The Association Between Body Mass Index and Age Related Cataract

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SUMMARY

This study was carried out to determine the association between body mass index and age related cataract among patients attending eye clinic. We conducted a case control study. The outcome of clinical eye assessment determined the patient's status. Mean body mass index among the cases was shown to be higher (25.4 ± 4.5) than the control group (24.4 ± 3.9) (p<0.01). Crude analysis showed that only obese respondents were 2.4 times more likely to develop age related cataract, however this association was not seen in the multivariate analysis after adjusting for other determinants (aOR 1.81; 95% CI 0.91 – 3.62). We conclude that there is no association between body mass index and age related cataract.

KEY WORDS:
Age related cataract, Body mass index, Case-control study

INTRODUCTION

Visual impairment and blindness from cataract is an important public health problem. Malaysia's National Eye Survey, 1996 showed that the prevalence of cataract in our overall population was 2.58%. The age-specific prevalence shows that there is an exponential increase of cataract after 40 years of age[1]. The consequence and treatment of cataract has significant impact on the country's healthcare system. Estimates have shown that a ten-year delay in the onset of cataract would result in a fifty percent reduction in the prevalence of cataract [2,3]. For that reason, identification of modifiable cataract risk factors has major public health relevance.

Numerous risk factors for age-related cataract have been studied including Body Mass Index (BMI). Body Mass Index is defined as weight in kilograms divided by square of the height in meters. Two studies in developing countries have found lower weight, shorter height and lower body mass index to be associated with increased risk of cataract[4,5]. This may result from strong association of lower socioeconomic status and nutritional deficiencies with the risk of cataract.

The relationship between body mass index and the risk of age related cataract in well nourished individuals is unclear. Studies conducted in developed countries shows conflicting results. An inverse association between body mass index and cataract was found in two case control studies[4,6]. A cross sectional study among black population also showed no association between BMI and risk of cataract[7]. In a third case control study and in three other prospective studies found BMI to be risk factor for cataract after adjusting several other risk factors [8,9,10,11]. In a fourth prospective study an association between BMI and cataract was not found [12]. Recently, Schaumberg *et al* revisit the relation between body composition and cataract risk. Their results indicated that after an average of twelve years of follow up, BMI was positively related to the risk of cataract [13].

The inconsistent observation between studies might be due to differences in the characteristics of study participants. Measurements of body size also differ from studies to studies. Some studies relied on self reported body measurements whereas in others, weight and height were measured directly. Different outcome definition used could also explain these inconsistencies. In some studies cataract was defined as cataract extraction surgery, cataract resulting in a specific amount of visual loss or graded lens opacity.

The purpose of this study was to determine the association between body mass index and age related cataract among patients attending eye clinic in University Malaya Medical Centre, Kuala Lumpur.

MATERIALS AND METHODS

In this study all 200 patients aged 50 years and above, newly diagnosed age related cataract were recruited as cases among patients attending eye clinic between 1st November 2004 till 31st December 2004. Controls were 216 patients aged 50 years and above, randomly selected from patients attending the eye clinic for other related eye problems with clear lenses in both eyes and visual acuity of better than 6/18 in both eyes. Patients found to be a probable control but who had minor lens opacities or visual acuity worse than 6/18 in either was excluded from the study. Patients who are physically disabled where measurements of height and weight cannot be taken and those with congenital or traumatic cataracts were also excluded from the study.

Exposure measurements that include height and weight were carried out following a standardized protocol with the researchers masked to the patients' status. Age related cataract was diagnosed by one ophthalmologist after performing the ophthalmologic examination. These include the best corrected visual acuity and slit lamp biomicroscopy. Patients' height was measured in a standing position using a

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tape measure that has been taped to the wall. Clothing was minimal when measuring height so that posture of the patient could clearly be seen. Shoes and socks were removed before measurement was taken. When measuring height, the patient stood with his or her back and head in a straight position with eyes focused forward, feet, knees, buttocks and shoulder blades in contact with the wall. Patients' weight was measured using a bathroom scale. The scale is positioned on a hard flat surface and checked for zero balance before each measurement. Patient is asked to stand unassisted, in the centre of the scale. Similarly shoes and socks were removed before measurement is taken. BMI was then calculated and formed into categories – underweight (BMI < 18,5), normal (BMI 18.5 – 24.9), overweight (BMI 25.0 – 29.9) and obese (BMI ≥30.0). A face to face interview using structured questionnaire was also conducted. Questionnaire provided information on patient's demographic characteristics (age, gender, ethnic group, education level), family history of cataract, history of smoking and alcohol consumption and medical history that includes diagnosis of hypertension and diabetes mellitus. Other questions obtained were the use of medication such as aspirin, steroids and antioxidant supplement.

This study was approved by the Medical Ethics Committee, University Malaya Medical Centre, Kuala Lumpur. (Ethics Committee IRB/ Ref. No: 338.11)

Individuals rather than eyes were the unit of analysis. A participant was considered to have cataract when it occurred in either eye. Data analysis was carried out using SPSS. The odds ratio (OR) and 95% CI for the association between Body Mass Index and Age Related Cataract were calculated by logistic regression model, controlling for possible confounding factors. Multivariate analysis was done on the basis of the univariate analysis. All statistical tests were carried out using a significance level of 0.05.

RESULTS

A total of 416 respondents were interviewed for this study of which 216 were controls and 200 were cases. Table I shows the distribution of cases and controls by gender, ethnic group, age and education status which reflects the socio-demographic characteristics of the respondents. The respondents comprised of more females (58.2%) than males (41.8%). Gender distribution was similar among cases and controls. Chinese constitute majority of the responders (43.8%), followed by Malays (30.5%), Indians (25.0%) and other groups (0.7%). The distribution of ethnic group was similar in both cases and controls. In terms of age, cases were generally older than controls with a higher mean age of 64.9 ± 8.9 years compared to controls 62.6 ± 7.8 years. The difference in the mean age between cases and controls is statistically significant ($p < 0.01$). The highest completed educational level of participants was recorded and categorized into two groups – those with high education level (secondary education and above) and low education level (primary education and those without any education). Majority of the respondents had low education level (57.0%) as compared to those who have high level of education (43.0%). The proportion of respondents with low education level were observed more among those with age-related cataract (63.5%) as compared to the controls (50.9%).

The mean BMI among age-related cataract patients was shown to be higher (25.4 ± 4.5) compared to those in the control group (24.4 ± 3.9). The difference seen is statistically significant ($p < 0.01$). Distribution of BMI categories among the cases shows majority (43.5%) were within the normal range followed by overweight (33.0%) and obese (19.5%). Among controls, 53.7% had normal BMI range, 31.5% were overweight and 9.7% were obese. The breakdown of categories show that a higher percentage of cases tend to be in the overweight or obese group as compared to the controls. Comparatively higher proportion of controls was in the normal category (53.7%).

Body Mass Index (BMI) of equal to or greater than 30, the obese group, was found to be the only significant risk factor among all BMI categories to age-related cataract in the univariate analysis. Respondents who were obese were 2.4 times more likely to have age-related cataract compared to those with normal BMI status. (cOR 2.48, 95% C I 1.36 – 4.51). Other BMI status such as underweight and overweight were not associated with age-related cataract (Table II). The relationship between Body Mass Index and age related cataract was examined using multivariate logistic regression. After controlling for all covariates, none of the BMI categories was significantly associated with age related cataract (Table III).

Table I: Characteristics of cases and controls among study subjects

Sociodemographic Variables	Cases No (%)	Control No (%)	Total No (%)
Age Group (years)			
50 – 59	65 (32.5)	93 (43.1)	158 (38.0)
60 – 69	66 (33.0)	72 (33.3)	138 (33.2)
≥ 70	69 (34.5)	51 (23.6)	120 (28.8)
Gender			
Female	113 (56.5)	129 (59.7)	242 (58.2)
Male	87 (43.5)	87 (40.3)	174 (41.8)
Ethnic Group			
Chinese	79 (39.5)	103 (47.7)	182 (43.8)
Malay	65 (32.5)	62 (28.7)	127 (30.5)
Indian	54 (27.0)	50 (23.1)	104 (25.0)
Others	2 (1.0)	1 (0.5)	3 (0.7)
Education status			
High level education	73 (36.5)	106 (49.1)	179 (43.0)
Low level education	127 (63.5)	110 (50.9)	237 (57.0)

Table II: Association between Body Mass Index Variables and Age Related Cataract

BMI Variables	Cases No (%)	Control No (%)	Crude Odds Ratio	95% C I
Body Mass Index status				
Normal	87 (43.5)	116 (53.7)	1.00	
Underweight	8 (4.0)	11 5.1)	0.97	0.37 - 2.51
Overweight	66 (33.0)	68 (31.5)	1.29	0.84 - 2.00
Obese	39 (19.5)	21 (9.7)	2.48	1.36 - 4.51

Table III: Adjusted Odds Ratio and 95% CI for the association between BMI and Age Related Cataract

BMI Variables	Adjusted OR	95 % CI
BMI (Underweight)	0.67	0.23 – 1.94
BMI (Overweight)	1.16	0.69 – 1.94
BMI (Obese)	1.81	0.91 – 3.62

Adjusted for age, gender, ethnic group, education status, occupation, alcohol consumption, smoking status, aspirin intake, steroid and antioxidant usage, family history of cataract, hypertension and diabetes mellitus.

DISCUSSION

Body Mass Index, a measure of body size has been implicated as an influencing factor in cataract formation. Malaysia's National Health and Morbidity Survey II (NHMS II) in 1996 has shown prevalence of obesity in the 50 - 59 age groups as 5.6% from the total population[14]. This is still lower than the prevalence of obesity in developed country but nevertheless worrying. In this study, the association between higher BMI or those in the obese category and age-related cataract was shown in the univariate analysis but not after adjustment for other variables. Similar result has been shown in other studies, in which association between BMI and age-related cataract was not found [7,12].

It is difficult to conclude the role of BMI in cataract formation due to several reasons. Lower BMI has been hypothesized to reflect nutritional deprivation and lower socioeconomic status. A higher BMI may be associated with diabetes, hypertension and other co-morbidities of all which also influence cataract formation. Furthermore in recent years, considerable attention has been given to the possibility that it is the fat distribution that is related to age-related cataract and other diseases rather than the overall obesity[15,16]. Adverse metabolic functions, including insulin resistance and excessive free fatty acid production, have been found in individuals with predominance of fat in the central region of the body [16].

Biological mechanism has also been postulated to explain the link between abdominal obesity and cataract formation. It has been suggested that there might be a common underlying process involving insulin resistance. Abdominal obesity would give rise to resistance to insulin stimulation, disrupt glucose uptake which in turns leads to glucose intolerance[5,7,12]. The hypothesis is that the actual mechanism of cataractogenesis would be via sorbitol pathway or as a result of diabetes mellitus. Hence, the association between cataract formation and obesity may arise from this shared pathology. The inconsistent relationship between cataract and obesity is more consistent with the hypothesis of an indirect mechanism (via insulin resistance) rather than a direct effect one [5,7,12,16].

Strengths of this study included the identification of cases and controls. Only patients attending the eye clinic for general eye services were recruited as cases. Controls were obtained from the same source as the cases. Multiple controls from other sites such as the out-patient clinic or the accident and emergency were not included as slit lamp biomicroscopy examination would not be possible. Controls were obtained from a large variety of different diagnosis to avoid admission diagnosis bias that could either increase or decrease the odds ratio findings. All potential cases and controls consented to participate, with no-non responses. This ensured selection bias does not occur. The objective manner in which diagnosis of cataract was made reduced misclassification of cases and controls. All variables collected among the cases and controls were obtained in a similar manner, with the researchers being unaware of the patient's status.

There are few possible limitations of this study. Recall bias could occur in which cases may provide different information than controls as they are more likely to remember risk factors such as smoking or the use of antioxidants. Some variables were verified from the medical records but there were others that were unable to be verified, thus subject to recall bias. Nevertheless, these variables were mainly the confounding variables and do not include the main independent variable for this study. The sample size was small in this study. Thus the inconclusive findings on the association between BMI and age related cataract could be due to limited number of subjects.

In assessing the weight and height, measurement error could occur. This would then lead to misclassification bias. Nevertheless, if misclassification does occur, it would more likely be a random or a non-differential misclassification. This is less dangerous as it causes bias towards the null that would only reduce the study's ability to detect significant different among groups.

In summary, the association between BMI (either elevated, reduced or both) and age related cataract was not shown in this study. Similar results have been shown in other studies, in which association between BMI and age related cataract was not found.

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