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Lifestyles and Migraine Attack

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Abstract: Problem statement: Migraine is a headache disorder of serious public health concerns as many sufferers are permanently disabled and incapable of carrying out simple daily routines. Migraine is contributed by biological and lifestyle factors. Understanding the association between these factors and migraine, particularly the modifiable lifestyle factors, can reduce the prevalence of this chronic disease and ease the burden on the health care system. **Approach:** Unilabiate and multivariate logistic regression methods were used to analyse the prevalence of migraine among the participants who completed the Australian National Health Survey during the 2007-2008 period. Demographical and lifestyle factors including age, gender, Body Mass Index (BMI), social marital status, equivalent household income, remoteness of residence, daily fruits and vegetables intake, participation in physical activities, alcohol use, tobacco smoking and distress level were investigated in this study. **Results:** The prevalence of migraine is on average 1.27 times higher among those who aged between 35-44 years old (95% CI = 1.03, 1.57) compared to the other age groups, 2.24 times higher among females (95% CI = 1.89, 2.67) compared to the males and 2.70 times higher among those who reported high to very high stress level (95% CI = 2.23, 3.27) compared to those who reported low to medium stress level. The prevalence of migraine of those participating in the recommended level of physical activity is 0.69 times of those who did not meet the recommended level (95% CI = 0.57, 0.84). The prevalence of migraine among the medium risk drinker and high risk drinker is 0.68 times (95% CI = 0.49, 0.92) and 0.42 times (95% CI = 0.27, 0.68), respectively, of the low risk drinker. **Conclusion:** The findings of this study suggested that engaging in physical activity and reduce the level of stress may reduce the risk of migraine attack.

Key words: Body Mass Index (BMI), Australian Standard Geographical Classification (ASGC), National Health and Medical Research Council (NHMRC), Total Metabolic Equivalent (MET), serious headache disorder

INTRODUCTION

Migraine, a serious headache disorder, is a severe public health issue as it is affecting the workforce and family with many sufferers classified as being disabled for work and even daily activities (WHO, 2006). The prevalence of migraine varied across the continents and is the lowest for Asian and African men and women (2.0-2.5% for men and 6.9-7.7 % for women), higher for European (5.7% of European men and 14.7% of European women) and the highest among South/Central American and North American (6.9-7.3% for men and 16.3-21.5% for women) (Lipton and Bigal, 2005). On average, about 6% of men and 14% of women around the world are affected by current migraine (Stovner *et al*., 2007). In addition, it is associated with other comorbidities, such as stroke and other cardiovascular diseases, respiratory diseases and allergies and depression (Schur *et al*., 2009; Diener *et al*., 2008). The World Health Organization (WHO) has urged the development of preventive measures for migraine (WHO, 2006). However, effective programs rely on good identification of the key precipitating factors of migraine. The difference in the prevalence across the continents suggests the likelihood of genetic make-ups and lifestyle factors as the key contributors to migraine.

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This has prompted research into this area to further confirm this assumption.

Studies have been carried out to look at the risk factors of migraine. Data from twin and family studies showed familial aggregation of migraine, suggesting that genetic factors may play important roles in the development of migraine (Schur *et al*., 2009; Nyholt *et al*., 2009; Ulrich *et al*., 1999; Gardner, 2006; Montagna, 2000). There is also some evidence about the effect of environmental factors such as seasonal change of temperature, sunlight and noise on migraine attacks (Mulder *et al*., 2003; Friedman and Dye, 2009; Hansen *et al*., 2011; Chakravarty *et al*., 2009 Zivadinov *et al*., 2003; Queiroz *et al*., 2009). Meanwhile, studies done in the United States of America, Finland, Denmark, Sweden, Spain, Croatia, Brazil, Japan and Hong Kong suggested that socioeconomic factors such as education level, income level, types of occupation and marital status as well as lifestyle factors including alcohol drinking, tobacco smoking, physical inactivity and stress level are also key influential factors of migraine (Lipton and Bigal, 2005; Le *et al*., 2011; Maki *et al*., 2008; Molarius *et al*., 2008; Fernandez-de-las-Penas *et al*., 2010; Panconesi, 2008; Vo *et al*., 2011; Cheung, 2000). However, there remain controversial statements about the association of these lifestyle factors in increasing or lowering the prevalence of migraine, in particular the association between migraine, physical activity, smoking and drinking amongst Brazilian, Danish, Spanish and Swedish population (Queiroz *et al*., 2009; Le *et al*., 2011; Molarius *et al*., 2008; Fernandez-de-las-Penas *et al*., 2010). One possible explanation of the 'J' or 'inverted J' shape relationship between these factors and migraine, as reported by some of the studies, is that the migraine sufferers recognized those factors as the precipitating factors of migraine and have modified their lifestyles to cope with it, the 'sick quitter' phenomenon (Shaper *et al*., 1988).

Despite the amount of cross-sectional studies conducted around the world on the relationship between lifestyle factors and migraine, the current literature lacks information on the Australian. Nevertheless, 59% of Australians drink, 19% smoke and 65% engage in some moderate to vigorous physical activity (ABS, 2008) with 45% of Australian suffering from life-long mental distress (ABS, 2008). The interaction of these factors on the prevalence of migraine warrants further investigation to understand the relationship between migraine and lifestyle factors in Australia. The aim of the study is to explore the association between lifestyle factors, health characteristics, social status and living environments (drinking, smoking, physical activity, daily fruits and vegetables intake, BMI, stress level, income level, marital status and remoteness of living area) and the prevalence of migraine in Australia.

MATERIALS AND METHODS

This is a population-based cross-sectional study using the data collected during the 2007-2008 Australian National Health Survey (NHS) by the Australian Bureau of Statistics (ABS). Participants were 18 years or older at the time of interviews. There were 9929 subjects who provided answers to all variables included in the multivariate regression analysis and these data are included in this study. The study collected detailed information on the health status of the population, use of health services and other actions people had recently taken for their health, health-related aspects of lifestyle (including daily fruits and vegetables intake, participation in physical activity), risky behaviour (including frequency and quantity of alcohol use, tobacco smoking and distress level), as well as demographic characteristics (age, gender, Body Mass Index (BMI), social marital status, equivalent household income, remoteness of residence). Information was obtained through face-to-face interviews by trained ABS interviewers. Details of the survey sampling strategy and data collection methods are described elsewhere (ABS, 2009a). A copy of the questionnaire can be obtained from the ABS website: www.abs.gov.au

Demographical data were used in the analysis as potential predictors of migraine. Gender, age, social marital status and equivalent household income were categorized following the ABS method while the remoteness of residence was grouped according to the Australian Standard Geographical Classification (ASGC) and Body Mass Index (BMI) was grouped as underweight, normal weight, overweight and obese for <18.5, 18.5-24.9, 25-29.9, >30 kg m^{-2}, respectively. Lifestyle factors, including daily intake of fruits and vegetables, physical activity, alcohol drinking behaviour, tobacco smoking and distress level were also used to predict the prevalence of migraine (one for with migraine, two for without migraine). Similarly, the daily intake of fruits and

vegetables were grouped into two groups according to the National Health and Medical Research Council (NHMRC) Dietary Guidelines for Australian adults: (1) lower than the recommended five serves of vegetables and two serves of fruits per day for adults (NHMRC, 2003), (2) on or above the recommended daily intake. The current physical activity guidelines for Australian adults of "at least 30 min of moderate intensity physical activity on most days" is adopted in this study (DOHA, 2005). Specifically, the physical activity level is defined according to the Australian NHS's method, where the level of physical activity is calculated and expressed in terms of Total Metabolic Equivalent (MET) score by multiplying the number of times activity undertaken in last week by the average time per session (minutes) by the intensity (3.5 for walking, 5.0 for moderate exercise or 7.5 for vigorous exercise). A total MET score of 800 or higher for the last week before the Australian NHS was defined as meeting the current physical activity guidelines for Australian adults (ABS, 2009b). Alcohol drinking behaviour was categorized into five categories with those who have never consumed alcohol as abstainer, those who had ever consumed alcohol for the past 12 months as ever drinker and those consumed alcohol in the last week were further categorized into three groups based on the 2000 National guideline (NHMRC, 2001): <50 mL, 50-75 mL, >75 mL of pure alcohol as low risk drinkers, medium risk drinkers and high risk drinkers, respectively, among men; <25 mL, 25-50 mL, >50 mL of pure alcohol as low risk drinkers, medium risk drinkers and high risk drinkers, respectively, among women. Tobacco smoking status was categorized into four groups: currently smoke daily; currently smoke weekly (less frequent than daily); ex-smoker (did not smoke at the time of the Australian NHS, but had smoked more than 100 cigarettes in the past); and never smoker. Stress level was measured by Kessler psychological distress scale and were grouped into low-moderate (10-21) group and high-very high (22-50) group.

Univariate and multivariate logistic regression models were used to investigate the associations between presence of migraine (dependent variable) and lifestyles (independent variables). In the multivariate analysis, age, BMI, daily intake of fruits and vegetables, physical activity level, Kessler psychological distress scale, equivalent household income, remoteness of residence, social marital status, alcohol drinking behaviour and tobacco smoking status were all included in the gender-stratified model. The significance level was set at 0.05 for these analyses. Logistic regression model was used to analyse the association. Odds ratio is an appropriate estimate of prevalence when prevalence of the outcome of interest (such as migraine) is low (i.e., lower than 15 % in the population) (Vandenbroucke *et al*., 2007; Walter, 2000; Greenland, 1987). Analysis was performed with STATA 11.

RESULTS

The demographic and lifestyle factors used to predict the self-reported migraine attacks are presented in Table 1. Both the Univariate and Multivariate analyses show that the prevalence of migraine is higher among those aged between 35-44 years old and lower among those aged 60 years old and above ($p<0.05$), after controlling for the other variables. The present study found that females have higher prevalence of migraine compared to the males ($p<0.05$). The prevalence of migraine is also higher among those who reported a high to very high stress level, compared to those who self-reported a low to moderate stress level ($p<0.05$). As illustrated by the Univariate analysis, readers should also note that the prevalence of migraine is higher ($p<0.05$) among those who are obese Table 1.

On the other hand, the prevalence of migraine is lower among those who follow a healthy lifestyle Table 1. In particular, the prevalence of migraine is lower among those who engaged in physical activity at the recommended level. Interestingly, the prevalence of migraine is lower among the medium risk drinker and high risk drinker when compared to the other drinker types. After controlling for the other variables, there are also evidences suggesting that those who earn a higher income, consume the recommended daily intake of fruits and live in the remote area of Australia have a lower prevalence of migraine Table 1. Similar trend of migraine prevalence was observed when the data was analysed separately for males and females Table 2. It is evident from this study that age, physical activity, stress level and alcohol drinking behaviour are significantly associated with migraine ($p<0.05$).

Table 1: Odds Ratio (OR) of demographical and lifestyle factors for migraine attacks

		Univariate				Multivariate			
Gender		OR			95% CI	OR			95% CI
	Males (Reference)					(Reference)			
	Females	2.38	2.02	2.81	p<0.001	2.24	1.89	2.67	p<0.001
Age (years old)									
	18-34 (Reference)					(Reference)			
	35-44	1.31	1.07	1.6	P = 0.009	1.27	1.03	1.57	P = 0.024
	45-59	0.98	0.80	1.2	N.S.	0.92	0.74	1.14	N.S.
	60-79	0.5	0.39	0.64	p<0.001	0.47	0.36	0.62	p<0.001
	80 and above	0.21	0.11	0.41	p<0.001	0.19	0.1	0.39	p<0.001
BMI									
	Normal					(Reference)			
	Underweight	0.83	0.45	1.52	N.S.	0.73	0.4	1.35	N.S.
	Overweight	1.06	0.90	1.26	N.S.	1.02	0.86	1.21	N.S.
	Obese	1.68	1.14	2.48	P = 0.009	1.42	0.96	2.12	N.S.
Daily intake of fruits									
	< 2 serves (Reference)					(Reference)			
	≥ 2 serves	0.85	0.73	1	P = 0.047	0.91	0.77	1.07	N.S.
Daily intake of vegetables									
	< 5 serves (Reference)					(Reference)			
	≥ 5 serves	0.89	0.68	1.16	N.S.	0.95	0.72	1.24	N.S.
Physical activity									
	< Recommended level (Reference)					(Reference)			
	≥ Recommended level	0.64	0.53	0.77	p<0.001	0.69	0.57	0.84	p<0.001
Kessler psychological distress scale									
	Low/moderate level (Reference)					(Reference)			
	High/very high level	2.82	2.36	3.38	p<0.001	2.7	2.23	3.27	p<0.001
Equivalent household income	Low (Reference)					(Reference)			
	Medium	0.73	0.59	0.91	P = 0.005	0.83	0.66	1.04	N.S.
	High	0.66	0.53	0.82	p<0.001	0.86	0.67	1.1	N.S.
Remoteness of residence									
	Major cities of Australia (Reference)					(Reference)			
	Inner regional Australia	1.14	0.94	1.37	N.S.	1.12	0.92	1.36	N.S.
	Other remote areas	0.77	0.59	1	N.S.	0.75	0.57	0.99	P = 0.041
Social marital status									
	Married [#] (Reference)					(Reference)			
	Not married	1.05	0.9	1.23	N.S.	0.97	0.82	1.14	N.S.
Alcohol drinking behaviour									
	Low risk drinker (Reference)					(Reference)			
	Medium risk drinker	0.71	0.52	0.96	P = 0.026	0.68	0.49	0.92	P = 0.014
	High risk drinker	0.49	0.31	0.78	P=0.003	0.42	0.27	0.68	p<0.001
	Ever drinker	1.1	0.92	1.3	N.S.	1	0.83	1.19	N.S.
	Abstainer	0.96	0.72	1.29	N.S.	0.89	0.65	1.21	N.S.
Tobacco smoking status									
	Currently smoke daily (Reference)					(Reference)			
	Currently smoke weekly	0.91	0.51	1.61	N.S.	1	0.55	1.79	N.S.
	Ex-smoker	1.03	0.83	1.28	N.S.	1.22	0.97	1.53	N.S.
	Never smoker	0.83	0.68	1.01	N.S.	0.98	0.79	1.22	N.S.

[#] :including de facto relationship; N.S. = p>0.05

Table 2: Gender-stratified odds ratio for migraine attacks

		Males				Females			
		OR			95% CI	OR			95% CI
Age (years old)									
	18-34 (Reference)					(Reference)			
	35-44	1.07	0.73	1.59	N.S.	1.39	1.08	1.79	P=0.01
	45-59	0.9	0.61	1.31	N.S.	0.94	0.73	1.22	N.S.
	60-79	0.57	0.36	0.9	P = 0.017	0.44	0.31	0.61	p<0.001
	80 and above	0.08	0.01	0.59	P = 0.013	0.24	0.11	0.5	p<0.001
BMI									
	Normal (Reference)					(Reference)			
	Underweight	1.62	0.54	4.85	N.S.	0.58	0.28	1.22	N.S.
	Overweight	0.98	0.72	1.35	N.S.	1.07	0.88	1.31	N.S.
	Obese	1.45	0.65	3.22	N.S.	1.42	0.9	2.25	N.S.
Daily intake of fruits									
	< 2 serves (Reference)					(Reference)			
	≥2 serves	1.2	0.9	1.59	N.S.	0.8	0.65	0.97	P=0.02
Daily intake of vegetablesa									
	< 5 serves	(Reference)				(Reference)			
	≥5 serves	1.08	0.66	1.79	N.S.	0.9	0.65	1.24	N.S.

Table 2: Continue

Physical activity									
	< Recommended level (Reference)					(Reference)			
	≥ Recommended level	0.61	0.44	0.85	P = 0.004	0.74	0.58	0.94	P=0.013
	Kessler psychological distress scale								
	Low/moderate level (Reference)					(Reference)			
	High/very high level	3.64	2.6	5.08	p<0.001	2.38	1.89	3.01	p<0.001
Equivalent household income									
	Low (Reference)					(Reference)			
	Medium	1.00	0.66	1.52	N.S.	0.75	0.57	0.98	P = 0.035
	High	0.95	0.61	1.48	N.S.	0.81	0.6	1.09	N.S.
Remoteness of residence									
	Major cities of Australia (Reference)					(Reference)			
	Inner regional Australia	1.27	0.9	1.77	N.S.	1.04	0.82	1.32	N.S.
	Other remote areas	0.72	0.44	1.17	N.S.	0.76	0.55	1.06	N.S.
Social marital status									
	Married [#] (Reference)					(Reference)			
	Not married	1.14	0.85	1.52	N.S.	0.91	0.75	1.11	N.S.
	Alcohol drinking behaviour								
	Low risk drinker	(Reference)				(Reference)			
	Medium risk drinker	0.83	0.47	1.45	N.S.	0.6	0.41	0.88	P = 0.008
	High risk drinker	0.42	0.21	0.85	P = 0.015	0.42	0.22	0.8	P = 0.008
	Ever drinker	1.19	0.86	1.66	N.S.	0.9	0.73	1.12	N.S.
	Abstainer	1.24	0.66	2.36	N.S.	0.78	0.55	1.11	N.S.
Tobacco smoking status									
	Currently smoke daily (Reference)					(Reference)			
	Currently smoke weekly	0.57	0.17	1.9	N.S.	1.25	0.63	2.49	N.S.
	Ex-smoker	1.13	0.77	1.67	N.S.	1.26	0.95	1.67	N.S.
	Never smoker	0.95	0.65	1.39	N.S.	1.01	0.78	1.32	N.S.

[#]: including de facto relationship; N.S. = p>0.05

DISCUSSION

The present study investigated the associations between selected social and lifestyle factors and prevalence of self-reported migraine attacks among Australians with the 2007-2008 Australian NHS data. The results presented in Table 1 showed that those being women, aged between 35-44 years old and experiencing high to very high stress level reported a higher prevalence of migraine than the other groups. The finding agrees with many of the previous studies conducted across the continents (Queiroz *et al*., 2009; Molarius *et al*., 2008; Fernandez-De-Las-Penas *et al*., 2010; Bigal and Lipton, 2006; Wong *et al*., 1995; Yokoyama *et al*., 2009; Aamodt *et al*., 2006).

Female sex hormones are known as the precipitating factors of migraine (MacGregor *et al*., 2011; Gupta *et al*., 2007; Martin and Lipton, 2008). This corresponds to our finding which shows that the prevalence of migraine is higher among women when compared to the males. The underlying cause for association between stress and migraine is not entirely clear; however it is certain that similar to many other chronic diseases (Liang and Lee, 2011), serious form of migraine increases the stress level among patients. There is also some data suggesting that stress may trigger migraine attack or increase the degree of headache (Wober *et al*., 2007; Leistad *et al*., 2006; Wacogne *et al*., 2003). Given the two-way association between stress and migraine, it is important to help migraine patients to develop stress coping skills (Silberstein, 2000; Deeromram *et al*., 2010). The present study also observed that the prevalence of migraine is lower among those age over 60 years old, those who live outside the major cities and regional areas and among high income earners (Table 1). The relationship between age and hormonal change is plausible to explain the 'protective' effect of ageing against migraine among females (Nyholt *et al*., 2009). The finding from the present study suggested that those who live outside the major cities lead a more relaxing lifestyle and experience low to moderate level of stress, which corresponds to the finding from the present study that higher stress level can increase the prevalence of migraine. Another plausible explanation is that the areas outside major cities and areas of Australia may not be exposed to high noise level (Ismail *et al*., 2010), which is another precipitating factor of migraine (Friedman and Dye, 2009; Martin *et al*., 2006).

The inverse relationship between exercise and the prevalence of migraine observed from the present study remain consistent with the findings of previous studies (Queiroz *et al*., 2009; Le *et al*., 2011; Molarius *et al*., 2008; Varkey *et al*., 2008). Physical activities reduce stress level (Norris *et al*., 1992; Fox, 1999) and may further reduce risk of migraine attack. Studies have also established a hypothesis that exercise is effective in regulating the aetiology of migraine by releasing hormones and nitric oxide in the cerebrovascular

system (Queiroz *et al*., 2009; Yokoyama *et al*., 2009; Lockett and Campbell, 1992). However, further experimental trials are necessary to investigate the validity of these assumptions. It is also interesting to note that the medium and high risk drinkers reported a lower prevalence of migraine. This inverted "J" shape finding is consistent with the previous findings from Japan, Spain, Norway and Austria (Fernandez-de-las-Penas *et al*., 2010; Yokoyama *et al*., 2009; Aamodt *et al*., 2006; Wober *et al*., 2007). The scenario is believed to be attributable to the sick-quitter behaviour (Shaper *et al*., 1988) as health professionals advises migraine sufferers to avoid the precipitating factor, such as alcohol (Panconesi, 2008; Kelman, 2007).

This study is a population-based study with relative large and representative sample of the Australian population. The main limitation of the present study is that the nature of a cross-sectional study does not allow the investigation into the actual causal relationship of these potential risk factors and migraine. Future prospective studies are necessary to confirm the relationship.

CONCLUSION

The findings of this study suggested that engaging in physical activity and reduce the level of stress may reduce the risk of migraine attack.

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