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Journal of Adolescence

journal homepage: [www.elsevier.com/locate/jado](http://www.elsevier.com/locate/jado)



## Physical activity buffers the effects of family conflict on depressed mood: A study on adolescent girls and boys

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### A B S T R A C T

#### Keywords:

Physical activity  
Family conflict  
Strain  
Adolescents  
Mental health  
Depressed mood

This paper investigates the relationship between physical activity and depressed mood, under conditions of family conflict. We analyze data from a representative sample of 7232 Icelandic adolescents. Analysis of variance was carried out to test for main and interaction effects. The study shows that while family conflict increases the likelihood of depressed mood, among adolescents, physical activity decreases the likelihood of depressed mood. Furthermore, physical activity plays a more important role among those adolescents living in aversive circumstances, than other adolescents, as family conflict and physical activity interact in the effect on depressed mood for adolescents living in such circumstances. The findings highlight the role of physical activity in decreasing mental distress among adolescents, especially those living in aversive circumstances at home.

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### Introduction

Numerous studies have found that aversive experiences have negative psychological consequences for children and adolescents (Bao, Whitbeck, & Hoyt, 2000; Lin, Ye, & Ensel, 1999; Thoits, 1995; Turner & Lloyd, 1999). For example, significant risks are associated with bereavement (Turner & Lloyd, 1995), divorce of parents (Amato & Sobolewski, 2001; Emery & Forehand, 1994) and family conflict, i.e. arguments and physical violence in the home (Amato & Sobolewski, 2001; Henning, Leitenberg, Coffey, Bennett, & Jankowski, 1997; Horwitz & Widom, 2001; Jekielek, 1998). According to Agnew's (1992) general strain theory, unpleasant events or circumstances, including aversive circumstances at home, particularly arguments and violence, create negative emotional reactions. These negative emotions frustrate the adolescent and may lead to desperate avoidance and/or delinquency (Agnew, 1985; 1992). Many studies have supported this association between aversive circumstances and negative emotions. Thus, conflict between adults has been shown to invoke fear in children, along with anger, aggression, and depressed mood (Amato, Spencer, & Booth, 1995; Sigfusdottir, Silver, & Farkas, 2004).

Whether it is possible to guard those adolescents and hence decrease the likelihood of strain resulting in negative emotions, has not yet been fully examined. To date, most prior studies have focused on the conditioning effects of support on mental distress among adults and adolescents (Gore & Aseltine, 1995; Grant et al., 2006; Wills & Cleary, 1996). Specifically,

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parental support has gained attention in this respect (Forehand et al., 1991). However, less is known about whether other kinds of environmental factors, such as physical activity may ameliorate the effects of stress on mental distress among adolescents.

### Physical activity, family conflict and negative emotions

Studies and reviews of the literature have linked physical activity to beneficial changes in emotional well-being, depression, anxiety and stress reactivity (Babiss & Gangwisch, 2009; Landers & Arent, 2001; O'Neal, Dunn, & Martinsen, 2000; Paluska & Schwenk, 2000; Phillips, Kiernan, & King, 2003; Weyerer & Kupfer, 1994). Various mechanisms have been suggested to account for this relationship. Strenuous exercise has been associated with increased cortical blood flow, release of endorphins and increased epinephrine and nor-epinephrine synthesis (Plante & Rodin, 1990; Rooks, Thom, McCully, & Dishman, 2010). Some scholars have suggested that participation in sports may provide a sense of meaning, coherence, and enhanced self-worth (Gore, Farrell, & Gordon, 2001). Others have suggested that physical activity may reduce emotional strain and serve as an important element in achieving emotional balance (Camacho, Roberts, Lazarus, Kaplan, & Cohen, 1991).

To untangle the complex web of relationships involved it is important to specify the social context in which the effects of physical activity are being studied. Social context may affect the relationship between physical activity and emotional well-being in several ways, and this relationship may be present in only some social conditions while not in others. Social conditions that decrease emotional well-being are of particular interest here. Consequently, it is an important theoretical question to what extent physical activity may counteract those conditions. The main contribution of this study is to examine the function of physical activity in helping adolescents cope with strain in their lives. In that context we draw upon Agnew's general strain theory. According to his theory, strain among adolescents increases the likelihood of a range of negative emotions, including depression (Agnew, 1992; 2006).

Agnew (1992) further acknowledges that not all adolescents respond to strain with negative emotions and deviance and predicts that several factors may condition the impact of strain on delinquency. A number of these factors include personal characteristics, such as coping skills, self-esteem, self-efficacy and level of social control one experiences through interaction with others (Agnew, Brezina, Wright, & Cullen, 2002). Other conditioning factors include those outside of the individual, such as association with delinquent peers and absence of social support (Agnew & White, 1992; Aseltine, Gore, & Gordon, 2000). One form of emotional coping strategy, that may alleviate negative emotions, according to Agnew, is physical activity. Adolescents participating in physical activity should thus be better able to respond to strain without experiencing negative emotions.

Only a handful of studies have considered the buffering effect of physical activity on the relationship between strain and depressed mood (Carmack, Boudreaux, Amaral-Melendez, Brantley, & De Moor, 1999; Harris, Cronkite, & Moss, 2006; Laperriere, Antoni, Schneiderman, & Ironson, 1990; Norris, Carroll, & Cochrane, 1992). Carmack and colleagues showed a buffering effect for physical activity on anxiety among college students, under conditions of minor stressful events and daily hassles. However, buffering effect was not found with depression. Among secondary school students, Norris et al. (1992) found that high intensity aerobic exercise program over 10 week period weakened the relationship between self appraised stressful situations and both depression and anxiety symptoms. Furthermore, Harris, Cronkite, and Moos (2006) found that physical activity buffered against the impact of major stressful life events on depression among depressed adult patients. These studies suggest that participation in physical activity may be an important factor in buffering the effects of strain on mental distress. However, the studies carried out hitherto, have not studied the effects of physical activity on the relationship between chronic strain, in the form of family conflict, and mental distress among adolescents.

Potential gender differences are of special interest in this regard. Prior studies have shown that adolescent girls report and exhibit more symptoms of depression than do adolescent boys (Nolen-Hoeksema, 2001; Sigfusdottir, Farkas, & Silver, 2004). These gender differences persist into adulthood, with the prevalence of depression in community studies of adults being about twice as high for women as men (Nolen-Hoeksema, 2001). Furthermore, girls have been found to be more emotionally affected by family conflict (Sigfusdottir et al., 2004). Finally, recent studies have found that in the last decade levels of depression have increased among girls while no significant differences are found in levels of depression among boys (Collishaw, Maughan, Natarajan, & Pickle, 2010). It is therefore of urgent importance to study what environmental aspects may prevent aversive circumstances to translate into depressed mood; this is especially important to find out for adolescent girls.

In this study we test whether high level of participation in physical activity, reduces depressed mood among adolescents. In line with studies on gender differences discussed above, we test whether these effects differ for girls and boys. We expect that family conflict will be positively associated with depressed mood. Furthermore, according to Agnew's general strain theory, we expect that physical activity will reduce the effects of strain, in the form of family conflict, on negative emotional reactions. The following hypotheses are put forth:

#### Hypothesis 1

Family conflict increases the likelihood of depressed mood.

#### Hypothesis 2

Physical activity decreases the likelihood of depressed mood.

### Hypothesis 3

The effects of family conflict on depressed mood are stronger when physical activity is low than when it is high.

### Method

#### Sample

The data used in the study comes from a national Youth in Iceland program of surveys that have been conducted in Iceland by ICSRA (Icelandic Center for Social Research and Analysis) for the past 14 years. ICSRA's *Youth in Iceland* surveys capture all 9th and 10th graders in all secondary schools in the country, yielding cohorts of about 8000–9000 participants per year. A set of core questions covers a wide array of demographic and social variables, including family structure, parental and peer support, structured and unstructured activities and pastimes, substance use, academic achievement, and psychosocial adjustment.

The survey used in this study was conducted on March 21st 2006. Anonymous questionnaires were administered to all ninth and tenth grade students who were present in class on that day. Teachers and research assistants distributed the questionnaires, and participants sealed them in blank envelopes upon completion. Valid questionnaires were obtained from 7430 participants, 49.9% of which were boys ( $N = 3.612$ ) and 50.1% girls ( $N = 3.620$ ). In total, the participants represented approximately 81% of all students in these age groups in Iceland (Statistics Iceland, 2007).

In Iceland, schooling is obligatory for these grades and all schools are funded by the municipalities, and supervised by the Ministry of Education. The Icelandic educational system is divided into nine geographical districts. In terms of student population, the largest districts include Reykjavik (33.8%), the surrounding capital area (24.6%), and the Northeast district where the large town of Akureyri is located (10.4%). The other six districts account for the remaining 31.2% of the student population in these age groups.

#### Measures

In Iceland around 94% of the population is of Norse and Celtic descent and 87% of the population belongs to the Lutheran State Church (Statistics Iceland, 2007). Due to this homogeneity, exogenous factors such as race, ethnicity and religion, often used in research in other countries, were not included in the study.

#### Control variables

##### Family Structure

Family structure measured whether adolescents lived with both biological parents (both parents = 1, total of 70.3% and  $N = 5.141$ ) or in other family arrangements (other = 0, total of 29.7% and  $N = 2.168$ ). Within the group of participants living in other arrangements, a total of 935 (12.8%) lived with a single mother and 816 (11.2%) with a mother and stepfather. The remaining participants, a total of 417 participants (5.8%) lived with a single father, their father and stepmother or in other settings such as with grandparents, siblings, relatives, or on their own.

##### Family financial status

As an indicator of socio-economic status, participants were asked about how well off financially their family was in comparison to the average family in Iceland. The answers ranged from 1 to 8, with higher score indicating lower financial status (1 = "much better off", 2 = "quite better off", 3 = "a bit better off", 4 = "similar", 5 = "a bit worse off", 6 = "quite better off", 7 = "much worse off").

##### Parental monitoring

Five questions were used to measure parental monitoring. The participants were asked how well or badly the following statements applied to them: "My parents set rules on what I can do at home", "My parents set rules on what I can do out of home", "My parents set rules on when I should be get home in the evenings", "My parents monitor with whom I am in the evenings", "My parents know where I am in the evenings". The items were rated on a four point scale from 0 = "Applies very well", 1 = "Applies rather well", 2 = "Applies rather badly", 3 = "Applies very badly". The items were combined into a scale ranging from 0 to 15 with Cronbach's  $\alpha = .82$ .

#### Independent variables

##### Family conflict

Four questions were used to measure conflict within the participants' homes. The participants were asked whether, in the last year, they had experienced the following: 1) witnessed severe arguments between their parents, 2) had severe arguments with their parents, 3) witnessed physical violence at home including an adult, or 4) experienced physical violence at home, including an adult. Answers to each question ranged from 0 = "no", 1 = "yes, 30 days ago or less", 2 = "yes, within the last

12 months”, and 3 = “yes, more than a year ago”. The participants who said they had been subject to any of the four events listed above within last 12 months were defined as belonging to the group of participants who had experienced family conflict in the last year before the survey, a total of 2529 individuals (yes = 1, total of 34.5%). The rest of the participants who either had not been subject to any of the events listed above or had been subject to these events more than a year ago were defined within the group of participants who had not experienced family conflict in the last year before the survey, a total of 4798 individuals (no = 0, total of 65.5%).

#### Physical activity

To measure physical activity participants were asked about the frequency of both participation as well as level of physical effect with questions on how often they did the following: “Practiced sports or physical training”, “Participated in sports or workout, excluding school obligated activities”, “Practiced organized sports within a sports club”, “Practiced sports or physical work out, excluding school and sport club activities”, “Worked out physically until winded or sweating”. The items were rated on a six point scale from 0 = “almost never”, 1 = “once a week”, 2 = “two times per week”, 3 = “three times per week”, 4 = “four to six times per week”, to 5 = “almost every day”. The items were combined into a scale ranging from 0 to 25 with Cronbach’s  $\alpha = .82$ . The scale was split into three groups on the sport participation scale at  $\pm$  one standard deviation (SD = 6.59) of the mean (Mean = 10.67) to represent low participation group (0), mid participation group (1) and high participation group (2). The first group therefore scored below approximately one standard deviation of the mean (a total of 957 or 13.9%), the second group scored approximately within the  $\pm$  one standard deviation of the mean (a total of 4780 or 69.6%), and the third scored approximately above one standard deviation of the mean (total of 1127 or 16.4%).

#### Dependent variable

#### Depressed mood

To measure participants’ depressive symptoms ten items from the depression dimension defined by Derogatis, Lipman, Covi, and Rickels (1971) were used. The participants were asked how often during the last week the following statements applied to them: “I was sad or had little interest in doing things”, “I had little appetite”, “I felt lonely”, “I had sleeping problems”, “I cried easily or wanted to cry”, “I felt sad or blue”, “I was not excited in doing things”, “I was slow or had little energy”, “The future seemed hopeless”, and “I thought of committing suicide”. The items were rated on a four point scale from 0 = “never”, 1 = “seldom”, 2 = “sometimes” to 3 = “often”. The items were combined into a scale ranging from 0 to 30, with Cronbach’s  $\alpha = .90$ .

#### Statistical analysis

One of the key questions in this study is whether physical activity buffered the effects of family conflict on depressed mood, or in other words, whether physical activity offers protection when stress is present, over and above the protection it offers when stress is absent. Therefore the main question in the study calls for a test of interactions, which is carried out by the use of univariate analysis of variance (ANOVA). We examine the main effects of family conflict, physical activity and gender on depressed mood. In order to examine the hypotheses put forward earlier, we developed the models illustrated in Fig. 1.

The univariate analysis of variance (ANOVA) gives an opportunity to examine the main effects of family conflict, physical activity and gender as well as the interaction effects between family conflict, physical activity and gender while controlling for the effects of family structure, family financial status and parental monitoring.

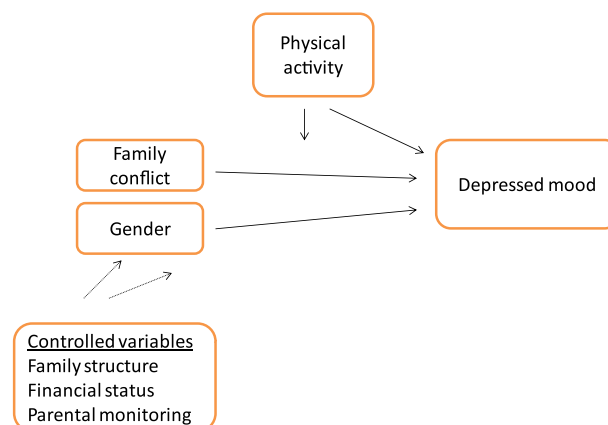


Fig. 1. A model of the effects of family conflict, physical activity and gender on depressed mood.

## Results

A univariate analysis of variance (ANOVA) was conducted to test significant effects of the independent variables; family conflict, physical activity and gender on the dependent variable depressed mood. In the model the fixed factors were family conflict, physical activity and gender while family structure, family financial status and parental monitoring were covariates. Table 1 shows the descriptive statistics for the analysis and Table 2 shows the between-subject effects, i.e. the effects of each fixed factor on depressed mood. In total, the model tested, explained 18% of the variance in the dependent variable depressed mood (partial Eta squared).

### Main effects

Looking at Tables 1 and 2 the fixed factors; family conflict, physical activity and gender all show significant main effects on depressed mood. Hence, the results indicate significant differences in mean levels of depressed mood between groups, whereas adolescents who report family conflict or low physical activity have higher mean levels of depressed mood than those adolescents who report no family conflict or high physical activity. Furthermore, girls show on average significantly higher levels of depressed mood than boys.

### Interaction effects

Of key interest was whether physical activity and family conflict would interact in its effects on depressed mood. This turned out to be the case. Looking at Table 2 the results indicate an interaction between family conflict and physical activity, significant at  $p < .05$  level. The three-way interaction between gender, family conflict and physical activity is also significant at  $p < .05$ . This indicates that the interaction is significantly stronger for girls than boys. Hence, physical activity serves as a buffer for the negative effects of family conflict on depressed mood for both genders but significantly more so among girls than boys. These results are demonstrated graphically in Fig. 2 by a much steeper line for girls who have experienced family conflict at home (green line), compared to girls who haven't experienced family conflict (blue line). Among boys the steepness of the lines, indicating the family conflict and no family conflict group, differ significantly, but not as much as among girls.

Finally, looking at the interactions in Table 2, gender also significantly interacts with both family conflict and physical activity. In Fig. 2, the stronger effect of family conflict for girls is demonstrated by larger differences between the lines of family conflict and no family conflict for girls than boys. The stronger effect of physical activity for girls is indicated by steeper lines for girls than boys (see Fig. 2).

Most importantly, these results indicate that physical activity is a buffer for depressed mood among adolescents who live under conditions of family conflict. Hence, physical activity is a stronger inhibitor of depressed mood among adolescents who live under conditions of family conflict at home, than those who don't live under such aversive circumstances.

## Discussion

In this study we examine what role physical activity plays for adolescents who live under conditions of family conflict. The results show that physical activity buffers the effects of family conflict on depressed mood among adolescents, in particular among girls.

In general the findings show that family conflict increases the likelihood of depressed mood among boys and girls. These findings are in accordance with previous research, as well as general strain theory, indicating that family conflict significantly increases the likelihood of negative emotions, including depressed mood (Amato & Sobolewski, 2001; Henning et al., 1997; Horwitz & Widom, 2001; Jekielek, 1998). Also, the results indicate that physical activity plays a significant role in decreasing the likelihood of depressed mood among adolescents. These findings are in line with prior studies on the role of physical activity in reducing mental distress. Hence, in a review of the literature in 1994 Weyerer and Kupfer concluded that studies had documented the effectiveness of physical exercise in prevention and treatment of depression. That finding is echoed in

**Table 1**

Descriptive statistics showing mean levels of depressed mood, standard deviations and number in each category, by family conflict, physical activity and gender.

	Physical activity	Mean boys/girls	Std. deviation boys/girls	N boys/girls
No family conflict	0	5.04/8.89	(5.496/7.638)	260/291
	1	4.31/6.27	(4.816/5.001)	1438/1423
	2	3.26/6.30	(4.231/6.135)	483/266
Total		4.16/6.66	(4.809/6.341)	2181/1980
Family conflict	0	8.25/13.82	(7.286/8.233)	92/233
	1	6.98/11.08	(5.863/7.429)	605/953
	2	6.23/8.60	(5.613/6.64)	196/99
Total		6.94/11.39	(5.989/7.634)	893/1285

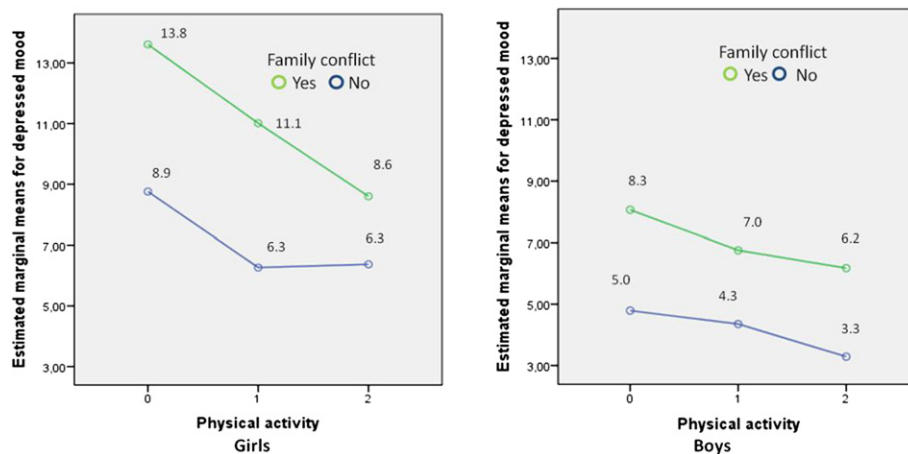
**Table 2**  
Test of between-subject effects with depressed mood as a dependent variable.

Source	df	F	p
<i>Main effects</i>			
Family structure	1	2.8	$P > .05$
Financial status	1	36.1	$P < .001$
Parental monitoring	1	6.3	$P < .05$
Family conflict (FC)	1	232.9	$P < .001$
Physical activity (PA)	2	34.6	$P < .001$
Gender	1	250.7	$P < .001$
<i>Interaction effects</i>			
FC × PA	2	3.0	$P < .05$
Gender × PA	2	6.1	$P < .01$
Gender × FC	1	5.9	$P < .05$
Gender × FC × PA	2	4.3	$P < .05$
Corrected model Partial Eta Squared = .18	14	96.26	$P < .001$

a more recent review by Paluska and Schwenk (2000) who argue that partaking in physical activity may play an important role in alleviating symptoms of depression.

Our findings support the key questions of this study. They show that family conflict increases the likelihood of depressed mood among adolescents, while participation in physical activity decreases the likelihood of depressed mood. Furthermore, the findings show that the effects of family conflict on depressed mood are stronger when physical activity is low then when it is high. These findings support the significance of physical activity for adolescents, especially girls who are living under strain, as for them physical activity counteracts the influence of family conflict on depressed mood. Thus, the effects of family conflict which has been shown to invoke quite strong emotional reactions among children (Amato et al., 1995) has less effects on adolescents who are physically active than those who are not. These results are important for policy making in the field of organized youth work and highlight the importance of encouraging adolescent participation in physical activity. Those responsible for organized youth work among adolescents need to attend to adolescents living in aversive circumstances, and strive for advancing their possibilities in taking part. This applies specifically for girls as physical activity indeed plays an even more important role for them than for boys who regularly experience family conflict at home. These findings are very important, since prior research has shown that family conflict has even more detrimental effects for girls than for boys. Also, recent studies have found that depression has increased among girls in the last decade. It is therefore of special relevance for policy makers and practitioners working with adolescent girls to know that physical activity buffers the effect of family conflict on depressed mood among them. In some local communities in Iceland, for example in the capital of Reykjavik, participation in organized youth work and sports has recently been encouraged by offering adolescents pre-paid cards on behalf of the local government, to partake in structured activities. It will be interesting to study whether and how those measures affect sport participation among youth, as they are intended to encourage physical activity as well as ensuring that youth of different socio-economic status have similar possibilities of participation.

The study has some limitations which need to be addressed. First and most importantly the study is cross-sectional and therefore the direction of causality between family conflict, mental health and physical activity cannot be determined.



**Fig. 2.** Estimated marginal means for depressed mood among girls and boys by family conflict and physical activity. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Second, all of the measures were based on self-report and some of the students may not have accurately reported their family situations, feelings or their participation in physical activity. Despite these limitations, there is a reason to be reasonably confident about the reliability of the data since the aim of the study was not to establish rates or prevalence of these measures, but to conclude about the relationships between them. Furthermore, the large size and the representativeness of the sample give confidence in the reliability of the data. The sample consisted of a total of 7,430 adolescents, representing approximately 81% of the population in the age group under study.

In conclusion, the findings indicate that physical activity buffers the negative effects of family conflict on depressed mood for adolescents. These findings confirm the suggestions made by Pyle, McQuivey, Brassington, and Steiner (2003) that more attention should be given to physical activity in decreasing mental distress. Accordingly, physical activity may be a simple, inexpensive and effective intervention for depressed mood (Paluska & Schwenk, 2000), especially for children and adolescents living under aversive circumstances at home. Furthermore, the current results mirror the complexity of the role of physical activity on mental health, and highlight the importance of specifying the social context in which the effects of physical activity are being studied.

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