THE CARBOHYDRATE CONTENT OF POLAR BEAR MILK CASEIN

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Received August 12, 1963

Several workers have reported on the carbohydrate content of bovine casein (Reynolds et al., 1959; Pilson et al., 1960; Alais and Jollès, 1961; Cayen et al., 1962; Marier et al., 1963). Johansson and Svennerholm (1957) determined total hexose, hexosamine and sialic acid in the casein from the milks of man, cow, goat, sheep, horse, reindeer and whale. The casein from human milk contained considerably more hexose and hexosamine than did any of the other caseins. The sialic acid contents of the various casein samples ranged from 0.76% for human milk to 0.11% for sheep milk.

During the course of a study on the composition of polar bear milk (Baker et al., 1963), it was observed that casein prepared from polar bear milk yielded an unusually large amount of humin when subjected to acid hydrolysis. This observation suggested that the casein of polar bear milk might contain a relatively high proportion of bound carbohydrate. The present communication presents the results of analyses of the casein of polar bear milk for carbohydrate.

Material and Methods

Polar bear milk casein. The milk was obtained from a young female bear which was killed near the north coast of Lowther Island, N.W.T. The bear had been accompanied by a 16 or 17 month old cub. The milk was centrifuged (International P.R.I. model I)under the following conditions: - temperature, 50°C, R.P.M., 2500, head No., 286, time, 6 hours. The top oily liquid was removed and the middle layer was decanted from the white solid which had collected at the bottom of the centrifuge tube. The middle layer, which was a greenish-yellow milky liquid, was extracted twice with equal volumes of ethyl ether and then acidified slowly with hydrochloric acid (0.1 N). At pH 4.59 the solution became clear and it was assumed that the casein was precipitated completely at this point The casein was recovered by centrifugation and was washed several times with water and then finally freeze dried.

Determination of carbohydrate. Sialic acid was determined by the method of Warren (1959). The sialic acid was liberated by treatment of the casein sample (0.020 g) with sulfuric acid (5 ml, 0.05 N) at 95°C for a period of 30 minutes. The standard curve was prepared by use of sialic acid isolated from submaxillary gland.

Bound hexose was determined by the method of Montgomery (1961) and hexoseamine by the method of Anastassiadis and Common (1955).

Results and Discussion

Table I shows the results of the analysis of polar bear milk casein. The results which were obtained with a sample of bovine whole casein (Warner 1944) and K-casein (Pilson *et al.*, 1960) are shown for the purpose of comparison.

TABLE I

Carbohydrate contents polar bear milk casein

Material	Bound hexose %	Hexosamine %	Sialic acid %
Polar bear milk casein (11.3% N)	2.80	1.09	1.92
Bovine whole casein (15.3% N)	0.296	0.18	0.30
Bovine K-casein* (14.4%)	0.920	0.606	1.44

* Fraction A (Pilson *et al.*, 1960)

There appear to be some striking differences between the carbohydrate contents of polar bear milk casein and of bovine casein. A comparison of the data reported in Table I with those reported by Johansson and Svennerholm (1957) shows that the carbohydrate content of polar bear milk casein resembles much more closely that of human milk casein than that of caseins obtained from goat, sheep, horse, reindeer or whale milks.

It should be noted that the value for the sialic acid content of bovine K-casein as determined by the thiobarbituric acid method is considerably lower than that obtained previously (Cayen et al., 1962) by the method of Svennerholm. However, the results reported in Table I show that the sialic acid content of polar bear milk casein was approximately 35% higher than of the bovine K-casein preparation. One would expect either that the casein which was isolated from the polar bear milk was essentially all K-casein, or that the K-casein of the polar bear milk casein complex has a much higher sialic acid content than bovine K-casein.

The polar bear milk casein was subjected to paper electrophoresis according to the method reported by MacRae and Baker (1958). Two well-defined zones, which will be referred to as α- and β- caseins, appeared on the paper together with one unresolved component which spread out fairly uniformly between the origin and the β- component. The zones were scanned on a Photovolt Densitomemter Model 525 and electrophoretic diagrams were prepared by plotting optical density against the distance along the strip. The areas under each peak, expressed as a percentage of the total mobile fraction were as follows: - α-casein, 55.6%; β-casein 27.5%; unresolved component 16.7%. These values are not markedly different from those which have been obtained with bovine casein (MacRae and Baker, 1958). Further experiments will be conducted to establish whether or not the sialic acid of polar bear milk casein is associated primarily with the subfraction of α-casein as it is in bovine casein.

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