



The Norwegian healthy body image intervention promotes positive embodiment through improved self-esteem[☆]



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ABSTRACT

We examined both direct and indirect effects of the Healthy Body Image (HBI) intervention on positive embodiment among Norwegian high school students. In total, 2446 12th grade boys (43 %) and girls (mean age 16.8 years) from 30 schools participated in a cluster-randomized controlled study with the HBI intervention and a control condition as the study arms. We tested mediation models using path analysis and found that among several hypothesized mediators, only self-esteem mediated a positive intervention effect on positive embodiment for both boys and girls. A direct effect of the intervention on positive embodiment was only found in girls. The study provides novel findings indicating that health promotion interventions to address a positive embodiment should focus on enhancing adolescent's self-esteem. Serial mediation modeling might reveal more complex explanations of change mechanisms and could further evolve current knowledge.

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1. Introduction

Positive embodiment is defined as positive body connection and comfort, embodied agency and passion, and attuned self-care (Piran, 2016). This construct does overlap with positive body image (Tylka, 2019), as both constructs emphasize positive connection to, and appreciation of, the body, as well as attuned care of the body (Tylka & Piran, 2019). However, positive embodiment captures an even broader construct by also introducing the experience of agency to act in the world and comfort with bodily desires (Piran,

2019). Holding a positive embodiment is important as it positively associates with self-esteem, body-esteem, and life satisfaction in women (Chmielewski, Tolman, & Bowman, 2018; Holmqvist, Frisé, & Piran, 2018) and men (Holmqvist et al., 2018), and negatively associates with self-objectification and eating restraint in woman (Holmqvist et al., 2018). It also serves as a protective factor towards eating disorders (Piran, 2016). Other health outcomes and behaviours such as e.g. physical activity and healthy eating habits have been positively associated with the related constructs body satisfaction (Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006), body appreciation (Andrew, Tiggemann, & Clark, 2016; Baceviciene & Jankauskiene, 2020), positive feelings and attitudes towards the body and appearance (Kantanista, Osiński, Borowiec, Tomczak, & Król-Zielińska, 2015; Kołło, Guskowska, Mazur, & Dzielska, 2012; Ramseyer, Jones, & O'Neill, 2019) and quality of life (Griffiths et al., 2017; Haraldstad, Christophersen, Eide, Natvig, & Helseth, 2011). Physical, mental and social changes during adolescence are challenging and can have a long-term impact on body image, and being an adolescent is defined as an eating disorder risk factor (Rosenvinge, 2015). Hence, as a counterbalance, promoting positive embodiment in adolescents is therefore vital to establish

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a good basis for health (Halliwell, 2015; Tylka & Piran, 2019), and can be viewed as a core issue for public health (Bucchianeri & Neumark-Sztainer, 2014).

1.1. Existing evidence

Meta-analyses and systematic reviews show that previous universal studies aiming to improve body image, either by reducing risk factors or enhance protective factors, have focused on media literacy, self-esteem, psychoeducation, or cognitive behavioral therapy (CBT) interventions. The majority of such interventions have had an overall aim to reduce internalization of unhealthy media ideals and/or improve self-esteem, by targeting specific risk or protective factors as presented below, to facilitate positive changes in body image outcomes (Alleva, Sheeran, Webb, Martijn, & Miles, 2015; Le, Barendregt, Hay, & Mihalopoulos, 2017; Watson et al., 2016).

1.1.1. Internalization of body ideals and perceived pressure from media

Internalization of body ideals has been defined as an established risk factor for eating disorders (Cafri et al., 2005; Stice, Presnell, & Spangler, 2002; Thompson & Stice, 2001), and several studies have found that targeting the thin-internalization in girls (Agam-Bitton, Ahmad, & Golan, 2018; Richardson & Paxton, 2010; Sharpe, Schober, Treasure, & Schmidt, 2013), and general internalization in boys (Bird, Halliwell, Diedrichs, & Harcourt, 2013; McVey, Tweed, & Blackmore, 2007) positively affected different body image outcomes. In addition, eating disorder prevention studies have found that the reduction of thin-internalization mediated the intervention effect on both body dissatisfaction and eating disorder symptoms in adolescent girls (e.g. Stice, Marti, Rohde, & Shaw, 2011; Stice, Presnell, Gau, & Shaw, 2007) and young females (Seidel, Presnell, & Rosenfield, 2009). However, only the mediational effect of internalization of the thin-body ideal, not the more current athletic body ideal, has been investigated (Novella, Gosselin, & Danowski, 2015; Schaefer et al., 2015). Also, the perceived pressure from media is often targeted along with internalization in interventions, but has not been investigated as a mediator, and should also be considered into future mediational analyses (Schaefer et al., 2015).

1.1.2. Media literacy

Exposure to appearance related content and appearance comparison in social media, predict negative body image outcomes (Andrew, Tiggemann, & Clark, 2016; Rodgers, McLean, & Paxton, 2015). Media literacy training has therefore been acknowledged as an important technique to prevent negative consequences from social media use. Media literacy training is characterized by enhancing the ability to more critically evaluate and challenge the presentation of idealized bodies and lifestyles, and to further acknowledge the unattainability of the extreme body ideal (McLean, Paxton, & Wertheim, 2016; Wilksch, 2019). Media literacy has extensively been used in body image interventions. One example is the school-based program from Spain which found that a media literacy program reduced level of disordered eating (González, Penelo, Gutiérrez, & Raich, 2011) and improved body satisfaction in adolescent boys and girls (Espinoza, Penelo, & Raich, 2013). The Media Smart from Australia was found to reduce weight and shape concern in adolescent girls (Wilksch & Wade, 2009; Wilksch et al., 2015), while preventing growth in eating disorder risk factors in boys and girls (Wilksch, 2010; Wilksch & Wade, 2014). Still, the majority of studies targeting media literacy have not measured changes in positive body image or embodiment outcomes, only a reduction in risk factors for body dissatisfaction or eating disorder (Wilksch, 2019). In addition, although the effect

of body image interventions including media literacy content has been reported, few studies have tested the mediational effect of media literacy. The only example is the study of Agam-Bitton et al. (2018) who found that media literacy mediated the intervention effect on “current body image” among a female adolescent sample.

1.1.3. Self-compassion

Self-compassion is described as how we relate to ourselves when we experience failures, inadequacy, or personal suffering (Neff, 2003). Self-compassion is not only thought to have a direct relationship with body image, but may buffer against the effects of risk factors, including sociocultural factors, on body image (Braun, Park, & Gorin, 2016; Rodgers et al., 2017). A longitudinal study found that self-compassion was positively associated with body satisfaction and negatively associated with eating pathology in adolescent boys and girls, while self-compassion predicted body satisfaction in girls (Pullmer, Coelho, & Zaitsoff, 2019). Studies targeting self-compassion in adolescent boys and girls through an app, adult females through a podcast, and female university students through a writing task, were found to promote self-compassion and appearance esteem (Rodgers et al., 2018), reduce body dissatisfaction and improve body appreciation (Albertson, Neff, & Dill-Shackleford, 2015), and promote body satisfaction (Seekis, Bradley, & Duffy, 2017), respectively. Self-compassion has been found to mediate the impact of body dissatisfaction and unfavourable social comparisons on psychological quality of life in female college students (Duarte, Ferreira, Trindade, & Pinto-Gouveia, 2015). However, self-compassion has not been evaluated as a potential mediator in intervention studies.

1.1.4. Self-esteem

Self-esteem strongly relates to how adolescents experience their body (van den Berg, Mond, Eisenberg, Ackard, & Neumark-Sztainer, 2010), and has been shown to correlate with body appreciation in European adolescent boys and girls (Lemoine et al., 2018). Enhancing self-esteem could make students accept and appreciate individual characteristics and more easily stay positively connected to their bodies, despite unhealthy exposures (Rousseau & Eggermont, 2018). Therefore, numerous of body image interventions have targeted self-esteem and positively changed body image outcomes (Agam-Bitton et al., 2018; O’Dea & Abraham, 2000; Richardson, Paxton, & Thomson, 2009; Sharpe et al., 2013). Still, to our knowledge, self-esteem has only been tested as a potential mediator in a body image intervention by Agam-Bitton et al. (2018), which found no intervention effect through self-esteem on body image outcomes in adolescent girls. More investigation into the mediational effect on both genders is therefore warranted.

1.1.5. Body image flexibility

Body image flexibility is described as one’s capacity to experience the range of perceptions, feelings, thoughts, and beliefs related to the body, and still act on chosen personal values (Sandoz, Wilson, Merwin, & Kellum, 2013). The construct positively associates with body appreciation, compassion, self-care, a general psychological flexibility, distress tolerance, and negatively associate with different measures of negative body image, disordered eating, and psychological rigidity and affect regulation (Rogers, Webb, & Jafari, 2018). Still, body image flexibility has scarcely been targeted or measured in intervention studies. One self-compassion and body image intervention for late adolescents measured the effect on body image flexibility, but found no intervention effect on this measure (Rogers et al., 2018; Sandoz, Webb, Rogers, & Squyres, 2019). Body image flexibility has been found to mediate the relationship between negative body image variables and maladaptive behavioral outcomes (Rogers et al., 2018), but due to the lack of focus in

intervention studies, the construct has not been investigated as a potential mediator.

Mediation analyses can contribute with the explanation of how an intervention effects the outcome through specific mechanisms, such as those previously described (Hayes, 2017). Improved knowledge on which constructs that should be targeted in an intervention for best effect on the outcome would likely enhance the efficacy of body image interventions in the future. Although it is acknowledged that boys as well as girls would benefit from improving their body image, existing interventions seem to be more effective in girls compared to boys (Bird et al., 2013; Diedrichs et al., 2015; Franko, Cousineau, Rodgers, & Roehrig, 2013; O'Dea & Abraham, 2000; Richardson et al., 2009; Sundgot-Borgen et al., 2019). Mediation analyses should be split on gender to investigate whether there are differences between genders in mechanisms of change, hence, which constructs that needs to be targeted for best intervention effect in both genders. Until now, among those few existing studies, only female samples have been included or studies did not split on genders in their analyses.

1.2. The healthy body image intervention

To answer to the existing need for more knowledge on how to promote positive embodiment in adolescents, the Healthy Body Image (HBI) intervention was developed (Sundgot-Borgen et al., 2018). The study was a universal, school-based, health-promotion intervention, which aimed to promote positive embodiment in high school boys and girls by targeting risk factors and protective factors through three interactive workshops.

1.3. Intervention targets

The HBI intervention workshops aimed to reduce *body ideal internalization* through discrediting body ideals, making the students become more media literate and use social media more constructively. We aimed to enhance *media literacy* by teaching the students about mechanisms used in social media that could affect perceptions, beliefs and attitudes about body appearance, to make them more critical to information sources and choose exposures in a more body image friendly way. We targeted *time spent on appearance related content in social media* by enhancing awareness of personal reactions to the volume and type of content, discrediting unhealthy ideals, and empowering their choice to choose constructive rather than destructive content. By targeting internalization and media literacy elements we simultaneously believed that the *perceived pressure from media* would be reduced. The workshops targeted enhancement of *self-compassion* by making the students understand consequences of unhealthy body modification, become more aware of-, and thereby engage more with, existing positive influences in their daily lives, by using social media in a more self-caring way, and by providing a wellness focus on lifestyle information. The workshops also focused on identifying and appreciating individual differences within a group but also become aware of, and appreciate, one's own positive controllable characteristic not related to appearance. This was believed to enhance students' *self-esteem*. Finally, by not striving for the idealized lifestyle or body, and by being more media literate, having a found self-esteem and being self-caring, we believed that it would be easier for the students to neglect the pressure to strive for other people's standards, and to maintain one's own individual standards, values, and preferences, and stay *body image flexible*.

In a previous publication, we reported that the HBI intervention promoted positive embodiment, with a 12-months follow up-effect in girls (Sundgot-Borgen et al., 2019). It is now necessary to understand change mechanisms within the intervention to gain knowledge on why the intervention effected the students, and

thereby which constructs might need to be focused on in future implementation. Also, such analyses can help explain potential gender differences in which targets one should focus on, to enhance effect on both genders. The Healthy Body Image (HBI) intervention therefore aimed to test hypotheses related to mediation of measured constructs, that theoretically account for the intervention effect on the main outcome positive embodiment.

We hypothesized that the HBI intervention would promote positive embodiment in boys and girls through reduced internalization of the athletic and thin-body ideal, improved media literacy, healthier social media use, reduced pressure from media, increased self-compassion, self-esteem, and body image flexibility.

2. Method

2.1. Sample characteristics

From the original intervention study, thirty schools were randomized in a 1:1 ratio to either the HBI intervention or the control condition, respectively. In total, 2446 male and female students consented to participate at pre-test, while dropout led to a total of 1254, 1278, and 1080 consenting students, respectively, who participated at the post-intervention tests (Fig. 1). Variable specific participation numbers and drop-out rates are found in Table 1. No differences were observed in the outcome variable between dropouts and completers in either boys or girls. However, more students in the control group ($p = .001$, $\phi = 10.61$), and more boys ($p < .001$, $\phi = 52.48$) dropped out. Boys who dropped out had slightly higher BMI ($p = .044$, $d = 0.15$) and body weight ($p = .010$, $d = 0.20$), while girls who dropped out were slightly older ($p = .014$, $d = 0.17$).

2.2. Procedure

The HBI intervention included all Norwegian public and private high schools in Oslo and Akershus county, and specifically invited all 12th grade school classes following a general study program. Students following a vocational study program were excluded, and no further exclusion criteria were set. The students consented by responding to an e-mail containing study information and a letter of informed consent. They accepted by pressing yes to the question of consent and were redirected to the online questionnaire package SurveyXact 8.2 offered by Ramböll, Aarhus, Denmark.

2.3. Ethics approval and consent to participate

The study met the intent and requirements of the Health Research Act and the Helsinki declaration, and was approved by the Regional Committee for Medical and Health Research Ethics (P-REK 2016/142). It was enrolled in the international database of controlled trials www.clinicaltrials.gov (ID: PRSNCT02901457). Further details are presented in a previous publication (Sundgot-Borgen et al., 2019).

2.4. Measurements

As described in the study protocol (Sundgot-Borgen et al., 2018), participants completed the same standardized questionnaires online and outside school hours at baseline, post-intervention, and at 3- and 12-months follow-up. All baseline assessments were conducted prior to the randomization. Students who responded to the questionnaire were in the draw for gift cards with a value of 500 NOK.

2.4.1. Positive embodiment

Positive embodiment was measured using the Experience of Embodiment Scale (EES) (Teall & Piran, 2012). The 34 items cov-

Table 1
Descriptive Statistics for the Intervention and Control Groups among both boys and girls.

	Boys										Girls									
	Intervention					Control					Intervention					Control				
	Drop-out*	n	M	SD	Drop-out	n	M	SD	P	Drop-out	n	M	SD	Drop-out	n	M	SD	P		
Positive embodiment (T1)		283	131.58	20.05		136	127.46	22.83	.074		582	117.92	22.39		282	114.14	24.93	.025		
Positive embodiment (T4)	32 %	192	137.15	19.59	31 %	94	131.54	24.43	.054	21 %	459	127.71	22.58	26 %	210	116.65	26.44	< .001		
Athletic internalization (T1)		281	3.23	1.11		136	3.37	1.04	.223		582	3.02	1.10		281	2.99	1.04	.653		
Athletic internalization (T3)	4 %	269	2.89	1.12	1 %	135	3.18	1.12	.017	7 %	540	2.70	1.05	7 %	260	2.80	1.06	.215		
Thin internalization (T1)		281	2.48	0.93		136	2.64	0.93	.101		582	3.28	1.07		281	3.40	1.14	.126		
Thin internalization (T3)	10 %	252	2.45	0.94	0 %	136	2.79	0.97	.001	7 %	542	2.56	1.01	6 %	264	2.84	1.02	< .001		
Pressure from media (T1)		281	2.09	1.14		136	2.16	1.17	.570		582	3.15	1.25		281	3.27	1.28	.182		
Pressure from media (T3)	10 %	252	2.03	1.11	0 %	136	2.16	1.06	.244	7 %	542	2.94	1.21	6 %	264	3.21	1.21	.002		
Media literacy (T1)		310	18.87	4.47		153	17.78	5.02	.019		611	20.91	3.85		298	20.57	4.05	.227		
Media literacy (T3)	44 %	179	19.19	4.83	43 %	87	18.38	5.25	.213	30 %	429	21.61	4.02	34 %	198	21.21	4.20	.247		
Time on appearance content (T1)		320	21.70	3.71		155	21.28	3.61	.245		621	18.51	4.53		313	18.14	4.59	.233		
Time on appearance content (T3)	86 %	46	21.15	4.35	83 %	26	18.77	4.89	.036	89 %	66	19.18	4.43	91 %	29	16.72	4.32	.014		
Self-compassion (T1)		328	3.28	0.54		174	3.24	0.61	.364		644	3.02	0.64		324	2.94	0.65	.106		
Self-compassion (T3)	26 %	242	3.41	0.67	27 %	127	3.30	0.64	.126	19 %	522	3.16	0.70	24 %	247	3.04	0.71	.038		
Self-esteem (T1)		276	33.13	5.46		135	32.63	6.47	.436		578	29.49	5.96		279	28.43	6.46	.017		
Self-esteem (T3)	15 %	234	33.57	5.88	12 %	119	31.75	6.36	.008	13 %	503	30.64	5.70	15 %	237	29.03	6.88	.002		
Body image flexibility (T1)		342	70.30	9.01		183	68.39	11.66	.055		649	58.48	15.37		334	57.47	16.67	.356		
Body image flexibility (T3)	32 %	234	73.47	12.13	33 %	122	68.51	15.78	.003	21 %	514	62.41	17.48	28 %	241	60.49	19.38	.174		

Note: T1= baseline, T3 = 3-months follow-up, T4 = 12-months follow-up.

* Drop-out represents the drop-out rates per group based on the total number of participants responding to the specific variable at T1.

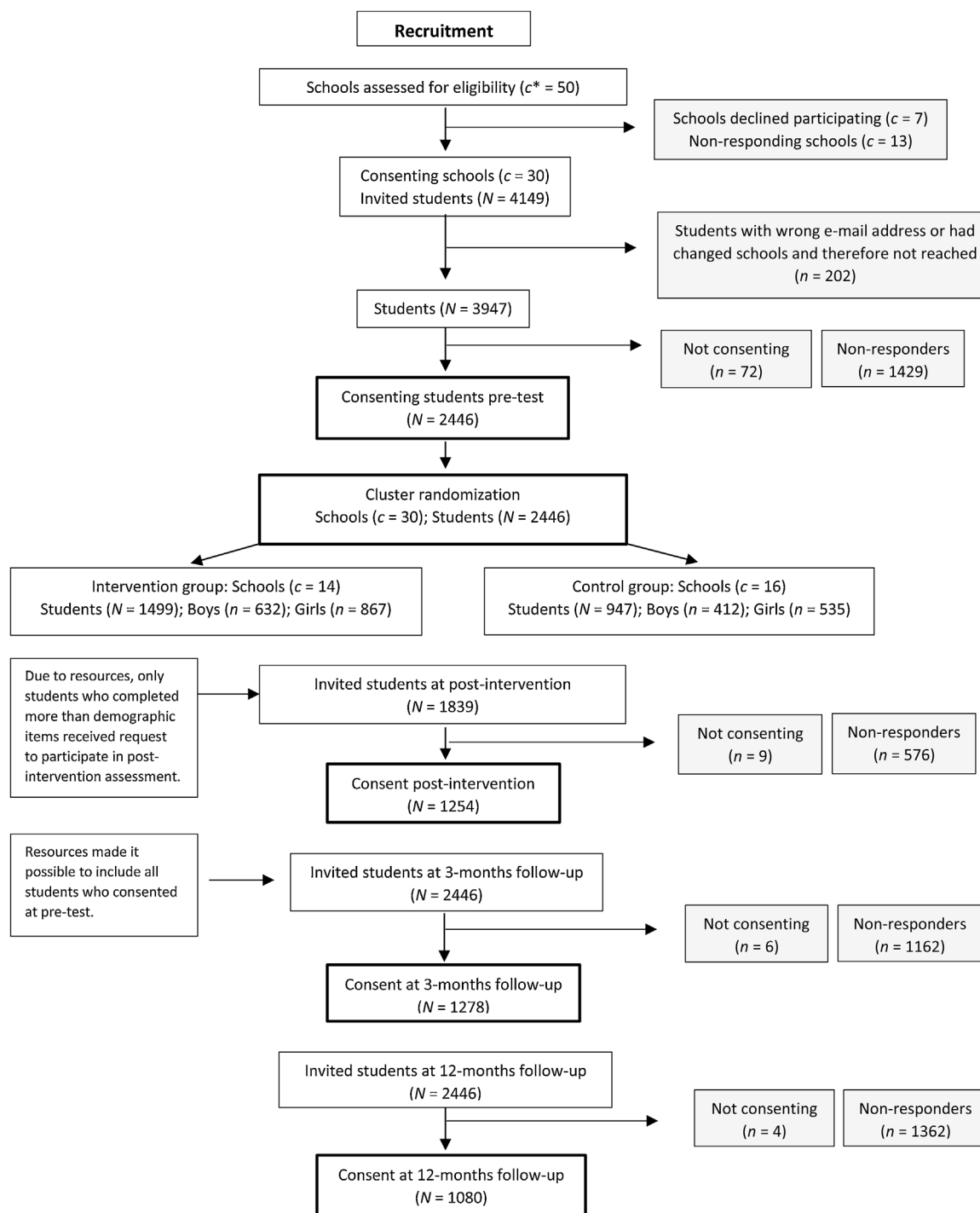


Fig. 1. Schools (c^*) and students (N), and response rate of participating students. Retrieved from Sundgot-Borgen et al. (2019). The healthy body image (HBI) intervention: Effects of a school-based cluster-randomized controlled trial with 12-months follow-up. *Body Image*, 29, 122–131.

ered positive connection with the body, agency and functionality, experience and expression of desire, body attunement, self-care vs. harm/neglect, and subjective lens vs. self-objectification. The items had a Likert-format ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and the 17 negatively framed items were reversed so that the sum score reflected higher levels of positive embodiment. The total score ranges from 34–170. Further examination of the instrument has been described previously (Sundgot-Borgen et al., 2019). The Cronbach's alpha for the current study was .93 for girls and .92 for boys, similar to other studies with the range

of .91–.94 (Chmielewski et al., 2018; Holmqvist et al., 2018; Teall, 2006, 2014).

2.4.2. Internalization of body ideals and pressure from media

The Sociocultural Attitudes Towards Appearance Questionnaire-4 (SATAQ-4) (Schaefer et al., 2015) was used to assess societal and interpersonal aspects of appearance ideals. From the five individual subscales, the Thin/Low Body Fat Internalization, Athletic/Muscular Internalization, and Perceived Pressure from Media, were used. Participants answered on a five-point

Likert-scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), where a higher score indicates a higher degree of internalization or perceived pressure. Cronbach's Alpha in the present sample was for boys between .85 and .94, and between .91 and .95 for girls, slightly higher than in the original study (Schaefer et al., 2015).

2.4.3. Media literacy and social media use

An unpublished social media scale was used, which originally measures impression management, social capital, social comparisons of body experience and physical appearance, and social media literacy (in submission process). The scale contains 20 items, and students respond on a standard Likert response format (1-*strongly disagree*, 5-*strongly agree*). For this current study, the two subscales Media Literacy (four items) and Time Spent on Body Appearance Related Content in Social Media (five items) were used as these concepts were specifically targeted in the HBI intervention. A higher score on both subscales was preferable, as the latter scale items in this study were reversed. The Cronbach's alpha for the Media Literacy sub-scale was .80 and .78 for boys and girls respectively. For the subscale Time Spent on Body Appearance Related Content in Social Media, the Cronbach's alpha was .78 and .79 for boys and girls respectively.

2.4.4. Self-compassion

The Self-Compassion Scale – Short Form (Raes, Pommier, Neff, & Van Gucht, 2011) measures an individual's ability to maintain warm, kind, caring, comforting towards themselves, and to maintain connected to themselves, when they experience personal failings. The 12-items are responded to on a Likert scale ranging from 1 (*almost never*) to 5 (*almost always*). All negative worded items were reversed, and a mean score was calculated. For the current sample, reported Cronbach's alpha was lower than for the original adult sample, with .57 and .76 for boys and girls respectively. This was slightly lower than previously found in adolescents ($\alpha = .88$) (Cunha, Xavier, & Castilho, 2016).

2.4.5. Self-esteem

Self-esteem was measured by the Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965) which is a 10-item scale that measures global self-worth by using both negative and positive worded items scored on a four-point Likert-scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). The total score ranges from 10 to 40 where a higher score represents a higher global self-worth. Negative worded items were reversed. In the present study the internal consistency of α .90 and .92 for boys and girls respectively was better than the α of .86 reported in the Norwegian validation study of the RSES (von Soest, 2005).

2.4.6. Body image flexibility

The Body Image Acceptance and Action Questionnaire (BIAAQ) (Sandoz et al., 2013) was used to measure body image flexibility. The scale consists of 12 items scored on a seven-point Likert scale ranging from 1 (*never true*) to 7 (*always true*), and total score ranges from 12 to 84. Negative worded items were reversed so that a higher score reflects a higher degree of body image flexibility. The internal consistency in the original study was α .93 (Sandoz et al., 2013), which was similar to girls (α .92), and slightly higher than for boys (α .85) in our sample.

2.5. The intervention

The intervention had an interactive educational approach, followed the elaboration likelihood model (Petty & Briño, 2012), and contained three 90-min interactive workshops. All workshops were arranged in mixed-gender classrooms during regular school hours. Three weeks interval between each workshop resulted in a

three-month intervention period. During the intervention period, students at the control schools followed their regular school curriculum. After the final 12-months follow-up, control schools were offered one lecture where the program highlights were compressed. The first and ninth author were Ph.D. students and led the workshops. Both are specialized in physical activity and health, sports nutrition, motivational interviewing, and body image among adolescents. A detailed account of the content and targets of the intervention is provided in previous publications (Sundgot-Borgen et al., 2018, 2019).

2.6. Statistical analyses

The analyses were conducted in Mplus version 8.3 (Muthén & Muthén, 2017 1998–2017). We used path analysis to examine direct effects (*a*, *b*, and *c*), total indirect effects (i.e., the sum of specific indirect effects), and specific indirect effects (*ab*) of the intervention on positive embodiment. Following recommendations in the literature (Preacher & Hayes, 2008) we relied on non-symmetric bootstrap confidence intervals (CI) to assess mediation. The bootstrap CIs were based on 10,000 bootstrap samples. Together these bootstrap samples provide an empirical representation of the sampling distribution of the indirect effect (*ab*) and non-symmetric CIs for the indirect effect. Evidence of mediation is supported if the 95% CI does not include zero (Hayes & Rockwood, 2017). We calculated the partially standardized indirect effect (*ab_{ps}*) as an effect-size measure for the indirect effects (Miočević, O'Rourke, MacKinnon, & Brown, 2018). This effect-size measure captures the size of the indirect effect in terms of standard deviations of the dependent variable for a one-unit change in the independent variable. In the case of a binary X variable (e.g., representing intervention and control group) it is the change in standard deviation units of Y between the two groups. However, the unstandardized slope coefficients from the path analysis are effect size measures as well (i.e., simple effect size; i.e., simple effect size; Baguley, 2009), and we primarily rely on these when interpreting the effects. The predictor was a dichotomous variable representing intervention (1) and control (0) group. The mediators were assessed at time point 3 (T3) and the outcome was assessed at time point 4 (T4). To only present data that is used in our analyses, T1 and T3 data on mediation variables and T1 and T4 data for the main outcome variable is presented in the results section (Tables 1–3). This particular mediation sequence was chosen because it was considered most relevant in order to explore longitudinal effects, and because we believed that skills taught in the intervention needed to be used in everyday life by the students post-intervention to effect different constructs over time, reflecting a maturation process. However, for transparency, the Appendix (in Supplementary material) presents results for the mediation sequence where mediators and outcome were assessed at T2 and T3, respectively.

We controlled for baseline scores of the mediators and the outcome in the path analysis (cf. Vickers & Altman, 2001). To account for the nested data structure (students nested in classrooms) we used the aggregated analysis method outlined by Muthén and Satorra (1995), which computes the usual parameter estimates but adjusts the standard errors and goodness-of-fit model testing. Model fit was evaluated with conventional fit indices such as the comparative fit index (CFI), the Tucker-Lewis Index (TLI), the standardized root mean residual (SRMR), and the root mean square error of approximation (RMSEA). CFI and TLI values around 0.90 and SRMR and RMSEA values around 0.08 indicated acceptable model fit (Marsh, 2007). Based on drop-out analyses we assumed the data to be missing at random. Missing data were handled by the full information maximum likelihood (FIML) estimator (Enders, 2010), which includes all available data in the analyses. A case was recorded as dropout and excluded from the analyses if all

Table 2
Parameter Estimates from the Path Analysis in Boys and Girls.

	Boys (n = 551)					Girls (n = 1010)				
	B	SE	p	95 % CI		B	SE	p	95 % CI	
				LL	UL				LL	UL
X → Y (c' path)										
Intervention → Positive embodiment	2.20	2.04	0.28	−1.90	6.20	5.86	1.12	<.001	3.61	7.97
X → M (a paths)										
Intervention → Athletic internalization	−0.22	0.10	.027	−0.41	−0.03	−0.10	0.06	.119	−0.21	0.02
Intervention → Thin internalization	−0.27	0.10	.005	−0.47	−0.08	−0.27	0.07	<.001	−0.40	−0.13
Intervention → Pressure from media	−0.10	0.10	.304	−0.28	0.09	−0.25	0.08	.001	−0.39	−0.09
Intervention → Media literacy	0.87	0.58	.136	−0.31	1.98	0.12	0.35	.734	−0.56	0.82
Intervention → Self-compassion	0.09	0.06	.127	−0.03	0.19	0.06	0.05	.213	−0.03	0.14
Intervention → Self-esteem	1.32	0.56	.017	0.25	2.41	1.21	0.41	.003	0.40	1.99
Intervention → Body image flexibility	3.27	1.51	.030	0.41	6.29	1.47	0.83	.078	−0.20	3.03
M → Y (b paths)										
Athletic internalization → Positive embodiment	0.26	1.27	.839	−2.29	2.67	0.87	0.85	.307	−0.78	2.55
Thin internalization → Positive embodiment	1.25	1.83	.496	−2.15	4.92	−1.12	0.94	.232	−3.03	0.70
Pressure from media → Positive embodiment	−0.64	1.35	.636	−3.46	1.76	−0.21	0.53	.695	−1.25	0.85
Media literacy → Positive embodiment	0.74	0.25	.003	0.25	1.23	0.20	0.13	.124	−0.07	0.43
Self-compassion → Positive embodiment	3.17	2.49	.204	−1.92	7.94	1.01	1.14	.332	−1.19	3.30
Self-esteem → Positive embodiment	0.86	0.28	.002	0.33	1.42	1.05	0.15	<.001	0.75	1.33
Body image flexibility → Positive embodiment	0.14	0.10	.181	−0.06	0.35	0.36	0.05	<.001	0.26	0.45

Note. A total of 1561 students were included in the analyses. Mediators were measured at T3 and the outcome was measured at T4. Baseline scores of the mediators and outcome were controlled for in the analysis. The 95 % CIs are non-symmetrical bootstrap CIs. LL = lower limit, UL = upper limit. *p*-values below .05 indicate a statistically significant effect and is marked by bold text.

post-intervention and follow-up data were missing. We specified a multigroup model to examine gender-specific effects. A *p*-value below .05 and a 95 % CI that did not include zero indicated statistically significant effect in the path analysis.

3. Results

Table 1 presents descriptive statistics of the study variables. Included as possible mediators in the estimated models were 1. internalization of the athletic body, 2. internalization of the thin body, 3. perceived pressure from media, 4. media literacy, 5. time spent on body appearance related content in social media, 6. self-compassion, 7. self-esteem, and 8. body image flexibility. However, the variable time spent on body appearance related content in social media had approximately 88 % missing data at T3 and was excluded from the analysis due to the uncertainty in the FIML estimation (Muthén & Muthén, 2017). Based on the FIML method, the overall number of included participants from the original sample into the path analyses was 1561, with 551 boys and 1010 girls (Table 2). This is based on the exclusion of participants who had no data on T2–T4, and participants with no data on gender.

3.1. Path analysis

The path analysis is displayed in Fig. 2a for boys and 2b for girls and the parameter estimates (i.e., direct effects) are presented in Table 2. Model fit of the multigroup model was, $\chi^2 = 607.389$, *df* = 128, *p* < .001, CFI = 0.907, TLI = 0.855, RMSEA = 0.069 (90 % CI [0.064, 0.075]), SRMR = 0.083. For boys the direct effect (*c*) of the intervention on positive embodiment was not statistically significant. The *a* paths (i.e., $X_{\text{intervention/control}} \rightarrow M_{T3}$) indicated that the intervention increased self-esteem and body image flexibility, whereas it reduced scores on internalization of the athletic and thin body, compared to controls. The *b* paths (i.e., $M_{T3} \rightarrow Y_{T4}$) showed that self-esteem and media literacy were positive and statistically significant predictors of positive embodiment (Fig. 2a).

For girls the direct effect (*c*) of the intervention on positive embodiment was positive and statistically significant. The *a* paths (i.e., $X_{\text{intervention/control}} \rightarrow M_{T3}$) indicated that the intervention

increased self-esteem, whereas it reduced scores on thin internalization and pressure from media. The *b* paths (i.e., $M_{T3} \rightarrow Y_{T4}$) showed that self-esteem and body image flexibility were positive and statistically significant predictors of positive embodiment (Fig. 2b).

Indirect effects were also calculated based on the unstandardized coefficients in the path analysis. As seen in Table 3, there was a positive and statistically significant total indirect effect ($ab_{\text{boys}} = 2.16$, 95 % CI [0.14, 4.44]; $ab_{\text{girls}} = 2.14$, 95 % CI [0.78, 3.58]) and a specific indirect effect of the intervention on positive embodiment through self-esteem ($ab_{\text{boys}} = 1.14$, 95 % CI [0.16, 2.49]; $ab_{\text{girls}} = 1.26$, 95 % CI [0.38, 2.29]) for boys and girls (see Fig. 2). None of the other indirect effects were statistically significant for this mediation sequence. It should be mentioned that when we conducted the additional mediation sequence (T2 → T3), self-esteem still mediated the intervention effect for both genders, while internalization of the athletic ideal mediated intervention effect in girls only (see Appendix (in Supplementary material)).

4. Discussion

The results are in line with the hypothesis that the HBI intervention increased positive embodiment via enhanced self-esteem in both adolescent boys and girls.

4.1. Indirect effects

The current study found a significant mediated pathway in boys and girls via self-esteem. Activities within the intervention such as enhancing the students' ability to identify and appreciate individual differences, appreciate one's own positive controllable characteristic, and develop positive attitudes and evaluation of themselves, seem to have affected the students' self-esteem. The development of self-esteem over time may have made it easier for the students to become comfortable with their individual characteristics and lower the desire to adopt and adhere to social standards. As a result, it may have become easier for the adolescents to reject unhealthy exposures and rather focus on growth of embodied experiences (Piran, 2019; Rousseau & Eggermont, 2018). Additionally, improving a stu-

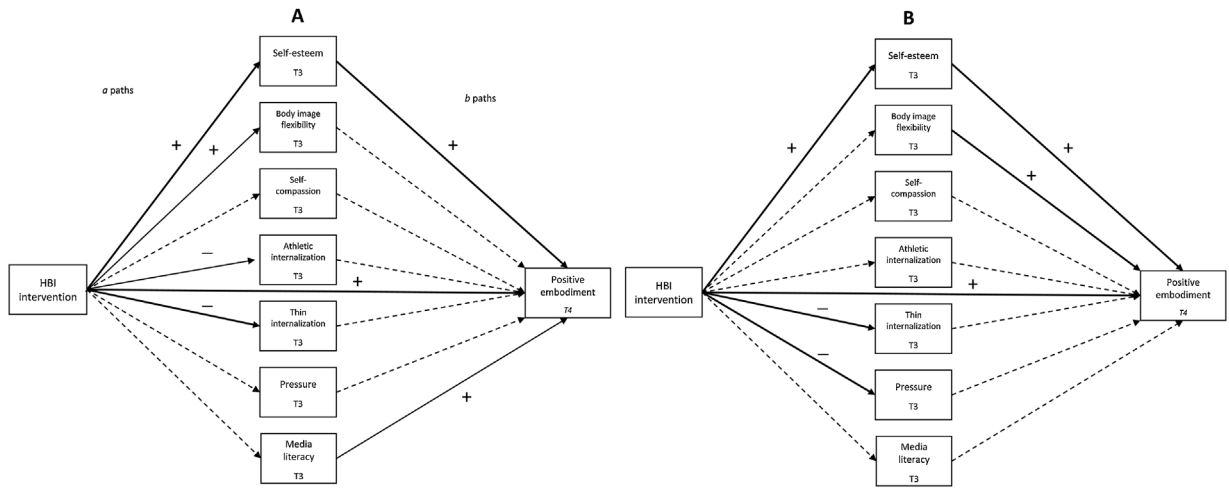


Fig. 2. Results of the mediation model in boys (A) and girls (B). Mediators were measured at T3 and the outcome was measured at T4. Baseline scores of the mediators and outcome were controlled for in the analysis. Correlations between mediators are omitted from the figure of clarity. Solid lines indicate statistically significant effects (+ or – indicate the direction of the effect), dashed lines indicate non-significant effects. The 95 % CIs are non-symmetrical bootstrap CIs. *ab* = indirect effect, LL = lower limit, UL = upper limit. *95 % CI that does not include zero indicate a statistically significant effect.

Table 3
Indirect Effects of the Intervention on Positive Embodiment in Boys and Girls.

	Boys (n = 551)						Girls (n = 1010)					
	95 % CI			95 % CI			95 % CI			95 % CI		
	<i>ab</i>	LL	UL	<i>ab_{ps}</i>	LL	UL	<i>ab</i>	LL	UL	<i>ab_{ps}</i>	LL	UL
Total indirect effect ^a	2.16*	0.14	4.44	0.10	0.01	0.21	2.14*	0.78	3.58	0.10	0.03	0.16
Intervention → Self-esteem → Positive embodiment	1.14*	0.16	2.49	0.05	0.01	0.12	1.26*	0.38	2.29	0.06	0.02	0.10
Intervention → Body image flexibility → Positive embodiment	0.45	-0.20	1.56	0.02	-0.01	0.07	0.52	-0.07	1.12	0.02	-0.00	0.05
Intervention → Self-compassion → Positive embodiment	0.27	-0.20	1.00	0.01	-0.01	0.05	0.06	-0.07	0.32	0.00	-0.00	0.01
Intervention → Athletic internalization → Positive embodiment	-0.06	-0.64	0.62	-0.00	-0.03	0.03	-0.08	-0.32	0.09	-0.00	-0.01	0.00
Intervention → Thin internalization → Positive embodiment	-0.34	-1.60	0.63	-0.02	-0.08	0.03	0.30	-0.19	0.86	0.01	-0.01	0.04
Intervention → Pressure from media → Positive embodiment	0.06	-0.27	0.55	0.00	-0.01	0.03	0.05	-0.21	0.34	0.00	-0.01	0.02
Intervention → Media literacy → Positive embodiment	0.64	-0.21	1.77	0.03	-0.01	0.09	0.02	-0.13	0.22	0.00	-0.01	0.01

Note. Mediators were measured at T3 and the outcome was measured at T4. Baseline scores of the mediators and outcome were controlled for in the analysis. The 95 % CIs are non-symmetrical bootstrap CIs. *ab* = indirect effect, *ab_{ps}* = partially standardized indirect effect, LL = lower limit, UL = upper limit.

* 95 % CI that does not include zero indicates a statistically significant effect.

^a Total indirect effect = sum of all specific indirect effects.

dent's self-esteem might have had ripple effects on psychological well-being, and might have facilitated healthier exposure choices such as people with positive attitudes, positive and constructive social media content, healthy lifestyle choices and positive self-communication. This might further improve positive embodiment subdomains described in the developmental theory of embodiment (Piran, 2017).

The suggested effect on body image outcomes by targeting self-esteem has also been found in previous prevention and promotion studies (Agam-Bitton et al., 2018; O'Dea & Abraham, 2000; Richardson et al., 2009; Sharpe et al., 2013). The study by Agam-Bitton et al. (2018) is the only study in addition to the current, to investigate the mediational effect of self-esteem on intervention outcomes (Agam-Bitton et al., 2018). In contrast to our findings, they found no mediational effect of self-esteem on promotion of body image. It should be mentioned that Agam-Bitton et al. only used three months follow-up time. In contrast, the HBI intervention reported a mediational effect on positive embodiment at 12-months follow-up. This could indicate that changes in self-esteem might need to affect positive embodiment over a longer period of time through maturation, where a 3-months follow-up might not have been sufficient for similar findings to be observed. However, for transparency, we also analyzed the short-term mediation sequence and found self-esteem at post intervention (T2) to mediate the intervention effect on positive embodiment at 3-

months follow-up (T3). The self-esteem intervention content in Agam-Bitton et al. was more focused on explaining and discussing self-esteem as a construct, while our intervention specifically taught the students how to promote their own self-esteem. This content and teaching technique might be a more plausible explanation for the different findings between the studies.

As seen in Table 1, changes in self-esteem in both boys and girls were significant, yet small. Also, the direct effect of the intervention on EES scores in girls indicates that the intervention was only partly mediated by changes in self-esteem. In addition to enhanced self-esteem, the intervention effect could be explained by other unmeasured factors such as reduced body dissatisfaction, improved eating and physical activity behaviors, and reduced comparison, which were topics also discussed in our intervention. Also, making the students feel like they were of great importance to the project, part of a group, and seen and heard by both facilitators, might have affected the students' feelings of belonging, acceptance, and self-worth. These are known as non-specific factors that are not constructs targeted by the intervention and not measured, but that might, nevertheless, be an effect of the therapeutic relationship between facilitator and student and may account for some of the intervention effect (Donovan, Kwekkeboom, Rosenzweig, & Ward, 2009).

Notably, the intervention effect in the present study was also highly gender specific. As shown in a previous publication, only

a small transient intervention effect was found in boys, while a sustained effect was found in girls (Sundgot-Borgen et al., 2019). It is natural to suggest that in addition to self-esteem, there are other factors that need to be focused on in future interventions to improve long-term effect in boys. According to the literature, such factors could be the gender of the facilitator (Yager, Diedrichs, & Drummond, 2013), chosen learning activities and methods (Wahistrom, 2002), and the fact that boys tend to describe body image as a girls thing (Adams, Turner, & Bucks, 2005; Hargreaves & Tiggemann, 2006), which would affect the chance of being affected by a body image intervention.

For future studies, it might seem important to not only measure the mediational effect of global self-esteem, as measuring specific domains of self-esteem could provide important information on what specific parts of self-esteem an intervention needs to target in boys and girls to provide an even stronger effect on embodiment (von Soest, Wichstrøm, & Kvaalem, 2016). As an example to further improve the effect in boys, one may speculate whether an inclusion of physical activity sessions could have promoted the athletic competence domain, which has been described as more important for boys' global self-esteem compared to girls (von Soest et al., 2016).

4.2. Non-mediating variables

For the primary mediation sequence, we did not observe hypothesized indirect effects of the intervention on positive embodiment through internalization of the athletic or thin body ideal, perceived pressure from media, media literacy, self-compassion, or body image flexibility in neither boys nor girls. Our additional analyses of the short-term mediational effect found that internalization of the athletic ideal mediated the 3-months intervention effect in girls only. However, comparing our primary mediational sequence, our results contradicts two studies with similar long-term mediation sequence, who found that reduction in thin-internalization fully (Stice et al., 2011) and partly (Seidel et al., 2009) mediated the effect of a dissonance-based intervention on body dissatisfaction and bulimic symptoms, respectively. An interesting question would be whether the dissonance-based approach used in these studies is superior to the psychoeducational approach used in the HBI intervention, in terms of changing participants' level of internalization. Another important aspect that also could explain some of the differences between study findings is that both previous studies intervened on high-risk girls, and the outcomes were related to negative body image in contrast to our mixed-gender universal sample with a positive embodiment outcome. Hence, methodological inequalities make further comparison difficult. When it comes to internalization of the athletic ideal and pressure from media, previous studies have not investigated these as mediators such as the thin ideal, and our findings provide new knowledge. Based on the HBI intervention content, the lack of mediational effect was surprising as internalization and pressure from media pervaded all workshops. Based on ours and previous findings, one might hypothesize that a reduction in internalization in general might have a stronger influence on the level of negative body image outcomes long-term compared to positive body image related outcomes. However, more studies are needed to back up this explanation.

The lack of identifying media literacy as a mediator contradicts findings from Agam-Bitton et al. (2018), who found that media literacy mediated the intervention effect on "current body image" among a female adolescent sample. However, the choice of questions to measure media literacy in our study provides an uncertainty to whether true intervention effects on this variable could be assessed. This is because the workshop content was more focused on students becoming critical to strategies used by profiles

and advertisers, retouching, and how these techniques influenced attitudes, beliefs and emotions, as in Agam-Bitton et al., compared to what the study questionnaire asked about. Another difference to Agam-Bitton et al. (2018), was their measure of girls-only in their analyses, and Current Body Image as one body image outcome. In contrast to the EES used in our study, their outcome did not capture the complex domain of positive embodiment as suggested in the literature (Webb, Wood-Barcalow, & Tylka, 2015), leaving the two studies to measure mediation effects from two different outcomes. Therefore, methodological differences could contribute to the explanation of various findings.

Although both self-compassion and body image flexibility were targeted throughout all three workshops by different activities, these constructs might have been less directly explained by the facilitators and discussed among the students. The constructs were rather believed to be indirectly affected through working with other more familiar constructs such as e.g. idealization, communication, comparison, lifestyle behaviours, and might not have been targeted to the extent that was intended. An additional explanation for the lack of mediation effects could be that these constructs protect against destructive consequences to body image threats and poor body image, but might not have a direct ability to improve scores on positive embodiment alone (Neff, 2003; Rogers et al., 2018). Reduction of internalization of both the athletic and thin body ideal, pressure from media, media literacy, self-compassion, and body image flexibility, might still be considered important in embodiment promotive interventions. This could possibly be through enhancing constructive coping mechanisms and work as protective factors against body image threats (Braun et al., 2016; Levine & Smolak, 2016). However, probably not as the main components that need to be enhanced in an intervention for the specific variable positive embodiment to change over time.

The parallel modeling made it possible to analyze whether any hypothesized variables alone mediated the intervention effect. The true mechanisms might be more complex than this study was able to capture through parallel mediation modelling. Serial mediation modeling is one example of additional methods that could provide supplemental information, indicating whether the intervention impacts the outcome through a longer chain of mediators. Based on the findings from the current study, self-esteem scores are likely to play an important role in this chain of mediators. Although our additional analyses of the short-term sequence show that internalization of the athletic ideal mediated intervention effect in girls, the remaining findings are similar between the primary and additional sequence, where the long-term sequence remain the most important in terms of evaluating meaningful effects of the intervention for potential implementation.

4.3. Strengths and limitations

The current study is to our knowledge the first one to report mediated effects of an intervention on a positive embodiment outcome using a mixed-gender sample. Also, the analyses were based on a cluster RCT with four measurement time-points, including the 12-months follow-up. All analyses were adjusted for nested data, and models estimated several mediators in boys and girls separately.

The main limitation was the high drop-out rate especially in boys and controls, which might have impacted the statistical power especially for boys and increases the risk of type II error. Although FIML is an appropriate method to use on large samples, estimates might have a bigger chance of bias in small samples, which was the case for some of the variables. The drop-out rate also led to the exclusion of one hypothesized mediator; Time Spent on Body Appearance Related Content in Social Media from analyses. Lim-

itations might also be the less optimal congruence between the measure of media literacy and the workshop content, and that specific domains of self-esteem were not captured.

4.4. Research implications

The findings clearly show that although boys and girls were equally exposed through an intervention, targeted constructs might be differently affected. Also, the prediction effect of constructs on positive embodiment differ between genders, which emphasize the need for gender specific analyses in future studies. The study provides novel evidence that intervention components that improve self-esteem might be especially important to target. Future studies should evaluate whether more time and additional focus on other domain-specific self-esteem content could result in long-term intervention effects in boys.

Serial modeling might provide more complex explanations to indirect effects of an intervention on the main outcome and could provide additional guidance to the design of future interventions. Additionally, more comparable research needs to be conducted to further contribute to fill gaps in the knowledge of mediated effects within a mixed-gender positive embodiment intervention. As a conclusion, the HBI intervention resulted in positive embodiment in boys and girls through self-esteem, and future interventions are guided towards especially focusing on self-esteem content to change adolescent boys' and girls' positive embodiment.

Authors' contributions

Christine Sundgot-Borgen:

Generated the original research idea, contributed to the development of the questionnaire package, ran the project and the piloting, wrote the first draft of the paper and revised it.

Andreas Stenling:

Conducted the statistical analyses, wrote the specific method and result section, revised the paper, and approved the manuscript.

Jan H. Rosenvinge:

Contributed to the protocol development, contributed to the development of the questionnaire package, contributed significantly to the paper writing process within the introduction and discussion, with revisions, and have approved the final manuscript.

Gunn Pettersen:

Contributed to the development of the questionnaire package, took part in the writing process and have approved the final manuscript.

Oddgeir Friberg:

Contributed to the development of the questionnaire package and took part in the paper writing process with focus on introduction and methods and have approved the final manuscript.

Jorunn Sundgot-Borgen:

Generated the original research idea, contributed to the development of the questionnaire package, took part in the writing process within the introduction and discussion, and have approved the final manuscript.

Elin Kolle:

Contributed to the development of the questionnaire package, took part in the writing process and have approved the final manuscript.

Monica Klungland Torstveit:

Contributed to the questionnaire package and took part in revisions of the paper and have approved the final manuscript.

Kethe M.E. Svantorp-Iveiten:

Contributed to the development of the questionnaire package, ran the intervention and piloting, and approved the final manuscript.

Solfrid Bratland-Sanda:

Contributed to the questionnaire package, had a significant part in the paper writing process with revisions, especially into introduction and discussion, and have approved the final manuscript.

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Declaration of Competing Interest

The authors report no declarations of interest.

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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.2020.08.014>.

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