

## CITRIC ACID IN AMNIOTIC FLUID AND MATERNAL BLOOD IN PREGNANCY

by

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Citric acid is a normal constituent of human bones and teeth (Hartles, 1964). 70-90 per cent of the total body citrate exists in the skeletal system. It forms an insoluble compound with calcium and thus is present on the surface of the bone crystals (Dickens, 1941). This is because of great affinity of hydroxyapatite of the bone has for citrate at the physiological H ion concentration (Patterson, 1954).

Cushard *et al* (1974) reported that pregnancy is accompanied by hyperparathyroidism which thus affects calcium and citrate metabolism.

Citric acid in amniotic fluid has been reported by Anteby *et al* (1973) and Patel (1977). Since growth changes are known to be reflected in the constituents of amniotic fluid and maternal blood levels, it seemed of interest to determine its concentration. It has been observed that there is progressive decrease of citric acid level in amniotic fluid, whereas it shows rise in maternal blood with advancement of pregnancy (Anteby *et al*, 1973 and Katz *et al* 1969).

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### Material and Methods

The material for the present study was collected from 50 pregnant mothers with gestational period ranging from 16-43 weeks admitted in State Zenana Hospital attached to S.M.S. Medical College, Jaipur during 1974-75. 4 ml of maternal blood and 2 ml of amniotic fluid were collected in sterile vials from cases of: (1) Therapeutic abortion of mid-trimester pregnancy before intrauterine instillation of hypertonic saline; (2) Caesarean Section; and (3) Induction of labour by amniotomy.

The method of estimation was by Taussky & Schorr (1947).

### Results

Table 1 shows mean levels of citric acid in amniotic fluid as  $5.80 \text{ mg}/100 \text{ ml} \pm \text{S.D. } 1.30$  during 16-20 weeks of gestation. During 28-32 weeks of pregnancy it falls to mean value of  $2.84 \pm 0.36 \text{ mg}/100 \text{ ml}$  and a term it falls to mean level of  $2.0 \pm 0.55 \text{ mg}/100 \text{ ml}$ .

Maternal blood levels show rise from mean value of  $1.39 \text{ mg}/100 \text{ ml}$  in 16-20 weeks of pregnancy to  $2.20 \pm 0.51 \text{ mg}/100 \text{ ml}$ .

Table II shows the fall of citric acid in amniotic fluid and maternal blood levels with increasing parity. However no correlation was observed with age of mother.

TABLE I  
Citric Acid in Amniotic Fluid and Maternal Blood in Different Periods of Gestation

S. No.	Gestation (weeks)	CITRIC ACID LEVELS (mg % IN:							
		AMNIOTIC FLUID			MATERNAL BLOOD				
		No.	%age	Mean	Range	S.D. (±)	Mean	Range	S.D. (±)
1	16-20	8	16.0	5.80	3.32-7.20	1.30	1.39	1.20-1.60	0.14
2	21-27	10	20.0	5.31	3.81-6.60	1.00	1.40	1.60-1.90	0.58
3	28-32	7	14.0	2.84	2.40-3.17	0.36	1.90	1.20-2.40	0.13
4	32-37	7	14.0	2.18	1.10-3.17	0.10	1.90	1.20-2.40	0.20
5	38-40	13	26.0	2.00	1.09-2.80	0.55	2.20	2.20-2.80	0.51
6	41-43	5	10.0	1.90	1.90-2.20	0.44	2.00	1.80-2.20	0.17

TABLE II  
Citric Acid Levels in Amniotic Fluid and Maternal Blood in Relation to Parity of Mothers

Gestation (weeks)	Parity	CITRIC ACID (mg/100 ml) IN:					
		AMNIOTIC FLUID			MATERNAL BLOOD		
		No.	%	Mean	Range	Mean	Range
16-20	Primi	4	8.0	5.99	4.19-7.20	1.30	1.20-1.60
	Multi	2	4.0	5.60	4.80-6.20	1.60	—
21-27	Grand Multi	2	4.0	4.96	3.32-6.20	1.35	1.30-1.40
	Primi	5	10.0	6.00	4.30-6.60	1.60	1.40-1.60
28-32	Multi	3	6.0	5.60	3.81-7.20	1.60	1.40-1.70
	Grand Multi	2	4.0	4.30	3.90-4.80	1.50	1.20-1.50
32-37	Primi	3	6.0	2.98	2.80-3.17	2.10	2.10-2.20
	Multi	4	8.0	2.40	2.20-2.80	1.70	1.20-2.40
38-40	Grand Multi	—	—	—	—	—	—
	Primi	7	14.0	2.30	2.10-2.40	1.90	1.10-2.50
41-43	Multi	7	14.0	2.30	2.10-2.40	1.90	1.10-2.50
	Grand Multi	—	—	—	—	—	—
38-40	Primi	—	—	—	—	—	—
	Multi	11	22.0	2.20	2.10-2.40	2.30	1.90-2.80
41-43	Grand Multi	1	2.0	2.10	—	2.20	—
	Primi	3	6.0	1.16	1.09-1.40	2.10	2.00-2.20
41-43	Multi	2	4.0	1.80	1.10-1.90	2.00	2.00
	Grand Multi	—	—	—	—	—	—

### Discussion

Citric acid levels in amniotic fluid decrease with the advancement of pregnancy, whereas the maternal blood levels show a rise (Anteby *et al*, 1973). The same reports have also been made in the experimental work on guinea pigs as reported by Fenton and Nixon (1974). Rooth and Sjosteds (1962) report that there is continuous exchange of organic acids including citric acid across the placenta from maternal blood to the foetal blood (Raiha and Neils, 1963).

The progressive decline of citric acid levels in amniotic fluid is due to enhanced foetal bone formation with the progress of pregnancy, because, according to Thomas (1969), the ossification of cuboid bones, scapulae and long bones occurs mainly during third trimester of pregnancy.

Hypercitraemia with advancement of pregnancy has been attributed to hormonal changes during pregnancy (Tanner 1967). In addition to this, it may be explained on the basis of increased energy demand by the foetus and changes in maternal metabolism.

### Summary and Conclusion

Amniotic fluid, citric acid levels fall

with advancement of pregnancy which is due to increased demand by the foetus for foetal bone formation.

Rise in maternal blood citric acid levels during pregnancy is due to change in maternal metabolism and hormonal changes.

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