

URINARY EXCRETION OF ESTRIOL AND PREGNANEDIOL IN NORMAL PREGNANCY

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Introduction

It is known that estriol and pregnanediol are excreted in urine in large amounts during pregnancy by the placenta (Keller *et al*, 1959). Some investigators have stressed the importance of serial estriol determinations on 24 hours urine samples as an index of fetal well-being and placental function (Smith *et al*, 1966; Beischner, 1967 and Frandsen *et al*, 1960).

This study was undertaken with a view to determine the normal range of urinary estriol and pregnanediol levels in Indian women during different stages of normal pregnancy. These base line values could be of practical importance in prognosticating pregnancy outcome and the well-being of the fetus in high risk pregnancies.

Material and Methods

A group of clinically normal pregnant women aged between 25 to 40 years were selected for this study. Twenty-four hours urine samples were collected under refrigeration during the different weeks of

gestation and stored in aliquots in the deepfreezer until assessed.

Estriol was estimated by the method of Frandsen (1963). One hundredth volume of a 24-hours urine sample was taken. It was hydrolysed with concentrated hydrochloric acid and extracted with diethyl ether. The estriol was finally measured by using the Kober reaction at 480, 520 and 560 $m\mu$ (Kober, 1931; Brown, 1952).

Pregnanediol was estimated by the method of Astwood and Jones (1941). Fifty ml urine aliquot was refluxed with concentrated hydrochloric acid using toluene as the extraction solvent. The method of Bongiovanni and Clayton (1954) involving enzyme hydrolysis was used for gestations of less than 8 weeks. The hormone was finally measured by using the Talbot reaction at 390, 425 and 460 $m\mu$ (Talbot, 1941). Estriol and pregnanediol values were expressed in mg per 24-hours.

Creatinine estimated by the method of Folin (1914) was done on all the samples to determine whether the 24-hours urine collections were complete. The values were expressed in gm per 24-hours.

Results

This study was based on 200 urine samples collected during different stages of pregnancy.

Table I and Fig. 1 show that there is a

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TABLE I
Urinary Excretion of Estriol in mg/24 Hours during Different Weeks of Pregnancy

Pregnancy weeks	No. of cases	Estriol values		S.D.	S.E.	95% Confidence limit
		Range	Mean			
12	15	0.6-1.1	0.91	0.149	0.038	0.99-0.93
14	11	0.8-1.9	1.42	0.34	0.103	1.62-1.21
16	10	0.8-2.9	1.98	0.56	0.17	2.32-1.64
18	11	1.0-3.1	2.35	0.65	0.19	2.75-1.96
20	13	1.8-4.8	3.08	0.88	0.25	3.57-2.57
22	9	2.8-5.1	4.1	0.71	0.24	4.57-3.63
24	14	3.0-6.4	4.74	1.05	0.28	5.3 -4.18
26	14	5.0-7.0	5.97	0.59	0.16	6.19-5.66
28	15	5.8-8.6	7.66	0.69	0.18	8.0 -7.29
30	16	7.8-11.0	9.0	0.97	0.24	9.48-8.52
32	22	8.8-15.5	11.43	2.31	0.49	12.41-10.45
34	18	9.0-18.5	12.18	3.26	0.79	13.76-10.65
36	19	11.2-22.0	14.81	2.63	0.6	16.0 -13.61
38-40	13	13.0-23.0	16.1	2.2	0.61	17.29-14.87

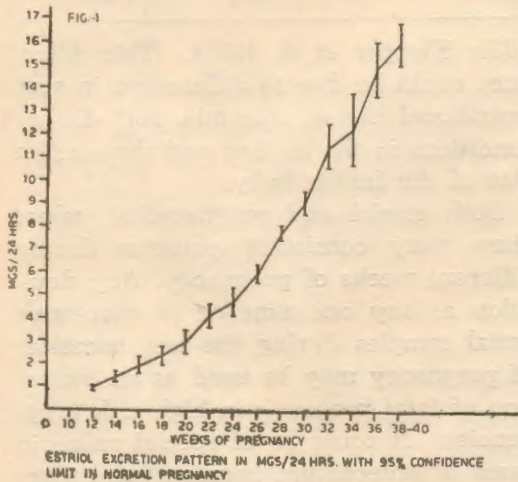
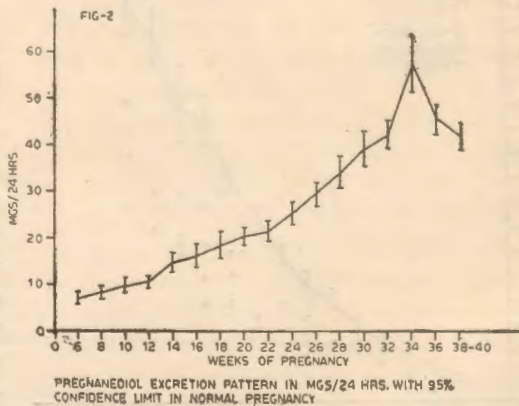


Table II and Fig. 2 show the mean values and the range of pregnanediol ex-



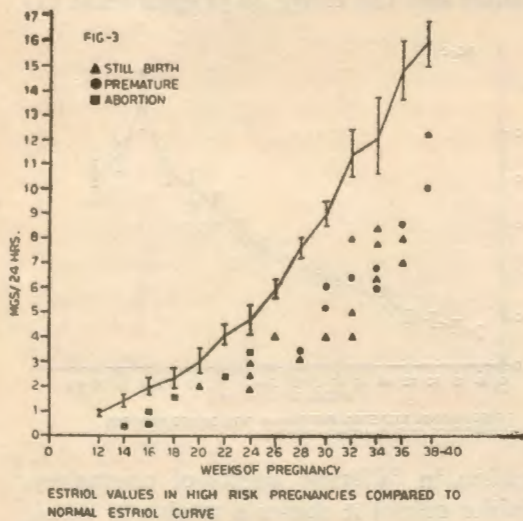
wide variation of estriol levels in different patients at the same stage of gestation. The mean of the values indicate that estriol excretion rose gradually during the early weeks but shows a sharp rise during the later weeks reaching maximum towards 38 to 40 weeks. Fig. 1 shows the mean values graphically with 95% confidence limits.

cretion in different weeks of pregnancy. Unlike estriol it shows a gradually rising curve which reaches its maximum at 34 weeks and then declines around 36 weeks to term. Fig. 2 represents the same results in a graphic manner showing the mean pregnancy value with 95% confidence limits.

Fig. 3 shows lower estriol values in high risk pregnancy cases.

TABLE II
Urinary Excretion of Pregnanediol in mg/24 Hours during Different Weeks of Pregnancy

Preg-nancy weeks	No. of cases	Pregnanediol range	Values Mean	S.D.	S.E.	95% Confidence limit
6	5	5.2-9.2	7.02	1.32	0.59	8.2-5.84
8	11	6.0-12.0	8.15	1.85	0.56	9.23-7.03
10	13	6.6-14.5	9.75	2.63	0.72	11.2-8.3
12	14	8.0-16.8	10.5	2.5	0.66	11.8-9.2
14	7	11.2-18.8	14.6	2.58	0.98	16.5-12.6
16	6	12.0-21.2	16.11	3.37	1.38	18.8-13.36
18	5	15.3-23.0	18.44	3.2	1.42	21.3-15.6
20	13	17.2-26.2	20.14	3.67	1.02	22.2-18.1
22	14	18.0-29.9	21.27	3.92	1.05	23.36-19.18
24	13	19.9-32.5	25.15	4.2	1.16	27.48-22.8
26	13	22.0-35.0	29.3	4.5	1.24	31.8-26.8
28	11	27.0-43.1	33.85	5.49	1.66	37.16-30.5
30	7	33.4-48.0	39.1	5.01	1.89	42.8-35.2
32	18	35.0-58.8	41.95	6.49	1.53	45.0-38.9
34	17	41.0-89.5	57.18	12.7	3.09	63.4-51.0
36	21	36.5-64.5	45.19	7.13	1.56	48.3-42.1
38-40	12	33.0-49.2	41.53	5.05	1.59	44.7-38.4



Discussion

The results indicate that estriol and pregnanediol follow an excretion pattern similar to that described by Wakhaloo and Dhall (1966) from India but the values seem lower than those in Western women (Frandsen, 1963; Shearman,

1959; Klopper *et al*, 1963). This difference could be due to differences in size, nutritional status, anaemia and dietary conditions in the mother and the smaller size of the Indian baby.

Both estriol and pregnanediol values show very consistent patterns during different weeks of pregnancy. Any deviation at any one time or in successive serial samples during the last trimester of pregnancy may be used as an indication of fetal prognosis in high risk pregnancies. It could be of special value in cases of antepartum haemorrhage, toxemia, premature labour and postmaturity. It could thus help the clinician in deciding on the optimal time for interference by operative measures in abnormal pregnancies and thereby improving fetal survival in such cases. Significantly low estriol values were seen in cases of stillbirth, premature labour and abortion (Fig. 3).

An attempt was made to relate fetal weight to estriol values at term in 34

cases. The birth weight of the babies varied from 1.4 kg. to 3.6 kg., the mean being 2.47 kg. which is normal for this country. In cases where the baby weight was less than 1.8 kg, the estriol values at 32-34 weeks of gestation were lower than the minimal accepted values for that period of gestation. Two still-births were reported in this series and in retrospect it was found that estriol values at term were about a third of the minimum values. Thus, lower estriol values might be an indicator of fetal risk and prognosis and if carried out as a routine, might forewarn the obstetrician and help in better management of high risk pregnancies.

Serial weekly estimations of pregnanediol during the later months of pregnancy may help the clinician in predicting the onset of labour because of the fall in levels occurring around 34-36 weeks.

Summary

This study was undertaken to establish and normal range of urinary estriol and pregnanediol in 24 hours urine in Indian women during different weeks of normal gestation. These baseline values could be of practical importance in prognosticating the pregnancy outcome in abnormal pregnancies.

The values obtained in this study seem to be lower than those reported by Western workers. This discrepancy could be due to difference in size, nutritional status, dietary conditions of the mother and smaller size of the Indian baby. Serial weekly estimation of this parameters are likely to be more infor-

mative than a single estimation at any one time.

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