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ASSOCIATION BETWEEN HEALTH STATUS AND VISUAL FUNCTIONING: A COMMUNITY BASED STUDY

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ABSTRACT

High blood pressure and abnormal body mass have been observed to correlate negatively with health status. Of interest in this study, is the impact such health status have on visual function indicated by near point of convergence. In this community based cross sectional study, 250 randomly selected apparently healthy subjects had their weight, height and blood pressure measured, along with near point vision using standard laboratory procedures. The results showed that subjects within the ages of 20-30 years had the best near point vision for right eye of (8.42±2.68cm), left eye (8.68±2.54cm) and when the both eyes are opened (9.46±2.63cm). Although not statistically significant, females were more likely to have wider near point vision than males. Also, subject groups with blood pressure outside the normotensive range and normal body mass index, had wider near point vision that is significantly different from the hypertensive and obese groups. The results therefore, suggest that normal visual functioning is dependent on maintaining a healthy blood pressure and body weight.

Keywords: Healthy wellbeing, Body mass index, Blood pressure, Visual functioning.

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INTRODUCTION

As a rule, values to measure overall health, Body Mass Index (BMI) and blood pressure have generated growing concern. In their usefulness, both measure a patient's symptoms as well as overall health. BMI might be to systemic health as blood pressure is to cardiovascular health.

Obesity is a major public health problem, with prevalence increasing at staggering rates in many countries (Friedrich, 2002; Friedman and Fanning, 2004; Haslam and James, 2005; Hill et al., 2005). The World Health Organization (WHO) (2002) defines obesity as a body mass index (BMI) of 30 kg/m or greater and overweight, as individuals whose BMI falls between 25 kg/m and 29.9 kg/m. It is implicated as risk factor for many systemic diseases including coronary heart disease (Eckel and Krauss, 1998), type 2 diabetes mellitus (Grundy, 2002), hypertension, stroke, dyslipidemia, osteoarthritis, sleep apnea (Haslam and James, 2006; Lawrence and Kopelman, 2004; Pi-Sunyer, 1993) and certain types of cancers (Calle et al., 2003; Bianchini et al., 2002).

On the other hand, hypertension or high blood pressure is a chronic medical condition in which the blood pressure in the arteries is elevated (Chobanian et al., 2003). It is summarized by two measurements; systolic and diastolic, which depends on whether the heart muscle is contracting (systole) or relaxed (diastole) between beats and equate to a maximum and minimum pressure, respectively. Hypertension is classified as either primary (essential) or secondary; with about 90–95% of cases categorized as "primary hypertension" which means high blood pressure with no obvious underlying medical cause (Carretero and Oparil, 2000). Normal blood pressure at rest is within the range of 100-140mmHg systolic (top reading) and 60-90mmHg diastolic (bottom reading). High blood pressure is said to be present if it is persistently at or above 140/90 mmHg.

Visual impairment adds to the burden of several microvascular and macrovascular complications in people with diabetes and compromises quality of life (Hirai et al., 2011; Jones et al., 2010; Collerton et al., 2009; Evans et al., 2002; Sinclai et al., 2000). Of interest in this study is the influence on well-being indicated by body mass index and blood pressure on visual functioning indicated by near point of convergence (NPC).

Obesity associated increasingly elevated BMI has been associated with ocular disease (Momeni-Moghaddam et al., 2012) and has recently been reported to be negatively associated with visual acuity (Bergman et al., 2004) but the ocular

conditions underlying this association and the potential implications are unclear.

On the other hand, hypertension has been reported to cause blurred and altered vision and fainting episodes (Rodriguez-Cruz and Ettinger, 2010; Dionne et al., 2012; Fisher and Williams, 2005). In fact, ophthalmoscopy findings give some indication as to how long a person has been hypertensive (Fisher and Williams, 2005). Also, pre-eclampsia; which is a hypertensive emergency has several serious complications including vision loss (O'Brien et al., 2007; Gibson, 2009).

Worrisome is the fact that limited study have been carried out to investigate the relationship between health status and visual functioning in Nigeria. Hence, the need to conduct an evaluation of the health status of Ekpoma inhabitants, a semi-urban community situated in Edo State, Nigeria.

MATERIALS AND METHODS

Study Area: The study was conducted in Ekpoma, Esan West Local Government Area of Edo State, Nigeria. The area lies between latitude 60 40^0 N 60 45^0 N and longitude 60 05^0 E 60 10^0 E (Obabori et al., 2006).

Sampling method: The target population consists of 250 subjects who were 18 years and above, but not more than 55 years.

Inclusion Criteria: Subjects with no history of eye and or head trauma and normal eye health.

Exclusion criteria: Subjects who use glasses, above the age of 55 years and with a history of visual impairment, as well as those who are on medication due to illness were excluded for this study.

Ethical consideration: Before enrolment into the study, informed consent was obtained. The principle of the declaration of Helsinki on the right of the subject was employed.

Study duration: The study was conducted between June and September, 2013.

Method of data collection: Data was obtained using direct interview and a pretested questionnaire, which was translated into the local language. Where the respondent is not fluent in English, the translated version was administered with the help of Esan speaking interpreters.

The questionnaire used was designed to elicit information on socio-demographic, as well as blood pressure, weight and height measurement and near point of convergence was measured using standard laboratory procedures.

Sample collection and analysis: Blood pressure was measured using automated arm blood pressure meter (Germany). The measurement was performed three times at an interval of 10 minutes and the average recorded.

Weight (Kg) was measured using the simple bathroom weighting scale (China). This was also performed three times and the average recorded.

Height (cm) was measured using tape rule (Nigeria). The value was then converted to meter.

Body mass index was accessed by calculation using the values obtained for weight (Kg) and height (m). Values less than 19.99 Kg/M^2 were classified as under weight; 20.0 to 24.99 Kg/M^2 as normal weight; 25 to 29.99 Kg/M^2 as overweight; and greater than 30 Kg/M^2 as obese (WHO 1998)

For determination of near point of convergence, a small isolated letter ‘‘E’’ of approximately 14 font size was slowly brought from 40 cm toward the subject along the subject’s midline. The subjects were instructed to keep the target single during the test and report when it appeared clearer. The distance between points was measured with a ruler (cm) (Griffin and Grisham, 2002).

Data analysis: Data collected was analyzed for statistics using statistical soft ware package (SPSS version 17).

RESULTS

The mean age of the sampled 250 population was 31.24±12.39 year among whom 54.80 were male and 45.20 were female. From the result, it was observed that advancing age brings about increasing blood pressure. Irrespective of age, near point of convergence was narrowest in the right eye compared to the left eye or when both eyes are opened. Advancing age greater than 39 years and lesser than 20 years were observed to widen near point of convergence while ages within 20 and 39 years presented the nearest near point of convergence (see table 1). The mean near point of convergence for subjects within the ages of 60 and above was significantly wider ($p>0.05$) than subjects that are younger.

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On the influence of gender, males were observed to have a lesser body mass index (23.24±3.80kg/m^2) and were likely to acquire reduced blood pressure (125.20±14.50/77.07±11.40) and nearer near point of convergence (12.06±3.11 cm for Right eye; 11.98±2.41cm for Left eye and 12.37±3.33cm for the combined eyes) compared to females. However, the difference in these parameters were not statistically significance (p>0.05) (see table 2).

Overall, majority of the studied population have normal BMI. BMI was observed to correlate positively with blood pressure with the obese presented the highest blood pressure (132.20±12.70/82.69±10.30mmHg). Also, BMI was observed to correlates positively with near point of convergence with the normal BMI presenting the nearest near point of convergence.

Interestingly, subjects who are under weight have wider near point of convergence (9.33±4.14 cm for right eye; 9.22±4.03cm for left eye and 10.32±4.12cm for the combine eyes) compared to subjects with normal weight (8.96±3.26cm for right eye; 9.14±3.01 for left eye and 9.77±3.11cm for combined eyes). The differences in near point of convergence with respect to BMI was however, not statistically significant (p>0.05).

Table 1: Influence of age on blood pressure and near point of convergence

Age (in years)	Mean Blood pressure (mmHg)	RNPC (in cm)	LNPC (in cm)	CNPC (in cm)
18 < 20	117.17±9.39/70.25±9.73	9.48±3.13	9.87±2.69	9.73±2.94
20 – 39	124.75±12.40/75.55±11.00	8.42±2.68	8.68±2.54	9.46±2.63
40 – 59	135.33±13.46/81.73±9.97	10.61±3.53	11.12±3.64	10.75±3.40
60 ≥ 65	148.50±23.43/90.13±11.61	20.00±2.14*	18.25±7.70*	21.38±2.39*

Key: RNPC= near point of convergence in the right eye; LNPC= near point of convergence in the left eye; CNPC= near point of convergence in combined eyes

Table 2: Influence of gender on BMI, blood pressure and near point of convergence

Gender	N	BMI (Kg/m^2)	Mean Blood pressure (mmHg)	RNPC (in cm)	LNPC (in cm)	CNPC (in cm)
Female	113	25.21±5.20	129.12±13.90/77.03±11.30	12.20±3.37	11.98±3.16	13.13±3.73
Male	137	23.24±3.80	125.20±14.50/77.07±11.40	12.06±3.11	11.98±2.41	12.37±3.33

Key: RNPC= near point of convergence in the right eye; LNPC= near point of convergence in the left eye; CNPC= near point of convergence in combined eyes

Table 3: Influence of BMI on blood pressure and near point of convergence

BMI (Kg/m^2)	N	Mean Blood pressure (mmHg)	RLDV (in cm)	LLDV (in cm)	CLDV (in cm)
Under wt.	56	120.88±13.05/71.00±11.55	9.33±4.14	9.22±4.03	10.32±4.12
Normal wt.	131	124.92±13.20/75.69±10.95	8.96±3.26	9.14±3.01	9.77±3.11
Over wt.	34	131.53±14.56/79.69±9.68	9.70±3.79	10.36±4.10	10.81±3.94
Obese	29	132.20±12.70/82.69±10.30	10.39±3.64	10.80±4.04	10.55±3.26

Key: Wt= weight; n= frequency; RNPC= near point of convergence in the right eye; LNPC= near point of convergence in the left eye; CNPC= near point of convergence in combined eyes

DISCUSSION

From the result of this study, age was observed to correlate negatively with BMI, blood pressure and near point of convergence. Indeed, it has been reported that older people often have multiple concurrent illnesses (Hajjar et al., 2007; Masoodi, 2008) and this has been linked to many chronic diseases (Martin and Coleman, 2007) of which vision is a part, based on the finding of this study. In addition, old age has been reported to be associated with health problems and decreasing functional capacity which may affect the sense of well-being of the individual (Gureje et al., 2008) including vision.

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This study also showed that hypertension may impair vision by increasing near point of convergence. The findings from some epidemiological studies in association with cardiovascular disease and glaucoma (Lee et al. 2006; Wu et al. 2008; Chauhan et al. 2008b), supports the findings of our this study. In view of this, ophthalmologist on physical examination, reported that hypertension may be suspected on the basis of the presence of hypertensive retinopathy detected on examination of the optic fundus, and this is usually found at the back of the eye using an ophthalmoscope (Wong and Mitchell, 2007). Classically, the severity of hypertensive retinopathy is graded from grade I–IV, although the milder types may be difficult to distinguish from each other (Wong and Mitchell, 2007).

Also, obesity indicated by BMI was observed to correlate positively with near point of convergence and by implication, may be involved in the impairment of vision. In the recent report that obesity is negatively associated with visual acuity (Bergman et al., 2004) supports of our finding, but the ocular conditions underlying this association and the potential implications remain unclear (Cheung and Wong, 2007).

Nevertheless, Momeni-Moghaddam et al. (2012) had reported that in terms of weight, those classified as normal or overweight, have better binocular performance than those classified as underweight or obese. In the same study, the worst binocular performance was found in underweight subjects and it was then concluded that further studies are certainly needed to see if these surprising results can be replicated with a larger sample (Momeni-Moghaddam et al., 2012). Interestingly, obesity has been associated with several eye diseases like cataract (Jacques et al., 2003; Klein et al., 2001; Kuang et al., 2005), age-related maculopathy (Schaumberg et al., 2001; Seddon et al., 2003), diabetic retinopathy (van Leiden et al., 2003; Schoenfeld et al., 1993), and glaucoma (Zang and Wynder, 1994; Leske et al., 1995; Gasser et al. 1999).

Conclusively, the results of this study suggest that maintaining a healthy living via managing one's weight and blood pressure, is beneficial for normal visual functioning. Moreover, the findings of this study indicate that hypertension and abnormal body weight may increase near point vision, impair visual functioning and subsequently, the need for corrective eye glasses.

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AUTHOR(S) CONTRIBUTION

Dr Ozor M.O. and Dr Ernest-Nwoke I.O. were involved in the conception, design and development of this article. Mr Oyakhire was involved in the supervision of the research assistants and collation of data for statistical analysis.