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Original Article

Relationship of Migraine and Body Mass Index (BMI)

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Abstract

Background*: Migraine is an important cause of headache and headache-related disabilities. It increases loss of working time, causes inability to carry out daily activities and disruption of family and social life. The pathophysiology of migraine is still poorly understood. On the other hand, the prevalence of obesity is constantly increasing worldwide. The consequence of overweight and obesity includes increased risk of diabetes mellitus, dyslipidemia, hypertension, cardiovascular disease and cancer.* ***Objectives****: This study was performed to assess the relationship between BMI and migraine by finding out the relationship between migraine frequency and duration in different BMI groups, comparing the socio-demographic variables in migraine and non-migraine patients and to find out the migraine related co-morbidities.* ***Materials and Methods****: This observational case-control study was conducted on 100 subjects aged 12–50 years in the Neurology Outpatient Department, Mymensingh Medical College Hospital, Mymensingh in the period of January 2011 to December 2012. Out of total subjects fifty migraine patients were selected as cases and fifty nonmigraineurs as controls. Subjects were then categorized in three groups based on BMI: <23, 23 to 25 and >25. Collected data were compiled and appropriate analyses were done by using computer based software, Statistical Package for Social Sciences (SPSS) version 16.0. For statistical analysis one way ANOVA tests were done for comparing means of quantitative data and Chi-square tests were done for qualitative data. A p value <0.05 was considered statistically significant.* ***Results****: In this study, majority (>95%) of the study subjects were between 10 and 35 years of age. Mean age of case group was found 25.55 ± 5.87 and that of control was 25.53 ± 4.22 years. Case group contained 10 (20%) males and 40 (80%) females whereas control group had 14 (28%) males and 36 (72%) females. Number of female cases and controls were higher than that of male. In control group 30 (60%) were unmarried and 20 (40%) were married. There was no significant difference in the financial condition between case and control groups. Students and housewives occupied the largest number of study subjects who were unemployed. Regarding residence, rural and urban patients were equal in case group and in control group 29 (58%) were urban and 21 (42%) rural. Mean duration of headache was 8.9 ± 7.5, 5.8 ± 6.7, 9.6 ± 14.3 years in different BMI groups (<23, 23–25, >25 respectively) in case group and 4.6 ± 5.3, 4.4 ± 3.4, 3.4 ± 1.4 years in control group respectively. There was significant difference in quality of headache. In migrainous group 58.6% in BMI <23, 30% in BMI 23–25, 36.4% in BMI >25 noted their headache as throbbing, in contrast most of the nonmigrainous described them as dull in nature. Mean frequency of headache per month was significantly higher in migraine group compared to non-migraine group (p=0.02). Regarding associated symptoms, nausea, vomiting, photophobia and phonophobia were observed significantly higher in migraine patients in BMI <23 group. Odd ratios (ORs) for vomiting, photophobia and phonophobia with 95% confidence interval*

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(CI) were 23.385 (2.752–97.739), 16.500 (3.060– 88.971) and 13.000 (2.922–57.846) respectively. Smoking was found significantly higher in nonmigrainous group than migraine group in case of BMI <23. ***Conclusion****: From the result of present study it can be concluded that there is statistically no significant relation of BMI with frequency of headache, but some relationship were observed for associated symptoms of migraine with low BMI.*

Key words*: Migraine; Headache; BMI*

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Introduction

Headache is one of the most common presenting complaints in neurology. The lifetime prevalence for any type of headache as estimated from population based studies is more than 90% for men and 95% for women.[1] Severe disabling headache is reported to occur at least by 40% of individuals worldwide annually.[2] A large percentage of headache patients will be diagnosed as having migraine, a specific subtype of headache affecting approximately 10–20% of the general population. The morbidity associated with the millions of migraine sufferers is staggering; approximately 64 million workdays each year are estimated to be lost in the United States due to migraine.[3] Migraine is a chronic, common disease that presents with mild to severe recurrent headaches, accompanied by autonomic and neurologic symptoms. It is a ubiquitous familial disorder characterized by periodic, commonly unilateral, often pulsatile headaches that begins in childhood, adolescence, or early adult life and recur with diminishing frequency during advancing years.[4] Migraine is more common among females with a ratio of male to female 1:3.[4] Recent progress on scientific basis of diagnosis, epidemiology, pathology and pharmacology of migraine has significantly improved diagnostic and therapeutic options.

There are several explanations for the pathophysiology of migraine headache attacks. The pathogenesis of migraine headache with the dopamine hypothesis was explained in 1977. In this hypothesis prodromal clinical and postdromal sign-symptoms of migraine headache are attributed to increased activity of the dopaminergic system. Postsynaptic receptor hypersensitivity of the dopamine in areas of central nervous system is involved in pain, vomiting and arterial blood pressure.[5] Prolactin secretion is a measure of dopaminergic function. Dopamine decreases prolactin secretion. An abnormal pattern of hypothalamic secretion, specially decreased nocturnal prolactin peak was found in chronic migraine.[6] Administration of dopaminergic drugs can trigger and maintain a migraine attack.[3] Dopamine antagonist may help the migraine patients.

Obesity affects an estimated 300 million people worldwide. Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in meters). A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more than 25 is considered overweight. In Asian populations BMI should be calculated using an upper limit BMI of 23 instead of 25.

In particular, general obesity or total body obesity, as estimated by the body mass index (BMI), has been shown to be related to headache disorders in several clinical and epidemiologic studies. However, there is considerable uncertainty about the nature of the obesity/headache relationship and whether it is specific to migraine, or chronic daily headache, or headache in general.

The prevalence of obesity is constantly increasing worldwide. The consequences of overweight and obesity include increased risk of diabetes mellitus, dyslipidemia, hypertension, cardiovascular disease and cancer. The obesity is associated with chronic pain condition.

Relation between obesity and migraine is important because the increasing prevalence of obesity led to an increase in the prevalence, frequency and severity of migraine. Such relation will increase the risk of comorbidities like ischemic stroke and often ischemic vascular events.

Materials and Methods

This observational case-control study was conducted on 100 subjects aged 12–50 years in the Neurology Outpatient Department, Mymensingh Medical College Hospital, Mymensingh in the period of January 2011 to December 2012. Out of total subjects fifty migraine patients were taken as cases and fifty non-migraineurs were taken as controls. Patients <10 years and >50 years, patients with known structural brain disease, having features of raised intracranial pressure and CNS infection suspected of meningitis/meningoencephalitis were excluded from the study. Both cases and controls were categorized in three groups based on BMI: <23, 23 to 25 and >25. Socio-demographic variables were compared between case and control groups in three different BMI categories with appropriate statistical method. Migraine patients were further characterized according to the frequency and duration of headache in three different BMI groups. Collected data were compiled and appropriate analyses were done by using computer based software, Statistical Package for Social Sciences (SPSS) version 16.0.

For statistical analyses one way ANOVA tests were done for comparing means of quantitative data and Chi-square tests were done for qualitative data. A p value <0.05 was considered statistically significant.

Results

In this study, mean age of case group was 25.55 ± 5.87 years and that of control was 25.53 ± 4.22 years. It was observed that the mean age difference of migraine and non-migraine subjects in all the groups was found statistically significant (p<0.001). Female subjects were predominant in both migraine and non-migraine groups. Case group included 10 (20%) males and 40 (80%) females and control group had 14 (28%) males and 36 (72%) females. However, the difference was statistically insignificant in all groups based on BMI (p=0.15, p=1.00 and p=0.56). In the case group 30 (60%) were unmarried and 20 (40%) were married. In control group 25 (50%) were unmarried and 25 (50%) were married. Table I and II show the occupational and residential status of the study subjects.

Table I: Occupation of the study subjects (N =100)

Occupation	Migraine group (n=50)		Non-migraine group (n=50)		Total (N=100)		p value
	Number	%	Number	%	Number	%	
Business	0	0.0	3	6.0	3	3.0	
Farmer	0	0.0	2	4.0	2	2.0	
Housewife	21	42.0	29	58.0	50	50.0	0.04
Students	23	46.0	13	26.0	36	36.0	
Service holder	6	12.0	3	6.0	9	9.0	

p value reached from Chi square test with Yates Correction for cell frequency less than 5

Table II: Residence status of the study subjects (N =100)

Residence	Migraine group (n=50)		Non-migraine group (n=50)		Total (N=100)		p value
	Number	%	Number	%	Number	%	
Urban	25	50.0	29	58.0	54	54.0	0.42
Rural	25	50.0	21	42.0	46	46.0	

p value reached from Chi square test

Duration of headache varied from less than one year to over 5 years. It was observed that mean duration of headache was higher in migraine than non-migraine in different BMI groups. But it was statistically insignificant (p=0.14). Table III shows the duration of each attack in different BMI groups and Table IV compares the quality of headache in different BMI groups. It was observed that in both throbbing and dull aching types of headache there was statistically significant difference between migraine and non-migraine groups in BMI <23 group (p=0.001) and BMI >25 group (p=0.03), but in BMI 23–25 group, there was no significant difference (p=0.64).

Table III: Mean status of duration of each attack in different BMI groups (N=100)

Duration of each attack in hours	BMI <23 (n= 49)		p value	BMI 23-25 (n=26)		p value	BMI >25 (n=25)		p value
	Migraine n=29	Non migraine n=20		Migraine n=10	Non migraine n=16		Migraine n=11	Non migraine n=14	
Mean ± SD	8.9 ± 7.5	4.6 ± 5.3	0.03	5.8 ± 6.7	4.4 ± 3.4	0.07	9.6 ± 14.3	3.4 ± 1.4	0.04

p value reached from unpaired t-test

Table IV: Distribution of the patients by quality of headache (N=100)

Quality of headache	BMI : <23 (n=49)		p value	BMI: 23 25 (n=26)		p value	BMI : >25 (n=25)		p value
	Migraine	Non migraine		Migraine	Non migraine		Migraine	Non migraine	
Throbbing	17	0		3	3		4	0	
Dull aching	12	20	0.001	7	13	0.64	7	14	0.03
Total	29	20		10	16		11	14	

p value reached from Chi square test and Fisher's Exact test was done in case of cell frequency less than 5.

With regard to the frequency of attack per month it was observed that frequency varied from less than one to fifteen times. Mean frequency of headache per month was significantly higher in migraine group compared to non-migraine group (p=0.02).

Table VI shows associated symptoms found in migrainous and non-migrainous groups. Nausea, vomiting, photophobia and phonophobia were observed significantly higher in migraine patients in BMI <23 group. Odd ratio (ORs) for vomiting, photophobia and phonophobia with 95% confidence interval (CI) were 23.385 (2.752–97.739), 16.500 (3.060–88.971) and 13.000 (2.922–57.846) respectively. In other groups the difference was insignificant (p>0.05). In this study migraine without aura was in 33 (66%) subjects and migraine with aura was in 17 (34%) patients.

Table V: Distribution of the subjects by frequency of attack (N=100)

Frequency of attack/ month	BMI <23 (n=49)		p value	BMI 23–25 (n=26)		p value	BMI >25 (n=25)		p value
	Migraine (n=29)	Non migraine (n=20)		Migraine (n=10)	Non migraine (n=16)		Migraine (n=11)	Non migraine (n=14)	
One time	1	0		0	2		0	0	
Two times	1	0		3	1		1	3	
Three times	11	15		2	9		4	9	
Four times	1	2		1	3		1	2	
Five times	9	2		3	0		5	0	
Ten times	5	1		1	1		0	0	
Fifteen times	1	0		0	0		0	0	
Total	29	20		10	16		11	14	
Mean±SD	5.1 ± 3.2	3.6 ± 1.6	0.04	4.1 ± 2.4	3.3 ± 1.9	0.10	3.9 ± 1.1	2.9 ± 0.6	0.01

p value reached from unpaired t-test

Table VI: Distribution of the subjects by associated symptoms (N=100)

Associated Symptoms	BMI: <23 (n=49)		p value OR (95% CI)	BMI: 23–25 (n=26)		p value	BMI: >25 (n=25)		p value
	Migraine n=29	Non migraine n=20		Migraine n=10	Non migraine n=16		Migraine n=11	Non migraine n=14	
Nausea									
Present	29	15	0.008 OR not applicable	9	13	1.00	11	13	1.00
Absent	0	5		1	3		0	1	
Vomiting									
Present	16	1	0.001 23.385 (2.752–97.739)	4	0	0.01	5	1	0.06
Absent	13	19		6	16		6	13	
Photophobia									
Present	27	9	0.001 16.500 (3.060–88.971)	6	7	0.68	7	9	0.97
Absent	2	11		4	9		4	5	
Phonophobia									
Present	26	8	0.001 13.000 (2.922–57.846)	6	6	0.42	7	6	0.43
Absent	3	12		4	10		4	8	

p value reached from Chi square test and Fisher's Exact test was done in case of cell frequency less than 5.

Regarding past history, previous history of migraine was significantly higher in the migraine patients than in non-migraine patients in BMI <23 group (p=0.01). But in other groups it was statistically insignificant. Stroke was found statistically insignificant in different status of BMI of migraine and non-migraine groups.

Table VII: Distribution of the subjects by past history (N=100)

Past history	BMI <23kg/m^2 (n=49)		p value	BMI 23–25kg/m^2 (n=26)		p value	BMI >25kg/m^2 (n=25)		p value
	Migraine n=29	Non-migraine n=20		migraine n=10	Non-migraine n=16		migraine n=11	Non-migraine n=14	
Migraine									
Yes	17	2	0.001	3	1	0.26	3	0	0.07
No	12	18		7	15		8	14	
Stroke									
Yes	2	0	0.51	2	0	0.13	1	0	0.44
No	27	20		8	16		10	14	

p value reached from Chi Square test and Fisher's Exact test for cell frequency less than 5

Table VIII: Distribution of the subjects by comorbidities (N=100)

Comorbidities	BMI <23kg/m^2 (n=49)		p value	BMI 23-25kg/m^2 (n=26)		p value	BMI >25kg/m^2 (n=25)		p value
	Migraine n=29	Non migraine n=20		Migraine n=10	Non migraine n=16		Migraine n=11	Non Migraine n=14	
Hypertension									
Present	4	1	0.63	2	4	1.00	1	4	0.34
Absent	25	19		8	12		10	10	
Depression									
Present	2	2	1.00	0	3	0.26	2	4	0.66
Absent	27	18		10	13		9	10	
Diabetes									
Present	3	1	0.88	2	4	0.85	1	4	0.48
Absent	26	19		8	12		10	10	
Smoking									
Yes	2	8	0.09	2	6	0.42	2	1	0.56
No	27	12		8	10		9	13	

p value reached from Chi Square test and Fisher's Exact test for cell frequency less than 5

It was also observed that smoking was significantly higher in non-migraine group than migraine group in case of BMI <23. No significant difference was found by comorbidities as hypertension, depression and diabetes between migraine and non-migraine groups in different BMI status (Table VIII).

Discussion

Migraine is a primary headache disorder characterized by recurring attacks of pain and associated symptoms. It is a major public health problem worldwide and it causes substantial illness and disability. Obesity is also a major medical and public-health problem affecting virtually all age and socioeconomic groups. Its prevalence is constantly increasing throughout the world and it threatens to overwhelm both developed and developing countries. Nearly 40% of middle-aged adults, aged 40–59 years, were found obese, which was more than younger adults, aged 20–39 years (30.3%) or older adults, aged 60 and over (35.4%).[7]

Apart from their immediate impacts on well-being and ability to function, migraine and obesity are independent risk factors for cardiovascular disease, co-morbid with pain-related and psychiatric conditions and lead to impaired quality of life. These associations add to their importance as causes of public ill health. There are, in addition, suggestions that obesity and migraine are themselves associated. Several general population studies have shown an association between migraine and obesity in reproductive age. There are reports that obesity is associated with higher frequency and severity of headache attacks among individuals who have migraine.

In this study, majority (>95%) of the study subjects were between 10 and 35 years of age which is similar to the findings observed by Lipton et al.[8] Mean age of case group was 25.55 ± 5.87 years and that of control was 25.53 ± 4.22 years. Lichten et al[9] studied a group with mean age of 37.85 ± 1.53 years, which was high in comparison to this study. Kelman[10] found mean age of migraineurs 37 ± 11.7 years which is also high.

In this study, case group included 10 (20%) males and 40 (80%) females and control group had 14 (28%) males and 36 (72%) females. Number of female cases and controls were higher than the males. The ratio observed by Lipton et al[8] was 3:1 (approximately). In the study of Russel et al[11] male:female ratios were approximately 1:2 in different subtypes of migraine.

In the case group 30 (60%) were unmarried and 20 (40%) were married. In control group 25 (50%) were unmarried and 25 (50%) were married. In the study of Boru et al[12] 91.7% of the migraine subjects were married.

There was no significant difference in the economic status between case and control groups. Lipton et al[8] showed that migraine prevalence was inversely related with socioeconomic status. In the study of Boru et al[12] 63% of the migraineurs were from middle class. Penas et al[13] found that migraine was more common in lower income people. Similar result was found by Stewart et al.[14]

In this study, students and housewives occupied the largest number of study subjects who were unemployed. In case groups, students and housewives were almost equal in number (23 and 21). In control group 29 (58%) were housewives and 13 (26%) were students. In the study of Boru et al[12] 91.7% of the migraineurs were housewives.

Regarding residence, in this study rural and urban patients were equal in case group (25 and 25) and in control group 29 (58%) were urban and 21 (42%) rural. Murray & Lopez[15] found that females, whites and individuals residing in rural areas were more likely to suffer from migraine. Stewart et al[14] found that there was no difference in migraine prevalence between urban and rural people.

Total duration of headache was studied in this study and it was found that mean duration of headache was 8.9 ± 7.5, 5.8 ± 6.7, 9.6 ± 14.3 years in different BMI groups (<23, 23–25, >25 respectively) in case group and 4.6 ± 5.3, 4.4 ± 3.4, 3.4 ± 1.4 years in control group respectively. No study was found to compare with our findings.

There was significant difference in quality of headache. Quality of headache was throbbing in migraineurs patients whereas it was predominantly of dull aching nature in nonmigraineurs group. In migrainous group 58.6% in BMI <23, 30% in BMI 23–25, 36.4% in BMI >25 noted their headache as throbbing, in contrast most of the nonmigraineurs described it as dull in nature. Kelman[10] observed that character of headache was throbbing in 73.5% cases of migraineurs. Pressure/ tightening (non-pulsating) quality, bilateral location and mild or moderate severity is the diagnostic features of chronic tension type of headache.[16]

Duration of headache and frequency of headache were studied in both case and control groups. In case group headache persisted for 8.9 hours in BMI <23, 5.8 hours in BMI 23–25, 9.6 hours in BMI >25 groups. In control group headache persisted for 4.6 hours in BMI <23, 4.4 hours in BMI 23–25 and 3.4 hours in BMI >25 groups. Kelman[10] observed that duration of headache in migraine patients was 24 hours in average.

In classic migraine there may be nausea, vomiting, photophobia or phonophobia. In this study both case and control groups had these symptoms, but there was significant difference between migrainous and nonmigrainous subjects in BMI <23 group. Boru et al[12] found phonophobia in 91.3%, nausea in 75% and photophobia in 67.3% of migraine patients. According to Oleson et al[17], there was significant difference in light discomfort threshold and sound discomfort threshold between migraineurs and nonmigraineurs.

Family history of migraine was present in 34.7% in BMI <23 group, 11.5% in BMI 23–25 group and 12% in BMI >25 group in our study. But it was present in 90% of cases in the study of Boes at el.[1] In this study migraine without aura was in 33 (66%) subjects and migraine with aura was in 17 (34%) patients. In one cross sectional population study the ratio is 5:1.[18] This variation may be due to small size of population of this study.

From the results of present study, it can be concluded that there is statistically no significant relation of BMI with frequency of headache, but some relationship were observed for associated symptoms of migraine with low BMI. So, migraine patients with low BMI should maintain an ideal body weight to minimize associated symptoms.

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