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Anaemia and Refractive Error Are Linked: a Pioneering Study

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ABSTRACT

Our frequent observation that medical students who had refractive error were also anaemic, coupled with lack of published literature on such an association, led us to determine if this was merely a chance occurrence or otherwise. The students were screened for anaemia and refractive error. The odds of refractive error co-existing in the anaemic were found to have been 2.48 times as compared to those in the non-anaemic, a statistically significant difference. We conclude the frequent co-occurrence of anaemia and refractive error is not just a chance occurrence. This pioneering study points to an association between anaemia and refractive error in the study group. Cause effect relationship remains to be explored.

Introduction:
Medical students determine their visual acuity (VA) as well as haemoglobin (Hb) level as part of the curriculum. We observed, frequently those who had refractive error were also anaemic.

Refractive error is the condition in which incident parallel rays of light do not come to a focus upon the light sensitive layer of retina [1]. Various types of refractive error are myopia, hyperopia, astigmatism and aphakia [1]. The prevalence of refractive error has been reported at 25% to 71% in different studies [2-5]. It has been reported to be the major cause of moderate visual impairment. Untreated, it is recognised leading cause of blindness and remains a significant problem [6-8].

Anaemia, a reduction in oxygen carrying capacity of the blood, occurs when the equilibrium is disturbed between blood loss and blood production [9]. WHO standards define anaemia as level below 13 gm. /dl for males and below 12 gm. /dl for females. Its prevalence in India has been reported to be 56% and 24% for females and males respectively [10].

Although refractive errors and anaemia have been reported to be the most common disorders among children and teenagers, search of published literature did not reveal any study to have probed association between these conditions [11]. Therefore we decided to determine if our observation was merely a chance occurrence or was there a real association between refractive error and anaemia? This pioneering study was, thus, designed to broadly explore if there exists an association between these conditions, without going into the specifics of types or severity.

Material and Methods:
A) Design:
This cross sectional, analytical study was conducted on 148 first MBBS students. After clearance from the institutional ethics committee and informed consent, the recruited students were screened for the presence of anaemia and assigned to anaemic group (group 1) or non-anaemic group (group 2). These groups were further screened for the presence of refractive error. Odds ratio for the presence of refractive error in the two groups was calculated.

B) Participants:
One hundred and fifty (150) MBBS students were considered for participation in the study. Being a first MBBS student was the sole inclusion criterion. Exclusion criteria followed were: history of blood transfusion/treatment with haematinics in the prior four months; history of major blood loss / blood donation in the prior four months; visit exceeding ten days to any area exceeding the altitude of 7000 feet from the mean sea level; history of eye injury or surgery; history of glaucoma or history of diabetes mellitus. Two students were excluded from the study because of Juvenile Diabetes Mellitus and a large central Corneal Ulcer. The study proceeded with 148 participants. The mean (SD) age of the participants was 18.82 (1.34) years. Age was recorded as number of completed years on the nearer birthday. The sex distribution was 59% (88/148) males and 41% (60/148) females.

The students were interviewed and their personal particulars and relent medical history was obtained using a questionnaire. Two students were excluded as per the exclusion criteria and the study proceeded with rest of the 148 students.

C) Diagnosis of Anaemia:
All the participants were screened for presence of anaemia by Cyanmethemoglobin method. The estimation was carried out by the same investigator for all the participants. Three samples of capillary blood were collected by the finger prick method, using 22 G disposable needles and Sahli's 20 micro-liter pipette. All samples were collected after lunch, after having ensured that there was no possibility of haemo-concentration or haemo-dilution. Drabkin's reagent batch number 1749ST and standard solution batch number 1579T, both manufactured by Biolab Diagnostics (India) Pvt. Ltd., were used. Absorbance was determined on Colorimeter of Kanad Vidyut make, model H 0392. An average of the three readings was taken as Hb level. As per the WHO standards, anaemia was diagnosed at level below 13 gm. /dl for males and below 12 gm. /dl for females [12]. The participants were assigned to either anaemic group (Group 1) or non-anaemic group (Group 2).

Group 1 comprised of the 84 participants. The mean (S.D.) age was 18.83 (1.33) years. The sex distribution of this group was 52% (44/84) males and 48% (40/84) females. Group 2 comprised of the 64 participants. The mean (SD) age was 18.80 (1.35) years. The sex distribution of this group was 69% (44/64) males and 31% (20/64) females.

D) Diagnosis of refractive error:
All the participants were subjected to screening for presence of refractive error. Distance vision as well as near vision were checked. The VA of each eye for distant as well as near vision was determined without the spectacles, if any.

The acuity for distant vision was determined using a single Snellen's test type. If it was worse than 6/6 in any of the eyes, the participant repeated the test with the spectacles currently in use. If spectacles were not yet prescribed, the participant repeated the test with a pinhole, instead. Any improvement or otherwise in the distant vision acuity with the current spectacles or a pinhole was recorded.

Acuity for near vision was determined for each of the eyes using a single Jaegar's chart. If it was worse than N6 in any of the eyes, the participant repeated the test with his spectacles currently in use. All the participants who had decreased near vision had been using spectacles for the same. Any improvement

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or otherwise in the near vision acuity with the spectacles was recorded. Participants, who were not using optical correction and had distance VA of 6/6 and near VA of N6 in each eye were considered as not having refractive error. A participant was classified as having a refractive error if at least one of the following criteria was met:

a) Acuity for distant vision worse than 6/6 in at least one of the eyes (which could be improved with the glasses currently in use or a pinhole instead)
b) Acuity for near vision worse than N6 in at least one of the eyes (which could be improved with the glasses currently in use).

E) Statistical analysis:
The values of the Hb level and VA were collapsed into categorical, dichotomous scale, based on the presence or absence of anaemia and refractive error. The improvement or otherwise in the VA with spectacles or pinhole was recorded on a categorical dichotomous scale.

The odds of presence of refractive error in Group 1 and Group 2 were determined and subjected to test of statistical significance of difference. Statistical analysis was done using the 'statcalc' function of software Epi Info 2002.

Results:
Prevalence of refractive error in group 1 was higher as compared to that in group 2 (Table1).

Group	Percentage of participants with refractive error. % (numerator/ denominator)	Percentage of participants with no refractive error. % (numerator/ denominator)	Total no. of participants.
Group 1.	55 (46/84)	45 (38/84)	84
Group 2.	33 (21/64)	67 (43/64)	64
All participants	45 (67/148)	55 (81/148)	148

Table 1: Comparison of prevalence of refractive error in group 1 and group 2.

Statistical analysis revealed that the odds of refractive error co-existing in the anaemic participants were 2.48 times as compared to those in the non- anaemic. Odds ratio 2.48 (95% CI, 1.20 to 5.17); p =0.013. This relationship was statistically significant.

Between the sexes, there was no statistically significant difference in the prevalence of anaemia [odds ratio 2.0 (95 % CI, 0.96 to 4.19); p=0.065] or that of refractive error [odds ratio 1.38 (95 % CI, 0.68 to 2.81); p=0.432]. This assures that our findings were not attributable to mismatch of sex distribution in the two groups.

Discussion:
There is no data available to compare the results as there has been no published work examining the relationship between the occurrence of anaemia and refractive error. A novel study question, suitable study design and absence of dropouts are the strengths of our study. A small study population and absence of comparable data of similar studies are the limitations noted. Because of the nature of this study, it is only possible to conclude that there is an association between the two conditions. Any cause- effect relationship remains to be explored.

Conventionally, refractive error was generally thought of as a genetically determined, unpreventable condition. It was followed by a 'nature versus nurture' debate. More recently emphasis has shifted in favour of environmental factors, particularly in view of the massive increases in the prevalence of myopia that have taken place in East Asia. Refractive error being linked to anaemia, a preventable and treatable condition is bound to be thought provoking.

Conclusion:
Observation of frequent co-occurrence of anaemia and refractive error amongst medical students is not just a chance occurrence. This pioneering study points to a real association between anaemia and refractive error in the study group. The phenomenon needs to be studied in larger studies in general population. Further, work needs to be undertaken to probe cause - effect relationship between anaemia and refractive error.

REFERENCE

1. Sihota R, Tandon R (2011). editors. Parsons' Diseases of the Eye. 21st ed. New Delhi: Elsevier, 72-78. | | 2. Uzma N, Kumar BS, Khaja Mohinuddin Salar BM, Zafar MA, Reddy VD (2009). A comparative clinical survey of the prevalence of refractive errors and eye diseases in urban and rural school children. Canadian Journal of Ophthalmology, 44(3), 328-333. | | 3. Raju P, Ramesh SV, Arvind H, George R, Baskaran M, Paul PG et al (2004). Prevalence of refractive errors in a rural South Indian population. Investigative Ophthalmology & Visual Science, 45(12), 4268-4272. | | 4. Rani PK, Raman R, Rachapalli SR, Kulothungan V, Kumaramanickavel G, Sharma T (2010). Prevalence of refractive errors and associated risk factors in subjects with type 2 diabetes mellitus SN-DREAMS, report 18. Ophthalmology, 117(6), 1155-1162. | | 5. Prema R, George R, Sathyamangalam Ve R, Hemamalini A, Baskaran M, Kumaramanickavel G et al (2008). Comparison of refractive errors and factors associated with spectacle use in a rural and urban South Indian population. Indian Journal of Ophthalmology, 56(2), 139-144. | | 6. Dandona R, Dandona L (2001). Refractive error blindness. Bulletin of the World Health Organization, 79(3), 237-243. | | 7. Naidoo KS, Wallace DB, Holden BA, Minto H, Faal HB, Dube P (2010). The challenge of uncorrected refractive error: driving the agenda of the Durban Declaration on refractive error and service development. Clinical and Experimental Optometry, 93(3), 131-136. | | 8. Nirmalan PK, Thulasiraj RD, Maneksha V, Rahmathullah R, Ramakrishnan R, Padmathi A et al (2002). A population based eye survey of older adults in Tirunelveli district of south India: blindness, cataract surgery, and visual outcomes. The British Journal of Ophthalmology, 86(5), 505-512. | | 9. Block AW, Borer WZ, Bruce BB, Christopher K, Drake RL, Jangid AK et al (2007). editors. Dorland's Illustrated Medical Dictionary. 31st ed. Philadelphia: Saunders Elsevier, 79. | | 10. National Family Health Survey, India. NFHS-3 Publications – Reports. [Last accessed on 2012 Sep 13]. Available from: http://www.rchiips.org/NFHS/report.shtml. | | 11. Bucşă D, Gavăt V, Albu A (2011). Aspects of child and youth health revealed by medical check-up in Botosani County, Romania. Revista medico-chirurgicala a Societatii de Medici si Naturalisti din Iasi, 115(4), 1225-1230. | | 12. World Health Organization (2008). Worldwide prevalence of anaemia 1993–2005. Gene: World Health Organization. ISBN 978-92-4-159665-7. Archived from the original on 12 March 2009. Retrieved 2009-03-25. | |