MATERNAL AND CORD FOLATE AND VIT.B_{12} LEVELS IN MALAYSIANS AT PARTURITION

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SUMMARY

Folate and vit.B $_{12}$ status in pregnancy was studied in a group of 190 Malaysian mothers belonging to the three major ethnic origins. Cord blood was also analysed for the same vitamins. Ethnic variations with regard to deficiency in these two vitamins was determined. About 58.5 percent of the pregnant mothers suffered from lowered serum folate levels and 32.4 percent had lowered RBC folate levels. In contrast vit.B $_{12}$ levels were within normal limits. Cord blood levels of these vitamins were significantly higher than the corresponding levels in the maternal blood, suggesting the possible involvement of an active process in the transfer of folates and vit.B $_{12}$ to the fetus.

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INTRODUCTION

Little information is available on the folate and vit.B $_{12}$ status during pregnancy in the Malaysian population. Such information is of considerable importance because of the clinical implications of deficiency of these vitamins in the mothers as well as the fetus. Pregnancy makes a vast demand on maternal folate and vit.B $_{12}$ stores. A number of disorders are associated with severe folate deficiency during pregnancy, which includes low birth weight, prematurity [1,2] and congenital malformation. [3] Besides, other conditions like abruptio placentae, abortion and toxaemia of pregnancy are also associated with severe folate deficiency during pregnancy. [4,5] Pregnancy in mothers with severe vit.B $_{12}$ deficiency may be associated with intra-uterine death. [6,7]

The present preliminary study attempts to determine the extent to which Malaysian mothers are folate or vit.B $_{12}$ deficient during pregnancy, and to detect the sequelae of this deficient state in the mother or fetus, if any.

MATERIALS AND METHODS

15 ml. of blood was obtained from 190 mothers admitted at term to the maternity hospital, Kuala Lumpur. A similar volume of cord blood was collected soon after delivery. 7 ml. of the blood in either case (maternal and cord) was collected in EDTA and the remaining 8 ml. was clotted, the serum being separated after about two hours. The EDTA samples were used to determine RBC folate levels and other blood parameters. The serum was used to estimate serum folate and vit.B $_{12}$. Serum and red cell folate levels were determined

TABLE I
SERUM FOLATE LEVELS IN NORMAL INDIVIDUALS AND IN MATERNAL AND CORD BLOOD AT PARTURITION

	CONTROL	MAT. BLOOD	CORD BLOOD
Mean ± 1 SD	7·6 ± 1·8 ng/mn	5·0 ± 3·5 ng/ml	19·9 ± 17·4 ng/ml
Range	5 - 12	1·0 - 18·5	5·9 - 68·0
n	23	104	35
't' Test		(P<0·001)	(P<0·001)

TABLE IA
MATERNAL AND CORD SERUM FOLATE LEVELS IN THE ETHNIC GROUPS OF MALAYSIA

	Malay	Chinese	Indian
Mean ± 1 SD	5.0±3.6 ng/ml	4.7±3.5 ng/ml	5.0±3.5 ng/ml
Range	1.0 - 18.5	1.0 - 14.0	1.1 - 12.2
n	45	27	32
't' test	NS	NS	NS

NS : Not significantly different

employing microbiological assay methods described by Herbert. [8] Serum vit. B_{12} level was determined by the Euglena gracilis microbiological assay methods of Anderson. [9] Mothers with high blood urea were excluded from the study. The various ethnic groups were studied separately so as to determine the differences between these groups. Healthy non-pregnant mothers of comparable age served as controls. Iron status was studied as well; the findings were presented in another communication. [10]

RESULTS

Tables I & IA give the observations on serum folate levels. Mothers with a serum folate level below 5.0 ng/ml were considered folate deficient. About 104 (58.5 percent) of Malaysian mothers are folate deficient at term (Fig. I). In the Malays the mean serum folate levels was 5.0 ± 3.6 ng/ml and the percentage of folate deficient subjects was 60 percent (45 of 104). (Fig. I). The cord serum folate levels in the Malay group were significantly ($P < 0.005$) higher in all the subjects studied with a mean of 22.4 ± 14.5 ng/ml.

With regard to RBC folate levels (Table II), the mean level in the Malay mothers was 301.4 ± 211.4; of a total of 71 mothers, 30 (40.7 percent)

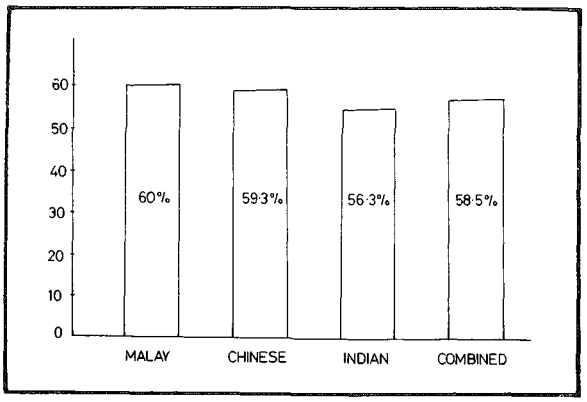

Fig. 1 Percent serum folate deficient mothers in the Malaysian population (< 5.0 ng/ml) at parturition

TABLE II
RED BLOOD CELL FOLATE LEVELS IN NORMAL HEALTHY INDIVIDUALS AT PARTURITION IN THE VARIOUS ETHNIC GROUPS IN MALAYSIA

	CONTROLS	AT PARTURITION				
	♂AND ♀ COMBINED	MALAY	CHINESE	INDIAN	COMBINED	CORD COMBINED
Mean ± 1 SD (ng/ml)	347·8 ± 141·6	301·4 ± 211·4	379·1 ± 261·8	337·5 ± 217·1	338·4 ± 227·5	569·6 ± 444·2
Range	146·0 - 839·1	83·8 - 758·9	70·0 - 845·2	114·2 - 840·6	70·0 - 845·2	91·0 - 1408·9
n	79	30	21	20	71	7
't' Test					(P<0·05)	

Malay mothers were deficient (Fig. 2) in RBC folate levels — below 160 ng/ml being considered deficient.

The Chinese mothers (21) had mean RBC folate level of 379.1 ± 261.8 ng/ml while in the Indian mothers (20) it was 337.5 ± 217.1 ng/ml. The percentage of RBC folate deficient mothers in these two groups were 23.8 and 30 percent respectively.

When the whole population is considered as a single group the percentage of RBC folate deficient mothers was 32.4 percent, with a mean of 338.4 ± 227.5 ng/ml. The levels of cord RBC folate was significantly higher ($P < 0.05$) than the maternal RBC folate levels with a mean of 569.6 ± 444.3.

The vit.B_{12} levels are within the normal range in all the subjects studied (Table III) with a mean of 382.7 ± 103.3 pg/ml. The cord vit.B_{12} was significantly higher ($P < 0.02$) with a mean of 546.8 ± 218.0 pg/ml. None of the mothers studied had vit.B_{12} deficiency.

TABLE III
VITAMIN B 12 LEVELS IN NORMAL HEALTHY FEMALES AT PARTURITION IN MALAYSIAN WOMEN AND CORD BLOOD

	CONTROL (a)	MATERNAL BLOOD AT PARTURITION (b)	CORD BLOOD (b)
Mean ± 1 SD	372·2 ± 96·1	370·4 ± 114·7	496·6 ± 188·7
Range	216·0 - 718·0	195·0 - 691·0	351·8 - 975·0
n	105	14	9
't' Test	(P > 0·5)		(P<0·02)

(a) Method used: Lau et al., 1965.
(b) Method used: Anderson, 1964.

Table IV and V show the results of other blood parameters. With regard to maternal haemoglobin levels of 187 mothers, (Table IV), 59 (5.1 percent) Chinese mothers had levels below 10.5 g/dl; with the proportion among the 79 Malays and 49 Indians being 20.3 and 30.6 percent respectively (Fig. 3).

With regard to other blood parameters, the hematocrit, mean corpuscular volume and reticulocyte counts were all elevated in the cord blood compared to the maternal blood levels, while the maternal blood levels of these parameters were reduced compared to the controls.

The birthweight of infants was mostly normal in the Malays and Chinese although a few were below 2.5 kgs (Table VI). The incidence of low birthweight was highest in the Indians. Twenty percent of the infants born to the Indians mothers studied were below 2.5 kgs. There is no correlation between birthweight and folate status at term observed in the population studied.

DISCUSSION

It is apparent that low serum folate levels are common in the Malaysian pregnant population. In the population studied 58.5 percent of the pregnant mothers had low serum folate levels at term. Low tissue folate level occurs in 30 percent of the pregnant population studied. In contrast vit.B_{12} deficiency does not occur, but the number of subjects studied was small. A significant positive correlation exists between the maternal and cord serum folate levels (Fig. 4) which suggest that the availability of folate to the fetus is dependant on the folate levels in the maternal circulation. The cord levels of both folate and vit.B_{12} were significantly higher than the maternal blood levels, suggesting that these vitamins are actively transported to the fetus,

TABLE IV
HAEMOGLOBIN LEVELS IN NORMAL HEALTHY INDIVIDUALS AND AT PARTURITION IN CORD AND MATERNAL BLOOD

	Controls		All races combined	
	Males	Females	MB	CB
Mean ± 1 SD (g/dl)	16·1 ± 1·3	14·3 ± 1·3	11·4 ± 1·3	14·4 ± 1·5
Range	12·2 - 17·9	11·4 - 17·8	6·5 - 14·6	11·2 - 18·5
n	67	48	191	35
't' Test	(P<0·005)		(P< 0·02)	

	Malay		Chinese		Indian	
	MB	CB	MB	CB	MB	CB
Mean ± 1 SD (g/dl)	11·3 ± 1·3	14·3 ± 1·5	11·7 ± 1·0	14·3 ± 2·9	11·1 ± 1·5	14·6 ± 1·2
Range	7·3 - 13·2	11·7 - 16·4	9·8 - 13·7	13·2 - 15·7	6·5 - 13·8	12·8 - 16·0
n	79	14	59	8	49	8
't' Test	(P < 0·005)	(P < 0·1)	(P < 0·5)	(P < 0·5)	(P<0·005)	

MB = maternal blood
CB = cord blood

TABLE V
HEMATOCRIT, MEAN CORPUSCULAR VOLUME AND RETICULOCYTE COUNTS IN NORMAL HEALTHY INDIVIDUALS AND AT PARTURITION IN CORD AND MATERNAL BLOOD

	Controls					
	Hematocrit %		mcv		Reticulocyte counts	
	Males	Females	Males	Females	Males	Females
Mean ± 1 SD	43·9 ± 5·2	40·4 ± 5·5	84·8 ± 5·8	90·3 ± 9·4		0·3824
Range	33 - 57	17·4 - 49·6	72 - 99	67 - 109	-	0·2 - 1·0
n	73	39	73	39		34

	At parturition					
	Hematocrit		mcv		Reticulocyte counts	
	MB	CB	MB	CB	MB	CB
Mean ± 1 SD	36 ± 3·7	45·5 ± 4·0	91·2 ± 6·0	92·6 ± 0·5	2·2 ± 1·1	5·6 ± 2·2
Range	21 - 44	37 - 57	90·0-92·5	91·5 - 94	0·2 - 8·0	2·0 - 10·0
n	190	34	193	33	188	33

mcv = mean corpuscular volume
MB = maternal blood
CB = cord blood

as movement of these two vitamins to the fetus across the placenta occurs against a concentration gradient. This mechanism would ensure adequate supply of folate to the fetus even in maternal folate deficiency. Similar observations have been made with regard to serum iron. [10]

No correlation between infant birthweight and serum or RBC folate levels at term was observed. The Indian mothers with the lowest incidence of tissue folate deficiency show the highest incidence of low birthweight infants of 20 percent. Thus our findings are not in agreement with those of Baumslag *et. al,* [1] and Iyenger and Rajalakshmi. [2] No obvious congenital malformations were observed even in the infants born to severely folate deficient mothers.

There were some differences observed amongst the three ethnic groups studied. Incidence of low birthweight appears to be highest in the Indians at 20 percent while in the Malays and Chinese it was 8.5 and 7.4 percent respectively. Similarly low haemoglobin levels are commonest amongst the Indians at 30.6 percent followed by the Malays at 20.3 percent; amongst the Chinese mothers only 5.1 percent had low haemoglobin levels. The reason for this difference is not clear. With regard to serum folate levels there were only slight differences between the three ethnic groups (Fig. I) but the incidence of RBC folate deficiency is highest among the Malays at 40.7 percent, while in the Chinese and Indians it was 30 and 23.8 percent respectively. No obvious correlation exists between haemoglobin levels and folate status. The reason for these discrepancies can only be brought to light by a carefully monitored nutritional survey.

CONCLUSION

Folate deficiency appears to be common in the Malaysian pregnant mothers studied but vit.B_{12} deficiency appears to be rare. The transport mechanism of folate and vit.B_{12} across the placenta is probably an active process that ensures

TABLE VI
BIRTHWEIGHT IN THE VARIOUS ETHNIC GROUPS OF MALAYSIA

	MALAY	CHINESE	INDIAN
Mean ± 1 SD	3·1 ± 0·5 kg	3·2 ± 0·5 kg	3·0 ± 0·6 kg
Range	2·2 - 4·6	2·2 - 4·5	1·7 - 4·4
% < 2·5 kg	8·5 %	7·4 %	20 %
n	71	54	45
't' Test	(P < 0·5)		

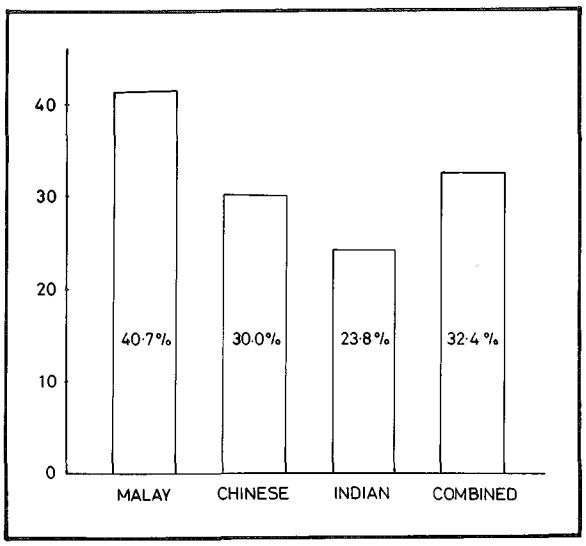

Fig. 2 Percent red blood cell folate deficient mothers at parturition in the Malaysian population. (< 160 ng / ml.)

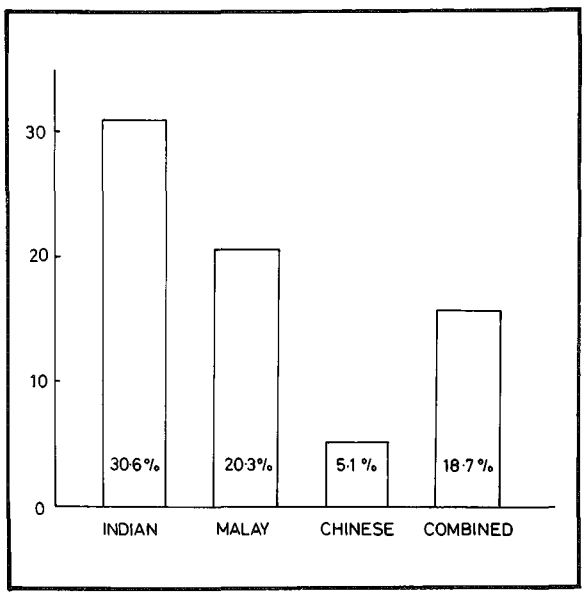

Fig. 3 Percent haemoglobin deficient mothers at parturition in the Malaysian population. (< 10.5 g / dl.)

adequate supply of these vitamins to the fetus even in maternal deficiency states. Variations with regard to the various parameters studied in the three ethnic groups are not clear; a separate nutritional study would be useful.

ACKNOWLEDGEMENT

This study was partly funded by the National Family Planning Board, Malaysia. We are grateful to Ragunathan T., Shamsiah Kassim and to the staff of Haematology Division, Institute for Medical Research, Kuala Lumpur, Malaysia. We are indebted to Halimah Abas for typing this manuscript.

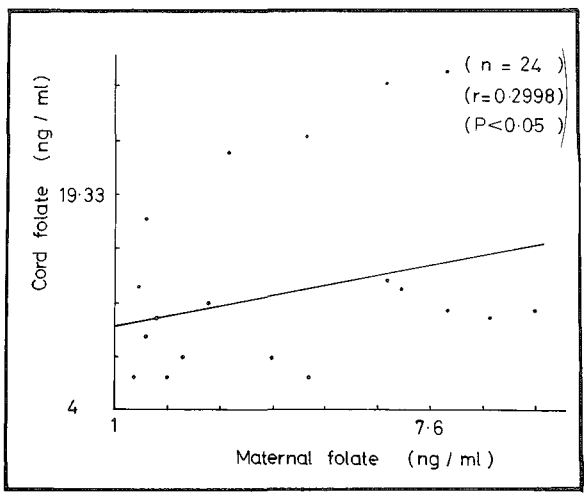

Fig. 4 Correlation between maternal and cord folate levels at parturition in the Malaysian population.

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