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Original Article

What Factors Contribute to Headache-Related Disability in Teens?

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ABSTRACT

BACKGROUND: Our aim was to describe the relationship between risk factors, such as stress, depression, and anxiety, and potentially protective factors against pediatric headache-related disability, such as mindfulness, resilience, and self-compassion, and to determine teens' interest in mind-body skills training to help reduce headache-related disability. **METHODS:** This was a cross-sectional survey among adolescents seen in an academic neurology clinic reporting four or more headaches monthly using standardized instruments to determine the relationship between putative risk and protective factors as well as physiologic markers of inflammation and vagal tone and headache-related disability. **RESULTS:** Among the 29 participants, 31% were male, the average age was 14.8 years, average headache frequency was 11.6 per month, and the most commonly reported trigger was stress (86%). The only risk or protective factor significantly associated with headache-related disability was depression ($r = 0.52$, $P = 0.004$). Depression was negatively correlated with mindfulness, resilience, and self-compassion ($P < 0.01$ each) and positively correlated with stress, sleep disturbance, and anxiety ($P < 0.01$ each). Biomarkers of vagal tone and inflammation were correlated with each other but not with headache-related disability or depression. There was strong interest in learning skills like slow, deep breathing practices supported by a smart phone application to reduce stress and the negative impact of headaches on daily life. **DISCUSSION:** Among teens with frequent migraine headaches, depression is the strongest risk factor for headache-related disability. Stress is viewed as a headache trigger, and teens reported wanting to learn simple stress management strategies supported by a smart phone application to help reduce headache-related disability.

Keywords: headache, migraine, pediatric, stress, depression, anxiety, heart rate variability

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Background

Headaches are a common pediatric problem with serious impact on overall health status, quality of life, and disability.[1,2] Tension-type headache (TTH) is the most common, with prevalence rates ranging from 10% to 25% in school-aged children.[3] Migraine headaches are somewhat less common, with prevalence ranging from about 3% in younger school-aged children to nearly 20% in older adolescents.[3]

Risk factors thought to increase the adverse impact of headaches in both adults and teens include anxiety, depression, stress, and sleep disturbances.[4-6] Addressing these risk factors is an important treatment goal in overall headache management. Protective factors that may lessen the impact of headache-related disability have not been as well characterized in pediatric populations. Adult studies suggest that mindfulness (defined as moment-to-moment nonjudgmental awareness)[7] and self-compassion (defined as kindness toward self, mindfulness, and a sense of common humanity

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with others)[8] are associated with decreased stress, anxiety, depression, perceptions of pain, and disability due to pain.[8-10] Furthermore, training in mindfulness and self-compassion can improve these factors for patients with chronic pain; in addition, training in these mind-body techniques affects brain physiology and function, autonomic function, telomerase activity, and inflammatory biomarkers.[11-15]

Although studies in adolescents suggest that training in mind-body skills is possible,[16] the effects of training in mindfulness and self-compassion have not been tested for adolescents with recurrent migraine headaches. Other mind-body techniques, such as self-hypnosis and therapist-administered biofeedback, have proven useful in preventing headaches in youth,[17-20] but have not been universally adopted. In our tertiary care setting, some of these techniques are offered, but additional techniques to reduce stress and improve overall resilience and mental health may be useful and desirable.

Before embarking on a study to determine the benefits of teaching mind-body skills to adolescents with chronic recurrent headaches, we conducted a pilot study to test the conceptual model underlying this intervention (Fig 1) and to more specifically assess teens' interest in mind-body training.

Specifically, we wished to characterize the relationships between potentially (1) negative risk factors (stress, anxiety, and depression), (2) positive protective factors (mindfulness, self-compassion), and (3) physiologic markers of inflammation and autonomic balance (heart rate variability [HRV], interleukin-6 [IL-6], and high-sensitivity C-reactive protein [hsCRP]) on (4) headache impact. If positive protective factors were found to be associated with lower impact of headache, subsequent studies could focus on enhancing these qualities. If not, future interventions might better focus on other factors. Finally, we wished to describe teens' interest in learning additional mind-body skills, and to determine which factors were most important to them in considering additional therapies.

Methods

This was a cross-sectional study conducted at a large Midwestern pediatric teaching hospital between May and November, 2014. Participants were recruited through flyers in the hospital's Neurology Clinic, Pain Clinic, and Gastroenterology Clinic. In addition, the electronic medical records were searched, and patients whose records indicated a diagnosis of migraine headache were sent a letter inviting them to participate. Subjects were offered a gift of $25 for completing one study visit, which included answering multiple questionnaires, having their blood drawn, and having their heart rate monitored for about 20 minutes. Our goal was to recruit 30 participants over 6 months.

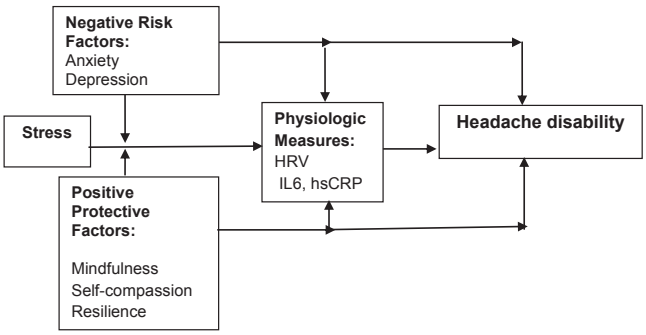

FIGURE 1.
Preliminary conceptual model showing expected relationships among risk, protective, and physiologic variables affecting the impact of headaches on functional status in adolescents.

Subjects were eligible if they were 12-18 years old and reported a primary diagnosis of migraines with or without aura, chronic migraines, or chronic TTH with a frequency of at least four headaches per month. Potential participants were excluded if they were currently enrolled in other headache studies at the institution; received onabotulinumtoxin A within 3 months for headache management; had secondary headaches associated with head trauma, brain tumors, or any other diagnoses that in the opinion of the study neurologists might make them unsuitable candidates for the study; or for whom the study itself would interfere with their medical care.

Study visits were scheduled separately from clinic visits and were held in the Children's Hospital's Clinical Research Center between 9 and 11 am to minimize diurnal variability. After obtaining informed consent from parents and assent from participants, participants completed study questionnaires, had blood drawn, and underwent continuous cardiac monitoring for 20 minutes while at rest to obtain data for HRV analysis. Questionnaire data were completed using REDCap, cleaned by the study coordinator, and exported to Microsoft Excel for transmission to the project biostatistician for analysis. Blood samples were flash frozen and sent to the laboratory for batch analysis.

Standard questionnaires were used to measure the main study outcome (headache disability) and proposed negative and positive predictive factors.

Headache disability was assessed using the six-item Headache Impact Test (HIT-6) (which is a validated assessment of the functional impact of headaches for both migraine and TTH in adults and has been used in adolescent as well as adult headache populations).[21-23] It has high reliability and correlates well with the Migraine Disability Assessment Scale, headache pain severity, and the number of headaches per month.[23-26] It is also sensitive enough to detect improvements associated with pharmacologic and nonpharmacologic treatments.[27-29] Scores over 55 indicate severe headache-related disability.[30] Headache frequency was asked with the question, "On average, how many days a month do you have a headache?"

Negative (risk) factors

Stress was assessed with the widely used Cohen's 10-item Perceived Stress Scale.[31] Anxiety and depression were assessed using the National Institutes of Health–funded Patient Reported Outcome Measurement Information System (PROMIS) Short-Form Pediatric Anxiety Scale and the PROMIS Short-Form Pediatric Depression Scale.[32,33] Sleep disturbance was measured using the PROMIS Sleep Disturbance Scale, in which higher scores indicate greater sleep disturbance.[34]

Positive (protective) factors

Mindfulness was assessed using the 10-item version of the Cognitive and Affective Mindfulness Scale, Revised,[35] and self-compassion was assessed using the 12-item version of Neff's Self-Compassion Scale.[36] Resilience was assessed using Smith's six-item Brief Resilience Scale.[37]

Intermediate physiologic factors

Autonomic balance was assessed with two measures of HRV, the standard deviation of the interbeat interval and the root mean square of the successive differences, which is thought to represent primarily vagal tone. HRV was assessed with a 20-minute recording in the Clinical Research Center, with the subject lying supine with the head of the bed raised 45 degrees. Electrocardiography (EKG) and impedance measures were obtained using a Bionex system (Mindware, Gahanna, OH). The EKG was performed in the standard lead II configuration. Following technician analysis for artifact and ectopy, the EKG results were downloaded into a computer software program that produces