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Observational study

Pain is prevalent among adolescents and equally related to stress across genders☆

Berit Østerås[a,*], Hermundur Sigmundsson[b,c], Monika Haga[d]

[a] Norwegian University of Science and Technology (NTNU), Department of Physiotherapy and Department of Psychology, Trondheim, Norway
[b] NTNU, Department of Psychology, Trondheim, Norway
[c] Reykjavik University, Iceland
[d] NTNU, Department of Physiotherapy, Trondheim, Norway

HIGHLIGHTS

- Musculoskeletal pain and perceived stress appear prevalent among 15 and 16 year olds.
- Adolescent females report higher stress, higher pain intensity and more head pain.
- Musculoskeletal pain seems significantly associated to perceived stress in adolescents.
- Pain complaints seem equally related to stress in adolescent males and females.

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ABSTRACT

Background: Young people seem increasingly disabled due to pain and stress. Pain and stress are health risks with adverse long-term health effects. Traditionally, these health risks have been most prevalent and strongest associated in females, also regarding children and adolescents. Main objectives in this study were to investigate current gender differences in musculoskeletal pain and perceived stress in adolescents aged 15 and 16 years with respect to prevalence and group differences for various aspects of stress and pain, and to explore the relationship between stress and pain, specified for gender.
Methods: A cross-sectional study was conducted with 17 participating public schools. The survey was administrated by the schools in accordance with given procedures, emphasizing the volunteer and anonymous participation of the pupils. Primary study measurements were pain and stress. The pain measurements addressed different aspects of musculoskeletal pain including pain sites, pain duration and pain intensity (measured by a Visual analogue scale; VAS). The stress instrument used was the Perceived stress questionnaire (PSQ) comprising different factors of stress, i.e. worries, tension, joy and demands. The secondary study measurement was body mass index (BMI).
Results: The study sample comprised 422 adolescents aged 15 and 16 years; 218 females and 204 males. The pain reporting was high in both genders, 57.3 per cent of the females and 44.6 per cent of the males. In general, the female adolescents reported more pain and stress, although several pain measures corresponded between genders. The pain prevalence was similar across genders with respect to lower extremity pain, back pain and arm pain. Lower extremity pain was the most frequent reported pain in both genders. More females reported head pain (Pearson Chi-Square 7.11, $p = .008$), severe pain (VAS ≥ 7, Pearson Chi-Square 13.12, $p = .004$) and moderate to severe stress (PSQ ≥ 0.45, Pearson Chi-Square 29.11, $p < .001$). Comparison analyses of the continuous pain and stress variables revealed significant mean (95% confidence interval [CI]) differences between genders for all stress variables with the highest mean scores in females. In both genders there were significant ($p < .01$) correlations between all the continuous pain and stress variables. In 9 out of 15 correlations, the stress-pain associations were strongest in males (Pearson product-moment correlation (r) between 0.34 and 0.38). Only in females, the body mass index (BMI) appeared associated (weakly) to pain and stress, in terms of pain intensity (VAS, $r = 0.19$) and lack of joy (as a factor of stress, $r = 0.16$).

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☆ The data collection process and entire study were approved by the Regional Committee for Medical Research Ethics, and the study was in line with the Declaration of Helsinki.
* Corresponding author at: NTNU, Department of Physiotherapy, Tungasletta 2, 7004 Trondheim, Norway. Tel.: +47 73412780.
E-mail address: berit.osteras@hist.no (B. Østerås).

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Conclusion: Pain and stress were prevalent in the adolescent sample, with generally higher reporting among females. Several pain measures corresponded between genders, but stress differed significantly between genders for all variables. Scrutinizing the relationship between pain and stress revealed significant stress-pain associations regarding all variables across genders, i.e. the pain complaints among the adolescents seemed equally related to stress in males and females in the sample.

1. Introduction

Musculoskeletal pain is a main contributor to global years lived with disability (YLDs) [1], and the combination of persistent pain and comorbid psychological disorders produce significant disability across the globe [2–4]. Long-term musculoskeletal pain and psychological distress are health risks with negative concurrent and long-term health effects and adverse impacts on other non-communicable diseases (NCDs) [5–11]. Young people seem increasingly disabled (16–24 years) due to pain and stress [12], but the mechanisms behind this are unknown [13–16].

Traditionally, females have reported most stress and musculoskeletal pain [17]. Also in young people, there is documented a female predominance in the reporting of psychosocial stress and musculoskeletal pain [18–20]. In adolescents aged 12–16 years old ($N = 3485$), neck/shoulder, low back and arm pain have been found associated with stress and depressive symptoms, with the highest prevalence among females [21]. This is supported in a systematic review by Prins et al. [22], showing that neck and shoulder pain were influenced by depression and mental distress in children and adolescents and most prevalent among females.

In older adolescents (aged 16–18 years), females have reported two to three times more subjective health complaints, including neck and shoulder pain, than the males, and the reporting of these complaints correlated strongly with the reporting of perceived stress [23]. Neck and shoulder pain have been the most prevailing musculoskeletal pain complaints reported in Scandinavian young people during the last decades, and these complaints are commonly categorized as stress-related pain [13,18,24–26].

Pain triggers stress responses and reactions on several levels [11,27]. Stress is the resource-intensive adaptive reaction to challenges that occur in the external or internal environment in the service of homeostasis [28–31]. A modified transactional model of stress explains how factors on different levels contribute in the stress perception process, involving personal aspects, stress exposures and reactions [32,33]. Stress might induce pain and exacerbate and prolong the pain experience The health consequences to stress depends on the individual appraisal of available resources under the influence of personality characteristics [32,33].

The interconnection between pain and stress on a behaviour level in young people remains unclear [13,15,16,20]. Gender differences regarding both prevalence and different stress-pain associations in the young population are widely unidentified [17]. Main objectives in this study were to investigate gender differences in musculoskeletal pain and perceived stress among adolescents regarding (1) prevalence, (2) possible between group differences with respect to different aspects of stress and pain, and (3) different stress–pain associations.

2. Methods

2.1. Procedure and participants

The Regional Committee for Medical Research Ethics in Trondheim approved the data collection process and the entire study, and the study was is in line with the Declaration of Helsinki [34]. Passive consent from the participants was confirmed to be sufficient by The Regional Committee for Medical Research Ethics, because no sensitive personally identifying data were collected. This study's cross-sectional sample included pupils in 10th grade (in their 16th or 17th year) in public schools in the Trondheim municipality in Norway. Of a total of 17 schools, six agreed to participate. The schools varied in size and localization (from city to suburb), admitting pupils with different sociocultural and economic backgrounds [35], considered to provide a representative sample of Norwegian 10th grade pupils to the study. 430 questionnaires were distributed. The number of completed questionnaires returned was $N = 423$, giving an overall response rate of 98.4 per cent; 218 (51.5 per cent) females and 204 (48.2 per cent) males. The data were collected during spring and autumn 2013.

The purpose of the study was explained in detail to the principals as well as described in the invitation and in the introduction of each questionnaire, emphasizing the volunteer and anonymous participation. The respective principals from each of the schools approved the content of the questionnaire prior to agreeing to participate in the survey. The pupils' answers were enclosed inside the questionnaire folder, thus invisible to the administrators (principals or teachers) who collected and returned the questionnaires in concealed envelopes. Questionnaire administration was completed in one session, in whole class groups, during one regular school period of 45 min. Demographic data included gender, high and weight.

2.2. Primary study measurements

2.2.1. Pain

Pain was measured by questions about localization (pain site), duration, and intensity:

Pain site (0–6) was divided into six main categories, corresponding to the questionnaire in the Young-HUNT Study 2008 [20,36]; head, neck, shoulder, back, arm, lower extremity, with an open line for additionally sites. Three or more (≤ 3) pain sites were termed multisite pain.
Pain duration (1–5) was divided into five categories; 0–2 weeks, 2–4 weeks, 1–2 months, 2–3 months, 3 months or more.
Pain intensity (Visual analogue scale VAS: 0–10) was measured using a VAS-line [37]. The participants were instructed to mark on the VAS-line (10 cm) to illustrate their average pain during the last week, with 0 indicating "no pain" and 10 "worst pain imaginable." VAS is described and applied as an acceptable measurement of average pain during the last week [38,39]. VAS is demonstrated to be reliable as a measure of pain intensity in children [40] and is used to detect differences in pain between groups of adolescents [41]. For analytic purposes, four VAS-categories were computed; VAS = 0, VAS ≤ 3, VAS $> 3 < 7$, VAS ≥ 7. These delineations are in accordance with common clinical procedures, assessing VAS ≤ 3 as mild or tolerable pain, VAS $> 3 < 7$ as moderate pain, and VAS ≥ 7 as severe pain [38]. A recent study in a corresponding sample demonstrated strong correlations between the included pain measurements (pain sites, pain duration, pain intensity) [42], implying

consistency of the measures, and hence supporting the utility of the measurement on a group level in this study.

2.2.2. Stress

Stress was measured by the Perceived stress questionnaire (PSQ) [32,43]. PSQ is proved to be a valid instrument for measuring perceived stress [33,44], and is demonstrated to be suitable for adolescents [45]. The PSQ includes 30 items that are assigned to four factors; worries, tension (lack of) joy, and demands [33,44]. The items in PSQ refer to the period of the last four weeks and can be answered with a 4-point rating scale (1 = almost never, 2 = sometimes, 3 = often and 4 = usually). The resulting PSQ Total Score is linearly transformed between 0 and 1; PSQ = (raw value − 30)/90 [32]. The cut-off score for moderate to high levels of perceived stress was set to PSQ ≥ 0.45. This was based on the mean stress score (total PSQ) in the present study population (0.33, standard deviation [SD] 0.16), which corresponds to previous studies using PSQ in population surveys [33,46]. The PSQ (the four factors) showed a Cronbach's α of 0.87 for females and 0.75 for males. Previous studies have shown a high Cronbach's α value of the entire PSQ (all questions; $\alpha = 0.93$) [33]. The authors of the PSQ granted us permission for translation and back translation of the PSQ, and authorized our final version.

2.3. Secondary study measurement

2.3.1. BMI

Body mass index (BMI) was also recorded, as this health variable is considered relevant for pain and stress [47,48]. BMI is demonstrated to have a significant effect on the increasing of work related musculoskeletal discomfort and occupational-psychosocial stress [47], and to have significant influence on low back pain in adolescents aged 12–15 years [48].

2.4. Statistical analysis

All data are analyzed with IMB SPSS statistics 21. Cronbach's α was computed to estimate the internal consistency of the PSQ, separately for gender (Tables 3 and 4). Descriptive analyses including means and standard deviations for the continuous variables were calculated separately for gender (Tables 1 and 2). Person Chi-square was used in 2 × 2-tables for dichotomous variables (Table 1). ANCOVA General Linear Models (GLMs) were used for between group (gender) analyses with adjustments for BMI (Table 2). Total stress (PSQ) and the different factors of stress (worries, tension, joy, and demands) as well as pain sites, pain duration and pain intensity (VAS) were applied as dependent variables, with gender as a fixed factor (main effect) and BMI included as a covariate. The adjustments for multiple comparisons were performed by using Bonferroni (Table 2). To evaluate the strength of gender on stress and pain, total stress (PSQ), effect sizes were calculated (Table 2). Effect size (Cohen's d) is defined as the difference in outcome between the groups divided by the standard deviation of the baseline scores for this outcome [49]. Cohen [50] has presented some guidelines for the strength of effects: small (.20), medium (.50) and large (.80+). p-values ≤.05 was considered statistically significant. Pearson product-moment correlation (r) was used to test bivariate associations between the continuous stress and pain variables, separately for gender (Tables 3–5). ANOVA General Linear Models (GLMs) were used in exploring stress (total PSQ as dependent variable) in relation to number of pain sites (categorized into five groups according to number of pain sites; 0, 1, 2, 3, 4–6) and pain intensity levels (categorized into four groups; VAS = 0, VAS ≤ 3, VAS > 3 < 7, VAS ≥ 7) as fixed factors, separately for gender (Figs. 1 and 2). The participants with missing data were excluded listwise in the analyses.

3. Results

There was a small number of missing data. One participant did not report gender and one did not report on pain/no pain. Two participants reported to have pain without specifying pain site. Mainly data from the items on page two in the questionnaire (the only back page) were exposed for missing. Apparently some of the participants overlooked these items, resulting in 18 missing responses on pain intensity (VAS), and 19 missing responses on pain duration.

Table 1 summarizes the descriptive analyses of dichotomous pain and stress variables separately for gender. After exclusion of the one not reporting gender, the final study sample encompassed 422 participants. Main descriptive findings were high pain and stress prevalence in both genders, with generally some higher reporting in females. Equal prevalence across genders appeared for lower extremity pain (28.9 per cent of the females and 24.0 per cent of the males), which was the most frequent pain reporting in both genders, back pain (17.0 per cent of the females, 15.7 per cent of the males) and arm pain (5.0% of females, 5.4% of males).

With respect to head pain, there were significant differences ($p < .001$) between genders (Person Chi-Square 14.13), with the highest reporting in females (24.8 per cent of the females and 10.8 per cent of the males). More adolescent females also reported moderate to severe stress (PSQ ≥ 0.45) (32.6 per cent of the females against 10.8 per cent of the males, Pearson Chi-Square 29.11, $p < .001$) and severe pain (VAS ≥ 7) (11.5 per cent of the females and 3.9 per cent of the males, Pearson Chi-Square 13.12, $p = .004$) (Table 1).

Comparison analyses revealed significant mean differences between genders regarding all continuous stress variables, with the highest scores among females (Table 2). The greatest effect sizes between genders appeared for worries (0.7). Among the continuous pain variables, there was a significant mean difference only regarding pain intensity (VAS), with a small effect size (0.3) (Table 2).

Correlation analyses revealed significant ($p < .01$) associations between all continuous stress and pain variables in both genders, which are summarized in Table 5. In 9 out of 15 correlations (when including the factors of stress in the analyses), the males demonstrated stronger stress–pain associations than the females. The summarizing in Table 5 only includes total stress (PSQ) in relation to the pain variables. The relationship between pain and stress for

Table 1
Prevalence of pain and stress separately for gender; dichotomous variables.

	Females ($n = 218$)	Males ($n = 204$)	Pearson Chi-Square
Pain			
Have pain	125 (57.3%)	91 (44.6%)	7.11* ($p = .008$)
Head pain	54 (24.8%)	22 (10.8%)	14.13** ($p < .001$)
Neck pain	24 (11.0%)	16 (7.8%)	1.27 ($p = .261$)
Shoulder pain	24 (11.0%)	16 (7.8%)	1.27 ($p = .261$)
Back pain	37 (17.0%)	32 (15.7%)	0.14 ($p = .705$)
Arm pain	11 (5.0%)	11 (5.4%)	0.03 ($p = .872$)
Lower extremity pain	63 (28.9%)	49 (24.0%)	1.35 ($p = .245$)
Multisite (≥3) pain	25 (11.5%)	11 (5.4%)	6.92 ($p = .140$)
Severe pain (VAS ≥ 7)	25 (11.5%)	8 (3.9%)	13.12* ($p = .004$)
Stress			
Moderate to severe stress (PSQ ≥ 0.45)	71 (32.6%)	22 (10.8%)	29.11** ($p < .001$)

Person Chi-square in cross tables was used. PSQ: Perceived stress questionnaire.
* $p < .01$.
** $p < .001$.

Table 2
Pain, perceived stress and BMI in adolescent females and males, and adjusted differences between genders.

	Group means (SD)		Adjusted mean (95% CI) difference between groups[a]	Effect size
	Females (n = 218)	Males (n = 204)		
Stress				
Total stress (PSQ; 0–1)	0.37 (0.18)	0.29 (0.13)	0.10*** (0.07–0.14), p < .001	0.6
Worries	0.32 (0.21)	0.22 (0.16)	0.13*** (0.09–0.17), p < .001	0.7
Tension	0.39 (0.20)	0.32 (0.15)	0.08*** (0.04–0.11), p < .001	0.5
Joy	0.38 (0.20)	0.33 (0.18)	0.06** (0.02–0.10), p = .002	0.3
Demands	0.46 (0.23)	0.38 (0.18)	0.10*** (0.05–0.14), p < .001	0.5
BMI	20.49 (2.58)	21.09 (3.60)		
	Group means (SD)		Adjusted mean (95% CI) difference between groups[a]	Effect size
	Girls (n = 116)	Boys (n = 91)		
Pain				
Sites (0–6)	1.69 (1.13)	1.59 (1.11)	0.09 (−0.25 to 0.42), p = .617	0.1
Duration (1–5)	3.46 (1.25)	3.06 (1.34)	0.31 (−0.08 to 0.70), p = .115	0.2
Intensity (VAS; 0–10)	4.76 (2.44)	4.05 (2.38)	0.74* (−0.01 to 1.47), p = .05	0.3

PSQ: Perceived stress questionnaire; CI: confidence interval; VAS: Visual analogue scale.
[a] ANCOVA General Linear Models were used for between group (gender) analyses with adjustments for BMI.
* p < .05.
** p < .01.
*** p < .001.

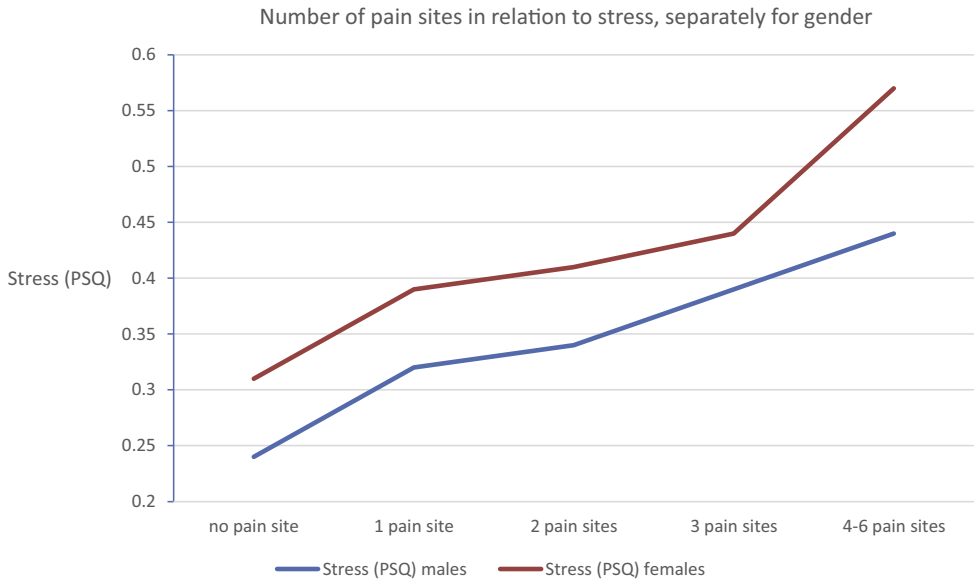

Fig. 1. The relationship between number of pain sites and mean stress (Perceived stress questionnaire; PSQ) in both genders.

both genders are illustrated for number of pain sites in relation to stress (PSQ) (Fig. 1), and for pain intensity (VAS) in relation to stress (PSQ) (Fig. 2). For females, there were also weak correlations (p < .05) between BMI and pain intensity (VAS) (r = 0.19) and lack of joy (r = 0.16) (Table 6).

4. Discussion

There was a high prevalence of pain and stress among the 15 and 16 year olds with the highest reporting in females. The relationship between pain and stress appeared equal across genders in the adolescent sample.

4.1. Pain prevalence

In general, the adolescent females reported more pain and stress (Tables 1 and 2). The female predominance in the pain reporting supports prior findings [17,18,51]. However, this study reveals higher prevalence and smaller gender differences than previously reported [13,15,19,26]. Hoftun et al. [19] reported musculoskeletal pain in at least one location in 54.1 per cent of the females (n = 2029) and in 34.2 per cent of the males (n = 1241), compared to this study with pain reporting in 57.3 per cent of the females and 44.6 per cent of the males. In the population-based study by Eckhoff and Kvernmo [26], the prevalence peak of musculoskeletal pain was almost twice as high in the adolescent females compared to the adolescent males (15–16 year olds). The findings in this study imply an increase in the pain reporting in adolescents, mainly among the adolescent males, suggesting reduced gender differences in pain prevalence.

The most common pain in both genders was lower extremity, with a corresponding prevalence between genders (28.9 per cent of the females and 24.0 per cent of the males, Table 1). Back pain reporting was also quite high (17.0 per of females and 15.7 per cent of males, Table 1) and more similar across between females and males than previously reported [19,52]. The prevalent lower extremity and back pain supports the findings by Rathleff et al. [51]. Among the Danish adolescents (N = 4007, aged 12–19 years)

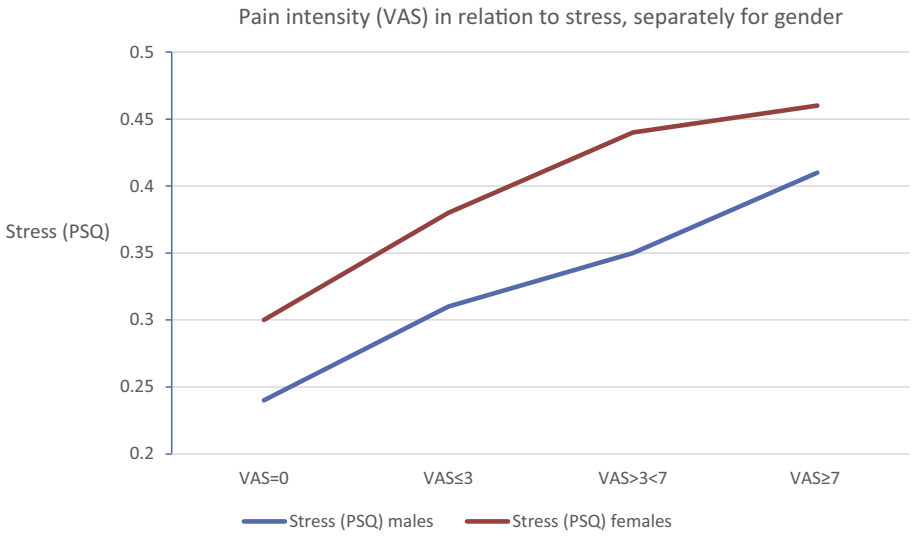

Fig. 2. The relationship between pain intensity (measured by a Visual analogue scale [VAS]) level and mean stress (Perceived stress questionnaire; PSQ) in both genders.

Table 3
Inter-item relationship of the Perceived stress questionnaire (PSQ) in females; correlations and Cronbach's α.

	PSQ	Worries	Tension	Joy	Demands
Total PSQ	–				
Worries	0.95**	–			
Tension	0.89**	0.76**	–		
Joy	0.70**	0.57**	0.61**	–	
Demands	0.82**	0.73**	0.69**	0.40**	–
Cronbach's α	0.87				

Pearson product–moment correlation (r) was used to test the bivariate associations.
** $p < .01$.

Table 4
Inter-item relationship of the Perceived stress questionnaire (PSQ) in males; correlations and Cronbach's α.

	PSQ	Worries	Tension	Joy	Demands
Total PSQ	–				
Worries	0.90**	–			
Tension	0.73**	0.54**	–		
Joy	0.63**	0.44**	0.32**	–	
Demands	0.73**	0.59**	0.43**	0.29**	–
Cronbach's α	0.75				

Pearson product–moment correlation (r) was used to test the bivariate associations.
** $p < .01$.

Table 5
Correlations between the pain variables, i.e. number of pain sites, pain duration and pain intensity, and perceived stress, separately for gender.

		Pain sites	Pain duration	Pain intensity (VAS)
Females	Stress (total PSQ)	0.33**	0.29**	0.37**
Males	Stress (total PSQ)	0.36**	0.34**	0.38**

Pearson product–moment correlation (r) was used to test the bivariate associations.
VAS: Visual analogue scale; PSQ: Perceived stress questionnaire.
** $p < .01$.

included in their population-based study, knee (35.5 per cent in females and 27.9 per cent in males) and back pain (27.1 per cent in females and 19.4 per cent in males) were most common. High level of sports participation and female gender were associated with increased odds of having almost daily pain and multi-site pain [51]. Traditionally, lower limb has been regarded a common site for traumatic pain and not a site for stress-related pain [13]. However, recent findings show similar stress-levels (perceived stress) across different categories of musculoskeletal pain in adolescents, with similar stress for lower extremity pain and neck and shoulder pain for example [42]. This suggests that stress-mechanisms also influence the typically activity induced pain experiences in adolescents (such as knee pain). This is important to take into account when seeing young patients with lower extremity complaints, or when working to prevent this prevalent pain complaint among the youth.

Head pain reporting was most frequent among the females (24.8 per cent against 10.8 per cent of the males) (Table 1). The higher prevalence of head pain or headache among female adolescents is also previously documented [23,26,51,53], varying from 12.6 per cent [50] to 62.7 per cent [26]. However, the head pain prevalence in the adolescent males in this study was higher than recently reported in Danish adolescent males (3.2 per cent) [51]. Head pain or headache is frequently associated with other conditions such as anxiety and mood disorders [53–55]. Internalizing symptoms such as anxiety and depression in children and adolescents (age 8–18) are found to correlate with mothers' point of view, outlining a specific attunement between young headache patients and their mothers [54]. However, a recent worldwide epidemiological study found the strongest association between generalized anxiety disorder and frequent or severe headache in males [55]. The findings in this study support that young males are also bothered by head pain or headaches, and that pain experiences in young males associate with psychological factors (measured by the PSQ in this study) (Table 5).

4.2. Stress and gender differences

Along with the higher reporting of head pain, the adolescent females also reported higher levels of stress (PSQ $\geq$ 0.45) and higher pain intensity (VAS $\geq$ 7) (Table 1). When higher pain intensity accompanies higher stress, stress-induced pain-sensitization might be suspected [56,57]. With respect to all stress-variables (total PSQ, worries, tension, joy, demands), the females presented with the highest mean scores, resulting in significant mean differences between genders (Table 2). The greatest effect size appeared for worries (effect size 0.7) (Table 2). Previous studies have also concluded that young females seem more bothered by stress and worries than young males [14,23,36,58]. Already at the age of four, girls seem to be more affected than boys by distress in terms of sleeping disorders [59]. The higher prevalence of sleeping disorders found in the preschool girls [59] might suggest that girls are

Table 6
Correlations between body mass index (BMI) and pain and stress variables, separately for gender.

		Pain sites	Pain duration	Pain intensity (VAS)	Total PSQ	Worries	Tension	Joy	Demands
Females	BMI	0.12	0.14	0.19*	0.12	0.16	0.09	0.16*	0.01
Males	BMI	0.05	0.00	0.10	−0.02	−0.02	−0.07	0.13	−0.07

Pearson product–moment correlation (r) was used to test the bivariate associations. VAS: Visual analogue scale; PSQ: Perceived stress questionnaire.
* $p < .05$.

more occupied by worries from early childhood on. To tend to worry represent a personal trait aspect [33]. An apparent female tendency to perceive more stress and worry than males is also found by Vibe et al. [60], revealing higher levels of neuroticism and conscientiousness among female students compared to their male fellow students. Wiklund et al. [61] identified several worries among adolescent females and young women with self-defined stress-related problems. These worries were mainly related to "stressors of gendered orders" and included "to please and care for other", "being responsible and taking responsibility", "problematic female body and self", "exposure to oppression and violence", and "conflicting feminine positions". The general gender differences regarding stress and worries found in this present study might support that young females are more bothered by worries than their male peers.

4.3. The relationship between pain and stress

Although the adolescent females reported more stress and pain, the relationship between pain and stress seemed equal between genders. There were significant correlations between all pain and stress variables in both genders (Table 5, Figs. 1 and 2). The adolescent males revealed even stronger stress–pain associations than the females (Table 5). This implies that musculoskeletal pain in adolescent males might be more related to perceived stress than previously assumed. The stress–pain associations among the males challenge previous reports, where adolescent females have been presented with the strongest stress–pain associations [21,23,26,62]. It is possible that modern clinical medicine (mainly based on the medical model) and health care services have insufficient focus on the pain context and the root structural, social and cultural factors that shape pain [2]. This might disguise important information, also regarding gender differences [17]. Both stress and pain might be symptoms of "allostatic load", i.e. an imbalance of appraised resources and risks [11,30,33]. For females, such imbalance might be expressed as psychological distress to a greater extent than among males [14,17,60], while the males may express it as pain [14,63].

4.4. BMI-associations

Only adolescent females showed some (weak) associations between BMI and pain (in terms of pain intensity) and stress (in terms of lack of joy) (Table 6). According to traditional views of "gendered orders", females have been most occupied by body weight, although this picture seems changing towards more gender equality [64]. Notwithstanding, the minor associations between BMI and stress and pain in this study might imply that body weight is still more critical and problematic in young females, possibly reducing joy and increasing pain intensity.

4.5. Strengths and limitations

Reliability testing of the stress instrument (the Perceived stress questionnaire [PSQ]) separately for gender showed a lower Cronbach's α for the males than for the females (Tables 3 and 4). This might imply that the stress instrument is more suitable for adolescent females than males. Similar to all questionnaire-based surveys, this study might be subject to potential self-reporting bias. The self-reporting of pain intensity on a VAS-line, illustrating the average pain during the last week, has additional limitations, as memory of pain is inaccurate and often coloured by changing context factors [65]. The use of group level mean scores and a relatively large sample size reduces some of these bias effects. However, the cross-sectional design does not allow us to determine causal direction among the variables. The associations between stress and pain do not reveal whether the adolescents are stressed because of pain, or have pain because of stress. Additional aspects and variables, which are not measured in this study, may influence or mediate both pain and stress, and this might confound the results.

5. Conclusions

Pain and stress were prevalent in the adolescent sample of 15 and 16 year olds, with the highest reporting among females. Several pain measures corresponded between genders, but stress (Perceived stress questionnaire [PSQ]; worries, tension, joy, demands) differed significantly between genders for all variables. Scrutinizing the relationship between pain (pain sites, pain duration, pain intensity) and stress, there appeared significant stress-pain associations for all variables across genders, i.e. the pain complaints among the adolescents seemed equally related to stress in males and females. This elucidates the importance of a comprehensive understanding of pain complaints across genders in the young population.

6. Implications

This study provides insight into relevant health risks among adolescents in terms of musculoskeletal pain and perceived stress. The current prevalence of pain and stress seem high across genders in the young population. Females seem to perceive higher stress and higher pain intensity than the males, although gender differences in general look smaller than previously documented. The study findings imply that adolescent pain is equally associated to stress across genders, with the strongest stress-pain associations in males. This knowledge might contribute to a more comprehensive understanding of health and well-being in adolescents, including the recognition of the multifactorial dimension of pain across genders in the young population. This is clinical relevant and important to be aware of when addressing young people with pain complaints. Additionally, an enhanced understanding of pain complaints in adolescents might contribute to health promotion strategies that is more efficient in preventing long-term illnesses and disability in the young population.

Conflict of interest

All authors declare that they have no conflict of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, our work.

Authors' contributions

BØ has made substantial contributions to conception and design, to acquisition and analysis and interpretation of data, and to drafting and revising the manuscript. HS participated in design and in revision of the manuscript for important intellectual content. MH participated in design and in coordination of the writing process, in the sequence alignment, and in revising the manuscript critically. All authors read and approved the final manuscript.

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