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Dissonance-based prevention of eating pathology in non-Western cultures: A randomized controlled trial of the Body Project among young Saudi adult women

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ABSTRACT

The aims of this study were to determine the effectiveness of an adapted version of the Body Project for young Saudi women, and to determine the impact of compliance (i.e. adherence to homework and attendance) on outcomes. A randomized controlled trial was used, allocating Saudi undergraduate females (N = 92; mean age = 20.48 years; SD = 2.28) to either a culturally-adapted version of the Body Project or a health education control condition. Participants completed self-report measures of eating pathology, body image, depression and social anxiety before and following the interventions and at three-month follow-up. Interaction terms showed that, relative to the control group, the intervention group had significantly reduced levels of eating concerns, body dissatisfaction and depression, but social anxiety did not change significantly in either group. Levels of session attendance and homework completion did not influence outcomes. Thus, the Body Project was effective for Saudi women in reducing eating pathology, body image dissatisfaction, and depression, though not social anxiety. This outcome indicates the value of the Body Project as a prevention tool when adapted to non-Western cultures.

1. Introduction

Young adult women in Saudi Arabia suffer from disordered eating attitudes and behaviours, body dissatisfaction, and emotional correlates at comparable levels with women in western cultures (AlShebali et al., 2020; Altwaijri et al., 2020). Internalization of western values impacts eating and body issues, with this impact being partially mediated by depression and social anxiety (AlShebali et al., 2020). Given this pattern, there is a need to consider treatment for eating disorders and body image in Saudi Arabia and other non-Western cultures undergoing 'westernization'. Importantly, preventative interventions should be considered where there is such a process of westernization, in order to reduce the numbers of people who go on to develop a full eating disorder.

Eating disorder prevention is a practical, cost-effective intervention, which can be provided by non-clinical facilitators (e.g., Becker & Stice, 2017; Diedrichs et al., 2015; Stice, Onipede, & Marti, 2021). It is commonly applied in a selective way, targeting those at risk (e.g., young women; those with less healthy eating attitudes and body image distress). Cognitive dissonance-based prevention is the most evaluated approach (Le et al., 2017), being based on the principle of encouraging individuals to undertake behaviours that are dissonant with their beliefs in order to modify those beliefs.

The only manualized dissonance-based prevention programme developed for university age and similar populations is the Body Project. Stice, Rohde, & Shaw (2013) describe how the Body Project draws on two models. First, in explaining the pathology of eating disorders and body image, the 'dual pathway' model assumes that body dissatisfaction is a result of individuals internalising the western model of the importance of thinness, particularly among women. This 'thin-ideal', combined with social and cultural pressures to be thin, results in long-term body dissatisfaction, leading to efforts to manage food intake and distress through restriction, bingeing and compensatory behaviors. Therefore, the targets for the intervention are eating pathology, body dissatisfaction, and the thin-ideal. Second, the Body Project employs cognitive dissonance theory

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to offer a means of overcoming these influences. Behavioral change is encouraged to counter to this thin-ideal attitude (e.g., asking participants to write an essay on the negative aspects of social media for individuals' body image and of pursuing that thin-ideal, to help them to challenge their own use of such media). This dissonant behavior generates psychological discomfort that leads to reduction in the thin-ideal, with subsequent impact on body image, disordered eating and mood. Cognitive dissonance-based prevention has evidence of effectiveness among young adult females, including reductions in bulimic behaviours, body image dissatisfaction, thin-ideal internalization, and psychological comorbidity levels (Le et al., 2017; Watson et al., 2016).

However, the programme was developed and has been tested primarily in Western cultures. Recent research supports the feasibility of a culturally-adapted version of the Body Project for Saudi women (AlShebali et al., 2021). However, the feasibility study did not have a control group and was not adequately powered to draw firm conclusions in terms of effectiveness. Therefore, it is important to extend this work in the form of an appropriately powered randomized controlled trial, in order to determine the effectiveness of the prevention method. Randomization allows attribution of any differences between intervention groups (Hariton & Locascio, 2018). Therefore, the present study utilized a randomized control trial design to assess the effectiveness of the Body Project in Saudi undergraduate women. The study investigated changes between an active group, who received the adapted version of the Body Project (AlShebali et al., 2021), and a control group, who were provided with health education material about balanced eating and body weight.

The primary aim addressed the effectiveness of the Body Project for reducing eating pathology, body image and comorbidities (depression and social anxiety), at end of treatment and at three-months follow-up. We evaluated whether the trajectory of change over time differed between the two groups, hypothesizing that the Body Project would result in improvements on all dependent variables over time, while that would not be the case for the control condition. The second aim addressed whether compliance (attendance; homework completion) influenced outcome in the active group, as cultures differ in their apparent willingness to attend or to complete homework. For example, Algahtani et al. (2019) have shown less engagement with therapy-related homework among Saudi individuals. We hypothesized that compliance would influence outcome in the active group.

2. Method

2.1. Ethical approval

This study was approved by the Institutional Review Board (IRB) of King Abdulaziz City for Science and Technology, IRB registration number H-01-R-059 (log number 20–0009). The study was also approved by the Scientific Research Ethics Committee of Princess Nourah bint Abdulrahman University. The trial is registered at www.clinicaltrials.gov (NCT05071521).

2.2. Design and setting

This randomised controlled study compared the outcomes of an active intervention group who received the adapted version of the Body Project (N = 47) with an active control group who received health education material (N = 45). The health education material that was given to the active control group was designed to improve eating attitudes and behaviours. The study used a longitudinal design, where measures were taken at pre-intervention, post-intervention, and three-months follow-up. A three-month follow-up period was chosen because it is comparable to earlier eating disorders prevention trials with limited funding (e.g., Sharpe et al., 2013).

The study was designed on the basis of the feasibility study of AlShebali et al. (2021), which had demonstrated the viability of this approach and the necessary adaptations for young Saudi women. In addition to those adaptations, the work had to be moved to online presentation, due to the COVID pandemic restricting face-to-face meetings. It is noted that Ghaderi et al. (2020) have produced and tested an online version of the Body Project (v-BP) that has shown very positive results in a randomised controlled trial. However, that paper was only published after the AlShebali et al. (2021) feasibility and acceptability pilot had been conducted, so could not be used to adapt the presentation of the Body Project in this study without losing the ability to implement the cultural adaptations fully. In short, this study should be seen in the context of its original design – prepared for the Saudi culture – rather than as being primarily intended as an online approach of the sort represented by Ghaderi et al.'s (2020) innovation.

2.3. Participants

Sample size was calculated based on a repeated measures design (Yue & Roach, 1998), with eating pathology as the main outcome variable. The effect size for eating pathology in Stice et al. (2017) was used in the calculation (d = 0.43), as it used a similar design (comparing outcomes of different groups). With a two-tailed p = .05 and power = 90%, and assuming the same attrition rate (37.5%) as AlShebali et al. (2021), the minimum target sample size was 72, with 36 participants in each group. The study over-recruited (92 participants) in case of a larger attrition rate. Therefore, the sample size was adequate for this study.

The 92 participants were female undergraduates recruited from different colleges in Princes Nourah bint Abdulrahman University in Riyadh, Saudi Arabia. This setting is part of an all-female University in Saudi Arabia, covering the range of sciences, social sciences, and humanities. Education is in both Arabic and English languages. The University was founded as part of an initiative within Saudi Arabia to ensure the education of women matches the level available to and achieved by men, thus supporting more balanced levels of gender representation across levels of society in Saudi Arabia, as part of the country's efforts towards cultural westernization. Therefore, the potential influence of the western thin-ideal made it important to consider the role of prevention. However, adaptations had to be considered in order to accommodate remaining cultural issues (as detailed below). The mean age of the participants was 20.48 years (SD = 2.28), and their mean baseline body mass index (BMI) was 24.48 (SD = 6.35). All participants were from the Arabic ethnic group.

2.4. Procedure

The study was conducted online for all participants, due to the COVID-19 pandemic. Fig. 1 shows a CONSORT diagram that details the process of recruitment and assessment.

Participation in this study was on a voluntary basis. Recruitment took place between 1st October and 15th November 2020. An invitation email was sent to 32,166 undergraduates, with a link to an online survey (Qualtrics) that included an information sheet, consent form, and the Eating Disorders Diagnostic Scale (EDDS) - DSM-5 version (Stice et al., 2000). In response, 137 undergraduate Saudi females agreed to participate. Participants were excluded if they met DSM-5 diagnostic criteria for any eating disorder, determined by the Eating Disorders Diagnostic Scale (EDDS) - DSM-5 version (Stice et al., 2000). Twenty-two participants were excluded because they met the criteria for bulimia nervosa (N = 12) or binge-eating disorder (N = 2), or because they were from other universities (N = 8). Individuals with eating disorders were encouraged to seek treatment.

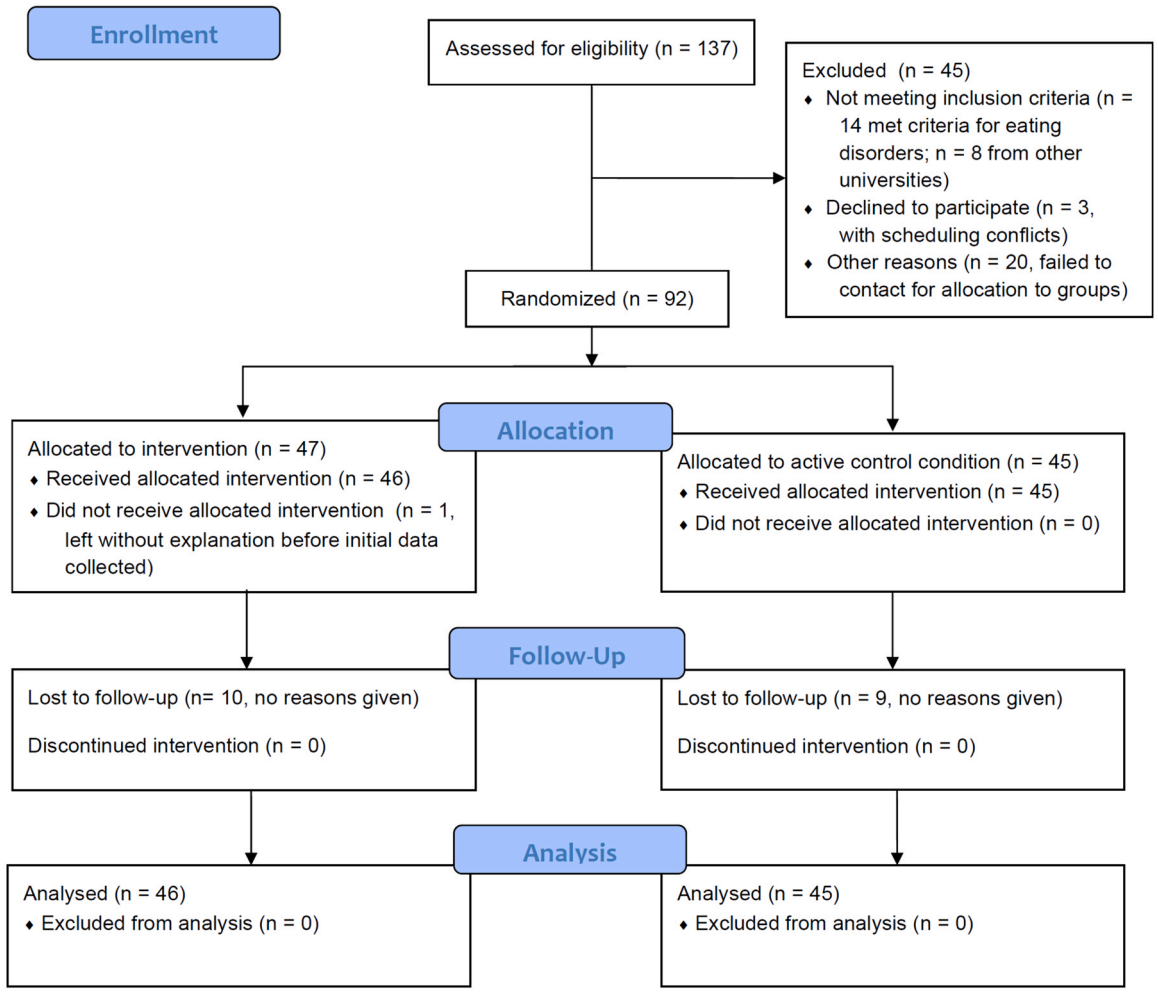

Fig. 1. CONSORT flowchart of participant enrolment, allocation, completion and data analysis.

Of the remaining 115 participants, 23 were lost prior to randomization because: their contact details were wrong ($N = 2$); they gave no contact information ($N = 1$); they left the study without stating any reason ($N = 15$); they did not respond to contact ($N = 2$); or they had scheduling conflicts ($N = 3$).

An electronic random number generator (Random.org, 2021) was used to divide the remaining 92 volunteers into the active group ($N = 47$), and the control group ($N = 45$). One participant left the active group after randomization but before the intervention. Participants in the active group ($N = 46$) were divided to four subgroups with 11 or 12 participants each. There was no blinding of the researcher (MA), who also delivered the prevention work.

2.5. Interventions

Interventions were delivered by MA, supervised by GW. MA had previously delivered the Body Project for AlShebali et al. (2021). MA self-trained and refreshed learning by using the manual and facilitator guide (Stice, Rhodes & Shaw, 2013) and supporting video material (ORI Body Acceptance Project, 2021), with support from GW and CB. Supervision was provided regularly, focusing on clinical points and issues relating to virtual delivery of the intervention. No substantial difficulties in virtual delivery were identified over the course of the study.

2.5.1. The Body Project

The Body Project is a dissonance-based eating disorders prevention programme, encouraging participants to decrease pursuing ideal-thinness. It involves written and behavioural tasks, group discussion, and role plays (Stice, Rohde, & Shaw, 2013), conducted over four weekly group sessions (one hour each). Following feasibility testing, it was adapted for Saudi culture, maintaining the psychological foundation of the intervention (Stice, Rohde, & Shaw, 2013), but changing some elements for non-Western cultures. Those changes (language adaptations for the programme material; adapted outcome measures; modification of some behavioural tasks) were based on a feasibility/pilot study (AlShebali et al., 2021), where the content of each group is described, alongside adaptations made. Groups were run in November to December 2020. Due to the COVID-19 pandemic (World Health Organization, 2021), a video meeting platform was used for delivery (Zoom Video Communications, 2021). Each group was run online, beginning with checks on online connections, access, and the ability to remain private for the hour-long session. Otherwise, as with Ghaderi et al.'s (2020) adaptation, changes to the format were minimal. One area where this protocol differed from that of Ghaderi et al. is that this study did not record sessions for catching up or revision. The rationale for not video recording sessions and making them availabile in Saudi is a potential legal one, explained in AlShebali et al. (2021). It is also noteworthy that groups in this study consisted of 11–12 participants, whereas

they were five to six in Ghaderi et al. (2020), and participation could not be anonymous in this study. Homework was prescribed and explained at the end of each group session, and then reviewed at the beginning of the following meeting.

2.5.2. Health education material

Participants in the control group were given health education material in Arabic from the Saudi branch of the World Obesity Federation (Kayl Association for Combatting Obesity, 2021). The material includes information about: balanced eating; daily caloric intake; body mass index; waist circumference; physical workout benefits; hunger scale; means to adopt healthier daily habits; and healthier food alternatives. Reading the material took approximately one hour.

2.6. Measures

The outcome measures were delivered by an electronic survey (Qualtrics). The EDDS (Stice et al., 2000) was used as a screening tool, in order to exclude potential participants with an eating disorder before randomizing participants to the study groups. Attendance and homework completion were recorded for each person at each group meeting.

2.6.1. Eating Disorders Diagnostic Scale (EDDS; Stice et al., 2000)

The EDDS is a 23-item self-report scale of criteria of eating disorder symptoms. The EDDS yields a diagnostic category of typical or atypical eating disorder (Stice et al., 2000). The DSM-5 scoring system was used (https://www.phenxtoolkit.org/protocols/view/120602). While this measure has previously been used in a feasibility study for this trial (AlShebali et al., 2021), it is important to note that the EDDS needs further validation for the Saudi population, as do all eating disorder measures.

2.6.2. Eating Disorder Examination-Questionnaire (EDE-Q, v.6; Fairburn & Beglin, 2008)

The EDE-Q is a self-report scale of eating disorders attitudes and behaviours. It contains 28 items that assess eating disorders pathology during the past 28 days. It has four subscales: restraint; eating concerns; weight concerns; and shape concerns. The Global EDE-Q score (mean of the four attitudinal scores) was used as the primary outcome variable in this study, as the subscale scores are not consistently supported in studies of the EDE-Q's psychometric properties (e.g., Allen et al., 2011). Higher scores indicate greater eating pathology. The EDE-Q has satisfactory psychometric properties in a Saudi population in terms of internal consistency of the Global scale (AlShebali et al., 2020; $\alpha = .80$), which is comparable to Peterson et al. (2007). It has strong test-retest reliability (Luce & Crowther, 1999), and validity in clinical and non-clinical populations (Fairburn & Beglin, 1994; Mond et al., 2004). The completers' mean EDE-Q Global score in this study at pretest was 2.00 (*SD* = 1.20), consistent with Saudi (AlShebali et al., 2020; 2021) and western non-clinical norms (Mond et al., 2006). The global scale had strong internal consistency (Cronbach's α) in this sample at all three time points for the control group (pre-intervention $\alpha = .868$; post-intervention $\alpha = .910$; follow-up $\alpha = .931$), and for the Body Project group (pre-intervention $\alpha = .858$; post-intervention $\alpha = .918$; follow-up $\alpha = .895$).

2.6.3. Body Shape Questionnaire (BSQ-8 C; Evans & Dolan, 1993)

The BSQ-8 C is a short version of the full Body Shape Questionnaire (Evans & Dolan, 1993). It is a self-report scale that contains eight items to assesses body image. A higher score shows a higher level of body image dissatisfaction. Internal consistency in a Saudi population (AlShebali et al., 2020; $\alpha = .927$) is similar to western norms (e.g., Peterson et al., 2007). It has excellent test–retest reliability and high convergent validity (Pook et al., 2008). The BSQ-8 C can be used in clinical and non-clinical populations (Welch et al., 2012). The BSQ-8 C had strong internal consistency (Cronbach's α) in this sample at all three time points for the control group (pre-intervention $\alpha = .921$; post-intervention $\alpha = .913$; follow-up $\alpha = .927$), and for the Body Project group (pre-intervention $\alpha = .916$; post-intervention $\alpha = .903$; follow-up $\alpha = .923$).

2.6.4. Brief Version of the Fear of Negative Evaluation Scale (BFNE; Leary, 1983)

The 12-item BFNE is a self-report scale that assesses anxiety associated with perceived negative evaluation. A higher score indicates a higher level of social anxiety. The BFNE has strong psychometric properties in a Saudi group (AlShebali et al., 2020; $\alpha = .872$), which are similar to western levels (Weeks et al., 2005). It has strong test-retest reliability ($r = .75$) (Leary, 1983). The BFNE's internal consistency (Cronbach's α) was acceptable to strong in this sample at all three time points for the control group (pre-intervention $\alpha = .782$; post-intervention $\alpha = .844$; follow-up $\alpha = .825$), and for the Body Project group (pre-intervention $\alpha = .798$; post-intervention $\alpha = .789$; follow-up $\alpha = .790$).

2.6.5. Patient Health Questionnaire (PHQ-9; Löwe et al., 2004)

The nine-item PHQ-9 is a self-report scale that assesses the severity of depression over the past two weeks. A higher score shows a higher level of depression. The scale includes nine items that correspond with the major depressive episode criteria described in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000). Its internal consistency in a Saudi population (AlShebali et al., 2020; $\alpha = .888$) is comparable to Western norms (Zuithoff et al., 2010). It also has strong test-retest reliability (Zuithoff et al., 2010). If participants had expressed suicidal thoughts during the meetings in the active group, they would have been referred to the psychiatry clinic in the university hospital for assessment and treatment. The PHQ-9 had strong internal consistency (Cronbach's α) in this sample at all three time points for the control group (pre-intervention $\alpha = .855$; post-intervention $\alpha = .880$; follow-up $\alpha = .938$), and for the Body Project group (pre-intervention $\alpha = .887$; post-intervention $\alpha = .899$; follow-up $\alpha = .878$).

2.7. Data analysis

General Linear Mixed Models (GLMM; SPSS 26.0) were used to analyse the data relating to the first aim. This approach relies on full information maximum likelihood estimation, and overcomes any issue of correlations between repeated measures. Thus, all available data are used, rather than imputing missing data. There were four dependent measures - eating pathology [EDE-Q Global], body satisfaction [BSQ], social anxiety [Brief FNE], and depression [PHQ-9] - all measured dimensionally. The first of these (EDE-Q Global) was treated as the primary outcome variable, and the others were treated as secondary outcomes. The GLMMs were used to analyse for main and interaction effects, with the interaction terms indicating differences between the trajectory of the two groups (Body Project vs Educational Control).

For each individual dependent variable, the time points were coded as 0, 1 and 4, to reflect the fact that the intervention lasted one month, while the follow-up lasted three months. Initial modelling of the repeated variable (Time) was conducted using linear and logarithmic ($\log_n$) transformation to determine which provided the best fit to the data (Information criteria, identified by the lowest −2 Log Likelihood score). As early change followed by slower change is a common pattern in psychological interventions (e.g., Saxon, Firth & Barkham, 2017), it was assumed that the $\log_n$ transformation would be the most appropriate unless the linear model had the better fit. Thereafter, the models (maximum iterations = 100) were built using:

Table 1
Demographic characteristics of the control group and active group at the outset of the interventions.

Groups	Age (years)		Body mass index		Arab ethnic group		Saudi nationality	
	M	(SD)	M	(SD)	N	%	N	%
Control	20.91	(2.52)	23.94	(6.13)	45	100	45	100
Body Project	20.06	(1.97)	25.01	(6.58)	46	100	46	100

the Random Intercept (to identify differences between the groups at the outset); the Intervention effect (to identify the overall difference between the Body Project and Educational interventions); the most effective Time measure (to show the overall change in scores over time); and the interaction of the relevant Time variable x Group (to determine whether the intervention conditions yielded different outcomes). For the interactions, estimated means were presented graphically, to enable interpretation.

For the second aim, correlations were used to assess associations between adherence and outcomes (change scores in the outcome measures) in the Body Project condition only. Change scores were calculated as the difference between the posttest score and the pretest score for all treatment completers. A negative change score is a positive outcome. Spearman's rho was used to ensure that non-normal distribution of scales was accounted for.

3. Results

Table 1 shows the demographic characteristics for the control group and the intervention group, showing that the two groups were well-matched at baseline. Mean pre-intervention scores (Table 2) were comparable with those of other non-clinical groups (Luce et al., 2008; Pitarch, 2010; Rogowska et al., 2020; Welch et al., 2012). Binary logistic regressions were used to determine whether there were any pre-intervention differences between completers and drop-outs for each of the two groups separately. The baseline predictors used were BMI, age, EDE-Q subscale and Global scores, BSQ-8 C score, PHQ-9 score, and BFNE score. There were no differences between the drop-outs and completers in the Body Project condition (chi-squared = 7.676, df = 24, P = .905) or the control condition (chi-squared = 11.09, df = 24, P = .679). Therefore, there were no predictors of attrition in either group.

3.1. Differences between the control group and the intervention group at baseline in eating pathology, body image dissatisfaction, and psychological comorbidities

Independent sample t-tests were used to compare the pretest scores of the control group and the intervention group. Table 2 shows that the intervention group had higher levels of body image dissatisfaction and depression at baseline, despite the randomization.

Table 2
Scores on eating pathology, body image, and psychological correlates for the control group and the Body Project group at baseline.

Measures	Control group (N = 45)		Body Project group (N = 46)		t	P
	Mean	(SD)	Mean	(SD)		
EDE-Q Global	1.89	(1.21)	2.42	(1.37)	1.96	.053
BSQ-8 C	20.26	(10.61)	24.86	(11.33)	1.99	.049
PHQ-9	8.24	(5.47)	11.91	(6.68)	2.86	.005
BFNE	28.11	(8.72)	30.65	(8.89)	1.37	.172

Key: EDEQ Global, Eating Disorders Examination Questionnaire Global score; BSQ-8 C, Body Shape Questionnaire; PHQ-9, Patient Health Questionnaire; BFNE, Brief Version of the Fear of Negative Evaluation Scale.

3.2. Outcome of the Body Project intervention

Generalised Linear Mixed Models (GLMM) were used to determine whether there were any significant differences in outcome between the young adult women receiving the Body Project intervention and those in the control condition. These were conducted separately for the primary outcome variable (EDE-Q Global score) and for each of the secondary outcome variables (BSQ, FNE, and PHQ-9 scores).

3.2.1. Eating pathology scores

The EDE-Q Global score was initially tested for the most appropriate model assumption. The $\log_n$ distribution had a slightly lower −2 Log Likelihood score (740.396) than the simple linear distribution (749.947). As these are not substantially different and indicate that the linear time distribution was a slightly weaker fit, the $\log_n$ distribution fit was used here. As noted above, this logarithmic distribution is commonly found in changes in psychopathology during and following effective treatment (substantial early clinical change, followed by slower change across the rest of therapy, with no substantial return of symptoms by follow-up).

The final model consisted of the random intercept, the intervention, the logarithmic transformation of the Time variable (the three time points of pre, post and follow-up), and the interaction of $\log_n$ Time by Group. Table 3 shows the fixed coefficients from the model. There was a significant difference between the scores on the Intercept variable, indicating that the Body Project group started with higher EDE-Q Global scores. There were no significant main effects of Group or Time. However, there was a significant interaction of $\log_n$ Time x Group. The negative sign of the coefficient indicates that the Body Project group had a significantly greater reduction in EDE-Q Global scores than the Educational intervention control group (whose scores remained relatively static over time). This pattern is detailed in Fig. 2, which demonstrates the expected relationship for the intervention group (falling scores during therapy, followed by maintenance of the lower scores by follow-up), but not for the control group. This pattern confirms the effectiveness of the intervention. The interactions illustrated in Figs. 3 and 5 can be interpreted in the same way, demonstrating effectiveness of the Body Project relative to the Educational Control condition.

3.2.2. Secondary outcomes

The GLMMs for the secondary outcomes are detailed in Table 4 and in Figs. 3–5. Again, these demonstrate the main and interaction effects of Time (pre, post and follow-up) and Group (Body Project vs Educational control).

3.2.2.1. Body satisfaction. Body satisfaction was assessed using the BSQ-8 C. The $\log_n$ distribution for time had a similar −2 Log Likelihood score (1786.124) to the simple linear distribution (1787.820). Therefore, the $\log_n$ transformation was used in the modelling for this outcome variable of BSQ-8 C (see above). Table 4 shows that the Body Project group had a higher BSQ score at the outset (Intercept), despite randomisation to groups. There were no main effects of Group or Time, but there was a Group x Time interaction, showing that the effect of the index intervention (Body Project) was more effective than the Education control condition in enhancing body satisfaction, as those in the Body Project saw an

Table 3
Generalised Linear Mixed Model, demonstrating impact of time (pre, post, follow-up) on EDE-Q Global scores for the active (Body Project) and control (Educational) groups.

Model term	Coefficient	Standard Error	t	P	Lower 95% Confidence interval	Upper 95% Confidence interval
Intercept	1.850	0.925	2.00	.047	0.027	3.672
Group	0.452	0.259	1.74	.082	-0.059	0.962
Log_n time	-0.160	0.110	1.46	.146	-0.376	0.056
Log_n time x Group	-0.344	0.155	2.22	.027	-0.649	-0.039

Key: EDEQ Global, Eating Disorders Examination Questionnaire Global score

improvement in BSQ scores compared to the stable scores of those Education control group (see Fig. 3).

3.2.2.2. Social anxiety. Social anxiety was assessed using the Brief FNE. Again, the log_n distribution for time had a slightly lower − 2 Log Likelihood score (1721.590) than the simple linear distribution (1727.311), so the log_n distribution was used in the final model. Table 4 shows that the Body Project group had a higher FNE score at the outset (Intercept), despite randomisation. There were no other main or interaction effects, indicating that social anxiety was not influenced by either intervention. (see Fig. 4).

3.2.2.3. Depression. Depression was assessed using the PHQ-9. Again, the log_n distribution for Time had a similar − 2 Log Likelihood score (1577.590) to the simple linear distribution (1582.508). so the log_n transformation was used to model the outcome variable of PHQ-9. Table 4 shows that the two groups did not differ in PHQ-9 score at the outset (Intercept). There was a main effect of Group, which was subsumed into the Group x log_n Time interaction. This showed that the index intervention (Body Project) led to a reduction in depression, while there was no change in the Educational control group's depression levels (see Fig. 5).

3.3. Association of compliance and outcomes in the Body Project group

3.3.1. Levels of compliance

Of the 46 participants, 40 attended at least 50% of the programme (two or three sessions), and 25 attended all four sessions. In total, 87% of participants attended at least two sessions. This percentage is higher than a recent virtual delivery trial of the Body Project (Ghaderi et al., 2020), and similar to other clinical trials of the Body Project (Stice et al., 2012; Stice, Butryn et al., 2013; Stice et al., 2014; Stice et al., 2020). In contrast, of the 460 total home exercises expected from participants, only 113 were carried out. This homework completion rate (25%) is considerably lower than in a similar trial, where participants completed 87% of the home exercises (Stice, Butryn, et al., 2013).

3.3.2. Association of compliance with outcomes

Table 5 shows the associations (Spearman's rho) between changes in the core measures of pathology (EDE-Q; BSQ-8 C; PHQ-9; BNFE) and the levels of attendance and homework completion. None of these associations were significant, indicating that the level of compliance was not linked directly to level of change in the measures.

3.4. Summary

The GLMM models demonstrated that the young women who received the Body Project benefitted more than those in the active control condition on the majority of the outcomes – specifically eating concerns, body satisfaction and depression. However, this was not the case for social anxiety. This finding supports the core hypothesis in three out of the four outcome variables, supporting the value of the Body Project across a range of outcome variables. These conclusions hold, despite the fact that the randomisation resulted in the Body Project group having slightly greater levels of initial pathology at the outset. Compliance (level of session attendance and homework completion) were not related to outcomes.

4. Discussion

The main aim of this randomized control trial was to determine the effectiveness of the Body Project for Saudi women. The

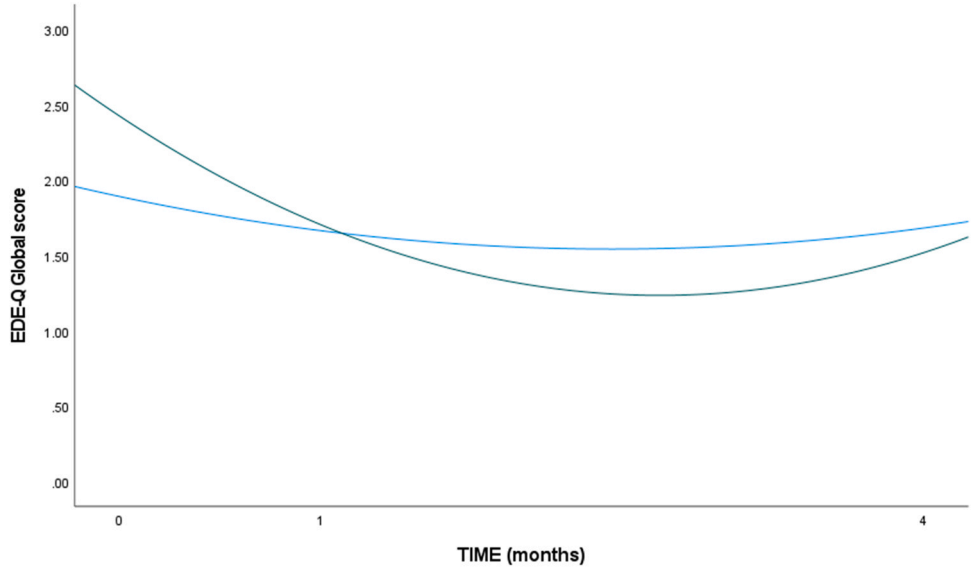

Fig. 2. Estimated EDE-Q Global scores across time (Month 0 = Pre-intervention; Month 1 = Post-intervention; Month 4 = Follow-up) for the Body Project group (green) and the Educational Control group (blue).

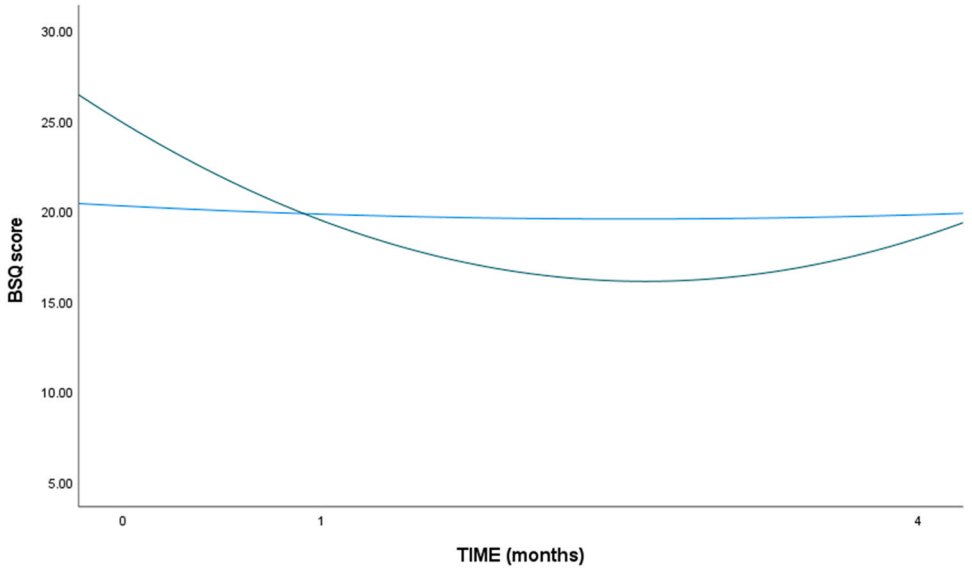

Fig. 3. Estimated Body Satisfaction Questionnaire (BSQ) scores across time (Month 0 = Pre-intervention; Month 1 = Post-intervention; Month 4 = Follow-up) for the Body Project group (green) and the Educational Control group (blue).

secondary aim was to determine whether or not attendance and homework completion influenced outcomes. Participation in the Body Project resulted in greater changes than the Educational Control intervention in eating pathology, body satisfaction and depression, and this pattern was maintained to follow-up. Homework completion was low compared to that in other cultures, possibly due to the online nature of the programme, or the tendency towards passive learning in young Saudi women (El-Naggar, 2012). Contrary to the second hypothesis, homework completion and attendance did not influence outcomes in the active group.

Comparison of our findings and those of other studies (Becker & Stice, 2017; Stice et al., 2013) indicates similar benefits from the Body Project for women across cultures, even when using online presentation (e.g., Hamatani et al., 2019), as long as the protocol is used appropriately (e.g., Stice, Rohde, & Shaw, 2013). These findings suggest that the underlying psychological processes are transcultural. Homework completion rates were low, but that had been foreshadowed by the feasibility study, where completion of homework had been low and participants had suggested reducing the number of such exercises. This reluctance seems to be a culture-specific phenomenon (Algahtani et al., 2019; AlShebali et al., 2021). However, homework review was a limited part of each session, and did not preclude core exercises being run during the subsequent sessions (AlShebali et al., 2021). Indeed, the importance of the homework exercises was not clear, as homework completion was not linked to outcomes. This might be because the Body Project sessions themselves include enough activities to make the homework redundant, even though homework completion in other interventions is suggested to improve outcomes (LeBeau et al., 2013). The findings are consistent with the predictions of cognitive dissonance theory (Festinger, 1957), suggesting that this intervention influences eating attitudes, body image and depression by inducing changes in behaviour (via group discussions and challenging societal norms).

A number of methodological factors merit consideration in understanding the findings of this specific study. The population was relatively typical of Body Project programmes, being drawn from

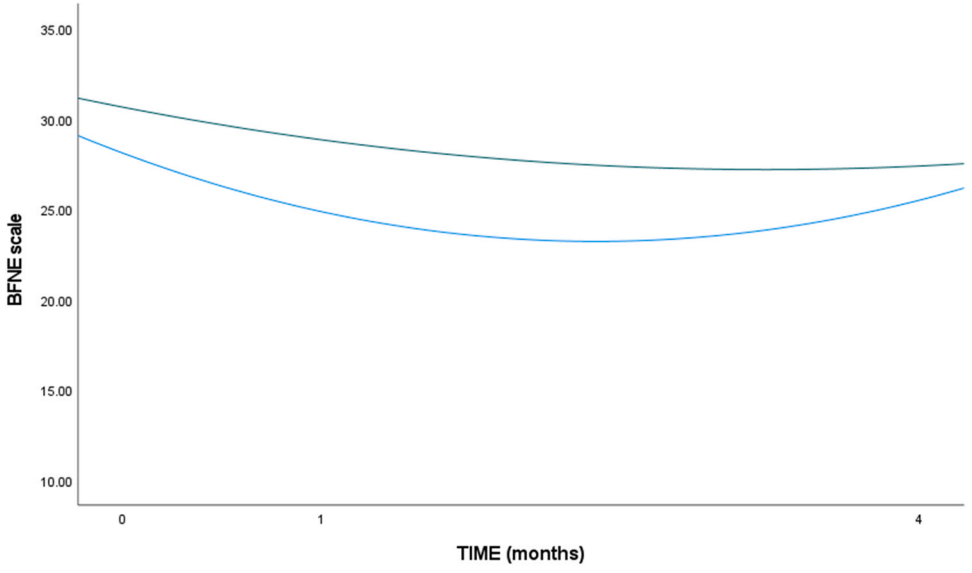

Fig. 4. Estimated Fear of Negative Evaluation (Brief FNE) scores across time (Month 0 = Pre-intervention; Month 1 = Post-intervention; Month 4 = Follow-up) for the Body Project group (green) and the Educational Control group (blue).

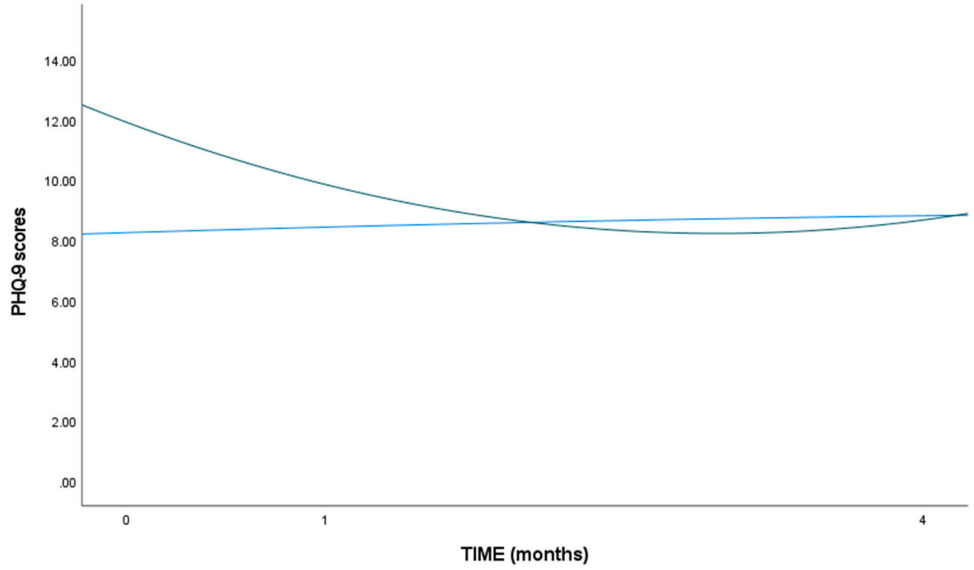

Fig. 5. Estimated depression (PHQ-9) scores across time (Month 0 = Pre-intervention; Month 1 = Post-intervention; Month 4 = Follow-up) for the Body Project group (green) and the Educational Control group (blue).

higher education, and so was likely to be relatively intelligent and able to engage with some of the core tasks of the programme (e.g., writing essays). It is also important to note that Saudi Arabia is a nation where there is currently a central drive towards adopting western culture, meaning that adaptations needed to focus on this fluidity of culture. While adaptations were needed, these had been piloted previously (AlShebali et al., 2021) to ensure their relevance in this study, and therefore one cannot assume that the same adaptations would be adequate for other countries and cultures. Instead, we recommend that pilot work should be undertaken as a part of any planned rolling out into other cultures, while considering the level of westernisation in those cultures. Finally, the study was delivered online rather than in the traditional face-to-face format. Fortunately, as shown by Ghaderi et al. (2020), it proved possible to deliver the therapy with positive results, despite the change of format. Therefore, these findings coincidentally support Ghaderi's conclusion that the Body Project can be delivered online. Despite these factors, the outcome of this study was similar to other Body Project interventions, adding to the evidence that the Body Project is a robust prevention method. Its impact on eating pathology, body image and depression and its cultural adaptability mean that its potential breadth of application and impact go beyond its existing application to traditional western cultures. Clearly, cultural considerations are important in rolling out any such interventions to new settings, and this study gives an indication of how that can be done to broaden the reach of the Body Project.

This is the first full test of the effectiveness of eating disorders prevention in Saudi Arabia. Strengths of the work include: the use of a randomized control trial design; adequate power; the use of a follow-up assessment; and the use of a clear protocol and measures that were culturally appropriate. We also demonstrated that videoconference delivery was effective for the Body Project in a non-Western setting. However, the study also had some limitations, including a focus on undergraduate women from the same ethnicity and location. The lack of males or younger people from different locations means that the findings cannot be generalised fully. Future study of males in particular is worthy of consideration, as they can also experience negative eating attitudes, though their tendency towards wanting to be larger might mean that the cognitive dissonance work needed to be adjusted to be selective for male body image concerns. Furthermore, it should be noted that while there were no substantial issues in virtual delivery in this study, that cannot be assumed in samples where the population are less educated and computer-literate.

Table 4
Generalised Linear Mixed Model, demonstrating impact of time (pre, post, follow-up) on secondary outcome variables (BSQ, BFNE, PHQ-9) for the active (Body Project) and control (Educational) groups.

Measure & Model term	Coefficient	Standard Error	t	P	Lower 95% Confidence interval	Upper 95% Confidence interval
BSQ-8 C						
Intercept	20.241	7.518	2.69	.008	5.433	35.049
Group	3.593	2.097	1.71	.088	-0.537	7.724
Log_n time	-0.465	0.937	0.50	.620	-2.311	1.380
Log_n time x Group	-3.007	1.322	2.27	.024	-5.611	-0.402
BFNE						
Intercept	27.414	6.362	4.30	.001	14.883	39.945
Group	3.075	1.743	1.764	.079	-0.358	6.508
Log_n time	-1.659	0.856	1.937	.054	-3.345	0.028
Log_n time x Group	-0.184	1.209	0.152	.879	-2.564	2.197
PHQ-9						
Intercept	8.248	4.541	1.82	.071	-0.697	17.193
Group	3.365	1.239	2.72	.007	0.925	5.806
Log_n time	0.410	0.681	0.60	.548	-0.931	1.751
Log_n time x Group	-2.042	0.961	2.12	.035	-3.935	-0.148

Key: BSQ-8 C, Body Shape Questionnaire; PHQ-9, Patient Health Questionnaire; BFNE, Brief Version of the Fear of Negative Evaluation Scale.

Table 5
Correlations between attendance of sessions and homework completion with changes in eating pathology, body image dissatisfaction, depression and social anxiety in completers in the active group ($N = 36$).

Change measure	Homework		Attendance	
	rho	P	rho	P
Change in EDEQ Global	.130	.449		.059
Change in BSQ-8 C	.131	.448	.317	.074
Change in PHQ-9	-.146	.395	.256	.670
Change in BFNE	-.134	.436	.074	.969
			.007	

Key: EDEQ Global, Eating Disorders Examination Questionnaire Global score; BSQ-8 C, Body Shape Questionnaire; PHQ-9, Patient Health Questionnaire; BFNE, Brief Version of the Fear of Negative Evaluation Scale

Duration of these effects is not clear. A longer-term follow-up would enhance the work by testing for protection against later life factors, as is the case across eating disorder prevention trials (Stice et al., 2007). Such future studies would also benefit from larger samples, to reduce the likelihood of the group differences in pre-intervention scores that were found here (although the reduction in scores specifically in the Body Project group was unlikely to have been influenced by any floor effects, given the ranges of scores reported. The differences in outcomes between groups could be due to differences between lengths of intervention in each group. It should also be noted that the use of self-report data creates a risk of socially desirability in participants' responses (Devaux & Sassi, 2016). One key area for future development of this work is the need to include an explicit measure of the internalisation of the thin-ideal across the intervention, to allow clinicians and researchers to test the mechanism by which dissonance-based approaches are hypothesised to work. Finally, the use of the EDDS (and all other measures of eating pathology) needs further validation in this population, given the lack of well-conducted eating disorders research in Saudi Arabia to date.

The Body Project should now be tested on larger populations in a range of non-Western settings, to demonstrate its generalizability and effectiveness over an extended period in reducing future eating disorders onset (Stice et al., 2008). Dismantling studies should also be considered to determine the active elements of the Body Project, given the lack of impact of homework compliance in this study. Furthermore, other such prevention approaches (e.g., Diedrichs et al., 2015) should also be tested, to determine whether they yield similar outcomes. Such studies should also include consideration of a wider range of outcome measures, including possible biological changes such as cardiac function and brain responses to thinness images (Green et al., 2016; Stice et al., 2015). Any such work should consider cultural adaptations at the pilot stage, as here.

Although further research is needed, policymakers and clinicians can use these findings as the basis for national planning of eating disorders prevention in Saudi Arabia and beyond, to reduce the personal, social, health and economic costs of eating and body disturbance. Such an approach would mean scaling up the availability of the prevention work through large-scale training of facilitators, as per existing approaches to rolling out the Body Project (e.g., ORI Body Acceptance Project, 2021; Stice, Rohde, & Shaw, 2013). Given that online approaches are viable, they should be tested with larger numbers, in order to enhance access to psychological support for those who live in rural areas or who cannot attend in person (Matheson et al., 2020), ensuring effective psychological help for a larger number of people.

5. Conclusion

The effectiveness of the Body Project for Saudi women indicates that its underlying psychological processes are relevant across cultures and delivery methods. These findings show that the large number of people in Saudi Arabia with pathological eating and body concerns can be helped through the appropriate adaptation of a prevention programme that was developed in a Western culture. The outcomes have implications for the potential utility of these approaches in other cultures and using other prevention methods.

CRediT authorship contribution statement

Munirah AlShebali: Investigation, Resources, Data Curation, Writing – original draft, Funding acquisition, Validation, Project administration. **Carolyn Becker:** Methodology. **Stephen Kellett:** Supervision, Writing – review & editing. **Ahmad AlHadi:** Supervision, Writing – review & editing **Glenn Waller:** Methodology,Conceptualization, Visualization, Formal analysis, Supervision, Writing – review & editing.

Data Availability

Data will be made available on request.

Declaration of Competing Interest

Dr. Becker is a Co-Director of the Body Project Collaborative, a social entrepreneurship company created to advance dissemination and implementation of the Body Project. The other authors have no conflict of interest to declare.

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