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Changes in Body Weight in Pregnancy.

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Some 10 years ago, the senior author began a study of certain phases of the metabolism in normal pregnancy as a basis for a later comprehensive investigation of the toxæmias incident to this condition. Many of the measurements could demonstrate their real significance only if presented as relative values or changes, using convenient and easily ascertained biometric magnitudes as bases of reference. A case in point is the so-called basal metabolic rate, all of the usual prediction criteria involving some expression of the body weight in the formula used. A review of the literature disclosed a paucity of dependable recent observations of weight changes, and the few older records were incomplete. Single measurements on isolated cases are of little worth. Only continuous studies, both ante- and post-partum, on the same individual, are significant. This involved the continued cooperation on the part of the individual patient. In the present study the work has been carried out on this basis.

For the purposes of the entire investigation, subjects were drawn from 2 independent sources, group "A" from a prenatal out-patient service, supplemented by a few private cases, groups "B" and "C" from inmates of 2 nursing homes for unmarried mothers. The living conditions of the 2 major divisions thus represent the extremes of possible practice.

Normal, healthy individuals were selected initially and only those retained who maintained this condition throughout the period of study. Considerably more than 200 individuals were at least partially studied to yield the 77 that form the basis of this report.

The present paper will be devoted to the record of weight changes. Weights were taken at a uniform hour in the early morning, after emptying the bladder, with the patient nude and in a post-absorptive state (i. e. at least 12 hours after the last meal). No allowance could be made for variations in the amount of the intestinal contents. A standard precise, platform type of scale was used, the accuracy of which was checked at intervals. All measurements were made in duplicate and checked independently.

With a series of consecutive measurements on each individual patient, the weight changes are susceptible to a somewhat detailed analysis. See Table I.

TABLE I. *Weight Relations.*

Datum		A	Group B	C	Average or Total
Number of patients		25	21	31	77
Av. Period of Observation, A.P. (weeks)		21	8	14	15
Gain per week	High (kg.)	0.74	1.03	0.90	1.03
	Low "	0.15	0.02	0.15	0.02
	Average "	0.32	0.52	0.54	0.46
Weight, 1 week A. P.	High (kg.)	84.8	81.2	87.0	87.0
	Low "	53.4	48.4	49.8	48.4
	Average "	67.0	64.4	66.8	66.3
Weight, P. P.	High (kg.)	76.0	74.6	74.9	
	Low "	43.1	40.4	43.2	
	Average "	57.8	57.1	57.2	57.4
Average interval	(wks)	2	3.5	5	3.5
Total loss in weight	(kg.)	9.2	7.3	9.6	8.9
Weight of child.*	High (kg.)	4.32	4.09	4.04	4.32
	Low "	2.41	2.00	2.38	2.00
	Average "	3.31	3.20	3.28	3.27

* This is net weight of child alone. Placenta and other factors to be considered later.

Group "A" (from the Prenatal Clinic) shows a definitely smaller average gain per week than do the 2 institution series. That this cannot be ascribed entirely to more rapid weight increment in the later stages of the pregnancy is shown by the fact that Group "C," although averaging a period of study nearly twice that of the comparable Group "B," still has a slightly larger increase. Group "A" contained many multiparae; they were living at home, were responsible for the cares of households, and from the social status of the majority, probably under a somewhat less liberal dietary regimen than were the institutional group. Further, the latter, while they performed certain domestic duties, were certainly not as actively employed as were the housewives of Group "A." The point is stressed as it is one of the few real differences between the 2 major groups which this study has disclosed. With the limited data, 0.3 kilo to 0.6 kilo, may be offered as a first approximation of the average weekly weight change under varied conditions at least during the last 5 months of pregnancy. Individual fluctuations in this presumptively normal group fall well outside of these boundaries.

The level of protein utilization of the patient is indicated quantitatively by the total nitrogen output in a 24-hour collection of urine. Further, experience has shown that with adequate protein

ingestion, the remainder of the diet can safely be assumed to meet the needs of the individual. The converse does not hold since the subject with partial protein starvation may utilize a sufficient excess of fat and carbohydrate to produce and maintain a marked obesity. It has long been recognized that the pregnant woman stores protein, significantly in excess of the foetal requirement. In the present study, the average weekly total nitrogen output ante-partum ranged from 6.73 gm. to 9.64 gm. for 24 hours with a total average for the period of 8.03 gm.¹ While this is but slightly above the maintenance level, it must be remembered that the women were anabolizing a further amount of nitrogenous food. It seems warrantable to conclude that these patients were adequately nourished. Possible additional support is derived from the average level of 8.04 gm. of nitrogen eliminated post-partum; the agreement of the 2 total average values being, of course, fortuitous. Post-partum an appreciable amount of metabolized nitrogen is being eliminated as protein in the breast milk and again there is no evidence of any nutritional inadequacy.

The body weight of the individual patients showed a fairly steady upward trend during the period of study. This can best be illus-

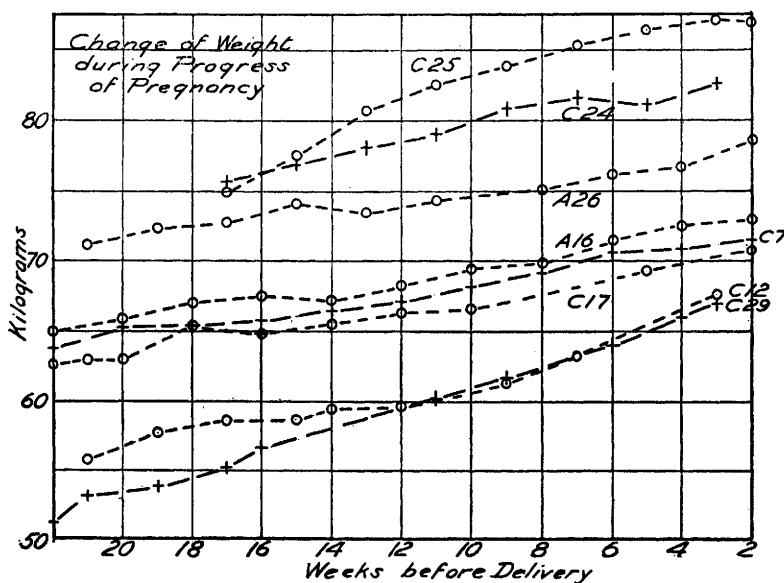


FIG. 1.

Periodic changes in weight of several individuals during the course of pregnancy.

¹ Rowe, A. W., Gallivan, D. E., and Matthews, H., *Am. J. Physiol.*, 1930, **95**, 592.

trated graphically from the data of a few characteristic protocols. (See Figure 1.)

The average weights of the sub-groups, both ante- and post-partum, show excellent correlation. The figures after delivery are not strictly comparable, as already noted, as the time of initial access to the patients after confinement varied materially as the result of attendant conditions. Group "A" were examined before discharge from the hospital after delivery, and in some cases as they returned at later intervals to the Post-natal Clinic. Group "B" were in an institution which combined the home and the maternity hospital in one plant with separate buildings, while the patients in Group "C" were transferred from the home to a sister institution for delivery and first became available for continuance of the study after their return to the home several weeks later.

The total weight losses were somewhat variable, particularly as the average net child weights were practically identical in the 3 sub-groups. This latter fact is interesting in view of the divergent values for the maternal weight increment already considered above. It is planned to make a more detailed study of the weight losses during the actual delivery and their allocation to the several factors involved. The present data warrant only the conclusion that of the very considerable weight loss, that of the child may constitute from 30% to 45% of the whole.

Conclusion.—1. Groups of pregnant women, maintained under divergent domiciliary conditions, have been studied continuously during both the ante- and post-partum periods. 2. Increments in weight averaged 0.46 kilo per week for the last 15 weeks. The individual variations were large. 3. Decrements post-partum showed an average value of nearly 9 kilos of which the average weight of the child was about one-third. During this period, also, the individual changes showed a wide scatter from the mode.

The authors take much pleasure in acknowledging their indebtedness to the staffs of the several institutions and to the patients who cooperated so helpfully in the study.