

A PRELIMINARY STUDY OF PLASMA ESTRIOL LEVELS IN MALAYSIAN PREGNANCIES

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INTRODUCTION

THE USE OF urinary estriol in the monitoring of the fetus-in-utero is well established (Klopper, 1968). However, certain practical disadvantages exist with this method which can be overcome by plasma measurements (Biggs, 1975). The use of a radio-immunoassay kit in the measurement of plasma estriol is sufficiently simple for use in a small establishment (Craig, 1976).

The study of plasma estriol levels in normal pregnancy using radio-immunoassay has been well documented (Shearman *et al.*, 1972; Masson, 1973; Biggs *et al.*, 1975; Chew *et al.*, 1976). However, very little emphasis has been made on the quantitative values of plasma estriol in different ethnic groups within the same community. This study aims to investigate the plasma estriol levels of normal pregnant mothers amongst the Chinese, Malay and Indian patients in the University Hospital, University of Malaya, Kuala Lumpur.

METHOD

All normal pregnancies in their second trimester, attending the ante-natal clinic for the first time from the 1.1.1977 to the 31.7.1977 were approached to be volunteers for this study. All patients had regular cycles varying between 28 to 35 days, and were sure of the dates of their last period. They were followed up fortnightly until the 36th week and weekly until delivery by two of the authors (Fong and Yusof).

Venopunctures were made fortnightly to withdraw 3 mls. of blood between 9.00 a.m. and 11.30 a.m.

The blood samples were collected in heparinised tubes and immediately centrifuged. The plasma obtained were then stored at -20°C until assay.

The plasma samples from 20 patients of each of the 3 ethnic groups (i.e. Chinese, Malay and Indian) were assayed for this preliminary report. The number of samples from each patient varied between one and ten. A total of 239 samples were assayed. There were altogether 18 primigravid and 42 multiparous patients. All had normal vaginal deliveries of a single healthy infant within the normal weight range for the community (Yusof and Sinnathuray, 1976).

The characteristics of the patients in the three different ethnic groups are shown in Table VIA and VIB.

The assay was carried out by kits purchased from the Radiochemical Centre, Amersham, United Kingdom.

A small sample of plasma is first incubated with an enzyme solution containing a mixture of glucuronidase and sulphatase enzymes. The conjugates of estriol in the samples are hydrolysed during the incubation and estriol is released. The total amount of estriol, including that liberated by the hydrolysis is then determined in aliquots of the hydrolysed samples using a radio-immunoassay method.

In the radio-immunoassay procedure, estriol is allowed to compete with ^{125}I -labelled estriol for the binding sites on a specific anti-estriol antibody. The antibody-bound ^{125}I -labelled estriol is separated

by precipitation with an ammonium sulphate solution. After centrifugation and removal of the supernatant solution the precipitated radioactivity is measured in a Pickard Compact Scaler gamma counter.

RESULTS

The mean plasma estriol levels of mothers in each ethnic group by gestational age are shown in Tables I – IV.

The mean plasma estriol levels of mothers in the three ethnic groups show three different patterns (Fig. 1). The Chinese mothers had the highest, while the Indian mothers had the lowest levels.

Table I

Mean plasma estriol (E₃) in normal pregnancy (Malay)

Gestation in weeks	Number of Estimations	Mean in Nanogram per ml	Standard Deviation
30 – 31	13	71.7692	34.2276
32 – 33	12	102.1667	40.1040
34 – 35	14	116.5714	59.6473
36 – 37	20	148.5500	75.0421
38 – 39	15	209.2667	92.0019
40 – 41	6	236.3333	66.0717

Table II

Mean plasma estriol (E₃) in normal pregnancy (Chinese)

Gestation in weeks	Number of Estimations	Mean in Nanogram per ml	Standard Deviation
30 – 31	9	88.333	25.5147
32 – 33	13	145.5385	99.2880
34 – 35	16	172.9375	101.9160
36 – 37	14	217.3571	139.0305
38 – 39	15	252.9333	111.4114
40 – 41	8	166.3750	79.0803

At term (i.e. between 38 – 40 weeks of gestation) the mean plasma estriol levels in Chinese mothers were 230.9 ng/ml.; Malay mothers 218.6 ng/ml.;

Table III

Mean plasma estriol (E₃) in normal pregnancy (Indians)

Gestation in weeks	Number of Estimations	Mean in Nanogram per ml	Standard Deviation
30 – 31	14	83.0714	25.8709
32 – 33	14	88.7857	37.9680
34 – 35	14	100.7143	43.3775
36 – 37	22	134.9545	44.4602
38 – 39	10	160.6000	54.6915
40 – 41	10	160.0000	67.5475

Table IV

Mean plasma estriol (E₃) in normal pregnancy (all races)

Gestation in weeks	Number of Estimations	Mean in Nanogram per ml	Standard Deviation
30 – 31	36	80.3056	29.0820
32 – 33	39	111.8205	68.4520
34 – 35	44	132.0227	79.2941
36 – 37	56	160.4107	91.6773
38 – 39	40	213.4750	97.5040
40 – 41	24	181.2083	75.5150

PLASMA OESTRIOL (E₃) PATTERN OF MALAYSIAN WOMEN (Chinese, Malay, Indian)

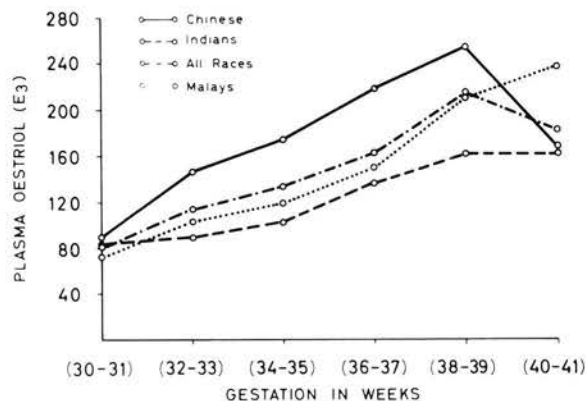


Fig. 1. Plasma estriol (E₃) pattern of Malaysian women (Chinese, Malay, Indian).

and Indian mothers 154.0 ng/ml. (Tables VA and VB). It can be seen that there is a significant difference in the mean plasma estriol levels at term between the Chinese and the Indians as well as between the Malays, and the Indians but not between the Chinese and the Malays.

Table V(a)

Plasma estriol (E3) at term among the three ethnic groups (Chinese, Malay and Indian)

Ethnic Group	Mean plasma estriol (E3) values at term (x)	Standard Deviation	Number of Estimation (N)
Chinese	230.9000	110.1205	20
Malay	218.6842	87.8294	19
Indian	154.0000	58.1584	16

DISCUSSION

In this study it has been shown that the mean plasma estriol levels in mothers of all ethnic groups rose steadily from 30 weeks to 38 weeks of gestation. This pattern is similar to that reported for Caucasians (Masson, 1973) and Asians (Chew *et al.*, 1976). Our average values were comparable to those obtained with radio-immunoassay in a Caucasian population (Masson, 1973) who used the method of Gurpide *et al.*, 1971, but were slightly lower than those obtained in an Asian population (Chew *et al.*, 1976) who used the method of Wilson, 1973. This difference could be due to differences in methodology.

It may be too early at this stage to conclude that there are three significant patterns in the mean plasma estriol levels in mothers of the three ethnic groups. It has been documented that the birth weights of babies born to mothers of the three main ethnic groups in Malaysia (i.e. Chinese, Malay and

Table VI(b)

Statistical comparison of biodata of the three ethnic groups (Chinese, Malay and Indian)

Biodata	Ethnic Comparison	df	t	P Value	= 0.05
Hb (gm/100 ml)	Chinese/Indian	38	0.3145	p > 0.10	
	Malay/Indian	38	0.3362	p > 0.10	
	Chinese/Malay	38	1.3294	p > 0.10	
Birth Wt. (Kilogram)	Chinese/Indian	38	0.2928	p > 0.10	
	Malay/Indian	38	1.6244	p > 0.10	
	Chinese/Malay	38	1.2422	p > 0.10	
Parity	Chinese/Indian	38	1.9424	0.10 > p > 0.05	
	Malay/Indian	38	0.2333	0.05 > p > 0.02	Sig.
	Chinese/Malay	38	1.9074	0.10 > p > 0.05	
Placenta Wt. (Gram)	Chinese/Indian	38	1.3821	p > 0.10	
	Malay/Indian	38	2.1648	0.05 > p > 0.02	Sig.
	Chinese/Malay	38	3.2984	0.01 > p > 0.001	Highly Sig.
Age	Chinese/Indian	38	0.7892	p > 0.10	
	Malay/Indian	38	0.1266	p > 0.10	
	Chinese/Malay	38	0.6257	p > 0.10	
Total Household Income	Chinese/Indian	38	0.7705	p > 0.10	
	Malay/Indian	38	0.4070	p > 0.10	
	Chinese/Malay	38	0.5080	p > 0.10	

Table VI(a)
Biodata of the three ethnic groups (Chinese, Malay and Indian)

Ethnic Groups Biodata	Chinese			Malay			Indian		
	x	S.D.	n	x	S.D.	n	x	S.D.	n
Hb (gm/100 ml)	10.4150	0.8331	20	10.7250	0.6273	20	10.3100	1.2392	20
Birth wt. (Kilogram)	3.1600	0.3500	20	3.3000	0.3627	20	3.1300	0.2958	20
Parity	0.7500	0.9105	20	1.5000	1.5444	20	1.4000	1.1877	20
Placenta Wt. (Gram)	522.5000	138.9386	20	605.5000	103.9977	20	577.2500	109.9219	20
Age at Interview	26.2500	3.8916	20	25.3500	5.1224	20	25.1500	4.8696	20
Total Household Cash income	627.0000	748.1774	20	531.2000	389.2677	20	478.7500	424.9423	20

Table V(b)
Statistical comparison of plasma estriol at term between Chinese, Malay and Indian

Ethnic comparison	df	t	P value	= 0.05
Chinese/Indian	34	2.5213	0.02 > p > 0.01	SIG.
Malay/Indian	33	2.5151	0.02 > p > 0.01	SIG.
Chinese/Malay	37	0.3817	p > 0.1	NOT SIG.

Indian) are different (Yusof and Sinnathuray, 1976). As there is a possible correlation between birth weight and maternal plasma estriol levels (Coyle and Brown, 1963; Baling, 1967; Chew *et al.*, 1976) it may not be too surprising that a significant difference may exist between the mean plasma estriol levels in mothers of the different ethnic groups.

The patients in the three ethnic groups were well matched except for parity. However, it is unlikely that this is an important factor accounting for the differences observed. This can be seen by the studies of Masson (1973) and Chew *et al.* (1976) who have shown that no difference in plasma estriol levels exist between primigravid and multiparous patients.

SUMMARY

Serial levels of total plasma estriol from 60 normal pregnant patients were measured by a simple radio-immunological method. It was found that the mean estriol values increased from about 80 ng/ml. at 30 weeks gestation to about 240 ng/ml. at term.

A significant relationship was found between the mean estriol levels at term in mothers of the different ethnic groups under study, matched for age, socio-economic group and birth weight.

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REFERENCES

- Baling, C.G. (1967): Estriol Excretion in Pregnancy and its Application to Clinical Problems, *Adv. Obstet. Gynecol.*, **Vol. 1**, 88-102.
- Biggs, J.S.G. (1975): Progress in Fetal Assessment, *Obstet. Gynecol.*, **45**, 227-233.
- Boulle, P. (1968): A Comparison of the Oestrogen Excretion During Normal Pregnancy in the Racial Groups of Durban, *S. Afr. Med. J.*, **42**, 13-15.
- Chew, P.C.T., Ratnam, S.S., and Salmon, J.A. (1976): Plasma Oestriol in Normal Pregnancy in the Asian Population, *Br. J. Obstet. Gynaecol.*, **83**, 430-433.
- Coyle, M.G., and Brown, J.B. (1963): Urinary Excretion of Oestriol during Pregnancy, *J. Obstet. Gynaecol. Br. Commonw.*, **70**, 225-231.
- Craig, A. (1976): A Simple Radioimmunological Method for the Determination of Plasma Total Oestriol During Pregnancy, *Clin. Chim. Acta*, **68**, 277-286.
- Gurpide, E., Giebehain, M., Tseng, L., and Kelly, W.G. (1971): Radioimmunoassay for Estrogens in Human Pregnancy Urine, Plasma, and Amniotic Fluid, *Am. J. Obstet. Gynaecol.*, **109**, 897-906.

- Klopper, A.I. (1968): The Assessment of Feto-Placental Function by Estriol Assay, *Obstet. Gynaecol. Surv.*, **23**, 813-838.
- Masson, G.M. (1973): Plasma Oestriol Concentration during Normal Pregnancy, *J. Obstet. Gynaecol. Br. Commonw.*, **80**, 201-205.
- Shearman, R.P., Jool, M.D., and Smith, I.D. (1972): Maternal and Fetal Venous Plasma Steroids in relation to Parturition, *J. Obstet. Gynaecol. Br. Commonw.*, **79**, 212-215.
- Yusof, Z.A., and Yusof, K. (1974): Some Socio-Economic and Medical Aspects of Malay Mortality in Urban and Rural Areas, Kuala Lumpur. Malaysian Centre for Development Studies (Occasional paper No. 1) 52 p.
- Yusof, K., and Sinnathuray, T.A. (1976): Fetal Growth Patterns in Normal Malaysian Pregnancies, *Aust. N.Z. J. Obstet. Gynaecol.*, **16 No. 4**, 213-216.
- Wilson, G.R. (1973): Radioimmunoassay of Oestriol in Pregnancy Plasma, *Clin. Chim. Acta*, **46**, 297-304.
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