# Albumin concentration in human amniotic fluid from normal pregnancies

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The present study is an attempt to estimate the albumin concentration in the human amniotic fluid of normal pregnancy. The study has been conducted from 12th to 20th week and from 30th to 43rd weeks of gestation. The results revealed a characteristic gestational profile with an increase in the concentration with the advancement of pregnancy from the 12th till the 20th week and an inverse relationship between the albumin level and the gestational age after the 30th week till term. The relationship between the albumin levels and the order of pregnancy indicated that the albumin concentration was not influenced by the birth order.

#### INTRODUCTION

The amniotic fluid has increasingly been used to study the health status of the developing fetus. The investigation of the biochemical components of amniotic fluid has proved to be of importance in the prenatal diagnosis of certain congenital disorders where the underlying defect is a deficiency or elevation of the specific metabolite. Hence, it is essential to establish the normal values of the constituents of the amniotic fluid to understand the developmental changes which would then facilitate the assessment of the fetal well being at different periods of gestation. Total proteins in the amniotic fluid have been widely studied at different gestations. The results of total proteins [14] and protein fractions  $(\alpha_1, \alpha_2, \beta, \gamma$ -globulins) [15], amongst Indians, during normal pregnancy, have been dealt with elsewhere. However, only some studies have been conducted on the albumin fraction of the amniotic fluid protein and the results presented show a wide range of variation [1, 5, 6, 8, 9, 11]. The albumin is known to constitute the most abundant fraction, forming about 60 to 70% of the amniotic fluid during different phases of pregnancy. It is considered to be the main carrier of bilirubin in the amniotic fluid [10, 17].

Though the albumin concentration in the amniotic fluid has been studied in Indians, there is paucity of information on the albumin concentration at each gestational week. The results reported have been pooled for a wide range of gestational weeks [9]. The present study is, thus, an attempt to understand the developmental changes of the albumin fraction of the amniotic fluid protein from normal pregnancies. This would also help establish the normal range of concentration of albumin amongst Indians; these normal values would be a unit of reference for the assessment of abnormal levels in the amniotic fluid.

## MATERIAL AND METHODS

The present study was conducted on the amniotic fluid samples obtained during normal pregnancy, from the hospitals of Delhi. A total of about 250 amniotic fluid samples were collected and the samples contaminated with blood or meconium were excluded from the series. The samples were collected at different gestational weeks, from 12 to 20 weeks (from patients undergoing medical termination of pregnancy, M.T.P.) and from 30 to 43 weeks (through amniocentesis or artificial rupture of membrane, A.R.M.), with a few samples from 24 weeks' gestation. However, samples from 21st to 29th week of gestation (except the 24th week) could not be obtained for ethical reasons. Patients with obstetrical complications were not included in the study. Relevant information regarding each patient's history was also collected.

For the qualitative study of albumin, the amniotic fluid samples were subjected to polyaerylamide disc electrophoresis [3, 12].

The total albumin concentration was estimated using the diagnostic kit (CSIR Centre for Biochemicals, New Delhi) [4, 13]. The absorbance of the solution was read at 628 nm on Spectronic 20 (Bausch and Lomb) and the albumin content was estimated using a reference standard.

## RESULTS

The albumin fraction was distinctly revealed, through disc electrophoresis, as a broad and intensely stained band throughout pregnancy. However, in the pre-albumin region some samples exhibited one to two fine bands. Three cases, each from 16th and 18th week showed a fine band in the prealbumin region. At the 20th week of gestation, only one sample had one band and another showed two fine bands. During later pregnancy (30 to 43 weeks), only two samples (one each of 35 weeks and 37 weeks) exhibited a band in the pre-albumin region.

The results of the mean albumin content at each gestational week are



FIG. 1. Mean albumin levels during pregnancy

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Gestation (weeks)	Range mg/100 ml	$\begin{array}{c} \text{Mean} \\ \text{mg/100} \pm \text{S.D.} \end{array}$
12	950.00 - 168.50	$133.75 \pm 31.18$
13	101.95 - 204.01	$147.22 \pm 42.45$
14	107.21 - 245.59	$165.72 \pm 43.88$
15	116.36 - 262.62	$179.99 \pm 48.21$
16	120.38 - 297.11	$202.34 \pm 39.13$
17	124.48 - 325.31	$241.65 \pm 65.20$
18	136.77 - 343.65	$249.48 \pm 58.20$
19	156.25 - 363.18	$272.44 \pm 58.83$
20	197.92 - 388.17	$300.20 \pm 38.88$
24	332.79 - 472.32	$415.55 \pm 54.74$
30	207.00 - 257.78	$232.39 \pm 25.39$
31	184.68 - 236.53	$206.91 \pm 21.79$
32	168.56 - 223.82	$185.09 \pm 22.59$
33	146.69 - 188.63	$167.66 \pm 20.97$
34	120.25 - 172.41	$148.97 \pm 17.64$
35	109.09 - 166.21	$138.16 \pm 20.86$
36	103.04 - 161.77	$131.91 \pm 16.09$
37	98.77 - 154.01	$128.98 \pm 18.64$
38	84.10 - 148.31	$116.86 \pm 15.24$
39	76.58 - 139.48	$109.47 \pm 25.75$
40	65.34 - 130.52	$105.62 \pm 19.69$
41	91.84 - 121.82	$106.84 \pm 14.99$
42		107.70
43		106.81

Mean values and standard deviation for the albumin levels

presented in Table I. It is evident from the results that the mean albumin levels exhibit a characteristic gestational profile (Fig. 1). At the 12th week, the mean level of 133.75 mg/100 ml increased to 179.99 mg/100 ml by the 15th week. From the 16th week to the 20th week, the albumin content further increased from 202.34 mg/100 ml to 300.20 mg/100 ml; the peak level being attained at 24th week of gestation (415.55 mg/100 ml).

During later pregnancy, the albumin content exhibited a decline from 232.39 mg/100 ml at the 30th week to 131.91 mg/100 ml at the 36th week of gestation. At 40 weeks, the level further decreased to 105.62 mg/100 ml. The steady increase in mean albumin content with respect to early gestation (12th to 20th week) and a decline during later pregnancy (30th till the 40th week) was further corroborated by the regression analysis (Y == -140.58 + 21.82X for 12 to 20 weeks; Y = 535.43 - 11.01X for 30 to 40 weeks). Thus, confirming an increase in the concentration with the advancement of pregnancy till the 20th week and an inverse relationship between the albumin level and the gestational age after the 30th week.

A wide range of variation has been observed in the albumin concentration during early gestation (12 to 24 weeks) (Table I). The albumin content at the 12th week ranges between 95.00 mg/ 100 ml and 168.50 mg/100 ml and was elevated considerably to a range of

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Gestational period weeks	No. of samples	Range mg/100 ml	$\begin{array}{c} \text{Mean} \\ \text{mg/100 ml} \pm \text{S.D.} \end{array}$
12 - 14	13	95.00 - 245.59	$151.61 \pm 42.40$
15 - 17	27	116.36 - 325.31	$205.48\pm50.50$
18 - 20	40	136.77 - 388.17	$274.91 \pm 56.15$
24	4	332.79 - 472.32	$415.55 \pm 54.74$
30 - 32	9	168.56 - 257.78	$202.87 \pm 29.46$
33 - 35	13	109.09 - 188.63	$146.85 \pm 22.17$
36 - 38	27	84.10 - 161.77	$124.68 \pm 17.70$
39 - 40	13	65.34 - 139.48	$106.50 \pm 21.31$
41 - 43	4	91.84 - 121.82	$107.04 \pm 10.60$

Distribution of albumin content at different gestational periods

120.38 mg/100 ml and 297.11 mg/100 ml during the 16th week. At the 20th week, a very wide range, that is, from 197.92 mg to 388.17 mg/100 ml, was observed. After the 30th week of gestation, this range narrows with the advancement of pregnancy and continued till term. By the 30th week, the range was 184.64 mg/100 ml to 236.53 mg/100 ml and at term (40 weeks), it was further reduced, varying between 65.34 mg/100 ml and 130.52 mg/100 ml.

A few post-mature cases in the present series showed a slight increase in the mean albumin levels (107.04 mg/100 ml) compared to those of the term patients (106.50 mg/100 ml) (Table II).

# Albumin content in relation to the order of pregnancy

The relationship between the albumin levels and the order of pregnancy was estimated through regression analysis. The analysis was performed on the amniotic fluid obtained during 30 to 40 weeks' gestation for two groups namely gravidae I & II (Y = 531.87 - 11.06X) and gravidae >III (Y = 516.65–10.19X). The two equations gave a similar slope of regression (Fig. 2) with nearly no statistically significant difference between them  $(t_s = 0.46; 0.70 > p >$ > 0.60). This indicated that the albumin level, during later pregnancy, was not influenced by the birth order.



FIG. 2. Linear regression for albumin content with respect to birth order

# DISCUSSION

The distribution of albumin levels exhibits an increase in the early pregnancy and a decrease during the last trimester [1, 6, 8, 11]. A similar trend has been revealed by the total albumin content of the amniotic fluid in the present series (Table I). The comparison of the albumin levels in the present study with that of other studies [1, 6, 8] also indicates a similar gestational profile. However, they have demonstrated slightly higher values for albumin than those observed in the present series. These differences in values could probably be due to the different techniques adopted for the estimation of albumin concentration. Comparison of the present study is limited to these investigations as there are no other reports available.

A high protein level in severe and mild cases of erythroblastosis has been reported, which is thought to be probably due to high bilirubin content; as bilirubin in amniotic fluid is bound to albumin [17]. It has been suggested that elevated protein levels may have a protective influence against the effects of isoimmunization [7]. There is evidence that prealbumin determinations are valuable in assessing prolonged pregnancies [16]. Another study reported higher concentrations of albumin in the amniotic fluid from patients with pregnancies complicated by an encephaly [2]. This was suggested to be probably due to leakage from fetal circulation in the exposed tissues of the anencephalic skull.

Hence, a characteristic gestational profile exhibited by the albumin content would be a helpful marker in the assessment of fetal maturity. The study of normal albumin concentration in the amniotic fluid would also be an important indicator in cases of fetal erythroblastosis and other abnormalities resulting in alterations in the levels. This would further facilitate the prenatal detection of certain fetal abnormalities and, thereby, result in a selective termination of a complicated pregnancy. It is possible to study such deviations only with respect to the normal standards as have been established in the present study.

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