

ON THE FACTORS DETERMINING THE SIZE OF THE NEWBORN

BY

HERMANN H. KNAUS, M.D. (GRAZ),

*Visiting Professor, The Department of Obstetrics and Gynaecology
Postgraduate Medical School of London.*

THE causes of the considerable variation in size and weight of the newborn at term are not clearly understood. But there is a definite relationship between the size and the weight of the foetus and those of the placenta, and the unusually heavy child is always associated with an unusually large placenta. A big foetus weighing, for instance, 11 pounds (5,000 g.) is never born with a small placenta of an average weight of 1 pound (450 g.) or less. The close dependence of the size and the weight of the foetus upon the weight of the placenta has been demonstrated by Bustamente, Krueger, Smith, Zentler, Blaucke, Levy, Sfameni, Mantou, Laurent, Holland, La Vake, Adair and Thelander, Westermarck, Aberle and Morse, Calkins, Wolfram, and Sinclair.

This dependence of the foetus on the placenta can best be illustrated by cases of binovular twins which show a distinct difference in size and weight in spite of the fact that they have developed under identical biological conditions. In the following 34 cases of binovular twins with completely separated placentas the relevant data concerning this question will be given. The placentas were weighed without the membranes and cord.

CASE 1. 1-para, last menstruation 28th March, 1940, delivery 31st December, 1940.

Boy, 6 pounds 10½ ounces (3,030 g.), 48 cm., placenta 1 pound 2½ ounces (530 g.), 22 × 15 cm.

Girl, 5 pounds 10½ ounces (2,570 g.), 46 cm., placenta 14 ounces (400 g.), 19 × 15 cm.

CASE 2. 1-para, last menstruation, 5th April, 1940, delivery 9th January, 1941.

Boy, 5 pounds 15½ ounces (2,750 g.), 47 cm., placenta 14 ounces (400 g.), 16 × 23 cm.

Boy, 5 pounds 4 ounces (2,450 g.), 46 cm., placenta 12½ ounces (360 g.), 18 × 20 cm.

CASE 3. 1-para, last menstruation, 10th May, 1940, delivery 10th January, 1941.

Boy, 3 pounds 5½ ounces (1,520 g.), 39 cm., placenta 9 ounces (250 g.), 14 × 16 cm.

Girl, 5 pounds 5½ ounces (2,420 g.), 47 cm., placenta 1 pound 1½ ounces (500 g.), 18 × 20 cm.

CASE 4. 1-para, last menstruation 8th June, 1940, delivery 4th February, 1941.

Girl, 3 pounds 13½ ounces (1,750 g.), 42 cm., placenta 13½ ounces (380 g.), 24 × 19 cm.

Boy, 3 pounds 7½ ounces (1,580 g.), 41 cm., placenta 7 ounces (200 g.), 17 × 17 cm.

CASE 5. 2-para, last menstruation end of Sept. 1940, delivery 4th June, 1941.

Girl, 6 pounds (2,730 g.), 48 cm., placenta 1 pound 1½ ounces (500 g.), 18 × 20 cm.

Boy, 5 pounds 14½ ounces (2,650 g.), 47 cm., placenta 12 ounces (340 g.), 18 × 15 cm.

CASE 6. 1-para, last menstruation 12th September, 1940, delivery 15th June, 1941.

Boy, 5 pounds 9 ounces (2,530 g.), 55 cm., placenta 14 ounces (400 g.), 17 × 15 cm.

Girl, 5 pounds 5½ ounces (2,430 g.), 53 cm., placenta 12 ounces (335 g.), 20 × 18 cm.

CASE 7. 1-para, last menstruation 17th November, 1940, delivery 1st August, 1941.

Girl, 5 pounds 8 ounces (2,500 g.), 48 cm., placenta 11½ ounces (330 g.).

Boy, 5 pounds 12½ ounces (2,620 g.), 48½ cm., placenta 12½ ounces (360 g.).

CASE 8. 2-para, last menstruation 16th January, 1941, delivery 14th September, 1941.

Girl, 4 pounds 7½ ounces (2,030 g.), 44½ cm., placenta 10½ ounces (300 g.), 19 × 15 cm.

Girl, 4 pounds 12 ounces (2,155 g.), 45 cm., placenta 11½ ounces (330 g.), 19 × 15 cm.

CASE 9. 3-para, last menstruation unknown, delivery 29th September, 1941.

Boy, 5 pounds 2 ounces (2,320 g.), 49 cm., placenta 11½ ounces (330 g.), 16 × 18 cm.

Girl, 5 pounds 4½ ounces (2,400 g.), 49 cm., placenta 12½ ounces (350 g.), 15 × 17 cm.

CASE 10. 4-para, last menstruation 11th March, 1941, delivery 29th December, 1941.

Girl, 6 pounds 13½ ounces (3,100 g.), 48½ cm., placenta 1 pound 8½ ounces (700 g.), 23 × 15 cm.

Girl, 6 pounds 8 ounces (2,950 g.), 47 cm., placenta 1 pound 5 ounces (600 g.), 14 × 18 cm.

CASE 11. 15-para, last menstruation 15th October, 1941, delivery 18th March, 1942.

Girl, 4 pounds 8½ ounces (2,060 g.), 42 cm., placenta 12½ ounces (360 g.), 17 × 16 cm.

Boy, 3 pounds 15½ ounces (1,800 g.), 41 cm., placenta 11 ounces (310 g.), 17 × 15 cm.

CASE 12. 1-para, last menstruation beginning of July 1941, delivery 2nd April, 1942.

Boy, 5 pounds 9 ounces (2,520 g.), 47 cm., placenta 11½ ounces (320 g.), 16 × 20 cm.

Boy, 6 pounds 3½ ounces (2,830 g.), 48½ cm., placenta 13 ounces (370 g.), 18 × 20 cm.

CASE 13. 1-para, last menstruation end of July 1941, delivery 12th April, 1942.

Boy, 6 pounds 6 ounces (2,900 g.), 48½ cm., placenta 14 ounces (400 g.), 20 × 17 cm.

Boy, 4 pounds 7 ounces (2,010 g.), 45½ cm., placenta 10½ ounces (300 g.), 14 × 17 cm.

CASE 14. 1-para, last menstruation end of October, 1941, delivery 15th July, 1942.

Boy, 5 pounds 13½ ounces (2,750 g.), placenta 14 ounces (400 g.), 17 × 17 cm.

Girl, 5 pounds 2¼ ounces (2,340 g.), placenta 12½ ounces (350 g.), 15 × 16 cm.

CASE 15. 2-para, last menstruation 30th January, 1942, delivery 6th September, 1942.

Boy, 2 pounds 1 ounce (930 g.), 36 cm., placenta 6½ ounces (180 g.), 13 × 13 cm.

Boy, 4 pounds 6½ ounces (2,000 g.), 44 cm., placenta 11½ ounces (320 g.), 19 × 15 cm.

CASE 16. 4-para, last menstruation 9th May, 1942, delivery 17th December, 1942.

Boy, 4 pounds ½ ounce (1,830 g.), 43 cm., placenta 14 ounces (400 g.), 18 × 16 cm.

Girl, 3 pounds 5 ounces (1,500 g.), 41 cm., placenta 8 ounces (230 g.), 14 × 13 cm.

CASE 17. 1-para, last menstruation 13th August, 1942, delivery 20th January, 1943.

Boy, 4 pounds 2 ounces (1,870 g.), 43½ cm., placenta 1 pound 3 ½ ounces (550 g.), 24 × 14 cm.

Girl, 3 pounds 10 ounces (1,650 g.), 42 cm., placenta 14 ounces (400 g.), 19 × 16 cm.

CASE 18. 3-para, last menstruation 20th March, 1942, delivery 18th November, 1942.

Boy, 4 pounds 2 ounces (1,870 g.), 45 cm., placenta 1 pound (450 g.), 24 × 25 cm.

Boy, 3 pounds 12 ounces (1,700 g.), 42½ cm., placenta 10 ounces (280 g.), 20 × 19 cm.

CASE 19. 1-para, last menstruation 4th August, 1942, delivery 22nd March, 1943.

Girl, 3 pounds 12 ounces (1,700 g.), 40½ cm., placenta 10½ ounces (300 g.), 17 × 15 cm.

Boy, 4 pounds 6 ounces (1,980 g.), 42 cm., placenta, 11½ ounces (320 g.), 15 × 20 cm.

CASE 20. 1-para, last menstruation 20th July, 1942, delivery 2nd April, 1943.

Girl, 5 pounds 11½ ounces (2,600 g.), 47 cm., placenta 1 pound (450 g.), 18 × 19 cm.

Boy, 5 pounds 1 ounce (2,300 g.), 46 cm., placenta 10½ ounces (300 g.), 16 × 15 cm.

CASE 21. 2-para, last menstruation February 1943, delivery 30th July, 1943.

Girl, 2 pounds 7 ounces (1,100 g.), 39 cm., placenta 9 ounces (250 g.), 17 × 12 cm.

Boy, 2 pounds 13 ounces (1,280 g.), 40 cm., placenta 10½ ounces (300 g.), 18 × 14 cm.

CASE 22. 19-para, last menstruation 1st October, 1942, delivery 24th July, 1943.

Girl, 6 pounds 15½ ounces (3,150 g.), placenta 1 pound 1½ ounces (500 g.), 13 × 21 cm.

Boy, 7 pounds 6 ounces (3,350 g.), placenta 1 pound 5 ounces (600 g.), 17 × 21 cm.

CASE 23. 2-para, last menstruation 3rd December, 1942, delivery 24th August, 1943.

Boy, 5 pounds 10 ounces (2,560 g.), placenta 12½ ounces (350 g.), 18 × 19 cm.

Girl, 6 pounds 10 ounces (3,010 g.), placenta 14 ounces (400 g.), 20 × 16 cm.

CASE 24. 2-para, last menstruation 15th January, 1943, delivery 26th November, 1943.

Girl, 5 pounds 3½ ounces (2,370 g.), placenta 1 pound (460 g.), 21 × 19 cm.

Boy, 6 pounds (2,730 g.), placenta 1 pound 2 ounces (510 g.), 23 × 24 cm.

CASE 25. 3-para, last menstruation 15th February, 1943, delivery 27th October, 1943.

Boy, 4 pounds 3½ ounces (1,910 g.), 44 cm., placenta 9½ ounces (270 g.), 22 × 25 cm.

Girl, 5 pounds 10½ ounces (2,570 g.), 45 cm., placenta 11½ ounces (320 g.), 22 × 25 cm.

CASE 26. 2-para, last menstruation 15th January, 1943, delivery 26th September, 1943.

Girl, 5 pounds 3½ ounces (2,370 g.), placenta 1 pound (460 g.), 21 × 19 cm.

Boy, 6 pounds (2,730 g.), placenta 1 pound 2 ounces (510 g.), 23 × 24 cm.

CASE 27. 2-para, last menstruation end of January, delivery 3rd November, 1943.

Girl, 4 pounds 10 ounces (2,100 g.), 44 cm., placenta 13 ounces (370 g.), 15 × 16 cm.

Boy, 5 pounds 9½ ounces (2,540 g.), 46 cm., placenta 1 pound 3½ ounces (550 g.), 19 × 17 cm.

CASE 28. 2-para, last menstruation 11th March, 1943, delivery 10th November, 1943.

Girl, 5 pounds 3 ounces (2,350 g.), 47 cm., placenta 12½ ounces (350 g.),

Girl, 4 pounds 2 ounces (2,160 g.), 44 cm., placenta 11½ ounces (320 g.),

CASE 29. 1-para, last menstruation 15th May, 1943, delivery 24th November, 1943.

Boy, 2 pounds 15½ ounces (1,350 g.), 39 cm., placenta 9 ounces (250 g.),

Boy, 2 pounds 4 ounces (1,020 g.), 36 cm., placenta 7 ounces (200 g.).

CASE 30. 3-para, last menstruation, 18th March, 1943, delivery 20th December, 1943.

Boy, 7 pounds 1 ounce (3,200 g.), 50 cm., placenta 1 pound 1½ ounces (500 g.).

Boy, 6 pounds 2½ ounces (2,800 g.), 49 cm., placenta 1 pound (450 g.).

CASE 31. 1-para, last menstruation 6th April, 1943, delivery 10th January, 1944.

Girl, 5 pounds 6½ ounces (2,450 g.), 46 cm., placenta 15 ounces (430 g.), 17 × 15 cm.

Boy, 6 pounds (2,720 g.), 46 cm., placenta 1 pound 1½ ounces (500 g.), 20 × 16 cm.

CASE 32. 6-para, last menstruation 11th August, 1943, delivery 2nd May, 1944.

Girl, 4 pounds 4½ ounces (1,940 g.), 43 cm., placenta 14 ounces (400 g.), 21 × 14 cm.

Girl 3 pounds 12 ounces (1,700 g.), 43 cm., placenta 10½ ounces (300 g.), 16 × 13 cm.

CASE 33. 3-para, last menstruation, 10th May, 1944, delivery 7th January, 1945.

Boy, 4 pounds 14½ ounces (2,230 g.), 44 cm., placenta 14 ounces (400 g.), 15 × 16 cm.

Boy, 4 pounds 12 ounces (2,150 g.), 43 cm., placenta 12½ ounces (350 g.), 15 × 17 cm.

CASE 34. 3-para, last menstruation May 1944, delivery 24th January, 1945.

Girl, 4 pounds 13½ ounces (2,200 g.), 44 cm., placenta 14 ounces (400 g.),

Girl, 5 pounds 3½ ounces (2,370 g.), 45 cm., placenta 1 pound (450 g.).

DISCUSSION.

The facts given above seem to speak for themselves, and need hardly any further explanation. Although it is evident that the development of the foetus may, at least in part, depend on the vitality of the ovum and on the nutrition of the mother, the figures obtained by this investigation reveal the significance of the correlation between the weight of the newborn and the weight of the placenta. All we can now say with certainty is that the weight and the condition of the placenta play a decisive role in the development of the human foetus and that this correlation is already apparent throughout the second part of pregnancy.

But, in addition to these findings in the human, there is sufficient evidence that the same relationship between the weight of the placenta and the weight of the foetus exists in mammals, as Ibsen has shown in the guinea-pig and Hammond in the rabbit. Hammond (1935) pointed out that this relationship is an example of a general principle and that the scale in which the organism starts has much to do with determining the size of the organism and applies particularly to the organs chiefly concerned with nutrition (foetal placenta and root development in plants).

Moreover, Hammond and Walton (1938) on crossing the Shire horse with the Shetland pony found that the foetus at birth is approximately proportional to the size of the mother, and that this proportion is not

significantly altered in the reciprocal crossings. Walton and Hammond, therefore, concluded that it is the uterine environment rather than factors inherent in the foetus which determines regulation of growth of the foetus. The authors explained this regulation by the hypothesis that the growth of the foetus may be determined by the level of nutrient substances available, and this level in turn may be a function of the size of the mother. But as there is ample proof in the human that the development of the placenta is closely dependent on the space available in the uterine cavity, the size of the foetus is clearly dependent upon the efficiency with which the placenta can develop in a uterus well shaped, easily distensible and rapidly growing. On the other hand, a placenta too small for the nutrition of a normal foetus can cause abortion, as I have observed in a case of striking disproportion in size of the foetus and that of the placenta. Placentas showing absolutely too small area are characterized by an extraordinary thickness not only in the centre but also at their margins.

CONCLUSIONS.

Excluding pathological conditions the size and the weight of the newborn child is very largely dependent on the weight of the placenta.

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