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Research Article

THE PREVALENCE OF MYOPIA VIS-À-VIS THE TYPE OF DIET IN YOUNG ADULTS IN INDIA

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ABSTRACT
'Nurture' and 'nature' interact to produce myopia. This study probed the relation of myopia with the type of diet i.e. vegetarian or non-vegetarian, in young adults in India. One hundred forty eight young adults were tested for myopia and the odds of the vegetarian and non-vegetarian participants being affected were calculated. These were subjected to test of statistical significance. We report a trend of vegetarian participants having a higher prevalence of myopia, though not reaching the level of statistical significance. Available evidence on the role of various components of diet has been compiled and reasoned out.

Key Words: *Myopia, Non-Vegetarian, Prevalence, Vegetarian, Young Adults*

INTRDUCTION
The 'biological theory' for the development of myopia proposes genetic influence whereas the 'use - abuse theory' proposes environmental influence. It is putative knowledge that both these influences of 'nature' and 'nurture' play a role. This study probed the relation of myopia with vegetarian diet, in young adults in India.

MATERIALS AND METHODS
Study Design
This study was designed as a descriptive cross sectional study. The participants were classified as vegetarian and non-vegetarian. The prevalence of myopia in the vegetarian and non-vegetarian participants was calculated separately, as proportion of the participants with myopia.
Study Population
All the first MBBS students at a medical college in western Maharashtra, India, were invited to enroll. Past history of ocular surgery, ocular injury, diabetes mellitus and glaucoma were the laid exclusion criteria. One hundred and forty eight first MBBS students volunteered to recruit after institutional ethics committee clearance was duly obtained. Among the participants, there were 59% (88/148) males and 41% (60/148) females. Age having been recorded as the number of completed years as on the nearer birthday, the mean (SD) age was 18.82 (1.34) years.
Diagnosis of Myopia
A distance visual acuity (DVA) worse than 6/6 in at least one of the eyes, which could be improved with the optical correction last prescribed (OCLP) or a pinhole instead, was used to classify the particular participant as having myopia.
Data Collection
Post informed consent, the participants were interviewed and their personal particulars and recent medical history was obtained using a questionnaire. Using a Snellen's test type, DVA was determined without the OCLP, if any. If it was worse than 6/6, the test was repeated with the OCLP or with a pinhole, in case the optical correction was not yet prescribed. DVA recorded was collapsed into categorical dichotomous scale, based on the presence or absence of myopia. Any improvement in the DVA with the OCLP (or a pinhole), was recorded directly on a categorical dichotomous scale.

Statistical Analysis

Prevalence of myopia was calculated separately for the vegetarian and non-vegetarian participants, as a proportion of the participants detected to have myopia, per hundred participants. The odds of the vegetarian and the non-vegetarian participants being affected by myopia were determined and subjected to test of statistical significance of the difference. Statistical analysis was done using the 'StatCalc' function of software EpiInfo 2007.

RESULTS AND DISCUSSION

The prevalence of myopia in the vegetarian participants was higher at 48% as compared to that in non-vegetarian participants at 42% (Table 1).

Table 1: Prevalence of myopia in vegetarian and non-vegetarian participants

Diet	Myopia present % (numbers)	Myopia absent % (numbers)	Total no. of participants
Vegetarian	48 (38/79)	52 (41/79)	79
Non- Vegetarian	42 (29/69)	58 (40/69)	69
All	45 (67/148)	55 (81/148)	148

Statistical analysis revealed the odds of myopia co-existing in the vegetarian participants to have been 1.28 times that compared to those in the non-vegetarian participants [Odds ratio = 1.28 (CI = 0.67 - 2.45); $p = 0.57$; $X^2 = 0.33$]. This trend in the relationship did not reach the level of statistical significance. Our findings are in agreement with those of an urban Nepal study having reported a higher prevalence of refractive errors in vegetarian children at 10.52% as compared to that in non-vegetarian children at 6.17% (Niroula and Saha, 2009).

Myopia is deemed to be an un-modifiable, genetic condition as per the 'biological theory of its development. This is in contrast to the advocacy of modifiable environmental factors under the 'the use – abuse theory' (Angle and Wissmann, 1980). That both these influences of 'nature' and 'nurture' play a role is generally agreed. More recently emphasis has shifted in favour of the environmental factors, particularly in view of the massive increases in the prevalence of myopia that have taken place in East Asia.

We attempted to probe the relation of myopia with the type of diet, among young adults in India. In our study population, we report a trend, of vegetarian participants being more prone to myopia, though not reaching the level of statistical significance.

The idea of dietary factors being responsible for myopia is an interesting one, hence much explored. Evolutionarily, human eyes are genetically geared to the demands of our being hunter-gatherer, as indicated by the glimpses of natural status of our primordial visual system, provided by a few isolated hunter-gatherer societies that persisted into the early 20th century. Several tribes in Gabon as well as the Angmagssalik Eskimos, which represent hunter-gatherer societies, had quite a low prevalence of 0.4 - 1.2% (Holm, 1937; Skeller, 1954).

A study published in 1969 documented the then recently acculturated Alaskan Eskimos had a very large difference in prevalence between older subjects (1.5%), who had little or no schooling contrasting the younger subjects (51%), who had compulsory schooling (Young et al., 1969). These findings were also reproduced in the then recently acculturated Eskimos and Indians elsewhere (Morgan and Munro, 1973). The process of westernization of these hunter-gatherer societies was rapid without any intermediate steps (Schaefer, 1977).

Thus the high prevalence of myopia in these younger Eskimos was then thought to be due to the excessive near work of reading, introduced into this formerly traditional society of hunters and fishermen (Young *et al.*, 1969; Morgan and Munro, 1973). It was however argued that excessive near work could not have been the cause as it had already been documented much before their acculturation that Eskimos engaged

in near work like sewing and tool making, for hours on end, during the long arctic winter (Stefansson, 1913). It was suggested the reason for myopia in younger Eskimo was increasing consumption of store-bought western food that was high in sugar and carbohydrate like cereals, bread, potatoes and sugar, rather than the fish and seal meat that their elders had eaten as youngsters (Cass, 1966; Cass, 1973; Morgan and Munro, 1973). Indeed, later studies looking at the diet of several hunter-gatherer societies reported that, if living in their traditional manner, the diet typically had high levels of proteins, moderate levels of fats and low levels of carbohydrates (Cordain, 1999). They rarely consumed refined cereals and sugars but these quickly became their staple diet following western contact (Cordain *et al.,* 2000).

In contrast to the fast process of westernization of the hunter-gatherer societies of the Arctic, the less westernized societies, intermediate between the modern societies and hunter-gatherer societies too have a low prevalence of myopia despite formalized educational system. A study, involving such a society in Nepal, revealed a low prevalence in the less acculturated society as compared to that in an urban society. Education was compulsory in both but the modern, processed foodstuffs were available only in the urban society, a fact missed by the authors (Garner *et al.,* 1999). Primitive populations had low rates of myopia even in those receiving formal education including eight hours of compulsory schooling a day (Garner *et al.,* 1985). The difference was that the dietary carbohydrates were of small quantity and of low glycemic index rather than white bread and cereals (Cordain *et al.,* 2002). High carbohydrate diet induced hyperinsulinaemia leading to excessive levels of insulin as well as insulin-like growth factor 1 is proposed to be the mechanism leading to myopia (Cordain *et al.,* 2002).

Similar is the evidence in domesticated dogs. Myopia is completely unknown in the wild animals. However the domesticated dogs were reported to develop myopia (Mutti *et al.,* 1999). As excessive reading was out of question, what other environmental factor could have been responsible? Was it confinement to houses instead of the wilderness? But the housing had not changed with acculturation of the young Eskimo. Both the recently acculturated young Eskimos and domestic dogs developed myopia on introduction of carbohydrate rich diet, such as dog biscuits for the dogs being domestication and sugars for young Eskimos being acculturated, is proposed to be the cause of myopia.

Nutritional deficiencies have been found associated with refractive errors. Refractive errors are prevalent among children with a history of preterm birth, probably due to nutritional deficits that occur following the abrupt loss of placental maternal-to-fetal transfer of essential nutrients (Birch and O'Connor, 2001). A higher prevalence of myopia was observed in those who had severe malnutrition during the first six months of life. This indicates early malnutrition interferes in the individual's visual health (Dantas *et al.,* 2005). Children who developed myopia were detected to have a generally lower intake of many of the food components like energy intake, protein, fat, vitamins B1, B2, C, phosphorus, iron, and cholesterol (Edwards, 1996). Deteriorating myopes were detected to consume less of all foods, specially, animal protein (Gardiner, 1960). Treatment of a group of myopic children with a high intake of animal protein showed a beneficial result (Chong *et al.,* 2005).

Various dietary supplements have been shown to have a protective value against refractive errors. Nacre, a traditional Chinese medicine containing minerals and amino acids, has been used to prevent and treat myopia (Xu *et al.,* 2001). Breastfeeding was found to have been independently associated with decreased likelihood of myopia (Chong *et al.,* 2005). Docosahexaenoic acid supplements in breast fed infants led to acceleration of maturation of visual acuity (Hoffman *et al.,* 2004). A drug called Difrarel E, containing vitamins or their precursors Tocopherol and Betacarotene is reported to achieve therapeutically valuable results in the treatment of progressive myopia (Politzer, 1977). Trace element Zinc could inhibit the axial elongation of myopia (Huibi *et al.,* 2001). Paleolithic type diet may reduce the risk of myopia as well as diabetes mellitus (Kowalski and Bujko, 2012).

Two studies from China indicate that intake of more saturated fat and cholesterol intake is associated with longer axial length in otherwise healthy schoolchildren (Lim *et al.,* 2010) and there is a positive interrelation of vision with weight which is affected by irrational food structure and food preference (Zhang, 1994).

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