Distribution of Oculo-Visual Anomalies According to Body Mass Index in Umuahia, Abia State, Nigeria

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***Abstract*: A prospective study aimed at determining the distribution of oculo-visual anomalies according to body mass index in Umuahia north local government area of Abia State, Nigeria was carried out through community eye health outreaches.**

A total of 112 subjects, made up of 34 (30.4%) males and78 (69.6%) females were examined. with a mean age of 43±47.63years. The subjects were examined using some optometric procedures like ophthalmoscopy, retinoscopy, penlight examination, visual acuity measurement etc. The height and weight of the subjects were equally measured and their BMI deduced.

The results of the study showed that 47 (42%) of the subjects were underweight, 43 (38.4%) have normal weight, 20 (17.8%) are overweight while 2 (1.8%) were obese.

It was noted that 96 subjects (85.7%) had at least one oculo-visual anomaly, while 16 subjects (14.3%) were seen to have no oculo- visual anomaly across various classes of BMI.

Refractive errors and presbyopia were noted to occur most in the study population occurring in 39 of the 112 subjects (34.8%) respectively.

While overweight was significantly found to be risk factor in age related cataract it was not a risk factor for refractive errors. Underweight was found not to be a risk factor in age related cataract and refractive errors.

BMI measurement should be one of the clinical procedures, not just in a general health outlet but in eye clinics. Individuals with abnormal BMI should undergo detailed clinical procedures to look out for possible oculovisual anomalies.

***Keywords*: Body mass index, Oculo-visual anomalies**

I. INTRODUCTION

Body Mass Index (BMI) has generated growing interest worldwide. (Momeni *et al.,* 2012). A person's sense of sight is fundamental to living a full life. Oculo-visual anomalies are those clinical manifestations on the eye that distorts vision or ability to see or have vision (Nwoke *et al*, 1986).

The body mass index (BMI)) or Quetelet index is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in meters (WHO, 2000). BMI is an attempt to quantify the amount of tissue mass (muscle, Fat, and bone) in an individual and then categorize that person as underweight, normal weight, overweight or obese based on that value. Commonly accepted BMI ranges are underweight: under $18.5kglm^2$; normal weight: 18.5 to 25; overweight: 25 to 30 and obese: over 30.

Relationship between BMI and some systemic diseases is well documented. These studies have implicated abnormal BMI states as risk factors in the etiology of illnesses including cardiovascular diseases, diabetes and certain cancers (Malik *et al.*, 2013; Bakari *et al.*, 2007; Grundy, 2000; Bianchini *et al.*, 2002). Following its relevance both a measure of patients' symptoms as well as overall health, BMI might be to systemic health as visual ability is to ocular health (Momeni *et al.*, 2012).

Body mass index is of increasing interest to eye care practitioners as researchers in eye care have sought relationships between values in BMI and oculo-visual status (Momeni *et al.*, 2012). With studies showing that excess body weight predisposes a person to various systemic diseases that can cause vision loss particularly cardiovascular diseases and diabetes, studies relating BMI to vision have been published. Amongst different eye diseases, overweight and obesity have been linked with age-related cataract, glaucoma, age-related maculopathy, and diabetic retinopathy (Turgut, 2018; Cheung & Wong, 2007).

Notwithstanding that the bulk of studies relating BMI and the eye more on overweight/ obesity, there are a few on underweight individuals. Park *et al.,* (2017), found that besides overweight and obesity showing a high risk in cardiovascular diseases, underweight individuals were also at risk compared to individuals with normal BMI. This relationship obviously concerns the etiology of corresponding eye conditions. More so, Momeni *et al.,* 2012 found the worst binocular vision performances in underweight individuals compared to other categories in BMI. The reason for this is yet speculative.

Obesity has been proposed to be a risk factor for cataract development (Kuang *et al.,* 2005; Bergman *et al.,* 2004), though the exact underlying mechanisms are unclear. In a review of studies, Cheung & Wong (2007) showed that lower BMI is also a risk factor for some forms of cataract. In

contrast to cataract, there are less data addressing the relationship between obesity and glaucoma, although there have been several studies that have provided evidence in support of a positive association between obesity and intraocular pressure (IOP), the strongest risk factor for glaucomatous optic neuropathy (Bengtsson & Heij, 2005; Gordon, 2002).

Other ophthalmic conditions that may also be associated with obesity include oculomotor nerve palsy, recurrent lower eyelid entropion, papilledema and floppy eyelid syndrome (associated with obstructive sleep apnea syndrome, a common co-morbid condition related to obesity) and Prader-Willi syndrome, an obesity- associated condition, was found to be related with a number of ocular abnormalities including myopia, astigmatism, amblyopia, strabismus and exotropia (Cheung & Wong, 2007).

Abnormal BMI has been established to be the cause of many health problems including ocular-visual impairments. This research thus aims at determining the oculo -visual anomalies distribution in the classes of BMI in Umuahia, Abia state, Nigeria.

II. METHODOLOGY

This research was carried out in Amaogwugwu village, Umuahia North Local Government Area of Abia State Nigeria. A total 112 subjects seen during community eye care outreaches in town halls of the area. Consent was gotten from the village head and announcements were made in churches and through town-criers. The researcher made sure it was not carried out on a working day or on the villagers' market day so as to obtain good turnout of people.

Demographic data including age, sex, and occupation of subjects were documented. A detailed ocular history was also taken and the following ophthalmic instruments were used: distance VA charts, keeler ophthalmoscope for internal examination, keeler retinoscope/ trial lens case for refraction, penlight for external examination. Also, body weight scale and measuring tape were used to get the weight and height of subjects and their respective BMI were calculated using the formula; BMI= weight (kg)/height^2 (m) (WHO, 2000).

The data collected were represented in tables while chi-square statistical distribution test was used to analyze them using 0.05 level of significance.

III. RESULTS

One hundred and twelve subjects examined with 34 (30%) males and 78 (69.6%) ad females. Ninety six subjects (85.7%) had at least one oculo-visual anomaly, while 16 subjects (14.3%) were seen to have no oculo-visual anomaly across the various classes of BMI.

Table 1: Distribution of subjects according to age and gender

Age (Years)	Male	Female	Total
16 – 25	15	28	43 (38.4%)
26 – 35	2	5	7 (63%)
36 – 45	1	12	13 (11.6%)
46 – 55	4	9	13 (10.7%)
56 – 65	2	10	12 (10.7%)
66 – 75	6	9	15 (13.4%)
76 – 85	4	5	9 (8.0%)
Total	34 (30.4%)	78 (69.6%)	112 (100%)

The mean age of the subjects is 43 ± 47.63 years with the youngest subject 17 years old and oldest being 85 years.

Table 2: Distribution of BMI according to Age

AGE	BODY MASS INDEX GROUP				
(years)	Underweight	Normal weight	Overweight	Obese	Total
16 – 25	28	15	-	-	43
26 – 35	1	3	3	-	7
36 – 45	4	6	3	-	13
46 – 55	3	6	4	-	13
56 – 65	3	5	4	-	12
66 – 75	6	4	4	1	15
76 – 85	2	4	2	1	9
Total	47 (42.0%)	43 (38.4%)	20 (17.8%)	2 (1.8%)	112 (100%)

From the above table, 47 subjects (42.0%) are underweight (BMI of 18.5); 43 (38.4%) have normal weight (18.5 – 25kg/m^2); 20 (17.8%) are overweight (25-30kg/m^2) while 2 (1.8%) are obese (above 30kg/m^2).

Table 3: Distribution of oculo-visual anomalies across BMI classes

Oculo-visual Anomalies	Underweight	Normal weight	Overweight/ Obese	Total
Refractive Errors	17	16	6	39
Cataract	11	9	14	34
Pterygium	5	4	6	15
Glaucoma	2	3	6	11
Conjunctivitis	5	2	1	8
Corneal opacity	-	-	1	1
Macular degeneration	-	-	1	1
Presbyopia	11	14	14	39
Hypertensive retinopathy	1	0	3	4
No abnormality	12	4	-	16

Refractive errors and presbyopia occurred most in the study population occurring in 39 of the 112 subjects (34.8%) each. Other abnormalities include cataract– 34 subjects (30.4%), pterygium– 15 (13.4%), glaucoma– 11 (9.8%), conjunctivitis– 10 (8.9%), hypertensive retinopathy– 3 (2.7%) while corned opacity and macular

degeneration are the least occurring in one subject each (0.9%).

IV. DISCUSSION

Table 2 shows distribution of BMI according to age. Forty-seven, 47 subjects (42.0%) were underweight (BMI of <18.5 kg/m^2); 43 (38.4%) had normal weight (BMI of 18.5-25 kg/m^2); 20 subjects (17.8%) are overweight while 2 (1.8%) were obese (BMI > 30kg/m^2). Genetics and certain lifestyle factors such as physical activities and eating behaviors have been implicated as risk factors in the etiology of underweight (Ochiai *et al.,* 2017). This could be as a result of the economic situation of the study area. In their study, Momeni *et al.*, (2012) attributed the high percentage of underweight to poor eating habits, malnutrition and poor economic status. One of these may be the case in this study. It was also observed that majority of subjects within the ages of 16 and 25 were underweight, while more overweight/obese subjects occurred beyond that age range than underweight.

Ninety six subjects (85.7%) had at least one oculo-visual anomaly, while 16 subjects (14.3%) were seen to have no oculo-visual anomaly across the various classes of BMI.

100% overweight/obese has at least one morbidity, statistical significance in RE, cataract, percentages in anomalies (Table 3). Among those who had at least one ocular morbidity, overweight/obese subjects had 100% morbidity occurrence; none of them were without at least one oculovisual anomaly. However the percentage with at least one ocular morbidity among underweight subjects was 74.5% (35 out of 47 of them) with normal weight subjects having 90.7% of occurrence. While these results may highlight the risk overweight/ obesity pose in eye health (Park *et al*, 2017), it may still be the case that there is an exaggeration about the risk underweight and overweight/obesity pose (Weitoft *et al.*, 2008). Nevertheless, the reason for a lower rate of morbidity occurrence in overweight than normal weight subjects may be because 59.6% of underweight subjects fall in 16- 25 age range compared to 34.9 of normal weight subjects (Table 2). This aligns with the work of Forrester (1997) that highlights age as a risk factor in the etiology of some eye diseases.

With a significance level of 0.05, the occurrence of refractive error in underweight subjects was not statistically significant. This was also the case in overweight/obese subjects. This agrees with the findings of Varma *et al.,* (2008). However contrary to Varma *et al.,* (2008), overweight/ obese individuals were more likely to have refractive error than underweight subjects.

With same level of significance, the occurrence of cataract in underweight subjects was not statistically significant just as (Richter *et al,* 2012) observed in their study; unlike in the study of Kuang *et al.,* (2005). However, there was statistical significance in the relationship between cataract and high BMI, agreeing with findings of Kuang *et al.,* (2005) as well as Bergman *et al.,* (2004). The chi-square analysis for cataract was done bearing in mind that the onset of age related cataract have been reported to be 30 years (Chatterjee *et al.*, 1982). Hence analysis was done with subjects from 26- 35 age group and above. Nevertheless, including all groups gave the same outcome.

There was also statistical significance when analyzing the relationship between high BMI and the occurrence of at least one disease affecting the retina (glaucoma, macular degeneration and hypertensive retinopathy). Since eye diseases like glaucoma, diabetes retinopathy and ARMD affect the blood vessels in the eye, especially retinal vessels, it is easy to understand why excess weight- which is known to create pulmonary problems, affects the eye (Daily Mail Online, 2005).

V. CONCLUSION

From the findings and analysis, underweight is not a risk factor for both refractive error and age related cataract. Also, excess weight is not a risk factor for refractive error. However, excess weight is a risk factor for age related cataract and also a risk factor for retinal morbidities, including; glaucoma, macular degeneration and hypertensive retinopathy.

With these in mind, BMI measurement should be one of the clinical procedures, not just in a general health outlet but in eye clinics. Individuals with abnormal BMI should undergo detailed clinical procedures to look out for possible oculovisual anomalies.

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