The effects of a dance intervention on somatic symptoms and emotional distress in adolescent girls: A randomized controlled trial

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Abstract

Objective: To investigate whether a dance intervention for adolescent girls reduces stress-related symptoms.

Methods: This was a randomized controlled trial of an after-school intervention. Participants were 112 girls aged 13 to 18 years with stress-related somatic symptoms and emotional distress. The intervention comprised twice-weekly dance sessions for 8 months with a focus on enjoyment and socialization. A questionnaire was administered at baseline and after 8, 12 and 20 months. Participants rated the frequency with which they had experienced somatic symptoms and emotional distress during the previous 3 months.

Results: After the intervention, there was a significantly greater reduction in somatic symptoms and emotional distress in the dance intervention group than in the control group. The difference in the mean score change on a 5-point scale was 0.26 (95% confidence interval [CI]: 0.04 to 0.47) for somatic symptoms and 0.30 (95% CI: 0.04 to 0.58) for emotional distress.

Conclusion: Dance interventions may reduce somatic symptoms and emotional distress in adolescent girls, and may constitute a nonpharmacological complement to school health services. However, continued participation is needed for long-term sustainable results. Additional randomized studies are required to further evaluate the effect of this type of intervention in different settings.

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Introduction

Mental health problems are currently among the greatest global public health challenges[1] and are estimated to affect 13% of children and adolescents worldwide.[2] Somatic symptoms (e.g. headache, stomachache, tiredness, aching shoulders and backache) combined with emotional distress (e.g. feelings of stress, anxiety or sadness) are important signals of mental health status[3] and tend to coexist.[4] Female adolescents show a higher prevalence of health complaints than male adolescents,[5–7] experience higher levels of stress and somatic symptoms,[8] and are more likely to experience pain and depressive symptoms.[4,9] Loneliness, which is a major risk to health and well-being, is also higher among adolescent girls.[10]

It has been demonstrated that somatic symptoms in adolescence predict severe mental illness in adulthood; therefore, regardless of the presence of co-occurring depression and anxiety, adolescents need early treatment to address these symptoms.[11] However, the type of treatment that should be provided remains unclear. Internet-delivered cognitive behavior therapy has shown promising effects in reducing pain intensity and worry and in increasing the quality of life for adolescents with functional abdominal pain.[12] Physical activity is another active strategy that can improve mental health.[13] Physical activity has beneficial effects on adolescent mental health (e.g. depression), well-being mood and self-esteem,[14,15] and positively influences social connectedness.[14] Steiner et al.[16] highlight the importance of connectedness and fostering a sense of caring, support and belonging in mental health interventions for young people. Group dance is a social type of physical activity popular with young women.[17] It can be cost effective[18] and is a potentially useful way of positively influencing physical health outcomes[19] and psychological well-being,[20] and increasing self-trust, self-esteem and self-expression in adolescents.[21] There is a need to improve the relatively low self-perceptions of adolescent girls and to reduce the risk of them developing negative ideas about their bodies.[5] As a physical activity, dance has several characteristics that could address these issues. These include emphasizing the expressive, creative and aesthetic aspects of physical activity, and improving poor body image.[22] Unfortunately, the number of adolescent girls who are sufficiently physically active is alarmingly low.[5] Multicomponent interventions underpinned by theory are effective in optimizing regular participation in physical activity,[23] and

motivational support and enjoyment are important for adolescent participation.[24]

The primary aim of this study was to investigate if an 8-month dance intervention for adolescent girls could reduce stress-related somatic symptoms and emotional distress. We hypothesized that the dance intervention group would show greater effects than the control group at the postintervention follow-up.

Methods

Design

A randomized controlled intervention trial was conducted in a Swedish city with a population of 130,000. The trial has been previously described.[25]

Study population

The study population comprised adolescent girls aged 13 to 18 years (mean = 16 years). The inclusion criteria were stress-related internalizing problems and repeated visits to the school nurse for somatic symptoms (e.g. headache, stomachache, tiredness and aching shoulders) and for emotional distress (e.g. persistent feelings of stress, nervousness and anxiety). Exclusion criteria

were severe hearing impairment, intellectual disability, difficulties with the Swedish language or advice against participation by the Child and Adolescent Psychiatric Care unit. Baseline characteristics, including aspects of personal, family and cultural background as well as previous experience of physical activity, are shown in Table 1. In the power analysis, we assumed that a 25% difference between the groups could be expected regarding a reduction in somatic symptoms, with a 5% significance level and 80% power; thus, we needed 58 participants in each group, a total of 116 individuals.

Procedures

Recruitment was carried out in collaboration with the school health services. The school nurses asked eligible girls whether they wished to participate. After being informed about the project, those who agreed to participate provided written consent. For girls aged < 15 years, written consent was also provided by their parents/guardians. Participants were randomly allocated to either a dance intervention group or a control group. An external statistician performed the randomization using a computerized randomization list.

Table 1. Baseline characteristics.

Demographics	Intervention group n = 59 (%)	Control group n = 53 (%)	P-value
Age distribution[a]			0.30
-13–14 years	8 (13%)	13 (25%)	
-15–16 years	27 (46%)	23 (43%)	
-17–18 years	24 (41%)	17 (32%)	
Born in Sweden	55 (93%)	49 (93%)	0.88
Mother on sick leave	6 (10%)	6 (11%)	0.85
Father on sick leave	3 (5%)	3 (6%)	0.88
Participated in dance before start of study	33 (56%)	36 (68%)	0.19
Physically active once/week or more before start of study	43 (73%)	33 (62%)	0.23

[a]Mean age for both the intervention group and the control group was 16 years.

Participants in the control group were encouraged to carry on with their lives as usual and received a cinema ticket as compensation each time they completed the questionnaire. School health services were available to all participants when needed, as usual. The questionnaire sessions occurred in an auditorium at the university hospital after school hours. At least three members of the project team were always present to provide assistance if needed. Participants who were found to be at risk for severe depression at any of the survey points, as indicated by a score of 34 points or higher on the Center for Epidemiologic Studies Depression Scale for Children,[26] were contacted by the research team through the guardians and offered contact with an experienced licensed psychologist.

Intervention

The dance intervention occurred in a central studio after school twice weekly for a period of 8 months. Each dance class lasted 75 minutes: 15 minutes of warm-up, 40 minutes of dance practice including body awareness, 15 minutes of relaxation prompted by a light massage in pairs, and 5 minutes for reflection. The dance was mostly choreographed in themes, such as African dance, show jazz and street dance, but improvisation and spontaneous movements were always included to encourage creativity. There were no shows or performances; the intention was to provide an opportunity to have a positive dance experience with peers without external pressure in a noncompetitive social environment (approximately 20 girls/group). There were three dance teachers (one teacher per session); to standardize the intervention in each class, dance choreographies, teaching style and approach were agreed upon. The dance intervention was underpinned by the theoretical framework of self-determination theory (SDT),[27] which highlights three basic psychological needs: competence, autonomy and relatedness; when these needs are satisfied, self-motivation and mental health are enhanced.[27] This was not measured, but to nourish these needs, the dance intervention goal was to translate the theory to a teaching approach in practical sessions. In short, the component *'competence'* in this case meant that the instructors identified the girls' different dance abilities, and thereby could adjust the instructions and choreographies to the groups' level and needs, so that everyone had the chance to experience enjoyment. The instructors also provided genuine encouragement, which also constitutes a type of competence support. The component *'relatedness'*, defined as the extent to which individuals feel a sense of belonging and connection with others in the social context,[28] was a key factor in the intervention. The dance instructors aimed to build trusting and meaningful relationships with and between the girls, especially because they came from different schools and most were not previously acquainted. This relatedness support was provided through different techniques to increase the feeling of social inclusion for everyone.

To facilitate the component *'autonomy'*, an internal perceived locus of causality,[27] participants had the opportunity to provide input into the dance classes regarding choice of music, warm-up activities, choreography and dance themes.

SDT also proposes that intrinsic motivation, engaging in an activity for the inherent pleasure and satisfaction of the activity, is associated with well-being[28] and greater adherence.[29] This has also been emphasized by Lubans et al.[30] For this reason, alongside the components of SDT, *enjoyment* was always a focus of the dance intervention. The stress-related problems were not mentioned during the dance classes. At the end of the intervention, participants were presented with several alternatives that allowed

them to maintain their dancing or to exercise elsewhere.

Measures

The questionnaire contained questions on different aspects of health, family, school, sleep, exercise and previous dance experience. In this article, we focus on results for somatic symptoms and emotional distress, as girls with internalizing problems often express their symptoms using these concepts.[31] The data were collected using a questionnaire administered at baseline and at 8, 12 and 20 months after baseline. The included questions originated from the Swedish survey 'Life and Health – Young People',[32] and are in line with the type of questions used in the 'Health Behavior in School-aged Children' (HBSC),[5] a cross-national study coordinated by the World Health Organization's Regional Office for Europe. Participants rated the frequency with which they had experienced various somatic and emotional symptoms during the previous 3 months on a 5-point scale (1 = never, 2 = infrequently, 3 = sometimes, 4 = frequently, and 5 = always).[32]

Importantly, the questions assessed the previous 3 months, so that the 12-month follow up evaluated the effect of the whole intervention. The first follow-up (8 months) represented the second semester during which the dance intervention was still running. The postintervention follow-up (12 months) covered the period after the intervention, and the long-term follow-up (20 months) covered the period approximately 1 year after the intervention had ended.

For *somatic symptoms*, we used a six-item measure that assessed symptoms commonly associated with adolescent internalizing problems.[5,31] The six items were headache, stomachache, vertigo, tiredness, aching shoulders and backache.[32]

The six-item measure of *emotional distress* captured negative emotional states that may arise as consequences of internal or environmental stressful experiences; these emotional states are of shorter duration than clinical depression. The six items assessed stress, nervousness, anxiety, sadness, irritation and powerlessness.[32] A mean individual score was calculated across items for each measure.

For five-item scales in basic research, Cronbach's alpha values at 0.7 and above are widely accepted.[33] Here, for somatic symptoms, Cronbach's alpha values were 0.64, 0.72, 0.77 and 0.74 at baseline, 8 months, 12 months, and 20 months, respectively. For emotional distress, the values were 0.70, 0.70, 0.82 and 0.80 at the same time points.

For both somatic symptoms and emotional distress, a series of separate factor analyses (principal axis factoring with eigenvalues ≥ 1.00) with all six items for each time point confirmed that all six items consistently loaded onto a single factor. Moreover, both measures correlated ($r > 0.50$) with scores on the Stress in Children Inventory[34] at the first follow-up and also at the postintervention follow-up, indicating acceptable criterion validity.

Statistical analysis

All analyses were performed using the IBM Statistical Package for the Social Sciences (IBM SPSS) version 21 (SPSS Inc., Chicago, IL, USA). All significance tests were two-sided and evaluated using a 0.05 significance level. Effects of the intervention were evaluated by calculating the score change from baseline to each follow-up. These score changes constituted the dependent variables used in each of the separate independent-samples *t*-tests that were performed to compare the control and intervention groups. Effect sizes were calculated for these comparisons by dividing the group differences (based on the change scores) by the corresponding standard

deviations (SDs). Of the 112 participants, 77% completed the data for all somatic symptoms and emotional distress outcome variables. The data coverage for each primary variable dyad was used to calculate the changes in the dependent variables. To calculate the correlation at baseline between emotional distress and somatic symptoms, Pearson's correlation was used. The multiple imputation procedure (fully conditional specification) was used to estimate missing values for the somatic symptoms and emotional distress variables. Multiple imputation is regarded as one of the best ways to address missing values.[35] The imputation model (using five imputations) included all three measurement time points for both of the primary outcome variables and for the grouping variable. Little's missing completely at random test showed that the pattern of internal attrition did not differ from data missing completely at random: χ^2 ($N = 112$, $df = 35) = 37.62$.

Ethical considerations

The study was approved by the Regional Ethical Review Board in Uppsala, Sweden (DNR 2008/134).

Results

A total of 112 adolescent girls with stress-related internalizing problems were included in the study; 59 were randomly allocated to the dance intervention group and 53 to the control group. At baseline, the overall mean value was 2.77 ($SD = 0.63$) for somatic symptoms and 3.06 ($SD = 0.61$) for emotional distress (highest possible value = 5). The Pearson correlation coefficient for the association between emotional distress and somatic symptoms was $r = 0.51$. No baseline differences between the intervention and control group were observed for somatic symptoms or emotional distress.

Somatic symptoms: The difference in the mean score change was 0.26 (95% confidence interval [CI]: 0.04 to 0.47). The mean values (and SDs) for somatic symptoms across the four time points are shown in Table 2. The effects of the intervention on somatic symptoms were also investigated by comparing change scores between the groups. At the first follow-up (8 months), there was no significant difference between the groups (effect size = 0.10). At the post-intervention follow-up (12 months), there was a significant effect; the intervention group reported a greater reduction in symptoms than the control group ($P = 0.021$; effect size = 0.22). At the long-term follow-up (20 months), the score change did not differ significantly between the groups (effect size = 0.03).

Emotional distress: The difference in the mean score change was 0.30 (95% CI: 0.04 to 0.58). Table 2 shows the mean values (and SDs) of emotional distress across the four time points. We further calculated whether the score change differed between the groups at each time point. For the first follow-up (8 months), no significant difference in emotional distress was found between the groups (effect size = 0.07). At the postintervention follow-up (12 months), there was a significant effect; there was a greater reduction in emotional distress in the intervention group than in the control group ($P = 0.023$; effect size = 0.22). At the long-term follow-up (20 months), the score change did not differ significantly between the groups (effect size = 0.12).

Overall, the hypothesis was supported: the between-group difference was significant for both outcomes at the postintervention follow-up: $P = 0.021$ for somatic symptoms; $P = 0.023$ for emotional distress.

Discussion

This randomized controlled trial demonstrated that an 8-month dance intervention

Table 2. Mean scores (and standard deviations) for somatic symptoms and emotional distress at baseline and at all follow-ups, mean change score compared with baseline, between-group difference in change score and *P*-value.

Group	Somatic symptoms[a]				Emotional distress[a]			
	Baseline	First follow-up[b]	Postintervention[c]	Long-term follow-up[d]	Baseline	First follow-up[b]	Postintervention[c]	Long-term follow-up[d]
Dance intervention group (n = 59)[e]								
Mean score (SD)	2.77 (0.63)	2.42 (0.73)	2.30 (0.64)	2.39 (0,68)	3.06 (0.61)	2.87 (0.66)	2.54 (0.71)	2.69 (0.74)
Mean change score		0.35	0.47	0.38		0.19	0.52	0.37
Control group (n = 53)[e]								
Mean score (SD)	2.77 (0.58)	2.54 (0.59)	2.56 (0.62)	2.44 (0.66)	2.91 (0.59)	2.82 (0.53)	2.69 (0.72)	2.74 (0.77)
Mean change score		0.23	0.21	0.33		0.09	0.22	0.17
Difference in mean change score (SD)		0.11 (1.17)	0.26 (1.15)	0.05 (1.48)		0.10 (1.35)	0.30 (1.43)	0.20 (1.69)
95% CI		−0.11 to 0.34	0.04 to 0.47	−0.24 to 0.34		−0.15 to 0.35	0.04 to 0.58	−0.12 to 0.52
P-value		0.30	0.021	0.72		0.44	0.023	0.21

[a]Somatic symptoms and emotional distress were rated on a five-point scale: 1 = never; 5 = always (i.e. more symptoms/distress).
[b]Data were missing for 9 (15%) participants in the intervention group and 3 (6%) in the control group.
[c]Data were missing for 10 (17%) participants in the intervention group and 8 (15%) in the control group.
[d]Data were missing for 10 (17%) participants in the intervention group and 10 (19%) in the control group.
[e]Mean values, standard deviations (SD), and 95% confidence intervals (CI) are based on the output of multiple imputation analysis (n = 59 for the intervention group and n = 53 for the control group).

significantly reduced somatic symptoms and emotional distress in adolescent girls postintervention, compared with the school health services alone. However, the between-group differences were not maintained at the long-term follow-up (1 year after the intervention had ended). The reason for this is not known; however, it is possible that participants needed to continue the intervention in the same form to sustain its effects.

Interestingly, somatic symptoms (headache, stomachache, vertigo, tiredness, aching shoulders and backache) and emotional distress symptoms (stress, nervousness, anxiety, sadness, irritation and powerlessness) followed the same pattern, in that both showed the greatest between-group difference at the postintervention follow-up ($P = 0.021$ and $P = 0.023$, respectively). The reason for this consistency is not entirely clear. However, a recent review by Alfvén et al.[36] indicated that negative stress affects recurrent pain in young people. The authors emphasize that understanding stress and its somatic consequences is a prerequisite for developing effective therapeutic strategies and may have implications in understanding the signs and treatment of stress in clinical practice.[36]

To our knowledge, this is the first study to investigate the effect of a dance intervention on stress-related symptoms in adolescent girls. A similar positive trend in stress-related or psychosomatic symptom reduction in adolescent girls was reported by Stromback et al.,[37] who evaluated an eight-session stress management course that included body-based practices. The study did not include a control group but showed significant postintervention reductions for internalized anxiety, depression and somatic symptoms. The authors conclude that body-based practices can be considered empowering. After the course, participants had a greater ability to listen to body signals and achieve vitality and presence, possibly because of an increase

in bodily awareness and social support, which may also help to explain the effects in the present study. The results of this study are also in line with qualitative data from the Bristol Girls Dance Project, an after-school dance intervention aimed at Year 7 girls (age 11–12 years).[38] Participants reported enjoying the dance and felt that the intervention had psychological and social benefits, improved perceived health and well-being, and led to greater energy.[39] Previously published qualitative data from the current target group[40] show that the intervention increased self-trust, underpinned by feelings of enjoyment and empowerment when dancing. Taken together, this could help to explain the postintervention health effects.

As dance may not be suitable for all individuals, other types of physical activity to improve mental health should be considered. Team sports, cycling,[13] crossfit, football,[15] aerobic and gym activities, and mindful exercises like yoga or tai chi[13,15] can help to reduce mental health burden. However, to achieve enjoyment, which tends to result in greater adherence to physical activities,[27,29] it is important to offer a form of physical activity that fits the interests of the intended target group. Dance is likely to suit the interests of adolescent girls.[17]

Motivational SDT is widely used by researchers and teachers to guide the delivery of organized physical activity sessions.[38] In the present study, the theory constituted a framework and approach for the intervention dance instructors; however, whether or how it influenced the results was not examined.

A possible explanation for the observed reduction in stress-related symptoms in the present study is that the intervention was undertaken in a social environment. Participation in team sports has been found to positively correlate with mental health in adolescents.[15] Togetherness and

a sense of unity can add meaning and strength to adolescent girls' lives;[41] moreover, a sense of 'not being alone' when facing stress-related problems may be a type of comfort.

Strengths of this study include the longitudinal randomized design, extensive intervention period, long-term follow-up and novelty of the intervention type for a vulnerable target group.

Several limitations should be noted. A potential source of bias is that it is generally not possible to blind participants in exercise trials. It is possible that participants in the intervention group reported more positive values to please the instructors or show gratitude to the research team. Additionally, when interpreting the data, we must consider the missing data for both outcomes, which ranged from 15% to 17% in the intervention group and 6% to 19% in the control group. An additional limitation concerns internal consistency. More specifically, Cronbach's alpha for the somatic symptom scale at baseline only reached 0.64. In comparison, values of 0.7 and above are widely considered to indicate good internal consistency in basic research.[34] Owing to the relatively low internal consistency for this measure, we cannot be certain that somatic symptoms were captured with consistency across measurement time points. The risk that the predictor variable may inflate or deflate the estimate calls for a certain amount of caution when interpreting the results. It is also worth noting that participants were asked to report information on the previous 3 months. Recall bias is always a threat to the internal validity of this type of self-reported data on past experiences, and responses can reflect memory limitations.[42] Although the girls reported no problems in completing the assessment, recall bias may have influenced the data.

More research with other target groups is needed to confirm the health effects of this kind of health-strengthening intervention in different settings. First, it is not known if the type of intervention reported here is suitable for boys with stress-related problems. Research to confirm this would provide guidance for the future development of interventions for both sexes. Second, although there is some evidence for the health effects of dance interventions in different age groups,[19,21] a recent systematic review[15] concluded that owing to the small number of studies, it was not possible to determine the effect of physical activity on the mental health of preschoolers and children. Studies of interventions that target children with stress-related problems would broaden the range of available data and address the possible benefits of early interaction. The positive findings of the present study can most likely be generalized to a similar group of adolescent girls with stress-related problems in an after-school setting. However, practical circumstances might limit the successful implementation of the intervention in other locations because it requires interested school nurses who can recruit participants, an educated dance instructor and an accessible dance studio located a reasonable distance from the school. Moreover, although it was not problematic during the current study, the recruitment procedure may be a challenge owing to the risk of stigmatization of individuals with stress-related problems.

Most of the girls that participated in this study had previous experience of physical activity (Table 1), although this target group probably has diverse attitudes towards physical activity. An interesting perspective for future research would be to narrow the inclusion criteria and study adolescents with stress-related problems who are also physically inactive.

It is common for adolescent girls to visit the school nurse to receive support for headache, stomach pain and social problems.[43] It has been suggested that early

treatment of adolescent somatic symptoms should have a high priority because of the increased risk of subsequent poor mental health outcomes.[11] Interventions that reduce symptoms and reduce the number of visits to school health care services and mental health services are warranted. Dance intervention may be an example of an active, cost-effective, nonpharmacological complementary treatment for this target group.

Conclusion

The present study indicates that dance interventions have the potential to reduce stress-related somatic symptoms and emotional distress in adolescent girls. However, the intervention effect was not maintained 1 year after the intervention had ended, suggesting that participants need continued regular participation in the intervention for sustainable results. More randomized studies are required to further evaluate the intervention's effect in different settings.

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