

## Correlation of Combined Adrenal Weight to Body Weight in Indian Fetuses

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### Abstract

In this study, the combined adrenal weight is correlated to the total body weight in Indian Fetuses. In particular, this is useful to pathologists in diagnosis of conditions like congenial hypoplasia and congenial hyperplasia. One hundred Indian human fetuses between 12–38 gestation weeks were examined for combined adrenal weight and total body weight. Their total adrenal weight and body weight were measured and recorded. Subsequently, correlation between the two factors was established and the mean standard deviation was calculated. Finally, it is noted that when the ratio of combined adrenal weight to total body weight  $<0.001$ , congenial hypoplasia is diagnosed.

**Keywords:** Combined Adrenal Weight; Congenial Hypoplasia; Congenial Hyperplasia.

### Introduction

The prominence of adrenal glands in the fetuses and in new born infants has been recognized for almost two centuries [1,5]. During the fetal life, there is a remarkable increase in the size of the adrenal gland that is mainly attributed to the presence of fetal or provisional cortex present between the medulla and thin rim of permanent cortex [3,4,6]. The involution of the provisional cortex after birth and development and differentiation of permanent cortex into its three layers (Zona glomerulosa, Zona fasciculata, and Zona reticulosa) strongly suggests that fetal adrenal gland has special function in fetal life [7].

There is convincing evidence that the fetal adrenal cortex synthesizes a considerable part of the precursors for the estrogens that are eliminated in maternal urine during pregnancy [10]. The fetal adrenal cortex is one of the main users of placental progesterone in the synthesis of adrenocortical hormones [8]. Thus, enlargement of the glands reflects

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a steroidogenic activity.

In general, the variation in weight of a particular organ relative to body weight correlates with its state of physiological function [9].

### Materials and Methods

The study was carried out on a sample size of one hundred normal human fetuses in various stages of development. The fetuses were preserved by immediately injecting formalin into the abdominal cavity. Subsequently, they were immersed in formalin solution.



Fig. 1: Dissected fetus at 12–14 weeks



**Fig. 2:** Dissected fetus at 27–28 weeks

First, each fetus was weighed on a scale with graduation of up to 5 grams. Morphological parameters such as crown rump length, skull

circumference were also noted. Next, the fetuses were dissected and the adrenals were extracted. Finally using a dispensing weighing balance, the adrenals were weighed.

The following parameters were calculated after the extraction and weighing:

1. Ratio of total adrenal weight to body weight.
2. Mean and standard deviation of the above statistics.

Next, fetuses based on their gestational age are grouped in Table 1.

The body weight and combined adrenal weight of the fetuses are recorded in Table 2.

Subsequently, we calculate and record our results to prove a correlation of combined adrenal weight to body weight.

The ratio of combined adrenal weight to body weight is recorded in Table 3.

**Table 1:** Grouping of Fetuses based on their gestational week

Group No.	Gestational Age (Weeks)	No. of Fetuses
1	12–14	10
2	15–16	10
3	17–18	15
4	19–20	12
5	21–22	9
6	23–24	13
7	25–26	11
8	27–28	9
9	29–30	5
10	31–32	5

**Table 2:** Measurement of combined adrenal weight

Gestational Age (Weeks)	Body Weight (gms)	Combined Adrenal Weight (gms)
12–14	35.50	0.18
15–16	83.00	0.22
17–18	126.00	0.40
19–20	158.75	0.42
21–22	204.44	0.57
23–24	323.85	0.91
25–26	349.09	0.97
27–28	427.78	1.01
29–30	563.00	1.22
31–32	854.00	1.51

**Table 3:** Ratio of Combined Adrenal Weight to Body Weight

Body Weight	Ratio of Combined Adrenal Weight to Body Weight
35.50	0.0051
83.00	0.0027
126.00	0.0033
158.75	0.0026
204.44	0.0028
323.85	0.0033
349.09	0.0028
427.78	0.0024
563.00	0.0022
854.00	0.0018

**Table 4:** Increase in combined adrenal weight with respect to total body weight

Gestational Age (weeks)	Body weight in grams Mean Standard Deviation	Adrenal Gland Weight in grams M/SD		Combined adrenal weight in grams M/SD
		Right	Left	
12-14	35.50	0.09	0.09	0.18
	18.33	0.05	0.04	0.09
15-16	83.00	0.11	0.11	0.22
	22.63	0.07	0.07	0.14
17-18	126.00	0.19	0.21	0.41
	21.15	0.10	0.10	0.20
19-20	158.75	0.20	0.22	0.42
	30.61	0.07	0.10	0.17
21-22	204.44	0.29	0.28	0.57
	39.88	0.09	0.07	0.15
23-24	323.85	0.45	0.46	0.92
	55.83	0.18	0.17	0.34
25-26	349.09	0.46	0.51	0.97
	56.47	0.17	0.18	0.34
27-28	427.78	0.49	0.52	1.01
	85.85	0.16	0.21	0.35
29-30	563.00	0.61	0.61	1.22
	48.94	0.19	0.17	0.35
31-32	854.00	0.73	0.78	1.51
	138.31	0.22	0.23	0.44

## Results and Discussions

Based on the above calculations and observations, we derive the following results:

1. The body weight of the fetus increases with increase in the gestational age
2. A linear functional exists between combined adrenal weight and body weight.

From the calculations, it is evident that the ratio of combined adrenal weight to body weight is maximum at the age of 12–14 weeks when the body weight is 35.50 gms. The ratio of the combined adrenal weight to body weight subsequently decreases reaching a value of 0.0028 and remains constant (0.26–0.03) till body weight reaches the value of 349 at the gestational age 25–26 weeks, after which the ratio remains at 0.002.

## Conclusion

From the study, it is evident that the growth of the adrenal gland is highest at 12–14 weeks of gestational age. Here, we can see that the value of adrenal weight to relative body weight is highest. The growth of the adrenal gland subsequently declines; however, a linear function does exist between body weight and combined adrenal weight, i.e., as body weight increases, we note a corresponding increase in adrenal weight as well. However, after 25–26 weeks of gestational age, we see a decrease in adrenal weight

relative to body weight. The ratio of combined adrenal weight to body weight varies from 0.005 to 0.002 from 12–14 to 31–32 weeks of gestation. When the ratio of combined adrenal weight to body weight is less than 0.001, congenital hypoplasia is diagnosed.

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