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CORRELATION OF BLOOD GLUCOSE AND LIVER GLYCOGEN PROFILE OF JAPANESE QUAIL AT DIFFERENT STAGES OF GROWTH*

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Although considerable informations are available on the carbohydrate metabolism of mammals, that pertaining to avian species is scanty. According to Ganong (1991) liver functions as a sort of glucostat maintaining a constant circulating blood glucose level. The present study was undertaken to assess the normal concentration of blood glucose, liver glycogen content and their correlation to different stages of growth in order to find out the carbohydrate status of the bird and the role of liver in carbohydrate metabolism of birds in general and that of Japanese quail in particular.

Materials and methods

The study was carried out with 360, day old Japanese quails of the same strain (egg type) and hatch procured from Kerala Agricultural University Poultry Farm, Mannuthy. The birds were provided with pre-layer ration from the day of hatch to six weeks and layer ration from six to sixteen weeks (Panda, 1990; Philomina, 1994). At fourth week of age the quails were sexed and divided into G1 (males) and G2 (females) groups and were housed in separate compartments of the cage with 20 birds in each. The levels of blood glucose and liver glycogen were estimated in twenty male and twenty female birds from the day of hatch to sixteen weeks of age at fortnightly intervals. For day old quail chicks blood and liver from two chicks were pooled for a sample. At two weeks of age the birds were sexed after sacrifice, by noting the development of testes in male birds. The estimations were carried out at fortnightly intervals from day old to sixteenth week of age. Blood was collected using sodium flouride as anticoagulant (10 mg/ml of blood) and the blood glucose was estimated by the method of Hyravinen and Nikila (1962). After recording the weight, samples of liver were frozen and the liver glycogen was estimated by the method of Seifter *et al.* (1950). Data regarding blood glucose and liver glycogen were subjected to statistical analysis (Snedecor and Cochran, 1967).

Results and discussion

The mean blood glucose level on the day of hatch in Japanese quails was 244.425 ± 2.204 mg/dl. After sexual maturity in females, the value ranged from 173.217 ± 6.996 mg/dl to 206.959 ± 6.513 mg/dl (Table 1 and Fig. 1).

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Table 1 Mean blood glucose level of Japanese quails at different ages (fortnightly intervals)

Age in weeks	Blood glucose level in mg/dl (Mean ± S.E.)		
	Males[1] G1	Females[2] G2	Pooled[3] (Males & Females)
0	244.425 ± 2.204 unsexed		
2	228.548 ± 7.241	241.308 ± 7.221	234.928 ± 0.219
4	218.372 ± 5.613	202.619 ± 3.575	210.496 ± 0.150
6	165.534 ± 7.959	206.959 ± 6.513	186.247 ± 0.191
8	168.934 ± 3.544	181.009 ±5.326	174.972 ± 0.354
10	189.297 ± 7.032	176.444 ± 4.678	182.871 ± 0.148
12	161.826 ± 3.734	176.833 ± 4.120	169.330 ± 0.243
14	184.264 ± 3.023	193.250 ± 9.184	188.757 ± 0.643
16	151.851 ± 5.992	173.217 ± 6.996	162.534 ± 0.246

1 & 2 - Values of 20 birds; 3 - Values of 40 birds

Fig. 1 Blood Glucose level of Japanese quail (0 to 16 Weeks period)

A decreasing tendency was noticed for blood glucose level with the advancement of age (Table 1.1). Kundu *et al.* (1993) supported the observation who recorded a lower erythrocyte count in young quails than their adults and they also recorded the glucose content in the red blood cells. As the number of erythrocytes increased with the advancement of age the glucose concentration in whole blood also got decreased. This may be the reason for the decreasing tendency of blood glucose level with the advancement of age. In the present study female quails had higher blood glucose level than their males (Table 1.2)

Table 1.1 Comparison of blood glucose level of male and female quails between age groups at fortnightly intervals from day of hatch to sixteen weeks

Weeks	0 V, 2	2 V, 4	4 V, 6	6 V, 8	8 V, 10	10 V, 12	12 V, 14	14 V, 16
Males t value	2.0715*	1.1012	5.4250**	0.3902	2.5859*	3.4503**	4.6709**	4.8297**
Females t value	0.4128	4.8014**	0.5842	3.0854**	0.6439	0.0623	2.4424*	2.4427*

* P≤0.05 ** P≤0.01

Table 1.2 Comparison of blood glucose between male and female Japanese quails at fortnightly intervals from day of hatch to sixteen weeks

	Age in weeks							
	2	4	6	8	10	12	14	16
Blood glucose	1.2392	2.3671**	4.0279**	1.8875	1.5217	2.6990*	1.7742	2.3196*

* P≤0.05 ** P≤0.01

may be due to their lower erythrocyte count in blood. Greenman and Zarrow (1961) had reported about the effect of testosterone, on red cell count and blood glucose level. The lower blood glucose level in male quails may be due to their higher red cell count.

Quail chicks on the day of hatch had a normal mean liver glycogen content of 2.039 ± 0.102 per cent of wet tissue (Fig.2, Table.2).

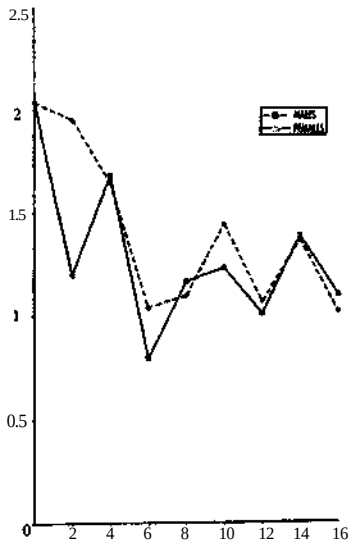

Fig. 2 Liver Glycogen level of Japanese quail (0 to 16 weeks period)

Table 2 Mean liver glycogen level in percentage of wet tissue (Mean ± S.E.) of Japanese quails at different ages (fortnightly intervals)

Age in weeks	Liver glycogen level in percentage of wet tissue		
	Males[1] G1	Females[2] G2	Pooled (Males & Females)
0	2.039 ± 0.102 unsexed		
2	1.953 ± 0.184	1.199 ±0.131	1.576 ± 0.160
4	1.647 ± 0.182	1.684 ± 0.251	1.666 ± 0.317
6	1.040 + 0.117	0.795 ± 0.072	0.918 ± 0.144
8	1.099 ± 0.159	1.168 ± 0.107	1.134 ±0.156
10	1.441 ± 0.174	1.232 ± 0.177	1.337 ± 0.213
12	1.068 ± 0.105	1.007 ± 0.076	1.038 ± 0.166
14	1.363 ± 0.153	1.386 ± 0.148	1.375 ± 0.228
16	1.016 ±0.133	1.098 ± 0.152	1.057 ± 0.260

1 & 2 - Values of 20 birds

As age advanced both male and female quails had a lowering tendency for the liver glycogen content (Table 2, 2.1). Hazelwood and Lorenz (1959) also observed a lowered concentration of glycogen in adult chicken compared to day old chicks. The lowering of liver glycogen content with advancement of age may be due to the increased utilization of this energy fuel to cope with the increased demand during growing period. No significant difference was noticed in liver glycogen content because of sex (Table 2.2).

Table 2.1 Comparison of liver glycogen level of male and female quails between age groups at fortnightly intervals from day of hatch to sixteen weeks

Weeks	0 V$_s$ 2	2 V$_s$ 4	4 V$_s$ 6	6 V$_s$ 8	8 V$_s$ 10	10 V$_s$ 12	12 V$_s$ 14	14 V$_s$ 16
Moles t value	0.4091	1.1851	2.8140**	0.2995	1.4565	1.8373	1.5835	1.7140
Females t value	5.0539**	7.7191	3.4080**	2.8894	0.3113**	1.1659	2.2753	1.3533*

* P≤0.05 ** P≤0.01

Table 2.2 Comparison of liver glycogen between male and female Japanese quails at fortnightly intervals from day of hatch to sixteen weeks

	Age in weeks							
	2	4	6	8	10	12	14	16
Liver glycogen	3.3430*	0.1211	1.7792	0.3608	0.8427	0.4742	0.1078	0.4120

* P≤0.05 ** P≤0.01

Narasimhan (1971) made a similar observation in chicken and ducks.

Correlation studies revealed an indefinite relation between the levels of blood glucose and liver glycogen in both sexes (Table 3).

Table 3 Correlation among blood glucose and liver glycogen in male and female female Japanese quail during 16 weeks period and feed restricted periods

	Weeks								2 weeks	4 weeks
	2	4	6	8	10	12	14	16	feed restriction	feed restriction
Blood glucose and liver glycogen (Male)	0.161	**-0.372**	**-0.133**	**0.117**	0.243	-0.320.	0.282	0.344	0.584	-0.177
Blood glucose and liver glycogen (Female)	-0.250	0.173	-0.117	0.843	**-0.221**	0.195	0.211	-0.021	0.457	0.090

* P≤0.05 ** P≤0.01

According to Ganong (1991) the liver functions as a sort of glucostat. The net uptake of glucose by liver is increased, when the concentration of glucose in plasma is increased and vice versa. This type of relation between the levels of blood glucose and liver glycogen was not recorded in the present study. According to Narasimhan (1971) chicken depended mainly on gluconeo-genesis for maintaining blood sugar level. Later, Watford *et al.* (1981) proposed that in chicken, kidney had a major role in net gluconeogenesis. Thus in addition to liver, kidney may also have a major role in controlling the normal blood glucose level in birds, which may be the reason for the indefinite relation observed in the study between the levels of blood glucose and liver glycogen.

Summary

In order to evaluate the carbohydrate status of Japanese quail the level of blood glucose and liver glycogen of male and female quails were estimated at fornightly intervals from the day of hatch to 16 weeks of age. The highest level of blood glucose and liver glycogen were recorded in the day old quails.

Female quails had a higher blood glucose level than their males. Sex had no influence on liver glycogen content. Correlation studies revealed an indefinite relation between the levels of blood glucose and liver glycogen. Over and above the informations on certain aspects of carbohydrate status of Japanese quail gathered from this study further studies are required to highlight the factors controlling blood glucose level and liver glycogen content in birds particularly the role of kidney in gluconeo-genesis and it's impact on the carbohydrate status of birds.

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