

# Normal Ocular Globe Measurements Among Adults, Using Magnetic Resonance Imaging in Zaria, Nigeria

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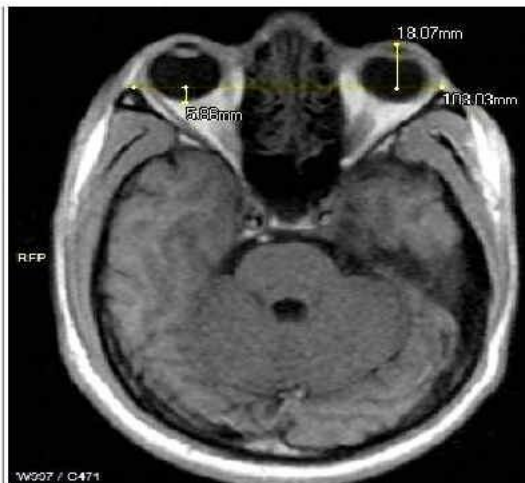
**Introduction:** The ocular globe measurements are objectively assessed at the level of the lens (mid-globe section)<sup>[1,2]</sup>. The perpendicular distance of the anterior and posterior margins of the globe to the interzygomatic line (IZL) on axial magnetic resonance imaging (MRI) could accurately determine the position of the globe within the

orbit<sup>[2]</sup> (Figure 1). Also, axial length (AL) of the globe is the distance from the corneal apex to an interference peak corresponding to the retinal pigment epithelium/Bruch's membrane<sup>[3,4]</sup>. It is an indicator of the refractive state of the eye<sup>[5]</sup>. MRI measurement of AL is also invaluable in the early detection of intrinsic ocular tumours and metastasis to the globe<sup>[6]</sup>. The aim of this study was to determine the normal AL of the ocular globes with the aid of MRI, and establish the correlation between AL, and age and sex, as well as to determine the normal position of the ocular globe among adults.

**Methods:** The study was conducted over a six month period from 29<sup>th</sup> November 2011 to 28<sup>th</sup> May 2012 at Ahmadu Bello University Teaching Hospital following authorization by the Ethical Committee of the institution. The AL of the globes, and the distance between the anterior and posterior borders of the globe, and IZL were measured at the level of the lens for 340 normal ocular globes of 170 patients on T1-weighted MR images.

**Results:** AL of the right globe was 23.32mm ± 1.34 and AL of the left globe was 23.29mm ± 1.22. The normal position of the posterior pole of the right globe was 6.34mm ± 0.99 from IZL, while that of the left was 6.56mm ± 0.93 (Table 1).

**Discussion:** The index study revealed significant differences in the right and left ocular globes' measurements, including globe position (P < 0.001). Findings of other authors in other parts of the world contrast this<sup>[7, 8, 9]</sup>. This observation may be due to asymmetrical extraocular muscles contraction which could occur as 0.2Tesla MRI system used in the index study normally results in prolonged scan time as against 0.5 and 1.5 Tesla MRI systems used by earlier authors<sup>[5,8]</sup>. Also, some authors<sup>[3,6,7]</sup> used Computerized Tomography (CT) for their studies. Image acquisition is faster with CT and asymmetrical extraocular muscles contraction may not occur with this modality. In the index study also, the posterior margin of the right ocular globe was 6.34mm behind IZL, while



**Fig. 1**

Axial T<sub>1</sub>W MRI image at the level of the lens, demonstrating the measurements of the ocular globes in relation to the interzygomatic line (IZL). Anterior margin of the left globe to the interzygomatic line (IZL). = 18.07mm Posterior margin of the right globe to the IZL. = 5.86mm Length of Interzygomatic line (IZL). = 103.03mm

**Table 1:** The mean and standard deviation of the ocular globes' parameters by age groups

Age group (year)	N	IZL±SD (mm)	RAM±SD (mm)	RPM±SD (mm)	LAM±SD (mm)	LPM±SD (mm)
≤19	9	102.12±(3.9)	16.60±1.48	6.81±1.44	16.51±1.44	6.70±1.20
20-29	42	102.60±5.13	16.87±1.38	6.54±1.11	16.52±1.23	6.69±1.00
30-39	35	104.63±4.40	17.12±1.47	6.20±0.82	16.93±1.10	6.49±0.82
40-49	47	102.09±4.53	16.99±1.86	6.13±0.96	16.81±1.74	6.35±0.97
50-59	17	104.62±4.64	16.68±1.69	6.47±0.92	16.50±1.64	6.65±1.09
60-69	11	103.37±6.70	17.37±1.23	6.18±0.95	16.56±1.39	6.66±0.86
≥70	9	103.99±(3.9)	17.91±1.2	6.57±0.80	17.12±1.5	6.60±1.22
<b>Mean of Total</b>	<b>170</b>	<b>103.18±4.78</b>	<b>17.01±1.56</b>	<b>6.34±1.00</b>	<b>16.72±1.43</b>	<b>6.56±0.98</b>

- SD = Standard deviation
- IZL = Length of the interzygomatic line
- RAM = Distance between the right corneal apex and the interzygomatic line (right Hertel index).
- RPM = Distance between the posterior margin of the right globe and IZL.
- RAL = Axial length of right globe (RAM+RPM).
- LAM = Distance between the left corneal apex and the interzygomatic line (left Hertel index).
- LPM = Distance between the posterior margin of the left globe and IZL.
- LAL = Axial length of left globe (LAM+LPM).

the left was 6.56mm. Ozgen and Aydingoz<sup>[5]</sup> used 0.5 Tesla MRI in Turkey and got 8.9mm. Also, Ozgen and Ariyurek<sup>[6]</sup> with the aid of CT in Turkey obtained a mean value of 9.4mm. And Jong, *et al*<sup>[3]</sup> got 11.2mm among Koreans. The observed differences between these findings and the index study might be due to racial variation and environmental influence<sup>[6]</sup>. A perpendicular line from the IZL to the corneal apex (Hertel index) has been used by other authors to depict the measurement of proptosis. A study conducted by Eberhard *et al*<sup>[8]</sup> in Switzerland showed that a Hertel-index greater or equal to 22mm is pathological and connotes proptosis. In the index study however, the mean Hertel indices were 17.01±1.56mm and 16.72±1.43mm on the right and left side respectively. Among adult population in Zaria, the mean ocular AL was found to be 23.31±1.28mm. This differs significantly from the values obtained in other parts of the world<sup>[9,10]</sup>. Conclusion: The results obtained may help ophthalmologists and other clinicians to objectively evaluate patients with changes in orbital morphology.

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- effectiveness in hospitals eye health system, patients' eye care management and day to day schedule of the ophthalmologists.
- Methods: The Eye - App is a soft ware designed to make patients - ophthalmologists' service delivery more effective and convenient. There are 2 forms of connectivity between the front end and back end. The first is the via any of the Nigeria telecommunication service providers ( i.e MTN, Airtel, Glo, Etisalat, Visaphone) or Nigeria based internet providers (Smile, Swift, etc). The second connectivity is via automated payment service platform (e.g interswitch, quick teller) for any eye care payment e.g registration/consultation/ investigations/treatment. The Eye - App has an alert sms notification system to the front and back end users i.e the patients and the ophthalmologists. Patient can easily assess the nearest ophthalmological services in the 6 Geopolitical zones, 36 states and 774 LGAs.
- Results: An effective patients' ophthalmological care via the mobile Eye - App system. Patients in