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# A STUDY OF THE BIRTH WEIGHT OF CALVES

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# A Study of the Birth Weight Of Calves

C. H. ECKLES\*

The marked variations in the size of calves at birth has attracted the attention of all close observing cattle breeders. Such observations naturally give rise to questions concerning the extent and cause of such variations, as well as their possible significance from the standpoint of the future welfare of the animal.

A limited amount of data on this subject have been reported by Beach,<sup>1</sup> Henry and Morrison,<sup>2</sup> and Eckles.<sup>3</sup> The new data to be presented were taken under the supervision of the author, and represent those accumulated during a period of twelve years from the dairy herd owned by the University of Missouri.

The animals included were all purebred and registered. The Holsteins and Ayrshires represented lines of breeding common in prominent herds and were considered to be entirely typical of the breeds. The Jerseys were of the lines of breeding generally known as the American type, altho some, the younger animals, represent one-fourth or one-half of the blood of those lines of breeding known as the Island type. The dairy Shorthorns were registered Shorthorns and represent the extreme dairy type of this breed. The lines of breeding represented are, however, among those used in the very best known herds of this breed. Unfortunately, the Guernsey breed is not represented in this herd and consequently no data are available.

For the last twelve years each calf dropped in the University of Missouri herd has been weighed soon after birth, usually within five hours. The dams have been weighed under conditions as nearly uniform as practicable, for three days in succession following calving, and the average of the three weights of the dam following calving has been used.

\*Resigned, March, 1919.

<sup>1</sup>Beach, C. L. The Birth Weight of Calves. Storrs Agr. Exp. Sta. 19th Annual Report, p. 147. 1907.

<sup>2</sup>Henry, W. A. and Morrison, J. B. Feeds and Feeding. Ed. 15, p. 424. 1915.

<sup>3</sup>Eckles, C. H. Dairy Cattle and Milk Production, p. 174. 1912.

One of the difficulties encountered in compiling data of this kind is to determine where the line shall be drawn between normal and abnormal gestation periods. As a result of accident or contagion the foetus may be expelled at any point during gestation. The question as to what is normal arises especially with gestation periods decidedly shorter than usual but which result in a living calf that may be raised to maturity.

The Earl of Spencer,<sup>4</sup> in his well-known report concerning the gestation period of cattle, states that the shortest gestation period from which he was able to raise the calf born was 242 days, but he states also that any gestation less than 260 days must be considered premature. Wing,<sup>5</sup> in his study of 192 gestation periods, reports that the shortest was 264 days. In the compilation of the data here given, gestation periods less than 260 days have been omitted. A few calves born following a gestation period shorter than this have been successfully raised but such cases are clearly abnormal and it is considered fair to draw the line at this point.

## RELATION OF BREED AND SEX TO BIRTH WEIGHT

The most important factor influencing the weight of the calf at birth is that of breed. Table 1 gives the data on this point. It shows that the Jersey calf, averaging 55 pounds, is the smallest

TABLE 1.—BIRTH WEIGHT OF CALVES, UNIVERSITY OF MISSOURI HERD

Breed	Average of both sexes		Males		Females		Weight of calf in proportion to dam
	Number	Average weight	Number	Average weight	Number	Average weight	
		<i>Pounds</i>		<i>Pounds</i>		<i>Pounds</i>	<i>Per cent</i>
Jersey .....	196	55	102	58	94	53	6.5
Holstein .....	154	90	69	93	85	88	8.0
Ayrshire .....	53	69	27	73	26	65	6.9
Dairy Shorthorn	30	73	11	74	19	73	6.0

for the breeds represented, and the Holstein with an average of 90 pounds is the largest. The figures expressing the weight of the calf in percentage of the weight of the dam shows that the Jersey not only has the smallest calf in weight but that the calf is the smallest in proportion to the dam. The Holstein calf, in addition

<sup>4</sup>Spencer, the Earl of. Gestation Period in Cattle. In Journal of Royal Agricultural Society of England, v. I, pp. 165-169. 1840.

<sup>5</sup>Wing, H. H. The Period of Gestation in Cows. Cornell University Agr. Exp. Sta. Bul., 162, pp. 323-334. 1899.

to being the largest of all in weight, is also the largest in proportion to the weight of the dam. These data also bear out the common opinion that male calves average larger at birth than do females. The Jerseys and Holsteins show a difference of five pounds between the sexes, the Shorthorns one pound, and the Ayrshires, eight pounds. Figure 1 shows the frequency distribution of the weights of the 196 calves of the Jersey breed including both sexes. It will be noted that over 60 per cent of all birth weights fall within 48 to 62 pounds, which is within a limit of seven pounds on either side of the average.

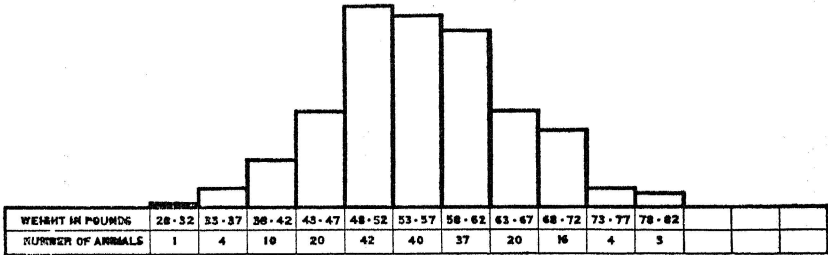


Fig. 1.—Frequency distribution of the weights of Jersey calves at birth, including both sexes. The average weight was 55 pounds.

Table 2 is a combination of all data available for dairy breeds including those presented in this paper and those summarized by Henry and Morrison,

TABLE 2.—BIRTH WEIGHTS OF CALVES OF THE DAIRY BREEDS  
*All available data*

Breeds	Number of calves	Average weight both sexes	Average weight of dams
		<i>Pounds</i>	<i>Pounds</i>
Jersey .....	253	55	867
Holstein .....	229	89	1137
Guernsey .....	57	71	996
Ayrshire .....	80	72	983
Brown Swiss .....	5	100	1123
Dairy Shorthorn .....	30	73	1216

RELATION OF AGE OF DAM TO BIRTH WEIGHT

Table 3 gives the data for the Jersey and Holstein breeds arranged to show the average birth weight of calves in relation to the age of the dam. The dams averaged close to twenty-nine months

\*Henry, W. A. and Morrison, J. B. Feeds and Feeding. Ed. 15, p. 424. 1915.

of age at the time of birth of the first calf. The intervals between the birth of successive calves in the herd from which the data are taken average about thirteen months. For this reason it cannot be assumed, as might be possible in some commercial herds, that the

TABLE 3.—INFLUENCE OF AGE OF DAM UPON WEIGHT OF CALF AT BIRTH

Number of Calf	Jerseys		Holsteins	
	Number of calves included	Average weight	Number of calves included	Average weight
		<i>Pounds</i>		<i>Pounds</i>
First .....	44	51	45	85
Second .....	35	55	31	88
Third .....	35	58	26	95
Fourth .....	18	62	19	93
Fifth .....	13	58	10	101
Sixth .....	16	52	5	90
Seventh .....	14	56	7	103
Eighth .....	8	56	5	98
Ninth .....	4	53	5	85
Tenth .....	3	64	2	89
Eleventh .....	3	51	---	---
Twelfth .....	2	50	---	---

first calf represents an age of two years for the dam, and each successive calf an interval of a year. The data show that the first calf is noticeably smaller than the second and third, and smaller than the average for the breed. On the average, the maximum weight for calves at birth will be found among those representing from the third to the sixth calf of the dam. The number of calves from the cows of advanced age is too limited for a safe conclusion to be drawn concerning the relation of extreme age to size of the calf. There are, however, indications of a tendency for the calves to be somewhat smaller after the seventh or eighth is reached, which represents an age of ten to twelve years for the dams. Between the ages of five and ten years the cow is, ordinarily, at her best for milk and the calves are at the maximum in size. Experience indicates that the same holds true regarding the vigor of the calves from cows between these ages.

#### LENGTH OF GESTATION PERIOD

Another possible factor influencing the weight of calf at birth is the length of the gestation period. The expulsion of the foetus before the normal time would be expected to result in an undersized calf. As previously mentioned, it is a difficult matter to decide how

short the gestation may be and still be classed as normal. The data given do not include any periods of less than 260 days. Table 4 gives the average length of the gestation period for Jersey calves grouped according to weight at birth. It appears from these data

TABLE 4.—RELATION OF LENGTH OF GESTATION PERIOD OF JERSEY COWS TO WEIGHT OF CALF AT BIRTH

Number of animals	Weight limits		Gestation period
	<i>Pounds</i>		<i>Days</i>
4 .....	33 to 37		274
10 .....	38 to 42		277
20 .....	43 to 47		279
42 .....	48 to 52		281
41 .....	53 to 57		281
34 .....	58 to 62		282
19 .....	63 to 67		284
13 .....	68 to 72		284
3 .....	73 to 77		281
3 .....	78 to 82		285

that the length of the gestation period is correlated to some extent with the size of the calf at birth, since the length of the gestation period is clearly longer for larger calves. This factor, however, is one of limited importance.

### RELATION OF THE SIZE OF THE DAM

Table 3 shows that on the average the first calf is lighter in weight than those born from mature animals. It is not clear from these data whether the cause of the lower weight for first calves is the smaller size of the dams or the immaturity in age. This point was studied further by compiling the weights of the dams of the Holstein breed following the first parturition, into groups based upon their weights. These data are given in Table 5. These figures

TABLE 5.—INFLUENCE OF WEIGHT OF DAM UPON WEIGHT OF CALF AT BIRTH

	Average weight of dam	Average weight of calf	Weight in proportion to dam
	<i>Pounds</i>	<i>Pounds</i>	<i>Per cent</i>
800 to 800 pounds .....	834	79	9.4
900 to 1000 pounds .....	948	87	9.4
1000 to 1100 pounds .....	1090	92	8.4

show a consistent relation between the weight of the dam and of the calf and suggest that the smaller weights of the first calves of heifers is probably due to the smaller size of the dam rather than to her immaturity. Data are not available for a sufficient number of undersized mature cows to carry the comparison further. That the breed factor is also present is shown by the fact that the calves from the young cows are somewhat heavier in proportion to their dams than those from the mature cows.

### INFLUENCE OF THE SIRE ON WEIGHTH OF CALVES

The possible relation of the sire to the size of the off-spring is of interest in considering the factors that may influence the size of the calves at birth. Mumford<sup>7</sup> concluded from his observations with sheep that the size of the sire did not exert any influence upon the birth weight of the lambs. The data available concerning the birth weight of the calves, altho more extensive than yet reported, involve the offspring from many sires and a safe basis is not furnished for generalization on this point. However, a study of the data from this viewpoint does not indicate any variation that can safely be attributed to this cause.

The data include a few cases of cross-breeding and these show unmistakable evidence that under these conditions the sire does influence the size of the offspring. Calves dropped by three purebred Jersey cows and sired by a purebred Holstein bull averaged 73 pounds in weight, while other calves from the same cows sired by a Jersey bull averaged 56 pounds in weight. Three calves sired by a Holstein bull from Ayrshire cows averaged 80 pounds, compared with an average of 66 pounds for three calves from the same cows by Ayrshire bulls.

### NUTRITION OF DAM

It is often assumed that the size of the calf at birth is influenced directly by the feeding of the dam during gestation. Such an assumption is not borne out by any available data from an investigation of the author. While the data in question were not taken for this special purpose, they have a bearing on the question.

<sup>7</sup>Mumford, F. B. Some Factors Influencing the Weight of Lambs at Birth. Missouri Agr. Exp. Sta. Bul. 53, pp. 3-17. 1901.



One group of Jersey and Holstein heifers used in an investigation previously reported by the author,<sup>8</sup> were fed a liberal ration from birth to first calving for the purpose of obtaining rapid growth and maintaining a state of flesh far above normal. The ration for the first six months was whole milk with as much grain and alfalfa hay as would be consumed. As a result of this manner of feeding, the Holstein group at 19 months averaged 932 pounds in weight compared to the normal of 715 pounds for animals of this breed at this age. The second group represented the same breeds and received skim milk and legume hay up to the age of six months, and from that age on to the time of first calving, only roughage of good quality. As a result the Holsteins of this group at 19 months averaged 588 pounds in weight, or 127 pounds below the normal weight for the breed, and 344 pounds below the group receiving the liberal ration. A portion of each of these groups was bred to calve at what would be considered an early age for the breed—20 to 22 months for the Jersey and 22 to 24 months for the Holstein. The others were bred to calve at what would be considered a late age, which was 32 to 34 months for the Jerseys and 34 to 36 months for the Holsteins. The data in Table 6 give the weights of the calves by groups and the weights of the dams following calving.

TABLE 6.—INFLUENCE OF NUTRITION OF MOTHER UPON WEIGHT OF CALF AT BIRTH

	Number of animals	Average weight cow following calf birth	Length of gestation period	Average weight of calf
		<i>Pounds</i>	<i>Days</i>	<i>Pounds</i>
Light-fed Jerseys .....	8	673	281	50
Heavy-fed Jerseys.....	7	936	276	44
Light-fed Holsteins.....	8	855	276	79
Heavy-fed Holsteins....	6	1032	275	81

These data show that the light-fed Jerseys weighing 673 pounds produced calves even a little heavier on the average than those from the heavy-fed group which averaged 263 pounds more in weight. The calves from the light-fed Holsteins averaged only two pounds less than those from the heavy-fed group which averaged 177 pounds more. If the results are expressed in terms of percentage of the weight of the dam, the results are even more striking. The calves from the light-fed Jerseys weighed 7.4 per cent of the weight of

<sup>8</sup>Eckles, C. H. The Ration and Age of Calving as Factors Influencing the Growth and Dairy Characteristics of Cows. Missouri Exp. Sta. Bul. 135, pp. 1-91. 1915.

their dams; the heavy-fed Jerseys 4.7 per cent; and the light-fed Holsteins 7.8 per cent. These data show that the breed is a much stronger factor in determining the size of the calf than the condition of the cow during gestation.

It is a common observation by cattlemen that cows poor in flesh to the point of emaciation, may bear calves of normal size for the breed. The data and observations taken by the author bear out this statement. On the other hand, cows fattened to excess during gestation may have calves small for the breed and lacking in vigor as well. Apparently, it is only extreme cases of poor nutrition or the lack of some constituent in the ration covering a long period of time that may be expected to exert any marked influence upon the size of the calf.

The relatively small influence of the nutrition of the dam upon the development of the foetus may be explained by the dependence of the foetus for nourishment upon the blood stream of the dam and, therefore, only indirectly upon the food of the dam. It is a well-known physiological fact that there is a stronger tendency for the composition of the blood to remain almost constant, even under adverse conditions of nutrition. If a temporary deficit of any constituent occurs in the blood, the shortage is made up by drawing upon the reserve of that constituent already in the body. For this reason the food supply of the foetus remains practically constant regardless of the food of the dam, and in case of a shortage of food during gestation, the mother and not the foetus suffers.

## CONCLUSIONS

Breed is the most important factor influencing the weight of calves at birth. On the average, calves of the Jersey breed weigh 55 pounds at birth and represent 6.5 per cent of the weight of the dam. Calves of the Holstein breed, at birth, average 90 pounds in weight and represent 8.0 per cent of the weight of the dams.

Male calves average from five to eight per cent heavier than females.

Calves produced by immature cows, two to four years old, are smaller than those from mature cows, five to ten years old. There is a tendency for cows of advanced age to produce calves rather smaller than those from cows in the prime of life.

The length of the gestation period is not correlated with the size of the calf at birth except in cases of extremely large or small calves, when such a relation usually exists.

The sire apparently has but little influence upon the size of the calf at birth, when both sire and dam are of the same breed, but in case of cross breeding the influence of the sire is evident.

The nutrition of the cow during gestation does not influence the size of the calf at birth to any appreciable extent except possibly under the most extreme conditions continued for a long time.