, 146) = 10.12, p = .002, η_p^2 = 0.07], with women (M = 4.91, SD = 1.69) feeling more overweight than men (M = 4.23, SD = 1.65). Clothing also had a significant effect on explicit perception of overweight [F (1, 146) = 73.48, p < .001, η_p^2 = 0.34], whereby participants who wore the obese body suit (M = 5.53, SD = 1.32) felt more overweight than controls (M = 3.63, SD = 1.50). The interaction between gender and clothing on explicit perceptions of overweight was not significant [F (1, 146) = 1.09, p = .299, η_p^2 = 0.01].

3.3.7. Inhibitory self-control

A 2 × 2 × 2 mixed measures ANOVA showed that the interactions between time point and gender [F (1, 146) = 0.24, p = .623, η_p^2 < 0.01], time point and clothing condition [F (1, 146) < 0.01, p = .980, η_p^2 < 0.01] and time point, clothing condition and gender [F (1, 146) = 1.56, p = .214, η_p^2 = 0.01] were not significant in terms of inhibitory self control.

3.3.8. Effortful self-control

A 2 × 2 × 2 mixed measures ANOVA showed that the interaction between time point and gender [F (1, 146) = 2.33, p = .129, η_p^2 = 0.02] and time point, gender and clothing [F (1, 146) = 0.05, p = .821, η_p^2 < 0.01] were not significant for effortful self control. The interaction between time point and condition was significant [F (1, 146) = 5.52, p = .020, η_p^2 = 0.04], whereby participants in the obese body suit condition performed significantly worse post clothing (M = 49.03, SD = 36.34) than at baseline (M = 56.25, SD = 38.70) [t (75) = 2.34, p = .044, d = 0.19]. There was however, no difference in effortful self-control between baseline (M = 52.77, SD = 35.75) and post task (M = 55.32, SD = 37.83) in the control condition [t (73) = 0.89, p = .756, d = 0.07].

3.3.9. Negative affect

A 2 × 2 × 2 ANOVA showed that the interactions between time point and gender [F (1, 146) = 0.25, p = .618, η_p^2 < 0.01] and time point, gender and clothing condition [F (1, 146) = 1.42, p = .236, η_p^2 = 0.01] were not significant for negative affect scores. There was a significant interaction between clothing condition and time point [F (1, 146) = 6.49, p = .012, η_p^2 = 0.04], whereby participants who wore the obese body suit reported significantly higher negative affect post task (M = 14.26, SD = 4.68) than at baseline (M = 13.04, SD = 3.23) [t (75) = 2.71, p = .016]. There was no significant difference between baseline (M = 13.50, SD = 3.99) and post task (M = 12.92, SD = 4.61) negative affect in the control condition [t (73) = 1.12, p = .266].

3.3.10. Positive affect

A 2 × 2 × 2 ANOVA showed that the interactions between time point and gender [F (1, 146) = 0.10, p = .750, η_p^2 < 0.01], time point and clothing condition [F (1, 146) = 1.00, p = .320, η_p^2 < 0.01] and time point, clothing condition and gender [F (1, 146) = 1.08, p = .301, η_p^2 < 0.01] were not significant for positive affect scores.

3.3.11. Mediation analyses

As the clothing condition did not affect inhibitory control or positive affect, the conditions for mediation analysis for these factors were not met. None of the proposed mediators that were affected by the clothing condition (body anxiety, self-esteem, self-presentation concerns, explicit perception of overweight, effortful self-control and negative affect) were associated with snack food consumption, so formal mediation analysis was not appropriate (Table 5). As the body suit only affected snack food consumption in women we also examined whether any of the potential mediators were associated with snack food consumption in women separately but did not find any evidence in support of this (all p's > 0.15).

Table 5
Correlations between snack food consumption and potential mediators for men and women in study 2 (N = 150).

Proposed mediator	r and p statistics for correlation with snack food consumption
Body Anxiety	.04, .635
Self Esteem	-.11, .200
Self-Presentation Concerns	-.03, .717
Explicit Perception of Overweight	.08, .360
Effortful Self-Control Change	.05, .543
Negative Affect Change	-.01, .873

3.4. Conclusion

The effect of the obese body suit on snack food consumption was moderated by gender, whereby women who wore the obese body suit ate more than women who wore the control clothing, but there was no difference in snack food consumption between the obese body suit and control condition for men. Wearing the obese body suit resulted in participants reporting feeling overweight, increased negative affect, heightened self-presentation concerns and body anxiety, as well as lower self-esteem and decreased effortful self-control. However, none of these factors mediated the effect of the obese body suit on increased consumption in women. The obese body suit did not affect inhibitory control or positive affect.

4. Additional analyses

4.1. Moderation analyses

We examined evidence for moderation of the relationship between clothing and snack food consumption by individual differences across the two studies (Body Satisfaction and Dietary Restraint in Studies 1 and 2 and Emotional Regulation in Study 2) but found no evidence of these factors moderating the relationship between study clothing, gender and snack food consumption. See supplementary materials for detailed analysis and results.

5. General discussion

Across two studies we examined the effect of wearing an obese body suit on snack food consumption. Study 1 showed that experimentally manipulating the feeling of being overweight with an obese body suit resulted in women consuming more snack food than those who were not made to feel overweight. These findings are in line with those of a previous study which demonstrated that wearing an obese body suit led to increased consumption of snack foods (Incollingo Rodriguez et al., 2016). However, another study which examined the effect of an obese body suit on snack food and alcohol consumption showed no significant effect of clothing on snack food consumption (Oldham, Tomiyama, & Robinson, 2017). This may have been due to the presence of alcohol in the taste test affecting appetite (see Oldham et al. (2017)). In Study 2 we examined whether the same effect was observed in men. The results of Study 2 indicated that wearing the obese body suit was associated

with an increase in snack food consumption among women, but not men. Across both studies we examined potential psychological mediators of the effect of the obese body suit on snack food consumption, but did not find evidence of mediation in either Study 1 or Study 2.

In Study 1 we examined whether fear of negative evaluation from others may in part explain the effect of the obese body suit on snack food consumption. We attempted to test this by manipulating whether participants were exposed to other people (public settings) or not (private settings) when wearing the study clothing. However, wearing the obese body suit resulted in increased snack food consumption and this effect did not appear to be significantly moderated by whether the obese body suit was worn in public or private settings. As obesity is such a widely stigmatised condition, internalised weight stigma could have affected eating behaviour in the absence of others (Heuer et al., 2011; Major & O'Brien, 2005). Alternatively, irrespective of wearing the suit in social isolation (with the exception of a single present experimenter), participants in the private conditions may have still feared potential negative evaluation from others.

Study 2 showed that the effect of the obese body suit on snack food consumption was moderated by gender, whereby women who wore the obese body suit ate more than women who wore the control clothing, but there was no effect of clothing on snack food consumption in men. There is more societal emphasis on the thin ideal for women (Spitzer et al., 1999) and the size of bodies which are considered normal for women is considerably smaller than the size of bodies considered normal (Oldham & Robinson, 2017) or acceptable (Cachelin, Rebeck, Chung, & Pelayo, 2002) for men. Women report experiencing more weight stigma than men in some studies (Puhl et al., 2008) and previous studies have shown that women are more reactive to anticipated weight stigma then men (Blodorn, Major, Hunger, Miller, et al., 2016). These studies suggest that women may have greater concerns about their weight than men and this may explain the gender effect we observed in Study 2.

Across both studies we examined a number of possible mechanisms that could explain why wearing the obese body suit increased snack food consumption. We hypothesised that the obese body suit may cause increased snack food consumption by increasing negative affect, heightening self-presentation concerns, increasing anxiety around physical appearance, reducing self-esteem and/or impairing self-control. However, none of these potential mediators were associated with snack food consumption in either study. One possible explanation of our failure to identify the psychological variables mediating the effect of the obese body suit on snack food consumption is that although where possible we used validated measures, the measures used to assess the proposed mediators did not do so sensitively. Alternatively, other processes may be responsible. For example, one factor that may be important is stress. Although similar to negative affect, stress is a theoretically distinct construct (Lazarus & Folkman, 1984) that could be relevant in this context. A previous study showed that stress-induced overeating mediated the effect of self-perceived overweight on weight gain (Robinson et al., 2015). Because of the stigma associated with obesity, wearing an obese body suit is likely to be stressful and stress has been consistently linked with the drive to eat (Groesz et al., 2012) and increased food consumption (Epel, Lapidus, & Mcewen, 2001). Future studies could examine the mediating role of stress and the extent to which individual differences in stress induced overeating may be important in explaining the effect that feeling overweight has on snack food consumption.

We also examined moderation of the effect the obese body suit had on snack food consumption by individual differences measured across both studies. However, these analyses were limited in sample size and should be considered exploratory in nature. Neither dietary restraint, body dissatisfaction nor emotional regulation moderated the effect of the experience of feeling overweight on snack food consumption. One factor which was not measured in this study and which may moderate the effect of the obese body suit on snack food consumption is stigma consciousness (Major & O'Brien, 2005). Individuals higher in stigma consciousness are more likely to be vigilant to potential stigma or threats (Pinel, 1999). As such, individuals higher in stigma consciousness may experience greater threat or anticipated stigma when wearing the obese body suit, which could lead them to eat more in response to heightened stereotype threat. Eating to cope is another factor that could moderate the effect of the obese body suit on snack food consumption. Eating to cope is a construct which quantifies the extent to which people are motivated to eat in response to negative affect (Lokken & Boggiano, 2013) and is associated with BMI (Boggiano, Lokken, & Wingo, 2014). Furthermore, increases in eating to cope motivations are associated with weight gain over time amongst individuals with overweight (Boggiano et al., 2015). Based on the effect of the obese body suit on negative affect in the present study and a previous study (Incollingo Rodriguez et al., 2016), it is possible that women who overeat in response to negative affect would eat more in response to the psychosocial experience of feeling overweight than those less motivated to eat in response to negative affect.

5.1. Limitations

The samples in the present studies were young women and men who were predominantly university students. Young women in particular report high levels of weight and shape concern (Grossbard, Lee, Neighbors, & Larimer, 2009; Lowery et al., 2005). Furthermore, age is associated with the amount of importance placed on appearance, whereby appearance is perceived as being less important as one grows older (Tiggemann, 2004). Thus, the same effects observed in the present studies may not be observed in older adults and replication in more diverse samples would now be of interest. Furthermore, the current studies also do not provide any evidence for the longevity of the effect that feeling overweight has on snack food consumption, as we examined consumption in a single session.

6. Conclusion

The psychosocial experience of feeling overweight leads to increased snack food consumption in women, but not men. However, the psychological mechanisms explaining this effect are unclear.

Conflicts of interest

None of the authors have any competing interests to declare.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.appet.2018.05.002. The datasets for both studies are available at https://osf.io/uka72/.

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