

Sodium and Potassium Concentrations in Bile from Human Gallbladders. (22873)

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Recent analytical studies on inorganic constituents of human gallbladder bile are wanting. This report is principally concerned with the concentrations of sodium and potassium in bile from human gallbladders obtained at necropsy.

Method. Analyses for sodium and potassium were made on bile after appropriate dilutions on Baird flame photometer. The pH was determined electrometrically on Beckman pH meter and total solids gravimetrically. Total pigments were determined by absorbance at 445 $m\mu$ on Beckman DU spectrophotometer and calculated as bilirubin.

Results. Specimens from 38 gallbladders obtained from 4 to 24 hours post mortem were examined. There was marked variation in volume, color and consistency of the bile. The mean sodium concentration in the 38 specimens was 169 ± 25 mEq/l with a range of 130 to 232, while the mean potassium concentration was 27 ± 11 mEq/l with a range of 12 to 68. Because of the wide variation in concentration of each of the 2 ions with no readily discernible relationship between them, additional analyses were performed on 15 of the 38 specimens. In these the mean pH was 6.72 ± 0.50 with a range of 5.79 to 7.55. The total solid content averaged $12.4 \pm 4.0\%$ with a range of 7.4 to 20.3. The total pigment concentration averaged 532 ± 462 mg % with a range of 156 to 1696 mg.

To compare the potassium and pigment concentrations in the gallbladder bile with that of hepatic bile, specimens of such bile were obtained from 5 patients with a draining tube in the common bile duct. The mean pigment concentration of bile from the common bile duct was 46 mg % and that of potassium 4.5 mEq/l.

The calculations indicated that bile from the gallbladder contained 12 times higher con-

TABLE I. Bile Concentration by Pigment and Potassium Contents Arranged in Order of Increasing Total Solids.

Total solids (%)	Concentration factors	
	Pigment	Potassium
7.4	3.4	4.5
7.6	3.8	6.0
8.5	4.2	2.7
9.4	3.4	9.8
9.5	6.2	5.8
10.5	5.6	6.2
10.8	15.9	5.0
12.0	13.6	8.0
12.8	9.1	7.5
13.1	3.5	4.7
13.5	24.8	4.1
14.2	9.2	4.0
17.6	37.9	6.7
19.2	24.9	8.4
20.3	9.2	5.1

centration of pigment than bile from the liver with a range of 3.4 to 38 (Table I). Furthermore, bile from the gallbladder contained 6 times higher concentration of potassium than bile from the liver with a range of 2.7 to 10.

Comment. According to the data obtained the average sodium concentration in gallbladder bile was approximately 25% higher than the average sodium concentration in extracellular fluids. The high concentrations of total solids and of total pigments may be explained by the resorption of water from the gallbladder and the lower concentrations by dilution with bile from the hepatic ducts.

The resorptive power of the canine gallbladder was estimated by Rous and McMaster(1). They observed, that measured by pigment content, the empty gallbladder concentrated bile 3.2 to 10.8 times and the full gallbladder 3.6 to 8.9 times. The resorptive power of the rabbit's gallbladder was studied by Halpert and Hanke(2). Using methylene blue, they observed that the dye reached a concentration in the gallbladder bile 2 to 22 times that in bile from the liver. Halpert, Thompson, and Marting estimated that the

rabbit's gallbladder resorbed half the volume of its content per hour(3).

Our data are in line with the above observations; namely, that certain constituents of the bile are retained in the gallbladder and reach concentrations considerably higher than that in bile from liver. Other investigators have noted a rapid loss of inorganic ions from the gallbladder(1). However, the high potassium concentrations in gallbladder bile have not previously been reported. Failure of the potassium to be resorbed and its accumulation in the gallbladder cannot be satisfactorily explained from the above determinations.

Summary. Measurements of sodium, potassium, pH, total solids and pigment in human gallbladder bile indicate wide variations. Potassium is present in higher concentrations than in extracellular fluids. The resorptive power as measured by pigment failed to correlate with the increase in potassium concentration and total solids.

1. Rous, P., and McMaster, P. D., *J. Exp. Med.*, 1921, v34, 47.
2. Halpert, B., and Hanke, M. T., *Am. J. Physiol.*, 1929, v88, 351.
3. Halpert, B., Thompson, W. R., and Marting, F. L., *Am. J. Physiol.*, 1935, v111, 31.

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Placental and Mammary Transfer of Ingested Chlortetracycline in the Rat. (22874)

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Results with animals indicate that the maximum growth response of antibiotics occurs when they are included in the diets from earliest possible age. The oral administration of antibiotics to young animals is difficult with certain species which do not consume food in the critical period following birth. An alternate means of administering antibiotics to such animals would be through either placental or mammary transfer or both. Placental transfer of penicillin was found to occur in human subjects by Charles(1) since significant amounts were found in the liquor amnii, cord blood and maternal blood following the injection of one million units of the antibiotic during labor. Chlortetracycline, chloramphenicol, oxytetracycline and streptomycin, when given in therapeutic amounts, were shown also to be transferred in therapeutic concentrations from the maternal to the fetal tissues. Carpenter and Larson(2) observed no transfer of chlortetracycline or penicillin across the placental tissues of the sow. Chlortetracycline, however, was detected in the milk of sows following oral administration of the antibiotic but the amounts

were small and variable and did not influence the growth rate of suckling pigs. Placental transfer of either antibiotic presumably failed to occur since detectable amounts were not shown in the blood serum of the pigs at birth following antibiotic administration to the sows. An earlier publication by Carpenter (3) reported that the size or viability of litters of pigs was not affected by giving chlortetracycline to gestating sows nor was the growth of the pigs influenced during the suckling period which indicated that mammary transfer did not result from the amounts consumed by the sows. Maddock *et al.*(4) were unable to obtain appreciable concentrations of chlortetracycline in the blood serum or milk from sows 8 hours after feeding the antibiotic at levels up to 20 mg per pound of ration for a week. Blood levels of 0.74 γ per ml and whey levels as high as 2.21 γ per ml were obtained, however, 8 hours after administering chlortetracycline orally in single doses at levels from 2.0 to 4.0 g. Little correlation was found between the concentration of chlortetracycline in the serum and that in the whey and milk. Uram *et al.*(5) re-