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EFFECT OF GLYCOGEN AND CHOLESTEROL CONTENT IN THE LIVER OF HOUSE SPARROW, *PASSER DOMESTICUS DOMESTICUS* (L) UNDER NORMAL AND EPINEPHRINE TREATED CONDITION

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ABSTRACT

A study was conducted on 12 randomly selected female House Sparrow (*Passer domesticus domesticus* L.) to observe the effect of Glycogen and Cholesterol in the liver under controlled and Epinephrine treated condition. The treated birds were given Adrenaline injection (Adrenaline Tartarate Ciba) daily at the dose of 500/^{u}g / 100g body weight and controls received 0.62 % NaCl intramuscularly at 10 a.m. for seven days. It has been observed that the Glycogen content of liver is depleted (-33.72 %) whereas the Cholesterol content increased (+70.05 %) after intramuscular administration of epinephrine. This might be due to altered metabolic rate of the bird after hormone treatment.Abbreviated title: Adrenaline effect on House Sparrow liver.

KEYWORDS: Adrenaline, Cholesterol, Glycogen & House Sparrow liver

INTRODUCTION

Liver is the vital gland of the vertebrates. In the higher vertebrates this gland performs as an organ for synthesizing different substrates and storage and breakdown of glycogen. Glycogen is found in maximum amount in liver and helps to maintain blood glucose level. This glucose subserves the function of energy requirements of the organism concerned (Duke, 1955). Liver acts as a glucostatic mechanism by storing carbohydrates as glycogen when they are in excess in the body, and by supplying carbohydrates from the reserve when they are deficient in the body (Shamsuddin and Medda, 1974). Moreover, epinephrine may act on mobilization of this liver glycogen and helps in increasing the blood glucose level. Cholesterol is an important biochemical component which, in liver is largely concerned with the formation of bile. In house sparrow role of epinephrine in liver cholesterol is not definitely known.

The present paper deals with the results of a preliminary investigation which has been undertaken to ascertain the role of epinephrine in mobilization of glycogen and cholesterol in *Passer domesticus domesticus* (L).

MATERIAL AND METHODS

The study was conducted on 12 randomly selected female house sparrow (*Passer domesticus domesticus* L.) well acclimatised in laboratory conditions. The birds were kept in full husbandry condition in the adjacent animal house and they were given food grains and water ad libitum. The birds were divided into two groups, one of which was given Adrenaline injection (Adrenaline Tartarate Ciba) daily at the standard dose of 500/^{u}g / 100g body weight intramuscularly at 10.00 IST and the other group which served as control received normal saline (0.62 % NaCl) at the same amount for 7

days. All the birds were sacrificed by decapitation. On the 8th day of experiment the liver tissue was collected carefully and processed for specific biochemical estimation.

DETERMINATION OF GLYCOGEN

Determination of glycogen was made according to the method of Carrol et al (1956). The dissected tissue was weighed carefully and homogenised with definite volume of 5% T.C.A., kept for 6 h for complete precipitation of proteins. The sample was centrifuged and the supernatant was collected quantitatively. Then 95 % ethanol was added to the supernatant in the ratio of 5:1, allowed to stand for 20 h for complete precipitation of glycogen. The mixture was centrifuged and the supernatant was removed. The precipitated glycogen was dried and dissolved in a known volume of glass distilled water. To 0.5 ml of the extracted glycogen solution, 2.5 ml of Anthrone reagent (prepared by dissolving 50 mg of Anthrone and 1g of Thio-urea in 100 ml of 72 % nitrogen free H_2SO_4) was added. It was then heated in a boiling water bath for 15 minutes followed by cooling in running tap water. The intensity of the colour developed was measured with the analysis blank at 620 nm in a spectrophotometer. The quantity of glycogen present in the tissue was determined by comparing the standard curve of glycogen prepared previously (figure 1). Each observation was repeated three times and the mean value with standard error was recorded.

ESTIMATION OF CHOLESTEROL

Cholesterol content of the liver was estimated by Colorimetric method of Roy et al (1955). The weighed tissue was homogenised with acetic acid, mixture was centrifuged for 15 minutes at 3000 R.P.M., 2 ml of the clear supernatant was transferred in a tube containing 4 ml of Acetic acid. Then 2 ml of colour reagent (1 ml of 10 % Ferric Chloride solution in Glacial Acetic Acid, mixed with conc. H_2SO_4 to make the volume finally to 100 ml) was added slowly along the wall of the tube. The layers were thoroughly mixed up and the tube kept in dark at room temperature for 30 minutes. The colour developed was measured in a spectrophotometer at a wave length of 560 nm with the analysis blank which was prepared containing 6 ml of glacial acetic acid and 2 ml of colour reagent. The readings were compared with the standard curve drawn with pure cholesterol in an identical way (figure 2) and the concentration of the tissue cholesterol was thus calculated. Each set of observation was repeated three times and the mean value with standard error was calculated.

The data on Glycogen and Cholesterol content was subjected to analysis of variance according to the procedure by Panse & Sukhatme (1985).

RESULTS

The liver tissue of *Passer domesticus domesticus* (L) contains 3.5 mg % of Glycogen and 1.87 mg % of Cholesterol normally. After the administration of Epinephrine for 7 days it has been found that the content of liver glycogen decreases and liver cholesterol increases remarkably (Table 1). The variation of glycogen and cholesterol content between control and treatment was highly significant (Table 1). But for cholesterol, variation due to bird was also highly significant.

DISCUSSIONS

Organisms require energy continuously in order to maintain various activities of the body, and carbohydrates are known as chief source of energy as they supply the major portion of the daily energy requirement of the normal individual. The glucose pool exists predominantly in the liver (Williams, 1968). Actually most of the energy is stored as carbohydrates in the liver and break down of glycogen is stimulated both by extrinsic and intrinsic factors. Epinephrine is known to be a

potent hormone which stimulates glycogenolysis an effect which is lesser in magnitude than glucogen (Williams, 1968). There is a considerable body of literature on the chemical changes that occur in the animal tissue chemistry. Cholesterol has been the subject of intensive investigation for the last several decades largely because of its importance in certain coronary diseases in human subjects (Jafri and Shreni, 1975).

Estimation of liver cholesterol has also been made in many species of freshwater and marine fishes (Siddiqi, 1966). However, very little literature is available on the evidence of cholesterol content in birds. It has been known that cholesterol content is high in the liver of birds than that of mammals (Sturkie, 1954). In the present investigation it has been found that the liver glycogen content of house sparrow is depleted (from 3.50 $\pm$ 0.12 mg % to 2.32 $\pm$ 0.07 mg %) which is due to the effect of epinephrine.

The normal liver cholesterol content of house sparrow is 1.87 $\pm$ 0.21 mg % which may be synthesized in the body from two carbon units in the form of Acetyl-Co-A formed either from fatty acids or from the metabolism of carbohydrates through pyruvate or obtained from food. As carbohydrate metabolism is largely influenced by the effect of epinephrine through break down of liver glycogen the increase in cholesterol content (3.18 $\pm$ 0.16) has been found to be occurred in case of this bird.

The significant variation between treatment and control assures the efficacy of epinephrine in predicting its impact in the regulation of oxidative metabolism in sparrow. Significant variation in cholesterol content due to bird indicates environmental participation (physiological status of the body) for the expressions of this trait.

In general, the rate of O_2 consumption is low during night and high during daytime. Almost a similar rate of metabolism during light and dark hours has been reported in other avian species (11, 17). A profound diurnal rhythm in O_2 uptake, with its peak during photo phase has already been reported in certain avifauna (9, 11, 17). Similarly, a significant decline in O_2 uptake of sparrows during night hours may either be attributed to an endogenous rhythm or it could be a mere reflection of the inactivity in darkness (8, 11). In sparrows, the number of circulating erythrocytes, haemoglobin content of the blood and plasma glucose concentration increase by 25-30 % during the light phase of the daily cycle (6).

Direct involvement of gonadal and adrenal hormones in the regulation of oxidative metabolism of reptiles exposed to low temperatures of winter months has been suggested (5, 7). Quick calorigenic action of adrenal hormones might be of adaptive significance under emergency. Thus the adrenal hormones, due to their quick and temperature independent calorigenic action, might be acting as emergency hormones for calorigenesis in frog as well as in reptiles (6).

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Table 1: Changes in Glycogen and Cholesterol content (mg/100mg) of liver of *Passer domesticus domesticus* (L) after Epinephrine Treatment

	Glycogen Content (mg %, M± SE)	Cholesterol Content (mg %, M± SE)
Controlled (6)*	3.50 ± 0.12	1.87 ± 0.21
Treated (6)*	2.32 ± 0.07	3.18 ± 0.16
Percent change	-33.72	+ 70.05
*The number in parentheses is the number of birds.		

APPENDIX

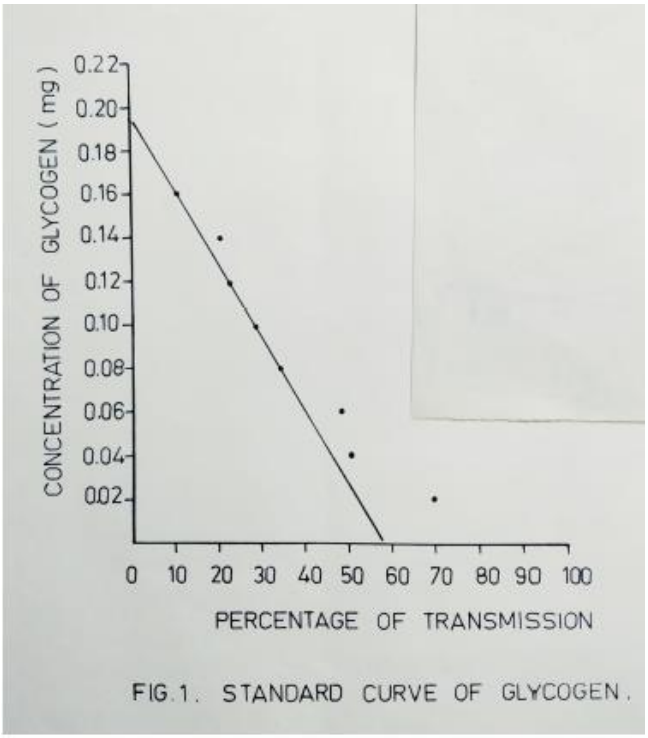

Figure 1: Standard Curve of Gycogen

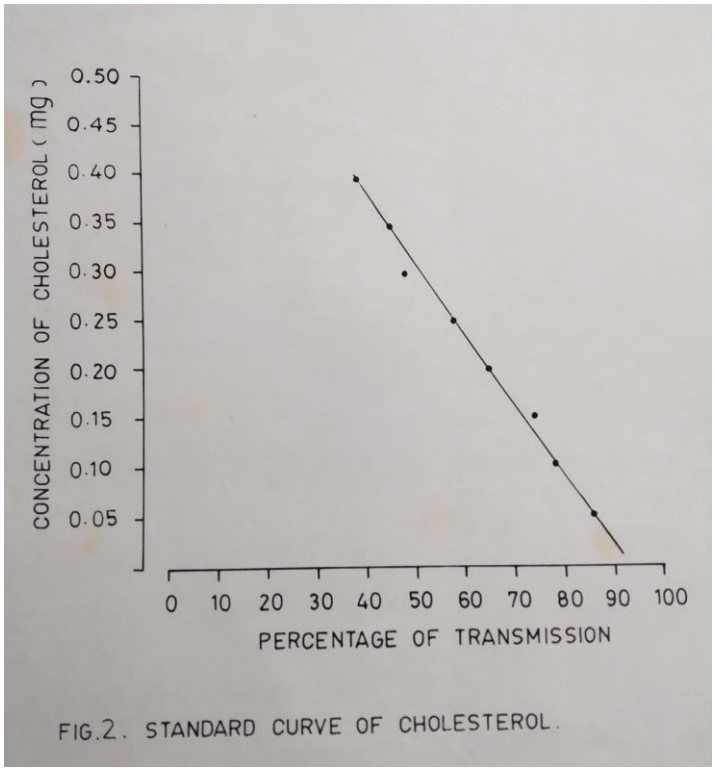

Figure 2: Standard Curve of Cholesterol