STUDY OF PLASMA AMINOACIDS AND THEIR RENAL CLEARANCES IN NORMAL PREGNANCIES AND PREGNANCIES COMPLICATED WITH ANAEMIAS

by

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Iron deficiency and megaloblastic anaemias often complicate pregnancies in this part of the country. Jacob and Fleming (1970) brought out some interesting results in their study of 16 cases of megaloblastic anaemias of pregnancy. Besides this work there are a few other papers (Weaver and Neil, 1954; Keeley and Politzer, 1956; Todd, 1959; Wickrama Singhe and Chalmers, 1968) investigating aminoacid metabolism in relation to iron deficiency or megaloblastic anaemias of pregnancy. Many findings in the above papers were controversial. It was therefore planned to investigate plasma aminoacids and renal clearances of aminoacids in normal pregnancies and in pregnancies complicated with megaloblastic and iron deficiency anaemias.

Material and Methods

The study material consisted of 26 near term pregnant women. Cases were divided into 3 groups:

(a) Seven with megaloblastic anaemia.

(b) Ten with iron deficiency anaemia and

(c) Nine normal cases having haemoglobin above 10 gm%.

The diagnosis of megaloblastic and iron deficiency anaemia was based on examination of peripheral blood smear. The diagnosis of megaloblastic anaemia was confirmed by bone marrow smear as well.

For study of plasma aminoacids in maternal blood and renal clearance of aminoacids the morning samples were collected when patients were fasting. The patients were given one or two glasses of water to drink to increase urine flow. Next they were asked to pass urine, which was discarded. After 2 hours again the patients were asked to pass urine. This urine was collected. Thus the exact amount of urine was collected over a period of 2 hours and during this period the blood sample was collected for the analysis of plasma aminoacids.

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Estimation of Plasma Aminoacids and Urinary Aminoacids

This was done by unidimensional and bidimensional techniques described by Saini (1971) and for quantitative evaluation the method of Whitehead (1964) was used.

The spots evaluated from unidimensional chromatograms (mg%) were the joint spot of leucine and isoleucine, phenylalanine, the joint spot of methionine and valine, tyrosine, the joint spot of glycine and glutamine (Complex 1), the joint spot of histidine and lysine (Complex II). The spots evaluated from bidimensional chromatograms were alanine, serine and threonine. Bidimensional chromatography had to be done because some spots were not suitable for quantitative evaluation in unidimensional chromatograms. Aminoacid clearances were worked out using the following formula:

$$\text{Clearance (ml/min.)} = \frac{\text{Conc. of aminoacid in 1 ml of urine} \times \text{Volume of urine passed in one min.}}{\text{Conc. of aminoacids in 1 ml of plasma.}}$$

Results

The range and the mean values (with S.D.) in the 3 groups are recorded in Tables I and II.

Discussion

In the present study predelivery levels of aminoacids were lower in iron deficient group as compared to the control group except for leucine and complex I (glycine and glutamine). The low plasma aminoacid levels encountered in iron deficiency group might not be related to iron deficiency as such. General malnutrition of these patients and other associated deficiencies might be more important in determining these low levels. Also increased urinary losses of some aminoacids might be contributory (see below).

Clearance values in the iron deficiency group were raised for methionine, threonine and complex II (histidine and lysine). Todd (1959) noted increased urinary excretions of taurine and beta amino-isobutyric acid but increased aminoacidurea was observed only in severely anaemic cases.

Jacob and Fleming (1970) reported higher levels of plasma aminoacids in megaloblastic anaemia of pregnancies compared to the levels of normal females. In the present study only the levels of complex I (glycine and glutamine), methionine and leucine were higher in megaloblastic cases compared to the levels in normal pregnancy. Thus we have not been able to confirm the findings of Jacob and Flemming (1970) about the generalised rise of plasma aminoacids in megaloblastic anaemia of pregnancy. Further more, Todd (1959) also failed to find any rise in the levels of plasma aminoacids in his 8 patients.

According to Jacob and Fleming (1970) the raised plasma aminoacids in megaloblastic anaemia of pregnancy were either because of reduced clearance (which of course they did not measure) or reduced incorporation into tissue proteins.

In the present study renal clearance of different aminoacids were higher for all aminoacids in megaloblastic cases (Table II). The raised clearances of aminoacids in the present cases of megaloblastic anaemia might be responsible for the fact that plasma levels were not raised or were only moderately raised in those cases. The present study appears to sub-

TABLE I

Maternal Plasma Aminoacids in Normal and Pregnancies Associated With Iron Deficiency and Megaloblastic Anaemias

S. No.	Aminoacids	Normal			Iron deficiency anaemia			Megaloblastic anaemia		
		Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D	Range
*1.	Leucine	2.98	2.25	1.43- 8.57	3.92	4.49	0.52-13.15	3.46	2.54	0.58- 7.11
2.	Ph. Alanine	—	—	—	1.14	0.41	0.85- 1.43	—	—	—
**3.	Methionine	3.995	3.13	0.48- 8.57	3.71	13.22	0.36-13.58	6.29	7.43	0.92-11.43
4.	Tyrosine	14.58	20.8	1.65-38.57	7.70	6.26	1.61-14.28	9.98	16.59	0.71-27.15
5.	Alanine	6.60	7.30	2.14-25.71	3.34	1.06	1.76- 4.71	3.43	1.31	0.29- 4.29
6.	Threonine	4.45	4.98	2.32- 8.75	2.01	0.895	0.71- 3.33	3.44	—	—
7.	Serine	13.32	24.14	1.94-62.5	1.71	0.68	0.89- 2.19	2.65	2.51	0.28- 6.25
8.	Complex I (Glycine and Glutamine)	5.05	5.72	1.49-18.93	9.44	7.48	1.26-47.14	7.09	6.55	0.95-22.86
9.	Complex II (Histidine and Lysine)	2.44	0.99	1.43- 4.45	1.85	0.895	0.92-10.71	1.80	0.61	0.80- 2.68

* Composite spot of leucine and isoleucine. ** Composite spot of methionine and valine.

TABLE II

Urinary Clearances of Aminoacids in Normal Pregnancies and Pregnancies Associated with Iron Deficiency and Megaloblastic Anaemias (ml/min.)

S. No.	Aminoacids	Normal			Iron deficiency			Megaloblastic		
		Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.	Range
*1.	Leucine	1.00	0.77	0.42-2.14	0.60	0.42	0.16-1.28	1.48	1.1	0.28-2.64
2.	Ph. Alanine	—	—	—	0.79	—	—	1.06	—	—
**3.	Methionine	0.43	—	0.43	0.93	0.95	0.23-2.01	1.02	0.65	0.57-1.49
4.	Tyrosine	2.49	—	—	1.25	1.00	0.06-2.6	—	—	—
5.	Alanine	1.18	0.65	0.32-2.2	0.71	0.61	0.34-0.92	1.42	0.89	0.79-2.94
6.	Threonine	0.22	—	—	1.81	0.93	0.78-3.1	—	—	—
7.	Serine	6.22	—	—	—	—	—	—	—	—
8.	Complex I (Glycine and Glutamine)	1.16	0.67	0.3 -2.14	0.98	0.34	0.09-1.75	2.04	1.24	0.88-4.33
9.	Complex II (Histidine and Lysine)	2.30	2.05	0.22-2.57	2.43	1.12	0.73-3.92	5.76	2.15	3.2 -9.56

* Composite spot of leucine and isoleucine. ** Composite spot of methionine and valone.

stantiate the renal effect of anaemia postulated by Todd (1959) at least in cases of megaloblastic anaemia and the increased clearances of aminoacids might be significant as far as plasma levels of aminoacids were concerned.

In the comparisons discussed above only mean levels of aminoacids or mean levels of clearances had been compared in various groups. In most instances the variations were statistically insignificant. This is because of great variations in the levels of aminoacids in the individual subject of the different groups. This is partly because of the technique used for the study which is semiquantitative one and partly because such variations are characteristic of plasma aminoacid levels which show greater variations even with better quantitative techniqe (Butterfield and O'Brien, 1962).

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