AN INVESTIGATION OF ARTERIAL DISEASE IN ALASKAN REINDEER AND CARIBOU

Authors: DIETERICH, ROBERT A., and LUICK, JACK R.

Source: Journal of Wildlife Diseases, 15(3) : 433-435

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-15.3.433

AN INVESTIGATION OF ARTERIAL DISEASE IN ALASKAN REINDEER AND CARIBOU

ROBERT A. DIETERICH and JACK R. LUICK, Institute of Arctic Biology, University of Alaska, Fairbanks, Alaska 99701, USA.

Abstract: No significant lesions of atherosclerosis or other vascular diseases were found in the aorta and coronary arteries of 34 reindeer and 15 caribou *(Rangifer tarandus).* Serum lipid, phospholipid, cholesterol and triglyceride levels were similar in caribou and reindeer and did not differ greatly from those reported in other ruminants.

INTRODUCTION

Atherosclerotic lesions similar to those seen in domestic ruminants have been reported in the aorta of caribou *(Rangifer tarandus).*[6] Plaque formation, fatty streaks, lipid and calcium deposition, internal elastic membrane duplication and disruption, and the occurrence of smooth muscle cells in the intima in the caribou were quite similar to changes observed in man and other animals. This information led to speculation on the value of reindeer and caribou as animal models for the study of human atherosclerosis.

Reindeer are considered domestic animals while caribou are considered the wild non-domesticated subspecies of *R. tarandus.* In Alaska both are free ranging and consume similar diets. During summer they eat primarily green vegetation, whereas in winter the diet is high in lichen with some dependence on other frozen vegetation.[5] Lichen are fungi/algae symbionts that contain about 83% carbohydrate as lichenin and isolichenin rather than as the starch-cellulose-hemicellulose carbohydrate complex consumed by domesticated ruminants. This unique diet is low in fat and essentially lacks cholesterol and is not the usual type of atherogenic diet used to produce lesions in animals. The size of the cardiovascular system in reindeer and caribou is similar to that of man and could possibly act as a model for human cardiac assist devices. With these considerations in mind, reindeer and caribou in Alaska were surveyed to determine the prevalence of arterial disease and to assess serum lipid values.

MATERIALS AND METHODS

Thirty-four reindeer and 15 caribou collected during other investigations or killed by hunters were examined. The reindeer originated from Nome or Nunivak Island, Alaska and were part of research herds held at Cantwell or Fairbanks, Alaska. The caribou were from herds in the Northeastern portion of Alaska. The animals ranged in age from 1 month to 12 years (Table 1). Age was determined by dental sectioning or estimated on the basis of dental wear. Tissues and sera were collected fresh and preserved for later processing. The aorta was removed intact, opened longitudinally, placed on chipboard strips within stainless steel catheter trays, and covered with 10% buffered formalin. The circumflex and descending branches of the coronary arteries were incised with a minimal amount of myocardium attached and fixed in 10% buffered formalin. Freezing of the tissues in the field was prevented by the use of insulated transport boxes and heated airplanes. Whole blood was collected from 10 caribou and 7 reindeer, all of

TABLE 1. Age group, sex and area of origin of reindeer and caribou examined for atherosclerosis.

Number	Age Group	Sex		Area of Origin	
Reindeer		male	female	Nome	Nunivak Island
9	1 month to 1 year	4	5	5	4
2	1 to 2 years	1	1	2	0
23	2 to 10 years	6	17	16	7
Caribou				Happy Valley	Old John Lake
1	1 month to 1 year		1	1	
1	1 to 2 years	1		1	
7	2 to 5 years	3	4		7
6	5 to 12 years	1	5		6

which were more than 2 years of age. Serum was stored at -50 C.

Coronary arteries were sectioned at 15 μm on a freezing microtome at approximately 1 cm intervals, stained with Sudan IV plus Harris' hematoxylin as a counterstain, and examined with a light microscope. The entire aorta from each animal was stained with Sudan IV and preserved in a plastic bag.[4] Aortas were examined grossly and representative sudanophilic and non-sudanophilic areas were sectioned on a freezing microtome and examined microscopically.

Sera were analyzed by a commercial laboratory. Total lipids were determined by the vanillin method[7,8] and phospholipids were measured by the ammonium molybdate and p-semidine method.[2] Cholesterol and triglycerides were determined by the use of a Technicon autoanalyzer (SMAC).

RESULTS

Vessels

No significant lesions of atherosclerosis were found in any of the cardiovascular tissues examined. A few areas of very slight sundanophilia, were seen in the stained aortas, but there was no evidence of fatty streaks or subendothelial stain uptake in these areas. All intimal surfaces were smooth and had the appearance of very healthy vascular tissue as did the tunica media and tunica adventitia.

Serum Total Lipids

There were no significant differences between reindeer and caribou in the means at the 95% confidence level for all the parameters measured except for total lipids, and total lipids were not significantly different at the 99% confidence level (Table 2). No age/sex differences were noted within the caribou and reindeer groups, but the sample size was not large enough to be considered significant.

DISCUSSION

The lack of atherosclerotic lesions in the 49 animals examined in this study differs from the results of a smaller study of Alaskan caribou[6] in which degenerative changes suggestive of those that precede plaque formation were observed in 3 of 9 caribou. These changes represented slight alterations in the concerned vessels and would not be considered significant to the well being of the animal. A study of exotic captive ungulates concluded that minor degrees of fatty streaking were fairly common in various species, but that gross atherosclerosis was rare.[3] The results of

this study indicate that reindeer and caribou living on natural diets do not develop lesions of atherosclerosis significant enough to warrant their use as normally occurring models of arterial disease.

Serum lipid values were not remarkable for a ruminant species.[1] Serum cholesterol levels were moderate and hypercholesterolemia was not detected in any of the individual samples.

TABLE 2. Serum lipid levels of reindeer and caribou.

	Age Range (years)	Total Lipids	Phospholipids	Cholesterol	Triglycerides
		mg/dl	mg/dl	mg/dl	mg/dl
Reindeer					
N=7	2-10	353±193*	118±79	119±56	16±14
Caribou					
N=10	2-12	193±58	83±21	91±54	23±12

*Mean ± Standard Deviation

Acknowledgements

This research was supported in part under an agreement between the Center for Disease Control and the University of Alaska.

LITERATURE CITED

1. ALTMAN, P.L. 1961. Blood lipids. In: *Blood and Other Body Fluids.* D. Dittmer, Ed. Federation of American Societies for Experimental Biology, Washington, D.C., pp. 80-82.
2. BAUMAN, E.G. 1924. Phospholipids - methods: ammonium molybate and p-semidine. J. Biol. Chem. 59: 667.
3. FINLAYSON, R. 1965. Spontaneous arterial disease in exotic animals. J. Zool. 147: 239-343.
4. HOLMAN, R.L., H.C. McGILL, JR., J.P. STRONG and J.C. GEER. 1958. Technics for studying atherosclerotic lesions. Lab. Inv. 7: 42-47.
5. LUICK, J.R. 1977. Diets for mammals. In: *CRC Handbook Series in Nutrition and Food.* M. Rechcigl, Ed. CRC Press, Inc. Cleveland, Ohio, pp. 267-278.
6. WIGGERS, K.D., N.L. JACOBSON and R. GETTY. 1971. Atherosclerosis in ruminants. J. Anim. Sci. 32: 1037-1041.
7. WOODMAN, D.D. and C.P. PRICE. 1972. Total lipids - method: vanillin. Clin. Chim. Acta 38: 39-43.
8. ZOLLNER, N. and K. KIRSCH. 1962. Total lipids - methods: vanillin. Zeitschr. Ges. Exp. Med. 1935: 545.

Received for publication 1 September 1978