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Migraine Features, Associated Symptoms, and Triggers: A Principal Component Analysis in the Women's Health Study

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Abstract

Aims—Migraine has a wide clinical spectrum. Our aim was to group information on migraine characteristics into meaningful components and to identify key components of the migraine phenotype.

Methods—We performed two principal component analyses, one among participants in the Women's Health Study enrolment cohort and one in a sub-cohort with additional migraine-specific information.

Results—Among the 9,427 women with migraine attack-related information at enrolment, the three most important components pertained to central nervous system (CNS) sensitization, attack frequency/pain location, and aura/visual phenomena. In the sub-group of 1,675 women with more detailed information, food triggers and unspecific symptoms constituted two principal components that explain more of the variance of the migraine phenotype than the three attack-related components.

Conclusions—Our results indicate that information on migraine-associated features, symptoms, and triggers is highly correlated allowing the extraction of principal components. Migraine attack-related symptoms are best summarized by symptoms related to CNS sensitization, attack frequency/pain location, and aura/visual phenomena. Taking a more general view, unspecific symptoms and food triggers appear to carry stronger importance in characterizing the migraine phenotype. These components are useful for future research on the pathophysiology and genetics of migraine and may have implications for diagnosing and treating patients.

Keywords

migraine; features; triggers; sensitization; principal component analysis

Introduction

Migraine is a common debilitating disorder with a complex and heterogeneous phenotype. It presents with recurrent headache attacks, associated symptoms of vegetative disturbance,

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and hypersensitivity of various functional systems of the central nervous system (CNS) (1,2). Meticulous descriptions of patients with migraine can be found in the medical literature for hundreds of years (3). However, there has also been long-standing controversy about obligatory characteristics for migraine (4). The International Classification of Headache Disorders (ICHD) from 1988 was among the most important achievements in this regard (5) and the revised version from 2004 is the current gold standard for headache diagnosis (4,6).

The ICHD-II focuses on attack-related features including pain intensity, localization, and characteristic as well as nausea/vomiting and photo- and phonophobia to diagnose migraine. However, in addition more general phenomena are considered typical for migraine. These pertain for example to severity of migraine, such as age at onset, attack frequency, family history, and presence of aura (1,7,8), but also to triggering factors including food, drugs, and hormones (9–11).

Attempts to systematically group, summarize, and prioritize this vast amount of information from attack-related features, unspecific symptoms, and triggers are sparse (12–14). However, categorizing this information into main groups (components) and identifying their importance in migraine would help to understand the complexity underlying migraine and further clinical, epidemiological, and genetic research in migraine.

We attempted to identify such main groups by performing principal component analyses using migraine-related information from a large cohort of women participating in the Women's Health Study (WHS). First, we analyzed attack-related features among women who reported migraine during the year prior to enrollment (n=9,427). Then we additionally investigated unspecific migraine symptoms and triggers among a sub-group of women for whom we had more detailed information from a migraine-specific questionnaire (n=1,675) and compared the results.

Subjects and Methods

Study population

The WHS was designed as a randomized, placebo-controlled trial to test the benefits and risks of low-dose aspirin and vitamin E in the primary prevention of CVD and cancer among apparently healthy women. The design, methods, and results have been described in detail previously (15,16). Briefly, a total of 65,169 U.S. female health professionals aged ≥ 45 years at baseline (between September 1992 and May 1995) without a history of CVD, cancer, or other major illnesses were enrolled, of which 39,876 were randomized to active aspirin (100 mg on alternate days), active vitamin E (600 IU on alternate days), both active agents, or both placebos. All participants provided written informed consent and the Institutional Review Board of Brigham and Women's Hospital approved the WHS. Baseline information was self-reported and collected by a mailed questionnaire, which asked about migraine, many cardiovascular risk factors, and lifestyle variables.

Of the women enrolled those who reported migraine attacks at least once per month during the previous year were sent a detailed migraine-specific questionnaire and asked if they were willing to participate in a migraine sub-study. This sub-study aimed to evaluate the role of low-dose aspirin in the prophylaxis of migraine (17). The time period between obtaining migraine information from the enrollment questionnaire and from the detailed migraine-specific questionnaire ranged from a few weeks to less than nine months.

Assessment of migraine and migraine-related information

Baseline questionnaire—Participants were asked on the baseline questionnaire: “Have you ever had migraine headaches?” and “In the past year, have you had migraine headaches?” From this information, we categorized women into “any history of migraine;” “active migraine,” which includes women with self-reported migraine during the past year; and “prior migraine,” which includes women who reported ever having had a migraine but none in the year prior to completing the questionnaire. Women with active migraine were asked further details about the migraine attack frequency (daily, weekly, monthly, every other month, less than 6 times per year), aura or any indication a migraine is coming (yes, no), unilateral pain location (yes, no), pulsating pain quality (yes, no), inhibition of daily activities (yes, no), nausea and/or vomiting (yes, no), sensitivity to light (yes, no), sensitivity to sound (yes, no), attack duration of 4–72 hours (yes, no), and aggravation by routine physical activity (yes, no). In a previous study of the WHS (18), we have shown good agreement of our migraine classification with modified 1988 International Headache Society (IHS) criteria for migraine (ICHD-I) (5). If a woman did not check the box regarding a migraine feature we categorized this as “no”.

Migraine-specific questionnaire—The detailed migraine-specific questionnaire contained questions pertaining to migraine features/characteristics, migraine-related symptoms, and migraine triggers. Women were asked about the following: age at migraine onset (<10 years, 11–20 years, 21–30 years, 31–50 years, >50 years); migraine attack frequency during past year (daily, weekly, every other week, monthly); migraine severity during past year (light, moderate, severe); migraine duration during past year (<4 hours, 4–24 hours, 25–48 hours, 49–72 hours, >72 hours); number of days unable to function due to migraines during past year (0 days, 1–12 days, 13–24 days, 25–36 days, 37–48 days, >48 days); location of migraine (unilateral or behind one eye, front of head, back of head, whole head); character of migraine (pounding, pulsating, crushing, sharp, aching, burning); frequency or severity of migraine related to menstrual cycle (yes, no).

History of migraine was asked for every blood relative (no, yes, don't know, not applicable) and combined into a variable “family history of migraine” (yes, other).

Frequency (never, sometimes, always) of the following symptoms was asked: aura or any indication a migraine is coming; double vision; other visual symptoms; nausea/vomiting; sensitivity to light; sensitivity to sound; behavioral or personality changes; unusual food cravings; bloating or fluid retention; sensory symptoms (tingling, numbness); speech or language symptoms; dizziness or vertigo; unilateral weakness in face, arms or legs. For the analysis these variables were categorized as “yes” or “no”.

In addition, women were asked if migraine is triggered or made worse by: physical activity; red wine; white wine; other alcohol; coffee; tea; cola drinks; cheeses; chocolate; artificial sweeteners; cold cuts or preserved meats; monosodium glutamate; hormones (post-menopausal estrogens, oral contraceptives); anti-angina drugs and vasodilators. Answer categories were “no” and “yes”, those pertaining to food also included “don't know”.

Based on information from this migraine-specific questionnaire, we have shown excellent agreement between self-reported migraine and ICHD-II based migraine classification in the WHS (19). We created a missing indicator variable for missing values.

Statistics

We used descriptive statistics to describe migraine-related information among women reporting migraine and report percentages and numbers.

Principal Component analysis—Principal component analysis is a technique based on matrix algebra to create summary components from a number of observed variables (20). This analysis approach is typically applied to datasets with a large number of variables and observations.

Principal component analysis uses a regression to select from a pool of variables a subset of variables that explain most of the variance among all observed variables in order to derive a first summary component. The first component accounts for the largest amount of variance among all observed variables. This is expressed by eigenvalues or by the proportion or percentage of the total variance. In the next step a new subset of the observed variables is selected that best accounts for the remaining variance to derive the second component. This process continues and the total number of components extracted equals the number of observed variables. However, only a small number of components accounts for most of the total variance in the dataset. We retained principal components with eigenvalues > 1, that means only those that explain more variance than any of the individual variables. A final transformation (“factor rotation”) is used to demonstrate more clearly which individual variables contribute to each principle component.

We performed two principal component analyses. The first analysis was among women reporting active migraine on the baseline (enrollment) questionnaire. We entered all available variables pertaining to migraine attacks as listed above.

The second analysis was among the subgroup of women with migraine with available information from the migraine-specific questionnaire pertaining to migraine features/ characteristics, migraine-associated symptoms, and migraine triggers as described above.

For each principal component retained we report two measures for the amount of variance explained: the eigenvalues and the percentage of variance explained. The percentage of variance explained equals the eigenvalue divided by the number of variables. Furthermore, we report the factor pattern matrix after rotation (containing correlation coefficients of the observed variables and principal components) along with the communalities for each observed variable. Communality is the proportion of variance of an observed variable that is due to common factors or shared with other variables. We labeled each principal component according to the variables contributing most heavily to them.

We further investigated the stability of the retained principal components in each of the two datasets by determining the variance of the eigenvalues with a resampling technique. For this we repeatedly calculated eigenvalues using 90% of the data with replacement after each calculation.

This was done ten times and we then calculated the mean and the standard deviation (SD) of the ten sets of eigenvalues for each principle component.

All analyses were performed using SAS version 9.1 (SAS Institute Inc, Cary, NC).

Results

Analysis among women reporting active migraine on the baseline (enrollment) questionnaire

Among the 65,169 women enrolled with available information from the baseline questionnaire, 12,917 reported ever having had a migraine. Among those 9,427 had migraine during the past year, for which we had detailed information on migraine features. The proportions of features among women with migraine are summarized in Table 1.

Based on the eigenvalue > 1 criterion three components were retained, explaining 48% of the total variance. These components had eigenvalues of 2.69, 1.10, and 1.04. Results using the resampling technique showed high stability with mean eigenvalues $\pm$ SD of $2.69 \pm 8.79 \times 10^{-3}$, $1.10 \pm 4.24 \times 10^{-3}$, and $1.04 \pm 2.83 \times 10^{-3}$. After orthogonal rotation of the factor pattern matrix we labeled these principal components as follows (Table 2): component 1—CNS sensitization; component 2—attack frequency/pain location; components 3—aura/visual phenomena.

Analysis among women with information from the migraine-specific questionnaire

Of the 9,427 women who had reported migraine during the past year on the baseline questionnaire, those who reported migraine attacks at least once per month ($n=2,588$) were sent a detailed migraine specific questionnaire. This questionnaire was returned by 1,817 women. Of those, 142 women, who now reported migraine frequencies of less than monthly were excluded, leaving 1,675 women for analysis. The proportion of migraine features/characteristics, migraine-associated symptoms, and triggers are summarized in Table 3.

Nine components explained 57% of the total variance and were retained with the following eigenvalues: component 1—7.54; component 2—4.48; component 3—1.73; component 4—1.41; component 5—1.22; component 6—1.16; component 7—1.07; component 8—1.05; component 9—1.01. Results using the resampling technique showed stable results with mean eigenvalues $\pm$ SD of: component 1— $7.57 \pm 4.63 \times 10^{-1}$; component 2— $4.55 \pm 9.8 \times 10^{-2}$; component 3— $1.72 \pm 2.78 \times 10^{-2}$; component 4— $1.43 \pm 6.4 \times 10^{-2}$; component 5— $1.23 \pm 1.9 \times 10^{-2}$; component 6— $1.16 \pm 2.67 \times 10^{-2}$; component 7— $1.09 \pm 3.64 \times 10^{-2}$; component 8— $1.05 \pm 2.84 \times 10^{-2}$; component 9— $1.01 \pm 1.11 \times 10^{-2}$. After orthogonal rotation of the factor pattern matrix we labeled the first 5 components, explaining 46% of the total variance, as follows (Table 4): component 1—food triggers; component 2—unspecific symptoms; component 3—CNS sensitization; component 4—migraine severity; component 5—aura/visual symptoms.

Component 6 largely overlaps with component 1 by combining variables for alcohol triggers with those for physical activity being a trigger and migraine duration. Component 7, which combines variables for migraine character, location, and severity conceptually overlaps with component 2, but explains much less of the variance. Component 8 is only characterized by anti-angina drugs/vasodilators and hormones being triggers and component 9 only by family history of migraine, hence explaining very little variance.

Sensitivity analysis

We also performed a principal component analysis among women participating in the sub-study restricted to information on migraine features from the baseline questionnaire. The results were stable and comparable to those obtained from among all women reporting migraine at baseline.

Three components explained about 47% of the total variance and had eigenvalues of 2.52, 1.16, and 1.01. After orthogonal rotation of the factor pattern matrix we labeled these principal components as follows (Table 5): component 1—CNS sensitization; component 2—aura, visual and acoustic phenomena; components 3—attack frequency and pain related characteristics.

Discussion

The main results from our analyses are that information regarding migraine attack-associated features, associated symptoms, and triggers are highly correlated allowing the extraction of summary variables (principal components). Specifically, analysis among

women with information on migraine features allowed extraction of three principal components. In order of importance these pertain to CNS sensitization, attack frequency/pain location, and aura/visual phenomena. Furthermore, analysis among the sub-group of women with more detailed migraine information allowed extraction of five principal components. In order of importance these pertained to food triggers, unspecific symptoms, CNS sensitization, migraine severity, and aura/visual phenomena. The principle components in both datasets appear to be reliable measures as indicated by the small standard deviations of the eigenvalues.

Migraine is a phenotypically heterogeneous headache disorder. The consensus diagnostic criteria established by the IHS (6) are based on migraine features and constitute a snap-shot of the most severe symptoms often occurring at the peak of an attack. However, many patients may only present a subset of or a mild form of features precluding the diagnosis of migraine. The concept of “probable migraine” partly accounts for this heterogeneity (6).

A related concept that attempts to explain the phenotypical heterogeneity and complexity among primary headaches from a functional-anatomical perspective is the modular headache theory. According to this theory certain features of primary headaches can be ascribed to modules—groups of neurons that produce a feature or symptom of headache (12).

Our statistical approach supports the idea that migraine features can be grouped into main categories. Features of CNS sensitization, which are also emphasized in the IHS criteria for migraine, appear to be most important. However, our analyses also suggest that considering more general phenomena may yield additional information. We identified food triggers and unspecific symptoms as the two most important components in the subgroup of women with additional information on the more general phenomena, explaining 21% and 12% of the total variance. We also identified components pertaining to CNS sensitization, migraine severity, and aura/visual symptoms in this sub-group; however, they were less important than the more general phenomena.

When comparing the results of the two analyses, differences among the two groups of migraineurs have to be considered. The smaller group of migraineurs is a more severely affected sub-group of the larger one. For example, women in the sub-group all have attack frequencies of at least monthly and they have a higher prevalence of aura, other migraine related features, and attack frequencies from 4–72 hours. This may have the following implications. First, CNS sensitization, migraine severity, and aura/visual phenomena are more general phenomena which are important for all migraineurs. This is supported by robust results from our sensitivity analysis indicating that among participants in the sub-group principal components with labels very similar to those in the whole cohort are retained. While features of CNS sensitization are most important in both groups, the importance of the second and third component has switched (Tables 2 and 5). This is not surprising when considering that for more severely affected migraineurs, like women in the sub-study, phenomena of hypersensitivity of the senses are often more compromising than the headache. Second, in addition to those three components food triggers and unspecific symptoms may be more specific for more severely affected migraineurs. However, we could not verify this, since detailed information was unavailable for the whole group of migraineurs.

An interview-based physician diagnosis is considered the gold standard for the diagnosis of migraine. Although this is not feasible in large population-based studies, standardized epidemiologic tools have been successfully implemented in such studies. We have previously shown that in the WHS (18,19). Standardized questionnaires are ideal tools to systematically acquire a large amount of data, which can then be analyzed by data mining

techniques like principal component analysis for underlying association patterns. Such an approach may be considered hypothesis generating in the sense that the new components may serve as surrogate outcomes in future studies aiming to decipher epidemiological, physiological, or genetic basis as well as for drug treatment trials. Previous studies in migraine have used other data mining techniques to investigate certain phenotypic and genetic migraine features (13,14,21). For example, migraineurs were investigated with latent class analysis based on their symptoms according to IHS criteria (13,14). Using this technique patients were classified into four phenotypic categories based on the severity of their symptoms, suggesting a continuum of the overall migraine phenotype. In contrast, our analysis aimed to identify main categories (principal components) among the many migraine features and characteristics that are most important in characterizing a migraine patient.

The strengths of our study include the large number of women with self-reported migraine both from the baseline and from the migraine-specific questionnaire as well as the detailed information regarding migraine features, migraine-associated symptoms, and migraine triggers.

However, the following limitations should be considered. We cannot exclude potential misclassification of women both based on the baseline questionnaire and on the migraine-specific questionnaire. We may have missed migraineurs, who did not check the box on migraine on the baseline questionnaire. Likewise, women with other moderate to severe headaches may have checked the box on migraine. However, in a previous study (18), we have shown good agreement of our migraine classification with the 1988 IHS criteria for migraine (5) and we have shown excellent agreement between self-reported migraine and 2004 IHS criteria for migraine in the WHS subcohort (19).

In conclusion, our results indicate that much of the migraine-related information is correlated and support the concept that features indicating CNS sensitization constitute the most important component of individual attacks. However, on a more general basis triggering factors and unspecific symptoms may be much more important for characterizing the migraine phenotype. The identified components are useful for targeted future research on the pathophysiology and genetics of migraine and may have implications with regard to diagnosing and treating patients.

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Table 1

Migraine features among women reporting migraine during the past year on the baseline questionnaire in the Women's Health Study (n=9,427)

Migraine feature	Percentage (Number)
Migraine attack frequency	
Daily	0.7 (61)
Weekly	5.7 (525)
Monthly	21.6 (2,002)
Every other month	9.9 (918)
Less than 6 times per year	62.2 (5,763)
Aura	39.0 (3,676)
Unilateral pain location	57.8 (5,453)
Pulsating pain quality	54.5 (5,140)
Nausea/Vomiting	63.1 (5,944)
Sensitivity to light	67.0 (6,317)
Sensitivity to sound	45.0 (4,246)
Attack duration of 4–72 hours	77.8 (7,332)
Aggravation by routine physical activity	35.5 (3,349)
Inhibition of daily activities	49.2 (4,637)

Percentages may not add up 100 due to rounding or missing values.

Table 2

Eigenvalues and percentage of variance explained for principal components as well as factor loading after orthogonal rotation from principal component analysis of migraine features among women with migraine during the past year from the baseline questionnaire of the Women's Health Study (n=9,427)

	Component 1: CNS sensitization	Component 2: Attack frequency and pain location	Component 3: Aura and visual phenomena	Communality
Eigenvalue	2.69	1.10	1.04	
Variance explained (%)	26.9	11.0	10.4	
Migraine feature				
Inhibition of daily activities	0.68	0.09	0.01	0.47
Sensitivity to sound	0.67	0.02	0.17	0.48
Aggravation by routine physical activity	0.62	0.03	−0.10	0.40
Sensitivity to light	0.61	0.08	0.41	0.54
Nausea/Vomiting	0.56	0.16	−0.05	0.35
Pulsating pain quality	0.40	0.36	−0.28	0.37
Unilateral pain location	0.12	0.64	0.01	0.43
Attack duration of 4–72 hours	0.47	0.47	−0.19	0.48
Migraine attack frequency	0.05	− 0.73	−0.18	0.57
Aura	0.03	0.08	0.86	0.75

Values >0.4 are in bold.

Table 3

Migraine features and other migraine characteristics among the subgroup of women participating in the Women's Health Study with information from the migraine-specific questionnaire (n= 1,675)

Migraine features/characteristics	Percentage (Number)
Age at migraine onset	
<10 years	7.9 (132)
11–20 years	27.9 (467)
21–30 years	29.1 (487)
31–50 years	32.6 (546)
>50 years	1.9 (32)
Family history of migraine	77.3 (1,294)
Migraine attack frequency during past year	
Daily	2.7 (45)
Weekly	17.8 (298)
Every other week	25.6 (428)
Monthly	52.6 (881)
Migraine severity during past year	
Light	21.9 (366)
Moderate	55.2 (924)
Severe	20.7 (347)
Migraine duration during past year	
<4 hours	9.2 (154)
4–24 hours	50.6 (848)
25–48 hours	21.6 (362)
49–72 hours	14.0 (234)
>72 hours	3.9 (66)
Number of days unable to function due to migraines during past year	
0 days	19.5 (327)
1–12 days	57.8 (968)
13–24 days	14.1 (237)
25–36 days	3.6 (61)
37–48 days	1.9(32)
>48 days	2.3 (39)
Location of migraine	
Unilateral or behind one eye	68.5 (1,148)
Front of head	12.1 (203)
Back of head	5.6 (93)
Whole head	10.3 (173)
Character of migraine	
Pounding	26.5 (444)

Migraine features/characteristics	Percentage (Number)
Pulsating	30.7 (515)
Crushing	12.2 (205)
Sharp	8.4 (140)
Aching	17.1 (287)
Burning	2.0 (32)
Frequency or severity of migraine related to menstrual cycle	60.3 (1,010)
Symptoms associated with migraines	
Aura or any indication a migraine is coming	59.8 (1,001)
Double vision	26.5 (444)
Other visual symptoms	50.9 (852)
Nausea/vomiting	89.1 (1,492)
Sensitivity to light	93.0 (1,558)
Sensitivity to sound	86.1 (1,442)
Behavioral or personality changes	63.0 (1,056)
Unusual food cravings	28.3 (474)
Bloating or fluid retention	55.9 (936)
Sensory symptoms (tingling, numbness)	39.7 (665)
Speech or language symptoms	24.7 (413)
Dizziness or vertigo	61.0 (1,022)
Unilateral weakness in face, arms or legs	20.8 (348)
Migraines triggered or made worse by...	
Physical activity	36.6 (613)
Red wine	43.1 (722)
White wine	25.6 (429)
Other alcohol	29.1 (488)
Coffee	8.1 (135)
Tea	3.4 (57)
Cola drinks	5.0 (83)
Cheeses	16.2 (272)
Chocolate	24.7 (413)
Artificial sweetener	7.4 (124)
Cold cuts or preserved meats	10.3 (173)
Monosodium glutamate	24.7 (414)
Hormones (post-menopausal estrogens, oral contraceptives)	67.5 (1,130)
Anti-angina drugs and vasodilators	2.8 (47)

Percentages may not add up 100 due to rounding or missing values.

Table 4

Eigenvalues and percentage of variance explained for principal components as well as factor loading after orthogonal rotation from principal component analysis of migraine features/characteristics among the subgroup women participating in the Women's Health Study with information from the migraine-specific questionnaire (n=1,675)

	Component 1: Food triggers	Component 2: Unspecific symptoms	Component 3: CNS sensitization	Component 4: Migraine severity	Component 5: Aura and visual phenomena	Communality
Eigenvalue	7.54	4.48	1.73	1.41	1.22	
Variance explained (%)	20.9	12.5	4.8	3.9	3.4	
Migraine feature						
Cola drinks as trigger	0.88	0.06	0	0.01	0.05	0.78
Artificial sweetener as trigger	0.82	0.08	0.01	0.04	0.03	0.70
Cold cuts or preserved meats as trigger	0.82	0.05	0.04	0.13	0.01	0.70
Tea as trigger	0.82	0.10	-0.03	0	0.08	0.69
Coffee as trigger	0.77	0.07	0	0	0.10	0.61
Monosodium glutamate as trigger	0.74	-0.01	0.08	0.22	-0.05	0.61
Chocolate as trigger	0.72	0.04	0.04	0.12	0	0.55
Cheeses as trigger	0.69	0.13	0	0.05	-0.02	0.51
White wine as trigger	0.67	0.04	0.13	-0.05	0.01	0.73
Other alcohol as trigger	0.66	0.03	0.04	-0.04	0.12	0.67
Bloating or fluid retention	0.05	0.83	0.01	0.04	0.12	0.72
Speech or language symptoms	0.09	0.83	0.07	0.07	0.07	0.71
Sensory symptoms (tingling, numbness)	0.07	0.77	0.18	0.08	0.04	0.64
Unusual food cravings	0.01	0.74	0.12	0.06	0.08	0.59
Unilateral weakness in face, arms or legs	0.07	0.62	0.21	0.03	0.08	0.44
Behavioral or personality changes	0.13	0.56	0.04	0.04	0.16	0.37
Dizziness or vertigo	0.08	0.50	0.43	0.07	0.09	0.47
Sensitivity to light	0.03	0.17	0.73	0.08	0.07	0.59
Sensitivity to sound	0.02	0.39	0.70	0.11	0.06	0.67
Nausea/vomiting	0.06	0.21	0.63	0.11	0.39	0.61
Age at onset of migraine	0.13	0.07	0.10	0.67	0.01	0.51

	Component 1: Food triggers	Component 2: Unspecific symptoms	Component 3: CNS sensitization	Component 4: Migraine severity	Component 5: Aura and visual phenomena	Communality
Number of days unable to function due to migraines during past year	0.12	0.12	0.08	0.64	-0.04	0.47
Migraine attack frequency during past year	0.05	0.04	0.07	0.51	0.03	0.33
Aura or any indication a migraine is coming	0.06	0.20	0.13	0.06	0.67	0.53
Double vision	0.09	0.33	0.30	-0.03	0.55	0.53
Frequency or severity of migraine related to menstrual cycle	0.06	0.04	-0.18	0.35	0.46	0.56
Other visual symptoms	0.04	0.26	0.24	-0.11	0.43	0.36
Red wine as trigger	0.52	-0.01	0.18	-0.02	0.01	0.73
Physical activity as trigger	0.13	0.14	0.02	0.12	-0.10	0.36
Migraine duration during past year	0.05	0.11	-0.01	0.36	0.17	0.34
Character of migraine	0.05	0.11	-0.05	0.10	0.05	0.59
Location of migraine	0.01	0.06	0.05	0.04	0	0.54
Migraine severity during past year	0.03	0.04	-0.02	0.21	0.20	0.48
Anti-angina drugs and vasodilators as trigger	0.03	-0.02	-0.09	0.08	0.16	0.65
Hormones (post-menopausal estrogens, oral contraceptives) as trigger	0.07	0.03	0.09	0.06	-0.11	0.63
Family history of migraine	0.02	0.01	0.05	-0.08	-0.15	0.72

Values >0.4 are in bold.

Table 5

Eigenvalues and percentage of variance explained for principal components as well as factor loading after orthogonal rotation from principal component analysis of migraine features among women with migraine during the past year from the baseline questionnaire of the Women's Health Study who participated in the sub-study

	Component 1: CNS sensitization	Component 2: Aura, visual and acoustic phenomena	Component 3: Attack frequency and pain related characteristics	Communality
Eigenvalue	2.52	1.16	1.01	
Variance explained (%)	25.2	11.6	10.1	
Migraine feature				
Inhibition of daily activities	0.69	0.21	0.04	0.53
Sensitivity to sound	0.41	0.59	0.06	0.52
Aggravation by routine physical activity	0.58	0.28	0.07	0.41
Sensitivity to light	0.31	0.67	0.11	0.56
Nausea/Vomiting	0.71	−0.07	0.06	0.51
Pulsating pain quality	0.18	0.18	0.45	0.27
Unilateral pain location	− 0.01	0.10	0.64	0.42
Attack duration of 4–72 hours	0.45	−0.11	0.53	0.50
Migraine attack frequency	0.04	0.01	− 0.66	0.44
Aura	−0.13	0.72	0.06	0.53

Values >0.4 are in bold.