The linear trend of headache prevalence and some headache features in school children

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ÖZET

Okul çocuklarında baş ağrısı prevalansı ve bazı baş ağrısı bulgularının yaş ve cins bağımlı değişimi

Bu çalışmada Mersin ilinde okul çocuklarında mevcut baş ağrısı prevalansının yaş ve cins bağımlı lineer trendinin belirlenmesi amaçlandı. Çalışmaya detaylı yöntem bilgileri daha önce yayınlanmış olan yapılandırılmış örneklemden oluşan 5562 çocuk dahil edildi. Çalışmamızda yaş ve cins bağımlı olarak baş ağrısı sıklığının arttığı, kızlarda belirgin olmak üzere 11 yaşında (% 27.2) pik yaptığı ve takiben plato izlediği saptandı. Verilerimiz çocuklarda baş ağrısı özelliklerinin sosyodemografik özelliklere ilaveten yapılan trend analizinde yaş, cinsiyet ve baş ağrısı tipine bağlı olarak anlamlılık taşıyan lineer trend gösterdiğini destekledi. Bu çalışmanın sonuçları gelecekte planlanacak epidemiyolojik çalışmalara zemin oluşturabilecek özelliktedir.

Anahtar kelimeler: Baş ağrısı, lineer trend analizi, migren, gerilim tipi baş ağrısı, okul çocukları

SUMMARY

The objectives of this study were to determine the age and sex dependent linear trend of recurrent headache prevalence in schoolchildren in Mersin. A stratified sample composed of 5562 children; detailed characteristics were previously published. In this study the prevalence distribution of headache by age and sex showed a peak in the female population at the age of 11 (27.2%) with a plateau in the following years. The great stratified random sample results suggested that, in addition to socio-demographic features, detailed linear trend analysis showed headache features of children with headache have some specific characteristics dependent on age, gender and headache type. This study results can constitute a basis for the future epidemiological based studies.

Key words: Headache, linear trend analysis, migraine, tension-type headache, schoolchildren

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Introduction

Headache is a common symptom in the paediatric age group, but consultation rates reported by physicians do not reveal the true prevalence (Lipton and Maytal 2001, Carlsson 1996). The reported headache prevalence ranges from 57 % to 82 % in ages between 7 and 15 (Sillanpaa and Anttila 1996, Wober-Bingol et al 1995, Bille 1962). On the other hand, Chu and Shinnar (1992) found that 75 % of all children referred to a child neurologist for headache evaluation met criteria for paediatric migraine. As a specific type of headache, migraine is a frequent disease with a prevalence of from 3 to 10 % in children and adolescents (Ozge et al 2003, Abu-Arafeh and Russell 1994).

The prevalence of headache varies with the case definition criteria, although studies using the International Headache Society (IHS) criteria have yielded uniform results (Wober-Bingol et al 1995, Stewart et al 1995, Gobels et al 1994). The prevalence of headache increased during the past 20 years: from 1972 to 1994, an increase of 40 % in headache was recorded in a sample population of children aged 7 years (Metsahonkala 1997). An increase in the overall headache prevalence has been shown in pre-school aged to school-aged children and then to adolescents in cross-sectional studies (Rothner and Winner 2001).

The most common headache types in paediatric headache groups include migraine and tension-typed headache. Adolescents and young adults have the highest risk for the onset of the most debilitating type of headache, migraine (Raieli et al 1995). Migraine prevalence rate at age 7 ranges between 1.2 to 3.2 %. From age 7 to 15, it increases to prevalence rates that range between 4 to 11 % (Mortimer et al 1992, Bille 1962). In children between the ages 4 and 7, migraine is more frequent in both genders. Between the ages 7 and 11, the prevalence rate is equal to each other. In children older than 11, the ratio changes to the classically 3 girls to 1 boy. Epidemiological studies have shown that the prevalence of headache and migraine depends on gender in children and adolescents (Laurell 2004, Wöber-Bingöl 2004, Linder and Winner 2001, Mortimer et al. 1992).

The presentation and symptom classification of childhood headaches are not completely understood (Gladstein et al. 1993). Also, there is limited knowledge about the detailed headache features of each age group of school children. To our knowledge, this is the first study on the linear trend analysis of headache features for each age group of school children by gender, performed by trained physicians in schools.

The specific aim of this study was to determine the age and sex dependent differentiation of recurrent headache prevalence rates in schoolchildren ranging from 2nd to 5th grades (ages 8 to 12 years) in the metropolitan city of Mersin, in a sample of schools from different districts representative of the different socio-economic structure of the city. The detailed headache features as well as the linear trend analysis of some characteristics of headache in these age groups were also investigated.

Table 1. One-year headache, migraine and TTH prevalence of schoolchildren by age and gender.

Ages	Headache Prevalence (%)		Migraine Prevalence (%)		TTH Prevalence (%)	
	Boys[1]	Girls[2]	Boys[3]	Girls[4]	Boys[5]	Girls[6]
8	37.8	46.4	7.9	11.8	15.4	20.4
9	40.0	49.0	9.3	10.1	15.3	24.6
10	45.2	56.6	8.8	10.2	22.3	31.0
11	52.9	54.6	10.1	12.7	29.6	31.3
12	54.9	61.8	9.3	18.4	25.7	33.8
Total	46.2	52.8	9.1	11.8	22.0	27.8

TTH: Tension-typed headache

[1] Chi Square for trend =47.0, $p<0.001$

[2] Chi Square for trend =18.3, $p<0.001$

[3] Chi Square for trend =3.11, $p>0.05$

[4] Chi Square for trend =2.12, $p>0.05$

[5] Chi Square for trend =35.8, $p<0.001$

[6] Chi Square for trend =24.1, $p<0.001$

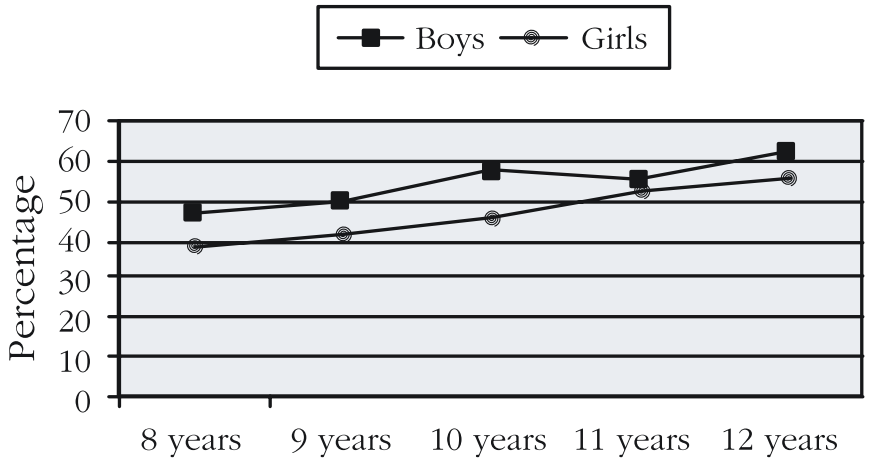

Figure 1. The linear trend of headache prevalence with the increasing age in schoolchildren (p<0.001).

Material and Method

This study was conducted in the metropolitan city of Mersin located on the eastern Mediterranean coast of Turkey. Its population is 759 785 and it is the tenth largest city in the country. Commercially it is an important and economically well developed harbour city. There are 60170 school children aged from 8 to 16, attending to school. Other parts of this study including epidemiological and headache diagnostic criteria results has been published previously. The detailed study methodology has been described previously (Bugdayci et al. 2005, Sasmaz et al. 2004, Ozge et al. 2003).

Statistical Analysis

The means and percentages were calculated with descriptive statistics. Univariate analysis has been made accordingly. Binary logistic regression analysis was used with Forward LR variable selection method. Odds ratio (OR) with a 95% confidence interval (CI) were calculated from logistic regression models. Two-tailed tests were considered significant at the 5% level.

Results

Headache prevalence

Of the 5562 children included in this study, 35.1% had one of the primary headache disorders, 0.8%

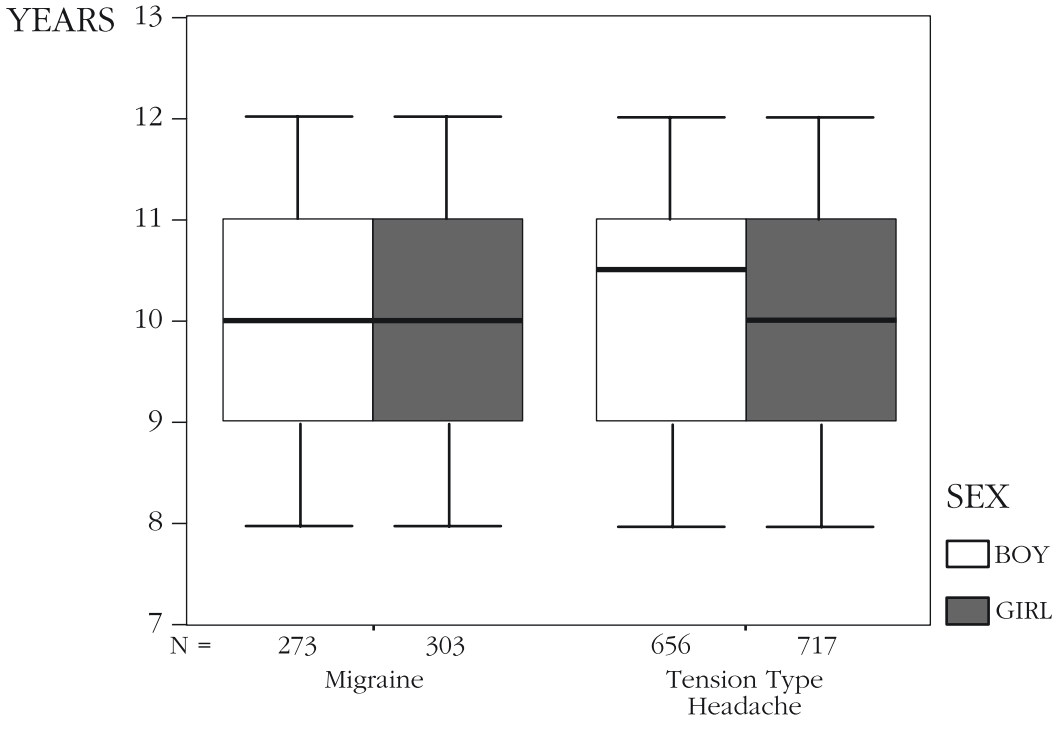

Figure 2. The age and sex dependent differentiation of migraine and tension-typed headache in schoolchildren. It shows the increased mean age of boys in pupils with TTH.

Table 2. The linear trend of some headache features in girls with migraine.

Headache characteristics	8 ages % /median	9 ages % /median	10 ages % /median	11 ages % /median	12 ages % /median	*p*
Duration of headache	1.0	1.0	1.0	1.5	2.0	NS
(hs) (min-max)	(0.17-24.0)	(0.03-24.0)	(0.25-19.0)	(0.08-24.0)	(0.5-48.0)	NS
Frequency of headache						
1-3 times/month	64.3	64.2	63.6	72.3	52.9	NS
> 4 /month	35.7	35.8	36.4	27.7	47.1	NS
Pulsating headache	52.9	45.9	60.9	70.9	56.8	0.046
Unilateral headache	17.3	9.8	13.8	7.5	10.8	NS
Associated nausea	54.0	47.5	57.1	45.5	51.4	NS
vomiting	38.0	39.3	38.1	35.1	45.9	NS
photophobia	16.0	4.9	12.7	20.8	18.9	NS
phonophobia	28.0	39.3	42.9	61.0	56.8	0.001
Aggravation by stress	15.4	11.5	15.9	32.9	19.4	0.026
studying	21.2	21.3	28.6	46.8	30.6	0.006
physical activity	13.5	23.0	28.6	50.6	33.3	0.001
hunger	17.3	23.0	23.8	41.8	30.6	0.007
ice-cream	30.8	26.2	17.5	8.9	13.9	0.001
eating chocolate	7.7	9.8	6.3	7.6	2.8	NS
TV watching	30.8	24.6	30.2	32.9	30.6	NS
cold weather	23.1	16.4	14.3	26.6	8.3	NS
warm weather	34.6	32.8	38.1	44.3	38.9	NS
Relieve by sleep	55.8	49.2	58.5	65.0	48.6	NS
eating	7.7	1.6	1.5	5.0	2.7	NS
medication	61.5	72.1	72.3	68.8	75.7	NS
School absence (day)	1.0	2.0	2.0	1.0	1.0	NS
(min-max)	(0.0-15.0)	(0.0-11.0)	(0.0-45.0)	(0.0-15.0)	(0.0-10.0)	NS
Divorced/lost parents	11.8	14.5	7.8	12.3	16.2	NS
Mother's headache	65.3	55.4	59.3	72.4	78.8	0.052
Family income	200.0	150.0	150.0	180.0	100.0	0.041
(NTL/month) (min-max)	(20.0-1000.0)	(0.0-950.)	(0.0-600.0)	(2.0-2000)	(0.0-750.0)	

NTL: New Turkish Lira at the time of the study
NS: Not significant difference

was diagnosed to have secondary headache disorders and in 13.3% not a specific headache diagnosis could be reached. The prevalence of headache among participants was 49.2%. Among participants, the prevalence of migraine was 10.4% and TTH was 24.7%.

Statistical analysis showed that only girls aged 12 years old had a higher prevalence than boys, whereas in other age groups such predominance was not detected. On the other hand TTH group analysis showed significant girl predominance for age groups, with the exception of the 11 age group (for details please see table 1). We also showed a significant increasing trend of headache prevalence for both of the gender and headache type (please see table 1, figure 1 and 2).

Characteristics of the current headache and linear trend analysis:

The average age of the children with headache (10.07±1.35 years) was significantly higher than healthy controls (9.80±1.34 years) (p<0.001). The mean age of the children with migraine (10.03±1.36) was significantly lower than children with TTH (10.17±1.30) (p=0.03).

The duration of headache varied from 10 minutes to 3 days. The mean duration was 2.09±3.61 hours (median=1 hour). The duration of headache was significantly longer in children with migraine (average: 2.6±4.9 hours) than children with TTH

Table 3. The linear trend of some headache features in boys with migraine.

Headache characteristics	8 ages % /median	9 ages % /median	10 ages % /median	11 ages % /median	12 ages % /median	*p*
Duration of headache (hs) (min-max)	1.0 (0.02-5.0)	1.0 (0.08-12.0)	1.5 (0.2-48.0)	1.0 (0.03-24.0)	1.8 (0.5-48.0)	NS NS
Frequency of headache						
1-3 times/month	68.0	55.0	50.0	60.0	40.6	
> 4 /month	32.0	45.0	50.0	40.0	59.4	
Pulsating headache	36.4	55.2	40.0	61.1	59.5	0.04
Unilateral headache	21.2	8.5	5.0	11.1	13.2	NS
Associated nausea	50.0	38.6	56.1	47.1	29.7	NS
vomiting	43.8	31.6	40.4	44.3	48.6	NS
photophobia	25.0	19.3	15.8	15.7	21.6	NS
phonophobia	21.9	35.1	15.8	34.3	45.9	NS
Aggravation by stress	12.1	15.5	18.3	12.5	10.8	NS
studying	18.2	31.0	18.3	23.6	27.0	NS
physical activity	12.1	36.2	16.7	16.7	35.1	0.007
hunger	24.2	34.5	10.0	26.4	51.4	0.001
ice-cream	39.4	32.8	43.3	33.3	29.7	NS
eating chocolate	15.2	10.3	1.7	2.8	5.4	0.02
TV watching	42.4	31.0	35.0	45.8	40.5	NS
cold weather	24.2	27.6	8.3	12.5	24.3	0.03
warm weather	12.1	34.5	35.0	51.4	43.2	0.001
Relieve by sleep	56.3	45.8	52.5	51.4	63.2	NS
eating	6.3	8.5	16.9	6.9	7.9	NS
medication	65.6	69.5	66.1	73.6	76.3	NS
School absence (day) (min-max)	2.0 (0.0-50.0)	2.0 (0.0-15.0)	3.0 (0.0-25.0)	2.0 (0.0-8.0)	1.0 (0.0-9.0)	NS
Divorced/lost parents	5.6	17.2	11.7	9.7	15.8	NS
Mother's headache	67.6	64.7	78.2	75.8	71.4	NS
Family income (NTL/month) (min-max)	160.0 (50.0-650.0)	150.0 (0.0-950.0)	150.0 (0.0-800.0)	150.0 (0.0-1000.0)	100.0 (0.0-600.0)	NS

NTL: New Turkish Lira at the time of the study
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(average: 1.9±3.1 hours) (p<0.001). The longest average duration was in 12 age's group. Median headache duration in children did not show any significant trend by age. On the other hand headache frequency showed only a significant trend for boys with TTH, especially higher age group (p=0.006, see table 5).

Headache was characterised as "tightening" (14.4 %), "pulsating" (41.4 %), "pressing" (15.0 %) and "beating" (6.0 %). As a most common headache quality, "pulsating headache" showed an important trend in both of the gender and headache types (see tables 2, 3, 4 and 5).

The most common location of headache was the forehead (38.6 %) bilaterally. The locations for pain were bilateral (20.2 %), whole head (11.3 %), temples (12.1 %), above eyes (8.4 %), sub occipital (5.4 %) and unilateral (4 %), respectively. Unilateral location of pain did not show any statistical significance neither for gender nor the type of headache.

The most common associate symptom of headache among children was phonophobia (34.1 %). Nausea (26.7 %), vomiting (15.1 %), vertigo (13.4 %) and photophobia (12.7 %) were also common in children with headache. Our study showed important trend of nausea for boys with TTH (p=0.006), vomiting for girls with TTH (p=0.045) and phonophobia showed increasing trend for both of the genders and headache types,

Table 4. The linear trend of some headache features in girls with tension-typed headache.

Headache characteristics	8 ages % /median	9 ages % /median	10 ages % /median	11 ages % /median	12 ages % /median	*p*
Duration of headache (hs) (min-max)	1.0 (0.17-12.0)	1.0 (0.08-40.0)	1.0 (0.02-10.0)	1.0 (0.17-14.0)	1.0 (0.5-10.0)	NS
Frequency of headache						
1-3 times/month	62.1	71.2	60.0	60.3	65.7	
> 4 /month	37.9	28.8	40.0	39.7	34.3	
Pulsating headache	30.8	31.5	41.8	53.1	41.2	0.001
Unilateral headache	0.0	1.3	1.5	1.0	0.0	NS
Associated nausea	35.0	32.6	37.4	31.2	20.9	NS
vomiting	23.8	10.1	10.1	10.2	11.9	0.045
photophobia	11.3	22.5	17.7	15.6	20.9	NS
phonophobia	42.5	47.8	52.0	65.1	56.7	0.001
Aggravation by stress	14.4	18.9	21.9	29.0	24.6	0.007
studying	28.9	26.4	37.2	46.1	33.3	0.004
physical activity	22.2	23	26.5	37.3	27.5	0.01
hunger	11.1	11.5	23.0	25.4	24.6	0.001
ice-cream	24.4	18.2	15.3	11.4	14.5	0.01
eating chocolate	7.8	4.1	2.0	3.6	1.4	NS
TV watching	28.9	33.8	29.6	33.7	27.5	NS
cold weather	15.6	13.5	14.8	12.4	14.5	NS
warm weather	25.6	23.0	30.1	43.5	44.9	0.001
Relieve by sleep	43.8	56.1	52.6	54.7	39.7	NS
eating	12.4	3.4	3.1	5.7	4.4	0.016
medication	52.8	57.4	68.6	70.3	72.1	0.001
School absence (day) (min-max)	1.0 (0.0-17.0)	2.0 (0.0-25.0)	1.0 (0.0-52.0)	1.0 (0.0-32.0)	2.0 (0.0-15.0)	0.006
Divorced/lost parents	0.0	11.3	8.7	9.8	20.3	0.001
Mother's headache	65.9	58.7	69.1	62.0	66.1	NS
Family income (NTL/month) (min-max)	150.0 (0.0-1000.0)	150.0 (0.0-1000.0)	150.0 (0.0-1200.0)	150.0 (0.0-1000.0)	120.0 (0.0-1000.0)	0.015

NTL: New Turkish Lira at the time of the study
NS: Not significant difference

except boys with migraine (see table 2, 3, 4 and 5). The prevalence of travel sickness among participants was 44.9 % (1231 of 2739), and this complaint was significantly higher in migraine group than TTH (53.2 % versus 46.2 %, p=0.01).

Over exposure to sunlight (26.8 %) was the most common trigger of headache. Hard studying (25.5 %), watching television (24.4 %), aggravation by physical exercise (18.7 %), missing a meal (18.0 %), eating ice-cream (16.2 %), school stress (14.4 %), over-exposure to cold whether (13.0 %) and eating chocolate (3.8 %) were also the other headache triggers. Linear trend analysis showed that school stress and studying hard at home showed an increased trend only for girls who were diagnosed with either migraine or TTH. Physical activity showed an increase trend for all groups, with the exception of boys with TTH. Missing a meal or hunger was associated both with gender and type of headache. Eating ice-cream was associated with a decreased trend as a trigger in girls having migraine and TTH. Eating chocolate was associated with a decreased trend as a trigger for only boys with migraine. Warm weather had an increasing effect of TTH in schoolchildren, whereas cold weather didn't show such a trend. Watching television did not show any significant effect on linear trend analysis (for details please see table 2, 3, 4 and 5).

Table 5. The linear trend of some headache features in boys with tension-typed headache.

Headache characteristics	8 ages % /median	9 ages % /median	10 ages % /median	11 ages % /median	12 ages % /median	*p*
Duration of headache (hs) (min-max)	1.0 (0.5-24.0)	1.0 (0.02-24.0)	1.0 (0.08-24.0)	1.0 (0.2-24.0)	1.0 (0.03-24.0)	NS
Frequency of headache						
1-3 times/month	77.0	75.8	57.4	58.3	64.8	0.006
> 4 /month	33.0	24.2	42.6	41.7	35.2	
Pulsating headache	24.3	22.3	27.5	34.1	41.3	0.001
Unilateral headache	2.8	0.0	0.0	1.4	2.9	NS
Associated nausea	41.5	39.5	42.2	30.4	26.3	0.006
vomiting	12.3	19.8	13.3	11.1	13.1	NS
photophobia	23.1	17.4	14.1	19.3	18.2	NS
phonophobia	26.2	38.4	46.7	52.7	58.6	0.001
Aggravation by stress	21.1	10.6	15.3	22.9	12.5	NS
studying	38.0	26.6	35.3	34.4	33.7	NS
physical activity	12.7	13.8	20.0	24.3	18.3	NS
hunger	14.1	16.0	20.0	27.1	32.7	0.001
ice-cream	15.5	35.1	21.3	19.7	23.1	0.02
eating chocolate	8.5	6.4	2.7	4.6	3.8	NS
TV watching	31.0	24.5	31.3	35.8	25.0	NS
cold weather	25.4	18.1	17.3	18.8	14.4	NS
warm weather	16.9	26.6	28.0	40.8	50.0	0.001
Relieve by sleep	36.1	47.4	47.0	54.6	46.2	NS
eating	5.6	6.3	6.7	6.0	5.8	NS
medication	65.3	69.5	63.8	68.8	69.2	NS
School absence (day) (min-max)	1.0 (0.0-7.0)	2.0 (0.0-30.0)	2.0 (0.0-9.0)	2.0 (0.0-15.0)	2.0 (0.0-90.0)	NS
Divorced/lost parents	4.3	6.4	14.8	7.6	10.2	0.05
Mother's headache	72.1	57.5	66.7	61.7	73.6	NS
Family income (NTL/month) (min-max)	150.0 (0.0-2000.0)	150.0 (0.0-1000.0)	150.0 (0.0-700.0)	150.0 (0.0-3000.0)	120.0 (0.0-800.0)	0.03

NTL: New Turkish Lira at the time of the study
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Among the pain relieving factors only eating and having analgesic medication showed an increasing trend for only girls with TTH (see table 4).

As commonly presentation time 51.7 % of the children reported that their headache started after midday while 38.5 % reported the morning hours. Onset of the headache after midnight wasn't reported by any of the children. Fifty-seven percent of the children reported headache only during school days and while 20.5 % of children had their headaches only during weekends. Absence from school due to headache showed a statistically significant trend for boys with migraine and for girls with TTH (sees tables 2 and 4).

A positive family history of headache was obtained in 81.1 % of the children with headache. The most common association was having a mother with suffering headache (56.7 %) and this trend was most prominent in girls with migraine. A high proportion (43 %) of second-degree relatives having headache was also a striking finding. Being the first child of the family is a favourable factor for the development of any type of headache (p=0.006).

Among socio-demographic variables, average family income showed important trend for all

Table 6. The socio-demographic and clinical variables, which had statistically significant effect on headache for each age group.

Age group/ variables	OR	*p*	95 % CI for OR	
			Lower	Upper
8 years old				
Mother's headache	0.4621	0.0032	0.2765	0.7724
Siblings headache	6.2589	0.0002	2.3758	16.4886
Being first children of family	1.7418	0.0335	1.0444	2.9046
Aggravation by exercise	2.1069	0.0232	1.1072	4.0095
9 years old				
Being first children of family	0.5849	0.0097	0.3894	0.8784
Having a crowded family	1.1321	0.0078	1.0372	1.2406
Pulsating quality of pain	0.5542	0.0484	0.3084	0.9958
Aggravation by studying	1.5099	0.0490	1.0018	2.2758
10 years old				
Gender (boys)	1.8984	0.0001	1.3962	2.5813
Increasing mothers age	1.0366	0.0093	1.0089	1.0650
Pulsating quality of pain	0.4750	0.0066	0.2776	0.8128
Associated phonophobia	1.6121	0.0018	1.1937	2.1773
Aggravation by studying	1.4945	0.0111	1.0960	2.0378
Aggravation by exercise	1.5758	0.0082	1.1248	2.2076
11 and older ages				
Being first children of family	1.6740	0.0445	1.0127	2.7672
Having a crowded family	1.2741	0.0000	1.1400	1.4240
Headache only school days	0.6034	0.0001	0.3969	0.9173

OR: Odds ratio

groups except boys with migraine. Also having divorced parents or losing one of the parents was associated with an increased trend for girls with TTH (see table 4).

Significant factors on headache:

Logistic regression analysis showed that, with the increasing age, being the first child of the family, having a crowded family, and having a high mother's age had significant effect on occurrence of headache in each age group. Also, pulsating quality of pain and mother's headache has an important effect on lower age groups. As an interesting finding having a sibling with headache history increased the ratio of headache 6.25 fold in children aged 9 when compared to the 8 years old ones ($p<0.001$) (details please see table 6).

Discussion

In this study we believe that our three stage face-to face interview with children ensured accurate diagnostic evaluation of the common headache subtypes. In addition the documenting the observations of the teachers on the behaviours of the child with headache and including physician based interviews with children instead of self administered questionnaires had powered the results obtained from this study. One methodological limitation of this study however, was the lack of neurological examinations of the study population.

Headache prevalence increases during the early school years (Laurell et al 2004, Egermark-Eriksson 1982, Bille 1962). The overall headache prevalence found in our study (49.2 %) in children under 13 year-olds, is lower than the rates found in the studies of Bille (75 %), Barea (82.9 %), Sillanpaa (69 %), but higher than Abu-Arafeh (18 %), Carlsson (26 %), Aromaa's (21 %) studies (Aromaa et al 1998, Carlsson 1996, Barea et al 1996, Abu-Arafeh and Russell 1994, Sillanpaa and Piekkala 1984, Bille 1962). Our population based ratios were similar to an important clinical based study from Ankara and a population based study from Denizli in our country (Zencir et al. 2004, Deda et al. 2000).

From the point of view of the headache subtypes, the epidemiological studies are limited. In one study a similar headache prevalence (44.8 %) to

our study, with a commonly girl predominance (50.3 % versus 39.3 %) was found (Laurell et al. 2004). This study also showed no significant gender differences in prevalence rates under the age of 11 years, but from this age on the prevalence rate was found to be higher in girls. Our study showed that in children aged 12 years or younger migraine was more frequent in boys than in girls by a ratio of 1.14:1 but in children aged over 12 migraine was more common in girls by a ratio of 2.0:1 (p=0.017). On the other hand, there is girl predominance both for migraine and TTH in children. A possible cause for these differences might be due to the other headache types than migraine or TTH that are seen in children. The prevalence rate of migraine at ages under 13 years was found to be higher girls than boys, on the contrary to previous studies (Sillanpaa and Anttila 1996, Congdon and Forsythe 1979, Bille 1962).

The prevalence rate of migraine for 12 years-old children/scholars in the present study was 13.2 % (13.9 % for boys and 12.5 % for girls), and is comparable to some previous reports (Sillanpaa and Anttila 1996, Barea et al. 1996, Sillanpaa and Piekkala 1984). Similar to the results reported by Stewart et al. (1992), in the present study migraine was peaked at 11 years of age in both genders, although the ratio of girls (51.6 %) was slightly greater than boys (48.4 %). However, migraine subtypes were not evaluated separately in this study because of the study design. Both of the greater prevalence of migraine and TTH among girls in the last year, observed in our study and in the literature emphasize the importance of considering headache as a gender-dependent symptom. As the design of present study, linear trend analyses suggested that the increasing prevalence of headache was depending on age and gender in children.

Data concerning the incidence and prevalence of TTH in children and adolescents vary greatly from 0.9 % to 40.8 % (Stewart et al. 1998, Abu-Arafeh and Russell 1994, Bille 1962). In their comprehensive clinical study Wöber-Bingöl et al. (1996) reported that episodic and chronic TTH were more common in adolescents, but the difference did not reach statistical significance. Our results showed that, TTH is the most frequent headaches in schoolchildren in Mersin. Although the total prevalence of TTH in girls (52.2 %) was significantly grater than boys (47.8 %), after the age 11, the ratio of boys with TTH was statistically frequent than girls. At age 12, the frequency of boys with TTH was one and half folds of girls. As recommended by Wöber-Bingöl et al. (1996), we evaluated specifically the incidence and prevalence of episodic and chronic TTH in children and adolescents. Most of the children with TTH (94.1 %) were diagnosed with episodic TTH and only a minority with chronic TTH (5.9 %) according to the criteria of IHS. Because of the small numbers with episodic TTH group, in this study we did not evaluate the linear trend for each gender and TTH subgroups.

In this study, we have seen that the features of migraine episodes vary with increasing age, while the features of other headache types vary with gender and increasing age. Headache features, such as severity, short duration and localisation of pain (forehead bilaterally), and the triggering and the aggravating factors were quite different when compared with the adults. These findings partly suggested the report of Gladstein et al. (1993), which the differences in headache features and applied therapies in children and adolescents had been shown.

The duration of migraine attack increases with the increasing age (Wöber-Bingöl et al. 2004). Our results highly suggested this clinically based data. The duration of headache in children with migraine was significantly longer than the children with TTH. The mean duration of migraine attacks in this study population was shorter than the mean duration reported by Wöber-Bingöl et al (2.6 versus 6.0 h) (Wöber-Bingöl et al. 2004). In contrast to the report of Wöber-Bingöl et al. (2004), there was a gradual increase in mean duration of headache with the increasing age which was not statistically significant. The different designs of the studies may probably explain these differences. On the other hand, a significant trend for boys with TTH was seen in headache frequency, especially at higher age group (p=0.006, see table 5) which was reported for girls previously (Wöber-Bingöl et al. 2004).

As a common sense, the frequency of headache, especially migraine attacks, increases with the age and more than 75 % of children with migraine have one or more attacks per month (Wöber-Bingöl et al. 2004, Wöber-Bingöl et al. 1996). Although a gradual increase in the frequency of headache was observed in boys and girls with increasing age, only a significant linear trend in boys with TTH was seen with the increasing age.

The earlier onset of puberty in females than males in tropical and subtropical climates (Mersin is located at the Mediterranean seaside), may be an alternative explanation for different prevalence rates of migraine and TTH in each gender. The early onset of puberty appears to coincide with an increasing frequency of migraine and TTH.

Forehead was the most common location of pain, independent from age and gender. Unilateral pulsating pain occurred more common in migrainous children (11.1%), when compared with TTH (1.1%, $p<0.001$). Although bifrontal location of pain was reported to be similar in children with migraine and TTH (21.4% vs 20.7%), linear trend analysis of pain location did not show any significant linear trend in headache type and gender. These results also supported some of the clinical and epidemiological reports (Wöber-Bingöl et al. 2004, Zencir et al. 2004).

Pulsating quality of pain has been reported in children with migraine commonly (54% vs 35.7%, $p<0.001$), and a significant trend with the increasing age in all of the headache types and in both gender was seen in our study. Our results were concordant with the clinic and epidemiologic studies (Wöber-Bingöl et al. 2004, Zencir et al. 2004). And although the pulsating quality of pain has been rarely reported in TTH, our epidemiological based results suggested that the quality of pain can not be an exclusion criteria for TTH in childhood.

Although the pain was more severe in younger children, generalised tightening pain was more prominent in older children in this study. As previously mentioned and expected commonly, migraineous children have been reported to have severe pain more than TTH children (86.6% vs 68.5%, $p<0.001$) independent from gender (Wöber-Bingöl et al. 2004, Zencir et al. 2004, Abu-Arafeh and Russell 1994). As a result, unlike all the other studies in the literature, we used a semi-structured face-to-face interview in order to evaluate the headache intensity properly, and related to the study design, we evaluated the pain intensity with additional questions (for example: ability to watch television, sleep or play during the headache attack). We also correlated the diagnosis with parents' questionnaire and teacher observation forms. We investigated the effect of headache characteristics, including IHS based ones (location, quality, intensity and aggravation), on the each primary headache type with age-dependently. Logistic regression analysis suggested that in younger age group location and severity of pain had an important effect on migraine like headache attacks, whereas aggravation by physical activity and unilateral location of pain were more prominent in older age groups. On the other hand mild intensity of pain was important in younger TTH children whereas the relation of school performance with headache and the absence of aggravation by physical activity were more prevalent in older children.

Detailed clinical based studies suggest that the aggravation of headache by physical activity, vomiting, photophobia and phonophobia decreases with the increasing age (Wöber-Bingöl et al. 1996, Wöber-Bingöl et al. 1995). However, the fulfilment of the minimum number of migraine attacks and the frequency of migraine attacks with aura increases in males, whereas nausea and vomiting decreases with the increasing age. In our study, among the aggravating factors of headache, we evaluated emotional stress, hard studying, hunger, ice-cream and chocolate eating, watching television and seasonal factors in addition to classical factors (physical activity, nausea, vomiting, photophobia, and phonophobia). The frequencies of these factors have been compared between two main headache types, and linear trend analyses have been evaluated for each group and gender. This evaluation is the first one in the literature with an epidemiological based detailed study design. Our results especially pointed the importance of emotional stress, studying and ice-cream in girls with headache. Additionally, we suggested significant effect of warm weather on TTH, independent from gender, with a positive trend of increasing age. We noticed the presence of school stress in 14.4% of patients, with the increasing linear trend for girls with migraine and TTH. This association was also observed by the other authors (Esposito et al. 2004, Guidetti et al. 1998, Gladstein and Holden 1996).

Aromaa et al. (1998) reported that children with headache during the elementary school entry, had more travel sickness (OR: 3.4) than controls. It is unclear whether patients with headache, especially with migraine, are more prone to travel sickness. Some reports have found a higher incidence of travel sickness in migraine subjects while others have not (Mortimer et al. 1992, Deubner 1977, Bille 1962). In our study, 44.9% of

the children with headache observed that a history of travel sickness (OR, 1.67; 95 % CI, 1.45-1.92, $p<0.001$) with a quite migraine predominance (53.2 %).

In this study, among the pain relieving factors sleeping, eating and use of analgesics were evaluated and our results suggested that these factors did not show any significant difference between migraine and TTH groups. On the other hand, linear trend analysis showed that only eating and using analgesics showed an increasing trend in girls with TTH. Suggesting to the report of Wöber-Bingöl et al. (2004), it can be proposed that these features may be completed with additional neuropsychological evaluations, and require longitudinal clinical based studies using headache diaries.

Karwautz et al. (1999) reported that patients with migraine were more often absent from school than TTH patients because of headache. However, they did not support increased prevalence of school problems and school stress in neither migraineurs nor children with TTH, in contrast to previous reports (Carlsson 1996a, Carlsson 1996b, Passchier and Orlebeke 1985, Leviton et al. 1984). Our epidemiological based study suggested these clinical based data and showed the importance of stress on headache, especially on TTH, predominantly young adolescents (Karwautz et al. 1999). Collin et al. (1985) reported that absence from school due to headache was reported to account for only 1 % of all school absences and the duration of this absence was one day or less in the vast majority. On the other hand, Larsson (1988) reported higher frequency of absence due to somatic complaints in migraineurs compared with the chronic headache patients and controls. In this study, we observed the important effect of headache on school absence, especially increasing trend by age in boys with migraine and girls with TTH.

The importance of headache onset times remains as a conflicting subject in both diagnosis and follow up. In order to evaluate this issue, we analysed headache onset time as afternoon or morning relating to gender and headache type. Afternoon predominance of headache, especially TTH was striking with a commonly school days preponderance. This observation may be an alternative explanation of high ratio of school absence because of headache.

Socio-economic structure has important effect on headache. In general, the prevalence of headache in childhood and adolescence seems to be associated with social class (Karwautz et al. 1999, Mortimer et al. 1992, Passchier and Orlebeke 1985, Maratos and Wilkinson 1982). One aspect suggested that, the lower socioeconomic status was associated with the higher prevalence of headache in preschool age, and the higher prevalence of frequent headache in girls (Sillanpaa et al. 1991). An important study showed that headache among children was more common in districts with high unemployment without showing any difference between children with migraine and TTH (Carlsson et al. 1996b). In our study we showed especially an increasing trend of family income on all types of headache frequencies, except boys with migraine.

Positive family history of headache has been reported with various frequencies related to the headache types and study designs (Zencir et al. 2004, Wober-Bingol et al. 1995). In the present study, we observed that 81.1 % of the children with headache had positive family history of headache, including second degree relatives. The most common association was mother's headache (56.7 %). Also mother's headache history showed important increasing trend for only girls with migraine. In contrast to common expectation, positive father's headache history was significantly higher in children with migraine when compared with TTH (49.3 % vs 43.6 %, $p=0.02$). Additionally, a high proportion of the positive headache history (43 %) of second-degree relatives was striking. We also observed an important effect of sibling's headache, as a commonly neglected data of headache questionnaires. Being the first child of the family was a favourable factor for headache compared with healthy students (46.9 % versus 53.1 %, $p=0.006$).

In contrast to one small study results, most of the authors did not confirm an association between disturbed family relations and headache (Karwautz et al. 1999, Larsson 1988, Maratos and Wilkinson 1982). However, divorced parents must be considered as a risk factor of TTH in this age group. As a frequently reported data, having divorced or lost parents showed an increasing trend in girls with TTH (Wöber-Bingöl et al. 2004, Wöber-Bingöl et al. 1996). Our study suggested the relationship between disturbed family relations and headache. We observed the ratio of

separated parents in children with migraine (12.2%) was significantly higher than children with TTH (9.4%) (p=0.05). However, linear trend analysis suggested increasing trend of separated parents only for girls with TTH.

In this study, the logistic regression analyses showed that increasing age, being the first child of the family, increasing number of siblings and increasing mother's age had significant effect on headache in each age and gender group. Pulsating quality of pain and the presence of mother's headache had also significant effects on lower age groups.

Conclusions

- Prevalence and characteristics of headaches in schoolchildren varies highly with age and gender. A possible explanation of this condition was a high prevalence of childhood TTH.
- The highest rate of headache was seen in schoolchildren in the group aged 11 year.
- General headache and TTH prevalence showed significant trend both for girls and boys, whereas not for migraine.
- General headache and TTH prevalence were significantly higher in girls compared to boys.
- Migraine prevalence showed an important trend only for girls with 12 ages.
- Some headache features (pulsating headache, associated phonophobia, aggravation by stress, studying, physical activity, hunger and eating ice-cream) was changed in the girls with migraine 11 years old.
- Increased mother's age, sibling's headache and aggravation by exercise had significant effects on headache frequency for children in the younger age group (8-9 ages), whereas having a crowded family and headache only during school days had significant effects on headache frequency for children in the older age group (11-12 ages).

Acknowledgements

This study was conducted in primary schools in Mersin, Centre. For this purpose, permission was obtained from the Provincial Governorship. We would like to express our gratitude to the school directors and student advisors who have contributed to data collection.

References

Abu-Arafeh I, Russell G: Prevalence of headache and migraine in schoolchildren. BMJ 1994; 309: 765-769.

Aromaa M, Sillanpaa Ml, Rautava P, Helenius H: Childhood headache at school entry: a controlled clinical study. Neurology 1998; 50: 1729-1736.

Barea LM, Tannhauser M, Rotta NT: An Epidemiological study of headache among children and adolescents of Southern Brazil. Cephalalgia 1996; 16: 545-549.

Bille B: Migraine in schoolchildren. Acta Paediatr 1962; 52 (Suppl 136): 3-151.

Bugdayci R, Ozge A, Sasmaz T, Kurt AO, Kaleagasi H, Karakelle A, Tezcan H, Siva A: Prevalence and factors affecting headache in Turkish schoolchildren. Pediatr Int. 2005; 47(3): 316-22.

Carlsson J: Prevalence of headache in schoolchildren: relation to family and school factors. Acta Paediatr 1996a; 85: 692-696.

Carlsson J, Larsson B, Mark A: Psychosocial functioning in schoolchildren with recurrent headaches. Headache 1996b; 36(2): 77-82.

Chu MI, Shinnar S: Headaches in children younger than 7 years of age. Arch Neurol 1992; 49(1): 79-82.

Collin C, Hockaday JM, Waters W.E: Headache and school absence. Arch Dis Child 1985; 60(3): 245-247.

Congdon PJ, Forsythe WI: Migraine in childhood. A Review. Clin Pediatr 1979; 18(6): 353-359.

Deda G, Caksen H, Ocal A: Headache etiology in children: a retrospective study of 125 cases. Pediatr Int 2000; 42(6): 668-673.

Deubner DC: An epidemiological study of migraine and headache in 10-20 year olds. Headache 1977; 17: 173-180.

Egermark-Eriksson I: Prevalence of headache in Swedish school-children. A questionnaire survey. Acta Paediatr Scand 1982; 71: 135-140.

Esposito SB, Gherpelli JI: Chronic daily headaches in children and adolescents: a study of clinical characteristics. Cephalalgia 2004; 24: 476-482.

Gladstein J, Holden EW, Peralta L, Raven M: Diagnosis and symptom patterns in children presenting to a pediatric headache clinic. Headache 1993; 33: 497-500.

Gladstein J, Holden EW: Chronic daily headache in children and adolescents: a 2-year prospective study. Headache 1996; 36: 349-351.

Gobels H, Petersen-Braun M, Soyka D: The epidemiology of headache in Germany: a nationwide survey of a representative sample on the basis of the headache classification of the international headache society. Cephalalgia 1994; 14: 97-106.

Guidetti V, Galli F, Fabrizi P, Giannantoni AS, Napoli L, Bruni O, Trillo S: Headache and psychiatric comorbidity: clinical aspect and outcome in 8-year follow-up study. Cephalalgia 1998; 18: 455-462.

Headache classification committee of the international headache society. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. Cephalalgia 1988; 8(Suppl 7): 1-96.

Karwautz A, Wober C, Lang T, Bock A, Wagner-Ennsgraber C, Vesely C, Kienbacher C, Wober-Bingol C: Psychosocial factors in children and adolescents with migraine and tension type headache: A controlled study and review of the literature. Cephalalgia 1999;19: 32-43.

Larsson B: The role of psychosocial health behavioural and medical factors in adolescent's headache. J Dev Med Child Neurol 1988; 30: 616-625.

Laurell K, Larsson B, Eeg-Olofsson O: Prevalence of headache in Swedish schoolchildren, with a focus on tension-type headache. Cephalalgia 2004; 24: 380-388.

Leviton A, Slack WV, Masek B, Bana D, Graham JR: A computerized behavioral assessment for children with headaches. Headache 1984; 24(2): 182-185.

Linder ST, Winner P: Pediatric Headache. Med Clin North America 2001; 85(4): 236-255.

Lipton RB, Stewart WF, Merikangas KR: Reliability in headache diagnosis. Cephalalgia 1993; 13(Suppl 12): 29-33.

Lipton RB, Maytal J: Epidemiology and classification of headache. In: Winner P, Rothner AD(Eds), Headache in children and adolescents. London: Bc Decker, 2001: 1-19.

Maratos J, Wilkinson M: Migraine in children: A medical and psychiatric study. Cephalalgia 1982;2:179-187.

Metsahonkala L, Sillanpaa M, Tuominen J: Outcome of early school-age migraine. Cephalalgia, 1997; 17: 662-665.

Mortimer MJ, Kay J, Jaron A: Childhood migraine in general practice: clinical features and characteristics. Cephalalgia 1992; 12: 238-243.

Ozge A, Bugdayci R, Sasmaz T, Kaleagasi H, Kurt O, Karakelle A, Tezcan H, Siva A: The sensitivity and specificity of the case definition criteria in diagnosis of headache: A school-based epidemiological study of 5562 children in Mersin. Cephalalgia 2003; 23: 138–145.

Passchier J, Orlebeke JF: Headaches and stress in schoolchildren: an epidemiological study. Cephalalgia 1985; 5(3): 167-176.

Raieli V, Raimondo D, Cammalleri R, Camarda R: Migraine headache in adolescents: A student population-based study in Montreal. Cephalalgia 1995; 15: 5-12.

Rothner AD, Winner P: Headaches in children and adolescents. In: Silberstein SD (Ed) Wolff's headache and other head pain. New York: Oxford University, 2001: 539-561.

Sasmaz T, Bugdayci R, Ozge A, Karakelle A, Kurt O, Kaleagasi H: Are the parents aware from their schoolchildren's headache? Eur J Public Health, 2004; 14(4): 366-368.

Sillanpaa M, Piekkala P: Prevalence of migraine and other headaches in early puberty. Scand J Prim Health Care 1984; 2: 27-32.

Sillanpaa M, Piekkala P, Kero P: prevalence of headache at preschool age in an unselected child population. Cephalalgia, 1991;11:239-242.

Sillanpaa M, Anttila P: Increasing prevalence of headache in 7-year-old school children. Headache, 1996;36:466-470.

Stewart WF, Lipton RB, Celentano DD, Reed MI: Prevalance of migraine headache in the United States. JAMA, 1992; 267: 64-69.

Stewart WF, Simon D, Shechter A, Lipton RB: Population variation in migraine prevalence: A Meta-Analysis. J Clin Epidemiol, 1995; 48: 269-280.

Stewart WF, Lipton RB, Simon D, Von Korff M, Liberman J: Reliability of an illness severity measure for headache in a population sample of migraine sufferers. Cephalalgia, 1998; 18(1): 44-51.

Winner P, Martinez W, Mate L, Bello L: Classification of pediatric migraine: proposed revisions to the ıhs criteria. Headache, 1995; 35: 407-410.

Wober-Bingol C, Wober C, Karwautz A, Vesely C, Wagner-Ennsgraber C, Amminger GP, Zebenholzer K, Geldner J, Baischer W, Schuch B: Diagnosis of headache in childhood and adolescence: A study in 437 patients. Cephalalgia 1995; 15: 13-21.

Wober-Bingol C, Wober C, Wagner-Ennsgraber C, Zebenholzer K, Vesely C, Geldner J, Karwautz A: IHS criteria and gender: A study on migraine and tension-type headache in children and adolescents. Cephalalgia, 1996; 16(2): 107-112.

Wöber-Bingöl C, Wöber C, Karwautz A, Auterith A, Serim M, Zebenholzer K, Aydinkoc K, Kienbacher C, Wanner C, Wessely P: Clinical features of migraine: a cross sectional study in patients age three to sixty-nine. Cephalalgia 2004; 24: 12-17.

Zencir M, Ergin H, Sahiner T, Kilic I, Alkis E, Ozdel L, Gurses D, Ergin A: Epidemiology and symptomatology of migraine among school children: Denizli urban area in Turkey. Headache, 2004; 44: 780-785.