Northumbria Research Link

Citation: Bellard, Ashleigh, Cornelissen, Piers, Mian, Emanuel and Cazzato, Valentina (2021) The ageing body: contributing attitudinal factors towards perceptual body size estimates in younger and middle-aged women. Archives of Women's Mental Health, 24 (1). pp. 93-105. ISSN 1434-1816

Published by: Springer

URL: https://doi.org/10.1007/s00737-020-01046-8 <https://doi.org/10.1007/s00737-020-01046-8 >

This version was downloaded from Northumbria Research Link: http://nrl.northumbria.ac.uk/id/eprint/43215/

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: http://nrl.northumbria.ac.uk/policies.html

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)





1	The ageing body: contributing attitudinal factors towards perceptual body size
2	estimates in younger and middle-aged women
3	
4	Ashleigh Bellard ¹ , Piers Cornelissen ² , Emanuel Mian ³ , Valentina Cazzato ¹
5	
6	¹ School of Psychology, Faculty of Health, Liverpool John Moores University, Liverpool, UK
7	² Department of Psychology, Northumbria University, Newcastle, UK
8	³ Interdisciplinary Centre for Obesity and Bariatrics (C.I.B.O.), Istituti Clinici Zucchi, via
9	Zucchi 24, 20052 Monza, Italy
10	
11	Corresponding author: Requests for reprints should be addressed to Valentina Cazzato,
12	School of Psychology, Faculty of Health, Liverpool John Moores University, Byrom Street,
13	Liverpool, L3 3AF. E-mail: V.Cazzato@ljmu.ac.uk, Tel.: +44 151 904 6340
14	
15	
15	
16	
17	
18	
10	
19	
20	
21	
22	
23	
24 25	
23 26	
27	
28	
29	
30 31	
32	
33	
34	
35 36	

37	Title: The ageing body: contributing attitudinal factors towards perceptual body size
38	estimates in younger and middle-aged women
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	
61	
62	
63	
64	
65	

66	Declarations
67	
68	Authors' contributions: VC conceived the study. AB, PC and EM contributed to the concept
69	and design of the study. AB performed data collection. AB performed the analyses under
70	supervision of VC and PC. The first draft of the manuscript was written by AB, with input from
71	VC and PC. All authors approved the manuscript before submission.
72	
73	Acknowledgements: This research was financially supported by an Experimental Psychology
74	Society Small Grant awarded to VC. The authors thank Verena Pisani for her assistance with
75	data collection.
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	
90	
91	
92	
93	
94	
95	
96	
97	
98	
99	

- 100 Abstract
- 101

Objectives: Over-estimation of body size, a core feature of Eating Disorders (EDs), has been
well-documented both in young healthy and EDs individuals. Yet, evidence that altered body
perception might also affect older women is limited. Here, we examined whether attitudinal
components of body image (i.e., the feelings an individual has about their body size and
shape) might affect perceived actual and ideal body shape self-estimates in midlife, similarly
to younger women.

108

109 *Methods:* Thirty-two younger (mean age: 24.22yrs) and 33 middle-aged (mean age: 53.79yrs)

110 women took part to a computerised body perception assessment of perceived, actual and ideal

111 aspects of body image. Body Mass Index (BMI), societal and interpersonal aspects of

appearance ideals, measured by means of Sociocultural Attitudes towards Appearance

113 Questionnaire (SATAQ-4) and assessment of body uneasiness and concerns for specific body

114 parts, measured by Body Uneasiness Test (BUT-A/B) scales were also investigated.

115

116 *Results:* Younger and middle-aged women with larger BMI showed greater discrepancy in

117 perceptual distortions from their perceived actual body size. However, middle-aged women

118 with greater body-part concerns over-estimated their perceived body size, as opposed to

119 younger women who were almost accurate. Unlike middle-aged women, younger women

120 with higher body part concerns desired slimmer ideal body image than their perceived actual.

121

122 Conclusions: Results suggest distortions in the perceived actual and ideal body size self123 estimates of younger and middle-aged women are best explained by a combination of BMI,
124 body parts concerns, and the particular age group to which a participant belonged. In future, a
125 personalized approach for the assessment of women's perceptions and concerns of specific
126 body areas during lifespan should be adopted.

127

128 Keywords: Attitudinal; Perceptual; Body Image; Body size estimates; Middle-aged; BMI;129

130

- 131
- 132

133

134 Introduction

Body image is a multidimensional construct that represents an individual's conscious 135 136 perception of, and attitude towards, their bodily appearance (Arbour & Ginis, 2008; 137 Reboussin et al., 2000; Tiggemann, 2004). It is strongly associated with an individual's 138 wellbeing and their satisfaction with life (Donaghue, 2009). According to an influential meta-139 analysis by Cash and Deagle (1997), dimensions relevant to the body image construct 140 substantially include: i) a perceptual component which corresponds to the accuracy with 141 which an individual can judge the physical dimensions of their own body and ii) an 142 attitudinal, affective component related to their attitudes and emotions they have about their 143 body, which may be positive or negative.

Excessive concerns about body weight and appearance are common amongst individuals in western cultures, and presage the development of eating disorders (EDs), such as anorexia nervosa (AN) and bulimia nervosa (Ricciardelli & McCabe, 2004; Slevec & Tiggemann, 2011a; Stice, 2002). Typically, individuals with severe body image concerns focus on the desire to appear thinner (Slevec & Tiggemann, 2011a) and tend to over-estimate the body size they believe themselves to have (Schuk et al., 2018).

150 Most research into people's body image concerns and eating attitudes has been 151 conducted in adolescents and young adults, with a particular focus on female university 152 undergraduates aged 18-24 years (Slevec & Tiggemann, 2011b). This coincides with the 153 median age of onset for EDs (Hudson et al., 2007; Favaro et al., 2003), with AN being 154 particularly prevalent in this age group (Smink et al., 2012). Nevertheless, as pointed out by 155 Saucier (2004) and Tiggemann (2004), comparably high levels of body image concerns may 156 occur at any age, including women of middle age who represent the focus for the current 157 study. As with their younger colleagues (Wardle et al., 2006), middle-aged women can 158 experience negative feelings and attitudes towards their body, such as body dissatisfaction 159 and drive for thinness (Bane & McAuley, 1998; Longo et al., 2009) along with over-160 estimation of their body size (Hayashi et al., 2006, but see Monteath & McCabe, 1997 and 161 Paul et al., 2015 for opposite results in the general population) leading to an increased risk for 162 late onset EDs (Marcus et al., 2007; Cumella & Kally, 2008; Hoek, 2006; Slevec & Tiggemann, 2011a). 163

However, unlike young women, some of the factors giving rise to distorted body
image in middle-age emerge from naturally occurring age-related processes. These include an
increase in body weight/fat distribution due to the menopause and a decrease in muscle mass,
which may also be side effects of different medications (Davis et al., 2012; Genazzani &

168 Gambacciani, 2006; Tchkonia et al., 2010; Vanina et al., 2002). As a result of these natural 169 occurring age-related changes in their body shape, middle-aged women may exert more of a 170 need for slimmer weight control to be classed as 'attractive', as they still show attentiveness 171 towards their bodily appearance (Lewis & Cachelin, 2001; McCabe et al., 2007; Pruis & 172 Janowsky, 2010). Linked to the need to maintain a thinner body size, Marcus and colleagues 173 (2007) have identified an increase in the number of middle-aged women being diagnosed 174 with an EDs i.e., 175 out of 589 Middle-aged women of various ethnicities reported having 175 an ED, predominately AN.

Furthermore, although several studies suggest body image in younger women is more susceptible to societal influence to attain a slim physique than in older women (Lewis & Cachelin, 2001), others reported that societal influence is also a predictor of body dissatisfaction, drive for thinness, and body shape concerns in older women (Pruis & Janowsky, 2010). This suggests that societal influence is an important factor in the development and maintenance of negative attitudes towards body image of older women, and that it may be pertinent to understanding body image in this age group.

Put together, findings like these suggest the need for further research specifically targeting middle-aged women. By shedding light on the perceptual mechanisms and women's attitudes and feelings towards their body shape, it might be possible to provide further insight into the predictive factors that may trigger, maintain and exacerbate symptoms in those psychiatric conditions characterised by body image disturbances (e.g., EDs and Body Dysmorphic Disorders) and hopefully contribute to the development of novel individualised body image treatments in lifespan.

190

191 The Current Study

192

193 In this study, we aimed at investigating whether performance in tasks that measure 194 perceptual (i.e., participants' estimates of their own body shape) and attitudinal aspects (i.e., feelings and attitudes towards body shape and size) of body image, that are relevant to the 195 196 development of EDs symptomatology, are essentially the same or different in younger 197 compared to middle-aged women. With this aim, in separate samples of younger and middle-198 aged women, we assessed perceptual self-estimates of perceived current (i.e., 'How do you 199 think you look like?') and ideal (i.e., 'How would you like to appear?') body shapes, by 200 means of a unique 2D digital computer-based distortion optical method, the Body Image 201 Revealer (BIR, Mian & Gerbino, 2009). In addition, we obtained measures of women's

202 attitudinal body image, by means of a battery of standard self-report scales to index women's 203 feelings and attitudes towards their body shape and beauty ideals. With these regards, we felt 204 it was important to have a wider range of self-report scales than has often been the case in 205 similar studies of younger women. For example, in three such studies, Cornelissen and 206 colleagues used the Beck Depression Inventory, the Rosenberg Self Esteem scale, the Body 207 Shape Questionnaire, and the Eating Disorder Examination Questionnaire to measure 208 participants' attitudes to body shape, weight, eating, self-esteem and depressive 209 symptomatology (Cornelissen et al., 2015, 2017; Irvine et al., 2018). In each study, a 210 principal component analysis (PCA) of the psychometric responses showed that the data 211 could be compressed onto a *single* principal component, or dimension, suggesting a rather 212 restricted view of participants' attitudinal body image. Therefore, here we chose a wider 213 spectrum of measurement including a measure of the cultural and interpersonal risk factors, 214 such as internalization of appearance ideals and appearance-related pressures which have 215 been implicated in the aetiology of negative body image and eating pathology (Cafri et al., 216 2005; Stice, 2002), here assessed by means of the Sociocultural Attitudes Towards 217 Appearance Questionnaire-4 (SATAQ-4, Schaefer et al., 2015). Furthermore, given that 218 healthy and clinical populations often report great dissatisfaction with body areas like weight 219 and torso (lower, mid and upper) (see Rosen & Ramirez, 1998; Hrabosky et al., 2009), but 220 also buttocks/hips/thighs, stomach and waist regions (Toh et al., 2019; Ralph-Nearman et al., 221 2019), we administered a measure of body uneasiness and dissatisfaction for the whole body 222 and for specific body parts, by means of the Body Uneasiness Test (BUT, Cuzzolaro et al., 223 1999). Anthropometric measures of Body Mass Index (BMI) were also measured. Finally, we 224 applied a multivariate analysis to investigate how similar was the pattern of responses across 225 the two age groups.

226 Consistent with the view of a multidimensional model of body image (Cash & Deagle, 227 1987), we expected that perceptual self-estimates of perceived current and ideal body shape 228 should best be predicted by a combination of participants own' BMI and their attitudes and 229 feelings towards their body shape/body parts, as well as internalization of beauty ideals. In 230 agreement with Pruis and Janowsky' results (2010) which provided evidence that ratings of 231 body image do not differ in normal, healthy younger and older women when personalized 232 measures of body shape assessment (in their study women's responses to line drawings of 233 bodies in the Figure Ratings Scale), are used, we also expected that BMI and body shape 234 concerns would be predictive of women's perceptual body size estimates in a way that should 235 be similar in both age groups. However, consistent with studies suggesting stronger societal

influence on body image in younger than older women, particularly pressure to conform to

the media ideal of women's bodies (Bedford & Johnson, 2006; Lewis & Cachelin, 2001), we

238 expected younger women's perceptual body size estimates to be more influenced by their

levels of societal influence and pressures to attain a slim physique, compared to older women.

240

241 Materials and Methods

242

243 Participants

244 Sample size calculation was based on the data from Irvine et al. (2019). In this study, 100 245 healthy adult women carried out a number of tasks including a psychophysical procedure for 246 self-estimation of body size, they had their BMI measured and they carried out the body 247 shape questionnaire (BSQ; Evans & Dolan, 1993). First, we calculated multiple regression 248 analyses in which body size self-estimation was predicted from a combination of BMI and 249 BSQ. Then, we used PROC POWER in SAS v9.4 (SAS Institute, North Carolina, USA) to 250 calculate sample sizes appropriate to estimate the effects of BMI and separately, BSQ, at an 251 alpha value = 0.01, and a power = 0.8. This rendered integer sample sizes for BMI and BSQ 252 of 23 and 59 respectively. To offset attrition in participant numbers and/or unexpected 253 sources of variability, we therefore recruited a total of 65 females (as assigned at birth) to the 254 study who gave their written consent to take part.

255 Participants, who self-identified as Caucasian, were preselected and assigned to two 256 groups based upon age: 32 participants were recruited to the younger women's group (age M 257 = 24.22 yrs, SD = 4.51 yrs, range: 18-37yrs) and 33 participants were recruited to the middle-258 aged women's group (age M = 53.79 yrs, SD = 3.72 yrs, range: 47-65 yrs, see Table 2). All 259 participants were recruited externally through poster advertisements situated in public 260 locations, social media and through individuals known to the researcher. Younger women 261 were also recruited internally through the *** Psychology SONA participation scheme for 262 undergraduate Psychology students. Middle-aged women were also recruited internally through members of staff at ***. Furthermore, some middle-aged women that had been in 263 264 prior lab studies (unrelated to body image) were contacted from our database of previous 265 study participants (Psychology Research Participants Panel). All participants were provided with an information sheet prior to investigation, in order to check for eligibility based on the 266 267 study inclusion criteria, which was also confirmed on the day of the experiment. Participants 268 were only eligible to take part if they (self)reported not to have any history of neurological or 269 psychiatric disorders, including EDs, had normal or corrected visual acuity, and were not

- 270 pregnant. As an incentive, participants either received SONA (participation point scheme) 271 points (if undergraduate students) and/or £10 in shopping vouchers. Younger women's BMIs 272 ranged between 17.73 and 33.18 (M = 22.74, SD = 4.36) and fell into the following WHO 273 categories: 4 underweight, 20 normal, 5 overweight and 3 obese. Middle-aged women's 274 BMIs ranged between 18.93 and 38.83 (M = 27.16, SD = 5.13) and fell into the following 275 WHO categories: 15 normal, 7 overweight, 7 obese and 4 severely obese. The study's 276 experimental procedures and methods were fully approved by *** Research Ethics Board and 277 complied with the ethical standards of the 1964 Declaration of Helsinki. 278 279 Assessment of body image 280 281 **Sociocultural Attitudes towards Appearance Questionnaire** 282 The Sociocultural Attitudes towards Appearance Questionnaire-4 (SATAQ-4, 283 Thompson et al., 2004) measures a woman's drive to attain attractiveness ideals dictated by 284 societal influence (Schaefer et al., 2015). For SATAQ-4, participants evaluated each of the 22 285 items on a 5-point scale (from 1 = definitely disagree to 5 = definitely agree). The 286 questionnaire comprises of 4 subscales: internalization athletic, internalization body fat, 287 pressures from family, pressures from peers, and pressures from the media (Thompson et al., 288 2004). This questionnaire had good internal consistency with Cronbach's alpha 0.81.
- 289

290 Body Uneasiness Test

291 The Body Uneasiness Test (Cuzzolaro et al., 2006) is considered a valuable tool for 292 the screening and for the clinical assessment of abnormal body image attitudes and EDs. 293 Particularly, it assesses body uneasiness and dissatisfaction with the whole body, as well as 294 specific body parts. It comprises of 34 questions about body experiences (BUT-A) and 37 295 questions about an individual's dislike of particular body parts (BUT-B). BUT-A is divided 296 into 5 sub-scales: weight phobia (BUT-WP), dissatisfaction regarding the body and its 297 weight, body image concerns (BUT-BIC), avoiding and compulsive self-monitoring 298 behaviour (BUT-AV, BUT-CSM) and experience of depersonalization, defined as separation 299 and foreignness regarding the body (BUT-D). These scores can be combined into a Global 300 Severity Index (GSI, the average rating of all 34 items constituting the BUT-A), which 301 indicates severity of abnormal body image concerns and eating behaviours. Each question is 302 indexed by a 6-point Likert scale, from 0 representing 'never' to 5 representing 'always'. 303 Higher scores indicate greater body uneasiness.

BUT-B measures specific worries about particular body parts, shapes or functions (e.g., mouth or skin). These scores are arranged into a Positive Symptom Total (PST, the number of symptoms rated higher than zero) and a Positive Distress Symptom Index (PDSI, the average rating of those items constituting the PST). A 6-point Likert scale, which ranges from 0 (never) to 5 (always) indicating how often participants happen to dislike each experience or part of their body, is used. The Body Uneasiness Test showed good internal consistency with Cronbach's alpha 0.90.

311

312 Body Mass Index

Each participant's actual body mass index (BMI) was physically measured and calculated from their weight and height by using a calibrated bioimpedance digital scale (OMRON BF511) for weight and a stadiometer for height.

316

317 Body Image Revealer

Perceived actual and ideal body size estimates were obtained by means of a computerbased method, which mimics changes in adiposity by simulating an optical distortion of the body. Known as the 'Body Image Revealer' (BIR; Mian & Gerbino, 2009; Cazzato et al., 2015, 2016; Zamariola et al., 2017), this technique provides a measure of the discrepancy between the dimensions of the real image and the sizes attributed by the participant during the task. The BIR has good ecological validity because it gives participants the experience equivalent to looking at their whole body in a mirror.

325 To generate the experimental stimuli, a frontal picture of each participant, standing in 326 a T-pose, was taken with a Panasonic TZ5 Lumix digital camera from a distance of 2 metres. 327 Participants wore skin-tight clothing to ensure that their body outline was clearly visible. The 328 image of a participant's was then extracted from the background in the raw image, using 329 Photoshop v7.0, and replaced on a standard white background for further image manipulation 330 in BIR. Once modified, the image was opened in the software and the experimenter selected 331 the parts that would be modified, that is from the neck to the feet (but excluding the face and 332 the arms). Importantly, whilst the experimenter was modifying the real picture, participants 333 were instructed to look away from the PC monitor, so they were not aware of the body 334 alteration. Importantly, the ecological validity of the test was increased by keeping the 335 participants' face in the final images. This way, the procedure was giving the sense that 336 participants were looking at themselves in the mirror (see Fig. 1 and Online Resource 1 for 337 more details).

338	
339	Please insert Figure 1 here

340

341 **Procedure**

342 During the experimental session, consenting participants' height and weight was 343 physically measured by using a calibrated bioimpedance digital scale and a stadiometer and 344 then their portrait taken. While this image was being edited, participants completed the 345 demographic questionnaires. Once completed, participants were sat 55 cm in front of the 346 display monitor and were asked to adjust their image according to two tasks read out to them: 347 Perceived Actual body image ('How do you think you look like?') and Ideal body image 348 ('How would you like to appear?'). By pressing the plus (+) or minus (-) key on the 349 keyboard, participants were able to increase or decrease the apparent adiposity of the image 350 within a possible range of \pm 50% in 1% increments/decrements (see Online Resource 1). 351 Participants could adjust the degree of distortion of the picture as much as they wanted. After 352 completion of the two self-body distortion tasks, participants were instructed to fill out the 353 BUT-A/B and SATAQ-4 questionnaires. Overall, testing lasted 45 minutes.

354

355 Statistical Analyses

All statistical analyses were conducted using SAS v9.4 (SAS Institute, North
Carolina, USA). In keeping with previous studies (Cazzato et al., 2014, 2016), the average
percentage body percentage distortion (%BDS) was calculated across all trials, separately for
each individual and the two tasks (i.e., perceived actual body size, ideal body size).

We wanted to model the relationships between participants' estimates of their perceived actual and ideal body size predicted from participants' AGE. In addition, we wanted to control for any influence of BMI and the psychometric variables (BUT-A/B and SATAQ-4). In order to avoid the possibility of introducing substantial variance inflation into the models, we first checked for evidence of co-linearity amongst the psychometric variables.

We used PROC CORR in SAS v9.4 to compute Pearson's correlations between all self-report psychometric task subscales, to look for potential association within and between the responses to the BUT-A, BUT-B, and SATAQ-4. Given that this analysis demonstrated substantial correlations amongst these variables (see Table 1), we then used PROC FACTOR in SAS v9.4 to carry out a PCA on this correlation matrix, to identify the smallest number of statistically independent dimensions in the psychometric tasks that we could use as covariates in our multivariate analysis, and avoid variance inflation due to multicollinearity amongst

372	explanatory variables. We found four components, corresponding to: i) the body part
373	responses in the BUT (referred to henceforth as BUT-Parts); ii) attitudinal responses in the
374	BUT (referred to henceforth as BUT-Att); iii) responses related to social pressure from the
375	SATAQ-4 (referred to henceforth as SATAQ-Press); iv) responses related to internalization
376	from the SATAQ-4 (referred to henceforth as SATAQ-Int) (see Online Resource 2).
377	In the last step, we used PROC MIXED in SAS v9.4 to build separate linear mixed
378	effects models of percentage distortion for perceived actual and ideal body size judgements.
379	For each model we included as putative fixed effects: age, BMI, BUT-Parts, BUT-Att,
380	SATAQ-Press, and SATAQ-Int, all of which were continuous explanatory variables.
381	Critically, we also tested all possible two-way interaction terms. Note that for the sake of
382	easy visualisation, instead of illustrating the response surface from the statistical models as
383	continuous 3D surface plots, consistent with the data, we plotted 2D slices through these
384	response surfaces which show the data separated into two age groups (see Fig. 2a and 2b).
385	
386	Please insert Table 1 here
387	
388	Results
389	
390	Univariate Statistics
391	
392	Table 2 shows means and standard deviations for the demographic and psychometric
393	questionnaire subscale scores, separately for younger and middle-aged women. The right-
394	hand column of Table 2 shows the output of pairwise comparisons between these two groups,
395	adjusted for multiple comparisons, using the permutation method in PROC MULTEST (SAS
396	262 v9.4). Middle-aged women were indeed significantly older, had higher BMIs, and
397	reported greater concerns on the thighs sub-scale of the BUT-B (this includes questions
398	about: stomach, abdomen, hips, thighs, and knees) than younger women.
399	Additional demographic characteristics (ethnicity, handedness, and regular menstrual
400	cycle) are reported in Table 3. We conducted a Chi-Square analysis between young and
401	middle-aged women to investigate whether there were any differences in characteristics
402	between these two groups. There were no significant differences for ethnicity ($\chi^2_1 = 2.00$; p=
403	.157) and handedness (χ^2_1 = 2.60; p= .107) between groups. As expected, there was a
404	significant difference for regular menstrual cycle (χ^2_1 = 32.32; p< .001) between groups.
405	

406	Please insert Table 2 here
407	Please insert Table 3 here
408	
409	Perceived Actual Body Size
410	
411	Table 4 shows the correlation matrices between the four principal components (BUT-
412	Parts, BUT-Att, SATAQ-Press, SATAQ-Int), age, BMI, and percentage distortion for
413	participants' estimates of their perceived actual body size (%BDS), calculated separately for
414	younger and middle-aged women.
415	For middle-aged women, percentage distortion for their perceived actual body size
416	was significantly, positively correlated with BMI, BUT-Parts and BUT-Att, but not with
417	SATAQ-Press or SATAQ-Int. BMI was significantly, positively correlated with BUT-Att and
418	SATAQ-Press but not with BUT-Parts or SATAQ-Int. For the younger women, percentage
419	distortion (%BDS) for the perceived actual body size was significantly, positively correlated
420	with BMI and SATAQ-Press, but not with any other component. BMI was significantly,
421	positively correlated with BUT-Parts, BUT-Att, and SATAQ-Press, but not SATAQ-Int (see
422	Table 4).
423	
424	Please insert Table 4 here
425	
426	We used PROC MIXED (SAS v9.4) to model percentage distortion for perceived
427	actual body size. We found statistically significant main effects of BMI, $F(1,60) = 17.19$,
428	p < .001, and BUT-Parts, $F(1,60) = 7.31$, $p = .01$. Critically, however, the effect of BUT-
429	Parts was age dependent, because we found a significant interaction between age and
430	BUT-Parts, $F(1,60) = 12.13$, $p < .001$.
431	Figure 2a shows clearly that over-estimation of perceived actual body size increases
432	as a function of increasing concerns about body parts in middle-aged women. Statistically,
433	however, there is no relationship between percentage distortion and BUT-Parts for
434	younger women, $F(1, 28) = 3.14$, $p = .087$. Moreover, since the 95% CI for their regression
435	line includes 0% body distortion, we conclude that these groups were mostly accurate in their
436	judgments.
437	Figure 2b shows plots of percentage distortion for perceived actual body size as a
438	function of participants' BMI, with the same colour scheme for younger and middle-aged
439	women. Statistically, the two groups were indistinguishable, and showed a significant

440	tendency to over-estimate their perceived actual body size with increasing BMI. These
441	results suggest that distortions in perceived actual body size estimation of younger and
442	middle-aged women are best explained by a combination of BMI, concern for body parts,
443	and the particular age group to which a participant belonged.
444	
445	Ideal Body Size
446	
447	Table 5 shows the correlation matrices between the four principal components (BUT-
448	Parts, BUT-Att, SATAQ-Press, SATAQ-Int), age, BMI, and percentage distortion for
449	participants' estimates of their ideal body size, calculated separately for younger and middle-
450	aged women.
451	For middle-aged women, percentage distortion for their ideal body size was not
452	significantly correlated with BMI or any principal component. BMI was significantly,
453	positively correlated with BUT-Att and SATAQ-Press, but not with BUT-Parts or SATAQ-
454	Int. For the younger women, percentage distortion was significantly, negatively correlated
455	with BUT-Parts, but neither with BMI nor any other component. BMI was significantly,
456	positively correlated with BUT-Parts, BUT-Att and SATAQ-Press, but not with SATAQ-Int
457	(see Table 5).
458	
459	Please insert Table 5 here
460	
461	We used PROC MIXED (SAS v9.4) to model percentage distortion for ideal body
462	size. We found significant main effects of BUT-Parts, $F(1,61) = 8.82$, $p = .004$, and Age,
463	F(1,61) = 4.83, $p = .03$, as well as a significant interaction between Age and BUT-Parts,
464	F(1,61) = 6.85, $p = .01$. Figure 2c clearly shows that as younger women's body part
465	concerns increase, their ideal body size becomes progressively slimmer. By contrast,
466	middle-aged women selected a slimmer ideal, irrespective of their body concerns, since
467	the regression of percentage distortion on BUT-Parts has a substantially negative intercept,
468	together with a regression slope no different from zero, $F(1, 30) = 0.06$, $p = 0.816$.
469	
470	Please insert Figure 2 here
471	
472	Discussion
473	

474 To our knowledge, this is the first study to use a personalised assessment, 2D optical distortion method, to compare young and middle-aged women's perceptual performance of 475 476 their perceived actual and ideal body image. Our analyses included also anthropometric 477 covariates, such as BMI, body dissatisfaction and sociocultural influences, which are all 478 factors that are well-known contributors to the aetiology and development of EDs (Culbert et 479 al.,2015; Pedersen et al., 2018) during lifespan. Ultimately, we investigated if specific 480 differences in negative attitudinal components of body image, i.e., beauty ideals/pressures 481 and body-related concerns, may interact with women' age and may affect body image 482 perceptual self-estimates in a way which is substantially different in younger and middle-483 aged women. In line with a multidimensional model of body image according to which the 484 size someone believes themselves to be is a combination of attitudinal and perceptual factors 485 (Cash & Deagle, 1997), our results suggest that the accuracy of women's judgments of their 486 perceived current and ideal body shape is modulated by the age group they belong to and 487 negative attitudes towards their bodies, particularly their concerns for body parts.

488

489 Perceived Actual Body Image

490 In agreement with studies reporting that women in the general population may 491 overestimate their body size (Johnson et al., 2008), but in disagreement with other findings 492 that instead suggest that women tend to underestimate their body size in the general 493 population (Monteath & McCabe, 1997; Robinson, 2017), we found that middle-aged women 494 with greater body parts concerns reported greater over-estimations in the perception of their 495 perceived actual body image. We did not observe the same outcome in younger women, who 496 were almost accurate. Similar results were also obtained by Deeks and McCabe (2001) who 497 reported that when middle-aged women were asked to pick a 'silhouette' which best 498 corresponded to their perceived actual body size, they chose a larger figure than was 499 objectively true. Critically and consistent with our findings, in Deeks and McCabe (2001)' 500 study, it was middle-aged women who displayed higher dissatisfaction with specific body 501 parts (lower and mid torso). As these regions are typically judged as larger than their actual 502 size (Smeets et al., 2009) possibly due to these areas being more prone to the effects of aging 503 (Genazzani & Gambacciani, 2006; Vanina et al., 2002), it may be plausible that 504 overestimation of body size for middle-aged women may have occurred if focus was placed 505 on those body parts of greater concern, when making their judgements (Kittler et al., 2007). 506 Both younger and middle-aged women over-estimate their perceived current body 507 size with increasing BMI, thus suggesting that as BMI increases over the lifetime, this factor

15

508 continues to influence body image perceptions similarly (Holsen et al., 2012). This finding is 509 in line with research by Wardle et al. (2006), who found that even young women with healthy

510 BMI inaccurately overestimated their body size. Likewise, as found in Thaler et al. (2018),

511 Toveé et al. (2003) and Zamariola et al. (2017), estimation of perceived actual body size was

- 512 predicted by BMI, so that women with higher BMI's demonstrated an overestimated
- 513 perception of their perceived actual body image.

514 A possible explanation for this finding is that body size distortion could occur as a 515 result of an individual's real body weight, as well as societal pressures to obtain a thin body 516 size. Particularly women with higher BMI's may have had greater discrepancies in their 517 ability to estimate their own body size, as they may perceive their body to be significantly larger than what society classes as thin, which as a result may distort their own mental image 518 519 of the self (Arciszewski et al., 2012; Zamariola et al., 2017). Societal stigmatisation of greater 520 weight may have also fed into body image concerns for these women, which has been 521 previously associated with overestimations of body size (Thaler et al., 2018).

An additional explanation could be that as larger body sizes are more typical in middle-aged women of Western societies (Sowers et al., 2007), this may have impacted and altered perceptions of a body silhouette classed as the 'norm', compared to a body size classed as being overweight (Robinson, 2007; Robinson & Kirkham, 2014).

526 Indeed, according to the 'Social Comparison Theory' individuals make constantly 527 evaluations about physical characteristics, such as body size by looking at the appearance of 528 those around us, which in turn may provide an internal standard (norm) or internal 529 representation of what is normal (Festinger, 1954; Mussweiler, 2003). With these regards, the 530 on-going obesity epidemic in both non-developing and developing countries, might have led 531 to a recalibration of body shape and particular to a perception that larger body sizes are 532 considered as 'normal'. If this was the case, then this altered shift in standard models of 533 different BMI classifications may have caused an overestimated shift in perceived actual 534 body size estimations, if middle-aged women used these standard models to base their 535 judgements on their own body.

Nevertheless, for younger women only, we found a positive association with sociocultural influences i.e. pressures from the media, family and peers (SATAQ-Press) with an increase in perceived actual body image distortions. This is in line with previous research reporting that although middle-aged women still care for their bodily appearance, they are less influenced from societal pressures compared to younger women, who are more influenced by these pressures (Pruis & Janowsky, 2010; Lewis & Cachelin, 2001). This could

- 542 be due to differences concerning traditional (television) and Social Media exposure
- 543 (Facebook, Instagram), with younger women having more exposure than middle-aged women
- 544 (Baugh, 2009; Wadsworth & Johnson, 2008).
- 545

546 Ideal Body Image

In the present study, both younger and middle-aged women consistently preferred a
slimmer body size when asked to judge how they would like to appear, a result which is
largely in agreement with the current literature (Baugh, 2009; Lewis & Cachelin, 2001;
McCabe et al., 2007; Pruis & Janowsky, 2010). Interestingly, as younger women's body part
concerns increase, their ideal body becomes progressively slimmer. By contrast, middle-aged
women selected a slimmer ideal, irrespective of their body concerns.

553 One possible explanation for this finding is that younger women may have placed a 554 greater importance for attractiveness on specific body parts, which prior research has found to 555 be in the lower region of the body, i.e. stomach and thighs (Irvine et al., 2019; Standford & 556 McCabe, 2002; Ralph-Nearman et al., 2019). If young women believe their body parts are not 557 similar to what they perceive to be attractive in terms of size, then their desire to be thinner 558 will be greater (Stanford & McCabe, 2002). Furthermore, 'Thinspiration', a class of body-559 idealising content that currently has emerged on social media, seems to be more important for 560 younger females, leading to young women to generally compare various body parts of the 561 'ideal model' to their own (Griffiths et al., 2018).

562 For both younger and middle-aged women, there was no effect of BMI on their ideal 563 body image perceptual self-estimates. This is somehow surprising since it was expected, 564 particularly for the middle-aged women, a relationship with higher BMI and ideal body 565 image distortions, as middle-aged women were also those women who showed greater 566 distortion in their perceived actual body size. Also, previous research has emphasised how BMI can account for body dissatisfaction in middle-aged women (Algars et al., 2009; Dunkel 567 568 et al., 2010; McKinley & Lyon, 2008) which results in a greater drive for thinness (Keski-Rahkonen et al., 2005; Lewis & Cachelin, 2001). Instead, our findings are in line with Pruis 569 570 and Janowsky (2010) in that BMI was not a predictor of ideal body image in older women. In 571 addition, it offers support for findings of Cheung et al. (2011), in that majority of women 572 with healthy BMI still have a desire for a slimmer body physique. Therefore, it is not just 573 women with higher BMIs who have a greater desire for a slimmer ideal body, but also 574 females with normal range BMIs. Moreover, as suggested by Cheung et al. (2011), it could 575 be plausible that ideal body image is more influenced by factors such as body self-esteem,

which contribute towards body dissatisfaction and that BMI is less important in influencingan individual's ideal body image.

578

579 Limitations

580 Certain limitations of the present study should also be acknowledged. 581 First, although the BIR software has been proved to be successful in investigating 582 perceptual body image in healthy and EDs populations (see Cazzato et al., 2014, 2016; 583 Zamariola et al., 2017), and is ecologically valid in the sense that it resembles a person's 584 mirror image, nevertheless the program does not adjust an individual's arms or face. 585 Therefore, particularly at the extremes of thinness and fatness, there may be image distortions 586 -i.e. departures from an ecologically valid image - which may cause participants to adopt a 587 compensatory strategy, whereby participants' judgements of the apparent body size of the 588 person in the stimulus might be based on the computation of surface area, or perhaps 589 perimeter-area ratio. Yet, we believe it is unlikely that the BIR inability of altering the face 590 and/or the arms of participants might have affected differently the two samples of women, 591 given that both groups displayed (low) similar levels of concerns for such body parts (as 592 measured by the BUT-B). Nevertheless, we believe that keeping participants' face during the 593 perceptual tasks might have added strength to the individualised assessment procedure, as it 594 might have improved the ecological validity of the test and reinforced women's self-body 595 identification during task performance.

596 Yet, it would be beneficial in future studies to investigate body image perception 597 using stimulus images that do not have the limitations listed above. For example, in previous 598 research of Cornelissen et al. (2017), different 3D avatars were generated depicting realistic 599 BMI physiques. As well as more realistic 3D representations (see Keizer et al., 2016, for a 600 clinical application of full body VR in EDs), this software should enable all body parts to be adjusted so as to represent a more accurate reflection of varying body sizes and that 601 602 individuals can view more than just a frontal perspective. This is especially important 603 considering the natural occurring age-related changes in older women which result in 604 different body composition and fat distribution than younger women (Genazzani & 605 Gambacciani, 2006; Hughes et al., 2004).

606 With these regards, a recent study from Ralph-Nearman and colleagues (2019) has 607 tested the feasibility of a novel mobile tool, the so called 'Somatomap' that allows 608 individuals to visually represent their perception of body-part sizes and shapes, as well as 609 areas of body concerns and record the emotional valence of concerns. In light of the results of our current study which highlight the importance of addressing specific body parts concerns
in women and related visual size (mis)perceptions, it would be extremely useful to adopt a
tool with such properties when assessing multiple components of body image across life span
in future.

614 Second, although previous studies of Cornelissen and co-authors (Cornelissen et al., 615 2015, 2017; Irvine et al., 2018) demonstrated that attitudinal components of body image can 616 be compressed into a *single* principal component reflecting variation in attitudes to body 617 shape, weight and eating, self-esteem, and tendency to depression, yet in this study we did 618 not include a measure of self-esteem and depression which could have mediated the need to 619 appear thinner. With these regards, albeit no evidence for a specific role of self-esteem has 620 been reported when investigating specific age-related differences in perceptual body image in 621 previous investigations, yet it would be interesting to investigate in the future the link 622 between self-esteem and body image concerns (Stapleton et al., 2017), as well as repeated 623 dieting behaviours in older women.

624

625 Conclusions

Despite the limitations discussed, the present study provided, for the first time, evidence that performance at tasks that measure perceptual and attitudinal components of body image are essentially different in young and middle-aged women. Most importantly, we have demonstrated that distortions in perceived actual and ideal body size estimation of younger and middle-aged women are best explained by a combination of BMI, concern for body parts, and the particular age group to which a participant belonged.

632 Overall, these results suggest that women regardless of age, show perceptual and 633 attitudinal body image distortions, yet it is important to focus on specific concerns towards 634 body parts, which accounts for perceived actual body image perceptions for middle-aged 635 women and a desire to appear slimmer for young women. Thus, this study highlights the need 636 for a multidimensional and personalized computerised approach for studies of body image in women across lifespan, which includes women of a variety of ages and a multitude of 637 638 potential attitudinal factors of body image, as well as women's perceptions and concerns of 639 specific body areas.

- 640
- 641
- 642
- 643

644	Compliance with Ethical Standards
645	
646	Conflict of interests: The authors declare no conflict of interest.
647	
648	Ethical approval: All procedures performed in studies involving human participants were in
649	accordance with the ethical standards of the institutional research committee and with the 1964
650	Helsinki declaration and its later amendments or comparable ethical standards.
651	
652	Informed consent: Informed consent was obtained from all individual participants included
653	in the study.
654	
655	Data availability: The datasets analysed during the current study are not publicly available
656	due lacking participant consent for data-sharing with third parties (according to our current
657	General Data Protection Regulation, GDPR), but are available from the corresponding author
658	on reasonable request.
659	
660	
661	
662	
663	
664	
665	
666	
667	
668	
669	
670	
671	
672	
673	
674	
675	
676	
677	

678 **References**

- Ålgars, M., Santtila, P., Varjonen, M., Witting, K., Johansson, A., Jern, P., & Sandnabba, N.
 K. (2009). The adult body: How age, gender, and body mass index are related to body
 image. *Journal of Aging and Health*, 21(8), 1112-1132.
- Arbour, K. P., & Ginis, K. M. (2008). Improving body image one step at a time: Greater
 pedometer step counts produce greater body image improvements. *Body Image*, 5(4),
 331-336.
- Arciszewski, T., Berjot, S., & Finez, L. (2012). Threat of the thin-ideal body image and body
 malleability beliefs: Effects on body image self-discrepancies and behavioral
 intentions. *Body Image*, 9(3), 334-341.
- Bane, S., & McAuley, E. (1998). Body image and exercise. *Advances in sport and exercise psychology measurement*, (pp. 311–324). Morgantown, WV: Fitness Information
 Technology.
- Baugh, E. J. (2009). *Body image and the aging female*. University of Florida, USA.
- Bedford, J. L., & Johnson, C. S. (2006). Societal influences on body image dissatisfaction in
 younger and older women. *Journal of Women & Aging*, *18*(1), 41-55.
- 694 Cafri, G., Yamamiya, Y., Brannick, M., & Thompson, J. K. (2005). The influence of
 695 sociocultural factors on body image: A meta-analysis. *Clinical Psychology: Science*696 *and Practice*, 12(4), 421-433.
- 697 Cash, T. F., & Deagle III, E. A. (1997). The nature and extent of body-image disturbances in
 698 anorexia nervosa and bulimia nervosa: A meta-analysis. *International Journal of*699 *Eating Disorders*, 22(2), 107-126.
- Cazzato, V., Mele, S., & Urgesi, C. (2014). Gender differences in the neural underpinning of
 perceiving and appreciating the beauty of the body. *Behavioural Brain*

702 *Research*, 264(1), 188-196.

- Cazzato, V., Mian, E., Mele, S., Tognana, G., Todisco, P., & Urgesi, C. (2016). The effects of
 body exposure on self-body image and esthetic appreciation in anorexia
 nervosa. *Experimental Brain Research*, 234(3), 695-709.
- Cazzato, V., Mian, E., Serino, A., Mele, S., & Urgesi, C. (2015). Distinct contributions of
 extrastriate body area and temporoparietal junction in perceiving one's own and
 others' body. *Cognitive, Affective, & Behavioral Neuroscience, 15*(1), 211-228.
- 709 Cheung, Y. T. D., Lee, A. M., Ho, S. Y., Li, E. T. S., Lam, T. H., Fan, S. Y. S., & Yip, P. S.

- F. (2011). Who wants a slimmer body? The relationship between body weight status,
 education level and body shape dissatisfaction among young adults in Hong
- 712 Kong. *BMC Public Health*, 825(11), 1-10.
- Cornelissen, K. K., Bester, A., Cairns, P., Tovée, M. J., & Cornelissen, P. L. (2015). The
 influence of personal BMI on body size estimations and sensitivity to body size
 change in anorexia spectrum disorders. *Body Image*, *13*, 75-85.
- Cornelissen, K. K., McCarty, K., Cornelissen, P. L., & Tovée, M. J. (2017). Body size
 estimation in women with anorexia nervosa and healthy controls using 3D
 avatars. *Scientific Reports*, 7(1), 15773.
- Culbert, K. M., Racine, S. E., & Klump, K. L. (2015). Research Review: What we have
 learned about the causes of eating disorders–a synthesis of sociocultural,
- psychological, and biological research. *Journal of Child Psychology and Psychiatry*, 56(11), 1141-1164.
- Cumella, E. J., & Kally, Z. (2008). Profile of 50 women with midlife-onset eating
 disorders. *Eating Disorders*, *16*(3), 193-203.
- Cuzzolaro, M., Vetrone, G., Marano, G., & Garfinkel, P. E. (2006) 'The Body Uneasiness
 Test (BUT): Development and validation of a new body image assessment scale'. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 11*(1), 1-13.
- Davis, S. R., Castelo-Branco, C., Chedraui, P., Lumsden, M. A., Nappi, R. E., Shah, D., &
 Villaseca. P. (2012). Understanding weight gain at menopause. *Climacteric*, 15(5),
 419–429.
- Deeks, A. A., & McCabe, M. P. (2001). Menopausal stage and age and perceptions of body
 image. *Psychology and Health*, *16*(3), 367-379.
- Donaghue, N. (2009). Body satisfaction, sexual self-schemas and subjective well-being in
 women. *Body Image*, 6(1), 37-42.
- Dunkel, T. M., Davidson, D., & Qurashi, S. (2010). Body satisfaction and pressure to be thin
 in younger and older Muslim and non-Muslim women: The role of Western and nonWestern dress preferences. *Body Image*, 7(1), 56-65.
- Evans, C., & Dolan, B. (1993). Body Shape Questionnaire: derivation of shortened "alternate
 forms". *International Journal of Eating Disorders*, *13*(3), 315-321.
- Favaro, A., Ferrara, S., & Santonastaso, P. (2003). The spectrum of eating disorders in young
 women: A prevalence study in a general population sample. *Psychosomatic Medicine*, 65(4), 701-708.
- 743 Festinger, L. (1954). A theory of social comparison processes. Human Relations, 7(2), 117-

744 140.

- Genazzani, A. R., & Gambacciani, M. (2006). Effect of climacteric transition and hormone
 replacement therapy on body weight and body fat distribution. *Gynecological Endocrinology*, 22(3), 145-150.
- Griffiths, S., Castle, D., Cunningham, M., Murray, S. B., Bastian, B., & Barlow, F. K. (2018).
 How does exposure to thinspiration and fitspiration relate to symptom severity among
 individuals with eating disorders? Evaluation of a proposed model. *Body Image*, 27,
 187-195.
- Hayashi, F., Takimoto, H., Yoshita, K., & Yoshiike, N. (2006). Perceived body size and
 desire for thinness of young Japanese women: a population-based survey. *British Journal of Nutrition*, 96(6), 1154-1162.
- Hoek, H. W. (2006). Incidence, prevalence and mortality of anorexia nervosa and other
 eating disorders. *Current Opinion in Psychiatry*, *19*(4), 389–394.
- Holsen, I., Jones, D. C., & Birkeland, M. S. (2012). Body image satisfaction among
 Norwegian adolescents and young adults: A longitudinal study of the influence of
 interpersonal relationships and BMI. *Body Image*, 9(2), 201-208.
- Hrabosky, J. I., Cash, T. F., Veale, D., Neziroglu, F., Soll, E. A., Garner, D. M., ... & Phillips,
 K. A. (2009). Multidimensional body image comparisons among patients with eating
 disorders, body dysmorphic disorder, and clinical controls: A multisite study. *Body Image*, 6(3), 155-163.
- Hudson, J. I., Hiripi, E., Pope Jr, H. G., & Kessler, R. C. (2007). The prevalence and
 correlates of eating disorders in the National Comorbidity Survey
 Replication. *Biological Psychiatry*, *61*(3), 348-358.
- Hughes, V. A., Roubenoff, R., Wood, M., Frontera, W. R., Evans, W. J., & Fiatarone Singh,
 M. A. (2004). Anthropometric assessment of 10-y changes in body composition in the
 elderly. *The American Journal of Clinical Nutrition*, 80(2), 475-482.

770 Irvine, K. R., McCarty, K., Pollet, T. V., Cornelissen, K. K., Tovée, M. J., & Cornelissen, P.

- L. (2019). The visual cues that drive the self-assessment of body size: Dissociation
 between fixation patterns and the key areas of the body for accurate judgement. *Body Image*, 29(1), 31-46.
- Johnson, F., Cooke, L., Croker, H., & Wardle, J. (2008). Changing perceptions of weight in
 Great Britain: Comparison of two population surveys. *Bmj*, *337*(1), 1-5.
- Keizer, A., van Elburg, A., Helms, R., & Dijkerman, H. C. (2016). A virtual reality full body

- illusion improves body image disturbance in anorexia nervosa. *PloS one*, *11*(10), 121.
- 779 Keski-Rahkonen, A., Bulik, C. M., Neale, B. M., Rose, R. J., Rissanen, A., & Kaprio, J.
- 780 (2005). Body dissatisfaction and drive for thinness in young adult twins. *International*781 *Journal of Eating Disorders*, *37*(3), 188-199.
- Kittler, J. E., Menard, W., & Phillips, K. A. (2007). Weight concerns in individuals with body
 dysmorphic disorder. *Eating Behaviors*, 8(1), 115-120.
- Lewis, D. M., & Cachelin, F. M. (2001). Body image, body dissatisfaction, and eating
 attitudes in midlife and elderly women. *Eating Disorders*, 9(1), 29-39.
- Longo, M. R., Betti, V., Aglioti, S. M., & Haggard, P. (2009). Visually induced analgesia:
 Seeing the body reduces pain. *Journal of Neuroscience*, *29*(39), 12125-12130.
- 788 Marcus, M. D., Bromberger, J. T., Wei, H. L., Brown, C., & Kravitz, H. M. (2007).
- Prevalence and selected correlates of eating disorder symptoms among a multiethnic
 community sample of midlife women. *Annals of Behavioral Medicine*, *33*(3), 269277.
- McCabe, M. P., Ricciardelli, L. A., & James, T. (2007). A longitudinal study of body change
 strategies of fitness center attendees. *Eating Behaviors*, 8(4), 492-496.
- McKinley, N. M., & Lyon, L. A. (2008). Menopausal attitudes, objectified body
 consciousness, aging anxiety, and body esteem: European American women's body
 experiences in midlife. *Body Image*, 5(4), 375-380.
- 797 Mian, E., & Gerbino, W. (2009). Body image assessment in the computer aided
- psychological support for eating disorders. Abstracts from cyber therapy 14,
- designing the future of healthcare, Lago Maggiore, Verbania, Italy. *Cyber Psychology & Behavior*, 12(1), 581-673.
- 801 Monteath, S. A., & McCabe, M. P. (1997). The influence of societal factors on female body
- 802 image. *The Journal of Social Psychology*, *137*(6), 708-727.
- Mussweiler, T. (2003). Comparison processes in social judgment: mechanisms and #
 consequences. *Psychological Review*, *110*(3), 472-489.
- Paul, T. K., Sciacca, R. R., Bier, M., Rodriguez, J., Song, S., & Giardina, E. G. V. (2015).
 Size misperception among overweight and obese families. *Journal of General Internal Medicine*, *30*(1), 43-50.
- Pedersen, L., Hicks, R. E., & Rosenrauch, S. (2018). Sociocultural pressure as a mediator of
 eating disorder symptoms in a non-clinical Australian sample. *Cogent*
- 810 *Psychology*, 5(1), 1-15.

- Pruis, T. A., & Janowsky, J. S. (2010). Assessment of body image in younger and older
 women. *The Journal of General Psychology: Experimental, Psychological, and Comparative Psychology, 137*(3), 225-238.
- Ralph-Nearman, C., Arevian, A. C., Puhl, M., Kumar, R., Villaroman, D., Suthana, N.,
 Feusner, J. D., & Khalsa, S. S. (2019). A Novel Mobile Tool (Somatomap) to Assess
 Body Image Perception Pilot Tested With Fashion Models and Nonmodels: Cross-
- 817 Sectional Study. *JMIR Mental Health*, 6(10), 1-15.
- Reboussin, B. A., Rejeski, W. J., Martin, K. A., Callahan, K., Dunn, A. L., King, A. C., &
 Sallis, J. F. (2000). Correlates of satisfaction with body function and body appearance
 in middle-and older aged adults: The Activity Counseling Trial (ACT). *Psychology and Health*, 15(2), 239-254.
- Ricciardelli, L. A., & McCabe, M. P. (2004). A biopsychosocial model of disordered eating
 and the pursuit of muscularity in adolescent boys. *Psychological Bulletin*, *130*(2),
 179-205.
- Robinson, E. (2017). Overweight but unseen: a review of the underestimation of weight
 status and a visual normalization theory. *Obesity Reviews*, *18*(10), 1200-1209.
- Robinson, E., & Kirkham, T. C. (2014). Is he a healthy weight? Exposure to obesity changes
 perception of the weight status of others. *International Journal of Obesity*, *38*(5), 663667.
- Rosen, J. C., & Ramirez, E. (1998). A comparison of eating disorders and body dysmorphic
 disorder on body image and psychological adjustment. *Journal of Psychosomatic Research*, 44(3-4), 441-449.
- 833 Saucier, M. G. (2004). Midlife and beyond: Issues for aging women. *Journal of Counseling*834 & *Development*, 82(4), 420-425.
- Schaefer, L. M., Burke, N. L., Thompson, J. K., Dedrick, R. F., Heinberg, L. J., Calogero, R.
 M., Bardone-Cone, A. M., Higgins, M. K., Frederick, D. A., Kelly, M., Anderson, D.
- A., Schaumberg, K., Nerini, A., Stefanile, C., Dittmar, H., Clark, E., Adams, Z.,
- 838 Macwana, S., Klump, K. L., Vercellone, A. C., Paxon, S. J., & Swami, V. (2015).
- Base Development and validation of the Sociocultural Attitudes Towards Appearance
 Questionnaire-4 (SATAQ-4). *Psychological Assessment*, 27(1), 1-54.
- Schuck, K., Munsch, S., & Schneider, S. (2018). Body image perceptions and symptoms of
 disturbed eating behavior among children and adolescents in Germany. *Child and Adolescent Psychiatry and Mental Health*, *12*(10), 1-11.
- 844 Slevec, J. H., & Tiggemann, M. (2011a). Predictors of body dissatisfaction and disordered

- eating in middle-aged women. *Clinical Psychology Review*, *31*(4), 515-524.
- Slevec, J., & Tiggemann, M. (2011b). Media exposure, body dissatisfaction, and disordered
 eating in middle-aged women: A test of the sociocultural model of disordered
 eating. *Psychology of Women Quarterly*, *35*(4), 617-627.
- Smeets, M. A., Klugkist, I. G., van Rooden, S., Anema, H. A., & Postma, A. (2009). Mental
 body distance comparison: A tool for assessing clinical disturbances in visual body
 image. *Acta Psychologica*, *132*(2), 157-165.
- Smink, F. R., Van Hoeken, D., & Hoek, H. W. (2012). Epidemiology of eating disorders:
 incidence, prevalence and mortality rates. *Current Psychiatry Reports*, *14*(4), 406414.
- Sowers, M., Zheng, H., Tomey, K., Karvonen-Gutierrez, C., Jannausch, M., Li, X., Yosef,
 M., & Symons, J. (2007). Changes in body composition in women over six years at
 midlife: Ovarian and chronological aging. *The Journal of Clinical Endocrinology & Metabolism*, 92(3), 895-901.
- Stanford, J. N., & McCabe, M. P. (2002). Body image ideal among males and females:
 Sociocultural influences and focus on different body parts. *Journal of Health Psychology*, 7(6), 675-684.
- Stapleton, P., Crighton, G. J., Carter, B., & Pidgeon, A. (2017). Self-esteem and body image
 in females: The mediating role of self-compassion and appearance contingent selfworth. *The Humanistic Psychologist*, 45(3), 238-257.
- Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic
 review. *Psychological Bulletin*, *128*(5), 825-848.
- Tchkonia, T., Morbeck, D. E., Von Zglinicki, T., Van Deursen, J., Lustgarten, J., Scrable, H.,
 Khosla, S., Jensen, M. D., & Kirkland, J. L. (2010). Fat tissue, aging, and cellular
 senescence. *Aging Cell*, 9(5), 667-684.
- Thompson, J. K., van den Berg, P., Roehrig, M., Guarda, A. S., & Heinberg, L. J. (2004)
 'The sociocultural attitudes towards appearance scale-3 (SATAQ-3): Development
 and validation'. *International Journal of Eating Disorders*, *35*(3), 93-304.
- Thaler, A., Geuss, M. N., Mölbert, S. C., Giel, K. E., Streuber, S., Romero, J., Black, M. J., &
 Mohler, B. J. (2018). Body size estimation of self and others in females varying in
 BMI. *PloS one*, *13*(2), 1-24.
- Tiggemann, M. (2004). Body image across the adult life span: Stability and change. *Body image*, *1*(1), 29-41.
- Toh, W. L., Grace, S. A., Rossell, S. L., Castle, D. J., & Phillipou, A. (2019). Body parts of

diagnostic comparison. Australasian Psychiatry, 28(2), 134-139. Tovée, M. J., Benson, P. J., Emery, J. L., Mason, S. M., & Cohen-Tovée, E. M. (2003). Measurement of body size and shape perception in eating-disordered and control observers using body-shape software. British Journal of Psychology, 94(4), 501-516. Vanina, Y., Podolskaya, A., Sedky, K., Shahab, H., Siddiqui, A., Munshi, F., & Lippmann, S. (2002). Body weight changes associated with psychopharmacology. Psychiatric Services, 53(7), 842-847. Wadsworth, L. A., & Johnson, C. P. (2008). Mass media and healthy aging. Journal of *Nutrition for the Elderly*, 27(3-4), 319-331. Wardle, J., Haase, A. M., & Steptoe, A. (2006). Body image and weight control in young adults: international comparisons in university students from 22 countries. International Journal of Obesity, 30(4), 644-651. Zamariola, G., Cardini, F., Mian, E., Serino, A., & Tsakiris, M. (2017). Can you feel the body that you see? On the relationship between interoceptive accuracy and body image. Body Image, 20, 130-136.

clinical concern in anorexia nervosa versus body dysmorphic disorder: a cross-

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 BMI	-																	
2 SATAQ_INTT	0.14	-																
3 SATAQ_INTM	-0.14	0.54***	-															
4 SATAQ_FP	0.50***	0.32**	0.05	-														
5 SATAQ_PP	0.36**	0.45**	0.37**	0.63***	-													
6 SATAQ_PM	0.40**	0.24*	0.09	0.33**	0.31*	-												
7 BUT_BIC	0.67***	0.40**	0.11	0.40**	0.39**	0.50***	-											
8 BUT_A	0.59***	0.32**	0.06	0.35**	0.38**	0.33**	0.84***	-										
9 BUT_CSM	0.28*	0.52***	0.38**	0.24	0.45**	0.39**	0.70***	0.61***	-									
10 BUT_D	0.27*	0.41**	0.31*	0.11	0.29*	0.18	0.58***	0.64***	0.76***	-								
11 BUT_WP	0.54***	0.41**	0.10	0.25*	0.36**	0.51***	0.88***	0.76***	0.81***	0.71***	-							
12 BUT_M	0.22	0.42**	0.35**	0.20	0.31*	0.28*	0.52***	0.43**	0.58***	0.47***	0.54***	-						
13 BUT_FS	0.35**	0.37**	0.16	0.30*	0.31**	0.29*	0.58***	0.51***	0.62***	0.56***	0.65***	0.66***	-					
14 BUT_TH	0.67***	0.24	-0.04	0.41**	0.32*	0.44**	0.69***	0.58***	0.52***	0.37**	0.67***	0.52***	0.62***	-				
15 BUT_L	0.40**	0.40**	0.18	0.21	0.27*	0.41**	0.61***	0.47***	0.62***	0.50***	0.69***	0.70***	0.70***	0.71***	-			
16 BUT_H	0.34**	0.33**	0.04	0.25*	0.25	0.37**	0.62***	0.55***	0.59***	0.44**	0.69***	0.73***	0.80***	0.66***	0.78***	-		
17 BUT_MOU	0.23	0.23	0.07	0.08	0.15	0.15	0.41**	0.30*	0.49***	0.36**	0.45**	0.38**	0.52***	0.35**	0.44**	0.43**	-	
18 BUT_SK	0.16	0.35**	0.26*	0.15	0.39**	0.25*	0.50***	0.41**	0.66***	0.56***	0.56***	0.57***	0.63***	0.47***	0.55***	0.57***	0.37**	-
19 BUT_BLU	0.31*	0.30*	0.22	0.31*	0.33**	0.27*	0.45**	0.40**	0.56***	0.50***	0.52***	0.52***	0.72***	0.52***	0.58***	0.64***	0.51***	0.52***

Table 1. Pearson's correlation coefficients for the inter-correlations for BMI and the 18 subscales of the self-report questionnaires for both young and middle-aged women combined.

*= p<.05, **= p<.01, ***= p<.0001

Note: BMI= Body Mass Index; SATAQ= Sociocultural Attitudes Towards Appearance Questionnaire; BUT= Body Uneasiness Test;

INTT= Internalisation-Thin/low body fat; *INTM*= Internalisation-Muscular/athletic; *FP*=Family Pressures; *PP*= Peer Pressures; *PM*= Pressures Media; *BIC*= Body Image

Concerns; A= Avoidance; CSM= Compulsive Self-Monitoring; D= Depolarisation; WP= Weight Phobia; M= Mouth; FS= Face Shape; TH= Thighs; L= Legs; H= Harms; MOU= Moustache; SK= Skin; BLU= Blushing.

	Middle-aged (n= 33)	Younger $(n=32)$	Middle-aged vs.
	M(SD)	M (SD)	younger
			р
Age (years)	53.79 (3.72)	24.22 (4.51)	<.001
BMI (kg/m ²)	27.16 (5.13)	22.74 (4.36)	<.005
SATAQ-4			
Internalization- Thin/Low body fat (max 5)	2.62 (1.03)	2.89 (0.68)	ns
Internalization- Muscular/ Athletic (max 5)	2.16 (0.98)	2.56 (1.07)	ns
Pressures-Family (max 5)	2.08 (1.22)	1.80 (1.04)	ns
Pressures-Peers (max 5)	1.98 (1.20)	1.76 (1.02)	ns
Pressures-Media (max 5)	3.44 (1.39)	3.16 (1.33)	ns
BUT-A			
Body Image Concern (max 5)	1.90 (0.93)	1.45 (1.07)	ns
Avoidance (max 5)	0.87 (0.75)	0.51 (0.74)	ns
Compulsive Self-Monitoring (max 5)	1.36 (0.86)	1.26 (0.90)	ns
Depersonalization (max 5)	0.76 (0.75)	0.65 (0.64)	ns
Weight Phobia (max 5)	2.00 (1.01)	1.55 (1.08)	ns
Global Severity Index (max 5)	1.46 (0.78)	1.13 (0.85)	ns
BUT- B			
Mouth (max 5)	1.56 (0.92)	1.26 (0.90)	ns
Face Shape (max 5)	1.22 (0.82)	1.04 (0.97)	ns
Thighs (max 5)	2.79 (1.19)	1.65 (1.13)	<.005
Legs (max 5)	1.72 (1.21)	1.23 (1.02)	ns
Harms (max 5)	1.53 (1.08)	1.17 (0.99)	ns
Moustache (max 5)	0.86 (1.12)	0.89 (1.02)	ns
Skin (max 5)	2.02 (1.23)	1.72 (1.15)	ns
Blushing (max 5)	1.47 (1.07)	1.22 (1.00)	ns
Positive Symptom Total (max 37)	26.85 (10.56)	23.84 (12.27)	ns
Positive Symptom Distress Index (max 5)	2.29 (.75)	1.94 (.72)	ns

Table 2. Demographic and psychometric responses from middle-aged (n=33) women and younger women (n=33).

Note: BMI= Body Mass Index; SATAQ-4= Sociocultural Attitudes Towards Appearance Questionnaire; BUT= Body Uneasiness Test.

		Group	
	Middle-aged n (%)	Young n (%)	Total n (%)
Characteristic			
Ethnicity			
Caucasian	31 (93.9)	32 (100)	63 (96.9)
Mixed Race	2 (6.1)	0 (0)	2 (3.1)
Handedness			
Right	29 (87.9)	23 (71.9)	52 (80)
Left	4 (12.1)	9 (28.1)	13 (20)
Menstrual Cycle			
Yes	8 (24.2)	30 (93.8)	38 (58.5)
No	25 (75.8)	2 (6.2)	27 (41.5)

Table 3. Demographic characteristics of middle-aged (n=33) women and younger women (n=32), analysed by Chi-square.

		Actual	Age	BMI	BUT-	BUT-	SATAQ-
					Parts	Att	Press
Middle-aged	Age	03	-				
women	BMI	.37*	08	-			
	BUT-Parts	.43*	.16	04	-		
	BUT-Att	.39*	13	.45*	12	-	
	SATAQ-Press	.06	02	.47*	00	11	-
	SATAQ-Int	.10	.14	09	.03	.13	.09
Younger	Age	26	-				
women	BMI	.41*	07	-			
	BUT-Parts	10	03	.39*	-		
	BUT-Att	.16	25	.42*	.08	-	
	SATAQ-Press	.39*	.21	.56**	06	.06	-
	SATAQ-Int	.00	09	18	.06	07	00

Table 4. Pearson correlations between each of the four principal components (BUT-Parts, BUT-Att, SATAQ-press, SATAQ-Int), age, BMI, and perceived actual body size distortion, presented separately for middle-aged women (n=33) and younger women (n=32).

p* <.05, *p* <.005, ****p* <.001.

Note: BMI= Body Mass Index; Att= Attitudinal; Press= Pressures; Int= Internalisation

		Ideal	Age	BMI	BUT-	BUT-	SATAQ-
					Parts	Att	Press
Middle-aged	Age	.26	-				
Women	BMI	11	08	-			
	BUT-Parts	.08	.16	04	-		
	BUT-Att	02	13	.45*	12	-	
	SATAQ-Press	11	02	.47*	00	11	-
	SATAQ-Int	06	.14	09	.03	.13	.09
Younger	Age	19	-				
women	BMI	.00	07	-			
	BUT-Parts	49**	03	.39*	-		
	BUT-Att	10	25	.42*	.08	-	
	SATAQ-Press	.08	.21	.56**	06	.06	-
	SATAQ-Int	.15	09	18	.06	07	00

Table 5. Pearson correlations between each of the four principal components (BUT-Parts, BUT-Att, SATAQ-press, SATAQ-Int), age, BMI, and ideal body size distortion, presented separately for middle-aged women (n=33) and younger women (n=32).

p* <.05, *p* <.005, ****p* <.001.

Note: BMI= Body Mass Index; Att= Attitudinal; Press= Pressures; Int= Internalisation

Figure Captions:

Fig. 1. Visual representation of the body distortion technique, using the Body Image Revealer (BIR); veridical (0 =original, centre), distortion (-50 = slimmer and +50 = fatter) of body size. Images of participants were viewed against a white background.

Fig. 2. (*a*) Significant two-way interaction between BUT-parts and Age for the perceived actual body image subcomponent. (*b*) Non-significant interaction between BMI and age group for the perceived actual body image. (*c*) Significant two-way interaction between BUT-parts and Age for the ideal body image subcomponent. For all figures, the shaded regions correspond to the 95% confidence intervals for the regression slopes, which have been computed separately for each group. Blue circles with a blue regression line represent the younger women, red circles with a red regression line, middle-aged women.