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Relation of maternal serum electrolyte, traces elements and other biochemical parameters in third trimester of pregnancy

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Abstract: One hundred outdoor and indoor pregnant women, having age group between 25–45 years, in their third trimester of pregnancy were recruited for this study. The statistical data were compared with the reference range. The biochemical parameters like, waste metabolites, enzymes, proteins, calcium, chloride and phosphorus were analysed by Kit reagent methods while sodium and potassium were analysed by flame photometer. The zinc, copper and cadmium were estimated by Atomic Absorption spectroscopy.

The data revealed that no significant difference was found in the mean values of urea , creatinine, uric acid, GPT , GOT , CPK , LDL , HDL , sodium , potassium , phosphorus and LDH in urban and rural resident females when compared with reference range. While mean values of ALP (377.72 ± 146.2 v/s 412.80 ± 204.8 U/l), cholesterol (207.80 ±62.45 v/s 189.03±71.7 mg/dl), triglycerides (223.04 ± 110.5 v/s 207.98 ± 86.5 mg/dl), and chloride (121.82 ±13.3 v/s 113.42 ± 18.0 mmol/l), were higher in both urban and rural resident females when compared with reference range. On the other hand total proteins (8.32 ±1.14 v/s 6.58 ±1.83 g/dl), albumin (4.22 ± 1.54 v/s 2.57 ± 0.87 g/dl) concentration is significantly higher in urban females compared with reference range. A significant decreased in the concentration of zinc (73.41 ± 10.91 v/s 69.31 ± 5.94 ug/dl), while the concentration of copper (324.43 ± 9.82 v/s 289.43 ± 11.92 ug/dl) and cadmium (4.1 ± 9.65 v/s 3.90 ± 13.02 ug/dl) were significantly higher in urban and rural resident of females compared with reference range.

Keywords: third trimester of pregnancy, Blood biochemical constituents.

1. INTRODUCTION

The present study was design to investigate the blood parameters of pregnant women, residing in rural and urban environment to correlate the diseases or disorders in their third trimester of pregnancy. For this purpose the blood samples of pregnant women in their third trimester of pregnancy were collected from the residence of urban and rural area of Sindh, Pakistan. It has been reported that the imbalances in metabolites depends on the factors including nutrition, genetic and mother's lifestyle (Janet, 2000). During third trimester of pregnancy the fetal organs mature, secreting hormones, and affecting the nutrients metabolism. The maternal body requirement increases during this time and the supplement diet is given to the mother, otherwise the growth of the fetus can be affected. The imbalances of nutrients can affect the composition of the blood of the mother, which support the growth of fetus and maintaining the process of homeostasis, helps for lactation. Estrogens and progesterone levels during third trimester increases and have effects on synthetic, excretory hepatic function and metabolic function. (Bacq *et al.* 1996). The changes in the people's lifestyle were observed in rural and urban infants (Elżbieta, 2007). The health affecting factors are physical activity and the changes in the diet among the among the peoples. The civilization illness may produce due the fast changes in the environment (Kędzierska., *et al.,* 1997). The researchers of various countries (Boreham, *et al.,* 1999) reported that living standards and nutritional habits can change the lipid metabolism in the human population. Riboflavin, folate and vitamin C were investigated in rural and urban population of Gambia during the pregnancy and was suggested that rural population was affected due to low concentration of vitamins (Reddy, *et al.,* 1987).

2. MATERIALS AND METHODS

One hundred pregnant (50 urban and 50 rural) women both outdoor and indoor ones, having age group between 25–45 years, in their third trimester of pregnancy were selected. The blood samples of pregnant women residing in rural and urban areas of Sindh, Pakistan were collected from government and private hospitals of Hyderabad region. The blood samples were collected into the sample bottles without anticoagulant and were kept in refrigerator at about 4°C to help sedimentation. Soon after the blood samples were centrifuged at 2500 rpm for 10 minutes and the serum was separated out and stored in refrigerator for analysis. The serum was used to investigate the serum metabolites.

Micro-lab-200 (Germany), Flame photometer (Corning) and Atomic absorption spectroscopy (180–50 Hitachi, Japan) were used for the investigation of blood metabolites, electrolytes and trace elements respectively.

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ALP = Alkaline phosphatase, GPT = Glutamic pyruvic transaminase, GGT = γ- Glutamyl transferase. GOT = Glutamic oxaloacetic transaminase, LDH = Lactate dehydrogenase. SCP = A/G ratio = Albumin/globulin ratio.

Estimation of waste metabolites: Blood urea estimated by Biomeriux reagent kit and uric acid, creatinine was analyzed by using Diasys reagents kits.
Estimation of electrolytes: The **s**odium and potassium were estimated by using flame photometer while, calcium was analyzed by Biomeriux reagents kit.
The estimation of chloride phosphorus was made by Diasys reagents kit.
Estimation of trace elements: Atomic absorption spectroscopy (AAS, 180–50 Hitachi Japan) was used for the estimation of zinc and copper while cadmium was analyzed by graphite furnace atomic absorption by same model.
Estimation of serum enzymes: The estimation ALP, GPT, GOT, LDH, CPK and GGT analyzed by Diasys reagents kit.
Estimation of nutrients: Serum lipoproteins, triglycerides and protein A/G ratio were analyzed by Diasys reagents Kit.

3. RESULTS AND DISCUSSION

The waste metabolites (urea, uric acid and creatinine) of serum are shown in Urea, uric acid and

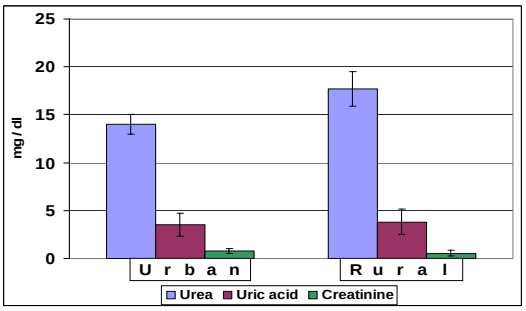

Fig. 01: Shows the serum mean ± SD values of wastes metabolites (urea, uric acid and creatinine) in urban and rural resident females during third trimester of pregnancy. (Reference range Urea 15 – 45 mg/dl, Uric Acid 2.6 – 5.4 mg/dl, Creatinine 0.4 – 1.2 mg/dl)

creatinine were analyzed to evaluate the kidney function during third trimester of pregnancy. The data revealed that there was no significant differences in mean values of urea (14.0±7.02 v/s 17.7±10.83 mg/dl), uric acid (3.53±2.2 v/s 3.80±2.33 mg/dl), creatinine (0.78±0.27 v/s 0.54±0.28 mg/dl), between urban and rural resident females during third trimester of pregnancy. The concentrations of urea, uric acid and creatinine were in the agreement of reference values of non pregnant females. It has been reported (Janet, 2000) that these waste metabolites decreases in concentration due to increased glomerular filtration rate and haemodilution during third trimester of pregnancy. It is suggested that (Egwuatu, 1983) changes in urea and uric acid may be due to the distribution of body fluid distribution and nutritional status in the female during pregnancy. **(Fig. 2)** shows serum enzymes (ALP, GPT, GOT, CPK

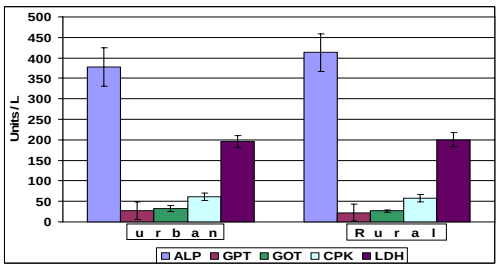

Fig. 02: Shows the serum mean ± SD values of enzymes (ALP, GPT, GOT, CPK and LDH) in urban and rural resident females during third trimester of pregnancy. (Reference range: ALP <258, GPT<39, GOT <31, CPK <165, LDH <250 U/L)

and LDH) in enzymes (ALP,GPT,GOT,CPK and LDH, U/L) in urban and rural resident females during third trimester pregnancy. GPT(27.0±16.64v/s21.76 ± 12.4 U/l), GOT (31.8±17.4v/s 26.2±12.8 U/l), CPK (61.56 ±28.8v/s57.64±28.7U/l),ALP(377.72±146.2v/s412 80± 204.8U/l),LDH(196.0±112.3v/s200.0±154.1 U/l) Unit per liter values did not significantly differ between the groups of urban and rural resident females. However the concentration ALP was higher in both groups of study. The elevation of ALP may be a normal change; during the second trimester ALP activity was higher than the first trimester. This increase in enzyme is due to placental isoenzyme production and an increase in the bone isoenzyme during third trimester of pregnancy. (Bacq *et al.,* 1996 Guntupalli, and Steingrub., 2005). On the other hand serum GOT and GPT activities were normal when compared with reference range in both group of studies and were in agreement reported in literature (Rahman, 2005).

The serum proteins (total proteins, albumin, globulin and A/G ratio) in rural and urban females during third trimester are shown in **(Fig. 3)**. Total proteins (8.32v/s 6.58 g/dl) albumin (4.22 v/s 2.57 g/dl)

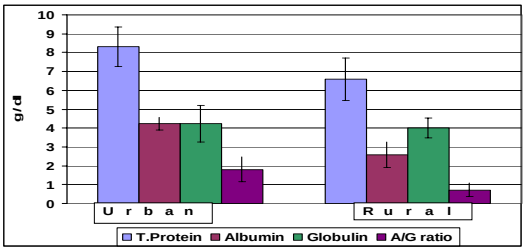

Fig.3. Shows the serum mean ± SD values of Proteins (Total proteins, albumin, globulin, A/G ratio) in urban and rural resident females during third trimester of pregnancy. (Reference range Protein 6.0 – 8.5, Albumin 3.5 – 5.5,globulin,2.0-3.5 g/dl)

concentration is significantly ($p<0.05$) higher in urban females, while A/G ratio (1.81 v/s 0.73) is significantly ($p<0.05$) lower in rural females compared with reference range. However the globulins (4.22 v/s 4.01

g/dl) did not show significant ($p>0.05$) differences. The lower concentration of total proteins and albumin in rural resident females is due to hemodilution and low protein diet. Normally the decrement becomes more accentuated as the pregnancy advances (Bacq *et al.,* 1996: Janet., 2000).

The energy metabolism parameters (total cholesterol, triglycerides, LDL and HDL) are shown in **(Fig. 4.)** The data demonstrates that the cholesterol

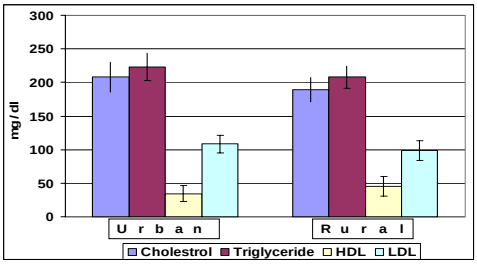

Fig. 04: Shows the serum ± SD values of lipid profile (Total cholesterol, triglyceride, HDL, LDL) in urban and rural resident females during third trimester of pregnancy. (Reference range Cholesterol ≤ 200, HDL 45 – 55, LDL <150, Triglycerides <150)

(207.80v/s 189.03 mg/dl), triglycerides (223.04 v/s 207.98 mg/dl), LDL (106.26 v/s 98.48 mg/dl), HDL (34.48 v/s 45.20 mg/dl) were not significant ($p>0.05$) when compared between the urban and rural population during third trimmest of pregnancy. The concentration of cholesterol and triglycerides were higher in both group of our study when compared with reference range. The alteration in lipid metabolism occurs during the pregnancy. The moderate increase in the concentration of phospholipids and cholesterol was observed, whereas triglyceride level rises markedly (Boyd., 1934: Williams *et al.,* 1976) .The results were in agreement with values reported by workers (Williams.1976Knopp *etal.,*1982)and**(Fig. 5)** shows the

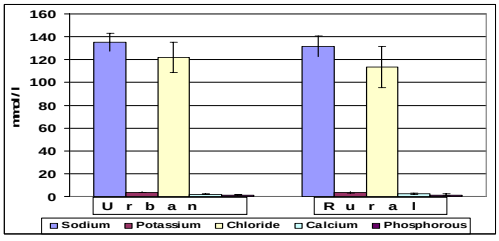

Fig. 05: Shows the serum ± SD values of electrolytes (sodium, potassium, chloride, calcium & phosphorus) in urban and rural resident females during third trimester of pregnancy. (Reference range Sodium 135 – 147, Potassium 3.5 – 5.2, Chloride 96 – 105 Calcium 2.15 – 2.55, Phosphorus 0.84 – 1.45 mmol/l)

serum minerals (sodium, potassium, chloride, calcium, phosphorus) in both groups (Urban and rural females) of our study. Sodium (135.28 v/s 131.80 mmol/l), potassium (3.81 v/s 3.58 mmol/l), chloride (121.82 v/s 113.42 mmol/l), Phosphorus (1.54 v/s 1.41 mmol/l) did not significantly differ between the study groups. The calcium concentration (2.03v/s2.35 mmol/l) significantly ($p<0.05$) lower in the urban females during third trimester of pregnancy when compared with reference range. Calcium is a vital nutrient during pregnancy and lactation. Its demand increases during third trimester of pregnancy (Oliveri, *et al.,* 2004). Calcium play major role for the development of bones in the fetus. If the dietary calcium of mother reduced during the third trimester of pregnancy than osteoporosis may develop in her future life. Furthermore low intake of calcium is the risk factor of low calcium in maternal milk and the chances of bone retardation of fetal. (Prentice, 2000). Physiologically maternal body during the third trimester of pregnancy balances the calcium by absorption and retained the calcium by kidney (Heaney *et al.,* 1971; Kent *et al.,* 1991; Gertner *et al.,* 1986; Ritchie *et al.,* 1998; Cross *et al.,* 1995). Serum phosphorus level is normal in case of rural female resident when compared to reference range and were in agreement with the results reported by authors (Dahlman *et al.,* 1994 Guntupalli, Steingrub. 2005 Gillette *et al.,* 1982; Cross *et al.,* 1995; Kent *et al.,* 1993; Brommage and DeLuca., 1984).

The serum trace elements (zinc, iron, copper, cadmium) in urban and rural resident are shown in (**Fig. 6)**. The concentration of zinc and iron were significantly ($p<0.05$) lower and were in agreement with values reported by other workers (Ma *et al.,* 2004; Kalra *et al.,* 1989; Black , 2001).

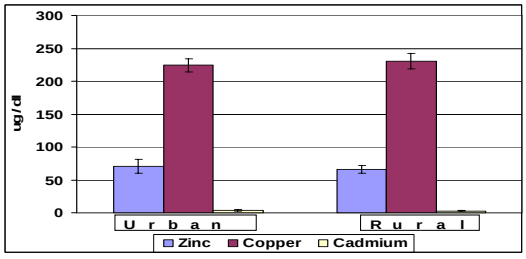

Fig. 06: Shows the serum ± SD values of trace elements (Iron, zinc, copper, cadmium) in urban and rural resident females during third trimester of pregnancy. (Reference Range Zinc <87.7, Copper <265, Cadmium <2.9 Ug/Dl)

The decrease in zinc concentration during pregnancy could also be due to increase in maternal blood volume (Deshpande *et al.,* 1977). The significantly ($p<0.05$) higher plasma concentration of copper and cadmium were found in both groups of our study, similar were reported by other workers (Upadhyaya *et al.,* 2004).The increase in serum copper is mainly due to the increase in concentration of ceruloplasmin the result by the stimulation by estrogen increased copper retention during pregnancy (Pathak *et al.,* 2003).

It is concluded that no significant difference was found in the mean values of waste metabolites (urea, creatinine, uric acid), enzymes (GPT, GOT, CPK,LDL,HDL),LDH, sodium, potassium, phosphorus in urban and rural resident females when compared

with reference range. While mean values of ALP (377.72±146.2v/s412.80±204.8U/l),cholesterol (207.80 ±62.45 v/s 189.03±71.7 mg/dl), triglycerides (223.04 ± 110.5 v/s 207.98 ± 86.5 mg/dl), and chloride (121.82 ±13.3 v/s 113.42 ± 18.0 mmol/l), were higher in both urban and rural resident females when compared with reference range. On the other hand total proteins (8.32±1.14 v/s 6.58±1.83 g/dl), albumin (4.22±1.54 v/s 2.57± 0.87 g/dl) concentration is significantly higher in urban females compared with reference range. A significant decreased in the concentration of zinc (73.41±10.91v/s 69.31±5.94 ug/dl), while the concentration of copper (324.43±9.82v/s 289.43±11.92 ug/dl) and cadmium (4.1±9.65 v/s 3.90±13.02 ug/dl) were significantly higher in urban and rural resident of females compared with control. The difference in the concentration of different blood metabolites in urban and rural pregnant females may be due the imbalances of nutrients, hormones and the changes in the life style.

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