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RB56-179 Comparative Measurements of Holstein, Ayrshire, Guernsey, and Jersey Females from Birth to Seven Years

H.P. Davis

University of Nebraska-Lincoln

I.L. Hathaway

University of Nebraska-Lincoln

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UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

W. V. LAMBERT, Director

E. F. FROLIK, Associate Director

Research Bulletin 179

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Ayrshire, Guernsey, and Jersey Females
from Birth to Seven Years

H. P. DAVIS AND I. L. HATHAWAY

Department of Dairy Husbandry

LINCOLN, NEBRASKA
MARCH, 1956

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SUMMARY

Weight comparisons and a number of body measurements are presented for females of the Holstein, Ayrshire, Guernsey, and Jersey breeds.

The Holsteins were largest at birth, grew the most, and maintained their size superiority throughout life. Ayrshires and Guernseys were much alike at birth and maintained this close size relationship throughout life. Jerseys were smallest at birth and throughout life, but for several measurements showed faster gains than the Ayrshires and Guernseys during the first 12 months.

Comparative Measurements of Holstein, Ayrshire, Guernsey, and Jersey Females from Birth to Seven Years

H. P. DAVIS AND I. L. HATHAWAY¹

BODY MEASUREMENTS are important for a proper understanding of how growth takes place in animals. Unfortunately, few growth data other than for weight have been published concerning dairy cattle.

This is a report of measurements of females in the University of Nebraska dairy herd made as part of a long-time growth study. During the period 1922 to 1942 each animal born into the herd was weighed and measured at regular intervals. Presented here are the data for weight, height, length, width, depth, girth and hide thickness for females of the Holstein, Ayrshire, Guernsey, and Jersey breeds. The average body measurements are presented by three-month intervals from birth through 12 months, and by six-month intervals thereafter through 84 months.

REVIEW OF LITERATURE

A review of the literature concerning dairy cattle growth was presented by Davis and Hathaway (1). Robbins *et al.* (2) have discussed growth in some detail. It need only be mentioned here that all of the publications reviewed indicate that growth in the animal body is an expanding process which proceeds rapidly at first, but which gradually slows as the animal approaches maturity.

PROCEDURE

The animals included in this study were weighed at birth and measured as soon as they could stand naturally. Additional weights and measurements were taken at the middle of each succeeding month as long as an animal remained in the herd. Toward the end of the experiment, animals were measured only at 3-, 6-, or 12-month intervals. That practice and the fact that not all measurements were started at the same time accounts for the different numbers of animals for the several measurements. The accuracy of measurements taken in the middle of each month, the methods and equipment used in taking the measurements, and the feeding management of the animals were discussed in a previous publication (1).

¹ H. P. Davis and I. L. Hathaway are Dairy Husbandmen, Nebraska Agricultural Experiment Station.

During the study described here, Ray F. Morgan had charge of taking the measurements and was assisted at various times by E. N. Hansen and G. W. Trimberger.

At birth the numbers of animals representing the several breeds were as follows: Holsteins—262, the offspring of 31 different bulls; Ayrshires—100, the offspring of 11 different bulls; Guernseys—78, the offspring of 11 different bulls; and Jerseys—105, the offspring of 17 different bulls. The disposal of animals for various reasons reduced the numbers so that at 84 months of age there were 21 Holsteins, the offspring of 9 bulls; 4 Ayrshires, the offspring of 2 bulls; 2 Guernseys, both sired by the same bull; and 4 Jerseys, the offspring of 3 bulls.

DISCUSSION

The mean estimates for each measurement and for each age are shown in tables 1 to 15. The measurements are for weight; heights at withers, hooks, and pinbones; diagonal length, body length, and rump length; widths at chest, hooks, and pinbones; depths of chest and of barrel; girths of chest and of barrel; and hide thickness at the last rib and at the twist. Data in the tables permit a comparison of the females of any one breed with those of the other breeds for each measurement and for each age period.

In table 1 are shown the average weights for the females of the four breeds by successive age periods from birth through 84 months, together with the gain in weight for each age interval. The ranking of the breeds at birth, from heaviest to lightest, was Holstein, Ayrshire, Guernsey and Jersey and that relationship was maintained through the first 60 months. Small numbers of animals, affected in some instances by pregnancy, caused some irregularities at the older ages. From the table the daily gains in pounds have been calculated as follows: For the first six months, Holsteins—1.70; Ayrshires—1.45; Guernseys—1.27; and Jerseys—1.26. For the first 12 months the daily gains in pounds were: Holsteins—1.69; Ayrshires—1.39; Guernseys—1.29; and Jerseys—1.25. For the first two years of life the daily gains in pounds were as follows: Holsteins—1.45; Ayrshires—1.24; Guernseys—1.15; and Jerseys—1.03.

In table 2 are presented the heights at withers together with the period gains. Throughout the age span, Holstein females were the tallest and Jersey females the shortest. Ayrshires and Guernseys were intermediate and were much alike, with first one and then the other breed being the tallest. The gains for the first 12 months, expressed in centimeters, were as follows: Holsteins—45.5; Ayrshires—42.4; Guernseys—41.9; and Jerseys—43.4. It is evident that growth in height at withers becomes slower after 12 months although it continues for many months thereafter. Attention is called to the rapid growth of the Jerseys, especially during the first year.

Heights at hook are shown in table 3. These measurements followed the same pattern as those for height at withers—the Holsteins were tallest, Guernseys and Ayrshires intermediate and much alike,

and Jerseys smallest. The gain in height at hooks during the first year was similar to the gain in height at withers for the same period. For the two-year period the gain in height at hooks was slightly smaller.

The third height measurement—height at pinbones—follows closely the pattern of the other height measurements as may be noted in table 4. The first year's gains for this measurement are much the same as for the other height measurements. Thus it is evident that in height growth the females of the four breeds follow much the same pattern, and that initial differences between breeds are maintained throughout life.

Length measurements are presented in tables 5, 6 and 7, with diagonal length data in table 5. At birth the breeds ranked the same in diagonal length as in height. Holsteins were first, followed by Ayrshires, Guernseys, and Jerseys. The gains in centimeters for 12 and 24 months, respectively, were as follows: Holsteins—66.9 and 86.1; Ayrshires—60.5 and 80.6; Guernseys—59.9 and 80.8; and Jerseys—64.5 and 81.7. Thus for the first two years of life, Jerseys gained more than either Ayrshires or Guernseys in diagonal length.

Body length data are shown in table 6. At birth the same rankings by breed were maintained for body length as for other measurements. The gains in length expressed in centimeters for the 12- and 24-month periods were as follows: Holsteins—56.8 and 74.4; Ayrshires—52.3 and 71.4; Guernseys—53.0 and 72.5; and Jerseys—56.6 and 71.6. Jerseys for the first year practically equaled the Holsteins and exceeded the other breeds in body length gains, but for two years they exceeded only the Ayrshires.

Measurements of rump length are shown in table 7. Increases for the 12- and 24-month periods expressed in centimeters were as follows: Holsteins—18.6 and 25.5; Ayrshires—17.6 and 24.2; Guernseys—18.5 and 25.3; and Jerseys 19.1 and 24.6. Rump length of Jersey females increased more than that of any other breed during the first year. This rapidity of gain for Jerseys may be an evidence of early maturity.

Width measurements are shown in tables 8, 9 and 10. Table 8 is devoted to chest widths, table 9 to hook widths, and table 10 to pinbone widths. For each of these width measurements the Holsteins ranked highest at birth. Ayrshires and Guernseys were intermediate and closely alike, and Jerseys had the narrowest measurements. For the first 12 months of life, the gains in centimeters for chest width, hook width and pinbone width, respectively, were as follows: Holsteins—18.7, 23.4 and 15.2; Ayrshires—16.7, 22.2 and 13.7; Guernseys—16.2, 20.9 and 13.2; and Jerseys—15.4, 22.1 and 12.6. For the two-year period Holsteins grew the most in width for each of the measurements followed by the Ayrshires, Guernseys, and Jerseys, except that the Jerseys had a larger gain than the Guernseys in width at hooks.

Measurements for depth of chest and depth of barrel are shown in tables 11 and 12. For the first year of life the gains in centimeters for depth of chest and depth of barrel, respectively, were as follows: Holsteins—29.4 and 33.2; Ayrshires—27.8 and 31.8; Guernseys—27.6 and 30.6; and Jerseys—29.0 and 32.7. For the first two years of life the gains in centimeters for the same measurements were as follows: Holsteins—41.2 and 43.1; Ayrshires—37.9 and 42.5; Guernseys—37.2 and 40.5; and Jerseys 37.7 and 41.5. Jerseys ranked next to the Holsteins in gains in both of the depth measurements for the first 12 months but ranked third, after the Holsteins and Ayrshires, in depth gains during the first two years of life.

Chest girth gains and barrel girth gains, expressed in centimeters in tables 13 and 14 respectively, were as follows for the first 12 months: Holsteins—79.9 and 108.1; Ayrshires—74.4 and 102.1; Guernseys—74.0 and 98.1; and Jerseys—74.1 and 103.3. For the 24-month period, the gains for the two measurements were respectively: Holsteins—111.2 and 145.0; Ayrshires—105.0 and 141.8; Guernseys—103.2 and 137.0; and Jerseys—101.6 and 135.7.

Hide thicknesses for the first 24 months of life are shown in table 15. Beyond that age there is no distinct trend and there are many irregularities in the data, probably due to the varying condition of fatness of the animals. A study of the table indicates that the thickness of the hide at the twist (escutcheon) region increases very little as the animal develops, and that there is little difference between Holstein, Guernsey and Jersey females. Although the differences were small, the Ayrshire females showed a consistently thicker hide in this area. The Ayrshires also showed greater hide thickness at the last rib. In the rib area the Jerseys consistently had the thinnest hide with the Guernseys ranking second and the Holsteins third. It should be remembered in studying the table that the measurements (expressed in millimeters) were made at a fold in the skin, and hence represent twice the hide thickness.

It is evident that for all the measurements presented the Holstein females were largest at birth, made the largest gains in weight and in each measured area, and maintained their size superiority throughout life. Ayrshires and Guernseys were much alike. The Ayrshires tended to be a little larger at birth, but thereafter the size relationship shifted back and forth between the two. Jerseys were always smallest at birth but for several measurements showed faster gains than the two intermediate breeds for the first 12 months of life, apparently an evidence of early maturity.

LITERATURE CITED

1. DAVIS, H. P. and HATHAWAY, I. L., 1955. Growth measurements of Holstein females from birth to seven years. Nebraska Agr. Expt. Sta. Res. Bul. 177.
2. ROBBINS, W. J., BRODY, SAMUEL, HOGAN, A. G., JACKSON, C. M., and GREENE, C. W., 1928. Growth. Yale University Press, New Haven, Conn.

TABLES

Tables 1 through 15, mentioned throughout the text, follow on pages 10 through 24.

TABLE 1.—Weights and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain lbs.	Av. weight lbs.	Animals no.	Period gain lbs.	Av. weight lbs.	Animals no.	Period gain lbs.	Av. weight lbs.	Animals no.	Period gain lbs.	Av. weight lbs.
Birth.....	262	...	88	100	...	79	78	...	72	105	...	54
3.....	256	127	215	81	106	185	59	...	81	82	83	137
6.....	247	184	399	91	158	343	69	151	153	97	147	284
9.....	244	169	568	75	147	490	56	139	304	76	130	414
12.....	242	136	704	86	96	586	68	99	443	89	96	510
18.....	233	220	924	76	194	780	54	184	542	78	154	664
24.....	215	225	1149	72	207	987	58	186	726	80	140	804
30.....	183	90	1239	55	20	1007	37	53	965	56	46	850
36.....	158	53	1292	56	96	1103	34	68	1033	47	45	895
42.....	134	50	1342	36	30	1133	19	38	1071	38	21	916
48.....	110	40	1382	32	24	1157	21	43	1114	37	55	971
54.....	99	25	1407	21	4	1161	12	49	1163	25	11	982
60.....	77	30	1437	18	51	1212	12	-20	1143	22	40	1022
66.....	65	14	1451	10	-53	1159	4	63	1206	12	-25	997
72.....	53	31	1482	8	36	1195	2	85	1291	7	-25	972
78.....	41	-2	1480	4	52	1247	2	64	1355	7	42	1014
84.....	34	14	1494	4	50	1297	2	-197	1158	4	47	1061

TABLE 2.—Height at withers and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.
Birth.....	261		74.0	99		68.5	78		69.6	105		64.6
3.....	214	15.2	89.2	81	14.8	83.3	59	12.3	81.9	82	14.5	79.1
6.....	225	14.2	103.4	91	13.0	96.3	69	13.8	95.7	97	14.2	93.3
9.....	201	9.7	113.1	75	9.6	105.9	58	9.9	105.6	76	9.4	102.7
12.....	229	6.4	119.5	86	5.0	110.9	68	5.9	111.5	89	5.3	108.0
18.....	192	8.8	128.3	76	8.1	119.0	54	7.9	119.4	78	6.8	114.8
24.....	185	5.0	133.3	72	4.6	123.6	58	4.6	124.0	80	4.3	119.1
30.....	146	3.0	136.3	55	2.6	126.2	37	1.8	125.8	56	2.2	121.3
36.....	130	1.5	137.8	56	.4	126.6	34	1.1	126.9	47	.1	121.4
42.....	104	.5	138.3	36	2.0	128.6	19	-.2	126.7	38	1.1	122.5
48.....	90	.4	138.7	32	-1.1	127.5	21	.4	127.1	37	.2	122.7
54.....	81	.3	139.0	21	1.2	128.7	12	-.2	126.9	25	.4	123.1
60.....	64	.2	139.2	18	.1	128.8	12	-.4	126.5	22	-.6	122.5
66.....	48	.3	139.5	10	-1	128.7	4	1.2	127.7	12	0	122.5
72.....	41	.3	139.8	8	.7	129.4	2	3.8	131.5	8	-.1	122.4
78.....	29	-1	139.7	4	.7	130.1	2	-1.5	130.0	7	0	122.4
84.....	21	.1	139.8	4	-.2	129.9	2	-1.3	128.7	4	1.7	124.1

TABLE 3.—Height at hocks and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.
Birth	261	...	77.1	99	...	71.8	78	...	72.7	105	...	67.3
3	214	15.1	92.2	81	14.8	86.6	59	13.0	85.7	82	14.3	81.6
6	225	14.4	106.6	91	13.2	99.8	69	13.7	99.4	97	14.1	95.7
9	201	9.8	116.4	75	9.3	109.1	56	8.8	108.2	76	9.0	104.7
12	229	5.8	122.2	86	4.6	113.7	68	5.8	114.0	89	5.0	109.7
18	192	8.4	130.6	76	7.5	121.2	54	8.1	122.1	78	6.8	116.5
24	183	4.1	134.7	72	3.8	125.0	58	3.2	125.3	80	2.8	119.3
30	146	3.0	137.7	55	2.7	127.7	37	1.4	126.7	56	2.1	121.4
36	130	1.0	138.7	56	-.4	127.3	34	.8	127.5	47	-.5	120.9
42	104	.3	139.0	36	.9	128.2	19	-1.5	126.0	38	.8	121.7
48	90	.1	139.1	32	-.6	127.6	21	1.2	127.2	37	0	121.7
54	81	0	139.1	21	.2	127.8	12	-1.0	126.2	25	.5	122.2
60	64	.2	139.3	18	-.3	127.5	12	-.5	125.7	22	-.8	121.4
66	48	.2	139.5	10	.5	128.0	4	2.8	128.5	12	-1.0	120.4
72	41	.1	139.6	8	.4	128.4	2	3.5	132.0	8	.3	120.7
78	29	-.5	139.1	4	-1.4	127.0	2	-2.5	129.5	7	-1.5	119.2
84	21	-.6	138.5	4	1.4	128.4	2	-.5	129.0	4	.7	119.9

TABLE 4.—Height at pinbones and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.	Animals no.	Period gain cm.	Av. height cm.
Birth.....	170		74.7	77		68.6	64		69.8	72		64.5
3.....	127	17.2	91.9	60	16.3	84.9	46	12.6	82.4	53	15.7	80.2
6.....	144	13.3	105.2	71	12.5	97.4	57	15.9	98.3	70	14.1	94.3
9.....	126	8.6	113.8	56	9.2	106.6	44	8.8	107.1	50	8.3	102.6
12.....	156	5.4	119.2	69	4.4	111.0	57	5.7	112.8	63	4.3	106.9
18.....	126	7.3	126.5	62	6.8	117.8	47	6.7	119.5	53	6.0	112.9
24.....	134	3.9	130.4	62	4.0	121.8	53	4.1	123.6	57	2.9	115.8
30.....	106	2.5	132.9	49	1.4	123.2	33	1.0	124.6	36	1.6	117.4
36.....	98	.4	133.3	50	0	123.2	32	1.1	125.7	33	-.7	116.7
42.....	81	0	133.3	32	.4	123.6	18	-1.4	124.3	27	.7	117.4
48.....	72	.2	133.5	31	-.7	122.9	20	.7	125.0	29	.8	118.2
54.....	68	-.6	132.9	21	-.8	122.1	12	-.3	124.7	19	-.1	118.1
60.....	56	.8	133.7	18	-.1	122.0	12	-.8	123.9	19	-1.0	117.1
66.....	41	-.4	133.3	10	.1	122.1	4	2.2	126.1	12	0	117.1
72.....	36	0	133.3	8	-1.0	121.1	2	2.1	128.2	8	0	117.1
78.....	27	-.5	132.8	4	1.0	122.1	2	-1.7	126.5	7	-.4	116.7
84.....	21	.3	133.1	4	1.1	123.2	2	0	126.5	4	-.5	116.2

TABLE 5.—Diagonal length and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.
Birth	170	...	68.2	79	...	66.8	64	...	65.9	71	...	60.7
3	127	25.5	93.7	60	21.6	88.4	46	19.6	85.5	53	23.4	84.1
6	144	20.4	114.1	69	21.5	109.9	57	18.3	103.8	70	20.8	104.9
9	125	12.8	126.9	56	10.4	120.3	44	14.8	118.6	50	12.9	117.8
12	156	8.2	135.1	69	7.0	127.3	57	7.2	125.8	63	7.4	125.2
18	126	11.5	146.6	62	12.3	139.6	47	11.8	137.6	53	10.3	135.5
24	134	7.7	154.3	62	7.8	147.4	53	9.1	146.7	57	6.9	142.4
30	106	5.7	160.0	49	4.4	151.8	33	3.6	150.3	36	2.1	144.5
36	98	2.7	162.7	50	2.9	154.7	32	3.1	153.4	33	2.9	147.4
42	81	2.3	165.0	32	2.9	157.6	18	2.2	155.6	27	1.9	149.3
48	72	1.0	166.0	31	-2	157.4	20	1.1	156.7	29	1.5	150.8
54	68	.6	166.6	21	-2	157.2	12	.8	157.5	19	.1	150.9
60	56	.6	167.2	18	1.2	158.4	12	.5	158.0	19	.5	151.4
66	42	.7	167.9	10	0	158.4	4	.2	158.2	12	1.3	152.7
72	37	.8	168.7	8	-1.0	157.4	2	8.8	167.0	8	-5	152.2
78	28	-1.2	167.5	4	2.3	159.7	2	-4.5	162.5	7	-6	151.6
84	20	.3	167.8	4	-1	159.6	2	-3	162.2	4	1.1	152.7

TABLE 6.—Body length and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.
Birth.....	170	...	59.3	77	...	56.5	64	...	55.5	72	...	51.6
3.....	127	20.3	79.6	60	18.5	75.0	46	16.6	72.1	54	19.2	70.8
6.....	144	17.9	97.5	71	17.0	92.0	57	17.9	90.0	71	19.3	90.1
9.....	126	11.6	109.1	56	12.1	104.1	44	11.8	101.8	50	11.8	101.9
12.....	156	7.0	116.1	69	4.7	108.8	57	6.7	108.5	64	6.3	108.2
18.....	126	10.5	126.6	62	11.8	120.6	47	10.1	118.6	54	8.9	117.1
24.....	134	7.1	133.7	62	7.3	127.9	53	8.4	127.0	59	6.2	123.3
30.....	106	5.7	139.4	49	5.0	132.9	33	4.1	131.1	37	4.4	127.7
36.....	98	3.4	142.8	50	1.5	134.4	32	3.0	134.1	34	1.7	129.4
42.....	81	1.9	144.7	32	3.6	138.0	18	.6	134.7	27	2.6	132.0
48.....	72	1.2	145.9	31	-1.4	136.6	20	1.5	136.2	28	.3	132.3
54.....	68	2.0	147.9	21	.9	137.5	12	1.8	136.0	19	.2	132.5
60.....	56	-1	147.8	18	.1	137.6	12	-7	137.3	19	.4	132.9
66.....	42	1.5	149.3	10	1.5	139.1	4	.1	137.4	12	.7	133.6
72.....	36	-1.6	147.7	8	.9	140.0	2	5.8	143.2	6	1.1	134.7
78.....	27	2.0	149.7	4	.6	140.6	2	.8	144.0	5	.4	135.1
84.....	21	-4	149.3	4	.4	141.0	2	-3.5	140.5	4	.1	135.2

TABLE 7.—Rump length and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.	Animals no.	Period gain cm.	Av. length cm.
Birth.....	170	....	20.5	77	....	19.6	64	....	18.5	72	....	18.3
3.....	127	6.1	26.6	60	6.0	25.6	46	6.0	24.5	54	5.5	23.8
6.....	144	5.4	32.0	71	5.2	30.8	57	5.2	29.7	70	6.1	29.9
9.....	126	4.5	36.5	56	4.3	35.1	44	4.6	34.3	50	4.7	34.6
12.....	156	2.6	39.1	69	2.1	37.2	57	2.7	37.0	63	2.8	37.4
18.....	126	3.5	42.6	62	4.0	41.2	41	4.0	41.0	53	2.9	40.3
24.....	134	2.4	45.0	62	2.6	43.8	53	2.8	43.8	57	2.6	42.9
30.....	106	1.5	46.5	49	.9	44.7	33	1.9	45.7	36	.9	43.8
36.....	98	.8	47.3	50	.4	45.1	32	.2	45.9	33	.7	44.5
42.....	81	.5	47.8	32	.4	45.5	19	.1	46.0	27	.2	44.7
48.....	72	.6	48.4	31	.3	45.8	21	.2	46.2	29	.8	45.5
54.....	68	— .1	48.3	21	— .6	45.2	12	— .3	45.9	19	— .3	45.2
60.....	56	.1	48.4	18	.4	45.6	12	1.0	46.9	19	0	45.2
66.....	42	.1	48.5	10	.2	45.8	4	— .7	46.2	12	.2	45.4
72.....	36	.8	49.3	8	— .1	45.7	2	2.0	48.2	8	— .1	45.3
78.....	28	— .7	48.6	4	— .3	45.4	2	.8	49.0	7	.1	45.4
84.....	23	0	48.6	4	1.5	46.9	2	— 1.3	47.7	4	0	45.4

TABLE 8.—Width of chest and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.
Birth	261	.....	17.2	99	.....	15.9	78	.....	14.8	105	.....	13.3
3	214	5.2	22.4	81	5.3	21.2	59	4.2	19.0	82	3.8	17.1
6	225	5.9	28.3	91	5.3	26.5	69	5.2	24.2	97	5.2	22.3
9	201	4.5	32.8	75	4.1	30.6	56	4.1	28.3	76	3.9	26.2
12	229	3.1	35.9	86	2.0	32.6	68	2.7	31.0	89	2.5	28.7
18	192	4.3	40.2	76	4.1	36.7	54	3.9	34.9	78	4.6	33.3
24	185	3.1	43.3	72	2.9	39.6	58	3.5	38.4	80	1.4	34.7
30	146	1.2	44.5	55	.6	40.2	37	1.3	39.7	56	.3	35.0
36	130	.6	45.1	56	1.0	41.2	34	.3	40.0	47	1.1	36.1
42	104	.5	45.6	36	1.2	42.4	19	1.5	41.5	38	.4	36.5
48	90	.9	46.5	32	-.4	42.0	21	-.5	41.0	37	.8	37.3
54	81	.9	47.4	21	.5	42.5	12	2.5	43.5	25	.7	38.0
60	64	.1	47.5	18	1.0	43.5	12	-.7	42.8	22	.2	38.2
66	48	.2	47.7	10	.1	43.6	4	3.1	45.9	12	-.2	38.0
72	35	.4	48.1	8	.2	43.8	2	.8	46.7	8	1.2	39.2
78	27	.9	49.0	4	-.1	43.7	2	1.8	48.5	7	.7	39.9
84	20	.6	49.6	4	-.1	42.6	2	3.0	51.5	4	2.3	42.2

TABLE 9.—Width at hooks and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.
Birth.....	253	....	17.0	97	....	15.9	75	....	15.0	99	....	13.9
3.....	204	6.5	23.5	79	6.6	22.5	56	5.5	20.5	75	6.3	20.2
6.....	215	7.3	30.8	89	6.9	29.4	69	5.4	25.9	91	7.1	27.3
9.....	191	5.5	36.3	73	5.3	34.7	53	6.4	32.3	71	5.4	32.7
12.....	219	4.1	40.4	84	3.4	38.1	65	3.6	35.9	84	3.3	36.0
18.....	182	5.9	46.3	74	5.7	43.8	49	6.9	42.8	72	5.2	41.2
24.....	177	4.8	51.1	70	4.7	48.5	54	3.0	45.8	76	4.2	45.4
30.....	136	3.2	54.3	55	2.0	50.5	35	2.5	48.3	52	2.1	47.5
36.....	115	1.6	55.9	56	1.7	52.2	33	1.6	49.9	44	.8	48.3
42.....	97	1.2	57.1	36	1.5	53.7	18	1.3	51.2	36	1.0	49.3
48.....	84	1.1	58.2	32	.3	54.0	20	.4	51.6	35	1.3	50.6
54.....	76	.6	58.8	21	.2	54.2	12	1.0	52.6	24	.4	51.0
60.....	60	.3	59.1	18	.5	54.7	12	.3	52.9	21	.3	51.3
66.....	48	.1	59.2	10	-1.0	53.7	4	.7	53.6	12	.1	51.4
72.....	35	.7	59.9	8	1.3	55.0	2	.6	54.2	7	.8	52.2
78.....	26	.1	60.0	4	.1	55.1	2	-2	54.0	7	-1.4	50.8
84.....	20	0	60.0	4	.1	55.2	2	-5	53.5	4	1.6	52.4

TABLE 10.—Width at pinbones and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.	Animals no.	Period gain cm.	Av. width cm.
Birth.....	227	...	12.0	90	...	10.5	70	...	10.0	89	...	8.9
3.....	191	4.4	16.4	73	4.1	14.6	52	3.5	13.5	66	3.6	12.5
6.....	218	4.7	21.1	83	4.3	18.9	63	4.1	17.6	83	4.2	16.7
9.....	174	3.6	24.7	68	3.7	22.6	50	3.4	21.0	63	2.9	19.6
12.....	205	2.5	27.2	79	1.6	24.2	62	2.2	23.2	76	1.9	21.5
18.....	166	4.3	31.5	69	3.3	27.5	49	3.2	26.4	65	3.0	24.5
24.....	164	2.6	34.1	67	2.4	29.9	53	2.6	29.0	69	2.1	26.6
30.....	120	1.8	35.9	54	1.0	30.9	34	1.5	30.5	44	1.2	27.8
36.....	104	.8	36.7	55	.9	31.8	32	.5	30.9	39	1.1	27.9
42.....	87	.9	37.6	35	1.0	32.8	18	.1	31.0	29	.9	28.8
48.....	77	0	37.6	32	.2	33.0	20	.4	31.4	29	.3	29.1
54.....	66	.8	38.4	21	.6	33.6	12	1.8	33.2	19	.5	29.6
60.....	54	.1	38.5	18	—	33.5	12	—	32.4	19	.2	29.8
66.....	39	.1	38.6	10	—	31.1	4	2.1	34.5	12	—	29.4
72.....	36	.1	38.7	8	—	32.4	2	.7	35.2	4	—	29.2
78.....	24	—	38.6	4	1.1	33.5	2	—	34.0	7	—	29.2
84.....	24	0	38.6	4	0	33.5	2	—	31.7	4	—	29.1

TABLE 11.—Depth of chest and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. depth cm.	Animals no.	Period gain cm.	Av. depth cm.	Animals no.	Period gain cm.	Av. depth cm.	Animals no.	Period gain cm.	Av. depth cm.
Birth	227	...	28.7	89	...	27.5	70	...	27.5	88	...	25.4
3	190	9.9	38.6	72	9.6	37.1	52	8.9	36.4	65	9.5	34.9
6	218	8.8	47.4	82	8.0	45.1	63	8.7	45.1	81	9.2	44.1
9	174	6.6	54.0	68	6.5	51.6	50	6.0	51.1	60	6.0	50.1
12	207	4.1	58.1	79	3.7	55.3	62	4.0	55.1	75	4.3	54.4
18	168	6.9	65.0	69	5.6	60.9	49	5.4	60.5	64	5.3	59.7
24	164	4.9	69.9	67	4.5	65.4	54	4.2	64.7	68	3.4	63.1
30	121	1.9	71.8	54	1.6	67.0	34	2.4	67.1	45	1.7	64.8
36	105	1.3	73.1	55	1.7	67.7	32	.6	67.7	39	1.0	65.8
42	88	.8	73.9	35	1.7	69.4	18	.6	68.3	30	.6	66.4
48	78	.7	74.6	32	-.5	68.9	20	.9	69.2	30	.5	66.9
54	67	.7	75.3	21	.5	69.4	12	.9	70.1	20	0	66.9
60	55	.4	75.7	18	.3	69.7	12	-.2	69.9	19	.9	67.8
66	39	.4	76.1	10	.7	70.4	4	.1	70.0	12	-.4	67.4
72	38	.2	76.3	8	0	70.4	2	2.0	72.0	8	.4	67.8
78	26	.3	76.6	4	1.0	71.4	2	1.0	73.0	7	.8	68.6
84	25	.1	76.7	4	-.9	70.5	2	2.0	75.0	4	-.2	66.2

TABLE 12.—Depth of barrel and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. depth cm.	Animals no.	Period gain cm.	Av. depth cm.	Animals no.	Period gain cm.	Av. depth cm.	Animals no.	Period gain cm.	Av. depth cm.
Birth	261		28.0	99		27.2	78		27.3	105		24.1
3	214	12.1	40.1	81	12.3	39.5	59	10.2	37.5	82	12.1	36.2
6	225	10.6	50.7	91	10.0	49.5	69	10.3	47.8	97	10.6	46.8
9	201	6.2	56.9	75	6.4	55.9	56	6.5	54.3	76	6.1	52.9
12	229	4.3	61.2	86	3.1	59.0	68	3.6	57.9	89	3.9	56.8
18	192	5.7	66.9	76	5.7	64.7	54	4.9	62.8	78	5.1	61.9
24	185	4.2	71.1	72	5.0	69.7	58	5.0	67.8	80	3.7	65.6
30	146	2.9	74.0	55	.7	70.4	34	1.3	69.1	56	1.5	67.1
36	130	1.0	75.0	56	1.0	71.4	34	1.2	70.3	47	1.1	68.2
42	104	1.1	76.1	36	1.8	73.2	19	1.0	71.3	38	.1	68.3
48	90	.7	76.8	32	-.3	72.9	21	1.2	72.5	37	1.2	69.5
54	81	.8	77.6	21	1.0	73.9	12	1.0	73.5	25	.1	69.6
60	64	.8	78.4	18	1.8	75.7	12	-.8	72.7	22	2.0	71.6
66	48	.8	79.2	10	-1.1	74.6	4	.5	73.2	12	-.4	71.2
72	41	.6	79.8	8	1.4	76.0	2	2.8	76.0	8	-1.3	69.9
78	29	-.9	78.9	4	.7	76.7	2	-.5	75.5	7	2.1	72.0
84	23	1.6	80.5	4	-1	76.6	2	1.5	77.0	4	.5	72.5

TABLE 13.—Chest girth and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. girth cm.	Animals no.	Period gain cm.	Av. girth cm.	Animals no.	Period gain cm.	Av. girth cm.	Animals no.	Period gain cm.	Av. girth cm.
Birth	261	...	78.7	99	...	75.2	78	...	73.6	105	...	67.6
3	214	23.9	102.6	81	24.3	99.5	59	20.8	94.4	82	21.8	89.4
6	225	25.0	127.6	91	22.1	121.6	69	23.3	117.7	97	24.7	114.1
9	201	18.6	146.2	75	17.2	138.8	56	18.0	135.7	76	17.6	131.7
12	229	12.4	158.6	86	10.8	149.6	68	11.9	147.6	89	10.0	141.7
18	192	18.2	176.8	76	16.9	166.5	54	16.5	164.1	78	16.4	158.1
24	185	13.1	189.9	72	13.7	180.2	58	12.7	176.8	80	11.1	169.2
30	146	6.4	196.3	55	1.7	181.9	37	3.3	180.1	56	2.3	171.5
36	130	2.7	199.0	56	3.3	185.2	34	4.8	184.9	47	3.5	175.0
42	104	1.7	200.7	36	3.7	188.9	19	3.1	188.0	38	1.2	176.2
48	90	2.9	203.6	32	.3	189.2	21	1.7	189.7	37	3.8	180.0
54	81	1.4	205.0	21	3.2	192.4	12	3.5	193.2	25	1.0	181.0
60	64	1.0	206.0	18	-.2	192.2	12	-3.0	190.2	22	1.7	182.7
66	48	1.6	207.6	10	-1.2	191.0	4	3.3	193.5	12	.5	183.2
72	41	1.3	208.9	8	2.4	193.4	2	7.5	201.0	8	-1.2	182.0
78	28	.3	209.2	4	4.3	197.7	2	-.5	200.5	7	6.4	186.4
84	21	1.9	211.1	4	-3.5	194.2	2	-9.0	191.5	4	2.1	188.5

TABLE 14.—Barrel girth and gains for Holstein, Ayrshire, Guernsey and Jersey females.

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain cm.	Av. girth cm.	Animals no.	Period gain cm.	Av. girth cm.	Animals no.	Period gain cm.	Av. girth cm.	Animals no.	Period gain cm.	Av. girth cm.
Birth	261	...	80.5	99	...	78.7	78	...	76.6	105	...	70.3
3	224	39.7	120.2	81	39.5	118.2	59	31.0	107.6	82	34.5	104.8
6	249	33.5	153.7	91	31.6	149.8	69	32.8	140.4	97	33.9	138.7
9	205	22.2	175.9	75	22.5	172.3	56	22.1	162.5	76	22.4	161.1
12	237	12.7	188.6	86	8.5	180.8	68	12.2	174.7	89	12.5	173.6
18	198	19.0	207.6	76	19.7	200.5	54	19.8	194.5	78	17.7	191.3
24	192	17.9	225.5	72	20.0	220.5	58	19.1	213.6	80	14.7	206.0
30	145	8.4	233.9	55	4	220.9	37	3.2	216.8	56	4.4	210.4
36	130	3.8	237.7	56	6.1	227.0	34	5.6	222.4	47	4.9	215.3
42	107	2.4	240.1	36	4.9	231.9	19	2.9	225.3	38	1.7	217.0
48	94	3.9	244.0	32	9	232.8	21	15.0	240.3	37	5.8	222.8
54	79	2.0	246.0	21	.1	232.9	12	-5.8	234.5	25	.6	223.4
60	66	2.4	248.4	18	5.5	238.4	12	-2.1	232.4	22	5.2	228.6
66	49	3.2	251.6	10	-6.5	231.9	4	9.3	241.7	12	-3.4	225.2
72	44	-1.3	250.3	8	5.3	237.2	2	-11.2	230.5	8	-6.7	218.5
78	31	1.0	251.3	4	.5	237.7	2	10.0	240.5	7	13.2	231.7
84	28	.6	251.9	4	1.8	239.5	2	-11.0	229.5	4	.3	232.0

TABLE 15.—Thickness of hide at last rib and gains for Holstein, Ayrshire, Guernsey and Jersey females.¹

Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain mm.	Av. thickness mm.	Animals no.	Period gain mm.	Av. thickness mm.	Animals no.	Period gain mm.	Av. thickness mm.	Animals no.	Period gain mm.	Av. thickness mm.
Birth	170	...	3.6	97	...	3.9	75	...	3.3	98	...	3.2
3	164	6	4.2	78	.9	4.8	55	.5	3.8	76	.5	3.7
6	172	2.3	6.5	89	2.6	7.4	65	2.6	6.4	91	2.5	6.2
9	163	1.3	7.8	72	1.1	8.5	53	1.1	7.5	70	1.2	7.4
12	174	.6	8.4	84	.6	9.1	65	.6	8.1	83	.3	7.7
18	164	.5	8.9	74	.2	9.3	51	.2	8.3	72	.2	7.9
24	170	—2	8.7	70	—3	9.0	55	—4	7.9	74	—3	7.6

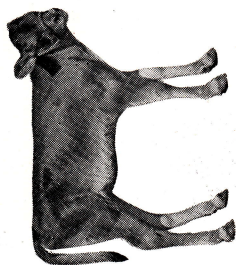
Thickness of hide at twist and gains for Holstein, Ayrshire, Guernsey and Jersey females. ¹												
Age in months	Holstein			Ayrshire			Guernsey			Jersey		
	Animals no.	Period gain mm.	Av. thickness mm.	Animals no.	Period gain mm.	Av. thickness mm.	Animals no.	Period gain mm.	Av. thickness mm.	Animals no.	Period gain mm.	Av. thickness mm.
Birth	169	...	3.2	97	...	3.5	75	...	3.1	95	...	3.1
3	164	.2	3.4	78	.4	3.9	55	.1	3.2	76	.2	3.3
6	172	.7	4.1	89	1.0	4.9	65	1.1	4.3	91	1.0	4.3
9	163	.4	4.5	72	.2	5.1	53	.1	4.4	70	.1	4.4
12	174	.3	4.8	84	.2	5.3	65	.2	4.6	83	.3	4.7
18	164	.2	5.0	74	.1	5.4	51	.2	4.8	72	0	4.7
24	170	—1	4.9	70	—1	5.3	54	—2	4.6	74	0	4.7

¹ Measurements were made at a fold in the skin and represent twice the hide thickness.

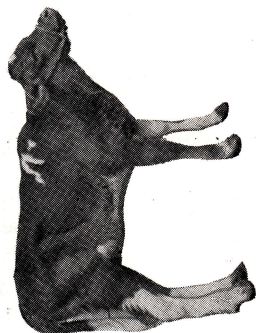
ANIMAL BODY GROWTH SHOWN BY PICTURES

Growth can be demonstrated by measurements of various parts of the body through a succession of age periods. It can be visualized by photographs of the same animal taken at a uniform distance from the camera, for progressive age periods. In this growth study, each animal was photographed at monthly intervals against a background marked off in six inch squares, with the camera at a fixed focus from the background. The pictures that follow represent one animal each of the Jersey, Guernsey, Ayrshire and Holstein breeds, taken at about five days of age (to represent birth), at six months, at one year, at two years, at three years, and at maturity (at least six years or over). The backgrounds have been removed so that the animal body outlines may be more readily apparent. This series, therefore, indicates how the animal body changes through the growth period.

AGE: 5 DAYS



Jersey



Guernsey

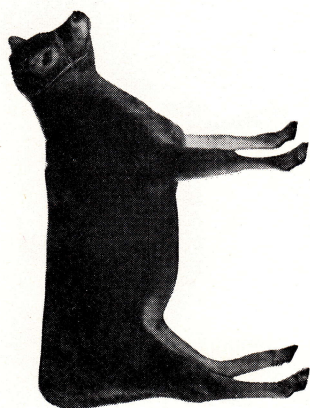


Ayrshire



Holstein

AGE: 6 MONTHS



Jersey



Guernsey

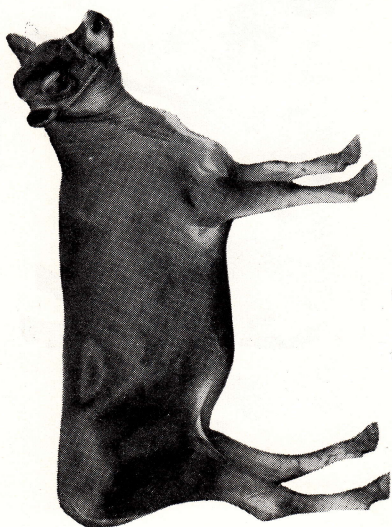


Ayrshire



Holstein

AGE: 1 YEAR



Jersey



Guernsey

AGE: 1 YEAR

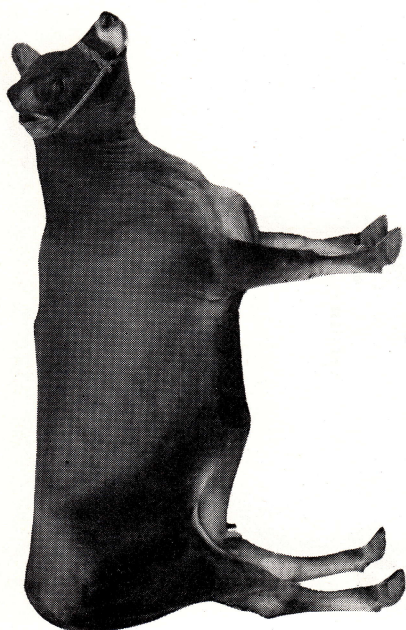


Ayrshire



Holstein

AGE: 2 YEARS



Jersey



Guernsey

AGE: 2 YEARS



Ayrshire



Holstein

AGE: 3 YEARS



Jersey



Guernsey

AGE: 3 YEARS

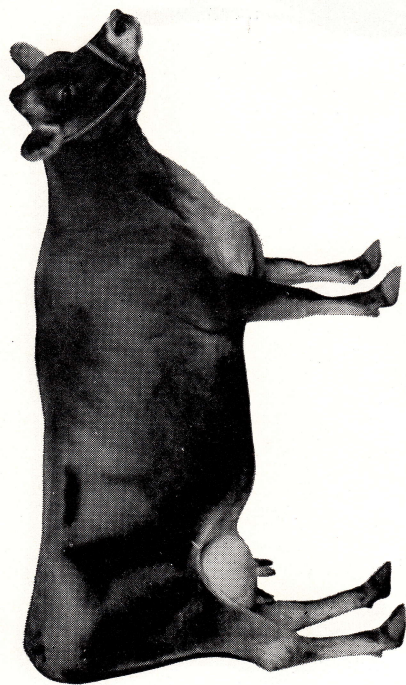


Ayrshire



Holstein

MATURE



Jersey



Guernsey

MATURE



Ayrshire



Holstein