



ESTABLISHING THE NORMAL BLOOD VALUES OF NINE KEY SERUM CHEMICAL PARAMETERS FOR CHILDREN FROM THE DIYALA GOVERNORATE IN IRAQ

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Abstract

The Iraqi ministry of health in recent years has adopted a table for the normal adults' values of the blood constituents to be used in every medical laboratory in the country. This table is applied to children too, with no evidence that shows the validity of this practice. Normal blood values of nine key medical indicators which are blood glucose, cholesterol, uric acid, total protein, alkaline phosphatase, aspartate transaminase, alanine aminotransferase, urea and creatinine, were determined for healthy children. Samples were collected from Baquba, Muqdadhiya, Khalis and Baladruz districts, which are parts of the Diyala governorate in Iraq. 446 child (225 males + 221 females) were included in this study. The results show that the normal values of the early mentioned blood chemical constituents were similar to the adult Iraqi standards, the data were classified on the basis of age and gender. The results indicate that there are no significant differences between the levels of blood chemical constituents of male and female individuals in all age groups. It was noticed that the normal blood values in the children at the age of zero - six months were almost the same as those of their mothers, then decreased during the next three years of development and began to increase again almost reaching adults' values at the age of 15 year. The use of the Iraqi ministry of health's table is applicable to children in the Diyala governorate.

Key words: Serum chemical parameters, blood glucose, Serum cholesterol, blood urea, Serum creatinine, aspartate transaminase, alkaline phosphatase.

Introduction

The term "normal values" or "the normal range" for the serum blood chemical constituents was used for the first time in 1953 by Wooton and King (1953).

Over the last three decades or more, the use of the blood reference values by the medical laboratories became a routine practice all over the world.

The reference values of serum blood constituents are affected by various factors such as the biological factors and the chemical analysis methods used. The biological differences include the age, gender, type of diet and the environment (Baqir, 1993).

The first study to establish the normal blood values for the Iraqi population was undertaken in 1982, with the focus on the adult's normal values. When a group of researchers from the college of medicine, university of

Baghdad, studied the ranges of the normal blood values of six blood chemical indicators. Blood samples were obtained from the healthy students of the college of medicine and a group of volunteers blood donors at Al-Jumhori hospital (the teaching hospital, university of Baghdad) and the medical town at Al-Ewadhiya, Baghdad (Al-Adhami *et al.*, 1982). By doing so succeeding in setting up standard reference values for the whole Iraqi population. Since then few local studies were carried out in some Iraqi governorates such as Al-Najaf Al-Ashraf (Baqir, 1993) validating the 1982 research's results.

The Iraqi ministry of health (IMOH) in recent years has adopted a table for the normal adults' values of the blood constituents to be used in every medical laboratory in the country, which are applied for children too. However, variations might appear between the children of different governorates which can be attributed to the same reasons that cause dissimilarities seen in adult values

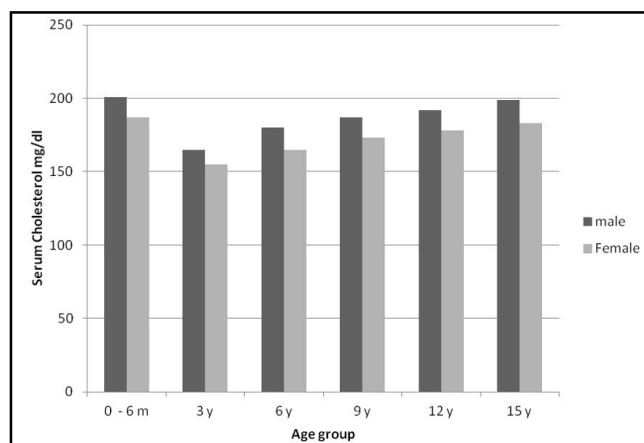
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Table 1: Normal values of blood serum chemical constituents of children from the Diyala governorate in comparison with the reference values adopted by the Iraqi ministry of health (IMOH).

Normal values of blood serum chemical constituents of children from the Diyala governorate, Iraq				The reference values adopted by the IMOH	
Blood serum chemical component	Male (225)	Female (221)	P value	Males	Females
Cholesterol (mg/dl)	187.3	173.5	0.087866	150.0-250.0	150.0-240.0
Blood glucose (mg/dl)	97.4	96.5	0.068733	74.0-100.0	80.0-100.0
Uric acid (mg/dl)	5.0	4.8	0.081553	3.5-7.2	2.5-6.8
Total protein (g/dl)	6.5	6.35	0.05648	6.8-8.6	6.0-7.8
Alkaline phosphatase (ALP) (unit/L)	56.2	53.4	0.053987	53.0-128.0	42.0-98.0
Aspartate transaminase (AST) (unit/L)	23.4	22.7	0.250237	1.0-45.0	0.0-40.0
Alanine aminotransferase (ALT) (unit/L)	28.1	26.8	0.260771	10.0-50.0	10.0-50.0
Blood urea (mg/dl)	36.5	35.5	0.22319	15.0-45.0	10.0-50.0
Creatinine (mg/dl)	0.942	0.932	0.104291	0.9-1.3	0.6-1.1

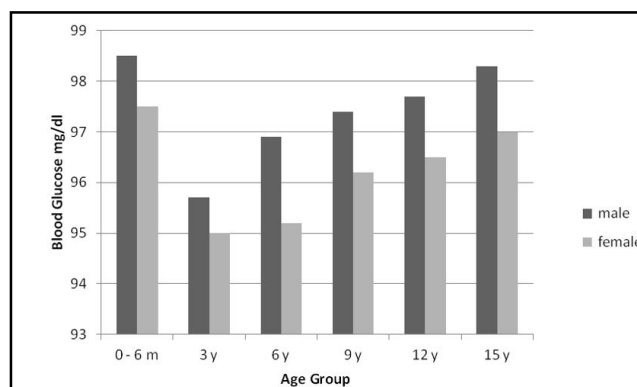
Table 2: Comparison of normal blood values of children with the normal blood values of the adults in The Diyala governorate.

Normal values of the blood serum constituents of children (0 – 15 year) in the Diyala Governorate				Normal values of blood serum constituents of adults in the Diyala governorate		
Blood serum chemical component	Male (225)	Female (221)	p value	Male	Female	Average
Cholesterol (mg/dl)	187.3	173.5	0.087866	177.0	173.6	175.8
Blood glucose (mg/dl)	97.4	96.5	0.068733	93.4	89.4	91.4
Uric acid (mg/dl)	5.0	4.8	0.081553	4.9	4.7	4.8
Total protein (g/dl)	6.5	6.35	0.05648	7.5	7.1	7.3
Alkaline phosphatase (ALP) (unit/L)	56.2	53.4	0.053987	90.1	75.7	82.9
Aspartate transaminase (AST) (unit/L)	23.4	22.7	0.250237	29.5	26.5	28.0
Alanine aminotransferase (ALT) (unit/L)	28.1	26.8	0.260771	25.6	23.9	24.8
Blood urea (mg/dl)	36.5	35.5	0.22319	28.4	24.8	26.6
Creatinine (mg/dl)	0.942	0.932	0.104291	0.980	0.730	0.855

**Fig. 1:** The serum cholesterol normal values according to age group and gender. m = month and y = year.

such as dietary, environmental and physiological conditions.

Although there are some studies on the normal ranges of adult serum parameters of normal healthy Iraqi individuals as mentioned earlier, to the best of our knowledge there is a gap in the literature about blood values of the children fraction of the population in Iraq.

**Fig. 2:** Profile of normal blood glucose in relation to child age and gender.

However, researchers in other countries have established the normal values for biochemical constituents of their children (Chio *et al.*, 1984).

The aim of this study is to validate the application of the IMOH normal values' of the chemical blood constituents with the children in the Diyala governorate.

Materials and Methods

The children who were included in this study were

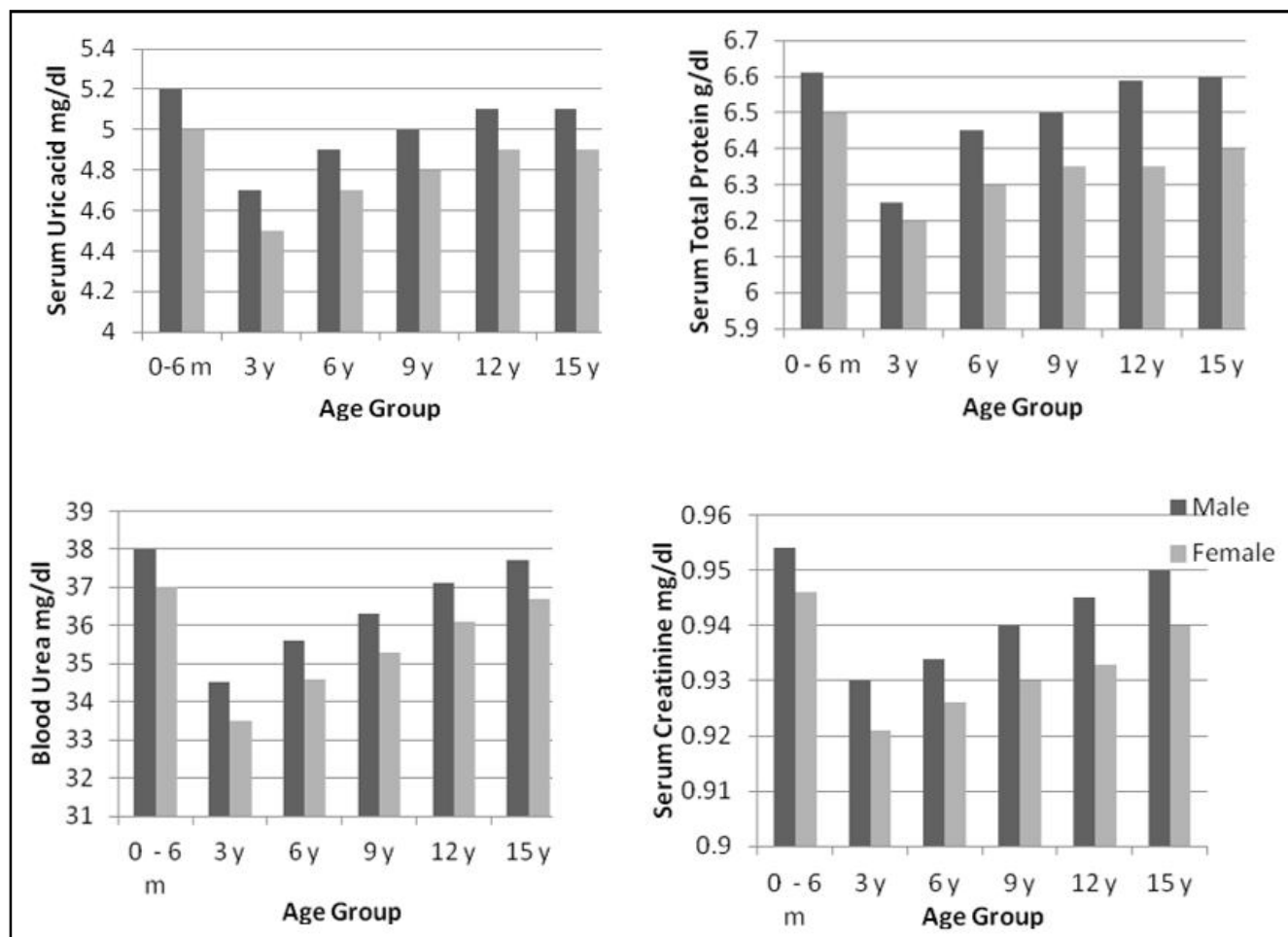


Fig. 4: Kidney function tests serum parameters for the Diyala governorate healthy children.

deemed healthy individuals based on specific selection criteria's adapted from Brinkworth *et al.*, (2004) and Lockitch *et al.*, (1988). Children attending the outpatient clinics, intensive care units and premature babies' results were excluded. Also children who had more than one test results during the study period and those with a marked result by a medical scientist were not included (Brinkworth *et al.*, 2004). Infants diagnosed with mild jaundice not requiring photo therapy during first days in life were included (Lockitch *et al.*, 1988). We ended up with 225 male and 221 female, who live in the Diyala governorate (Baquba, Muqdadiya, Khalis and Baladruz districts). These children belonged to different social groups, their ages ranged from 0 to 15 years. They were grouped according to age and gender, with three year gaps after the first six months of age (0 - six months, three year and so on until fifteen year). The study covered the period from the beginning of November 2016 till the end of March 2017. Moreover, the laboratories results were also checked for a month on either side of the study period to exclude children with repeated results.

Values of nine key medical indicators which are blood

glucose, cholesterol, uric acid, total protein, alkaline phosphatase (ALP), aspartate transaminase (AST), alanine aminotransferase (ALT), urea and creatinine, were determined.

The measurements were performed using cobas integra® 400 plus analyzer instruments (Roche Diagnostic, Germany). Results obtained by collaboration of Baqubas' hospitals (teaching hospitals), Al-Muqdadiya general hospital, Al-Khalis general hospital and Baladruz general hospital. All hospitals review boards have provided waived all consent because it is a minimal risk study.

All statistical calculations and comparisons between means were performed in a Microsoft Excel 2010 environment using standard worksheet functions for the Student t-test at a significance level of $P < 0.05$.

Results and Discussion

Results were represented by two tables table 1 and table 2 and nine figures Figs. 1-4. These results cover and compare nine key chemical blood constituents. Table 1 includes the average values of the normal healthy children, in addition to the normal values adopted by the

Iraqi ministry of Health (IMOH). In table 2 we compare between the data of the children's blood normal values with those of adults in the Diyala governorate (Ahmad and Talfan unpublished data).

The comparison between the ranges of serum chemical parameters of both male and female subjects of the study for each age group are illustrated in Figs. 1-4.

It is obvious that the normal blood values for Diyala children are similar or fall in the normal range values adopted by IMOH. This might be attributed to genetic reasons (the local genetic pool), dietary and environmental factors (Baqir, 1993, Mold *et al.*, 1998, Wilding *et al.*, 1972 and Schauble *et al.*, 1977). The results also show there are little or no variations between the normal values of males and females. This agrees with what was reported by other studies which indicate no statistical differences related to gender (Baqir, 1993, Wilding *et al.*, 1972, McPherson *et al.*, 1978). That applies to all blood chemical constituents. Noting that males' normal values tend to be slightly higher which increase the upper limits of the ranges as shown in table 1. This agrees with other studies (Baqir, 1993) and also with the normal values in adults obtained in table 2 (Ahmad and Talfan unpublished data).

An important observation from all the Figs. 1-4 is that the normal values of chemical blood constituents of both genders are almost equal to those of their mothers for the 0-6 month's age group. Which indicates that there is a correlation between the blood chemical contents of the mother and those of the infant during the first six months of the child's life. The normal blood chemical values then decreased at the age group of three years, followed by a gradual increments with increasing age from three years onwards, becoming nearly equal to the adults' normal values at fifteen years of age. This could be explained by the fact that babies are born equipped with their mothers' blood constituents and armed with maternal antibodies, these substances lose their biological functions in a time period of up to six months. Also the time taken for the body's organs such as the kidneys and the liver to fully mature correlates with the observed results.

In conclusion our study has proved that the normal values of the blood chemical constituents of children from the Diyala governorate fall within the normal national adults' ranges adopted by the IMOH.

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