

EFFECT OF MATERNAL NUTRITION ON THE SYNTHESIS AND TRANSFER OF IgG, IgA and IgM IN MOTHER AND FETUS

by

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SUMMARY

Maternal nutrition does affect the synthesis of IgG, in the mother, low in poor nutritional groups. But its transfer across the placenta to the foetus is not affected as no correlation existed in the nutritional groups of materno foetal levels of IgG. Only maternal height, weight and albumin had any correlation with the levels of IgG in both maternal and cord sera high in Gr. I and low in Gr. II and Gr. III Nutrition.

Introduction

Malnutrition in pregnancy is not a problem of the developed world, but it is still a major problem in a developing country like India, carrying a high maternal and perinatal mortality. Though the literature is replete with the knowledge of materno-foetal immunoglobulins, not much of a study had been conducted so far, as to whether the maternal malnutrition has any role to play in the synthesis and transfer of immunoglobuline to the foetus. In a tropical set up as in South India where not only bacterial and parasitic diseases are endemic, but malnutrition of all varieties abound, it was thought

worthwhile to study the effect of maternal nutrition of the humoural immunity of mother and fetus.

Material and Methods

The study was conducted on 100 random cases of uncomplicated pregnant women who had delivered vaginally. Paired samples of maternal and cord blood about 5 cc were collected within 5 minutes after delivery. IgG, IgA and IgM, were estimated from maternal and cord sera. In addition to the above both the maternal and cord area were estimated for Hb, Iron, Proteins and Albumin.

The estimation of the immunoglobuline were carried out by the modified method of Fahey and Mekelvey (1965). The precipitating rings were read at the end of 18-24 hours for IgG, 36 hours for IgA and 72 hours for IgM, using the immuno measurable scale. Using Semi-logarithmic

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graph paper the diameters of the precipitin rings of three reference sera were plotted on the horizontal scale, and the concentration of the corresponding reference sera were plotted on the vertical scale. The straight line of the best fit was then drawn. The concentration of the appropriate immunoglobulin of the test sera were determined by off the calibration curves which was plotted for each run and for each type of immunoglobulins measured.

The normal values (Chandra, 1970) of adults are as follows:

IgG 1500 mgm%, IgM 135 mgm% IgA 280 mgm%. The cord values of are IgM 10 mgm%, and IgA 3 mgm%.

Results

The nutritional groups were classified by taking the clinical as well as the biochemical factors into consideration. Group I as good maternal nutrition. Group II as fair and Group III as poor.

The following criteria were laid down in grouping them. Group I weight above 50 Kg., Height above 150 cm., Hb above 12.5 Gm., Iron above 90 Mgm., total proteins above 7 Gms. and Albumin above 4 Gms. Out of these 6 parameters if 3 were positive they were grouped as Group I. The same criteria were followed for the other 2 groups also. Group II weight between 45-50 Kg., height 145-150 Cm., Hb 10.5 to 12.5 Gm., Iron 70-90 Gm., proteins 6-7 Gm. and albumin 3-4 Gm. Group III weight below 45 Kg. height below 145 Cm., Hb below 10.5 Cm. Iron below 70 mgm., protein below 6 Gms. and albumin below 3 Gm.

Table I: shows the criteria in grouping and mean levels of each criteria.

Table II: Out of 100 cases there were 22 cases in Gr. I, 39 cases in Gr. II and 39 cases in Group III.

In each nutritional groups for all the three immunoglobulins a comparative study was made between the maternal and foetal levels separately as well as a

TABLE I

Parameters	Group I		Group II		Group III	
Height in Cm.	More	150	145-150		Less	145
Weight in Kg.	"	50	45-50		"	45
Hb in Gms%	"	12.5	10.50-12.5		"	10.5
Iron in mgm%	"	90	70-90		"	70
Protein in Gms%	"	7	6-7		"	6
Albumin in Gms%	"	4	3-4		"	3

TABLE II
I.G.G. in mg/100 ml.

Nutritional Groups	Maternal Mean \pm S.E.	Range	Foetal Mean \pm S.E.	Range
I	1175.5 \pm 89.59	500-2300	1047.9 \pm 81.96	260-1520
II	873.18 \pm 50.45	360-1580	923.03 \pm 62.42	200-1720
III	825.00 \pm 47.66	380-1370	827.50 \pm 53.55	310-1680

correlative study of materno foetal levels. In comparing maternal levels of IgG Group I had a mean of 1175 mgm. There is a statistically significant difference between Groups I and II and Groups III and I (P. 0.01 and P. 0.001 respectively) In cord IgG Group I had a mean of 1042.91 mgm. Group II 922.03 mgm. Group III 872.56 mgm. The difference between the groups were satisfically not significant.

Comparing the foeto-maternal IgG levels in each group it was also not satisfically significant.

Table III: Taking the normal adult IgG level as 1150 mgm% (Mean) (Chandra *et al*) it was found that 54.5% of maternal and 40.9% of foetal levels were less than 1150 mgm. in Group I, 84.6% of maternal and 74.4% of foetal levels were less than 1150 mgm. in Group II 82.1% of maternal and 82.1% of foetal

levels were less than 1150 mgm.% in Group II. This again shows a significant difference between Groups I and II and Groups I and III in both maternal and cord blood.

Table IV: When a comparison was made between the maternal and cord IgG levels it was found in Group I 36.4% of both maternal and cord showed normal values. 31.8% showed both low values, 9.1% showed maternal normal and Cord low level, and 22.7% showed maternal low and cord normal levels. In Group II 2.6% had both maternal and cord normal levels, 66.6% had both low levels, 10.3% had maternal normal and cord low, 20.5% had maternal low and cord normal values. In Group III 10.2% IgG levels were normal in both in 74.4% both low, 7.7% maternal normal and cord low, and 7.7% maternal low and cord normal. Here again a significant difference was there

TABLE III
Maternal and Foetal I.G.G. Levels as per mean

Nutritional Groups	MATERNAL		CORD	
	Less 1150 mg%	1150 mg%	More 1150 mg%	Less 1150 mg%
I	54.5	45.5	40.9	59.1
II	84.6	15.4	74.4	25.6
III	82.1	17.9	82.1	17.9

Adult I.G.G. 1150 mg% (Mean) Chandra *et al*.

TABLE IV
Maternal and Foetal I.G.G.'s Comparison

Nutritional Groups	Both Normal	Both Low	MNCL	MLCN
	%	%		
I	36.4	31.8	9.1	22.7
II	2.6	66.6	10.3	20.5
III	10.2	74.4	7.7	7.7

MNCL — Maternal Cord Low.

MLCN — Maternal Low Cord Normal.

between groups I and II and Groups I and III.

Table V: When estimating IgA only in 21 cases out of 100. IgA was detectable in cord sera and in rest there was no diffusion. The mean IgA for Group I was 230 mgm. Gr. II 234.37 mgm/100 ml. Gr. III 232.31 mgm. No significant difference was there between each nutritional groups in the maternal as well as foetal levels and no correlation in the foeto maternal groups.

Table VI: As far IgM out of 100 cases there was no detectable IgM in 66 cases. Among the maternal levels there was no difference in the levels between each group. Whereas among the foetal levels

Gr. I had a mean of 57.23 mgm%, Gr. II 8.76 mgm% and Gr. III 5.97 mgm%. A correlation which was statistically significant existed between Gr. I and II (P. 0.05 and P. 0.01 respectively).

Table VII: Shows the socio-economic status of the nutritional groups there were no cases in Ist IInd or IIIrd Socio-economic status. 18% of Gr. I and 10% of Gr. II and 9% of Gr. III belonged to Gr. IV Socio-economic status. 4% m. of Gr. I 29% of Gr. II and 30% of Gr. III were in Gr. V Socio-economic groups.

Table VIII: Mean weight of babies in Gr. I was 2.7 Kg. Gr. II 2.9 Kg. and Gr. III 2.8 Kg. The difference between the groups were not significant. Out of the

TABLE V
I.G.A. in Mg/100 ml.

Nutritional Groups	Maternal		Foetal	
	Mean \pm SE	Range	Mean \pm SE	Range
I	230.00 \pm 20.36	0-380	5.91 \pm 4.04	0-75
II	234.37 \pm 21.24	0-740	20.13 \pm 7.19	0-210
III	232.31 \pm 15.14	50-360	16.92 \pm 6.88	0-235

TABLE VI
I.G.M. in mg/100 ml.

Nutritional Groups	Maternal		Foetal	
	Mean \pm SE	Range	Mean \pm S.E.	Range
I	73.20 \pm 5.97	0-160	57.23 \pm 39.83	0-905
II	102.26 \pm 26.68	0-1062	8.76 \pm 2.32	0-50
III	171.74 \pm	32-1172	5.97 \pm 1.66	0-32

TABLE VII
Nutritional GPS and Socio-Economic Status

Nutritional Groups	Grade I	Grade II	Grade III	Grade IV	Grade V	Total Nos.
	Rs. 1000 P.M.	Rs. 750-1000 P.M.	Rs. 500-750 P.M.	Rs. 250-500 P.M.		
I	18	4	22
II	10	29	39
III	9	30	39

39 cases in Gr. III only in cases the babies were below 2.5 Kg.

Table IX: The nutritional groups were compared with the cord, Hb, Iron, total protein and Albumin. Here again no correlation existed between maternal nutrition and foetal bio-chemical levels thereby showing even in the poor nutritional groups cord levels of Hb, Iron, Protein and Albumin are not affected.

begins as early as 12 weeks and the foetal serum IgG increases with gestational age. Nutritional deficiency may reduce the synthesis and levels of IgG and perhaps of other immunoglobulins (Chandra 1970). This is our observation also. When comparing the IgG levels in good nutritional Groups (Gr. I) and poor nutritional (Gr. III) Groups there is a significant reduction in the levels i.e. fair

TABLE VIII
Weight of the Babies

Nutritional Groups	Mean Wt. in Each Group	3	2.5-3	2.2-5
I	2.7	7	11	4
II	2.9	12	26	1
III	2.8	8	24	7

TABLE IX
Mean Value of Cord Hb. Iron etc.

Nutritional Groups	Hb. in Gms%	Iron in mgm%	Protein in mgm%	Albumin in gms%
I	15.6	129.4	6.3	3.3
II	15.5	125.4	6.2	3.2
III	14.9	127.9	5.9	3.0

Table X: When comparing each parameter which were taken for nutritional grouping it was found that only maternal height weight and albumin had any correlation to maternal and cord IgG value. High in good nutrition and low in poor nutrition. There were no correlation in other parameters.

Discussion

Gitlin *et al* found that IgG is synthesised in foetal liver and lymph nodes by 12 weeks and in spleen and thymus at 18 weeks. Though the foetus can synthesise IgG a high proportion of IgG present in the new born is of maternal by selective placental transfer. The transfer of IgG

in Gr. II and poor in Gr. III nutritional groups.

The foeto-maternal IgG ratio varies in different population. Foetal IgG levels is high in Caucasians (Jones and Payne 1967; Cochran 1972 and low in Africans and Chinese) (Michaux *et al* 1966; Mc. Farlane, 1966). In our study except the Gr. II and Gr. III foetal IgG levels which showed an increase when compared to the maternal but in all others viz. Gr. I IgG, IgA and IgM the foetal levels were low when compared to the maternal levels.

It is doubtful if IgA is produced by the foetus (West *et al* 1962) (Moma 1965) had failed to detect any IgA in Caucasians. But in African Studies traces of

IgA were found in cord sera (Mc Farlane 1966). In our study out of 100 cases only 21 cases showed traces of IgA.

The synthesis of IgM is detected in the foetus as early as 10 weeks of gestation (Gitlin and Biasucci 1969). Soon after this IgA, IgD and IgG are also found (Chandra 1975 b). The production of these is mainly in the spleen. In our study in only 34 cases out of 100 detectable IgM was present.

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