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Do Experienced Stress and Trait Negative Affectivity Moderate the Relationship Between Headache and Quality of Life in Adolescents?

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Objective: **To test the moderating effects of trait negative affectivity (NA) and experienced stress (ES) on the interrelation between headache and health-related quality of life (HQL) in adolescents.**
Method: **Participants with migraine or with no-migraine primary headache (n = 64) were selected from the total population of two secondary schools (N = 1,566). Across a 4-week interval, participants completed a headache and stress diary and an HQL questionnaire. Additionally, a neuroticism scale was completed as a measure for NA.**
Results: **Independent of negative affectivity and stress, headache was found to affect these HQL domains: functional status, satisfaction with life in general, and satisfaction with health. The ES moderated the effect of headache on psychological functioning and satisfaction with life in general.**
Conclusions: **Headache activity in adolescents leads to a lower functional status, health satisfaction, and life satisfaction. The effect of headache on life satisfaction is greater in adolescents who experience high levels of stress.**

Key words: *headache; migraine; adolescents; health; quality of life; neuroticism; experienced stress; trait negative affectivity.*

Health-related quality of life (HQL) has become an important aspect of health outcome in the evaluation of medical treatment (Miettinen, 1987). Another valuable application of HQL measurement is to survey the impact of different diseases on HQL (Stewart et al., 1989). Functional status (role activities, mobility, physical activities, and self-care), psychological functioning, social functioning, and physical symptoms are defined as core HQL domains (Aaronson, 1988). Further, an evaluation of satisfaction with life in general and with health is commonly included in HQL evaluations. Initially, HQL evaluation was primarily performed in patients with life-threatening diseases, requiring treatments that significantly interfere with the patient's physiological, psychological, social, and role functioning (Aaronson, 1990). Currently, HQL evaluation is also targeted on patient groups with less severe disorders, such as headache sufferers (Cavallini, Micieli, Bussone, Rossi, & Nappi, 1995), since their quality of life is more affected than medical outcome variables such as mortality. In children with chronic physical conditions, issues of quality of life have also become salient (Wallander & Thompson, 1995).

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The burden of migraine, although not a life-threatening disorder, is often underestimated (Essink-Bot, Royen, Krabbe, Bonsel, & Rutten, 1995). Therefore, systematic evaluation of HQL is a worthwhile procedure to document quantitatively the influence of migraine on the lives of young migraine patients. Linet, Steward, Celentano, Ziegler, and Sprecher (1989) demonstrated, in a large epidemiological study, that the experience of migraine or no-migraine headache and subsequent impairment of role functioning is relatively common in adolescents and young adults. Counting school or work absence, as in that study, is one feasible approach to quantify the impact of the participants' headache on one HQL domain, in this case functional status. Another approach is to employ specific self-report scales designed for measuring one or more HQL domains. For example, Kaiser (1992) used standardized self-report measures in an attempt to survey the impact of headache on psychological functioning in adolescents. Of the participants with chronic daily headache, 86% reported high levels of depression. Using a similar approach, Engstrom (1992) showed that, compared to healthy individuals, 9- to 18-year-old headache patients experience more somatic complaints, lower general well-being, more physiological anxiety, and are less communicative than other adolescents. Langeveld, Koot, Loonen, Hazebroek, and Passchier (1996) developed the Quality of Life Headache-Youth questionnaire (QLH-Y) as a measurement scale for HQL in adolescents with recurrent headache or migraine. In a study employing this instrument, they found that adolescent headache participants, compared with healthy control participants, reported a poorer HQL, that is, worse psychological functioning, more physical symptoms, a poorer functioning status, and less satisfaction with life and health. Furthermore, in adolescents changes in headache activity across adjacent weeks were found to be related to parallel changes in the HQL domains of functional status, psychological functioning, and satisfaction with life and health (Langeveld, Koot, & Passchier, 1997).

For some HQL domains, the direction of causality regarding the interrelation of headache and quality of life is more evident than for others. For example, it is most likely that the frequent experience of headache will result in increased school absence. Here, a causal effect in the opposite direction is less likely. For other HQL domains, the direction of causality is less apparent. For example, regarding psychological functioning, poor psychological functioning might result in headache complaints but could also be a consequence of headache. Similarly, some authors suggest that migraine, although originating from a biological disposition, might be triggered by experienced stress in youngsters (Andrasik, Holroyd, & Abell, 1979; Egermark-Eriksson, 1982; Maratos & Wilkinson, 1982; Passchier & Orlebeke, 1985). By contrast, others (Cunningham et al., 1987) say that low psychological functioning probably is a consequence of the experience of chronic pain.

The problem of causality in the interrelation between headache and psychological functioning might be even more complex than just a question of causal direction. It could be hypothesized that a third variable interacts with the effect of headache on HQL. Such a variable can act as a moderator, which is defined as a variable that affects the direction or strength of the relation between an independent of predictor variable and a dependent or criterion variable (Baron & Kenny, 1986). The level or value of the moderator influences the nature of the impact of a predictor (Holmbeck, 1997).

Several studies point at stress and trait negative affectivity (NA) as potential moderators of the relation between headache and HQL. Crandall, Preisler, and Aussprung (1992) operationalized experienced stress (ES) as "daily hassles" and showed that daily hassles predicted physical symptoms and future headache frequency. Labbe, Murphy, and O'Brien (1997) suggest that perception of stress at home, school, and work may be a powerful predictor of future headache frequency in college students. Siegel and Brown (1988) found evidence that in female adolescents stress rated as negative experience was associated with both poor physical health and mental health. Thus, in adolescents, ES can be expected to have a negative main effect on both migraine and headache activity and the HQL domains physical functioning and psychological functioning. Following, an interactional effect of ES and headache activity on these HQL domains can be expected, indicating a moderating effect of ES on the association between headache and quality of life.

In a similar way, NA might moderate the relation between headache and HQL, as high NA may both increase the number of self-reported headache symptoms and lower the level of self-reported HQL. As such, an interactional effect of NA and headache activity on HQL can be expected. In line with Watson and Pennebaker (1989), one can hypothesized that the relation between self-reported physical

symptoms (such as headache) and self-reported health might be spuriously inflated by the moderating effect of NA.

In the present study, we tested main effects of NA and ES on HQL in adolescents, concurrently with the effect of headache activity, employing data from one of our previous groups of youngsters with headache (Langeveld et al., 1996). Further, we tested whether the observed positive relation between headache activity and different aspects of HQL in adolescents (Langeveld et al., 1997) is moderated by NA or ES. The following hypotheses are tested: In a multifactorial design (1) headache, NA, and ES have main and independent effects on HQL; (2) the relation between headache and HQL is moderated by the levels of NA and ES, that is, the strength of the effect of headache on HQL will be affected by the effects of NA and ES on HQL. To test these hypotheses, we closely followed the analytic model recently proposed by Holmbeck (1997).

Method

Participants

To recruit a sample of adolescents with migraine or chronic headache, in cooperation with the Rotterdam Municipal Health Service, all students of two comprehensive schools were screened on headache or migraine by way of a short questionnaire. One of these schools was a Technical Education and Lower Economic and Administrative Education school (N = 917). The other was a school for Lower and Higher General Secondary Education and Pre-University Education (N = 649). The headache screening questionnaire asked the students whether they had been bothered by headaches at any time. If they had, they were asked to indicate since when and how often. Then they were asked whether their headaches had been diagnosed as migraine by a doctor, or whether their headache symptoms resembled migraine. For this purpose, a short description of migraine and its symptoms, as used by the Dutch Association for Migraine Patients, was given. Migraine was described as a type of headache that occurs episodically, most often at one side of the head and frequently accompanied by nausea and vomiting. Students were included in the study: (1) if they were between 12 and 18 years of age; (2) if headache symptoms were present that had ever been diagnosed by a physician as "migraine" or that were considered by the participants to resemble the symptoms in the migraine description; (3) if the headache frequency was at least twice a month; and (4) if the headaches had been present for at least one year. For more details on subject selection, see Langeveld et al. (1997).

From the 1,566 students (758 girls and 755 boys), 129 fulfilled the criteria for inclusion in the headache or migraine subgroup. Of these, 64 students (38 girls and 20 boys) and their parents agreed to participate. These participants were seen by a neurologist for an expert diagnosis. The neurologists' expert diagnoses resulted in 38 migraine headache participants (24 girls [60%] and 14 boys [40%]) versus 20 no-migraine headache participants (14 girls [70%] and 6 boys [30%]). No organic pathology was found in the participants screened by the neurologist. Six participants did not meet at the doctor's office (four girls and two boys) and, therefore, no diagnosis was set for them. All 64 students included in the study returned one or more complete diaries and questionnaires. Of these, 54 returned all completed diaries and questionnaires. The missing values from the 10 participants with incomplete responses were exchanged with the mean of each participant's scores at other measurement times. The two diagnostic groups did not differ in age (t = 0.41, p = .685) or gender distribution (χ^2 = .16, p = .693).

Variables and Instruments

Health-Related Quality of Life. To assess health-related quality of life we employed the Quality of Life Headache-Youth (QLH-Y) questionnaire (Langeveld et al., 1996), which includes 69 multiple-choice items (four response categories, with values 0 through 3) and two visual analogue scales. The multiple-choice items cover the following four HQL domains: physical functioning (10 items) asking for physical symptoms, except headache; functional status (13 items) asking for the impact of headache on the participants' daily living; psychological functioning (34 items) including the subscales "stress," "harmony," "fatigue," "strength/vitality," "depression," "cheerful mood/good humor," and "optimism about future"; and social functioning (12 items) including the subscales "functioning at home and at school," "social interaction with peers," and "social interaction with brothers and sisters." The two visual analogue scales cover the HQL domains, satisfaction with life in general and satisfaction with health. Nearly all subscales of the QLH-Y show satisfactory internal consistency

(Cronbach's alpha of above .70 [Nunnally, 1978]), with lowest coefficients (.66–.72) for the two subscales within the HQL domain social functioning. Scores for the different HQL domains are computed by summing subscale scores within each domain, with higher scores on all QLH-Y subscales indicating a higher HQL. For a more detailed description of format and content of the QLH-Y questionnaire and its reliability and validity, see Langeveld et al. (1996).

Headache Activity. An index for headache activity was derived from the QLH-Y headache diary, modeled after Blanchard, Theobald, Williamsen, Silver, and Brown (1978). Participants rated headache four times a day on a 5-point Likert scale: 0 = No headache, 1 = Headache—I am only aware of it if I pay attention to it; 2 = Headache—but I can ignore it at times; 3 = Headache—I can't ignore it but I can do my usual activities; 4 = Headache—It's difficult for me to concentrate. I can only do easy activities; and 5 = Headache—Such that I can't do anything (for a detailed description of the diary see Langeveld et al. [1997]). For each subject a headache activity index was computed by adding up the diary intensities of all diary-reported headache during the 4-week study period (Blanchard, Andrasik, Neff, Jurish & O'Keefe, 1981).

Experienced Stress. To record events of ES, a life-event schedule could be employed. Yet, as Crandall, Preisler, and Aussprung state (1992), "even the most carefully created life-events schedule may not properly characterize the stressors in the lives of particular samples" (p. 630). Therefore, a qualitative method of gathering data on ES in our sample was chosen. We defined ES as "any thoughts or events that the participants perceive as stress-provoking." To assure accuracy of recording, a diary format was chosen and ES was recorded once a day as part of the QLH-Y diary. Instances of ES were captured by asking the participants, "Please write down any thoughts that frequently came into your mind this day or bothered you." After completion of the diary, two senior psychologists independently coded all instances reported in the diaries (n = 951) as (1) school-related ES, (2) health-related ES, (3) interpersonal ES, (4) other incidences of ES, and (5) not stress-provoking instances. For each subject, all coded ES instances, collected over the four weeks the diary was kept, were summed into total category scores and into a total score for ES (sum of ES categories 1–4). Cohen's kappa for interrater agreement regarding the coding in five categories (1–5) as described above was .76. Cohen's kappa for the stress provoking (categories 1–4) and no stress provoking (category 5) distinction was .93.

Trait Negative Affectivity. The NA can be assessed by common personality inventories including the Eysenck Personality Neuroticism scale (Watson & Pennebaker, 1989). For this study, to measure NA the Korte Amsterdamse Biografische Vragenlijst voor Kinderen (KABVK) neuroticism scale was chosen. The KABVK is a shortened version of the Eysenck Personality Inventory (Farley, 1970), translated into Dutch and modified to be applicable with youths between 9 and 15 years of age. The validity of the three original Eysenck scales (neuroticism, extraversion, and psychoticism) is supported by a study by Zuckerman (Zuckerman, Kuhlman, & Camac, 1988). Test-retest reliability of the KABVK neuroticism scale is reported as .68 for boys and .72 for girls (Dijl & Wilde, 1982). Some examples on items on the KABVK neuroticism scale are "Often falling asleep is hard for me"; "I am often scared that something terrible will happen to me"; "Often, I feel guilty"; "Many things scare me."

Procedure

In writing, all participants (n = 64) were instructed on how to complete the QLH-Y questionnaire and the diary. The diary was filled out over a 4-week period (Day 1 to 28). On day 7 (measurement 1, called Week 0), day 14 (measurement 2, Week 1), day 21 (measurement 3, Week 2), and day 28 (measurement 4, Week 3) of the period of diary recording, all participants completed the QLH-Y questionnaire. To prevent contamination between state and trait measures of stress, respectively NA, all participants filled out the KABVK personality questionnaire six months after day 1 of the diary recording period. All questionnaires and diaries were posted with a preposted envelope enclosed, in which questionnaires and diaries had to be returned on days 8, 15, 22, and 29. After all diaries and questionnaires were completed and returned, participants were given a gift voucher worth 30 Dutch guilders (about US$15) in appreciation for their participation.

Data Analyses

To test any differences between the migraine and no-migraine headache groups on the study variables, t tests were performed. In order to explore the interrelations between the variables in this study, Pearson correlations were computed.

The preferred strategy to test moderator effects

Table I. Headache, Number of Experienced Stress (ES) Incidents, Negative Affectivity (NA), and Quality of Life in the 4-Week Research Period for Migraine and No-migraine Headache Participants

	Migraine (n = 38) Mean (*SD*)	No migraine (n = 20) Mean (*SD*)	*T* value
No. of days with headache	9.05 (5.73)	14.70 (7.48)	3.20**
Headache index	5.92 (5.21)	10.79 (9.00)	2.37*
Negative affectivity	6.36 (2.70)	5.95 (2.96)	−.53
No. of ES incidences			
Related to school	7.55 (5.87)	5.20 (5.90)	−1.45
Related to health	1.03 (1.24)	0.50 (1.40)	−1.47
Related to interpersonal	2.95 (3.45)	1.75 (2.49)	−1.37
Other incidences	1.71 (3.36)	0.40 (0.60)	−2.33*
Total incidences	13.24 (9.83)	7.85 (7.55)	−2.32*
HQL domains			
Physical functioning	33.42 (1.10)	33.62 (1.64)	.53
Functional status	52.23 (3.55)	51.65 (2.96)	−.62
Psychological functioning	89.93 (11.08)	88.96 (9.71)	−.30
Social functioning	20.44 (5.79)	19.25 (5.18)	−.63
Satisfaction with life in general	299.73 (84.49)	297.06 (78.48)	−.11
Satisfaction with health	307.71 (77.52)	288.81 (77.51)	−.81

High scores on HQL domains indicate a better quality of life.
n = 58.
*$p < .05$.
**$p < .001$, two-sided.

is to use multiple regression techniques (Holmbeck, 1997). To test the two main hypotheses of this study, six separate hierarchical multiple regression analyses were performed, one for each HQL domain. Multicollinearity effects between first-order terms (i.e., the independent variable and the potential moderators) and the higher-order terms (i.e., the interaction terms) can be problematic (Aiken & West, 1991; Holmbeck, 1997). Therefore, the independent variables were "centered" before they were entered in the regression analysis by substracting the mean of the variable from all individual scores, producing a revised sample mean of zero. For each regression analysis, one of the six HQL domains was treated as a dependent variable. Since NA was assessed as a trait (i.e., trait NA), not as a state, in all six regression analyses NA was entered as independent variable at step one. At steps two and three, ES and headache activity were entered subsequently. Finally, since interaction effects should be entered after main effects, at steps four and five interactions between NA and headache activity, and between ES and headache activity, were entered.

Results

In Table I, number of days bothered by headache, headache indexes (as measures for headache activity), NA scores, and number of ES incidences are presented for migraine participants and nomigraine participants. Migraine headache participants reported a significantly lower number of days with headache over the 4-week measurement period as compared with the no-migraine headache participants. Additionally, their summed headache index was significantly lower; NA was not significantly different for migraine and no-migraine participants. In migraine participants the total score of ES and the number of ES incidences not related to specific situations were significantly higher than in no-migraine headache participants. By far the most instances of ES were related to school. Only about 5% of reported ES of the headache participants was related to the participants' health.

Table II displays the Pearson zero-order correlations between all variables entered in the regression analyses. The NA correlated strongly with physical functioning. Moderate but significant correlations were found between NA and satisfaction with life in general and between ES and psychological functioning. Headache activity showed moderate to strong correlations with functional status, satisfaction with life in general, and satisfaction with health. All correlations indicated a poorer quality of life co-occurring with higher levels of NA, ES, and headache. Correlations between NA, ES, and headache were weak and not significant. Intercorrela-

Table II. Correlations Between NA, ES, Headache Index (Summed), and QLH-Y Scores

	NA	ES	HI	PHF	FS	PF	SF	SLG
NA	1.00							
ES	.14	1.00						
Headache index	.24	.05	1.00					
HQL domains								
Physical functioning	−.57***	−.04	−.27	1.00				
Functional status	−.27	.15	−.44**	.54***	1.00			
Psychological functioning	−.32	−.38**	−.21	.33*	.04	1.00		
Social functioning	−.19	−.24	−.08	.01	−.07	.53***	1.00	
Satisfaction with life in general	−.31*	−.28	−.44**	.43**	.21	.74***	.26	1.00
Satisfaction with health	−.14	−.20	−.51***	.49***	.18	.47***	.12	.72***

High scores in QLH-Y scales indicate a higher quality of life.
$n = 64$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

tions between HQL domains varied from low and nonsignificant to high.

In Table III, results are displayed for the hierarchical regression analyses with NA, ES, and headache activity (i.e., summed headache index) as independent variables and the HQL domains as dependent variables. Further, interaction effects between NA and headache activity and between ES and headache activity on HQL are presented.

As shown in Table III, and following Cohen's criteria (1988), NA had a strong effect on the HQL domain physical functioning and a moderate effect on the HQL domain psychological functioning. Furthermore, ES showed a small but significant effect on psychological functioning. Headache activity showed strong predictive relationships with the HQL domains functional status and satisfaction with health. It predicted moderately the HQL domain satisfaction with life in general, controlling for levels of NA and ES.

Interactional effects of moderate size were found of ES and headache on the HQL domains psychological functioning and satisfaction with life in general. To explore the direction in which these interactions affect the interrelation between headache and HQL, simple regression lines were plotted for high (above the 66th percentile) and low (below the 33rd percentile) values of the moderator variables (Figures 1 and 2). These regression lines indicate that in the presence of high ES, headache showed a greater effect on psychological functioning and on satisfaction with life in general, indicating that more ES is accompanied by a poorer psychological functioning and satisfaction with life in general.

After a Bonferroni correction was performed on the six multiple regression analyses (a familywise protection level of .05 results in a per comparison protection level of .008), all final F tests remained significant.

Discussion

Main Effects

In our sample of headache participants studied in a multifactorial design including measures for NA and ES, diary-recorded headache activity firmly predicted the HQL domains functional status, satisfaction with life in general, and satisfaction with health. The more headache was reported by the adolescents, the lower their HQL, supporting the first hypothesis that headache has a main effect on HQL, independently from effects of NA and ES. Thus, we found that in adolescents, headache leads to a lowered HQL, unbiased by effects of NA and ES on HQL.

Further, we found that NA significantly predicted the physical functioning and psychological functioning HQL domains. This finding is in line with Watson and Pennebaker's (1989) conclusion that questionnaire data on subjective health and distress are affected by trait negative affectivity or, in other words, by a tuning toward the report of somatopsychic distress. Participants high on NA are more tuned toward the observation and report of physical symptoms and psychological distress. A final main effect was found of diary-recorded ES on HQL, that is, on the psychological functioning HQL

Table III. Results of Multiple Hierarchical Regression Analyses of HQL Domains on NA, ES, Headache Index, and Interactions between Headache and NA and Headache and ES

Step predictor	β	R^2 (adj.)	*F* change	Cum. R^2 (adj.)	Final *F*	Power in each step
Physical functioning						
1 NA	−.54***	.31	20.51	.31		.99
2 ES	.10	−.02	−10.50	.29		.09
3 Headache index	−.21	.01	−2.86	.30		.22
4 NA * headache index	.06	−.01	−1.65	.29		.19
5 ES * headache index	−.22	.03	−.44	.32	5.06**	.35
Functional status						
1 NA	−.15	.05	3.36	.05		.94
2 ES	.26	.01	.83	.06		.87
3 Headache index	−.53***	.14	2.24	.20		.89
4 NA * headache index	.21	.04	−0.22	.24		.39
5 ES * headache index	−.17	.01	−.57	.25	3.93**	.14
Psychological functioning						
1 NA	−.30*	.08	4.68	.08		.89
2 ES	−.28*	.10	.83	.18		.70
3 Headache index	−.13	.00	−1.56	.18		.26
4 NA * headache index	−.12	−.02	−1.05	.16		.30
5 ES * headache index	−.30*	.06	.36	.22	3.26**	.55
Social functioning						
1 NA	−.19	.00	1.15	.00		—[a]
2 ES	−.28	.02	.21	.02		—[a]
3 Headache index	.08	−.03	−.47	−.01		—[a]
4 NA * headache index	−.20	.02	.16	.01		—[a]
5 ES * headache index	.16	−.01	−.08	.00	.97	—[a]
Satisfaction with life in general						
1 NA	−.23	.07	4.20	.07		.98
2 ES	−.17	.08	−.61	.15		.92
3 Headache index	−.39*	.09	1.85	.24		.79
4 NA * headache index	−.10	−.02	−1.46	.22		.40
5 ES * headache index	−.31*	.07	.51	.29	4.49**	.65
Satisfaction with health						
1 NA	.03	.00	.85	.00		.96
2 ES	−.11	.01	.28	.01		.96
3 Headache index	−.60***	.23	4.34	.24		.97
4 NA * headache index	.13	.01	−.94	.25		.25
5 ES * headache index	−.21	.02	−.38	.27	4.15**	.24

Headache index (summed) is treated as a measure for headache activity.
$n = 64$.
[a]Power cannot be computed, since $R^2 = 0$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

domain, showing that participants who experience more stress during a week subsequently report a poorer psychological functioning.

Moderating Model

The second hypothesis of this study was partly supported as interactional effects between headache and ES were found on the psychological functioning and satisfaction with life in general HQL domains. Adolescent participants with recurrent headaches who had reported high levels of ES during the 4-week study period showed more problems with regard to psychological functioning than those who had reported low levels of ES. Further, these participants revealed a lower satisfaction with life. This

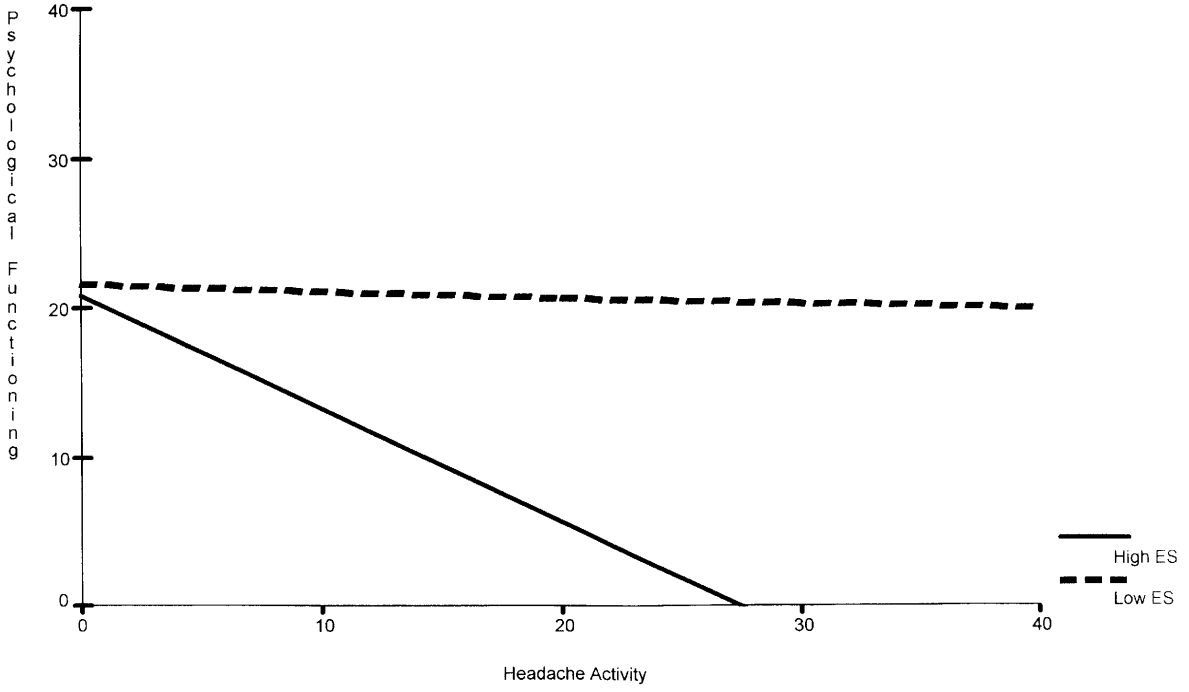

Figure 1. Significant effects of interactions between experienced stress (High ES, Low ES) and headache activity on the psychological functioning HQL domain.

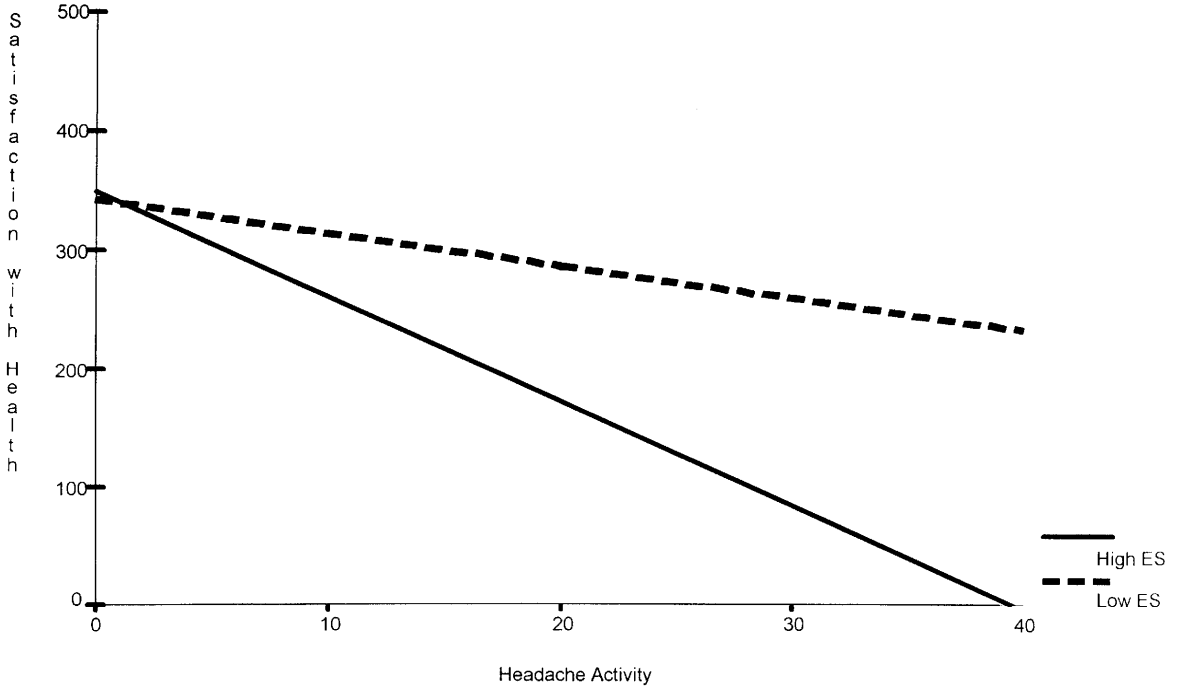

Figure 2. Significant effects of interactions between experienced stress (High ES, Low ES) and headache activity on the satisfaction with health HQL domain.

finding implies that in adolescents the relation between headache and different aspects of quality of life is clearly moderated by ES, but not by NA.

Other Findings

The adolescent migraine participants in our study reported less headache than the no-migraine headache participants, but they did report more ES. These findings are in line with studies in adult tension headache and migraine patients (Andrasik & Passchier, 1993; Blanchard, Andrasik, & Arena, 1984). Further, in our study migraine patients and no-migraine headache patients revealed rather similar patterns of quality of life including psychological functioning. This is in accord with the results of a study by Passchier, de Boo, Quaak, and Brienen (1996), which demonstrated similar patterns of quality of life in adult participants with different headache diagnoses. In our study no differences in NA were found between adolescents with migraine and those with other types of headache. As such, no support for the assumption of the existence of an anxious and depressive migraine personality in young participants was found. In adults, Blanchard et al. (1984) came to the same conclusion.

In contrast with our previous study on the interrelation of diary-recorded changes in headache activity and quality of life (Langeveld et al., 1997), in our present study no significant effect of headache activity on psychological functioning was found. Apparently, the aggregate and summed index for psychological functioning used in the present study disguises more subtle time-related or short-term effects of headache on the different psychological functioning subscales shown in our previous study.

Implications

Our findings confirm that, as in adults (Essink-Bot et al., 1995), in adolescents the burden of migraine and other frequent headache syndromes on HQL is serious. Our findings suggest that the co-occurrence of headache complaints and reports of a lowered HQL in adolescents do not simply reflect a tuning toward the overreport of bodily symptoms and negative affect. Neither can a lowered HQL in adolescents with recurrent headache barely be attributed to high levels of ES.

Further, as we found that the effect of headache on HQL is greater in participants high on ES, we suggest that intervention programs directed at reduction of headache impact on HQL in young chronic headache or migraine participants should include cognitive-behavioral techniques aimed at the increase of stress-coping skills.

Although a questionnaire format to survey quality of life yields reliable and valid data with adolescents (Langeveld et al., 1996, 1997) the results of this study suggest that the responses of adolescents to questionnaire-gathered data on physical symptoms and psychological distress are more likely to be affected by their emotional characteristics (i.e., trait negative affectivity) than data recorded by use of a diary. Hence, when adolescents are asked to report on their health and physical symptoms, the timespan should be as short as possible. Therefore, we encourage the increased use of diary formats in health psychological research on young participants.

Limitations

Despite these distinct findings, several aspects concerning the design of our present study diminish the strength of our conclusions.

First, the number of participants in our study is limited. Therefore, the power of our findings is less than optimal. This means that only strong effects reach the level of significance. Although the power for the first step of each regression analysis was sufficient (power .89–.93) for all scales except the social functioning scale, the power for subsequent steps in each analysis was limited (see Table III). In other words, because of multiple testing on a limited number of participants, some of our results may reflect chance findings that definitely require replication.

Second, only the migraine diagnosis was set following internationally accepted criteria. Beyond the study's inclusion criteria, no other specific headache diagnoses were set. As a consequence, regarding headache diagnosis, the no-migraine headache sample may have been rather mixed. However, in our participants no organic pathology was found. In children and adolescents, most common nonorganic headaches are migraine and muscle contraction headache (McGrath & Humphreys, 1989). Thus, the majority of the no-migraine headache participants probably are muscle contraction headaches.

Finally, although measurement of HQL was performed *after* the diary registration of ES and headache activity, the participants were asked to rate

their HQL retrospectively for the previous week. Therefore, one might question the prospective design of our study. Hence, the design of our study does not definitely rule out that HQL may affect ES and headache instead of HQL being affected by ES and headache, as assumed in our study.

General Conclusion

The general conclusion of this study is that in adolescents with recurrent headache, headache activity as measured by a diary leads to a lower health-related quality of life in different HQL domains. This effect cannot be attributed to the participants' emotional characteristics or to instances of stress they have experienced. However, adolescents high on ES show a greater impact of headache on their psychological functioning and satisfaction with life. As such, experienced stress moderates the relation between headache and HQL in adolescents.

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