

**Monitoring
Dairy Heifer**

Growth



PENNS^TATE



COLLEGE OF AGRICULTURAL SCIENCES

Monitoring Dairy Heifer Growth

INTRODUCTION

Raising dairy heifers to an adequate size and with an age at first calving between 22 and 24 months can optimize profitable milk production. This achievable goal requires proper nutrition and feeding management so heifers are large enough to breed at 13 to 15 months old. Both contract heifer growers and dairy producers who raise their own replacements should follow these breeding and calving age guidelines.

On many dairy farms, heifer management is not the most critical part of the day-to-day activities; however, chronic neglect of nutrition, feeding management, and preventative health care can lead to stunted growth. This results in heifers that calve much later than 24 months of age and that produce considerably less milk during their lifetime than those that are properly fed and well grown. Undersized heifers not only are smaller and less productive, but they also are prone to more problems at calving.

On the other hand, accelerating the growth of heifers until they become fat also reduces their lifetime milk production and longevity. Overfeeding concentrates or high-quality forages such as corn silage can cause this condition. Published research studies show that excessive energy intake (140 percent of the National Research Council's recommended amount) before breeding can decrease the rate of development of the secretory tissue in the cow's mammary gland and thereby reduce the number of alveolar cells available for milk synthesis. Feeding to achieve accelerated growth rates after breeding does not appear to hinder mammary development. Optimal secretory tissue development also can be aided by ensuring that heifers receive an adequate level of protein before breeding.

MEASURING HEIFERS

The success of a heifer-rearing program can be evaluated by monitoring the height and weight of calves and heifers and comparing the results against breed averages for a specific age group. Although most dairy producers, consultants, feed industry representatives, and veterinarians can recognize underconditioned or overconditioned animals, it is difficult to visually determine whether a heifer's height or weight is normal for her age. Measuring and weighing heifers allows them to be compared to standards that can indicate a problem in the heifer program.

To estimate a dairy animal's body weight, use a weight tape, which is accurate to within 5 to 7 percent of the actual body weight. Make certain that the animal is standing with her head upright. Pull the weight tape snug, but not too tight, around the heart girth just behind the front legs and shoulder blades.

When measuring the height at the withers, hold the animal's head upright on a clean, hard, level surface, and make sure that she is standing comfortably and not pulling against the halter. Measure the animal at the highest point of the withers. Hip height or width can be measured with less concern about the orientation of the animal's head. Measure body length with the animal straight and with its head held forward and upright.

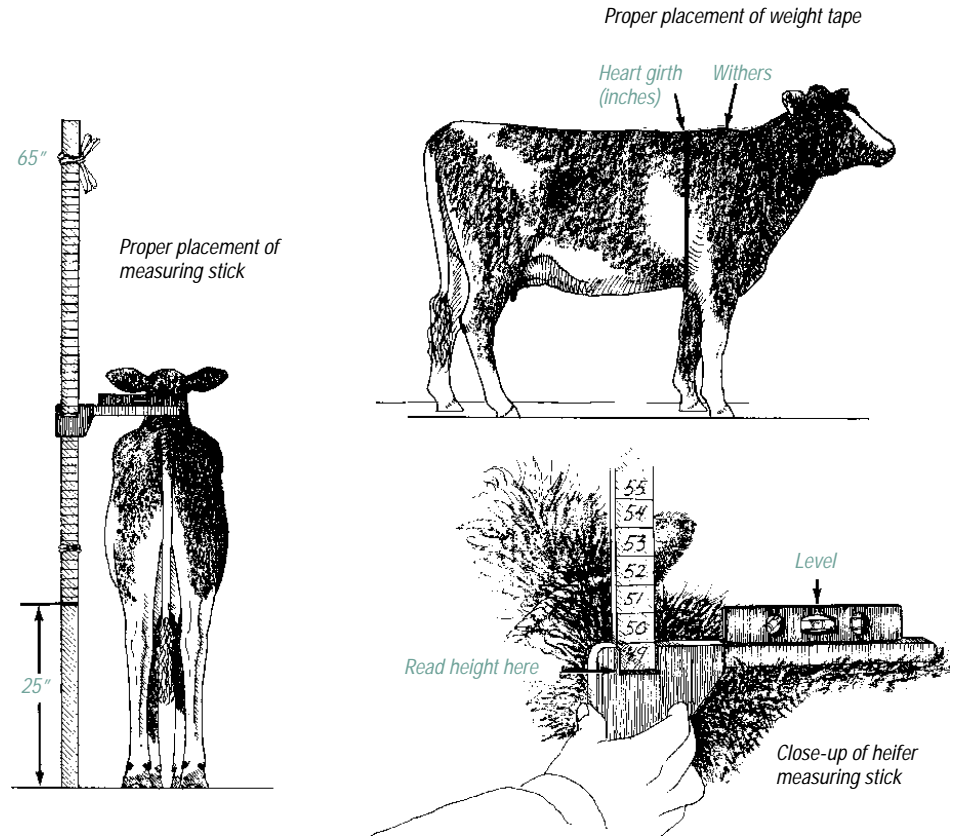


Figure 1. Weight by Month of Age—U.S. Holsteins

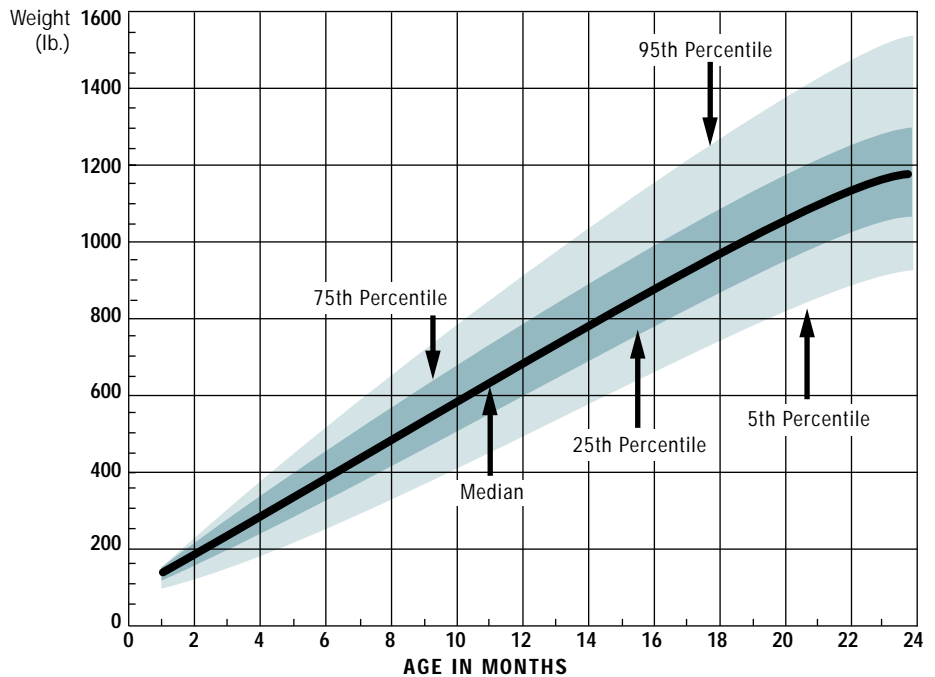


Figure 2. Height by Month of Age—U.S. Holsteins

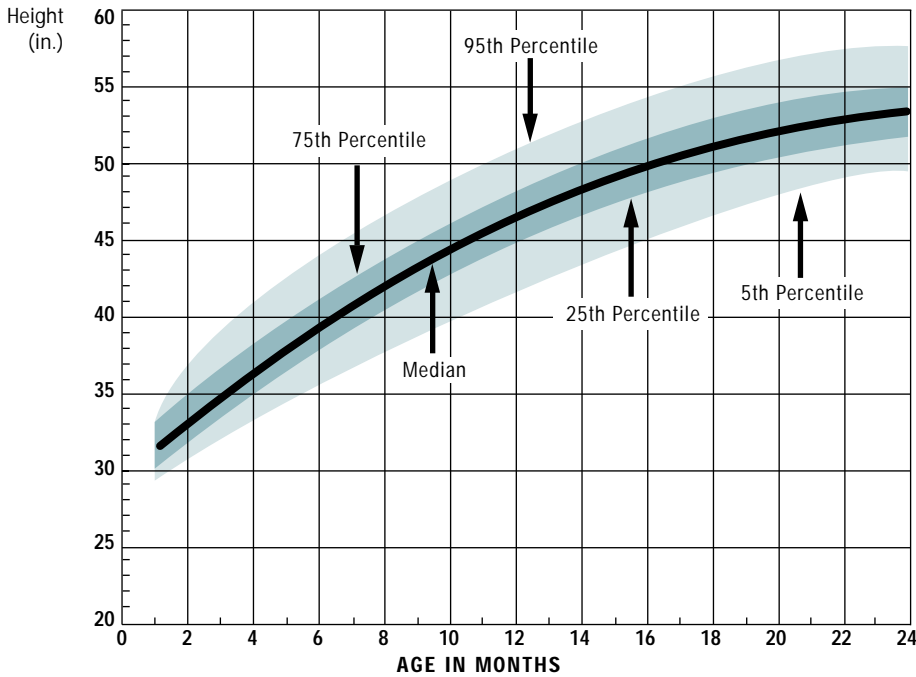
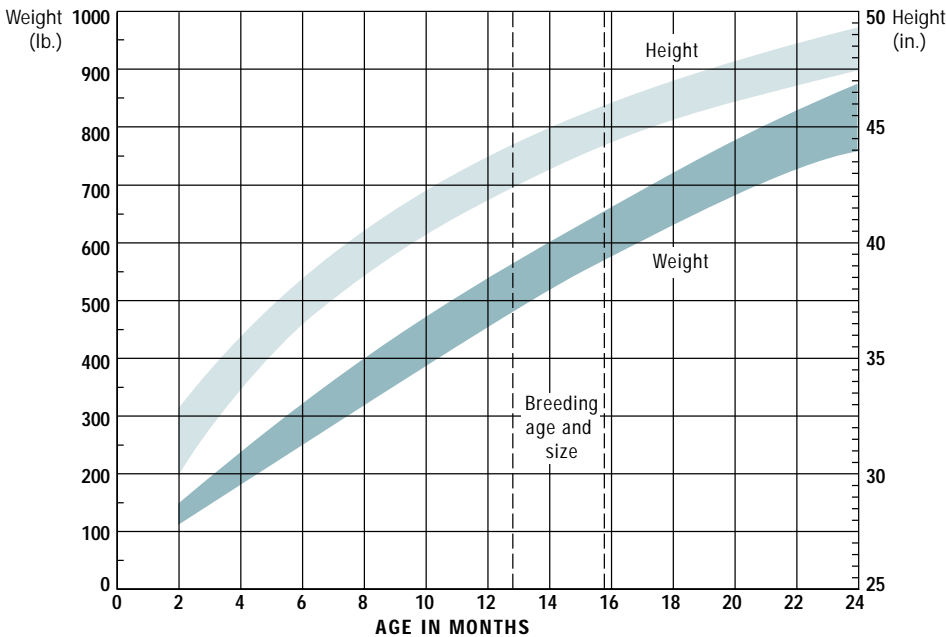


Figure 3. Penn State Calf and Heifer Growth Chart—Jerseys



GROWTH CHARTS

Figures 1 through 7 (beginning on page 2) depict the results of measuring a large number of heifers of various breeds throughout the United States. The Holstein population was part of a nationwide USDA study conducted during 1991 and 1992. Most of the data was collected from herds in which the average age at first calving was slightly greater than 24 months (see Table 1, page 6). As a result, the heifers probably were smaller for any given age than those found on today's well-managed dairy farms that calve heifers at 22 to 24 months of age.

The Holstein heifer growth charts indicate several percentiles of the U.S. population, allowing a producer to compare an individual heifer to all others and to set growth goals. Previous research has shown that heifers large enough to calve at 22 to 24 months old with acceptable levels of milk production must be near or above average in size. Growers should keep in mind that producing extremely large heifers may not result in increased levels of lifetime milk production, and is expensive from a feeding perspective because of the larger animals' increased daily caloric requirements.

It also is important to realize that calving age is highly correlated to the profitability of the animal, and that body weight after calving (1,250 pounds for Holsteins) is highly correlated to first lactation milk production. An achievable goal for dairy producers or contract heifer raisers is to keep a majority of heifers near the 75th percentile and the entire herd ranging between the median and the 95th percentile.

For all breeds of heifers except Holsteins, the recommended growth ranges shown are between the average and the top 67th percentile of the population. To achieve early calving (24 months or less) and high production potential, individual heifers should fall near the top of or slightly above the shaded area. It can be interpreted from these graphs that the height at the withers is more variable for younger heifers and, in general, that the variability in weight increases as age increases. Breed standards developed from the measurements are listed in Tables 2 through 8 (beginning on page 6).

The objective of a heifer-raising program is to achieve a relatively constant rate of growth. Holstein heifers should reach 750 to 800 pounds and 48 to 50 inches by the desired breeding age of 13 to 15 months. After calving, heifers should weigh 1,137 to 1,296 pounds and measure 52 to 55 inches tall at the withers. The recommended breeding heights and weights for all heifers are shown in Table 9 on page 10.

A variety of growth measurements can be used in addition to or in lieu of body weight and height at the withers. These include heart girth, hip width, body length, and hip height. Figures 8 to 11 (beginning on page 10) show these measurement recommendations for Holstein heifers. These data are a compilation of USDA and Pennsylvania data sets and are available for Holstein heifers only. The range in each figure represents the population average plus one standard deviation above the average.

Figure 4. Penn State Calf and Heifer Growth Chart—Guernsey

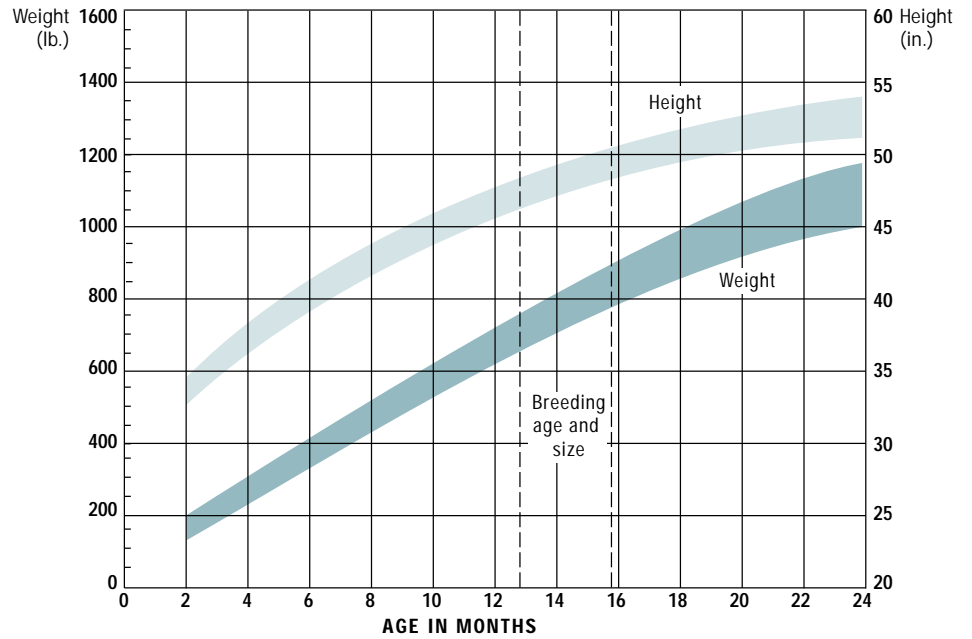


Figure 5. Penn State Calf and Heifer Growth Chart—Ayrshire

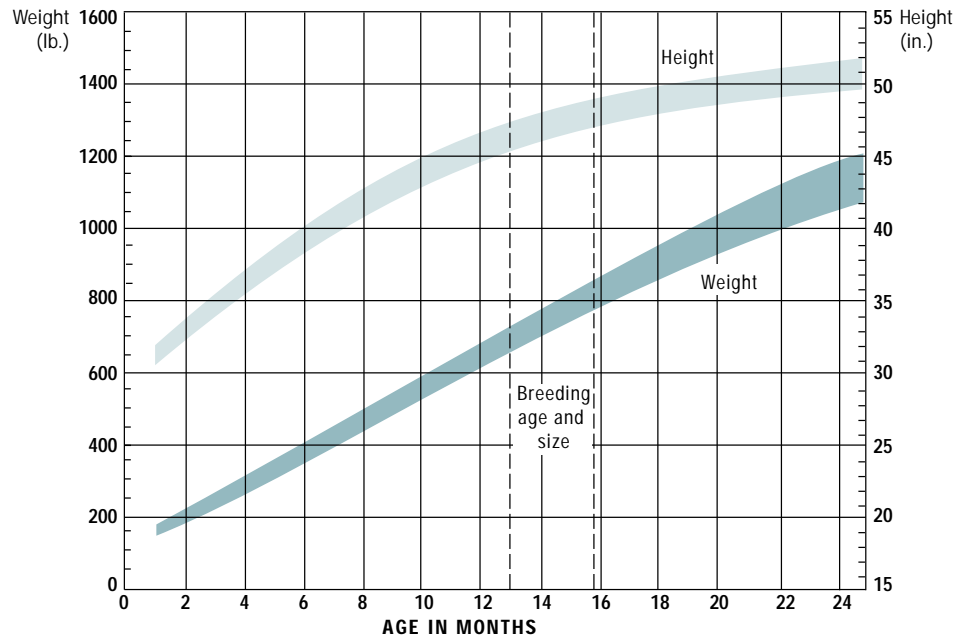


Figure 6. Penn State Calf and Heifer Growth Chart—Brown Swiss

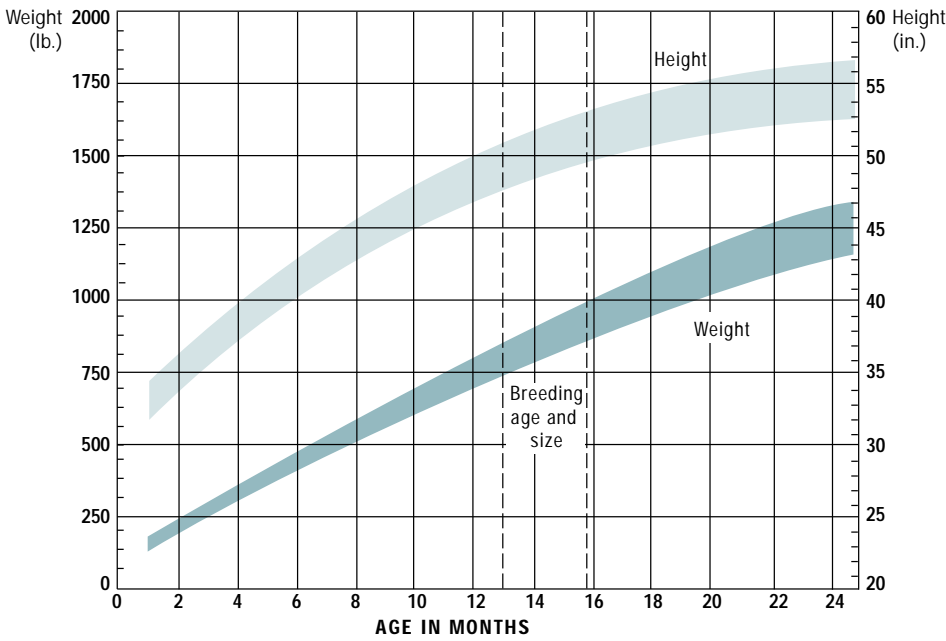
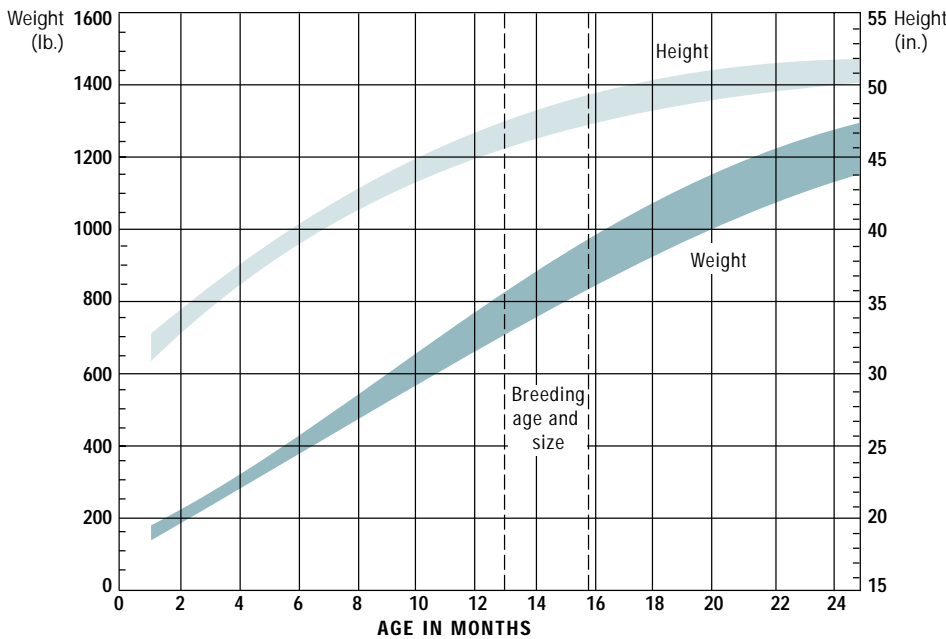


Figure 7. Penn State Calf and Heifer Growth Chart—Milking Shorthorn



EVALUATING GROWTH CHARTS

Growth charts can help in evaluating the performance of a heifer management program and can alert the producer to problem situations such as those in which entire groups of animals are undersized, underweight, or overweight. Low- or poor-quality forages (hay and silage) generally are responsible for inferior growth performance in young heifers, but lack of a balanced grain supplement and overcrowded housing can add to the problem. Underfed calves typically do not receive adequate energy and protein to meet their growth requirements. Inadequate housing and ventilation can contribute to poor growth by causing subclinical respiratory problems, and can negate an adequate feeding program. The level of management and sanitation also can affect heifer growth.

Adequate weight but restricted skeletal growth may occur in a particular age group. This problem usually is caused by relying on poor-quality hay and corn silage for all or most of the heifers' diet. Both of these forages typically have low protein, mineral, and vitamin levels. Feeding cereal grains with very little protein, mineral, and vitamin supplementation along with these forages may exacerbate the problem.

Feeding 2 to 4 pounds of grain per day and balancing the diet for protein, energy, minerals, and vitamins can solve a feeding problem, often within several months. Rations must be more than adequate, however, if heifers are to compensate with increased growth rates.

Another common scenario involves overweight animals with fairly normal skeletal growth for a specific age group. Heifers as young as 6 to 8 months of age may appear fat, but the problem generally is more common in breeding-age heifers. This condition most often is caused by marginal to adequate dietary protein but excessive energy intake. This can result from free-choice corn silage feeding along with moderate levels of supplemental grain, and arises on farms where good- to excellent-quality forages are produced and unrestricted amounts are fed to the heifers. Restricting the heifers' intake of these high-quality forages usually will correct the problem.

Table 1. Average heifer age at calving.

<i>Breed</i>	<i>Age</i>	<i>Standard Deviation</i>
Holstein ¹	25.9	+ 0.1
Ayrshire ²	27.6	1.8
Brown Swiss ²	27.0	1.7
Guernsey ³	26.2	2.0
Jersey ³	24.9	1.8
Milking Shorthorn ³	26.5	1.6

1. *Journal of Dairy Science* 77:1548-1555.

2. *Journal of Dairy Science* 77:1676-1681.

3. *Journal of Dairy Science* 74:1684-1689.

Table 2. Median weights (pounds) by month of age with 5th, 25th, 75th, and 95th percentiles indicated for Holstein heifers in The National Dairy Heifer Evaluation Project.

<i>Age in Months</i>	<i>Number of Animals</i>	<i>5th Percentile</i>	<i>25th Percentile</i>	<i>Median</i>	<i>75th Percentile</i>	<i>95th Percentile</i>
1	27	82	102	119	136	143
2	267	113	149	161	189	238
3	996	149	182	211	234	284
4	1202	189	234	258	284	339
5	997	218	275	311	339	411
6	683	266	320	369	422	480
7	523	301	369	422	468	542
8	420	330	422	468	530	603
9	380	379	468	530	596	705
10	293	422	517	575	653	776
11	242	445	556	638	712	776
12	203	504	596	682	760	843
13	240	504	660	728	809	913
14	237	542	697	776	878	1026
15	238	582	744	843	931	1067
16	200	653	826	913	988	1096
17	199	682	860	931	1026	1191
18	214	744	895	969	1066	1191
19	195	776	913	1007	1086	1279
20	189	776	950	1066	1170	1302
21	205	792	988	1086	1191	1372
22	176	843	1026	1148	1235	1420
23	182	809	1066	1148	1279	1420
24	197	776	1026	1170	1301	1545

Table 3. Median heights (inches) by month of age with 5th, 25th, 75th, and 95th percentiles indicated for Holstein heifers in The National Dairy Heifer Evaluation Project.

<i>Age in Months</i>	<i>Number of Animals</i>	<i>5th Percentile</i>	<i>25th Percentile</i>	<i>Median</i>	<i>75th Percentile</i>	<i>95th Percentile</i>
1	27	29	30	31	33	33
2	267	30	32	33	34	37
3	996	31	34	35	36	38
4	1202	33	35	36	38	40
5	997	34	37	38	39	42
6	683	36	38	40	41	44
7	523	37	40	41	43	45
8	420	38	41	43	44	47
9	380	39	42	43	45	47
10	293	41	43	45	46	49
11	242	42	44	46	47	49
12	203	43	45	47	48	51
13	240	43	46	47	49	51
14	237	44	47	48	50	52
15	238	43	47	49	51	53
16	200	46	48	50	51	53
17	199	46	49	50	52	54
18	214	47	49	51	52	54
19	195	48	50	51	52	54
20	189	47	50	51	53	57
21	205	48	50	52	54	56
22	176	49	51	52	54	57
23	182	49	51	53	54	57
24	197	48	52	53	55	57

COMPENSATORY GROWTH

Compensatory growth is a term used to describe a period of increased growth rate that follows a growth restriction imposed early in the heifer's life. These restricted-growth periods may have been caused by poor diets fed for short periods of time. Compensatory growth can allow poorly grown young heifers to reach breeding age on time (13 to 15 months), and can be achieved by feeding heifers diets high in energy, protein, and other required nutrients.

Increasing diet nutrient density by 10 to 20 percent will stimulate compensatory growth, but care must be taken to ensure that dry-matter consumption does not limit nutrient intake. Compensatory growth also can help older bred heifers to calve at the proper weight and to produce quantities of milk nearer to their genetic potential, rather than to make up the growth difference during their first lactation. Three to four months of compensatory growth may be necessary to assure that animals reach the desired weight and skeletal growth by one of the benchmark time periods (breeding or calving).

Table 4. Range of recommended Jersey heifer weights and heights.

<i>Age (months)</i>	<i>Weight (pounds)</i>	<i>Height (inches)</i>
1	93-108	29-32
2	122-146	30-33
3	155-177	32-34
4	183-217	34-36
5	233-278	35-38
6	259-321	36-39
7	303-362	38-40
8	335-412	39-41
9	373-436	40-42
10	391-483	40-42
11	428-499	41-43
12	471-548	42-44
13	500-571	43-45
14	535-602	44-45
15	565-640	44-46
16	583-661	45-46
17	609-696	45-47
18	639-753	45-47
19	651-769	46-47
20	698-813	46-48
21	719-827	47-48
22	758-860	47-49
23	760-878	48-49
24	790-893	48-50

Table 5. Range of recommended Guernsey heifer weights and heights.

<i>Age (months)</i>	<i>Weight (pounds)</i>	<i>Height (inches)</i>
1	122-143	31-33
2	166-193	33-35
3	203-233	35-37
4	255-299	37-38
5	299-354	38-41
6	366-434	40-42
7	384-448	41-43
8	433-503	42-44
9	482-568	43-47
10	511-588	44-46
11	574-662	45-47
12	576-674	46-48
13	643-756	46-48
14	696-803	47-49
15	740-866	48-50
16	779-899	49-51
17	830-950	50-52
18	864-1001	50-52
19	900-1015	51-52
20	914-1046	51-53
21	967-1112	51-53
22	996-1123	52-54
23	1025-1177	52-54
24	1026-1178	52-55

Table 6. Range of recommended Ayrshire heifer weights and heights.

<i>Age (months)</i>	<i>Weight (pounds)</i>	<i>Height (inches)</i>
1	131-154	31-32
2	177-205	32-34
3	223-256	34-36
4	269-307	36-38
5	315-357	37-39
6	360-407	39-41
7	405-457	40-42
8	450-506	41-43
9	494-554	42-44
10	538-602	43-45
11	581-650	44-46
12	624-697	45-47
13	666-743	46-48
14	707-789	46-48
15	748-834	47-49
16	787-878	48-49
17	826-922	48-50
18	864-965	48-50
19	901-1007	49-50
20	937-1049	49-51
21	972-1089	49-51
22	1006-1129	50-52
23	1039-1168	50-52
24	1070-1206	50-52
25	1101-1244	51-53

Table 7. Range of recommended Brown Swiss heifer weights and heights.

<i>Age (months)</i>	<i>Weight (pounds)</i>	<i>Height (inches)</i>
1	134-163	32-34
2	187-223	34-36
3	240-283	36-38
4	293-343	37-40
5	345-403	39-42
6	396-462	40-44
7	447-521	42-45
8	498-580	43-46
9	548-637	44-48
10	597-694	45-49
11	645-750	46-50
12	693-805	47-51
13	739-859	48-52
14	785-912	49-52
15	829-963	49-53
16	872-1013	50-54
17	914-1061	50-54
18	955-1107	51-55
19	994-1152	51-55
20	1032-1194	52-56
21	1068-1235	52-56
22	1103-1273	52-56
23	1136-1309	53-57
24	1167-1343	53-57
25	1197-1374	53-57

Table 8. Range of recommended Milking Shorthorn heifer weights and heights.

<i>Age (months)</i>	<i>Weight (pounds)</i>	<i>Height (inches)</i>
1	128-160	31-32
2	175-210	33-34
3	223-262	34-36
4	272-315	36-38
5	320-370	37-39
6	369-425	37-41
7	418-482	40-42
8	467-539	41-43
9	515-596	42-44
10	564-653	43-45
11	611-709	44-46
12	658-765	45-47
13	705-820	46-47
14	750-874	46-48
15	794-926	47-49
16	838-977	47-49
17	880-1025	48-50
18	920-1071	48-50
19	959-1115	49-50
20	997-1155	49-51
21	1033-1192	49-51
22	1066-1226	50-51
23	1098-1256	50-52
24	1128-1281	50-52
25	1155-1303	51-52

USE OF IONOPHORES TO IMPROVE GROWTH

Two feed additives that enhance growth and increase feed efficacy are Bovatec (lasalocid sodium) and Rumensin (monensin sodium). The active ingredient in these products is an ionophore.

Ionophores alter rumen microbial populations and the total volatile fatty acids produced in the rumen, increase propionic acid production, and decrease the amount of acetic and butyric acid produced. Furthermore, both compounds decrease rumen methane production. These alterations within the rumen environment improve feed efficiency and increase the rate of weight gain in heifers. Many published studies have shown that heifers fed either of these two compounds gained 0.1 to 0.2 pounds per day more than those that were not fed the additives.

Ionophores can be used effectively in well-balanced feeding programs for heifers, but will not be used to their full potential if rations are not properly balanced, especially for protein and energy. In situations whereby animals are allowed free-choice access to high-quality forages, incorporating ionophores can be detrimental to the animal if it is allowed to become overconditioned.

BODY CONDITION OF DAIRY HEIFERS

Body condition scoring is an additional tool that can be used to evaluate the overall nutrition and management of a heifer program. Some limitations in conducting heifer body condition scoring include long winter hair coats (in colder climates) and the problem of catching heifers to closely observe fat over the ribs and tail head.

The recommended range of body condition scores for heifers is illustrated in Figure 12 on page 12. Young calves generally are thin by nature (2.0 to 2.5 on the five-point scale), but their body condition score should increase to or near 3.0 by breeding age. A body condition score of 3.5 to 3.7 is considered ideal for heifers calving at age 22 to 24 months. This score allows a moderate amount of stored body fat to be used in early lactation when dietary energy is insufficient for milk output.

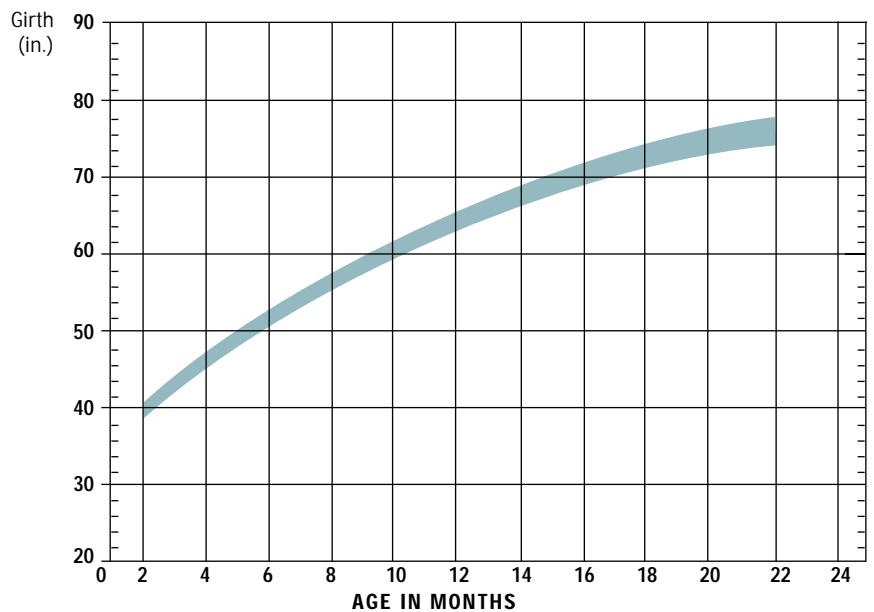


Measuring wither height.

Table 9. Suggested weights and heights for breeding-age heifers.

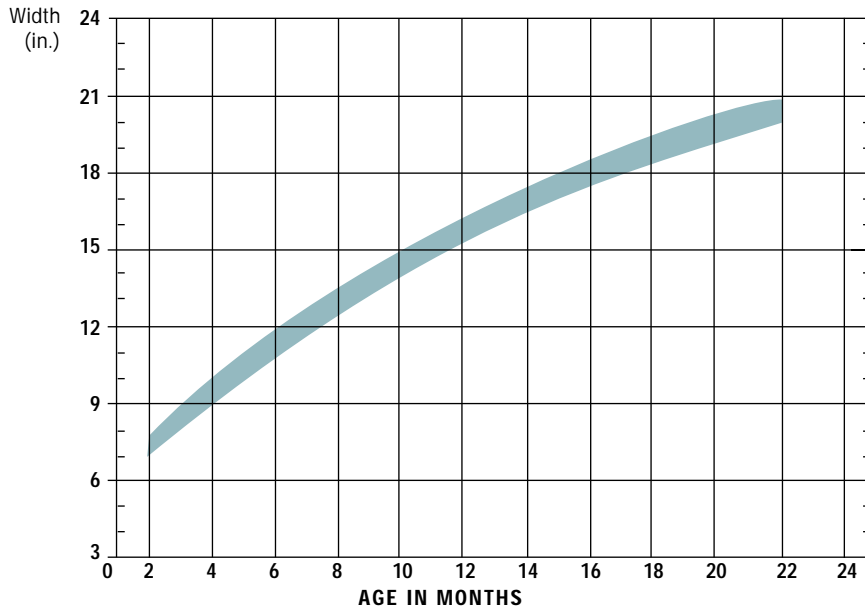
Breed	Body Weight (pounds)	Wither Height (inches)	Hip Height (inches)
Jersey	525-575	43-45	45-47
Ayrshire	700-750	46-48	48-50
Guernsey	700-750	46-49	48-51
Milking Shorthorn	750-800	46-48	48-50
Holstein	750-800	48-50	50-52
Brown Swiss	750-800	48-51	50-53

Figure 8. Penn State Calf and Heifer Growth Chart—Holstein Heart Girth*



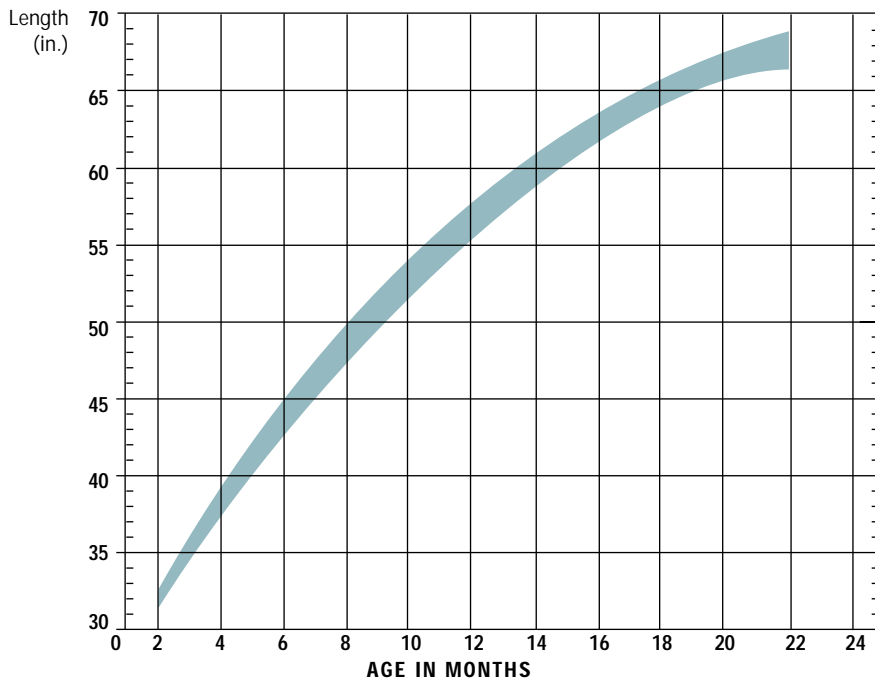
*Range represents population mean and +1 standard deviation above.

Figure 9. Penn State Calf and Heifer Growth Chart—Holstein Hip Width*



Measuring heart girth.

Figure 10. Penn State Calf and Heifer Growth Chart—Holstein Body Length*



Measuring hip width.



Measuring body length.

*Range represents population mean and +1 standard deviation above.

SUMMARY

Healthy, productive herd replacements are the result of good management that starts before the calves are conceived and continues until they enter the milking herd. Keep accurate records to ensure that a sound breeding program is followed. The entire process ensures that genetically superior animals will enter the herd with the maximum potential for milk production.



Measuring hip height.

Figure 11. Penn State Calf and Heifer Growth Chart—Holstein Hip Height*

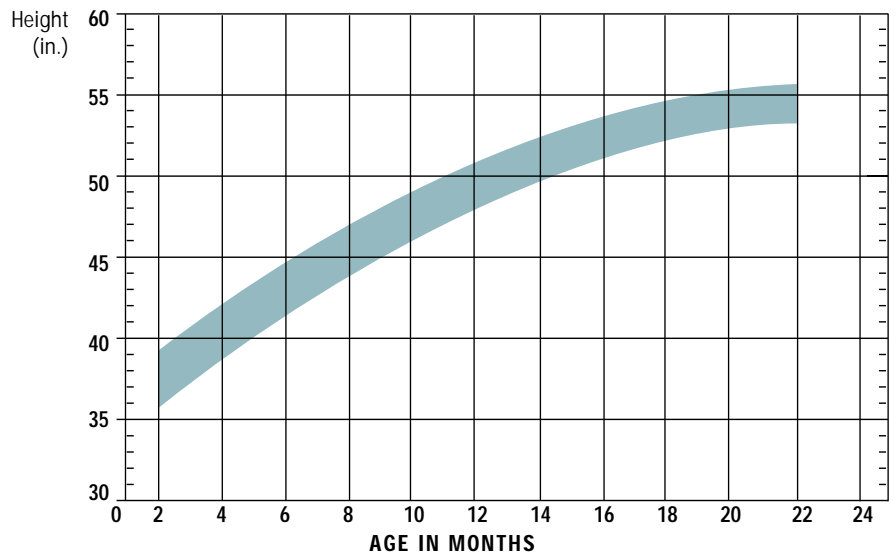
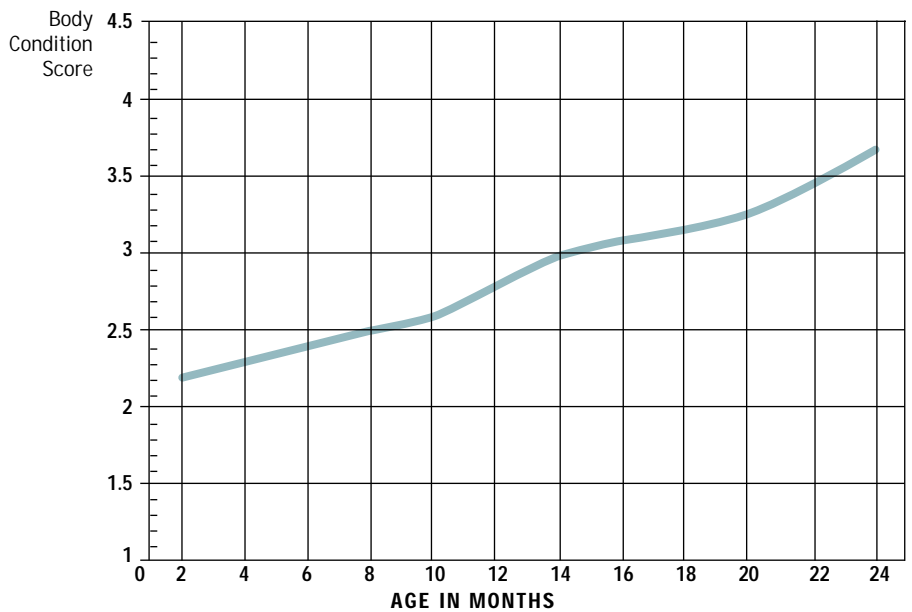


Figure 12. Body Condition Score—Dairy Heifers



*Range represents population mean and +1 standard deviation above.

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