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Physical activity, bodyweight, health and fear of negative evaluation in primary school children

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Fear of negative evaluation (FNE) is regarded as being the core feature of social anxiety. The present study examined how FNE is associated with physical activity (PA), body mass index (BMI) and perceived physical health (PPH) in children. Data were collected in a sample of 502 primary school children in first and fifth grades taking part in a randomized-controlled trial ("Kinder-Sportstudie KISS") aimed at increasing PA and health. PA was assessed by accelerometry over 7 days, PPH by the Child Health Questionnaire and FNE by the Social Anxiety Scale for Children – Revised. BMI *z*-scores were calculated based on Swiss norms. Cross-sectional analyses indicated that children high in FNE exercised less, reported lower levels of PPH and had higher BMI *z*-scores ($P<0.01$). Using mixed linear models, the school-based PA intervention did not manage to reduce FNE scores. Overweight children demonstrated a greater increase in FNE ($P<0.05$) indicating that enhanced weight may be a risk factor for FNE. In conclusion, the associations among high FNE, low PA and increased BMI should be considered when promoting an active lifestyle in children.

Fear of negative evaluation (FNE) is defined as "apprehension about others' evaluations, distress over their negative evaluations, avoidance of evaluative situations, and the expectation that others would evaluate oneself negatively" (Watson & Friend, 1969, p. 449). Along with anxiety sensitivity and injury/illness sensitivity, FNE is one of three fundamental fears thought to cause more general fears, anxiety and psychopathologies (Reiss & McNally, 1985). In particular, it is regarded as being the core feature of social anxiety (SA). Specifically, "fear of negative evaluation pertains to the sense of dread associated with being evaluated unfavourably while anticipating or participating in a social situation, whereas social anxiety pertains to affective reactions to these situations" (Weeks et al., 2005, p. 179).

Because of its clinical relevance, SA has received widespread interest in the past few years (e.g. Essau et al., 1999; Khalid-Khan et al., 2007). Accordingly, epidemiological assumptions on FNE have to be derived from SA research. Following recent reviews, the prevalence rates of SA in youth range from 0.08% to 4% (Cartwright-Hatton et al., 2006; Khalid-Khan et al., 2007). About every third to fifth child shows symptoms of a subclinical form or shyness (Petermann, 1997). However, when looking at young children, generalization of epidemiological findings on SA to FNE requires caution. While the onset of clinical SA most commonly lies between 10 and 13 years (Greist, 1995), fundamental dimensions of SA, especially FNE, have already been observed in prepubertal children (Spence et al., 2001; Schniering & Rapee, 2002).

SA in childhood and adolescence usually goes along with comorbid psychopathology. According to the Bremen Youth Study (Essau et al., 1999), strong associations are found with other anxiety disorders, substance abuse, affective, eating and psychosomatic disorders. Furthermore, symptoms like dizziness, headache, feelings of sickness and back pains are frequently reported. In addition, epidemiologic findings in adult samples show that being obese is positively related to SA (Petry et al., 2008).

From a therapeutical point of view, physical activity (PA) is often regarded as a possibility to prevent or reduce fears and anxiety (Woll & Bös, 2004). Referring to this, the underlying mechanisms remain poorly understood. Psychological factors like an enhanced self-concept (Ekeland et al., 2004) as well as hormonal changes (Broocks, 2005) are discussed. Following a review of the pertinent empirical literature, there is a small effect in favor of PA in reducing anxiety scores in the general population of children and adolescents (Larun et al., 2006). In-line with these findings on general anxiety, it seems reasonable that PA might reduce FNE. In addition to the mechanisms discussed above, the possibility to experience joyful social interactions during sporting activities could play a favorable role.

However, research does not yet allow to establish a causal link between PA and FNE. A few correlative studies have focused on SA and PA. In a university student sample, Pinto and Sarkin (1996) found that interpersonal deficits (as SA) were related to reduced time spent in exercise or active recreation. In a nationally representative adult sample in the United States, regular PA was associated with a lower rate of SA (Goodwin, 2003).

In summary, FNE affects school children at all ages. While research on FNE is sparse, more data exist in the related field of SA. A few cross-sectional studies have examined the association between SA and PA, mostly focusing on adult populations. To our knowledge, corresponding studies on FNE and PA in childhood populations do not exist. We aimed to overcome this existing gap in research by focusing our attention on three research questions. Firstly, we wished to determine the cross-sectional association between PA and FNE in children aged 7–12 years. Based on data in adults with SA, we hypothesized that FNE would be associated with lower levels of PA. Furthermore, considering the occurrence of psychosomatic and health complaints in SA patients, the present study examined whether FNE was related to reduced perceived physical health (PPH) and/or increased body mass index (BMI). Secondly, we hypothesized that participation in a school-based PA intervention would reduce FNE. Thirdly, by incorporating longitudinal data obtained in the control group, we examined whether low PA and increased BMI predicted future FNE to identify potential risk factors.

Our empirical data were drawn from a school-based PA program over one academic year aiming at improving health and fitness in first and fifth grade children ("Kinder-Sportstudie KISS").

Method

Study design and participants

The study was performed in two provinces of Switzerland that harbor 919 elementary schools. Of these, 95 fulfilled our stratification criteria, i.e. a clear rural or urban localization, and a prevalence of 10–30% children from ethnic minorities. These strata were chosen in order to be representative for the Swiss population. Recruitment of participating schools (i.e. cluster randomization) was based on the willingness of these 95 elementary schools to be randomized either to an intervention group with a PA curriculum or a control group. Fifteen schools with a total of 27 classes were randomized by a random-number table. Sixteen classes in nine schools located in six communities were randomized to the intervention group (INT), and 11 classes in six schools in other communities of the same provinces were randomized to the control group (CON). A higher number of schools in the INT than in the CON group were chosen to gain more experience with the intervention. In summary, 502 children were assessed at baseline; 233 were in first grade (6–8 years) and 269 were in fifth grade (10–12 years). Gender was evenly distributed. Post-treatment assessments included 449 children.

Informed consent for the questionnaires and all measurements was necessary for all participants and was given by the children and a parent. The study was approved by the Ethics Committees of the University of Basel, the University of Zürich, as well as the cantonal ethical committee of Aargau, Switzerland.

Data collection

All questionnaires and measurements were conducted at baseline (August 05) and then again after one academic year (June 06).

To assess PA, all children constantly wore an accelerometer around the hip over a period of 7 days. Weight and height were measured at the schools. The Child Health Questionnaire (CHQ-PF50) and the Social Anxiety Scale for Children – Revised (SASC-R.D) for the fifth graders were distributed to the children at school in coded envelopes. The fifth graders filled in the SASC-R.D at home. The parents completed the CHQ-PF50. Both questionnaires were brought back to school some days later, where they were collected by the teachers. The SASC-R.D for the first graders was conducted at school as an oral interview. Questions and answers for the questionnaire were read to the child and the answers were filled in by one researcher. All procedures were completed by the staff of the Institute of Exercise and Health Sciences from the University of Basel.

Measures

FNE

FNE was measured using the Fear of Negative Evaluation scale (FNE-scale) from the German version of the SASC-R.D (Melfsen & Florin, 1997). The FNE scale consists of eight descriptive self-statements regarding fears, concerns or worries about negative evaluations from peers. Each item is rated on a five-point Likert scale, ranging from 1 *(not at all)* to 5 *(all the time)*. The psychometric properties of the German version of the FNE-scale have been shown to be adequate in samples of school children (age: 8–16 years) (Melfsen, 1998). Internal consistency ($\alpha = 0.83$) and test–retest reliability ($r = 0.84$) were satisfactory. Significant correlations to related measures confirmed construct validity (e.g. German version of the Social Anxiety Inventory for Children: $r = 0.59$; German version of the Anxiety Questionnaire for Children: $r = 0.49$). Psychometric analyses within the present study demonstrated a reasonable internal consistency ($\alpha = 0.79$).

PA

PA was assessed by accelerometers (MTI/CSA 7164, Actigraph), which were constantly worn around the hip over 7 days. The sampling time was set at 1 min, and data were included if at least 4 full days (at least 3 weekdays for 12 h and 1 weekend day for 10 h) of measurements were available (Freedson et al., 2005). Children wore the accelerometers a mean of 13.4 h/day during waking hours. The Actigraph has been validated in children against spiroergometry ($R^2 = 0.74$) and energy expenditure measured by doubly labelled water

($R^2 = 0.75$) and was found to be accurate (Freedson et al., 2005). PA was calculated by multiplying the mean of weekday counts $\times$ 5 and the mean of weekend counts $\times$ 2 and dividing the sum by 7, and was expressed as counts/min.

Anthropometry and body composition

BMI was calculated with the individual's bodyweight divided by the square of his or her height. Standing height was measured by a wall-mounted stadiometer (Seca, Basel, Switzerland, accuracy 0.2 cm) and body weight was determined using an electronic scale (Seca, accuracy 0.05 g). Because of the wide age range of our children, BMI *z*-scores were calculated based on Swiss national norm values (Prader et al., 1989). Overweight was defined when BMI exceeded the 90th percentile.

PPH

PPH was operationalized using the physical summary score from the German version of the CHQ-PF50 (Landgraf et al., 1998). The CHQ-PF50 is an instrument evaluating children's health-related quality of life from a parent's view. The physical summary score includes a broad spectrum of child- and family-focused health areas divided into physical functioning, role/social limitations as a result of PPH, bodily pain/discomfort and general health perception. Items require participants to respond on a Likert-type scale, with higher scores indicating better health status. Psychometric properties of the German Version of the CHQ-PF50 justify application in pediatric outcome studies (Warschburger et al., 2003). Internal consistency was higher than 0.70 in all hypothesized scales. Within the present study, the internal consistency was reasonable for physical functioning ($\alpha = 0.95$), bodily pain ($\alpha = 0.82$), and role/social limitations ($\alpha = 0.94$) and low for general health ($\alpha = 0.34$).

PA intervention

The intervention took place over 1 academic year. The intervention was based on daily physical education classes (two additional lessons of 45 min each, given by physical education teachers), several short activity breaks per day during academic lessons, PA homework and playgrounds adapted and improved to encourage activities during school breaks, before and after school. The three regular physical education classes were given by the class room teachers, but the content of the lessons was provided by the physical education teachers. The CON group continued to follow their usual school curriculum including three physical education lessons per week (45 min each), but none of the intervention arrangements mentioned above.

For more detailed information concerning the Kinder-Sportstudie KISS, the reader is referred to the design paper (Zahner et al., 2006).

Statistical analysis

One-way analyses of variance (ANOVA) were used to evaluate between-condition differences at baseline. To allow a comparison between FNE and the secondary study variables at baseline, Pearson's correlation analyses adjusted for grade and gender were performed. With regard to data distribution, Spearman's correlation coefficient was used for analyses containing PPH. Partial correlation analyses were conducted to control for potential confounding effects caused by secondary study variables. For the intervention analyses, accounting for the clustered study design, we used a mixed linear model to compare FNE delta scores between the INT and the CON group. We designated group, grade and sex as fixed effects and school as the random effect. We included FNE baseline scores as a covariate in the model. Preliminary tests were performed to identify possible sex-by-treatment or grade-by-treatment interaction effects for the main outcome variable, but none were statistically significant. Therefore, mixed models with only main effect terms are presented.

To evaluate whether low PA and high BMI were risk factors for future FNE similar mixed models were constructed. To avoid the confounding effects caused by the intervention, we focused on the control group.

Results were considered significant at $P < 0.05$. Effect sizes (Cohen, 1988) were interpreted as negligible (< 0.15), small (≥ 0.15 and < 0.40), medium (≥ 0.40 and < 0.75) and large (≥ 0.75). All analyses were performed using SPSS 13.0.

Results

Randomization and baseline equivalence

The randomization process performed was successful in creating equivalent groups at baseline. Using one-way ANOVA the control and intervention group did not differ by FNE ($P = 0.75$), BMI ($P = 0.73$), PA ($P = 0.43$) or PPH ($P = 0.48$).

Program compliance

Program compliance was evaluated with a short feedback form distributed to teachers and children. Two-thirds (66%) of the children stated that they had done their daily PA homework often or always. The majority of intervention teachers provided exercise-related games during school breaks (79%) and short activity breaks during academic lessons (71%) at least three to four times a week. Compliance with daily physical education lessons was guaranteed by mandatory school curriculum.

Descriptive data

Table 1 presents the mean scores for the main study variables at baseline by gender and grade. Gender was evenly distributed (51% female vs 49% male). Regarding ethnicity, 63% of the children had Swiss parents, 23% had two foreign parents and 14% had one Swiss parent and one foreign parent. Analyses of parents' educational background revealed that 15% had no professional qualification at all, 47% had qualified successfully from their vocational training and 38% had a university diploma.

The means for FNE varied between 2.1 and 2.4 (*seldom* to *sometimes*). FNE was significantly higher in girls, $F(1, 472) = 18.1$, $P < 0.01$, $d = 0.29$. Fifth graders showed higher FNE than first graders, $F(1, 472) = 19.5$, $P < 0.01$, $d = 0.43$.

Using BMI cut-offs based on a Swiss reference population (Prader et al., 1989), about one-quarter

Table 1. Subjects' characteristics for at baseline shown separately for gender and age groups

Variables	Mean (SD)				
	Girls ($n = 258$)	Boys ($n = 244$)	First grade ($n = 233$)	Fifth grade ($n = 269$)	Total ($n = 502$)
Age (years)	9.2 (2.2)	9.3 (2.2)	6.9 (0.3)	11.1 (0.6)	9.3 (2.2)
Fear of negative evaluation (range: 1–5)	2.4 (0.7)	2.2 (0.7)	2.1 (0.7)	2.4 (0.7)	2.3 (0.7)
Body mass index (kg/m^2)	17.1 (2.5)	17.1 (2.8)	16.1 (2.2)	17.9 (2.8)	17.1 (2.7)
Physical activity (average counts per min)	666 (182)	797 (212)	809 (209)	673 (188)	729 (207)
Perceived physical health (T-scores)	53.6 (7.9)	53.5 (8.0)	54.4 (6.6)	52.8 (8.8)	53.6 (8.0)

Samples sizes correspond to measurement of fear of negative evaluation and may vary slightly from other variables because of missing values. Data are mean values (SD).

Table 2. Correlations of study variables at baseline adjusted for age and gender

Variable	1[†]	2[†]	3[†]	4[‡]
1. FNE				
Correlation coefficient	1	0.14**	−0.2**	−0.16**
Effect size		0.28	0.4	0.32
N		467	359	445
2. BMI (*z*-scores)				
Correlation coefficient		1	−0.15**	0.06
Effect size			0.3	0.12
N			375	449
3. Physical activity				
Correlation coefficient			1	0.13*
Effect size				0.26
N				350
4. Physical health				
Correlation coefficient				1
Effect size				
N				

[†]Pearson's correlation.
[‡]Spearman's correlation.
*$P<0.05$, **$P<0.01$. FNE, Fear of negative evaluation; BMI, body mass index.

was either overweight or obese (26%). Gender and the examined age groups did not differ.

Overall PA was higher in boys, $F(1, 389) = 42.9$, $P<0.01$, $d = 0.67$. Furthermore, the overall PA scores indicated that fifth graders were less active than first graders, $F(1, 389) = 44.7$, $P<0.01$, $d = 0.68$. For PPH, no gender and age differences were found.

Cross-sectional results

The cross-sectional results are presented in Table 2. In-line with our hypothesis FNE was negatively correlated with PA. Likewise, there was a negative correlation between FNE and PPH. In other words, children with high FNE exercised less and reported lower levels of PPH. Furthermore, BMI *z*-scores

Table 3. Intervention effects on fear of negative evaluation (FNE)

Variable	Condition	*n*	Pre M ± SD	Post M ± SD	*F* condition	*P*
FNE	Intervention	277	2.3 (0.7)	2.3 (0.8)	1.7	0.23
	Control	172	2.3 (0.7)	2.2 (0.8)		

Results are from a mixed-model analysis. Group, grade and sex were designed as fixed effects, school as random effect. FNE scores at baseline were included as a covariate.

were positively associated with FNE, indicating that overweight and obese children experienced more FNE. These correlations correspond to a medium adjusted effect size for PA and small adjusted effect sizes for BMI *z*-scores and PPH. Gender- and age-specific analyses yielded to the same conclusion. Based on the significant correlations among the secondary study variables (see Table 2), partial correlation analyses were conducted controlling for potential confounding effects of PA, BMI *z*-scores and PPH. The negative correlation between FNE and PA remained significant after adjusting for BMI *z*-scores, $r(351) = -0.18$, $P<0.01$, $d = 0.37$. Controlling for PA, FNE was still positively correlated to BMI *z*-scores, $r(351) = 0.1$, $P<0.05$, $d = 0.2$. There was a significant negative correlation between FNE and PPH after adjusting for PA, $r(309) = -0.11$, $P<0.05$, $d = 0.37$, as well as for FNE and PA after adjusting for PPH, $r(309) = -0.17$, $P<0.01$, $d = 0.22$.

Intervention effects

To evaluate whether the KISS intervention reduced FNE, a mixed linear model was conducted. No significant intervention effect was found (see Table 3). Mixed model analyses looking at male and female first and fifth graders separately did not find any intervention effects either.

Longitudinal analyses

In a last step, we evaluated whether low PA and high BMI were potential risk factors for future FNE. To

Table 4. Change in fear of negative evaluation (FNE) in the control group comparing overweight and obese children to normal weight children

Variable	Condition	*n*	Pre M ± SD	Post M ± SD	Pre 95% CI	Post 95% CI	*F* condition
FNE	Normal weight	126	2.3 (0.7)	2.1 (0.7)	2.18, 2.41	1.94, 2.19	4.46*
	Overweight and obese	45	2.3 (0.6)	2.5 (0.7)	2.11, 2.50	2.24, 2.67	

Results are from a mixed-model analysis. Group, grade and sex were designed as fixed effects, school as random effect. FNE scores at baseline were included as a covariate.
$^*P<0.05$.

avoid confounding effects caused by the intervention, we focused on the control group.

Mixed model analyses showed no significant effect for PA at baseline on change in FNE, $F(1, 118) = 0.65$, $P>0.05$. BMI at baseline significantly predicted change in FNE, $F(1, 165) = 5.35$, $P<0.05$; children with a high BMI faced a greater increase in FNE. Further mixed model analyses compared overweight children with normal-weight children with regard to change in FNE. A significant effect for group was found (see Table 4). Thus, overweight is a potential risk factor for future FNE.

Discussion

Corresponding to our first hypothesis, we found that children with high FNE exercise less, report lower levels of PPH and are more overweight. Our second hypothesis was not confirmed, i.e. the PA intervention did not reduce FNE. Our third hypothesis was partly confirmed; while high BMI scores predicted an increase in FNE, PA did not show an influence.

Our finding from the cross-sectional analysis, that high FNE is associated with low PA, agrees with previous studies on SA and PA obtained in adults (e.g. Pinto & Sarkin, 1996; Goodwin, 2003). This relationship may be explained by considering typical settings in which childhood PA is performed. Norton et al. (2000) stated that sporting situations are frequently outcome-oriented and lend themselves to perceptions of negative evaluation. Even non-competitive PA is often observed and evaluated by others. These circumstances may cause discomfort in children who are concerned of being evaluated by others. In a study by Beidel et al. (1999), children suffering from SA were asked to report the social situations they feared most. Thereby, 61% reported at least moderate stress for musical or athletic performances. These feelings of anxiety may thus lead to avoidance of sporting situations. A recent study provides further information on how PA may be associated with FNE (Ridgers et al., 2007). Their data reveal a negative relationship between FNE and perceived athletic competence. In this context, Vernberg et al. (1992) noted that unpleasant experiences that reinforce low perceptions of competence often lead to greater FNE, which in turn could encourage avoidance behaviors.

Contrary to our hypothesis, longitudinal analyses did not detect low PA as a risk factor for FNE. However, in comparison with a number of European countries and with the United States (Moses et al., 2007), the PA scores obtained in the present sample can be considered as high. Thus, a ceiling effect with a small variation could be possible explanation for this finding. In more sedentary children low PA might predict FNE.

Our longitudinal data revealed that overweight children showed greater increases in FNE. These findings coincide with a recent prospective study on anxiety and obesity (Anderson et al., 2007), indicating that female obese adolescents were at increased risk for development of anxiety disorders. Discussing their results, the authors conclude that social pressure for thinness and greater body dissatisfaction might make overweight adolescents more vulnerable to anxiety disorders. These factors could also help to explain why overweight children in the present study developed higher FNE. While Anderson et al. (2007) detected an enhanced risk for the female population, our longitudinal analyses did not find any gender-specific effects.

However, our baseline data emphasizes that FNE seems to be a greater concern in girls. These findings are consistent with previous research conducted in primary school children (Ridgers et al., 2007) and among early adolescents (Vernberg et al., 1992). The reasons for these gender differences are not fully understood yet. According to La Greca and Lopez (1998), girls may internalize problems more than boys, thus leading to a greater sensitivity to negative evaluations. Looking at age-specific differences, class comparisons showed that FNE was higher in fifth graders than in first graders. These findings coincide with prevalence data indicating that SA is more common in adolescence than in childhood (Greist, 1995). The increase in FNE might be related to developmental tasks, which typically occur in early adolescence and are accompanied by a heightened sense of being evaluated. In this context, Eisen (2007) refers to making new friends, obtaining peer acceptance, establishing romantic relationships and dealing with an increase in expectations and demands at school.

Similar to Beidel et al. (1999), who focused on childhood SA, our cross-sectional results revealed that high FNE was associated with low PPH. Overall, PPH might play a crucial role and could be an underlying variable influencing both FNE and time spent in PA.

A central question of the present study was whether PA reduces FNE. Compared with the control group, the PA intervention did not have any influence on FNE. The absence of a significant effect might have been caused by the fact that the FNE values at baseline were already quite low and the variability was small. In other words, a PA intervention in a clinical setting might show stronger effects. The lack of an intervention effect on FNE could be related to the duration of the study. A longer intervention, including the transition from childhood to adolescence, when FNE (Greist, 1995) and physical inactivity (Kimm et al., 2002) become more prevalent, might have demonstrated other results. To our knowledge, there are no intervention studies directly examining whether PA reduces FNE or SA. Despite this lack of empirical evidence, PA is believed to be a component in treating SA. Clinical reports indicate that multimodal therapies sometimes include exposures to playing individual and team sports, jogging and working out in a health club (Chambless & Hope, 1996). However, considering PA as a possible treatment for FNE or SA, the underlying mechanisms remain unclear.

Regarding the pharmacologic treatment of SA, researchers (e.g. Beidel et al., 2001) stress the effectiveness of selective serotonin reuptake inhibitors. This indicates that the serotonergic function plays a role in the etiology of SA. In turn, PA has been shown to increase serotonin levels (cf. Broocks, 2005). Therefore, one would expect PA to influence FNE positively. Possibly, PA has to be performed at a certain intensity so that increased serotonin levels and enhanced aerobic fitness can reduce FNE. These considerations regarding exercise intensity may help to explain why the KISS intervention failed to reduce FNE. The KISS study was designed as a broad exercise program. In addition to aerobic exercise, the program also included motor tasks, strength training and play activities. With regard to the serotonergic function, greater therapeutical benefits may be derived from more specific programs focusing on endurance sports as for example jogging, swimming or team sports involving a lot of running.

The present findings indicate that FNE is negatively associated with PA. Therefore, physical educators should look out for children who might be suffering from FNE and consequently adapt their methodical-didactical approach. Goal oriented teaching styles, emphasizing performance and social comparison, may lead to discomfort in children high in FNE and eventually to avoidance of PA. In turn, a task-oriented learning environment, enabling a self-referenced feedback, might lead to more enjoyment, a higher sense of achievement, less concerns about being evaluated negatively and consequently fewer dropouts (cf. Harwood & Biddle, 2002).

Highlighting the association among FNE, PPH, BMI *z*-scores and PA, the present study addressed an innovative and important research topic. By integrating cross-sectional, longitudinal and intervention data we aimed to cover a wide range of questions. Because of the careful selection of participating schools and based on the sample size, the present findings are representative for the Swiss population. Furthermore, a strength of the current study was that PA was measured objectively using accelerometers. Thus, we hoped to overcome the methodological shortcomings typically occurring when young children are asked to fill in retrospective questionnaires (Going et al., 1999). The limitations of the present study should be recognized and addressed in future studies. For the main part, one must bear in mind that the KISS study was designed to examine a wide range of research topics. FNE was only one issue among various, mainly medical, questions. Because of the limited interview time, only one scale on FNE was integrated in the study. A future study focusing on FNE could incorporate additional related psychometric measures to gain a broader view on FNE. Thus, the role of self-esteem, perceptions of competence and sports enjoyment should be established. Furthermore, a supplemental measure on SA as well as inputs from significant others (e.g. parents, teachers) are recommended. From a clinical point of view, PA-based studies with children high in FNE are required. Different types of sports and exercise forms could be compared with respect to their potential to influence FNE. While the exercise units in the KISS intervention were aimed at a general population, a future study could adapt the implemented PA toward the needs of a population high in FNE. Concentrating on methodological aspects, the use of a structural equation model could help evaluate reciprocal influences among PA, BMI *z*-scores, PPH and FNE.

Perspectives

The present study aimed to overcome an existing lack of research regarding FNE in children. We found a significant association among PA, BMI or PPH on the one hand and FNE on the other. While more research on the possible therapeutical benefits of PA needs to be conducted, certain conclusions may be drawn from this study. Our results suggest that overweight can predict the development of FNE. In

turn, there may be a risk that FNE results in avoidance of sporting activities. The latter is a major concern and indicates that the phenomena of FNE should be taken into account while trying to promote a permanent active lifestyle.

Key words: Fear, Anxiety, Exercise, Health, Child, Body weight.

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