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The Association between Bullying Victimization in Childhood and Fibromyalgia. Data from the nationwide Finnish Health and Social Support (HeSSup) study based on a sample of 64,797 individuals

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Abstract

Background: Fibromyalgia is a functional pain syndrome presenting with various psychological symptoms. Several studies have shown that adverse life events are associated with fibromyalgia. The aim of the current study is to explore the association between self-reported bullying victimization in childhood and self-reported fibromyalgia in adulthood.

Methods: The basic study setting is cross-sectional - with focused use of retrospective data - derived from a large on-going postal follow up survey (sample N = 64,797) initiated in Finland in 1998. Only respondents having answered the questions on fibromyalgia in both follow ups in 2003 and 2012 were included (N = 11,924). Severity of bullying was divided into three groups starting from no bullying followed by minor and severe bullying. Covariates having shown statistically significant associations with fibromyalgia in cross tabulation using Pearson's chi-squared test were included in the final multiple logistic regression analyses.

Results: In our study, 50.6% of the respondents reported victimization of minor and 19.6% of severe bullying in childhood. Participants reporting fibromyalgia in adulthood reported more bullying, and in females alone this association was statistically significant ($p = .027$). In multiple logistic regression analysis statistically significant associations between bullying victimization in childhood (reference: no bullying) and fibromyalgia were found: adjusted odds ratio (OR) for minor bullying was 1.35 (95% CI 1.09 – 1.67) and for severe bullying 1.58 (95% CI 1.21 – 2.06). However, in log-linear and logistic regression interaction models the association between bullying and fibromyalgia was not statistically significant when depression was included in the models.

Conclusions: Our results suggest that peer bullying victimization might be associated with fibromyalgia. However, in logistic log linear and logistic interaction models there was no statistically significant association when depression was included. As a result, there is need for further, preferably prospective cohort studies. The findings also emphasize the importance of actions to prevent childhood bullying.

Keywords: fibromyalgia, peer bullying, cross-sectional, childhood adversity

Introduction

Fibromyalgia, classified as a functional syndrome, is characterized by central sensitization (1,2). Central sensitization refers to altered processing of pain in the central nervous system and can become a lifelong disorder. Various genes and neurotransmitters are associated with pain sensitivity. Failure in breakdown or binding of these transmitters or inflammatory mediators can result in increase of pain sensitivity. (1)

In recent studies, a prevalence of 2 – 5% has been reported for fibromyalgia (3-5). In a study published in 1991 using Yunus diagnostic criteria, the prevalence of fibromyalgia was reported to be only .75% in Finland (6). The current prevalence of fibromyalgia in Finland is unknown as no recent studies on this topic are available. Traumatic incidents, sexual and physical violence, severe illness, surgical procedures, and stressful life events are associated with fibromyalgia (7-12). Furthermore, childhood adversities are risk factors for chronic pain and fibromyalgia (13,14). Neurotransmitters mediating pain also have an effect on mood, and they are linked to psychiatric disorders, including depression, which is a common comorbidity of fibromyalgia (1). Moreover, individuals with genetic risk factors for the fibromyalgia syndrome and depression are particularly vulnerable to triggering events (15).

Peer bullying is one of the most common childhood adversities, but the prevalence of childhood peer bullying depends on country and definition (16). Moreover, there are several definitions for peer bullying in childhood. According to the Olweus definition bullying is defined as follows: ‘A student is being bullied or victimized when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students’ (17). Lereya et al. defined it as a physical or verbal abuse and systematic social exclusion committed by children (18). In Finland, the term school bullying is more commonly used to describe peer bullying among school-aged children.

In a British cohort study from the 1950s, prevalence of occasional childhood bullying was 28% (19). In Finnish surveys, 3.7 – 5% of the girls and 6 – 9.4% of the boys have reported regular

bullying victimization (20,21) and 47.8% of the boys and 36.2% of the girls reported it to have happened sometimes (21). Similar exposure rates were reported in a study, conducted simultaneously in 40 countries. The prevalence of bullying victimization was 13.3% among boys and 8.8% among girls in Finland in that study. (22)

Effects of childhood bullying have been studied mainly among children and young adults in cross-sectional settings. Children being bullied present with more sleep disturbances, bed wetting, sadness, headaches and abdominal pain (23). On the other hand, the association has been suggested to be relatively weak (24).

There are only few studies reaching beyond adolescence and addressing the long-term impact of bullying. In a Finnish birth cohort study, frequent bullying was a risk factor for suicidal behaviour (21). Furthermore, bullying victimization in childhood has similar, and in some cases worse, long-term adverse effects on mental health, than being a target of maltreatment (18). In a British birth cohort study, victims of bullying had higher rates of depression, anxiety disorder and suicidality. The victims also had fewer social relationships and had poorer perceived quality of life at the age of 50 (19). In an Australian cross-sectional study, adult victims of childhood peer bullying had significantly poorer health-related quality of life (25). Additionally, workplace bullying was associated with risk of a newly diagnosed fibromyalgia in a Finnish cohort study (26), and being bullied was associated with chronic pain in adolescence in a Dutch study (27).

To the best of the authors' knowledge, there are no studies addressing the association between bullying victimization in childhood and fibromyalgia in adulthood. The aim of this study is to explore this association in a population-based sample of the adult population in Finland.

Methods

Study Design and Setting:

The study setting is cross-section based on data from the on-going Health and Social Support (HeSSup) postal questionnaire study initiated in 1998 in order to explore psychosocial risk and protecting factors of subsequent health of the Finnish working-age population. Questionnaires

were sent to a representative sample of 64,797 individuals of the Finnish population. The sample comprised four age groups: 20 – 24, 30 – 34, 40 – 44 and 50 – 54 years at baseline in 1998. Initially 25,898 questionnaires had been returned leading to a response rate of 40%. A non-response analysis revealed only slight differences between responders and non-responders. Women, more educated, younger women, and older men responded somewhat more actively to the initial survey as compared to the rest. There were only slight differences in physical health between respondents and the general population. (28) In a study of mortality of respondents and non-respondents, male non-respondents showed a small but significant increase of mortality due to external causes as compared to respondents, whereas female non-respondents again showed small but significant elevation of disease mortality as compared to respondents. A detailed demographic description of the respondents was provided as well. The minority of Swedish speaking Finns as well as the Turku region were slightly over-represented on purpose. (29) Two follow-up questionnaires were sent to the respondents of the initial survey in 2003 and 2012. In the first follow-up the response rate was 80% (N = 19,629) and in the second follow-up 57% (N = 13,050). Later, the survey data were - with respondents' written consent - linked to several national health registries, among them the Finnish Hospital Discharge Register (HILMO).

Participants and study size:

Two follow-up questionnaires (2003 and 2012) included a question about presence of various medical diagnoses with the phrase: 'Has a doctor ever told you that you have or have had' followed by a number of names on diseases or conditions'. Fibromyalgia was one of the conditions included here. Response alternatives were "no" and "yes". Only those who responded to this question in both follow-ups were included in the final study population (N = 11,924). Flow chart of the study population is presented in Figure 1.

Variables and data sources:

As mentioned above, information about fibromyalgia was collected in 2003 and 2012. Those having reported the condition affirmatively in either of the questionnaires were considered as

having fibromyalgia (n = 515). Participants not reporting fibromyalgia were classified as not having fibromyalgia (n = 11,409). We also carried out additional analyses with patients that did not report fibromyalgia at the 2003 survey, but reported it in the 2012 questionnaire. We identified 185 newly diagnosed fibromyalgia patients. Childhood bullying victimization was inquired in the 2012 questionnaire with two questions. The first question was: 'When you think about your school age, were you being bullied in school or in the neighbourhood?' with response alternatives 'never', 'seldom', 'sometimes' and 'often'. The second question was: 'Was bullying heavy for you?' with alternatives 'not at all', 'a little bit disturbing', 'quite heavy' or 'very heavy'. The age of respondents was grouped into four categories, i.e. 20 – 24, 30 – 34, 40 – 44 and 50 – 54 years. Marital status and education were inquired in the 2012 questionnaire and were divided into two groups with those reporting to be single, divorced, widowed combined to one group and married, re-married and cohabiting into another group. Education was also dichotomized with those reporting having completed vocational college, polytechnic or university education classified as having higher education. Those without vocational education or training or lacking completed apprenticeship training, trade school or vocational course were classified as having lower education. Information of depression was obtained from Beck's Depression Inventory (BDI), with scores ranging from 0 to 63 (30). The responses were divided into two groups and a BDI score of more than 18 was considered marking at least moderate depression (31).

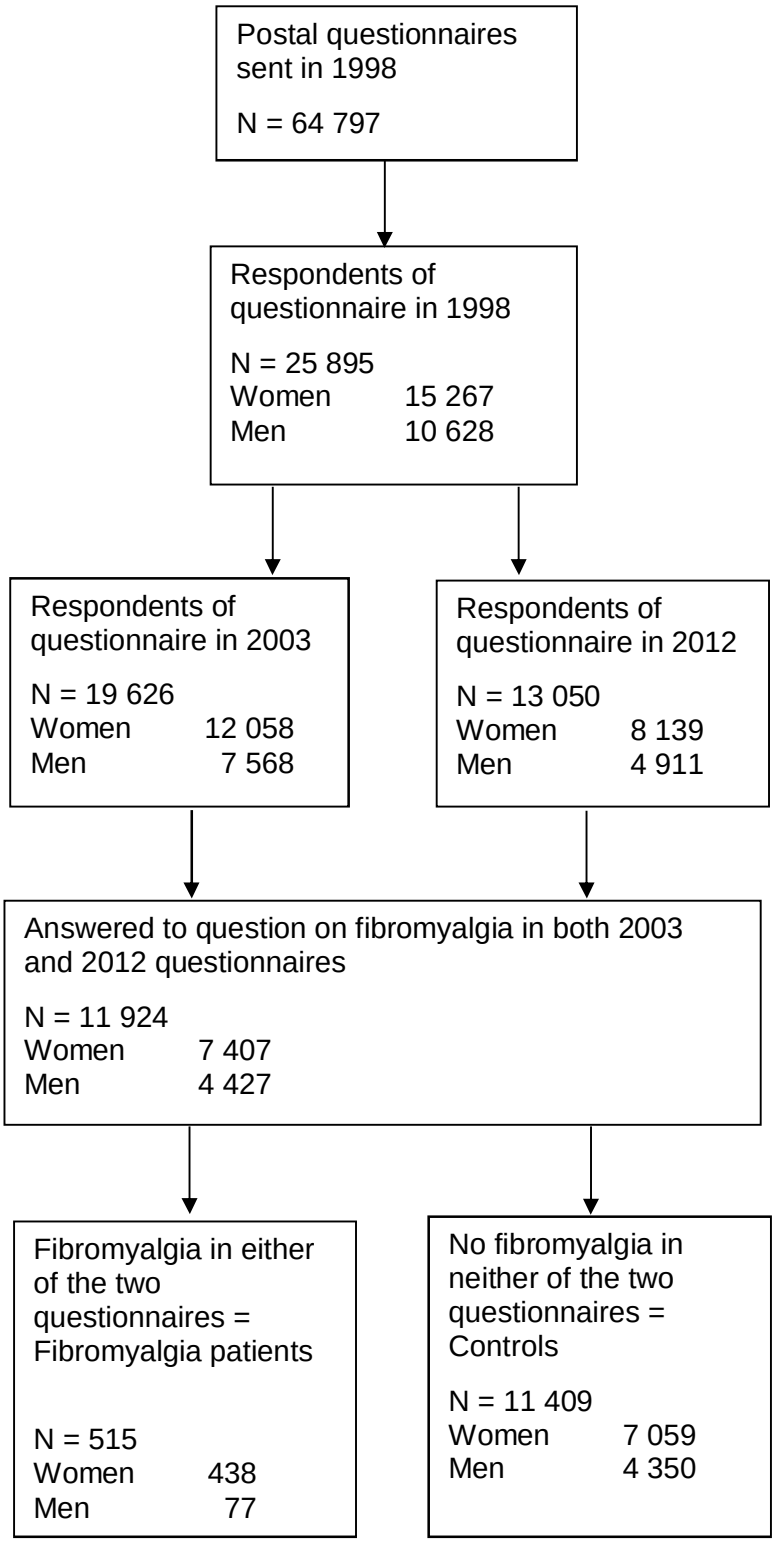

Figure 1. Flow chart of study population.

Statistical methods:

The severity of bullying victimization was divided into three groups: 1) No bullying: those reporting not being bullied. 2) Minor bullying: those reporting being bullied seldom, sometimes or often but reporting it not having been heavy at all or only a little bit disturbing. 3) Severe bullying: those reporting bullying victimization seldom, sometimes or often and having perceived it being quite or very heavy. Responses with missing data or the option 'I do not know' were considered as missing values in statistical analyses. First, the association between self-reported bullying in childhood and other potentially significant explanatory variables and self-reported fibromyalgia in adulthood was explored with cross tabulation using Pearson's chi-squared test. The associations were further analysed with multiple logistic regression models including all explanatory variables with a statistically significant association with self-reported fibromyalgia. The models yield odds ratios (OR) with 95% confidence intervals (CI). The associations between fibromyalgia, bullying and depression were also explored with log-linear and logistic regression interaction models. Alpha level of .05 was used to indicate statistical significance. Data were analysed using SAS software version 9.4 for Windows (2012, SAS Institute Inc., Cary, NC, USA).

Results

Demographic background of the study population (N = 11,924) and results from logistic regression analyses (OR with 95% CI) with demographic background and depression as explanatory variables of fibromyalgia are presented in Table 1. In Pearson's chi-squared test age *(p = <.001)*, gender *(p = <.001),* education *(p = <.001)* and depression *(p = <.001)* were statistically significantly associated with fibromyalgia whereas marital status *(p = .480)* was not.

Minor bullying victimization was reported by 50.6% and severe bullying by 19.6% of all respondents. Men reported minor bullying more often, but severe bullying was more common among females. Altogether, female respondents with fibromyalgia reported bullying more often than those not reporting fibromyalgia and the difference was statistically significant (*p = .027*).

However, when gender and bullying were included in the model as explanatory variables there was no statistically significant interaction *(p = .379)* between these variables. Among all participants minor bullying was reported slightly more often in the fibromyalgia group, but the difference was not statistically significant (*p = .337*). Likewise, severe bullying was a bit more common in those reporting fibromyalgia, but the association was neither here statistically significant (*p = .075*). Proportions of study population reporting childhood bullying are presented in Table 2.

There were statistically significant associations between minor and severe bullying victimization in childhood and fibromyalgia in adulthood after adjustments for gender, age, educational level and depression in multiple logistic regression analysis (Table 3). The observed association was more evident in severe bullying, but statistically significant in minor bullying as well.

Table 1. Basic characteristics and logistic regression analysis results (OR with 95% CI) of demographic features and depression as predictors of fibromyalgia.

	Fibromyalgia					
	Yes		No			
	n = 515		n = 11409		Simple logistic regression models	Multiple logistic regression model
	%	n	%	n	OR (95% CI)	OR (95% CI)
Age (years of birth)						
1974−1978	10.7	55	21.2	2415	1.00 (Ref.)	1.00 (Ref.)
1964−1968	13.4	69	20.8	2371	1.28 (.89 – 1.83)	1.26 (.87 − 1.83)
1954−1958	31.1	160	26.5	3025	2.32 (1.70 – 3.17)	2.20 (1.58 – 3.05)
1944−1948	44.8	231	31.5	3598	2.82 (2.09 – 3.80)	2.66 (1.93 – 3.68)
Gender						
Male	15.0	77	38.1	4350	1.00 (Ref.)	1.00 (Ref.)
Female	85.0	438	61.9	7059	3.51 (2.74 – 4.48)	3.89 (3.04 – 4.98)
Education						
Higher education	52.2	268	62.4	7072	1.00 (Ref.)	1.00 (Ref.)
Lower education	47.8	245	37.6	4262	1.73 (1.43 – 2.09)	1.51 (1.24 – 1.85)
Marital status						
Married/Re-Married/Cohabiting	74.8	382	76.1	8648	1.00 (Ref.)	1.00 (Ref.)

Single/Divorced/Widowed	25.2	129	23.9	2713	1.27 (1.04 – 1.56)	1.09 (.88 – 1.35)
Depression						
No depression (BDI ≤ 18)	91.2	469	96.0	10898	1.00 (Ref.)	1.00 (Ref.)
Depression (BDI > 18)	8.8	45	4.0	455	2.30 (1.67 – 3.17)	1.98 (1.43 – 2.75)

Table 2. Frequencies and percentages of participants reporting victimization of childhood bullying. Results from the Finnish nationwide HeSSup 2012 follow-up study.

Fibromyalgia	Yes		No		
	n	%	n	%	p[a]
Males					*.887*
No bullying	20	26.0	1057	24.6	
Minor bullying	44	57.1	2420	56.4	
Severe bullying	13	16.9	815	19.0	
Females					***.027***
No bullying	119	27.3	2324	33.2	
Minor bullying	216	49.5	3285	47.0	
Severe bullying	101	23.2	1387	19.8	
All					*.203*
No bullying	139	27.1	3381	30.0	
Minor bullying	260	50.7	5705	50.5	
Severe bullying	114	22.2	2202	19.5	
Total	512	100.0	11288	100.0	

[a]: Pearson's chi-squared test.

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Table 3. Childhood bullying victimization in logistic regression analyses for fibromyalgia in adulthood. Finnish nationwide HeSSup study.

	Simple logistic regression model	Multiple logistic regression model [a]
	OR (95% CI)	OR (95% CI)
No bullying (Ref.)	1	1
Minor bullying	1.11 (.90 – 1.37)	1.35 (1.09 – 1.67)
Severe bullying	1.26 (.98 – 1.62)	1.58 (1.21 – 2.06)

[a]: Adjusted for gender, age, educational level and depression (BDI > 18).

However, when interactions were added into the logistic regression models in order to explore the role of depression with fibromyalgia patients the three-way interaction between bullying, gender and depression was not statistically significant (*p = .994*). In further analyses the two-way interaction between bullying and gender (*p = .314*) or gender and depression (*p = .240*) or bullying and depression (*p = .122*) were neither statistically significant. After removing these interaction terms from the model depression (p <*.001)* and gender (p <*.001*) showed statistically significant associations with fibromyalgia whereas bullying did not (*p = .171*).

In a log-linear models there was no statistically significant four-way association between fibromyalgia, bullying, gender and depression (*p = .994*). In a three-way model the associations between bullying, fibromyalgia and gender (*p = .314*), fibromyalgia, bullying and depression (*p = .142*), fibromyalgia, gender and depression (*p = .188*) or bullying, gender and depression (*p = .779*) were neither statistically significant. On the contrary, in the two-way model there were associations between fibromyalgia and gender (p <*.001*), bullying and gender (p <*.001*), fibromyalgia and

depression (p <*.001*), bullying and depression (p <*.001*) and gender and depression (*p = .002*) but not with fibromyalgia and bullying (*p = .173*).

When the subgroup of 185 newly diagnosed fibromyalgia patients were analyzed, there was no statistically significant association in logistic regression analysis between bullying and fibromyalgia before adjustments either with minor bullying *(p = .512)* or severe bullying *(p = .063)*. After adjustments for gender, age and educational level there was a borderline statistically significant association between bullying and fibromyalgia *(p = .043)*, but when depression was added to the model the interaction was no longer significant *(p = .071)*.

Discussion

We found statistically significant associations between bullying victimization and fibromyalgia after adjustments for gender, age, educational level and depression. However, effect size of this association was small according to Cohen's categories and should be interpreted cautiously because of the cross-sectional design of our study (32). Furthermore, in log-linear and logistic regression interaction models this association was not statistically significant. Gracely et al. hypothesized that there are common predisposing genetic and environmental factors that make individuals vulnerable to adversities that can trigger fibromyalgia or depression or both (15). Hence, it might be possible that the association between childhood peer bullying and fibromyalgia syndrome is attributable to depression and peer bullying victimization in childhood would be associated with adulthood fibromyalgia only when depression is present but our cross-sectional setting allows us only to observe associations. Furthermore, is has been suggested that fibromyalgia and depression might even be part of same affective spectrum disorder, but the evidence is controversial (15,33).

Compared to recent Finnish surveys, bullying was more common in our study, as half of the subjects studied reported minor bullying victimization. This was particularly evident among females. In their study, Klomek et al. suggested that from 20% to 30% children were involved in frequent bullying victimization in 1989 in Finland (21). The prevalence of 19.6% of severe bullying

among the participants in our study is in line with this finding. Furthermore, in our study the question about bullying victimization included both school and neighbourhood. In a British study – aiming at a holistic exploration of victim experiences – adolescent participants experienced on average 2.8 different types of victimization (34). Furthermore, our aim was to capture the emotional impact, rather than the frequency of bullying. As a result, our definition of minor bullying also included bullying, that occurred only seldom, and was not perceived to be burdensome by the victim. It is unlikely, that all of our study subjects reporting minor bullying would fulfil the Olweus definition of bullying.

There are studies of underreporting childhood adversities. In a German case-control study depression accounted for the group difference in physical abuse and emotional neglect and partially in emotional abuse, but did not account for the group difference in sexual abuse (35). However, depressed mood can also result in biased recall towards negative information (36). Fibromyalgia patients with mental disorders report childhood adversities more often than patients without mental disorders (37). On the other hand, Hardt et al. proposed that false positive memories of easily defined childhood adversities are rare (38). Nevertheless, it is possible that increased recall of childhood peer bullying victimization in fibromyalgia patients could lead to slight over-estimation of the association between bullying and fibromyalgia before adjustment for depression.

In a Dutch study with 15,220 adolescents a similar association between bullying and adulthood chronic pain was reported. OR for suffering from pain was 1.23 (95% CI 1.17–1.29) for those having been bullied after adjustment for gender, age, ethnic origin (Dutch vs. non-Dutch) and school level (27). In our study, the OR was slightly higher with those reporting severe bullying and similar with those who reported minor bullying. However, in our study there was a longer follow up between bullying and fibromyalgia. Furthermore, we concentrated in fibromyalgia whereas Voerman et al. studied chronic pain, which is to some extent a different condition (27).

In our study, the fibromyalgia diagnosis was self-reported. We used information from the Finnish Hospital Discharge Register (HILMO) to confirm the validity of the data. However, a vast majority of

fibromyalgia patients lack data on their condition because fibromyalgia is often treated in primary or ambulatory health care. For 477 patients the fibromyalgia diagnosis was only self-reported which could be considered a weakness of the study. On the other hand, over time the diagnostic criteria for fibromyalgia have varied and according to recommendations the diagnosis should be based both on clinical findings and patient history in clinical work (39,40). Thus, we considered patient reported diagnosis applicable to our study. Out of the 38 patients who had ICD-10 code corresponding to fibromyalgia in HILMO only one failed to report it in the HeSSup questionnaire. However, there is possibility of either under- or overestimation of the prevalence of fibromyalgia in our study. Altogether 4.3% of individuals included in the study reported fibromyalgia (41). The occurrence of fibromyalgia was slightly higher in our study than the arithmetic mean prevalence rate of 2.7% reported by Queiroz in a review article, but it is not exceptional compared to other studies (41). Furthermore, response rates of our surveys, and the fact that women responded to the survey more actively than men, might have influenced the prevalence estimates, but should not affect the associations between the variables studied (29,42). We gathered information from fibromyalgia diagnosis from two different sources and time points and as a result we have period prevalence which is expected to be higher than point prevalence. In addition, the characteristics of fibromyalgia patients and controls in our study are consistent with other studies (3).

Unfortunately, the HeSSup study did not include questions about respondent's participation in bullying so we do not know how many were also involved as bullies. In addition, data on bullying are based on participant's recollection. However, a study conducted in Britain showed that participants were able to recall important events in their lives, including childhood bullying victimization, and there was great consistency in these memories across the 12 – 14 -months period (43).

The total response rate was 40.0%, with women (47.7%) responding more actively than men (32.1%). The youngest age group responded most actively, especially women in this age group (54.6%). Among men, the oldest age group responded most actively (36.8%) (44). A non-response analysis showed that no significant selective health-related factor among the respondents was

identified (28). This is an important strength of our study, as our large and non-selected population increases the generalizability of the results. Low response rate could have influenced prevalence estimates, but should not have had considerable effect on our analyses of association (14,29). According to the most likely scenario, with higher dropout for bullying victims and fibromyalgia patients, the observed associations would have been weakened.

It is still unclear how childhood bullying victimization leads to poorer health in adulthood (19). One possible explanation is that the stress of victimization leads to the development of health problems (16,26). It is known that psychosocial stress initiates many behavioural, neural, hormonal and molecular responses (45). Additionally, genetic factors play an important role via epigenetic mechanisms (46). There are some life periods with more plasticity in the epigenome for stress exposure –for example adolescence and stress-induced epigenetic changes also accumulate through life (45). This could explain why childhood adversities could have life-lasting effects and increase the later risk of stress-related diseases. You et al. studied mechanisms of widespread pain in young adults. Their findings suggested depressive symptoms were more common within the group reporting more adversities, but they did not explain the observed relationship between childhood adversities and chronic pain (47). It is also known that depression is a relatively common comorbidity with fibromyalgia and that may also be a result of common risk factors (1,2). Moreover, depressed children are more likely to be victims of peer bullying (16). As a result, we suggest the relationship between peer bullying, depression and fibromyalgia as a subject for further studies.

To the best of the authors knowledge, our study is the first reporting the association between peer bullying and fibromyalgia. Although our cross-sectional setting allows us only to observe associations, it may suggest that peer bullying has long-lasting effects, especially on those who have encountered severe bullying. However, it is also possible that children who later develop fibromyalgia have features that predispose them to bullying. Furthermore, not all participants reporting bullying in childhood develop fibromyalgia later in life. This leads us to the concept of resilience: why do some bullying victims get fibromyalgia, while others do not. This, however, is beyond the scope of our study, but we suggest it as a topic for further studies.

Conclusion

We found a statistically significant association between bullying victimization in childhood and fibromyalgia after adjustments for gender, age, educational level and depression and this association was stronger in those reporting more severe bullying. However, in log-linear and logistic regression interaction models the association between bullying and fibromyalgia was not statistically significant when depression was included in the models. It is unclear whether this is for example due to recall bias or whether fibromyalgia is associated with peer bullying only when depression concomitantly as a comorbidity is present. As a result, there is need for further prospective cohort studies. The findings also emphasize the importance of actions to prevent childhood bullying.

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