

REVIEW ARTICLE

Headache in School Children: Prevalence and Risk Factors

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SUMMARY

Background: Recurrent headache is a common problem in school children. Evaluation generally leads to the diagnosis of a primary headache syndrome (migraine or tension-type headache). This review is addressed to the question whether headaches in school children are becoming more common and, if so, what risk factors are associated with the rise in frequency.

Methods: We selectively searched the PubMed database for pertinent publications that contained the terms “primary headache AND children/adolescent AND risk factors/prevalence.” Articles published in either English or German up to April 2013 were considered. Articles on secondary types of headache were excluded.

Results: Headaches are becoming more common among school children. At present, 66% to 71% of 12- to 15-year-olds have at least one headache every three months, and 33% to 40% have at least one per week. Headache is often accompanied by other physical and/or emotional manifestations. Studies from Scandinavia reveal increasing prevalence in age groups from 8 years of age and upward. Various studies have identified the following risk factors for headache or for its chronification (up to 5.8-fold elevation of risk): a dysfunctional family situation, the regular consumption of alcohol, caffeine ingestion, smoking, a low level of physical activity, physical or emotional abuse, bullying by peers, unfair treatment in school, and insufficient leisure time.

Conclusion: Headaches are becoming more common among children and adolescents. They are often associated with other physical and emotional complaints.

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Headaches are one of the most common complaints in the general population, as well as among children and adolescents. In school children the most common form are primary headaches, defined as headaches not associated with an underlying disorder (group 1–4, IHS classification (1)). The median frequency of headaches (1-month to lifetime prevalence) in 50 population-based studies was 58.4% in school children, while the prevalence of migraine headaches was 7.7% (2). The ratio of girls to boys was 1.5:1 (all headaches) and 1.7:1 (migraines). Secondary headaches (headaches associated with an underlying disease) are uncommon in patients with recurrent headaches. The prevalence of headaches in school children (11–18 years of age) in Turkey was 34.1% for primary headaches and 4.4% for secondary (e1). The most common causes of secondary headaches were viral respiratory infections (29–39%) and mild skull injuries (3) (*Boxes 1, 2*).

Methods

This review was prepared as an expert consensus (modified Delphi technique). Publications that were identified through a selective literature search in PubMed (through April 2013) under the key word combinations „primary headache AND children AND prevalence“ (318 citations); „primary headache AND adolescent AND prevalence“ (411 citations); „primary headache AND children AND risk factors“ (84 citations); and „primary headache AND adolescent AND risk factors“ (115 citations) were reviewed by at least one author. Only publications in English or German which had appeared in a peer-reviewed journal were considered.

Clinical features of primary headaches in children and adolescents

The median age for the onset of headaches was 7.5 years (4). The clinical signs and symptoms differed from those in adults. In children it is often impossible to distinguish with certainty between migraines and tension-type headache (e2). The duration of migraine attacks is shorter (it can be less than two hours) (e2, e3) and is rarely longer than 12 to 24 hours. The headaches are more often bilateral and associated nausea and vomiting decrease with increasing age (e4). Intense pain and a pulsatile nature suggest migraines. These

BOX 1

IHS criteria for migraine without aura (1.1)

● **Description:**

Recurrent headache disorder manifesting in attacks lasting 4–72 hours. Typical characteristics of the headache are unilateral location, pulsating quality, moderate or severe intensity, aggravation by routine physical activity and association with nausea and/or photophobia and phonophobia.

● **Diagnostic criteria:**

- A. At least 5 attacks fulfilling criteria B–D
- B. Headache attacks lasting 4–72 hours (untreated or unsuccessfully treated)
- C. Headache has at least two of the following characteristics:
 - 1. unilateral location
 - 2. pulsating quality
 - 3. moderate or severe pain intensity
 - 4. aggravation by or causing avoidance of routine physical activity (e.g. walking or climbing stairs)
- D. During headache at least one of the following:
 - 1. nausea and/or vomiting
 - 2. photophobia and phonophobia
- E. Not attributed to another disorder

BOX 2

IRS criteria for infrequent episodic tension-type headache (2.1)

● **Description:**

Infrequent episodes of headache lasting minutes to days. The pain is typically bilateral, pressing or tightening in quality and of mild to moderate intensity, and it does not worsen with routine physical activity. There is no nausea but photophobia or phonophobia may be present.

● **Diagnostic criteria:**

- A. At least 10 episodes occurring on <1 day per month on average (<12 days per year) and fulfilling criteria B–D
- B. Headache lasting from 30 minutes to 7 days
- C. Headache has at least two of the following characteristics:
 - 1. bilateral location
 - 2. pressing/tightening (non-pulsating) quality
 - 3. mild or moderate intensity
 - 4. not aggravated by routine physical activity such as walking or climbing stairs
- D. Both of the following:
 - 1. no nausea or vomiting (anorexia may occur)
 - 2. no more than one of photophobia or phonophobia
- E. Not attributed to another disorder

usually start in the morning hours (58.5%) and resolve after a period of sleep (76.7%). The most specific features separating migraines from tension-type headache are improvement after sleeping, the presence of nausea and vomiting, worsening with physical activity and photo-, phono- or osmophobia (5).

Children can have a variety of migraine equivalents including:

- cyclic vomiting (recurrent stereotypic attacks with nausea, vomiting and need for rest)
- abdominal migraines (episodes of abdominal pain, loss of appetite, nausea and introverted behavior)
- benign paroxysmal vertigo of childhood (recurrent attacks of vertigo, sometimes with nystagmus).

The diagnosis of abdominal migraines was made in 4.4% of 600 children referred to a pediatric gastroenterology clinic for recurrent abdominal pain (6). Small children with such symptoms are at an increased risk of developing migraines or tension-type headache later (7, e5). In adolescents (12–15 years of age), the clinical symptomatology of migraines and tension-type headache is similar to that of adults. The stability of the diagnosis over time is less for headaches in childhood, as compared to those in adults. Only 30–50% of those patients diagnosed with migraines received the same diagnosis when evaluated three years later (e6). A migraine with aura, usually visual, was present in 23–50% of cases (e3, e4). In childhood and adolescence, spontaneous remissions are uncommon; in a Swedish study, 80% of patients still had headaches three years later (8). A parental survey revealed that over a year 57% of children showed no changes in their headaches, while 22% improved and 21% worsened (9). Patients in whom initiation of therapy is delayed have less chance of becoming free of headaches (e7). Girls are less likely to clear than boys (e7). A high frequency of headaches and the diagnosis of migraines predict headaches later in life (10). tension-type headache resolves more often than migraines.

Effects of headaches on quality of life and health

Children and adolescents with headaches frequently describe a number of other somatic complaints and emotional disturbances. Among children who were evaluated in a special pain clinic, 74.5% had headaches while 55% had other pain diagnoses, such as abdominal pain or back pain (11). The combined appearance of various somatic complaints (headaches, back pain, gastrointestinal complaints, sleep disorders, allergic diseases) can already be observed in 5- to 7-year-olds (12, 13) (Table 1).

Among 2200 children who were re-questioned one year after their initial evaluation, over half reported two or more types of pain (14). Girls were more likely to have multiple forms and only 27% were free of pain. A similar association of headaches with other complaints was also seen in a survey of high school students:

- headaches (83%)
- back pain (48%)
- increased tiredness (47%)
- neck or shoulder pain (45%) (15).

Neck and shoulder pain were mentioned significantly more often by students with migraines than by those with tension-type headache (16). Behavioral disorders were also more common in children with migraines (e8). We identify an increased risk for affective disorders and attention deficit/hyperactivity disorder in adolescents with migraine headaches (e9). There is conflicting data over the association of depression or anxiety disorders with headaches, but the majority of publications indicate that adolescents with headaches are at greater risk for these problems as well as for psychopathological disturbances (e10–e12). For example, the suicide risk is elevated in adolescents with chronic headaches (e13).

Effect of age on the prevalence of chronic headaches

Parents tend to underestimate the headaches of their children (e14) and the distinction between migraines and tension-type headache is difficult in this age group (e15). Epidemiologic cross-sectional (4, 17, 18) and longitudinal (19) studies show that the prevalence of headaches increases with age; in 7-year-olds it is 37–51% increasing to 57–82% in 15-year-olds (20, 21). In the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), headaches were the most common pain in the group 11–17 years of age, surpassing abdominal pain and back pain (the 3-month prevalence for all forms of pain was 77.6%) (22). The prevalence of migraines was 3.8% for 5- to 12-year-olds (23) and 6.9% for 12- to 15-year-olds (24). In a German study the prevalence of headache was 39% for 7-year-olds and 63% for 14-year-olds (4). Similar results were found in the USA (17) and Sweden (18). This tendency to increase with age was confirmed by a longitudinal study over six years which identified an increase in prevalence from 45.2% to 78.7% (19).

In addition, there is an increasing prevalence of frequent headaches (at least once weekly) with increasing age (24, e16–e18). Gaßmann et al. (25) reported that 3.6% of 8-year-olds and 10.7% of 15-year-olds had at least one headache weekly. Other studies contain similar prevalence estimates for weekly headaches:

- in Canada (26.3% of the 12- to 13-year-olds and 31.2% of the 14- to 15-year-olds [e16])
- in southern England (20%) (17) and
- in Italy (40% of the 11- to 15-year-olds (e18).

In the region of Greifswald, Germany, 9.6% of the 12-year-olds and 12.1% of the 15-year-olds reported headaches for at least 14 days over the preceding 3 months (24). Chronic migraines (migraine headaches >15 days/month for at least 3 months) were found in 0.1% of school children (24).

Frequent headaches also lead to an increased use of pain medications. In Brazil, 6.7% of children report taking an analgesic for more than 5 days monthly (23).

TABLE 1

Association of somatic complaints with headache/migraine, age group 13–18, N = 6483*

Complaint	Result (OR; 95% confidence interval)
Epilepsy	2.02 (1.04–3.94)
Persistent nightmares	2.28 (1.34–3.87)
Motion sickness	1.6 (1.07–2.4)
Allergies	1.5 (1.17–1.92)
Abdominal complaints	2.36 (1.59–3.51)

* after (13); OR: odds ratio

In the Head-HUNT-youth study, the prevalence of daily headaches associated with overuse of medications (analgesics on >15 days/month; opiates or triptans >10 days/month) was 0.8% among girls and 0.2% among boys (e19).

A variety of studies show an increasing prevalence of headaches in children. In Finland 1000 8-year-old school children were queried in both 1989 and 1999. The prevalence of frequent headaches increased by a factor of 1.5 (e20). Another Finnish study evaluated more than 1000 7-year-olds in Turku in 1974, 1992 and 2002; the prevalence of migraines rose from 14.5/1000 in 1974 to 91.9/1000 in 2002. The same trends were seen for migraines with and without aura, as well as for headaches in general (26, 27). In Denmark both tension-type headache and frequent migraines increased over a 12-year period in young adults (28). The percentage of migraine patients with more than 14 attacks annually rose over 12 years from 24% to 38% (28). In Uppsala, Sweden, 1800 school children ranging from 7 to 15 years of age were surveyed to compare the frequency of tension-type headache with that in 1955. There was a significant increase in the prevalence of migraines from 3.9% to 6.6% and the share of children without headaches dropped from 41.4% (1955) to 16% (1997) (18). We found no increase in the prevalence of headaches in German adults between 1995 and 2010, in sharp contrast to all the evidence demonstrating an increase in children (29). In Norway there was a slight increase in the prevalence of migraines in adults (12.1% to 13.2%) but not for headaches in general (e21). Longitudinal studies on the frequency of migraines in adults in the USA and France (from 1989 to 1999) also showed no increase (e22, e23).

The data strongly suggest that headaches (especially migraines) are now appearing earlier in life even though the overall prevalence has not increased. The number of patients with frequent headaches is increasing in parallel fashion.

Risk factors for headaches in school children

Various studies have identified risk factors but interventional or preventive studies showing that altering

TABLE 2

Risk factors for headaches in children and adolescents

Risk factor	Age group (years)	n	Result OR; 95% confidence interval)	Author (reference)
Too little activity	13–19 12–18	1260 5847	OR: 2.2 (1.3–3.7) OR: 1.2 (1.1–1.4)	Milde-Busch et al. 2010 (31) Robberstad et al. 2010 (32)
Regular nicotine use	11–26 13–19 12–18	980 1260 5847	OR: 2.16 (1.39–3.35) for frequent headaches OR: 2.7 (1.4–5.1) OR: 1.5 (1.3–1.7)	Milde-Busch et al. 2010 (31) Robberstad et al. 2010 (32)
Regular alcohol ingestion	13–19	1260	OR: 3.4 (1.9–6.0)	Milde-Busch et al. 2010 (31)
Overweight	12–18	5847	OR: 1.4 (1.2–1.6)	Robberstad et al. 2010 (32)
Regular coffee ingestion	13–19	1260	OR: 2.4 (1.3–4.7)	Milde-Busch et al. 2010 (31)
No free time	8–15	1434 boys 541 girls	OR: 2.12 (1.29–3.48) OR: 0.99 (0.28–3.47)	Gaßmann et al. 2009 (25)
Listening to music	13–17	1025	OR: 2.1 (1.2–3.7) for 1–2h/daily	Milde-Busch et al. 2010 (31)
Divorce of parents	13–15	4645	OR: 5.8 (1.2–28.0)	Juang et al. 2004 (e27)
Negative personal experience	12–13	1694	OR: 1.88 (1.41–2.52)	Dooley et al. 2005 (e16)
Lack of satisfaction	12–13	1694	OR: 1.85 (1.48–2.31)	Dooley et al. 2005 (e16)
Familial disagreements	8–15	1434 boys 541 girls	OR: 1.78 (1.05–3.02) OR: 1.25 (1.01–1.55)	Gaßmann et al. 2009 (25)
Abuse	13–15	3955	OR: 1.6 (1.4–1.9)	Fuh et al. 2010 (e28)
Bullying	11–15	123 227	rare: OR: 1.40 (1.30–1.50) weekly: OR: 1.86 (1.70–2.05)	Due et al. 2005 (38)
Unfair treatment by teacher	11–15	4119	OR: 1.24 (1.15–1.34)	Santinello et al. 2009 (e18)
High familial expectations	12–13	1694	OR: 1.40 (1.11–1.74)	Dooley et al. 2005 (e16)

OR = Odds Ratio

TABLE 3

Pharmacologic and non-pharmacologic therapy of migraines*

Indication	Substance	Side effects	Recommendation
Acute treatment	Ibuprofen 10 mg/kg BW	Gastrointestinal tract	↑↑
	Paracetamol 15 mg/kg BW	Liver damage	↑
	Sumatriptan nasal spray 10–20 mg	Chest tightness	↑↑
	Zolmitriptan 2.5 mg	Chest tightness	↑
	Zolmitriptan nasal spray 5 mg	Chest tightness	↑
	Rizatriptan 10 mg	Chest tightness	↑
Prophylaxis	Metoprolol 1,5 mg/kg BW	Fatigue	↔
	Flunarizine 5 mg	Fatigue	↑↑
	Propranolol 2 mg/kg BW	Fatigue	↔
	Magnesium 300–400 mg	Diarrhea	↔
	Topiramate 1–3 mg/kg BW	Cognitive deficits	↑↑
	Amitriptyline 1 mg/kg BW	Fatigue	↔
Non-pharmacologic therapy	Patient education		↔
	Relaxation therapy		↑↑
	Regular sports		↔
	Training programs		↑↑
	Biofeedback		↑↑

* after (39, 40)
BW, body weight

such factors influences headache prevalence are lacking.

In general, one can divide the risk factors into the categories of life style, school and psyche. Typical frequently confirmed life style factors include:

- caffeine ingestion
- alcohol ingestion
- smoking
- lack of physical activity.

Regular caffeine intake correlates with the frequency of headaches in adults (30) and adolescents (31). Both the HUNT study and a survey of high-school students in Munich, Germany, showed a significant association between smoking and headaches (31, 32). In contrast to adults (33, e24), in adolescents ingestion of alcohol is also a risk factor. A significant association between drinking cocktails and headaches was found among high school students (31). Both the HUNT and Munich studies showed a correlation with lack of physical activity (31, 32). Not surprisingly, being overweight is also associated with childhood headaches (32, 34). An American study showed that losing weight was also correlated with a reduction in headaches (34). Other studies showed no influence by the daily fluid intake (31), skipping meals (31) or a history of meningitis (e25). Daily computer use (video games, electronic media) also had no effect (e26).

Stress at school as well as high parental expectations are risk factors for increased headaches. Two studies show that regular free time (true free time without planned activities) reduces the risk of getting headaches (25). In a survey of high school students, 80% complained of headaches and over 40% had less than two unplanned hours per day (15).

Additional risk factors include emotional stress arising from both family and daily life factors. In a study from the German state of Lower Saxony, a correlation between regular family conflicts and headaches was seen, especially in boys (25). A Taiwanese study showed that children with chronic headaches, when compared to the total population, had a significantly lower Global Family Environment Score and more frequently reported physical abuse and separation of their parents (e27).

Several studies (35, e28–e31) have shown a correlation between physical abuse and the frequency of headaches. In addition to physical abuse, both sexual and emotional abuse, as well as lack of attention, were significant risk factors for both early onset and chronicity of headaches (e30). This relationship was independent of the diagnosis of depression or anxiety disorder (e30, e31). In contrast, a cooperative, non-punitive family relationship protected against headaches (36, e16) (Table 2).

School is a major part of every child’s world. Research has devoted considerable attention to the influence of bullying and physical trauma on development of somatic and emotional problems. For example, the risk of developing recurrent headache increases by 25% when school children feel their teacher is treating them unfairly (e18). Conversely, feeling fairly treated reduces the risk by more than 40% (e16). Bullying increases the risk of developing headaches (37) and of taking pain medications (38). There is a close correlation between the perceived severity of the bullying and the frequency of the headaches. A cross-sectional study in 28 countries showed that occasional bullying

TABELLE 4

Pharmacologic and non-pharmacologic therapy of tension-type headache*

Indication	Substance	Side effects	Recommendation
Acute treatment	Ibuprofen 10 mg/kg BW	Gastrointestinal complaints	↑↑
	Paracetamol 15 mg/kg BW	Liver damage	↑
	Flupirtine 50–100 mg	Liver damage	↑
Prophylaxis	Magnesium 300–400 mg	Diarrhea	↔
	Amitriptyline 1 mg/kg BW	Fatigue	↔
	Topiramate 50–100 mg	Cognitive deficits	↔
Non-pharmacologic therapy	Patient education		↔
	Relaxation therapy		↑↑
	Regular sports		↔
	Training programs		↑↑
	Biofeedback		↑↑

* after (39, 40)
BW, body weight

increases the risk by 40%, while weekly bullying raises it by 80–90% (38).

If one groups all these factors together as stressors, then one can ask if the perceived stress correlates with headache frequency. Studies that show a correlation between frequency of migraines and examination periods point in this direction (e33). About 20% of high school students complain of excessive stress, usually but not always naming school as the main stress factor (15). The subjective level of stress was higher in students with migraines than in those with tension-type headache or without headaches (e34) (Table 2).

Conclusion and therapeutic consequences

Headaches in children and adolescents are increasing in frequency. They appear to be embedded in the complex of somatic and emotional maturation processes and complaints. Since the prevalence of headaches in not increasing in the general adult population in Germany, we suspect there is a dual acceleration process:

- transition from childhood to puberty and adolescence occurs earlier and
- headaches appear earlier and more often in adolescence.

External factors must be responsible, as the genetic matrix cannot have changed so rapidly. Increasing time demands (with resultant loss of true free time), pressure to succeed from school and family, and increased social pressures from both peer group and school all seem important. Individual, context-dependent risk factors include reduced physical activity, smoking, increased consumption of caffeine and alcohol, and being overweight.

When counseling patients, these risk factors should be addressed. Evaluation of headache treatment programs has shown that effective patient counseling is a major part of any therapeutic success (e35–e37). Early results are also available for Internet-based programs that offer cognitive behavioral therapy or relaxation techniques. Both approaches are equally effective (e38). Regular athletic activity (e39) and insuring free, unplanned time are also both helpful. As in other areas of pediatric drug therapy, the treatment of childhood headaches has not been well-addressed in controlled studies. Reviews are available (39, 40) (Table 3, 4).

If there is evidence suggesting that familial or school issues are causing emotional stress, child and adolescent psychologists or psychiatrists should be integrated

KEY MESSAGES

- The prevalence of headaches increases with increasing age. Up to 40% of school children have at least one headache weekly.
- Primary headaches are by far the most common cause of childhood headaches. A clear diagnostic distinction between tension-type headache and migraines is not possible in 30–50% of patients.
- The frequency of headaches in children is increasing. The most likely explanation is a shift in age of onset of headaches, rather than a global increase in headaches.
- Headaches significantly reduce quality of life. The degree of disability is underestimated by parents as well as teachers.
- Both factors arising from the social circle of the child (familial conflicts, bullying, abuse) and specific behavioral factors (lack of physical activity, overweight, alcohol or caffeine ingestion) correlate with the development of headaches. A high frequency of headaches in childhood and adolescence increases the risk of chronic headaches later in life.

into the therapeutic plan. Children and adolescents who complain of chronic headaches or multiple types of pain benefit from an interdisciplinary therapeutic approach. In this group, psychiatric co-morbidities such as depression, anxiety disorders or somatization are common (36) and the risk of a chronic course is high. Frequent pain in childhood is a risk factor for chronic pain as an adult (e40). Thus it is crucial to develop preventive strategies to address headaches in school children at the earliest possible point.

Conflict of interest statement

Prof. Straube received lecture honoraria or travel costs from: Allergan, Hormosan, Boehringer Ingelheim, Merck Serono, Desitin, Pfizer, Berlin Chemie and MSD. He received research support or honoraria for carrying out scientific studies from: Allergan, Novartis, MSD, Boehringer Ingelheim, Weber & Weber, FGK, Fresenius Stiftung, DFG and BMBF.

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REVIEW ARTICLE

Headache in School Children: Prevalence and Risk Factors

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