

Age Related Serum Cholesterol, Glucose, and Total Bilirubin Concentrations of Female Dairy Cattle¹ (36055)

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Serum, or plasma, cholesterol concentrations have been reported (1-4) to increase with advancing age in human beings. The incidence of spontaneous atherosclerosis in cattle has been reported (5-8). To elucidate the underlying mechanisms of lipid metabolism, a suitable animal species must be found to complement studies with human beings. This study was designed to evaluate bovine serum cholesterol, glucose, and total bilirubin concentrations as a function of age. From previous studies, it was known that serum total bilirubin concentrations were age dependent; therefore, this parameter was also included.

Methods. During a 3 week period in June, 50 ml jugular blood samples were collected, between 5 and 8 a.m., from 510 (311 guernsey and 199 holstein) female dairy cattle ranging from 1 month to 16 years of age. None of the cattle were fasted prior to sample collection. The blood was allowed to clot, at room temperature for 4 to 6 hr, and the serum was separated by centrifugation at 12,500g and 2° for 10 min. The serum was recentrifuged at 20,000g and 2° for 5 min to remove any remaining cells and fibrin conglomerates. Each serum sample was frozen and stored at -10° until analyzed. Cholesterol, glucose, and total bilirubin determinations were made with a Sequential Multiple AutoAnalyzer (SMA-12/30) (9).

Results. Data for each of the measured serum components were grouped as depicted in Table I. There was no difference in mean serum cholesterol concentration between the 2 breeds. Through 3 years of age, there was a significant ($p < .001$) linear ($\hat{Y} = 106.0702 + 10.2924 X$) increase in mean serum chole-

sterol concentration for all animals. Mean serum cholesterol concentration was 110.4 ± 5.4 and 100.9 ± 4.7 mg/100 ml at <0.5 years and increased to 197.7 ± 8.0 and 180.6 ± 5.3 mg/100 ml at 3 years of age for the holsteins and guernseys, respectively. From 3 years of age, there was a significant ($p < .01$) decrease for both breeds.

There was a significant ($p < .001$) linear ($\hat{Y} = 74.6653 - 3.9935 X$) decrease, for all animals, in mean serum glucose concentration from <0.5 to 5 years of age, with no change thereafter. The decrease was from 69.8 ± 3.5 and 94.7 ± 2.9 mg/100 ml at <0.5 years to 51.4 ± 3.7 and 51.2 ± 2.3 mg/100 ml at 5 years of age for the holsteins and guernseys, respectively. There was no difference between breeds. There was a significant ($p < .001$) linear ($\hat{Y} = 0.2539 + 0.0200 X$) increase, for all animals, in mean serum total bilirubin concentration with age. The increase was from 0.24 ± 0.01 mg/100 ml at 1 year to 0.32 ± 0.05 mg/100 ml at 10 years of age. There was no difference in mean serum total bilirubin concentration between the 2 breeds.

Discussion. The marked increase in mean serum cholesterol concentration, during the first 3 years of age, was not consistent with previously reported studies with deer (10, 11), swine (12), rats (13), or rabbits (14). The lower serum cholesterol concentration of older cows may reflect the process of natural, or production, selection as has been suggested previously (3, 15) for man. The mean values for the adult holsteins and guernseys in this study were greater than previously reported for Ayrshire cattle (16), zebu and Scotch Highland cattle (17), white-tailed deer (10), or aoudads (18).

An inverse relationship existed, during the

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TABLE I. Mean ($\pm$ SEM) Concentrations of Serum Cholesterol, Glucose, and Total Bilirubin of 510 (311 Guernsey and 199 Holstein) Female Dairy Cattle Ranging from 1 Month to 16 Years of Age.

Age (years)	No. of animals	Cholesterol (mg/100 ml)	Glucose (mg/100 ml)	Total bilirubin (mg/100 ml)
<0.5	26 ^a	110.4 $\pm$ 5.4	69.8 $\pm$ 3.5	0.28 $\pm$ 0.01
	37 ^b	100.9 $\pm$ 4.7	94.7 $\pm$ 2.9	0.21 $\pm$ 0.01
0.5-1.5	22	119.4 $\pm$ 3.6	67.8 $\pm$ 2.4	0.25 $\pm$ 0.02
	72	121.3 $\pm$ 2.6	76.5 $\pm$ 2.6	0.23 $\pm$ 0.01
1.5-2.5	22	147.6 $\pm$ 4.4	61.8 $\pm$ 2.2	0.38 $\pm$ 0.01
	61	128.5 $\pm$ 3.4	66.2 $\pm$ 1.3	0.27 $\pm$ 0.01
2.5-3.5	23	197.7 $\pm$ 8.0	57.8 $\pm$ 2.4	0.29 $\pm$ 0.02
	37	180.6 $\pm$ 5.3	53.8 $\pm$ 2.3	0.30 $\pm$ 0.02
3.5-4.5	42	190.0 $\pm$ 6.3	56.3 $\pm$ 2.5	0.32 $\pm$ 0.01
	28	188.0 $\pm$ 9.6	55.4 $\pm$ 2.2	0.30 $\pm$ 0.01
4.5-5.5	19	179.5 $\pm$ 10.2	51.4 $\pm$ 3.7	0.30 $\pm$ 0.02
	19	195.4 $\pm$ 13.1	51.2 $\pm$ 2.3	0.33 $\pm$ 0.02
5.5-6.5	9	177.7 $\pm$ 11.5	54.9 $\pm$ 5.9	0.36 $\pm$ 0.03
	16	180.9 $\pm$ 12.4	53.6 $\pm$ 2.9	0.29 $\pm$ 0.02
6.5-7.5	8	165.1 $\pm$ 11.8	60.2 $\pm$ 4.3	0.39 $\pm$ 0.04
	13	169.5 $\pm$ 9.4	59.6 $\pm$ 3.9	0.30 $\pm$ 0.02
7.5-8.5	8	178.1 $\pm$ 10.8	57.8 $\pm$ 2.6	0.28 $\pm$ 0.03
	7	195.0 $\pm$ 28.9	47.1 $\pm$ 4.2	0.26 $\pm$ 0.02
8.5-9.5	11	156.8 $\pm$ 11.3	67.1 $\pm$ 4.1	0.39 $\pm$ 0.04
	6	182.3 $\pm$ 41.6	60.7 $\pm$ 2.2	0.33 $\pm$ 0.05
9.5-10.5	4	152.2 $\pm$ 23.4	70.8 $\pm$ 12.2	0.32 $\pm$ 0.08
	5	192.6 $\pm$ 27.2	55.5 $\pm$ 6.6	0.32 $\pm$ 0.04
>10.5	5	149.6 $\pm$ 17.0	62.8 $\pm$ 8.6	0.42 $\pm$ 0.05
	10	166.1 $\pm$ 8.6	58.2 $\pm$ 4.3	0.31 $\pm$ 0.02

^a Holstein.^b Guernsey.

first 3 years of age, between serum glucose and cholesterol concentrations; mean serum glucose concentration decreased while mean serum cholesterol concentration was markedly increased. Mean serum glucose concentration, for adult cows, was similar to that previously reported for Ayrshire cattle (16), but lower than reported for zebu and Scotch Highland cattle (17), deer (10) or aoudads (18). The lower values obtained in this study may have been a reflection of the minimal excitement at the time of collection as these dairy cattle were sampled in the lots where they were housed. The increase in mean serum total bilirubin concentration, with advancing age, was similar to that reported by

Mylrea and Healy (19) for healthy female dairy cattle. The values given herein were similar to those reported for dairy cattle in South Wales (19), zebu and Scotch Highland heifers (17) and aoudads (18), but lower than reported for white-tailed deer (10).

Summary. Serum cholesterol, glucose, and total bilirubin concentrations were determined for female holstein and guernsey cattle ranging from 1 month to 16 years of age. Serum cholesterol increased during the first 3 years of life and decreased thereafter. Serum glucose decreased during the first 5 years of age and remained stable thereafter. Serum total bilirubin increased with advancing age.

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