Physical activity and depressive symptoms

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CHAPTER V

Competitive Sport Participation, Sport Competence and Depressive Symptoms in Adolescent Boys and Girls

"Serious sport has nothing to do with fair play. It is bound up with hatred, jealousy, boastfulness, disregard of all rules and sadistic pleasure in witnessing violence: in other words it is war minus the shooting."

George Orwell, in *The Sporting Spirit*, 1945

"Certification from one source or another seems to be the most important thing to people all over the world. A piece of paper from a school that says you're smart, a pat on the head from your parents that says you're good or some reinforcement from your peers that makes you think what you're doing is worthwhile. People are just waiting around to get certified."

Frank Zappa, in *Oui* interview, 1979

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ABSTRACT

Purpose: Physical activity is inversely but moderately related to depressive symptoms in adolescents. This might indicate that not all types of physical activity are associated with depressive symptoms, or that the association is present only in a subgroup. We set out to investigate: a) whether participation in sports with a clear competitive element is associated with current depressive symptoms and symptom changes over time in adolescents; b) whether these associations are modified by gender and sport competence.

Methods: Data came from the Dutch TRacking Adolescents' Individual Lives Survey (TRAILS), a longitudinal population-based study in adolescents (N = 2149; girls = 51%, mean age = 13.65, SD = 0.53). Depressive symptoms were measured by the Affective Problems scale of the Youth Self-Report. Based on participants' reported participation in sports, we selected sports with a clear competitive element. Sport competence was assessed by peer nominations.

Results: Participation in competitive sports was significantly associated with lower current depressive symptom scores ($p = 0.002$) but not with positive changes in depressive symptoms ($p = 0.23$). After adjustment for sport competence the association between sport participation and current depressive symptoms was no longer significant ($p = 0.41$). No three-way interactions between competitive sports, gender, and sport competence were observed.

Conclusion: Participation in competitive sports was related to lower current depressive symptoms, which could be explained by sport competence, but not with changes in depressive symptoms. Finally, we found no evidence that associations between sport participation and depressive symptoms are modified by gender and sport competence.

INTRODUCTION

Physical activity (PA) has received significant attention over the last years as being potentially beneficial in alleviating depressive symptoms (Vilhjalmsson & Thorlindsson, 1992; Sanders et al., 2000; Salmon, 2001; Gore et al., 2001; Dunn et al., 2005; Rimer et al., 2012). Reviews and meta-analyses of intervention studies investigating the relationship between PA and depressive symptoms in adults have also shown that PA can reduce depressive symptoms, but their conclusions should be taken with caution because of the low methodological quality of most studies included (Rimer et al., 2012; Cooney et al., 2013; Rosenbaum et al., 2014). Two meta-analyses of intervention studies in adolescents also showed that PA was inversely related to depressive symptoms but the effect sizes were small, and again there was a lack of high methodological quality studies (Larun et al., 2006; Brown et al., 2013). Because depressive symptoms in adolescence have been shown to predict the development of a depressive disorder in adulthood (Hankin et al., 1998; Lewinsohn et al., 1999; Fergusson et al., 2005; Monshouwer et al., 2012), it is pertinent to investigate the relationship between PA and depressive symptoms at an early age. According to recent reviews, the majority of observational studies in adolescents, regardless of design, show an inverse association between PA and depressive symptoms, with weak to moderate effect sizes (Biddle & Asare, 2011; Johnson & Taliaferro, 2011). Two possible reasons that might explain the relatively weak associations observed in the relationship between PA and depressive symptoms were investigated in the current study. First, the definition of PA is broad, which could mean that not all types of PA are associated with depressive symptoms, resulting in an overall small-sized association. Second, PA might be inversely associated with depressive symptoms only in specific subgroups of individuals and not in others, also resulting in an overall modest association. For example, a recent study showed that PA was inversely associated with depressive symptoms in males but not in females (Edman et al., 2014).

PA is defined as any bodily muscle movement that leads to energy expenditure, and includes a broad range of activities regardless of the environment (e.g., leisure-time vs. occupational) or intensity of the activity (see: Caspersen et al., 1985). Sport participation is a more specific definition relying on a competitive element of the activity. Previous research has shown an inverse association between sport participation and depressive symptoms (Vilhjalmsson & Thorlindsson, 1992; Sanders et al., 2000; Gore et al., 2001), with effect sizes similar to the association between PA and depressive symptoms (see for a review: Johnson & Taliaferro, 2011). However, these studies did not define sports according to the competitive element of the activity, but used an unspecified definition of sports, or categorized sports according to their social aspect (club, individual, or team) (Vilhjalmsson & Thorlindsson, 1992; Sanders et al., 2000; Gore et al., 2001). Because participation in sports is suggested to have an

evolutionary origin (Lombardo, 2012), we hypothesized that in particular the competitive element of sports might play a crucial role in the association with depressive symptoms.

According to Lombardo (2012), one of the best ways to achieve social status is through sports and especially those with a highly competitive element, because sport competitions in the modern world closely resemble hunting activities and primitive warfare. Competing in sports gives an opportunity for males to rank each other according to their abilities and therefore be able to select capable allies or avoid capable enemies. This ranking is assumed to result in improved or diminished chances of being selected by females (Lombardo, 2012). This can be seen in both ancient (e.g., Olympians in Classical Greece, see: Poliakoff, 1987 and Golden, 2008) and modern athletes, who tend to gain status fast, especially if they are champions (Loy, 1972; Chase & Dummer, 1992; Holland & Andre, 1994; Buss, 2007; Chase & Machida, 2011). This suggests that individuals who are athletically competent will be more likely to achieve high status than their less competent peers.

The social status that the individual attains or maintains has also been hypothesized to influence the development of mental disorders. Price's Social Competition Hypothesis of Depression (Price et al., 1994) suggests that depressed mood is a result of inhibitory mechanisms that force the individual to concede defeat and downplay their ambitions and desires in situations where it is impossible or unlikely for them to succeed. This involuntary defense mechanism, is hypothesized to help individuals to psychologically deal with 'what would otherwise be unacceptably low social status' (Price et al., 1994; in abstract). Status can be operationalized in many ways (Linton, 1936; Price, 1972; Price et al., 1994; Anderson et al., 2001). In this study, we will focus on status in terms of achievements (Price, 1972), which mainly depends on the ranking of individuals according to their competency levels as perceived by their peers. We focus on peer-perceived sport competence because of the importance given to sport competence and sport participation in adolescence, especially in boys (Gill, 1992; Kavussanu & Harnisch, 2000; Sallis et al., 2000).

There are reasons to assume that the above-described mechanisms apply to males in particular. Boys and men attach more importance to sport participation and are conspicuously more competitive than girls and women (Price, 1988; Balafoutas et al., 2012; Deaner et al., 2012), as their achievement status will directly influence their chances of being selected by women (Fieder & Huber, 2012; Lombardo, 2012; Li et al., 2013). Furthermore, several reports suggest that achievement status is more strongly associated with well-being in men than in women (Brendgen et al., 2005; Tiffin et al., 2005; Oldehinkel et al., 2007). Taken together, this indicates that the way competition for status influences social hierarchy formation and subsequently the development of mental health problems may be different for boys and girls.

The aims of this study were to investigate: 1) whether sport participation is inversely asso-

ciated with current depressive symptoms and depressive symptom change in late adolescence, and 2) whether these associations are modified by peer-perceived sport competence and gender. We hypothesized that peer-perceived sport competence modifies the relationship between sport participation and depressive symptoms, and that sport-competent boys will benefit more from performing competitive sports than girls and less competent boys.

METHODS

Design

Data used for this study were part of a large population cohort of adolescents in the Netherlands called TRacking Adolescents' Individual Lives Survey (TRAILS). The aim of TRAILS was to delineate the development of mental health problems from childhood to adulthood. Approval of the study was obtained from the Dutch Committee on Research Involving Human Subjects. Data for the first measurement wave (T1) were collected in 2001, and for the second (T2) and third (T3) measurement waves data collection took place between 2003 and 2007, with approximate intervals of 2.5 years between each wave. Informed consent was collected from the parents at T1, while both parents and participants gave informed consent at T2 and T3. Extensive descriptions of TRAILS design, data and sample collection can be found elsewhere (de Winter et al., 2005; Huisman et al., 2008; Ormel et al., 2012). The present study was based on data from T2 and T3.

Participants and Procedure

The total sample at T1 included 2230 adolescents (50.8% girls, mean age = 11.1, SD = 0.6). The response rates at T2 and T3 were 96.4% (N = 2149; 51% girls, mean age = 13.7, SD = 0.5) and 81.4% (N = 1816; 52.3% girls, mean age = 16.3, SD = 0.7) respectively (Ormel et al., 2012). Detailed information on sampling procedures can be found elsewhere (de Winter et al., 2005; Nederhof et al., 2012). During T2 and T3, parents received a questionnaire by mail. Adolescents and their teachers were asked to complete questionnaires at school.

Outcome Variables

Depressive Symptoms

Depressive symptoms were assessed using the Affective Problem Scale of the Youth Self Report (YSR; Achenbach & Rescorla, 2001). The Affective Problem Scale consists of 13 items, which correspond to DSM-IV depressive symptoms (van Lang et al., 2005). These items are scored on a three-point scale (0 = never or not at all true, 1 = sometimes true and 2 = very often or very true) and include questions on sadness, loss of pleasure, crying, self-harm, suicidal

ideation, feelings of guilt and worthlessness, loss of energy, eating problems, overtiredness, and sleeping problems (3 items). The internal consistency (Cronbach's alpha) for the 13 items was 0.77 for T2 and 0.78 for T3. A mean score of all 13 items for T2 and T3 was used in the analyses.

Predictors

Sport Participation

According to the Oxford dictionary a sport is: "an activity involving physical exertion and skill in which an individual or team competes against another or others for entertainment" (Oxford dictionaries; http://oxforddictionaries.com/definition/english/sport?q=sport). Throughout this manuscript we will use this definition of sports, because we were interested in the competitive element of activities. During T2, adolescents were asked to indicate whether they participate in any sports and what types of sports they participate in (maximum of four sports). From these responses, we created a binary variable indicating whether at least one of the activities reported, corresponded to the definition of sports we used. If none of the activities met the criterion for a sport the participant was coded as a non-sporter. Activities such as 'running', 'walking' or 'dancing' were not considered as sports per se, because these activities do not necessarily imply direct competition with other individuals or teams. In contrast, activities such as "running in competitions" were considered a sport. For responses that had an ambiguous competitive element (such as gymnastics and roller-blading), the frequencies per week (more or less often than two times per week) were used to distinguish between sporters and non-sporters. In total, 2089 adolescents had valid responses on the sport participation measure. The 141 (6.3%) individuals that did not respond to the sport participation and the general PA questions were considered missing. More information on the sport participation measure can be found in the Appendix, Table F.

Peer Nominations of Sport Competence

At T2, peer nominations were assessed with regard to various characteristics, including sport competence. These nominations were assessed in classes with at least three regular TRAILS participants. Peer nominations were assessed in 172 classes of 34 schools in the first year (72 school classes) and second year (100 school classes) of secondary education, each including 7 to 30 participating adolescents per class (mean = 18.4, SD = 5.99). In total, 3312 students (1675 boys; 1637 girls) including 1007 regular TRAILS participants filled out the peer nomination questionnaire (mean age = 13.7, SD = 0.66). For the purpose of this study, we selected the question on sport competence ('Who is good at sports?'), and used the percentage of nominations as a continuous measure in the analyses. Further details on the peer nomination measures in TRAILS and the representativeness of the peer nominations sample have been described elsewhere (Dijkstra et al., 2008).

Teacher Evaluations of Sport Competence

At T2, the teachers were asked to rate the athletic competence of each TRAILS participant in their class. This question was rated on a five-point scale, with 1=inadequate, 2=more or less adequate, 3=adequate, 4=good, and 5=outstanding. Information on the teacher's evaluation of sport competence was collected for 1455 adolescents.

Socioeconomic Status

Socioeconomic status (SES) of the family was obtained by averaging five standardized variables measured at T1, i.e., professional occupation and educational attainment of both parents/guardians, and household income. The internal consistency of the SES scale was 0.84. The scale captures 61.2% of the variance in the five items. SES was used as a continuous measure in the analysis. At T1, 16.8% of the TRAILS participants lived in families with a disposable income annual up to € 13620, which is below the at-risk-of-poverty-threshold. Further information on each of these variables and the aggregated SES can be found elsewhere (Amone-P'Olak et al., 2010).

Analyses

Missing Data

Differences between responders and non-responders at T3, and between the adolescents that completed the peer evaluations and those that did not, for all predictor variables were estimated using independent t-tests and chi-square difference tests depending on whether the variables in question were continuous or dichotomous. Non-responders at T3 were more likely to be males ($x^2=15.7$, df=1, p=0.001), participate in sports ($x^2=9.5$, df=1, p=0.002), report more depressive symptoms at T2 (t=-2.7, p=0.01) and have lower SES (t=-10.1, p=0.001) than responders. There was no significant difference between responders and non-responders at T3 regarding the peer evaluations of sport competence (t=-0.6, p=0.53). Adolescents who had completed the peer nominations were more likely to have higher SES (t=-6.3, p=0.001) and participate in sports ($x^2=8.6$, df=1, p=0.004) than those who did not, while they did not differ regarding gender ($x^2=0.7$, df=1, p=0.42), depressive symptoms at T2 (t=0.8, p=0.40) and depressive symptoms at T3 (t=0.5, p=0.64).

Correlations

All analyses were performed using SPSS (version 20, SPSS Inc., Chicago, Illinois). The associations between the predictors, outcome variables and covariates were calculated using Pearson's correlations (*r*). For the sport participation and gender variables, the correlations can be interpreted as point-biserial correlations because of the dichotomous nature of these variables (Field, 2009).

Linear Regressions

The hypotheses were tested by two-tailed tests with an alpha-level of 0.05. Because the residuals of the outcome variable (i.e., depressive symptoms) were positively skewed, we performed linear regressions with bootstrapping, that is, estimations of confidence intervals based on repeated sample extractions from the original dataset, which do not rely on *a priori* distributional assumptions (for more information see Field, 2009 p. 163; Hayes, 2009). Bootstrapping of 1000 samples with Bias Corrected and Accelerated confidence intervals (CIs) was performed for all analyses.

In order to test associations with current depressive symptoms, sport participation was used as the predictor, and gender and SES as covariates. In order to predict depressive symptom change, baseline (T2) depressive symptoms were included as an additional covariate. In total, 2054 participants were included in the cross-sectional analysis, while 1614 adolescents were included in the depressive symptom change analysis. We repeated these analyses including sport competence. Because the peer perceptions of sport competence were collected from a subsample of TRAILS, a total of 960 adolescents were included in the cross-sectional analysis, while 785 adolescents were included in the depressive symptom change analysis. In order to test interactions between sport participation, sport competence, and gender, we created a model including all possible two-way and three-way interactions among these variables, and removed any non-significant interactions from the model, providing the model was still hierarchical.

Finally, in order to examine to what extent the results were affected by the measures used, the analyses were repeated using the teacher evaluations of sport competence and a broader definition of sports. In this broader definition, all reported physical activities (including, for example, walking in the park, dancing, or running) were categorized as a sport.

RESULTS

Descriptive Statistics

From a total of 2089 participants (51% girls) with valid responses in the sport participation measure, 1177 (56.3%) reported at least one competitive sport, while 912 (43.7%) did not take part in any activity that fit our definition. Within the sample that participated in the peer nominations, 134 (13.3%) adolescents received no nominations for being good at sports from their peers, 391 (38.8%) received between 1 and 25% nominations, 245 (24.3%) between 26 and 50%, and 237 (23.6%) between 51 and 100%. Table 1 shows the frequencies of all predictors according to sport participation. Depressive symptoms at T2 (mean age = 13.7) had a mean score of 0.27 (SD = 0.26) while depressive symptoms at T3 (mean age = 16.3) had a mean score of 0.30 (SD = 0.27).

Correlations

As can be seen from table 2, for boys sport participation was significantly correlated with depressive symptoms at both T2 and T3, whereas for girls sport participation was only significantly correlated with depressive symptoms at T2. Sport competence was significantly associated with T2 and T3 depressive symptoms and with sport participation for both boys and girls (see also table A in appendix).

Linear Regressions

In the cross-sectional analysis, sport participation was significantly associated with depressive symptoms at T2 after adjustment for gender and SES (B = -0.05, CIs = -0.07 to -0.02, p = 0.002), but its effect was no longer significant after inclusion of sport competence (table 3). This model explained around 4% of the variance in the depressive symptoms. Neither sport participation nor sport competence was significantly associated with change in depressive symptoms between T2 and T3 (table 4). This model explained approximately 30% of the variance, due to the inclusion of T2 depressive symptoms as a covariate.
The three-way interaction between sport participation, sport competence, and gender did not predict current depressive symptoms significantly (SES-adjusted B = 0.06, CIs = -0.03 to 0.16, p-value = 0.17), and was therefore removed from the model. In the remaining model there were no significant two-way interactions (B ranges = -0.04 to -0.00, p-value ranges = 0.31 to 0.95), hence a model with only main effects described the data best. The same was true for the prediction of change in depressive symptoms between T2 and T3 (B ranges = -0.04 to 0.01, p-value ranges = 0.30 to 0.98).

Repeating the analyses with the teacher evaluations of sport competence (tables B and C in the appendix) yielded similar results, with only one small difference: the cross-sectional association between sport participation and depressive symptoms remained marginally significant (B = -0.03, CIs = -0.06 to 0.001, p = 0.054) after adjustment for the teacher evaluations of sport competence. When using a broader, non-competitive, definition of sport participation, sport participation remained a significant predictor of current depressive symptoms after adjustment for (peer-perceived) sport competence as well. Apart from this, the results were very similar to the results obtained when sports was defined as being competitive (see appendix, tables D and E).

Table 1. Gender, SES, and Peer-Perceived Sport Competence by Sport Participation.

Variable	Sport Participation			
	Yes	Percentage %	No	Percentage %
Gender (N = 2089)				
Boys	745	63.3	273	29.9
Girls	432	36.7	639	70.1
Indices of SES (N = 2058)				
Maternal Education				
Elementary	52	4.5	67	7.6
Lower-Track Secondary	332	28.9	293	33.3
Higher-Track Secondary	413	35.9	315	35.8
Senior Vocational	252	21.9	157	17.8
University	100	8.8	49	5.5
Paternal Education				
Elementary	49	4.8	46	6.2
Lower-Track Secondary	259	25.1	214	28.8
Higher-Track Secondary	326	31.7	243	32.7
Senior Vocational	232	22.5	151	20.3
University	164	15.9	89	12
Maternal Occupation				
Low Level	144	16.7	122	18.6
Intermediate Level	462	53.6	349	53.1
High Level	314	29.7	122	28.3
Paternal Occupation				
Low Level	266	27.1	240	33.9
Intermediate Level	307	31.3	213	30
High Level	409	41.6	256	36.1

Table 1. *continued.*

Variable	Sport Participation			
	Yes	**Percentage %**	**No**	**Percentage %**
Family Income				
Low (less than €2,500 per month)	139	12.9	159	19.6
Intermediate (€2,500-5,500 per month)	597	55.6	482	59.4
High (more than € 5,500 per month)	338	31.5	171	21
Aggregate SES (N = 2058)[a]				
Low SES	249	21.5	251	27.9
Intermediate SES	560	48.3	466	51.8
High SES	350	30.2	182	20.2
Percentage of Peer Nominations of Sport Competence (N = 1007)[a]				
No Nominations (0%)	46	7.9	85	21.6
1 to 25% of Nominations	166	28.5	210	53.4
26 to 50% of Nominations	170	29.2	68	17.3
51 to 75% of Nominations	130	22.3	24	6.1
76 to 100% of Nominations	71	12.1	6	1.5

SES = socioeconomic status.
[a] For SES and sports competence, categories were created for descriptive purposes; in the analyses continuous measures were used.

Table 2. Pearson Correlations according to Gender.

Variables	1. Sport Participation	2. Sport Competence	3. Depressive Symptoms T2	4. Depressive Symptoms T3	5. SES
1. Sport Participation[a]	—	0.36**	-0.07*	-0.05	0.15**
2. Sport Competence	0.40**	—	-0.12**	-0.10**	0.12**
3. Depressive Symptoms T2	-0.12**	-0.15**	—	0.51**	-0.05
4. Depressive Symptoms T3	-0.12**	-0.14**	0.53**	—	-0.10**
5. SES	0.13**	0.11*	-0.02	-0.02	—

The top half shows correlations for girls while the bottom half shows correlations for boys.
SES = socioeconomic status, T2 = second measurement wave and T3 = third measurement wave.
Two-tailed significance **p<0.01, *p<0.05.
[a] Point-biserial correlation was conducted for sport participation because of the binary nature of this variable.

Table 3. Prediction of Depressive Symptoms at T2 (N = 960).

Variable	Adjusted R^2	B (SE)	p-value	CI (95%)
Sport Participation	0.04	-0.02 (0.02)	0.41	-0.06 to 0.02
Gender		-0.05 (0.02)	0.01	-0.09 to -0.01
Sport Competence		-0.04 (0.01)	0.001	-0.05 to -0.02
SES		-0.01 (0.01)	0.41	-0.02 to 0.01

SES = socioeconomic status, CI = Bias Corrected and Accelerated confidence intervals, SE = standard error, T2 = second measurement wave.
All continuous/interval predictors were z-transformed prior to analysis.

Table 4. Prediction of Depressive Symptoms at T3, adjusting for Depressive Symptoms at T2 (N = 785).

Variable	Adjusted R^2	B (SE)	p-value	CI (95%)
Sport Participation	0.30	0.02 (0.02)	0.28	-0.02 to 0.06
Gender		-0.08 (0.02)	0.001	-0.11 to -0.05
Sport Competence		-0.01 (0.01)	0.24	-0.03 to 0.01
SES		-0.02 (0.01)	0.05	-0.03 to -0.00
Depressive Symptoms T2		0.14 (0.01)	0.001	0.12 to 0.16

SES = socioeconomic status, CI = Bias Corrected and Accelerated confidence intervals, SE = standard error, T2 = second measurement wave and T3 = third measurement wave.
All continuous/interval predictors were z-transformed prior to analysis.

DISCUSSION

Three findings emerged from the current study. First, participation in sports was associated with current depressive symptoms but not depressive symptom change. Second, when peer-perceived sport competence was included in the model, the association between participation in competitive sports and current depressive symptoms was no longer statistically significant. Finally, interactions between sport participation, perceived sport competence, and gender were associated with neither current depressive symptoms nor depressive symptom change in adolescence.

Participation in both competitive and more broadly defined sports was associated with low current depressive symptom levels. This suggests that the association with depressive symptoms cannot be ascribed to the competitive element of some physical activities. The effect sizes were relatively weak and comparable with the ones observed in a previous study investigating the relationship between general PA and depressive symptoms in the same sample (Stavrakakis et al., 2012). Therefore, our hypothesis that focusing on the competitive element of sports might strengthen the association with depressive symptoms was not supported.

The reason why we evaluated this question was that it has been suggested that sports have an evolutionary origin (Lombardo, 2012), and that the competitive element of activities plays a role in subsequent hierarchy formations. The positive correlations observed in the

current study between sport participation and peer-perceived sport competence allude to this, i.e., peers regarded the adolescents participating in competitive sports as being more competent than non-sporters. The perceived competence can be considered an indication of social status, which has been linked to depressive symptoms (Price et al., 1994; Gilbert & Allan, 1998; Oldehinkel et al., 2007). Consistent with these findings, peer-perceived sport competence was cross-sectionally associated with depressive symptoms in the current study, and explained most of the variance observed in this association. This suggests that being perceived as not being very competent by peers might increase the likelihood of depressive symptoms regardless of participation in competitive sports. Interestingly, while the association between participation in competitive sports and depressive symptoms became non-significant after including peer-perceived sport competence in the model, the effect of more broadly defined PA remained significant. Hence, the ranking achieved according to peer-perceived sport competence may be a more important mediator of the effect of participation in competitive sports than of the effect of PA in general, with regard to depressive symptoms.

Not only the measurement of sport participation, but also that of perceived sport competence affected the results: when sport competence was assessed by teacher reports, it explained less of the effect of participation in competitive sports on depressive symptoms than when assessed by peer nominations. These diverging results for peer nominations and teacher evaluations could be due to sample size differences: peer nominations were collected in only part of the sample. Another explanation is that these two measures cover different aspects of perceived sport competence, as suggested by the only moderate correlations between the two. Perhaps teachers' evaluations are a more accurate and objective measure of adolescents' athletic competence than perceptions of peers. On the other hand, adolescents spend a lot of time with each other, so may have a better notion of their peers' actual competence than teachers. Because we were particularly interested in the hierarchy formation among adolescents, we consider peer nominations of sport competence as a better measure than teacher evaluations within the context of this study. Additionally, we did not know whether the peer perceptions of sport competence were based on school sports only or also on observations made outside the school setting. Considering the discrepancy between the peer perceptions and the teacher evaluations of sport competence observed in this study, it is possible that the perceptions of the peers and the teachers were partly based on different situations. It would be interesting for future studies to explore the influence of their teammates perceptions of sport competence on depressive symptoms, since they might differ from the perceptions of their schoolmates.

Regardless of its definition, sport participation did not predict change in depressive symptoms; apparently its benefits, if any, were not strong enough to affect mood in the longer term. The lack of prospective associations between sport participation and depressive

symptoms might indicate a reciprocal association between sport participation and depressive symptoms. Indeed, previous studies have shown not only that physically active individuals will be less likely to suffer from depressive symptoms, but also that individuals who suffer from depressive symptoms will be less physically active (Jerstad et al., 2010; Lindwall et al., 2011; Stavrakakis et al., 2012). Therefore, any long-term effects of sport participation on depressive symptoms might be counteracted by the fact that adolescents with many depressive symptoms are less likely to participate in sports (reverse causality/ inhibition hypothesis).

The Social Competition Hypothesis (Price et al., 1994) provides an interesting theoretical framework to predict depressive problems, and we tried to extend this theory to investigate whether hierarchy formations through ritual agonistic behaviors could be a possible explanation of the relationship between sport participation and depressive symptoms. We expected that adolescents who participated in competitive sports would report fewer depressive symptoms than non-sporters, and that the beneficial effects of sport participation would be especially strong for boys who were perceived as highly sport competent. However, the lack of interactions between sport participation, gender and perceived sport competence on depressive symptoms did not support this expectation. Perhaps other factors, such as the results of competitions (winning or losing), self-esteem and self-worth, or biological mechanisms (e.g., neurotrophin levels) are more important moderators of the relationship between sport participation and depressive symptoms than the external perceptions of an individuals' sport competence (Dishman et al., 2006; Buss, 2007; Laske et al., 2010). A further point that needs to be acknowledged is that our assumption that peer-perceived sport competence is an indication of social status is an oversimplification of a complex construct. Social status is multidimensional and can be operationalized in diverse ways (see: Linton, 1936; Gilbert et al., 1995; Anderson et al., 2001), and modern social hierarchies do not depend as strictly on ritual agonistic fighting as suggested in Price's Social Competition Hypothesis. Social hierarchies can also be formed by how much social attention is given to an individual by others (for example see: Baumeister & Leary, 1995; Leary & Baumeister, 2000), or through capacities that do not rely on physical abilities, such as intelligence (Nettle, 2003). Having a high status in non-sport domains might counteract the effect of a low peer-perceived sport competence status on depressive symptoms in adolescents and especially in boys, regardless of their sport participation levels. Some support for this counteracting of other social hierarchy dimensions has been shown in previous studies (Seroczynski et al., 1997; Oldehinkel et al., 2007).

Limitations

Our study has some limitations. First, some of the sports reported were uninformative with regard to the competitive element. Activities such as ballroom dancing, horse riding, or gymnastics can be competitive in specific circumstances, but are not necessarily so. Because we did not have information on the actual competitions that adolescents took part in, we used the frequency of these hard-to-categorize activities, assuming that competitive engagement requires a frequency of more than twice a week. This limitation could have led to an overestimation or underestimation of the proportion of competitive sporters. However, because using a broader definition of sports in the analysis hardly altered the results, this potential source of bias is probably not very influential. Second, peer evaluations of sport competence were not assessed at T3. Therefore, we could not investigate whether adolescents who regularly participated in sports improved their actual athletic competence and subsequently the perceptions of their peers and how these changes might have affected depressive symptom changes over time. Moreover, participants with missing data at T3 were more likely to be males, to participate in sports and to have more depressive symptoms at T2. Missing data were not accounted for in this study and it is possible that non-response might be directly caused by the adolescents' previous depressive symptoms. Therefore, our findings might not be accurately generalizable to the population. Furthermore, we based our hypotheses on a combination of two distinct evolutionary hypotheses, namely the evolution of sports and an evolutionary perspective of the development of depressive symptoms. The measurements used in TRAILS were not selected from an evolutionary perspective per se, and perhaps were not optimal to test the full extent of these theories. Therefore the negative findings observed in the current study might be explained by the less than optimal measures. Finally, we did not take into account the frequency, duration or intensity of sport participation. It is possible that only individuals who engage moderately or frequently in sports or PA experience fewer depressive symptoms (Sanders et al., 2000; Dunn et al., 2005; Goldfield et al., 2011). Although we cannot exclude this possibility, it has been previously shown that the frequency, duration and intensity of PA did not predict the onset of a first major depressive episode in adolescents (Stavrakakis et al., 2013), so a dose-response influence of PA or sport participation on depressive symptom levels seems unlikely.

CONCLUSION

Sport participation was inversely related to current depressive symptoms. This association might be explained by peer-perceived sport competence. However, we found no evidence that the interactions between peer-perceived sport competence, sport participation and gender predicted current depressive symptoms or depressive symptom change over time.

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SUPPLEMENTARY MATERIAL

Table A. Correlations in the Total Sample.

Variable	1.	2.	3.	4.	5.	6.	7.	8.
1. Competitive Sport	—							
2. Broader Definition of Sports	0.54**	—						
3. Peer Nomination of Sport Competence	0.42**	0.26**	—					
4. Teacher Evaluations of Sport Competence	0.22**	0.22**	0.27**	—				
5. Gender	0.33**	0.03	0.31**	0.01	—			
6. Depresive Symptoms T2	-0.14**	-0.10**	-0.17**	-0.10**	-0.19**	—		
7. Depressive Symptoms T3	-0.14**	-0.08**	-0.18**	-0.14**	-0.24**	0.54**	—	
8. SES	0.12**	0.18**	0.09**	0.11**	-0.03	-0.04	-0.06*	—

SES = socioeconomic status, T2 = second measurement wave and T3 = third measurement wave. Shown here are Pearson correlations between the variables. Point-biserial correlations were conducted for sport participation (both competitive and broad definitions) and gender because of the binary nature of these variables. Because the teacher's evaluations of sport competence are in an ordinal scale, Spearman Rho correlations were calculated. The correlations between the teacher evaluations of sport competence and dichotomous variables (both sport participation and gender) were converted to rank-biserial correlations using the following formula: $rb = (2/n)^{*}(Y1-Y0)$ where Y1 and Y0 are the mean scores for the group with 1 and 0 respectively (Kraemer, 1982).

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Table B. Prediction of Depressive Symptoms at T2 by Competitive Sport Participation, Teacher Evaluations of Sport Competence and Gender (N = 1396).

Step	Variable	Adjusted R^2	B (SE)	p-value	CI (95%)
1	Sport Participation	0.04	-0.03 (0.02)	0.05	-0.06 to 0.001
	Gender		-0.07 (0.02)	0.001	-0.10 to -0.04
	Sport Competence		-0.03 (0.01)	0.002	-0.04 to -0.01
	SES		-0.004 (0.01)	0.63	-0.02 to 0.01
2	Sport Participation* Gender* Sport Competence	0.04	-0.01 (0.03)	0.81	-0.06 to 0.05

SES = socioeconomic status, CI = Bias Corrected and Accelerated confidence intervals, SE = standard error, T2 = second measurement wave.
All continuous/interval predictors were z-transformed prior to analysis.
Step 1: shows the main effects of the predictors without interactions (adjusted for SES) with current depressive symptoms.
Step 2: shows the three-way interaction of sport participation, teacher evaluations of sport competence and gender (adjusted for SES) with current depressive symptoms. In this model the three-way interaction, all two-way interactions (not shown here) and main effects of the predictors (not shown here) were included.

Table C. Prediction of Depressive Symptoms at T3 by Competitive Sport Participation, Teacher Evaluations of Sport Competence and Gender, adjusting for Depressive Symptoms at T2 (N = 1134).

Step	Variable	Adjusted R^2	B (SE)	p-value	CI (95%)
1	Sport Participation	0.33	-0.01 (0.02)	0.55	-0.04 to 0.02
	Gender		-0.09 (0.02)	0.001	-0.12 to -0.06
	Sport Competence		-0.02 (0.01)	0.003	-0.04 to -0.01
	SES		-0.02 (0.01)	0.02	-0.03 to -0.001
	Depressive Symptoms T2		0.14 (0.01)	0.001	0.12 to 0.15
2	Sport Participation* Gender* Sport Competence	0.33	0.02 (0.04)	0.65	-0.05 to 0.08

SES = socioeconomic status, CI = Bias Corrected and Accelerated confidence intervals, SE = standard error, T2 = second measurement wave and T3 = third measurement wave.
All continuous/interval predictors were z-transformed prior to analysis.
Step 1: shows the main effects of the predictors without interactions (adjusted for SES and baseline depressive symptoms) with depressive symptom change.
Step 2: shows the three-way interaction of competitive sport participation, teacher evaluations of sport competence and gender (adjusted for SES and baseline depressive symptoms) with depressive symptom change. The three-way interaction, all two-way interactions (not shown here) and main effects of the predictors (not shown here) were included in this model.

Table D. Prediction of Depressive Symptoms at T2 by Sport Participation according to a Broader Definition, Peer Nominations of Sport Competence and Gender (N = 960).

Step	Variable	Adjusted R^2	B (SE)	p-value	CI (95%)
1	Sport Participation	0.05	-0.06 (0.03)	0.01	-0.11 to -0.02
	Sport Competence		-0.03 (0.01)	0.001	-0.05 to -0.02
	Gender		-0.06 (0.02)	0.003	-0.09 to -0.01
	SES		-0.001 (0.01)	0.68	-0.02 to 0.01
2	Sport Participation* Gender* Sport Competence	0.05	0.11 (0.07)	0.13	-0.02 to 0.24

SES = socioeconomic status, CI = Bias Corrected and Accelerated confidence intervals, SE = standard error, T2 = second measurement wave.
All continuous/interval predictors were z-transformed prior to analysis.
Step 1: shows the main effects of sport participation, sport competence and gender (adjusted for SES) with current depressive symptoms.
Step 2: shows the three-way interaction of sport participation, peer nominations of sport competence and gender (unadjusted) with current depressive symptoms. In this model the three-way interaction, all two-way interactions (not shown here) and main effects of the predictors (not shown here) were included.

Table E. Prediction of Depressive Symptoms at T3 by Sport Participation according to a Broader Definition, Peer Nominations of Sport Competence and Gender, adjusting for Depressive Symptoms at T2 (N = 785).

Step	Variable	Adjusted R^2	B (SE)	p-value	CI (95%)
1	Sport Participation	0.30	-0.02 (0.03)	0.42	-0.07 to 0.04
	Sport Competence		-0.01 (0.01)	0.52	-0.02 to 0.01
	Gender		-0.08 (0.02)	0.001	-.011 to -0.05
	SES		-0.01 (0.01)	0.12	-0.03 to 0.01
	Depressive Symptoms T2		0.14 (0.01)	0.001	0.12 to 0.16
2	Sport Participation* Gender* Sport Competence	0.30	0.01 (0.06)	0.89	-0.11 to 0.13

SES = socioeconomic status, CI = Bias Corrected and Accelerated confidence intervals, SE = standard error, T2 = second measurement wave and T3 = third measurement wave.
All continuous/interval predictors were z-transformed prior to analysis.
Step 1: shows the main effects of sport participation (adjusted for baseline depressive symptoms and SES) with depressive symptom change.
Step 2: shows the three-way interaction of sport participation, peer nominations of sport competence and gender (adjusted for baseline depressive symptoms at T2 and SES) with depressive symptom change. The three-way interaction, all two-way interactions (not shown here) and main effects of the predictors (not shown here) were included in this model.

Table F. All Sports (sport1, sport2, sport3, sport4) classified according to decision on Competitiveness, Non-Competitiveness and Uncertain Competitiveness.

Decision	# of Sport Activities	Frequencies of Participants for each of Four Sports			
		Sport1	Sport2	Sport3	Sport4
Sum Competitive	48	1008	332	117	74
Sum Non-Competitive	17	647	541	280	135
Sum Ambiguous	65	59	27	15	9
Total	130	1714	900	412	218