

A METHOD FOR COMPARING POLAR BEARS EATING NEARLY 100% FAT WITH FASTED BEARS

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Abstract: Plasma lipids (triglycerides and cholesterol) from polar bears (*Ursus maritimus*) fed a nearly 100% seal fat diet and from fasted bears are compared. Fasted bears had plasma with more triglycerides and cholesterol than fed bears. Fatty acid composition of both triglycerides and cholesterol differed between fed and fasted bears. Omega-3 fatty acids (found in seal fat) were higher in both plasma lipids from fed bears than fasted bears.

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In this paper, we summarize a preliminary study of serum chemistry in polar bears comparing plasma lipids of 2 bears eating nearly 100% fat to 2 fasted bears. Rationale for conducting further investigations is provided.

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METHODS

Bears Eating Nearly 100% Fat

Two captive polar bears, a 450 kg male and a 205 kg female, were maintained near their natural environment at the Naval Arctic Research Laboratory, Point Barrow, Alaska. The male had been raised at the laboratory since it was brought in as a cub some 4 years before. The female had been immobilized on the pack ice near Point Barrow 4 months prior to blood sampling, brought to the laboratory, and maintained in a separate cage. For 2 months prior to sampling, both bears were fed whole seal (*Phoca richardii richardii*) carcasses. Both bears almost exclusively limited their consumption to blubber portions, leaving almost all remaining portions of each carcass. Because bears would wait 3 or 4 days before consuming the muscle portions, seal carcasses were fed frequently to minimize protein consumption. Blood samples were collected while animals were immobilized with phencyclidine HCl in June 1981. Blood was drawn into tubes containing 1 mg of ethylene-diaminetetraacetate (EDTA) per ml of blood and immediately centrifuged for 10 min at 600 rpm. The plasma was removed, centrifuged at 2,000 rpm for 10 min, and then transferred into screw-capped vials. The plasma was transported by air from Point Barrow to Iowa City, Iowa, with the temperature of the plasma maintained at 4°C. Serum chemistries were analyzed at the Department of Biochemistry, University of Iowa, Iowa City, Iowa.

Fasted Bears

Because the previous 2 bears could not be fasted for comparative study, other sources of polar bears were utilized. On approximately 1 October 1991, 2 bears which had been captured in the city of Churchill, Manitoba were designated as experimental subjects. One was a 4-year-old male weighing 176 kg, and the other was a 9-year-old female weighing 124 kg. We can presume that these 2 bears fasted at least one month and probably very much longer prior to capture, since during this season, bears rarely eat while waiting for pack ice to form on Hudson Bay. We had requested that the Wildlife Branch monitor the coast for dead whales or seals upon which these animals could feed, of which none were found. In addition no fecals were produced by either bear during the 1 month of confinement prior to sampling. Captured bears were confined within a holding facility for bears causing problems in the city of Churchill. Because free-ranging bears normally fast during this season, confined bears were not fed. On 6 November 1991, the 2 bears were immobilized with phencyclidine HCl for relocation by helicopter north of Fort Prince of Wales in Northwest Territories. Blood samples were collected during immobilization. Collection, handling, transport, and analysis of samples were similar to that for samples collected from fed bears. During transport from Churchill to Iowa City, the samples were maintained at 4°C; however, for a brief period the dry ice with which they were packed did freeze the plasma. Serum chemistries for this study were not influenced by the brief freezing.

RESULTS

Preliminary results from fed bears have been published (Kaduce et al. 1981). The preliminary results for plasma lipids from fed and fasted bears are presented in this paper. Plasma from polar bears fed 100% fat diet contained more lipid than in humans,

reaching a triglycerides level of 199 mg/dl \pm 15 SE and total cholesterol level of 298 mg/dl \pm 24 SE, which would be fatal for dogs or rabbits (Kaduce et al. 1981). Yet lipid was higher still in fasted bears as indicated by a triglycerides level of 292 mg/dl and a cholesterol level of 381 mg/dl \pm 36 SE in fasted bears. There were substantial changes in the fatty acid composition of plasma lipids in fed polar bears versus fasted. The omega-3 fatty acid #20:5 (OFA) (which is found in seal fat and fish oil) was considerably higher in the fed state than in the fasted state. Twenty-nine percent of fatty acids in cholesterol of fed bears were OFA in contrast to 3% in cholesterol from fasted bears. Likewise, 13% of fatty acids in triglycerides from fed bears were OFA compared to 4% from fasted bears.

DISCUSSION

It is a common belief in medicine today that the dietary omega-3 fatty acids reduce the level of saturated fat in human subjects. In our experiment, the most reasonable interpretation is that the known quantity of dietary omega-3 fatty acids in seal meat reduces the level of saturated fat in the blood of bears eating nearly 100% fat; those bears that had fasted for 1 to 3 months were not eating dietary omega-3 fatty acids and as in human subjects without this material, the level of saturated fat in their blood was increased.

Criticism of the Experiment

This was not an ideal experiment because samples were taken from 2 bears at Point Barrow and 2 different bears at Hudson Bay. Also, it is possible that the population on the pack ice off Point Barrow is different from the population at Hudson Bay in respect

to biochemical behavior. However, in these preliminary studies, there appeared to be a reasonable pattern in the data in that the 2 results from a male and female at Point Barrow were significantly different from the 2 results that were much higher in the Hudson Bay bears. One point that should be made in favor of doing this experiment is that the 2 fasted bears did not have to be immobilized strictly for obtaining blood samples because they were chemically immobilized for relocation to the north.

Future Experiments

It is important that these experiments should be continued because of the relevance of these results to human clinical work. It is still debated whether the omega-3 fatty acids can reduce the level of saturated fat in the blood of human subjects. Clearly, the data presented above should be amplified so that it may be used to assist in the interpretation of results from human clinical trials. The procedure might well be to study the same 2 polar bears on the next occasion; 2 marked male polar bears on the ice (clearly well fed from eating seals) could provide blood samples and then be released. Under ideal circumstances, if these same bears migrated and fasted to Cape Churchill, they could then be maintained for 1 month in a fasted condition. It is of considerable importance to clinical medicine to complete an experiment of this sort.

LITERATURE CITED

- KADUCE, T.L., A.A. SPECTOR, AND G.E. FOLK, JR. 1981. Characterization of the plasma lipids and lipoproteins of the polar bear. *Comp. Biochem. Physiol.* 69B:541-545.