Title: Effect of A Healthy Body Image intervention on risk- and protective factors for eating disorders: A cluster randomized controlled trial

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Abstract

Objective: To investigate the immediate and 12-months effects of a school-based intervention aiming to reduce risk and enhance protective factors for eating disorder development in high school boys and girls.

Method: In total, 4,149 adolescents from 30 high schools were eligible for inclusion and 2,446 consented to participate and were randomly allocated to the Healthy Body Image (HBI) intervention or a control group (classes as usual). The HBI intervention is multicomponent consisting of three workshops targeting body image, social media usage and lifestyle. Linear mixed model and intention-to-treat analyses were applied to investigate the effects of group, time, and gender at posttest, 3-, and 12-months follow-up. The main outcome variable was weight and shape concerns, and secondary outcome variables were self-esteem, mental distress, body image flexibility, thin internalization, muscular internalization, drive for leanness, perceived media pressure, protein- and creatine supplement use, and diet aid use.

Results: The HBI intervention significantly reduced eating disorder risk factor scores related to ED pathology, thin internalization and perceived pressure from media, which was particularly pronounced in girls. Positive intervention effects on body image flexibility were only observed at posttest for boys but grew increasingly larger for girls across the 12-month follow-up time span. Favorable intervention effects on protein and creatine supplement use were only present at 3-months follow-up in boys solely. A general favorable intervention effect was observed for self-esteem, mental distress, muscular internalization, and drive for leanness.

Conclusion: The HBI intervention produced consistent reductions in risk factors and enhancements in protective factors associated with eating disorder development in adolescents.

1. Introduction

Disordered eating (DE) and eating disorders (EDs) have a profound effect on health influencing all bodily systems (Herpertz-Dahlmann et al., 2015; Keski-Rahkonen & Mustelin, 2016; Westmoreland, Krantz, & Mehler, 2016). The high prevalence (13 - 50 %) of DE , clinical and subclinical and EDs among males and females warrants the invention of programs that may successfully prevent augmentation of risk factors related to the development of EDs (Hammerle, Huss, Ernst, & Bürger, 2016; Limbers, Cohen, & Gray, 2018; Mitchison et al., 2020; Ortega-Luyando et al., 2015; Sparti, Santomauro, Cruwys, Burgess, & Harris, 2019; Torstveit, Aagedal-Mortensen, & Stea, 2015).

Established risk factors for DE and ED replicated in several studies are perceived appearance pressure, thin- and muscular appearance internalization , appearance comparison, body dissatisfaction, weight and shape concerns, dissatisfaction with muscularity, muscle building behaviors and dieting (Girard, Chabrol, & Rodgers, 2018; Girard, Rodgers, & Chabrol, 2018; Rodgers, Ganchou, Franko, & Chabrol, 2012; Rodgers, McLean, & Paxton, 2015; Rodgers et al., 2020; Stice & van Ryzin, 2019). Moreover, low self-esteem, depression and anxiety also act as risk factors for DE and EDs (Cruz-Sáez, Pascual, Wlodarczyk, & Echeburúa, 2020; Maraldo, Zhou, Dowling, & Vander Wal, 2016; McClelland, Robinson, Potterton, Mountford, & Schmidt, 2020; Pearson et al., 2017). Studies also suggests that reducing appearance pressure, appearance internalization, and comparison will result in reduced body dissatisfaction (Rodgers et al., 2015) and prevent the onset of EDs (Stice & van Ryzin, 2019).Protective factors for ED development is suggested as a new paradigm in the prevention of ED (Levine & Smolak, 2016; Piran, 2015). Protective factors include high self-esteem, body image flexibility, body appreciation and self-compassion (Gurung, Sampath, Soohinda, & Dutta, 2019; Halliwell, 2013; Maraldo et al., 2016; Meland, Breidablik, Thuen,

& Samdal, 2021; Rogers, Webb, & Jafari, 2018). Features protective factors have in common are that they facilitate constructive coping mechanisms, self-care and emphasize the focus on body functionality rather that appearance (Levine & Smolak, 2016). However, protective factors are less studied in relation to ED prevention (Levine & Smolak, 2016; Piran, 2015).

Universal ED prevention programs show promising findings in adolescents as most programs are successful in improving at least one established risk- or protective factor for ED development (Le, Barendregt, Hay, & Mihalopoulos, 2017; Schwartz et al., 2019; Stice, Shaw, & Marti, 2007; Watson et al., 2016). Despite promising findings in universal ED prevention in general, most studies include girls only (Kusina & Exline, 2019; Levine, 2021). Studies recruiting mixed gender populations often show that boys benefit less than girls from such interventions (Schwartz et al., 2019; Warschburger & Zitzmann, 2018; Wilksch & Wade, 2013). However, only one universal, mixed gender ED prevention program using a randomized controlled design included adolescents above the age of 16 (Eickman et al., 2018), and two studies had a younger mean age, but included 15-16 year old adolescents in their sample (Agam-Bitton, Abu Ahmad, & Golan, 2018; Mora et al., 2015). The rationale for recruiting younger samples in universal prevention is that one should intervene before the age of 14-15 where ED risk factors increase to a level that may need professional attention (Stice & van Ryzin, 2019). However, the risk for ED development increases through adolescence where the mean age of ED onset is approximately 18 years (Volpe et al., 2016). This leaves a possible gap for universal prevention that until now has been understudied. In addition, it has been argued that universal prevention also includes features from targeted or selected prevention programs as a proportion of the participants already experience increased ED risk or suffer from an ED (Schwartz et al., 2019). This emphasizes one of the advantages of universal prevention as being both preventive and health promotive and may benefit participants independent of risk status (Schwartz et al., 2019; Stice & Shaw, 2004).

Several reviews have summarized hallmarks of successful universal ED prevention programs .(Kusina & Exline, 2019; Le et al., 2017; Schwartz et al., 2019; Stice et al., 2007; Watson et al., 2016; Yager, Diedrichs, Ricciardelli, & Halliwell, 2013) It's recommended that universal ED prevention programs are 1) led by a professional, 2) consist of multiple and interactive sessions, 3) targets media literacy, and 4) apply a model of change creating cognitive dissonance.

However, the efficacy of universal ED prevention programs may be improved by adapting intervention content to better target more current challenges in older adolescents' lives (Anderson & Jiang, 2018; Rodgers et al., 2020; Steinsbekk et al., 2021). The *first* area of improvement is related to the raising popularity of "new" appearance ideals focusing on a fit and toned appearance with extremely low body fat percentage (Wiklund, Jonsson, Coe, & Wiklund, 2017). Such ideals may enhance appearance internalization, comparison and negative body image (Dignard & Jarry, 2021; Jarman, Marques, McLean, Slater, & Paxton, 2021), and thereby increase the risk for DE, ED and muscle building behaviors (Rodgers et al., 2020). Especially in adolescent boys, the use of supplements, such as protein and creatine is highly prevalent and predicts negative body image and drive for muscularity (Yager & McLean, 2020; Yager & O'Dea, 2014). The use of muscle building supplements has been suggested as an important target of interventions aiming to prevent negative body image, particularly in boys (Yager & McLean, 2020; Yager & O'Dea, 2014). To our knowledge, no programs have targeted the athletic and fit body ideal in a mixed gender setting, and only two programs aiming to prevent muscle building supplements have been carried out for regular high school students in a universal or school-based setting (Lucidi et al., 2017; Yager, McLean, & Li, 2019).

A s*econd* arena for improving prevention programs addresses the major societal changes in communication and social influence, that has evolved from non-interactive media and commercials to a high number of different interactive social media platforms where almost 90 % of older adolescents report being online almost constantly (Anderson & Jiang, 2018). This growth makes social media an important domain of social influence acting as an arena for appearance comparison (Jarman et al., 2021; Rodgers et al., 2020) and unhealthy lifestyle and fitness inspiration (Sabbagh, 2019; Tiggemann & Zaccardo, 2016). To our knowledge, no previous universal intervention has targeted social media usage and social media literacy in a universal ED prevention program.

The present study complements existing research by investigating the immediate and 12-month follow-up effects of a universal school-based intervention. We hypothesized that a multicomponent, health promotion intervention (Sundgot-Borgen et al., 2018) targeting social media usage and literacy, body image awareness, social comparison, self-esteem, lifestyle, and lifestyle literacy. would reduce risk- and enhance protective factors for ED development in girls and boys with effects that sustain over time.

2. Materials and methods

2.1. Participants and procedure

In August 2016, all public and private high schools in the Norwegian counties Oslo and Akershus were asked to take part in the study. The request, together with the study information was presented to the school principals and administrators. In total, 30 out of the 50 eligible schools agreed to participate.

We arranged a meeting at each school, and all students were thoroughly informed of the study aims and the implications of participation. The students subsequently received an electronic information letter, and an informed consent letter together with the questionnaires. Figure 1 shows the school and participant flow at all measurement points. A total of 4,149 students aged 16–18 years and attending the 12th grade was eligible for inclusion from the 30 consenting schools. The decision of only including the 12th grade was made in consultation with the school principals who expressed limited time resources to include all grades in the study. in order to proceed. After baseline, all students who completed the posttest questionnaire were offered a movie ticket (valued at $15). Due to limited funding, we were only able to invite participants who had consented and partially answered the baseline questionnaire to the posttest. Additional funding made it possible to re-invite all those who had consented at baseline for the 3-, and 12-month follow-up. A total of 1,228 adolescents were included in the effect analyses, as they responded at both baseline and on at least one follow-up measure. All questionnaires were completed electronically outside school hours using the web-based survey tool Survey XACT developed by Ramboll, Norway.

Figure 1

Figure 1. Study flow, number of consenting participants, dropouts/nonresponders, and measurement time points. k=number of clusters, n=number of participants

2.2. Randomization

The schools were randomly allocated to either the intervention (k=14) or control group (k=16) to equalize school size and to capture the urban-rural dimension, ensuring that all regions in the catchment area were included. A cluster randomized design with 1:1 ratio was applied to minimize contamination biases within schools. Each school represented an individual cluster to reduce the diffusion of effects due to information crossover between intervention and control students. The randomization was performed by a professional outside the research team.

2.3. The Healthy Body Image (HBI) intervention

The universal and school-based intervention aim to reduce ED pathology through the promotion of students' critical understanding of the influence of social- and mass media and peers. The intervention involved three 90-minute workshops including group and peer discussions, reflection, lectures, and short video clips.

The *first* workshop had a main theme of *body image* and included topics such as body image awareness, peer and family influences, appearance and social comparison, self-esteem and social media. The aim was to increase the students' awareness of what made them feel good about their body making them more able to take constructive actions to fill their daily life with positive influences, and to reflect upon how their own behavior could influence their peers' body image and self-esteem. The s*econd* workshop expanded content from the first workshop with a specific focus of *social media.* The objective was to make the students aware of how they could act and take responsibility for what type of content they got exposed to and how to make social media a positive social arena for themselves. We also aimed to increase the students' awareness of how themselves influenced their peers on social media making them critical about what content they posted, "shared" commented and "liked". The *final* workshop had an overarching theme of *lifestyl*e and included topics such as exercise, supplement use and nutrition. The aims were to increase the students' literacy towards health information in social- and mass media, and to increase their understanding of how exercise and nutrition could be beneficial in improving their body experience. To achieve this, the workshop facilitators provided student-active tasks where they reflected upon how physical activity and healthy eating habits made them feel. A final aim was to discuss how social- and mass media make lifestyle a profitable industry, and to refute myths related to supplement use, nutrition and exercise. A comprehensive outline of the methodological and theoretical rationale for the HBI is described in the protocol paper (Sundgot-Borgen et al., 2018). On average, each workshop included 60 students; however, for practical reasons, workshop size varied between schools. The first and fourth authors, two women, headed the intervention. The workshops were obligatory for all students, as the intervention content reflected regular school curriculum and the different subjects' learning objectives. Workshop attendance (adherence to the intervention) was recorded for every workshop by the intervention facilitators. The intervention was held from September to December 2016, with an approximately three-week time interval occurring between each workshop. Several measures were taken to maximize intervention fidelity and reliability. The same two professionals worked as a pair both in the preparation phase and during all workshops at every school and were highly coordinated about how to make minor practical adjustments in naturalistic contexts. Materials and presentations were developed prior to intervention start. The materials and presentation provided a rigid and systematic overview of the content and topics to target and discuss for each workshop. The intervention was piloted by the two professionals. All students and staff taking part in the pilot test were asked to provide information on areas of improvement. In addition, the pilot study was video recorded allowing for further refinement of content and delivery style.

2.4. Outcome measures

The main outcome variable was *ED pathology* and was measured by an empirically derived brief version (Friborg, Reas, Rosenvinge, & Ro, 2013) of the Eating disorder Examination Questionnaire (EDEQ) (Fairburn & Beglin, 2008). The EDEQ-11 is found to be a suitable measure of overall ED pathology (Friborg et al., 2013). The scale consists of 11 items scored on a seven-point Likert scale ranging from 0 to 6 were higher scores represent more severe ED pathology. All items are summed, and an average score was calculated. The Cronbach's alfa in our sample was .91 and .94 for boys and girls, respectively.

A summary of secondary outcome measures, instruments and internal consistency are presented in table 1.

Table 1. List of instruments included as secondary outcomes.

Instrument	Concept	Scale description	Cronbach's alpha boys/girls
Rosenberg Self-esteem scale (Rosenberg, 1965)	Global self-worth	10-items, Likert scale (0-4), negative worded items are reversed, sum score. Higher score represents higher self-esteem	090/.92
SCL-10 (Strand, Dalgard, Tambs, & Rognerud, 2003)	Mental distress (symptoms of anxiety and depression)	10-items, Likert scale (1-4), average score. Higher score indicates more mental distress.	.89/.90
BIAAQ (Sandoz, Wilson, Merwin, & Kate Kellum, 2013)	Body image flexibility. Ability to constructively cope with negative emotions and situations challenging body image	12 items, Likert scale (1-7), negative worded items are reversed, sum score. Higher score represents more body image flexibility.	.85/.92
SATAQ-4 (Schaefer et al., 2015)	Societal and interpersonal aspects of appearance ideals subscales; thin and muscular internalization and media pressure	14 (5 + 5 + 4) items, Likert scale (1-5), average score. Higher scores equal greater experience of pressure and internalization.	.85-.94/.91-.95
DLS (Smolak & Murnen, 2008)	Drive for leanness. Degree of drive towards attaining	6 items, Likert scale (1-6), average score. Higher score indicates more drive for leanness.	.86/.86
Supplement use	Protein, creatine and diet aids use	3 standalone items asking about the weekly frequency of use. Likert scale (0-7). Higher scores represent more frequent use.	

SCL-10 = Hopkins symptom checklist 10, BIAAQ = Body image action and acceptance questionnaire, SATAQ-4 = Societal attitudes towards appearance questionnaire 4, DLS = Drive for leanness scale

2.5. Statistical analyses

All analyses were performed using IBM SPSS statistics version 24. The adequacy of the randomization procedure was tested with independent *t*- or chi-square tests examining whether group differences on the outcome variables at baseline were non-significant.

Cases without baseline or any follow-up data were defined as dropouts, otherwise retained. All baseline demographic measures correlating significantly with dropout status (Spearman's rho = > .19) were included as a covariate if significant in the final regression model. All analyses were intention-to-treat as all eligible participants with at least one post or follow-up assessment were included.

Due to several layers of dependency in the different outcome data, a linear mixed regression model (West, 2009) was specified. Dependency within the school clusters was accounted for by adding school as a random factor, whereas dependency between the repeated measures was accounted for by fitting a compound symmetry matrix to the residual matrices. The analysis is also robust against missing data because it analyzes all available data owing to the maximum likelihood function (restricted type used). To account for an imperfect randomization and to increase the statistical power, the baseline score of the outcome variable was added as a covariate. Fixed factors included *group* (mean difference between the intervention and control groups), *time* (mean change across the three measurement times), *gender* (mean difference between girls and boys), *group* × *time* (mean intervention difference at certain measurement occasions), *group* × *gender* (mean intervention difference between boys and girls) and *group* × *time* × *gender* (mean intervention difference at specific measurement occasions depending on gender). Type III F-tests were performed, and alpha values of < .05 were required. Hypothesized group differences observed at specific measurement times were examined as planned comparison tests (LSD). The weekly frequency of supplement use was recoded as follows: 1 (never) = 0, 2 (1-2 times per week) = 1.5, 3 (3-4 times per week) = 3.5, 4 (5-6 times per week) = 5.5 and 5 (every day) = 7.

The results are expressed as absolute numbers (n) and percentages (%) for categorical data and model estimated means including standard errors (SEs) and standard deviations (SDs) for continuous data. Effect sizes were calculated as standardized mean differences (or Cohen's $d = \frac{\text{estimated mean difference}}{\text{observed pooled SD}}$) and interpreted as negligible, small, moderate, or large when d = < .20, .20 – .49, .50 – .79, or > .79, respectively (Cohen, 1988). The power calculation used an α level of .05 and an average within-cluster sample size of 70 students. For each group, 10 clusters were needed to achieve a statistical power of 81 %. The total required sample size was calculated as 10 × 2 groups × 70 students in each cluster, resulting in 1,400 students.

2.6. Ethics

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 (2016/142). The study was further enrolled in the international database of controlled trials, www.clinicaltrials.gov (ID: PRSNCT02901457). Students at consenting schools who did not want to participate in the study (i.e. not answer the questionnaires) did also receive the HBI intervention as the HBI content was founded in the subject curriculum.

3. Results

The response rate at baseline was 60 % of potential students with a higher number of girls than boys (girls 58 %, boys 42 %, p = <.01). Some significant differences in baseline variables between dropouts and responders were observed (p = <0.01). Control boy dropouts consumed more protein (1.71 vs. .97), creatine (1.50 vs. .69), diet aids (.86 vs. .19) per week than control boy responders, respectively. Control girl dropouts consumed more protein (.55 vs. .20) and creatine (.20 vs. .04) per week than control girl responders, respectively. No differences in psychometric variables were observed between dropouts and responders. Table 2 presents workshop attendance in boys and girls who were included in the effect analysis of the main outcome (ED pathology). Demographic characteristics for the whole sample, and baseline and 12-months scores for outcome variables for participants included in the effect analyses are found in Table 3.

Table 2. Workshop attendance among intervention boys and girls included in the effect analysis on ED pathology. Presented as percentage, and number of participants parenthesized.

	Boys (n = 276)	Girls (n = 590)
Attended at least one workshop	94.2 (260)	95.3 (562)
Attended all three workshops	64.5 (178)	57.5 (339)
Attended two workshops	25.4 (70)	29.7 (175)
Attended only one workshop	5.8 (16)	8.1 (48)
Attended the first workshop	88.0 (243)	88.6 (523)
Attended the second workshop	87.0 (240)	85.4 (504)
Attended the third workshop	73.6 (203)	65.8 (388)
Did not attend any workshops	5.8 (16)	4.7 (28)

Table 3. Sample characteristics and 12-month follow-up score shown as the mean and standard deviation (SD) or percentage and number of observations (N).

	Boys				Girls			
	N	Intervention	N	Control	N	Intervention	N	Control
Age (yrs.)	615	16.80 (.45)	403	16.74 (.50)	865	16.79 (.50)	534	16.78 (.49)
BMI (kg/m^2)	605	21.77 (2.70)	391	21.81 (3.21)	862	21.39 (2.80)	524	21.36 (3.06)
Parental income > $104,000, % (n)	615	50.4 (310)	403	44.7 (180)	867	37 (321)	535	26.7 (143)
Immigrant status % (n)	615	11.4 (70)	403	18.9 (76)	867	12.6 (109)	535	17.8 (95)
Paternal university education % (n)	615	75.6 (465)	401	66.3 (266)	867	72.9 (632)	535	59.8 (320)
Maternal university education % (n)	615	76.9 (473)	402	64.7 (260)	867	75.5 (655)	535	66.7 (357)
Eating disorder pathology								
Baseline	276	.97 (1.08)	131	1.14 (1.16)	590	2.38 (1.58)	276	2.68 (1.70)
12-month	155	.69 (.90)	67	.68 (.75)	436	1.59 (1.51)	177	2.44 (1.83)
Self-esteem								
Baseline	263	33.00 (5.63)	123	32.72 (6.37)	574	29.50 (5.97)	259	28.41 (6.50)
12-month	142	33.86 (6.00)	61	32.72 (6.95)	399	31.03 (6.11)	163	28.11 (7.41)
Mental distress								
Baseline	279	1.64 (.58)	134	1.77 (.62)	595	2.12 (.73)	261	2.25 (.78)
12-month	150	1.49 (.62)	65	1.72 (.75)	407	1.93 (.68)	166	2.23 (.78)
Body image flexibility								
Baseline	320	70.16 (9.35)	169	68.84 (11.05)	649	58.34 (15.32)	311	57.41 (16.53)
12-month	173	70.65 (11.31)	83	67.72 (12.66)	449	63.03 (16.00)	195	56.51 (19.43)
Media pressure								
Baseline	281	2.08 (1.13)	135	2.15 (1.17)	596	3.15 (1.25)	283	3.28 (1.27)
12-month	151	1.89 (1.03)	64	2.06 (1.09)	420	2.90 (1.27)	170	3.37 (1.23)
Thin internalization								
Baseline	281	2.48 (0.93)	135	2.63 (.92)	596	3.27 (1.07)	283	3.41 (1.14)
12-month	151	2.06 (.88)	64	2.26 (.79)	420	2.79 (1.13)	170	3.28 (1.19)
Muscular internalization								
Baseline	281	3.23 (1.11)	135	3.37 (1.03)	596	3.01 (1.09)	283	2.98 (1.05)
12-month	151	2.77 (1.06)	64	3.08 (1.09)	420	2.68 (1.03)	170	2.73 (1.09)
Drive for leanness scale								
Baseline	332	3.58 (1.02)	175	3.70 (1.09)	664	3.49 (1.00)	324	3.42 (1.06)
12-month	180	3.63 (1.01)	86	3.86 (.99)	467	3.37 (1.00)	202	3.56 (1.03)
Protein supplement use % (n)								
Baseline	294	22.8 (67)	137	30.7 (42)	613	6.9 (42)	286	7.3 (21)
12-month	158	8.9 (14)	68	29.4 (20)	440	5.0 (22)	185	5.4 (10)
Creatine supplement use % (n)								
Baseline	294	10.5 (31)	137	17.5 (24)	613	2.3 (14)	286	2.4 (7)
12-month	158	3.1 (9)	68	9.7 (9)	440	1.3 (8)	185	1.6 (3)
Diet aid use % (n)								
Baseline	294	5.4 (16)	137	8.0 (11)	613	3.9 (24)	286	4.5 (13)
12-month	158	1.0 (3)	68	1.4 (1)	440	2.4 (15)	185	1.6 (3)
Weekly frequency of protein supplement use (0-7)								
Baseline	294	.86 (1.83)	137	1.01 (1.80)	613	.21 (.93)	286	.23 (.98)
12-month	158	.56 (1.50)	68	.96 (1.77)	440	.26 (1.13)	185	.14 (.76)
Weekly frequency of creatine supplement use (0-7)								
Baseline	294	.46 (1.48)	137	.74 (1.82)	613	.07 (.56)	286	.04 (.30)
12-month	158	.25 (1.14)	68	.52 (1.46)	440	.05 (.47)	185	.02 (.19)
Weekly frequency of diet aid use (0-7)								
Baseline	294	.25 (1.16)	137	.24 (.95)	613	.10 (.60)	286	.10 (.60)
12-month	158	.06 (.59)	68	.02 (.18)	440	.08 (.60)	185	.05 (.19)

BMI = body mass index, immigrants = two foreign born parents, ED pathology = eating disorder pathology. Significant differences between the intervention and control groups are highlighted in bold.

3.1. ED pathology

A significant overall *group*, *time* and *gender* effect was found for ED pathology (Table 4) with post hoc comparisons showing that the intervention group scored significantly lower than the control group at the 3- and 12-month follow-ups (Table 5). The intervention effect was moderated by *gender (group* × *gender)*, as girls benefitted from the intervention (p = <.001, d = .21) and boys did not (p = .470, d = .05) (Table 5).

Table 4. Type III test showing main and interaction effects for group, time and gender for all outcome variables adjusted for baseline outcome scores.

	Group			Group x Time			Group x Gender			Group x Time x Gender		
	df	F	p	df	F	P	df	F	p	df	F	p
Eating disorder pathology	41.87	8.90	**.005**	1895.40	2.20	.111	1197.50	3.90	**.048**	1895.90	1.28	.279
Self-esteem	27.98	11.79	< **.001**	1858.55	4.17	**.022**	1216.86	.23	.628	1859.73	.07	.928
Mental distress	33.75	4.76	**.036**	1881.96	8.68	< **.001**	1283.49	.04	.846	1882.83	.23	.792
Body image flexibility	22.20	18.63	< **.001**	2104.43	2.04	.131	1307.67	.27	.602	2104.80	4.48	**.011**
Media pressure	31.02	16.42	< **.001**	1963.22	.18	.836	1132.52	4.39	**.036**	1963.20	.07	.934
Thin internalization	38.84	20.94	< **.001**	1936.98	.02	.979	1290.61	4.23	**.040**	1937.68	.78	.460
Muscular internalization	35.44	12.92	**.001**	1938.00	1.75	.175	1306.63	.47	.492	1938.75	1.37	.255
Drive for leanness	36.94	9.77	**.003**	2118.03	.03	.967	1477.63	.45	.501	2119.61	.86	.423
Protein	32.06	5.11	**.031**	1924.36	1.56	.210	1070.81	11.73	**.001**	1925.55	3.49	**.031**
Creatine	19.33	2.06	.167	1891.91	8.43	< **.001**	1122.31	2.34	.127	1.892.46	7.77	< **.001**
Diet aids	809.07	.06	.808	1585.40	1.00	.367	809.11	.90	0.343	1585.35	.31	.737

Group = intervention vs. control, Time = measurement timepoint, gender = boys vs. girls, Protein, Creatine and Diet aids = weekly frequency of use. Significant effects are highlighted in bold.

3.2. Secondary outcomes

For self-esteem, a significant *group* × *time* effect was present (Table 4) as the control group had a small decrease whereas the intervention group had an increase in their score at the 12-month follow-up (Table 5).

A significant main effect of *group* was found for mental distress (Table 4) as the intervention group scored more favorably on mental distress than the control group (p = .035, d = .10). The intervention group maintained their mental distress over time while the control group increased their scores (g*roup* × *time p* = < .001, d = .20). Significant differences in mental distress between the intervention and control group were present at the 12-month follow-up (Table 5).

For body image flexibility, a significant *group* × *time* × *gender* effect was observed (Table 4) as girls from the intervention group increased their body image flexibility from the posttest to the 12-month follow-up (p = .001, *d* = .16) while control girls significantly decreased their scores between the 3- and 12-month follow-up (p = .004, *d* = .21) (Table 6). The 3-month effect observed in boys faded to the 12-month follow-up.

A *group* × *gender* effect was observed for thin internalization (Table 4) with a larger effect for girls (*p* = <.001, *d* = .24) than for boys (p = .052, *d* = .15). This effect was additionally moderated by *time* as a *group* × *gender* × *time* effect was present. The immediate effect in boys faded whereas the effect among girls sustained across the entire 12-month follow-up time span (Table 6).

A significant main effect was found for muscular internalization (Table 4) as intervention students scored lower than control students (p = .001, *d* = .15; Table 4). However, post-hoc comparisons revealed only 12-month effect in girls (Table 6).

A significant interaction between *group* × *gender* was observed for media pressure (Table 5) as effects were observed at all measurement timepoints in girls only (Table 6).

A significant main effect was found for drive for leanness (Table 4) as the intervention group had lower scores than the control group at all measurement time points (p = .003, *d* = .12) (Table 5).

For protein supplement use, a significant *group* × *time* × *gender* effect was present (Table 4) where the weekly frequency of protein supplement use in intervention boys remained stable while it increased for control boys across the 12-month follow-up period (p = .045, *d* = .28) with significant group differences found at the 3- and 12-month follow-ups (Table 6).

A significant *group* × ti*me* × *gender* was also present for weekly frequency of creatine supplement use (Table 4) as boys from the control group increased their creatine supplement use to the 12-month follow-up (p = .006, *d* = .35) with significant between group differences found at the 3- and 12-month follow-ups (Table 6). No main or interaction effects were observed for diet aid use.

Table 5. Difference in outcome scores between intervention and control group showed as mixed model estimated marginal mean scores and standard errors (SEs) and effect size, Cohen's d (*d*). Adjusted for baseline outcome scores. Outcomes where the effect was moderated by gender are printed in grey font color.

	Intervention		Control				
	N	Mean (SE)	N	Mean (SE)	Mean difference (SE)	*P*	*d*
Eating disorder pathology (covariate: 2.02)							
Posttest	753	1.68 (.04)	360	1.79 (.05)	-.11 (.07)	.093	
3 months	664	1.70 (.04)	303	1.86 (.06)	-.16 (.07)	.022	.17
12-month	578	1.52 (.04)	244	1.79 (.06)	-.27 (.07)	.001	.27
Self-esteem (covariate: 30.33)							
Posttest	456	31.23 (.22)	739	30.39 (.27)	.84 (.35)	**.020**	**.15**
3-month	390	30.71 (.23)	654	30.10 (.30)	.62 (.37)	.103	
12-month	305	31.74 (.24)	562	30.03 (.32)	1.71 (.40)	**<.001**	**.33**
Mental distress (covariate: 2.01)							
Posttest	754	1.86 (.03)	347	1.86 (.03)	.00 (.04)	.993	
3-month	661	1.82 (.03)	292	1.88 (.03)	-.06 (.04)	.179	
12-month	557	1.82 (.03)	231	2.00 (.03)	-.18 (.04)	**<.001**	**.31**
Body image flexibility (covariate: 61.79)							
Posttest	778	63.44 (.43)	366	61.75 (.60)	1.70 (.74)	.026	.14
3-month	740	63.90 (.45)	352	61.26 (.61)	2.65 (.76)	.001	.22
12-month	622	64.28 (.48)	278	60.83 (.69)	3.45 (.83)	<.001	.30
Media pressure (covariate 2.86)							
Posttest	777	2.55 (.04)	372	2.75 (.05)	-.21 (.06)	.002	.20
3-month	687	2.59 (.04)	312	2.70 (.06)	-.20 (9.07)	.006	.19
12-month	571	2.57 (.04)	234	2.82 (.06)	-.246 (.08)	.002	.24
Thin internalization (covariate: 3.07)							
Posttest	777	2.65 (.03)	372	2.90 (.05)	-.20 (.09)	<.001	.26
3-month	687	2.62 (.04)	312	2.87 (.05)	-.15 (.10)	<.001	.26
12-month	571	2.61 (.04)	234	2.85 (.06)	-.11 (.11)	.001	.26
Muscular internalization (covariate 3.05)							
Posttest	777	2.75 (.04)	372	2.96 (.05)	-.204 (.06)	**.002**	**.20**
3-month	687	2.73 (.04)	312	2.99 (.05)	-.26 (.07)	**<.001**	**.26**
12-month	571	2.76 (.04)	234	2.89 (.06)	-.13 (.07)	.065	
Drive for leanness (covariate: 3.50)							
Posttest	785	3.48 (.04)	381	3.63 (.05)	-.15 (.06)	**.012**	**.16**
3-month	756	3.52 (.04)	371	3.69 (.05)	-.17 (.06)	**.008**	**.17**
12-month	624	3.56 (.04)	287	3.73 (.05)	-.17 (.06)	**.013**	**.18**
Weekly frequency of protein supplement use (covariate: .37)							
Posttest	769	.33 (.04)	377	.37 (.06)	-.05 (.07)	.461	
3-month	690	.32 (.04)	318	.53 (.06)	-.21 (.07)	.005	.20
12-month	598	.39 (.04)	253	.50 (.06)	-.10 (.08)	.213	
Weekly frequency of creatine supplement use (covariate: .17)							
Posttest	769	.18 (.03)	377	.12 (.04)	-.06 (.06)	.291	
3-month	690	.15 (.03)	318	.32 (.05)	-.17 (.06)	.008	.20
12-month	598	.15 (.03)	253	.26 (.05)	-.10 (.06)	.123	
Weekly frequency of diet aids use (covariate: .12)							
Posttest	769	.04 (.02)	377	.07 (.03)	-.03 (.04)	.442	
3-month	690	.06 (.02)	318	.08 (.03)	-.03 (.04)	.472	
12-month	598	.08 (.02)	253	.05 (.03)	.03 (.04)	.377	

Posttest = after intervention, SE = standard error of the estimated, *d* = Cohen's d. Significant effects are highlighted in bold.

Table 6. Post-hoc comparisons with gender as moderator. Scores are presented as mixed model estimated marginal mean scores and standard error (SE) and effect size, Cohen's d (*d*), for boys and girls. Adjusted for baseline outcome scores. Gender was included as moderator and the analyses were not stratified by gender.

	Boys							Girls						
	Intervention		Control		Mean difference (SE)	*P*	d	Intervention		Control		Mean difference (SE)	*P*	d
	N	Mean (SE)	N	Mean (SE)				N	Mean (SE)	N	Mean (SE)			
Eating disorder pathology (covariate: 2.02)														
Posttest	240	1.56 (.06)	115	1.63 (.08)	-.07 (.10)	.481		513	1.81 (.04)	245	1.96 (.06)	.15 (.07)	**.042**	**.16**
3 months	196	1.62 (.06)	88	1.69 (.09)	-.06 (.11)	.583		468	1.78 (.04)	215	2.04 (.06)	.26 (.08)	**.001**	**.28**
12-month	155	1.43 (.07)	67	1.55 (.09)	-.12 (.12)	.343		423	1.61 (.04)	177	2.02 (.06)	.41 (.08)	**<.001**	**.50**
Self-esteem (covariate: 30.33)														
Posttest	226	31.36 (.31)	230	30.70 (.41)	.66 (.51)	.195		230	31.09 (.23)	509	30.08 (.31)	1.02 (.38)	**.010**	**.21**
3-month	189	30.43 (.33)	201	29.85 (.47)	.58 (.57)	.310		201	31.00 (.24)	453	30.34 (.32)	.66 (.40)	.102	
12-month	142	31.99 (.36)	163	30.41 (.52)	1.59 (.62)	**.011**	**.38**	163	31.48 (.25)	399	29.66 (.34)	1.82 (.42)	**<.001**	**.39**
Mental distress (covariate: 2.01)														
Posttest	235	1.80 (.04)	116	1.78 (.05)	-.02 (.06)	.752		519	1.92 (.03)	231	1.94 (.04)	.02 (.05)	.681	
3-month	196	1.77 (.04)	88	1.82 (.06)	.05 (.05)	.444		465	1.87 (.03)	204	1.94 (.04)	.07 (.05)	.160	
12-month	150	1.74 (.05)	65	1.94 (.06)	.20 (.05)	**.009**	**.38**	407	1.89 (.03)	166	2.07 (.04)	.17 (.05)	**.001**	**.30**
Body image flexibility (covariate: 61.79)														
Posttest	247	63.65 (.70)	124	62.21 (.96)	-1.44 (1.18)	.223		531	63.23 (.49)	242	61.28 (.70)	-1.95 (.85)	**.024**	**.18**
3-month	225	64.00 (.73)	115	60.37 (.99)	-3.64 (1.22)	**.003**	**.34**	515	63.80 (.50)	237	62.14 (.71)	-1.65 (.86)	.057	
12-month	173	63.62 (.80)	83	61.79 (1.13)	-1.83 (1.37)	.181		449	64.92 (.52)	195	59.87 (.76)	-5.08 (.92)	**<.001**	**.47**
Media pressure (covariate 2.86)														
Posttest	244	2.35 (.06)	120	2.43 (.09)	.08 (.11)	.449		244	2.74 (.04)	120	3.07 (.06)	.33 (.08)	**<.001**	**.35**
3-month	201	2.38 (.07)	91	2.48 (.10)	.10 (.12)	.150		201	2.79 (.04)	91	3.09 (.06)	.30 (.08)	**<.001**	**.32**
12-month	151	2.36 (.08)	64	2.51 (.11)	.14 (.13	.291		151	2.78 (.05)	64	3.13 (.07)	.35 (.09)	**<.001**	**.38**
Thin internalization (covariate: 3.07)														
Posttest	244	2.52 (.06)	120	2.72 (.08)	.20 (.09)	**.029**	**.24**	533	2.78 (.04)	252	3.08 (.05)	.30 (.07)	**<.001**	**.34**
3-month	201	2.51 (.06)	91	2.66 (.08)	.15 (.10)	.140		486	2.74 (.04)	221	3.09 (.06)	.35 (.07)	**<.001**	**.40**
12-month	151	2.53 (.07)	64	2.64 (.09)	.11 (.11)	.341		420	2.69 (.04)	170	3.06 (.06)	.37 (.08)	**<.001**	**.44**
Muscular internalization (covariate 3.05)														
Posttest	244	2.78 (.06)	120	3.06 (.07)	.28 (.09)	**.003**	**.34**	244	2.72 (.04)	120	3.06 (.06)	.28 (.09)	.064	
3-month	201	2.82 (.06)	91	3.13 (.08)	.30 (.10)	**.003**	**.38**	201	2.64 (.04)	91	3.13 (.06)	.30 (.10)	**.004**	**.24**
12-month	151	2.78 (.06)	64	2.88 (.09)	.10 (.11)	.370		151	2.73 (.04)	64	2.88 (.06)	.11 (.13)	**.033**	**.19**
Drive for leanness (covariate: 3.50)														
Posttest	257	3.55 (.05)	127	3.70 (.07)	-.15 (.09)	.089		528	3.41 (.04)	254	3.57 (.05)	-.16 (.06)	**.018**	**.18**
3-month	231	3.64 (.05)	122	3.81 (.07)	-.16 (.09)	.065		525	3.40 (.04)	249	3.57 (.05)	-.17 (.07)	**.014**	**.19**
12-month	175	3.71 (.06)	86	3.80 (.08)	-.09 (1.00)	.347		449	3.42 (.01)	201	3.66 (.05)	-.24 (.07)	**.001**	**.26**
Weekly frequency of protein supplement use (covariate: .37)														
Posttest	248	.41 (.06)	120	.50 (.90)	-.09 (.11)	.408		521	.24 (.04)	257	.25 (.06)	-.01 (.07)	.911	
3-month	202	.39 (.07)	93	.83 (.09)	-.47 (.12)	**<.001**	**.50**	452	.27 (.04)	215	.22 (.06)	.05 (.08)	.531	
12-month	158	.42 (.07)	68	.77 (.09)	-.35 (.13)	**.020**	**.43**	440	.35 (.05)	185	.23 (.07)	.12 (.08)	.178	
Weekly frequency of creatine supplement use (covariate: .17)														
Posttest	248	.31 (.05)	120	.19 (.07)	.12 (.09)	.203		521	.06 (.04)	257	.06 (.05)	.00 (.07)	.992	
3-month	202	.23 (.05)	93	.53 (.08)	-.30 (.09)	**.003**	**.40**	452	.08 (.04)	215	.11 (.06)	-.03 (.07)	.703	
12-month	158	.22 (.06)	68	.45 (.08)	-.23 (.11)	**.045**	**.32**	440	.08 (.04)	185	.08 (.06)	.00 (.07)	.979	
Weekly frequency of diet aids use (covariate: .12)														
Posttest	248	.02 (.03)	120	.05 (.05)	-.03 (.05)	.531		521	.08 (.02)	257	.09 (.03)	-.01 (.04)	.695	
3-month	202	.03 (.04)	93	.10 (.05)	-.07 (.06)	.261		452	.09 (.02)	215	.07 (.03)	.02 (.04)	.631	
12-month	158	.06 (.04)	68	.04 (.06)	.02 (.07)	.814		440	.10 (.02)	185	.05 (.04)	.05 (.04)	.185	

SE =standard error of the estimate, *d* = Cohen's d. Significant effects are highlighted in bold.

4. Discussion

The aim of the HBI was to reduce risk and enhance protective factors for EDs in adolescent boys and girls. Our findings lend partial support for the universal impact of the HBI intervention being effective in addressing most of the risk and protective factors for ED development with sustained and even strengthened effects one year after the intervention. Both boys and girls benefited from the intervention; however, a tendency towards stronger and effects were present in girls.

Baseline levels of ED pathology in girls where higher compared to normative values of ED pathology previously reported in Norwegian and Swedish adolescents (Mantilla & Birgegård, 2016; Reas, Øverås, & Rø, 2012) and young adults (Reas et al., 2012). Fortunately, all boys reduced their ED pathology score over the follow-up period suggesting a decrease in ED risk. The reduction in ED pathology observed in boys is not surprising and may be explained by pubertal changes such as weight gain and increased muscle mass which brings boys closer to the male appearance ideal (McCabe, Ricciardelli, & Finemore, 2002), and increased circulating testosterone in post pubertal boys decreasing ED risk (Culbert, Burt, McGue, Iacono, & Klump, 2009). One may debate that it could be difficult to reduce ED pathology exceeding the natural developmental trajectory. Especially considered that boys in general had low scores on ED pathology at baseline raising the issue of floor effects leaving little room for improvement (Stice & Shaw, 2004). Our results on ED pathology align with two previous intervention programs (Wilksch et al., 2014; Wilksch & Wade, 2009). In contrast, one other intervention study has successfully reduced ED pathology in boys (Wade, Davidson, & O'Dea, 2003). These previous studies have thus included younger adolescents which may influence comparability as boys in early adolescence are less likely to have gone through puberty and may exist in a different sociocultural milieu than older adolescent boys.

The moderate effect size found in girls 12-months after the intervention gives hope for lasting effects in ED pathology in girls. The finding is promising as ED risk is found to increase from adolescence to early adulthood in girls (Slane, Klump, McGue, & Iacono, 2014) as the pubertal changes during puberty bring girls further away from the ideal body. Moreover, biological changes during puberty affect the genetic influence on ED development in girls (Culbert et al., 2009; Klump, Perkins, Burt, McGue, & Iacono, 2007) resulting in a post-pubertal increase in ED risk (Klump et al., 2007). The HBI intervention did not target ED pathology directly. The observed effect in girls is likely influenced by improvements in other factors targeted in the intervention, such as self-esteem, body image flexibility, appearance internalization, and media pressure.

A promising finding was the intervention effect in self-esteem and mental distress in both boys and girls at the 12-month follow-up. The reduced mental distress observed in the intervention students raises additional support for the HBI intervention as a health promotive and preventive intervention (Stice, Gau, Rohde, & Shaw, 2017). The reduced mental distress is also highly relevant considering the cross-sectional and longitudinal increase in mental distress observed the past two decades (Bakken, 2018; Kleppang, Thurston, Hartz, & Hagquist, 2019; Potrebny et al., 2019).

The sleeper effect observed may be explained by the need for time to elaborate on the intervention content and implement skills and routines before it can facilitate a further change in outcomes. In addition, immediate improvements in other psychological variables may have facilitated a change in self-esteem and mental distress, such as social media usage (Rodgers et al., 2020), body image and ED pathology (Meland et al., 2021; Puccio et al., 2017). Sleeper effect may also be partially explained by delays in the improvements in peer environment, where change in (e.g.) social comparison, appearance conversation, fat talk and peer appearance focus need time to mature and develop before it results in change in the outcomes.

Several aspects of adolescent self-esteem development are important when interpreting the results. The small increase in self-esteem observed in the intervention group could be the result of a natural developmental course. In both girls and boys, self-esteem development follows a reversed u-shaped curve through life where it increases from childhood to early adolescence where it then remains stable, possibly explained by more rapid fluctuations due to external contingencies (Crocker & Wolfe, 2001). During late adolescence, self-esteem becomes less contingent and continues to increase into to midlife before it decreases in older age and elderly (Orth, Erol, & Luciano, 2018). Lastly, the intervention effect in mental distress and self-esteem may relate to baseline difference between intervention and control group in socioeconomic status which is a strong predictor of mental health development (Kivimäki et al., 2020; Orth & Robins, 2014).

Our lack of lasting effect with respect to body image flexibility are promising compared to one previous study finding no effect of an internet based universal prevention program on body image flexibility (Rodgers et al., 2018). Importantly, they did not include gender as a moderator in the analysis and the proportion of boys was small. In contrast, intervention girls increased their body image flexibility relative to control girls who decreased their body image flexibility resulting in a 12-month effect among girls. Our findings suggest that the intervention girls increased their capacity to constructively cope with challenging perceptions, emotions, beliefs and thoughts without compromising chosen personal values. The increase in body image flexibility in girls may have reduce their risk of developing EDs, as it may protect them from engaging in DE behaviors to cope with stressful cognitions challenging their body image (Rogers et al., 2018; Wendell, Masuda, & Le, 2012). Increasing adolescent's literacy towards unhealthy appearance ideals, discussing truths and myths related to idealized lives, diets, and exercise as well as equipping them with skills to handle negative exposures and stressors, may have facilitated lasting improvements in body image flexibility in girls.

The girls in our sample experienced more thin internalization compared to previously reported scores for young women (Schaefer, Burke, & Thompson, 2019). Fortunately, intervention girls reduced their thin internalization relative to the control girls. The effect on thin internalization and perceived pressure is positive and has most likely contributed to the reduced ED pathology in girls. This finding is highly relevant as elevated thin internalization or experienced appearance pressure is present in almost half of adolescent girls who later develop an ED (Stice & van Ryzin, 2019).

Fortunately, both control and intervention boys decreased their thin internalization and media pressure scores. The lack of 12-month effect in both internalization, media pressure, and ED pathology reflects the theories explaining how change in perceived media pressure could facilitate reduced ED pathology through reduced appearance internalization (Schaefer, Rodgers, Thompson, & Griffiths, 2021). Our results are in contrast to previous universal interventions creating improvements in general internalization (Gonzalez, Penelo, Gutierrez, & Raich, 2011; Sharpe, Schober, Treasure, & Schmidt, 2013; Wilksch, Tiggemann, & Wade, 2006) and media pressure (Warschburger & Zitzmann, 2018). However, these studies have assessed general internalization and not thin or muscular internalization in particular and have included a younger sample than this present study.

Girls baseline scores on drive for leanness and muscular internalization underline that the athletic, muscular and lean appearance ideals and strives are not only relevant to boys. Our findings suggest that also targeting internalization of a wider range of appearances, not only thin internalization, may be beneficial when aiming to reduce ED risk in girls. Previous research has concluded that drive for leanness compromises of elements from both drive for thinness and drive for muscularity, and thus represents a unique dimension of body image (Smolak & Murnen, 2008). Therefore one could suggest that the reduction in both thin and muscular internalization observed in our study has facilitated a reduction in drive for leanness in girls (Tod, Edwards, & Hall, 2013). The HBI intervention created an *overall* effect on muscular and athletic internalization and drive for leanness as gender did not significantly moderate the intervention effect. The post-hoc comparisons, revealed, however, no 12-month effect on muscular internalization or drive for leanness in boys. Our results are still promising for muscular internalization even if the effect faded 12-months after the intervention due to a reduction in muscular internalization among control boys. The non-significant post-hoc comparisons with respect to muscular reinternalization and drive for leanness may also be partially explained by low statistical power as gender did not moderate the effect.

In theory, improvements in muscular internalization and drive for leanness could in turn facilitate change in supplement use, if such use is motivated by appearance or muscularity enhancement reasons. The 12-month effect on protein and creatine supplement use in boys may be partially related to the small improvements observed for muscular internalization and drive for leanness (Rodgers et al., 2020), and by the intervention content which aimed to increase knowledge and literacy towards nutrition and supplement advertisement. Such content may also be relevant to boys who use supplements for other reasons than appearance (e.g. performance or “because their friends do”). The stable scores on protein and creatine supplement use in intervention boys are fortunate, as one would expect an increase among boys as they age (Bartee, Grandjean, Dunn, Eddy, & Wang, 2004; Whitehouse & Lawlis, 2017), as observed among control boys. Importantly, control boys and girls who were characterized as dropouts consumed significantly more protein, creatine and dieting aids than control responders. Therefore, the fact that we found any improvements among boys were somewhat surprising, yet fortunate. In contrast to one previous study in girls (Austin, Field, Wiecha, Peterson, & Gortmaker, 2005) no improvement was observed for diet aids use. This is unfortunate, but aligned with current knowledge that universal prevention rarely show sustained effects in preventing DE or ED behaviors (Le et al., 2017). The results in boys may also be influenced by dropout status as control boy dropouts consumed diet aids more often than control boy responders. Floor effects may also be present for supplement and diet aids use in girls and diet aids use in boys.

4.1. Strengths and limitations

Strengths to this study were the clustered randomized controlled design, equal number of control and intervention schools, and an equalization of error variance in questionnaire responses. The students represented wide ranges of socioeconomic and demographic backgrounds strengthening the study generalizability. Moreover, the large sample size provided adequate statistical power to detect both immediate and distal main effects. The benefit of a longitudinal design was, however, diminished as moderator analyses were hampered by a loss of power at the 12-month follow-up in boys. The statistical methods used to investigate the intervention effect may be considered a strength as individuals who missed one or two follow up-assessments were still included in the analyses. Another strength was the inclusion of baseline scores and school cluster as covariates (Smith, 2012), which could have compensated for the observed demographic and socioeconomic differences between the intervention and the control group. Challenges related to the validity and reliability of intervention delivery remain unaddressed since facilitator protocol adherence was not measured.

4.3. Implications and future research

The effect sizes raise issues of clinical importance. However, baseline outcome scores in universal prevention and health promotion interventions rarely reach a clinical level (Franko, Cousineau, Rodgers, & Roehrig, 2013). Additionally, even small changes in mental health outcomes in universal health promotion interventions may result in important changes at population level (Huppert, 2009). Gender differences in effects may be related to factors such as facilitators' gender, where only using female facilitators might have influenced relevance and credibility for boys, and the intervention setting and learning trajectories which might favor girls preferences and developmental stage (Honigsfeld & Dunn, 2003; Van Houtte, 2004). In addition, taking these factors into consideration. Further replication of our findings is necessary to prove the efficiency of the HBI program. Also, the inclusion of a longer follow-up period could determine if effects fade or increase over time. Clinical interviews should be performed to investigate if the HBI intervention is successful in reducing ED onset, which will help determining the clinical relevance of the HBI intervention. Lastly, future studies should aim to perform the assessments within the school hours to prevent unnecessary dropout.

5. Conclusion

The HBI intervention was successful in reducing risk and enhancing protective factors for ED development with sustained effects found at 12-month follow-up. The HBI intervention was equally successful in increasing self-esteem and reducing mental distress in girls and boys.

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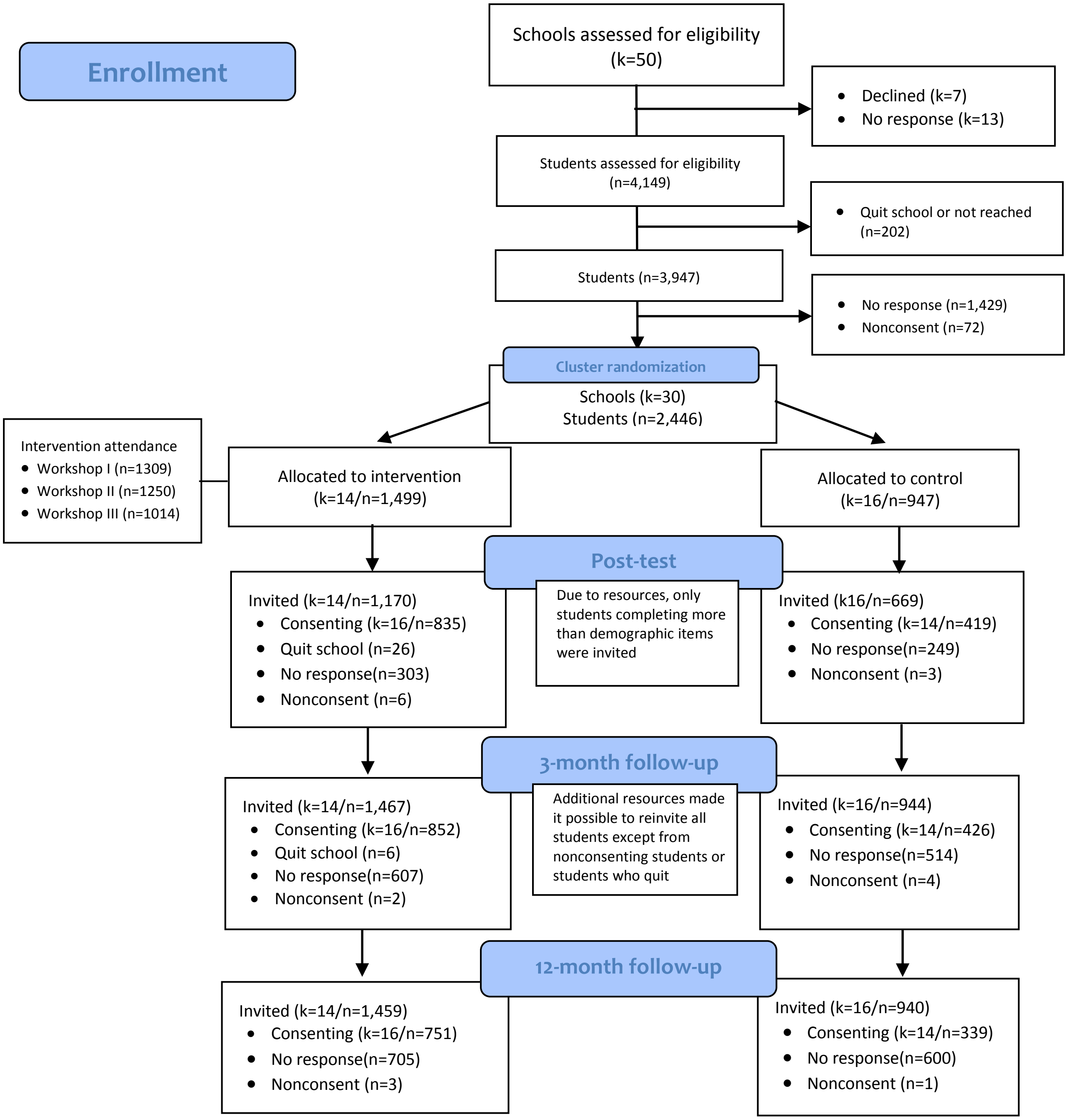
Figure 1



Enrollment
Schools assessed for eligibility (k=50)
Declined (k=7)
No response (k=13)
Students assessed for eligibility (n=4,149)
Quit school or not reached (n=202)
Students (n=3,947)
No response (n=1,429)
Nonconsent (n=72)
Cluster randomization
Schools (k=30)
Students (n=2,446)
Intervention attendance
Workshop I (n=1309)
Workshop II (n=1250)
Workshop III (n=1014)
Allocated to intervention (k=14/n=1,499)
Allocated to control (k=16/n=947)
Post-test
Due to resources, only students completing more than demographic items were invited
Invited (k=14/n=1,170)
Consenting (k=16/n=835)
Quit school (n=26)
No response(n=303)
Nonconsent (n=6)
Invited (k16/n=669)
Consenting (k=14/n=419)
No response(n=249)
Nonconsent (n=3)
3-month follow-up
Additional resources made it possible to reinvite all students except from nonconsenting students or students who quit
Invited (k=14/n=1,467)
Consenting (k=16/n=852)
Quit school (n=6)
No response(n=607)
Nonconsent (n=2)
Invited (k=16/n=944)
Consenting (k=14/n=426)
No response(n=514)
Nonconsent (n=4)
12-month follow-up
Invited (k=14/n=1,459)
Consenting (k=16/n=751)
No response(n=705)
Nonconsent (n=3)
Invited (k=16/n=940)
Consenting (k=14/n=339)
No response(n=600)
Nonconsent (n=1)

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