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Anthropometric Measurements in Children and Their Relationship to Ocular Refraction

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Contents

	Page
Introduction	1
Aim of the work	3
Review of literature	4
Growth and development :	
1-Somatic development.	4
2-Neurological development.	7
3-Visual development.	10
Determinants of growth and development :	13
1-Genetic factors.	14
2-Environmental factors.	14
3-Gene - environment interaction.	18
Statistics used in describing growth	19
Ocular refraction :	22
1-The anatomic components of refraction.	22
2- The evolution of refractive errors.	24
3- Abnormalities of refraction.	24
4- Prevalence of refractive errors.	27
5- Emmetropization.	33
6-Visual acuity tests for children.	34
7- Measurement of refraction.	39
Patients and Methods	42
Results	46
Discussion	58
Conclusion and Recommendation	66
English summary	67
References	70
Arabic summary	1

List of figures

No.	Title	Page
1	The sensitive or critical periods in prenatal development.	8
2	The primitive central and peripheral nervous system	9
3	Change of proportions during development	9
4	The embryonic eye	12
5	The cornea, lens, anterior chamber and axial length of the globe	23
6	Emmetropia, hyperopia and myopia	26
7	Focus in hyperopia and adjusted focus by accommodation	29
8	Pediatric visual acuity chart	35
9	Snellen's visual acuity chart	36
10	Landolt's ring visual acuity chart	37
11	Illiterate E visual acuity chart	38
12	Measuring weight	43
13	The autorefractometer	4

List of tables

No.	Title	Page
1	Milestones of prenatal development	6
2	Relationship Between SD and Normal Range	20
3	Age distribution among the study group	46
4	Gender distribution among the study group	46
5	Number of patients in each group	46
6	Age distribution among the3 groups	47
7	Distribution of Weight among each group	48
8	Distribution of Height among each group	49
9	Distribution of skull circumference among each group	50
10	Distribution of BMI among each group	51
11	Chi square test correlation between ocular refractions and anthropometric measurements	53

No.	Title	Page
12	Chi square test correlation between emmetropes and anthropometric measurements	54
13	Chi square test correlation between myopes and anthropometric measurements	55
14	Chi square test correlation between hyperopes and anthropometric measurements	56
15	Chi square test correlation between age and anthropometric measurements in the 3 groups	57

List of Graphs

No.	Title	Page
1	Age distribution among the 3 groups	47
2	Body weight distribution among the 3 groups	49
3	Body height distribution among the 3 groups	50
4	Skull circumference distribution among the 3 groups	51
5	Body Mass Index distribution among 3 groups	52

Introduction

Health is not merely the absence of disease, but includes many dimensions of well-being including physical, mental, social, environmental, and personal dimensions. Promoting health requires pediatricians to acknowledge the complex forces that impact health, such as familial, socioeconomic, educational, developmental, and biologic entities. With these complexities in mind, pediatricians tailor health supervision visits to individual children to provide optimal care and promote health (*Green M., 2000*).

The data generated from observation, history, and physical examinations are greatly influenced by a child's developmental stage. A portion of the observational assessment of a child focuses on signs related to specific organ systems that are intimately related to age. A child of 1 month has a more rapid respiratory rate (30 breaths/min) than a 3-yr-old child. Other aspects of observational assessment focus on indicators of the child's overall state of well-being or functional status, such as how the child responds visually to the environment. These visual responses undergo developmental change as does the manner in which stimuli should be presented to elicit a child's optimal visual response (*Richard E. et al, 2003*).

A 1-month-old infant, for example, is more nearsighted and tends to focus on objects held within 1-2 feet of the face; objects presented in the peripheral fields of vision may be ignored. A young infant's ability to maintain attention on a visual stimulus is less developed than that of an older child. (**Richard E. et al, 2003**).

Pediatricians must be aware of the developmental dimensions of observed children in order to gather and interpret clinical information accurately. The data generated during the physical examination are also closely linked to a child's stage of development. Height and weight are usually taken as important indicators of well being .These two parameters are influenced by other factors such as environmental, socioeconomic and hereditary conditions (**silventoinen, 2003**).

Children height and other anthropometric parameters were subjected to many studies as regards their effect on the psychological, cognitive and visual state of children (**Saw et al., 2002; Ojaimi et al., 2005**).

Hypothesis:

The study hypothesizes that there is a relationship between anthropometric measurements in children and ocular refraction.

Aim of the study:

The aim of this study is to find the relationship between anthropometric measurements in children and ocular refraction.

Design of the study:

Analytical cross sectional study.

Review of Literature

Growth and Development

The most dramatic event in growth and development occur before birth. With processes so complex much can grow wrong. The uterus is permeable to adverse social and environmental influences: such as maternal under-nutrition, alcohol, cigarette, drug use and perhaps psychological trauma. The complex interplay between these forces and the somatic and neurological transformations occurring to the fetus influence the infant's behavior at birth and may affect parent-infant interactions throughout infant period (*Brazelton TB, Cramer BG., 1990*). (Fig.1)

Somatic Development

Embryonic Period

Milestone of prenatal period is presented in Table-1. By the 6th day of post conceptual age, as implantation begins the embryo consists of a spherical mass of cells with a central cavity (Blastocyst). By 2 weeks, implantation is complete and the uteroplacental circulation has begun; the embryo has 2 distinct layers ectoderm and endoderm, and the amnion has begun to form (*Richard et al, 2003*).

By 3 weeks, the third primary germ layer has appeared (mesoderm) along with the primitive neural tube and blood vessels, the paired heart tube has begun to pump.

During weeks 4-8, lateral folding of the embryonic plate, followed by growth at the caudal and cranial ends and the budding of arms and legs produce the human like form. Precursors of skeletal muscles and vertebrae appears (somites) together with the branchial arches that will form the maxilla, mandible and face (**Richard et al, 2003**).

Lens placode appears, marking the site of fetal eyes. The brain grows rapidly, by the end of week-8 the rudimentary of all organs have developed closing the embryonic period. The average embryo weighs average of 9-gm and crown-rump length of 5 cm (**Richard et al, 2003**).

Fetal period (Fig.1 & table 1)

From week 9 (fetal period), somatic changes consists of increase cell numbers, size and structural remodeling of several organ system, together with changes in body proportion .

By week 10, the face is recognizable human. The mid-gut returns from the umbilical cord into the abdomen.

By week 12, the external genitals become clearly distinguishable. Lung development proceeds with budding of bronchi, bronchioles and successively division. By 20-24 weeks, primitive alveoli has been developed (**Richard et al, 2003**).

During the third trimester, weight triples and length doubles as body stores of protein, fat, iron and calcium increase. (table-1)

Table-1. Milestones of prenatal development (Richard et al, 2003).

Week	Developmental events
1	Fertilization and implantation beginning of embryonic period.
2	Endo and Ectoderm, Bilaminar embryo.
3	First missed menstrual period (appearance of mesoderm) Trilaminar embryo, somites begin to form.
4	Neural fold fuses, folding of the embryo into human like shape, arms and legs buds appear, crown-rump length 4-5mm.
5	Lens placodes, primitive mouth, digital rays on hands.
6	Primitive nose, philtrum, primary palate, crown-rump length 21-23mm.
7	Eye lids begin to fuse.
8	Ovaries and testis distinguishable.
9	Fetal period begins, crown-rump length 5 cm, weight 9 gm.
10	External genitalia distinguishable.
20	Usual lower limit of viability, weight 460 gm, length 19cm.
25	Third trimester begins, weight 900 gm, length 25 cm.
28	Eye open, fetus turns head down, weight 1,300 gm.
38	Term.

Neurological Development

During the 3rd week, a neural plate appears on the ectodermal surface of the trilaminar embryo. Enfolding produces a neural tube that will become the central nervous system (CNS) and a neural crest that will become the peripheral nervous system(Fig.2).

Neuroectodermal cells differentiate into neurons, astrocytes, oligodendrocytes, and ependymal cells, whereas microglial cells are derived from mesoderm. By the 5th week, the three main subdivisions of forebrain, midbrain, and hindbrain are evident. The dorsal and ventral horns of the spinal cord have begun to form, along with the peripheral motor and sensory nerves. Myelination begins at midgestation and continues throughout the 1st 2 years of life (**Richard et al, 2003**).

By the end of the embryonic period (week 8), the gross structure of the nervous system has been established. on a cellular level, the growth of axons and dendrites and the elaboration of synaptic connections continue at a rapid pace, making the CNS vulnerable to teratogenic or hypoxic influences throughout gestation. Rates of increase in DNA (a marker of cell number), overall brain weight, and cholesterol (a marker of myelination) increases (**Richard et al, 2003**).

The prenatal and postnatal peaks of DNA probably represent rapid growth .(Fig.3) .

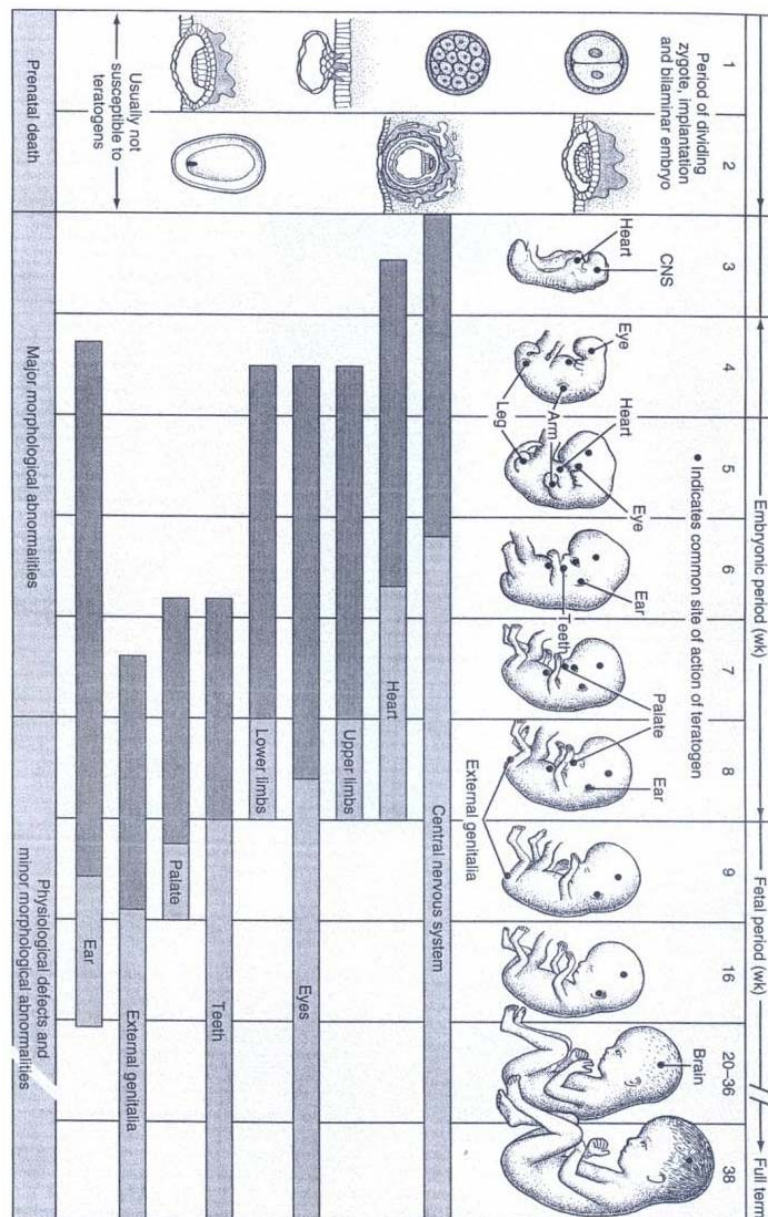


Fig. 1 The Sensitive or Critical Periods in Prenatal Development. Dark Boxes Denote Highly Sensitive Periods, Light Boxes Indicate States That are Less Sensitive to Teratogens. (Moore, 1977)

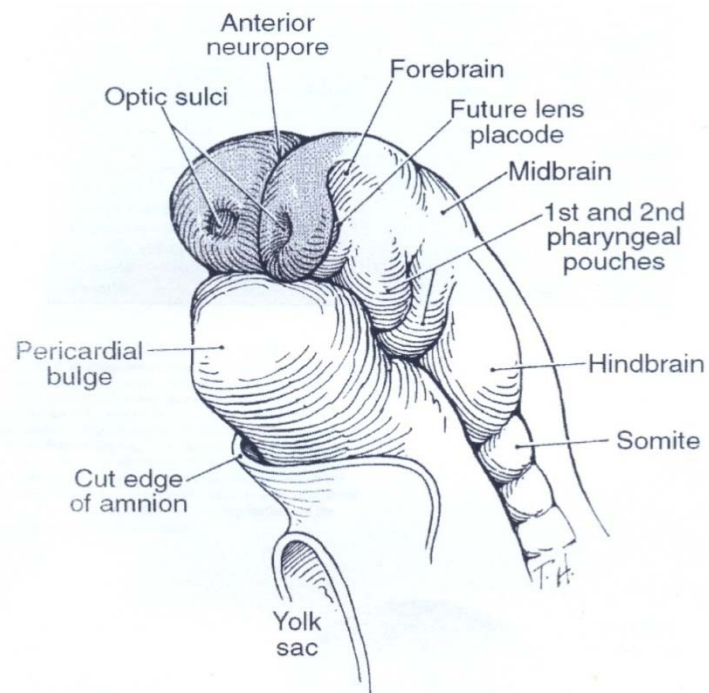


Fig.2 The primitive central and peripheral nervous system
(Webster *et al*, 1988)

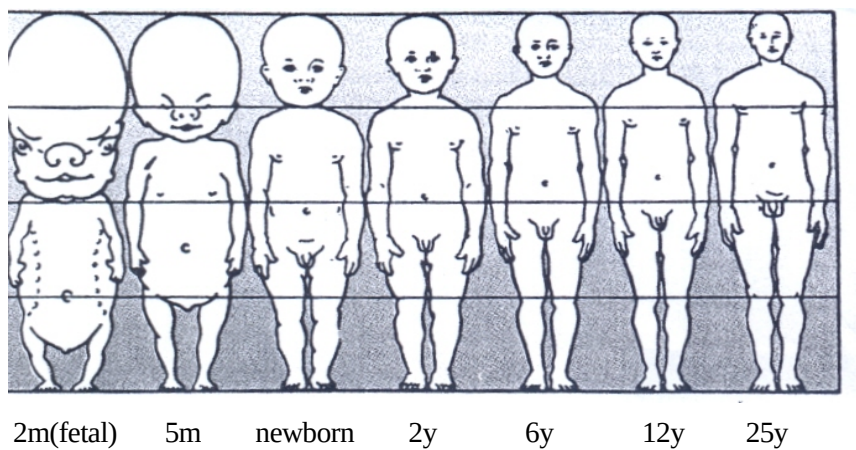


Fig.3 Change of proportions during development
(Robbin, 1928)