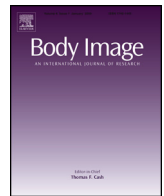




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Nature exposure and positive body image: (Re-)examining the mediating roles of connectedness to nature and trait mindfulness



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ABSTRACT

Previous studies have reported a significant association between nature exposure and positive body image, but understandings of the mechanisms that help to explain this link remain nascent. Here, we considered the extent to which trait mindfulness and connectedness to nature, respectively, mediate the aforementioned relationship both in parallel and serially. An online sample of 398 participants (199 women, 196 men, 3 other; age $M = 28.1$ years) from the United Kingdom completed measures of self-reported nature exposure, mindful awareness and acceptance, connectedness to nature, and body appreciation. Results indicated that inter-correlations between scores on all measures were significant and positive. Following the elimination of non-significant pathways, path analysis resulted in an adequately-fitting model in which the direct relationship between nature exposure and body appreciation was significant. In addition, connectedness to nature – but not trait mindfulness – significantly mediated the direct relationship. Finally, we also found evidence of a serial mediation, where the association between nature exposure and body appreciation was mediated by mindful awareness followed by connectedness to nature. The implications of these results for scholarly and practitioner understanding of the impact of nature exposure on positive body image are discussed in conclusion.

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1. Introduction

For the first time in history, a majority of individuals globally live in urbanised spaces (United Nations, 2014), but urban living and decreased time spent outdoors have been associated with increased rates of mental illness (e.g., Lecic-Tosevski, 2019; Okkels, Kristiansen, & Munk-Jørgensen, 2017). In response, scholars and policy-makers have focused on understanding how natural environments – the continuum of environments from wild nature to designed greenspaces (Abraham, Sommerhalder, & Abel, 2010) – can support psychological health. Indeed, there is now a wealth of evidence to suggest that nature exposure is associated with a range of mental health benefits, including enhancements to self-esteem, positive affect, and cognitive functioning (for reviews, see Collado, Staats, Corraliza, & Hartig, 2017; Frumkin et al., 2017; Norwood et al., 2019; van den Bosch & Bird, 2018). Importantly, these effects have been shown to be robust across diverse social identity groups

(for a review, Harshfield et al., 2019), which has important implications not only for urban planning but also the design of therapeutic care.

As part of the research agenda on nature exposure and psychological well-being, some scholars have focused specifically on the construct of *positive body image*, which refers to an “overarching love and respect for the body” that includes appreciation of the body and its functions, acceptance of the body despite its imperfections, and body-protective behaviours (Tylka, 2018, p. 9). This focus is warranted not only because promoting healthier body image is important in its own right (Guest et al., 2019; Tylka & Piran, 2019), but also because of the range of benefits that are related to positive body image. Such benefits include more positive emotional and eudaimonic well-being (e.g., Davis, Fowler, Best, & Both, 2019; Swami, Weis, Barron, & Furnham, 2018), positive self-care health behaviours (e.g., Andrew, Tiggemann, & Clark, 2016; Gillen, 2015), and adaptive eating styles that are associated with lower body mass indices and weight stability (e.g., Tylka, Calogero, & Daniëlsdóttir, 2015; Tylka, Calogero, & Daniëlsdóttir, 2020). In short, promoting more positive body image via nature exposure may provide individuals with opportunities to optimally care for their bodies and minds.

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Studies supporting a link between nature exposure and positive body image have used a number of different methodologies. First, the findings of cross-sectional studies have shown that self-reported nature exposure is significantly associated with indices of positive body image, including body appreciation and functionality appreciation (Swami et al., 2019; Swami, Barron, Weis, & Furnham, 2016). Second, one-group pretest-posttest studies have shown that spending time in natural environments (e.g., allotments, beaches, and botanic gardens) significantly elevated state body appreciation in samples from Malaysia, Romania, Spain, and the United Kingdom (Swami, 2020a; Swami et al., 2020). Finally, experimental studies have shown that exposure to natural environments, but not built environments, is associated with significant elevations in state positive body image (Swami, Barron, & Furnham, 2018; see also Rosenberg, Lange, Zebrack, Moulton, & Kosslyn, 2014). Experimental studies have also presented evidence that exposure to simulated natural environments – presented in the form of films of a first-person walk in nature (Swami, 2020b; Swami, Pickering et al., 2018) and photographs of nature (Swami, Barron et al., 2018) – significantly elevates indices of state positive body image.

One class of explanations for these influences on positive body image has focused on direct effects. For example, it has been suggested that nature exposure may help individuals to distance themselves physically and mentally from contexts that are heavily appearance-focused, facilitate holistic self-care attitudes, and direct attention toward greater appreciation of the body's functions rather than appearance (Hennigan, 2010; Holloway, Murray, Okada, & Emmons, 2014; Swami, Barron et al., 2018). However, a multiplicity of pathways involving both direct and mediated relationships also seems likely, as has been suggested within the broader literature on nature exposure and health outcomes (e.g., Markevych et al., 2017). For example, one possible mediator of the relationship between nature exposure and positive body image is *connectedness to nature*, which refers to a sense of oneness with nature (Mayer & Frantz, 2004). Spending time in nature is known to promote greater subjective connectedness to natural environments (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009) and, in turn, connectedness to nature may help individuals shift away from appearance concerns onto more holistic embodying experiences (Holloway et al., 2014). Consistent with this theorising, previous research has shown that connectedness to nature significantly mediates the relationship between nature exposure and body appreciation (Swami, Barron et al., 2016; see also Swami, von Nordheim, & Barron, 2016).

Another construct that has been found to mediate relationships between nature exposure and positive body image is self-compassion (Swami et al., 2019). Specifically, Swami et al. (2019) found that relationships between nature exposure and positive body image (operationalised in terms of body appreciation and functionality appreciation, respectively) were mediated by the self-compassion facets of self-kindness and common humanity, though not the facet of mindfulness. The finding that mindfulness did not significantly mediate the relationship between nature exposure and positive body image is puzzling, especially given evidence that the construct is significantly associated with both nature exposure (e.g., Hamann & Itzvan, 2016; Stewart & Haaga, 2018) and positive body image (for a review, see Cook-Cottone, 2018). One possibility is that the non-significant mediating effect was artefactual, given that Swami et al. (2019) operationalised mindfulness as a facet of self-compassion rather than as a multidimensional construct in its own right. Indeed, Kabat-Zinn's (1994) seminal formulation of mindfulness distinguished between two main features, namely *mindful awareness* (i.e., the regulation of attention on present-moment experiences) and *mindful acceptance* (i.e., the capacity to view experiences from a stance of openness and acceptance). Of the two mindfulness facets, mindful awareness is the

more likely to mediate relationships between nature exposure and body image, given that the capacity to attend to, notice, and receive impressions from the natural world is likely crucial for promoting a self-care stance (see Harrison & Clark, 2020).

An alternative possibility is that mindfulness does not in fact mediate relationships between nature exposure and positive body image, but instead exerts an effect on body image indirectly via connectedness to nature. In the first instance, there is some evidence that spending time in nature may be related with greater mindfulness (Duvall, 2011a, 2011b; Passmore & Holder, 2017). In turn, greater trait mindfulness has been shown to be significantly associated with connectedness to nature (weighted effect size of $r = .25$; Schutte & Malouf, 2018). In particular, the non-judgemental awareness that is central to trait mindfulness may allow individuals to fully engage with nature, thus helping to promote greater connectedness to nature (e.g., Aspy & Proeve, 2017; Hanley, Bettmann, Kendrick, Deringer, & Lynn Norton, 2020; Unsworth, Palicki, & Lustig, 2016). In short, there are reasons to think that the relationship between nature exposure and positive body image may be serially mediated by trait mindfulness and connectedness to nature, respectively. To date, however, this possibility has not been explicitly examined, though it is worthy of investigation (Swami et al., 2019).

1.1. The present study

To summarise, the available research has shown that nature exposure is reliably associated with positive body image, but there are unresolved issues and gaps in knowledge *vis-à-vis* mediating pathways. As a contribution to this literature, therefore, the present study had a number of inter-connected objectives. First, we examined the extent to which connectedness to nature and trait mindfulness (operationalised here in terms of mindful awareness and mindful acceptance), respectively, significantly mediate the relationship between nature exposure and body appreciation. In this model, we assume that both connectedness to nature and mindfulness will have comparable effects on body appreciation (i.e., parallel mediation), as they are conceptualised as being separate channels of influence (that is, we wanted to examine whether these dimensions play different, parallel roles in the relationship between nature exposure and body appreciation).

Second, given previous findings showing that mindfulness does not mediate the relationship between nature exposure and positive body image, we also considered the possibility of a serial mediation. Specifically, we examined whether the relationship between nature exposure and body appreciation is mediated firstly by trait mindfulness and secondly by connectedness to nature. Here, we treated the variables included in the present study as functioning within a causal chain, which seems plausible for the reasons we have discussed above. Although complete causal chains are often unlikely (Hayes, 2017), serial mediation is important to explore to better understanding previously reported null effects (Swami et al., 2019). Finally, as a subsidiary objective, we also aimed to replicate previous cross-sectional work (Swami et al., 2019; Swami, Barron et al., 2016) documenting a direct link between nature exposure and positive body image (operationalised here as body appreciation). A graphical representation of the hypothesised relationships is presented in Fig. 1.

2. Method

2.1. Participants

The initial participant pool consisted of 402 individuals, but 4 participants who failed an attention-check item in the survey were

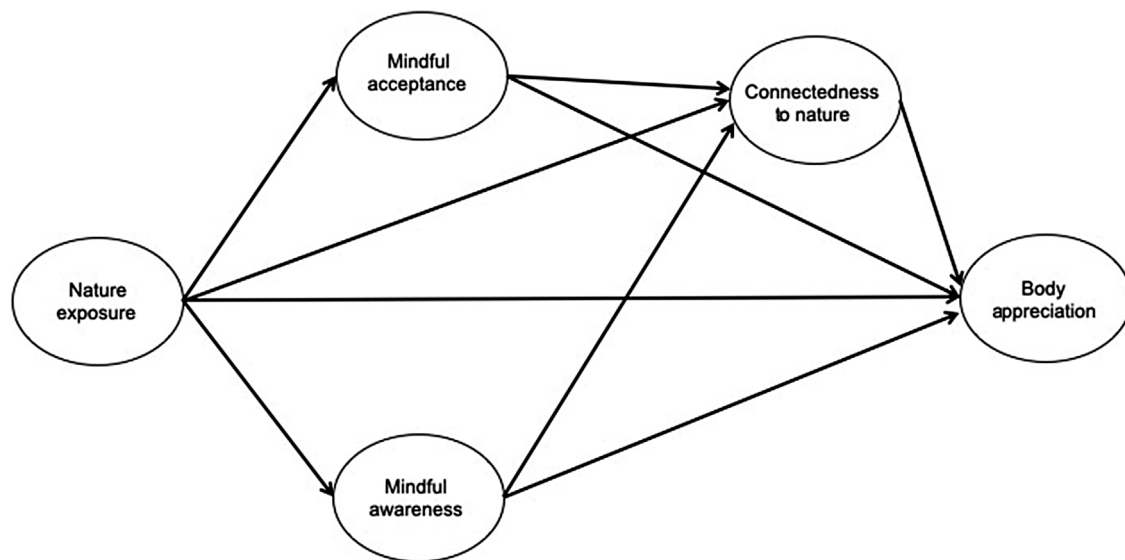


Fig. 1. Hypothesised relationships between nature exposure, trait mindfulness (acceptance and awareness), connectedness to nature, and body appreciation.

excluded. The final sample, therefore, consisted of 199 individuals who identified as women, 196 as men, and 3 as other. Participants ranged in age from 18 to 67 years ($M = 28.05$, $SD = 9.47$) and in body mass index (BMI) from 14.74 to 46.67 kg/m² ($M = 24.73$, $SD = 5.30$). The majority of participants identified as being of British White ancestry (84.7 %; British Asian = 7.0 %; African Caribbean = 2.5 %; mixed = 2.3 %; other = 3.5 %). In terms of educational attainment, 19.6 % had completed secondary schooling, 40.1 % had an undergraduate degree, 23.2 % had a postgraduate degree, 14.4 % were still in full-time higher education, and 2.8 % had some other qualification.

2.2. Measures

2.2.1. Body appreciation

To measure body appreciation, we used the 10-item Body Appreciation Scale (BAS-2; Tylka & Wood-Barcalow, 2015), which measures acceptance of one's body, respect and care for one's body, and protection of one's body from unrealistic beauty standards (sample item: "I respect my body"). All items were rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*), and an overall score was computed as the mean of all items. BAS-2 scores have been shown to have a 1-dimensional factor structure and have been judged as adequate in terms of internal consistency estimates, test-retest reliability after 3 weeks, and indices of convergent and discriminant validity in English-speaking adults (Tylka & Wood-Barcalow, 2015). In this study, ω for scores on this scale was .94 (95 % CI = .93, .95).

2.2.2. Nature exposure

Nature exposure was measured using the Nature Exposure Scale (NES; Kamitsis & Francis, 2013). This is a 4-item scale that measures an individual's level of exposure to nature in everyday life and activities, and levels of exposure to nature outside of everyday environments (sample item: "How much do you notice the natural environments in your everyday life?"). Response anchors varied depending on the item, but all included 5-point scales. An overall score of nature exposure was computed as the mean of all four items. Scores on the NES have been shown to have a 1-dimensional factor structure (Swami, Barron et al., 2016) and adequate internal consistency and criterion validity in English-speaking adults

(Kamitsis & Francis, 2013). In this study, ω for NES scores was .73 (95 % CI = .70, .76).

2.2.3. Mindfulness

Trait mindfulness was measured using the 20-item Philadelphia Mindfulness Scale (PMS; Cardaciotto et al., 2008), which measures distinct facets of present-centred awareness (10 items; sample item: "I am aware of what thoughts are passing through my mind") and acceptance (10 items; sample item: "I try to distract myself when I feel unpleasant emotions"). Items were rated on a 5-point scale ranging from 1 (*never*) to 5 (*very often*) and subscale scores were computed as the mean of relevant items. Scores on the PMS have been shown to be bi-dimensional with adequate internal reliability and good construct validity in English-speaking adults (Cardaciotto et al., 2008). Here, ω was .73 (95 % CI = .69, .77) for awareness scores and .72 (95 % CI = .86, .76) for acceptance scores.

2.2.4. Connectedness to nature

The survey package included the 14-item Connectedness to Nature Scale (CNS; Mayer & Frantz, 2004). This is a widely-used instrument that measures an individual's affective and experiential connection to nature (sample item: "I often feel a sense of oneness with the natural world around me"). Items were rated on a 5-point scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). An overall CNS score was computed as the mean of all items. Scores on the CNS have been shown to have a 1-dimensional factor structure, with estimates supporting internal consistency and construct validity in English-speaking adults. In the present study, ω for CNS scores was .82 (95 % CI = .78, .86).

2.2.5. Demographics

Participants were asked to provide information about their gender identity, age, ethnicity, educational attainment, height, and weight. The latter two items were used to compute self-reported BMI as kg/m², which we used for sample descriptive purposes.

2.3. Procedures

Our project was approved by the School ethics committee at Anglia Ruskin University (approval code: PSY-S19-010). All data were collected via the Prolific website, a crowdsourcing Internet marketplace that allows individuals to complete academic surveys

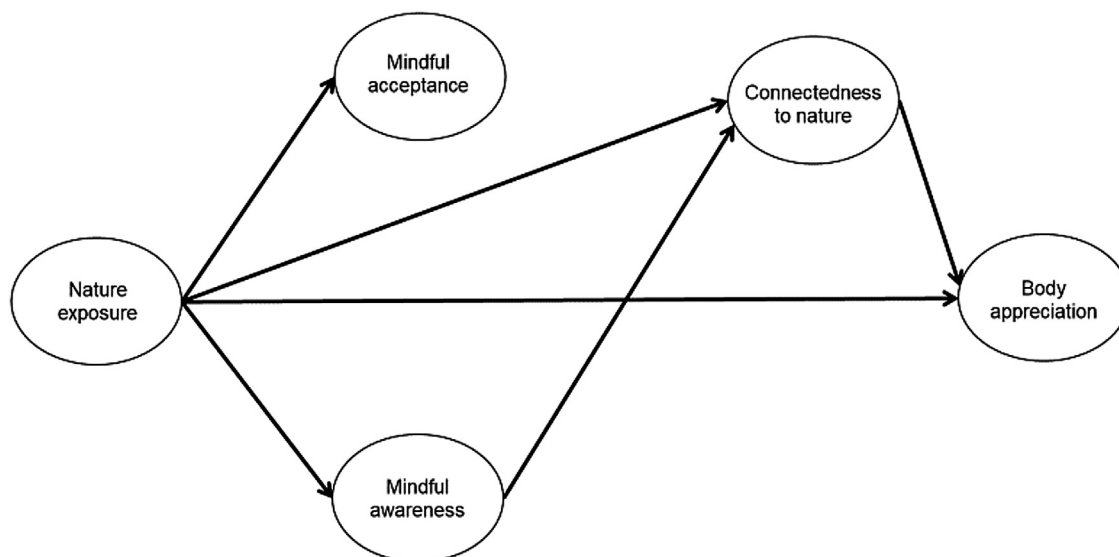


Fig. 2. Model of best-fit.

Table 1
Descriptive Statistics and Inter-Scale Correlations between All Variables Included in the Present Study.

	(1)	(2)	(3)	(4)	(5)
(1) Nature exposure		.55**	.22**	.14*	.34**
(2) Connectedness to nature			.35**	.30**	.39**
(3) Mindful awareness				.78**	.21**
(4) Mindful acceptance					.14*
(5) Body appreciation					
<i>M</i>	3.46	3.39	3.57	3.61	3.40
<i>SD</i>	0.72	0.59	0.53	0.51	0.82

Note. $N = 398$. * $p < .05$, ** $p < .001$.

for monetary compensation, on March 26, 2020. The project was advertised as a study on “nature and body image” and included an estimated duration. Participation was limited to citizens of the United Kingdom, those of adult age, and those fluent in English, so as to recruit a nationally homogeneous sample. In addition, Prolific ID codes and IP addresses were examined to ensure that no participant took the survey more than once. After providing digital informed consent, participants were directed to the scales described above, which were presented in a counter-balanced order in Qualtrics™ (www.qualtrics.com). Demographic items were completed last. An attention check item was embedded half-way through the questionnaire. The questionnaire was anonymous and, in exchange for completion, participants were paid £1.50. All participants received debriefing information at the end of the survey.

3. Results

3.1. Preliminary analyses

In total, 0.6% of the data were missing and Little’s (1988) Missing Completely At Random (MCAR) test indicated that these data were MCAR, $\chi^2(592) = 641.44$, $p = .078$. In addition, 10 participants had improbable BMI values ($> 50 \text{ kg/m}^2$) and 11 were missing height and/or weight data. All of these data were therefore treated as missing and were replaced using the mean replacement method. Descriptive statistics and inter-scale correlations are reported in Table 1. As can be seen, scores on all variables were significantly and positively correlated with small-to-medium effect sizes in most cases.

3.2. Path analysis

We tested the hypothesised pathways specified in Fig. 1 using IBM SPSS AMOS 25 (Arbuckle, 2017). Maximum likelihood estimation was used to estimate parameters, and individual scales or subscales were treated as observed variables. Model fit was assessed using four indices recommended by Hu and Bentler (1999): the normed model chi-square (χ^2/df ; values < 3.0 considered indicative of good fit), the Steiger-Lind root mean square error of approximation (RMSEA) and its 90% CI (values close to .06 considered indicative of good fit and values up to .08 indicative of adequate fit), the standardised root mean square residual (SRMR; values $< .09$ indicative of reasonable fit), and the comparative fit index (CFI; values close to or $> .95$ indicative of adequate fit).

The hypothesised model did not fit these data well, $\chi^2 = 357.632$, $p < .001$; $df = 1$; $\chi^2_{\text{normed}} = 357.632$; CFI = .438; SRMR = .198; RMSEA = .948 (90% CI = .751–1.064). Accordingly, non-significant paths were removed and modification indices were assessed to identify covarying terms that would improve the overall fit of the hypothesised model. Specifically, we removed the pathways from mindful acceptance to body appreciation (estimate = $-.109$, SE = .074, $p = .141$) and mindful awareness to body appreciation (estimate = .115, SE = .075, $p = .126$). We also applied a covariance between the residuals of mindful acceptance and mindful awareness (MI = 235.727, parameter change = .201). Further analysis revealed that the pathway from mindful acceptance to connectedness to nature was not significant and was, therefore, deleted (estimate = .143, SE = .073, $p = .051$). The final model, presented in Fig. 2, provided good fit to our data, $\chi^2 = 7.040$, $p = .071$; $df = 3$; $\chi^2_{\text{normed}} = 2.347$; CFI = .994; SRMR = .023; RMSEA = .058 (90% CI = .001–.116).

3.3. Mediation analyses

Next, the bootstrap approach (Hayes, 2017) was used to conduct mediation analyses. The bootstrap method does not require normal sampling distribution and has a better balance of Type I error and statistical power than alternative methods (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002). As recommended by Preacher and Hayes (2008), 5000 bootstrap samples were drawn from the dataset to calculate indirect and direct effects, as well as bias-corrected 95% CIs. Effects were considered to be significant if a respective CI did not overlap zero.

Table 2
Direct and Indirect Effects with Corresponding Standard Error (SE) in Parentheses and 95 % Confidence Intervals in the Final Model.

Pathway	Direct Effect		Indirect Effect			
	Unstd.	Std.	95 % CI	Unstd.	Std.	95 % CI
Nature exposure → Mindful acceptance	.100 (.040)	.139 (.056)	.020, .178	–	–	–
Nature exposure → Connected to nature	.414 (.041)	.501 (.045)	.334, .492	–	–	–
Nature exposure → Mindful awareness	.159 (.038)	.216 (.050)	.082, .235	–	–	–
Nature exposure → Body appreciation	.207 (.074)	.181 (.063)	.059, .351	–	–	–
Mindful awareness → Connectedness to nature	.269 (.049)	.238 (.043)	.175, .363	–	–	–
Connectedness to nature → Body appreciation	.400 (.085)	.290 (.061)	.231, .566	–	–	–
Nature exposure → Connectedness to nature → Body appreciation	–	–	–	.183 (.042)	.160 (.037)	.103, .266
Nature exposure → Mindful awareness → Connectedness to nature	–	–	–	.043 (.012)	.052 (.014)	.021, .068
Nature exposure → Mindful awareness → Connectedness to nature → Body appreciation	–	–	–	.108 (.030)	.069 (.019)	.053, .171

Note. Unstd. = Unstandardised effect, Std. = Standardised effect.

(MacKinnon, Lockwood, & Williams, 2004; Mallickrodt, Abraham, Wei, & Russell, 2006). The results, reported in Table 2, showed that there were significant direct effects for all pathways in the final model. There were significant indirect effects from nature exposure via connectedness to nature to body appreciation and from nature exposure via mindful awareness to connectedness to nature. In addition, there was a significant serial mediation from nature exposure via mindful awareness and connectedness to nature to body appreciation.

4. Discussion

In the present study, we first examined the extent to which connectedness to nature and trait mindfulness mediate in parallel the relationship between nature exposure and body appreciation. Our findings provide support for only one part of the hypothesised relationship: we found that connectedness to nature – but not the mindfulness facets of acceptance and awareness – significantly mediated the aforementioned direct relationship. In terms of the effects of connectedness to nature, our findings corroborate the work of Swami, Barron et al. (2016), who similarly found that connectedness to nature mediated associations between nature exposure and body appreciation in an online sample of adults from the United States. As Mayer et al. (2009) have posited, spending time in nature can promote stronger subjective connections with the natural environment, which in turn may have benefits on psychological well-being. In terms of positive body image specifically, connectedness to nature may help individuals shift away from immediate self-interest (e.g., a focus on one's appearance or impression management rituals) onto more holistic embodying experiences (Swami, Barron et al., 2016; Swami, von Nordheim et al., 2016). For instance, Holloway et al. (2014) have suggested that connectedness to nature helps individuals to respect and appreciate one's body as part of a wider ecosystem, both of which are deserving of protection and compassion. Greater connectedness to nature may also facilitate greater eudaimonic well-being (e.g., self-regulation, thoughtfulness, flourishing, personal growth; for a meta-analysis, see Pritchard, Richardson, Sheffield, & McEwan, 2020) that has follow-on positive influences on body appreciation (Swami, Barron et al., 2016; Swami, von Nordheim et al., 2016).

Conversely, when we examined the extent to which trait mindfulness mediated the relationship between nature exposure and body appreciation, we found that neither mindful awareness nor mindful acceptance were significant mediators. Interestingly, both mindfulness facets were significantly (albeit weakly) associated with body appreciation in correlational analyses. However, it appears possible that any mediatory link may be lost once the effects of other constructs are accounted for – the self-compassion facets of self-kindness and common humanity in previous work (Swami et al., 2019) and connectedness to nature here. Another

possibility is that trait mindfulness, as measured in the present study, may be too broad to capture the most relevant aspects of the construct that may mediate the relationship between nature exposure and body appreciation. One way this could be rectified would be to utilise a more body-focused mindfulness measure (e.g., the Body Mindfulness Questionnaire; Burg et al., 2017), which would specifically assess compassionate, non-judgemental awareness and acceptance of the body.

Despite the lack of a direct mediatory role for trait mindfulness, our findings did present evidence of a significant serial mediation, wherein the relationship between nature exposure and body appreciation was mediated by mindful awareness followed by connectedness to nature. That is, greater nature exposure appears to enhance the capacity to regulate attention on present-moment experiences, which in turn is associated with greater connectedness to nature, with follow-on impacts on body appreciation. Unpacking this further, it is possible that greater time spent in nature provides recurrent and sustained opportunities to develop greater trait mindfulness (see Duvall, 2011a, 2011b; Passmore & Holder, 2017). In turn, the non-judgemental awareness that is a core component of mindfulness may allow individuals to more fully engage with nature and thus develop greater connectedness to nature (Aspy & Proeve, 2017; Hanley et al., 2020; Schutte & Malouf, 2018; Unsworth et al., 2016). That is, the ability to regulate attention on present-moment experiences – rather than the capacity to observe experiences non-judgementally – appears to be key in terms of the relationships between nature exposure, connectedness to nature, and body image.

Beyond the focus on mediating effects, our study also replicates the findings of previous cross-sectional studies (Swami et al., 2019; Swami, Barron et al., 2016) where a significant and positive association between self-reported nature exposure and positive body image has been documented. Replication of this effect is important in its own right (e.g., multiple replications are often required in order to provide enough power to identify true effects; for a discussion, see Maxwell, Lau, & Howard, 2015), but beyond replication our results support the large and growing body of evidence that nature exposure can effectively promote enhancements to psychological well-being (e.g., Collado et al., 2017; Frumkin et al., 2017; Norwood et al., 2019; van den Bosch & Bird, 2018). However, given that all cross-sectional studies to date have drawn samples from high income and urbanised societies, an important next step for this research will be to examine the degree to which the association between nature exposure and positive body image is robust across national and cultural groups.

Still, there are a number of limiting issues to consider in relation to the present results. First, our data were cross-sectional and, while we have interpreted associations based on available evidence, any causal implications should be treated cautiously. Swami et al. (2019) provide the following example, which is of rel-

evance here: while it seems likely that nature exposure serves as an antecedent of body appreciation, it is also possible that individuals with greater body appreciation seek out and engage in body-care activities, such as spending time in nature. Similarly, while it is possible that higher mindful awareness promotes greater connectedness to nature, the opposite causal route is also possible (Huynh & Torquati, 2019). Future longitudinal research may be useful to better understand causal relationships, although it should be noted that experimental research does suggest that exposure to real and simulated nature is effective at elevating state indices of positive body image (Rosenberg et al., 2014; Swami, 2020b; Swami, Barron et al., 2018; Swami, Pickering et al., 2018). Another way of approaching this issue would be through qualitative research that attempts to understand whether those who are high in body appreciation use natural environments differently to those low in body appreciation (e.g., see Frisén & Holmqvist, 2010).

In addition, although crowdsourcing Internet marketplaces have been shown to produce reliable and valid data as compared with offline samples (e.g., Buhrmester, Kwang, & Gosling, 2016), it should be noted that our sample are unlikely to be representative of the wider population in the United Kingdom. Given data collection was conducted in March 2020, it is also difficult to know how our results may have been affected by the nationwide lockdown due to the COVID-19 pandemic. Indeed, there is some preliminary evidence from Austria indicating that lockdown conditions may have curtailed exposure to outdoor natural environments, although being outdoors was still significantly associated with greater psychological well-being (Stieger, Lewetz, & Swami, 2020). In addition, future studies should endeavour to replicate our findings in other national and cultural groups. Emerging evidence suggests that the benefits of nature exposure on body image are consistent across national groups (see Swami et al., 2020), but this is an aspect of the research that requires sustained consideration. Finally, future studies may benefit from more complex modelling that includes a wider range of variables. Such variables could include those that have been previously found to mediate relationships between nature exposure and positive body image, such as self-compassion (see Swami et al., 2019), as well as possibly relevant factors, including engagement with natural beauty (Diessner, Solom, Frost, Parsons, & Davidson, 2010) and recurrent or perceived restorative experiences in natural environments (Pasanen, Ojala, Tyrväinen, & Korpela, 2018).

To summarise, our findings suggest that nature exposure is both directly and indirectly associated with more positive body image in a sample of adults from the United Kingdom. While the direct link has been previously described, the finding of a serial mediation involving mindful awareness and connectedness to nature is novel and may lead to novel methods of promoting more positive body image. From a theoretical point-of-view, the goal of using nature exposure to promote positive body image could be expedited through theory- and data-informed conceptual modelling that better describes mechanisms (i.e., mediators and moderators) that can be used to help answer how, for whom, and under what conditions nature exposure promotes more positive body image (e.g., see Cox & Tylka, 2020). From a more practical point-of-view, it may be possible to promote more positive body image through nature-based interventions (e.g., Bruni, Fraser, & Schultz, 2008; Mayer et al., 2009) and environmental education programmes (Liefländer, Fröhlich, Bogner, & Schiltz, 2013) that leverage greater connectedness to nature. Likewise, fostering nature-based mindfulness – such as by encouraging people to attend more to their natural surroundings (e.g., Weinstein, Przybylski, & Ryan, 2009), giving individuals tasks that enhance their awareness of natural surroundings (Passmore & Holder, 2017), or using signposts in natural environments (e.g., Korpela, Savonen, Anttila, Pasanen, & Ratcliffe, 2018) – could enhance the beneficial effects of nature

exposure on connectedness to nature (e.g., see Choe, Jorgensen, & Sheffield, 2020; Nisbett, Zelenski, & Grandpierre, 2019) and, in turn, positive body image. More distally, our findings may also have important implications for the therapeutic interventions aimed at promoting body and self-care in the treatment of disordered eating (e.g., Jepsen Transgrud, Borg, Bratland-Sanda, & Klevan, 2020).

CRedit authorship contribution statement

Viren Swami: Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Project administration. **David Barron:** Methodology, Formal analysis, Writing - review & editing, Visualization. **Jennifer Todd:** Formal analysis, Writing - review & editing. **George Horne:** Investigation, Data curation, Writing - review & editing. **Adrian Furnham:** Investigation, Writing - review & editing.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.bodyim.2020.06.004>.

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