due to leptospiraemia, as reported earlier in cattle\textsuperscript{10}. The occurrence of a biphasic fever curve was interesting. This may be due to reseeding of organisms in the blood from liver, spleen, etc. where organisms could have been lodged following the initial leptospiraemia phase. This requires further investigation as the organisms could not be demonstrated in these organs collected during post-mortem, either culturally or by direct microscopy. It is possible that the organisms did localize initially but were soon cleared as a result of the development of immune response as indicated by the presence of MAT and IHA titres in animals and the increase in total globulin contents.

The immune response elicited in animals following the inoculation of \textit{hardjo} cells was milder in nature. MAT titres in these animals developed slowly and did not change appreciably. However, the titres as detected by IHA developed quickly and then declined. These observations suggested that in fact two different antibody classes were detected by these tests in spite of the fact that in MAT and IHA, antibodies directed against lipopolysaccharide antigen were supposedly responsible for agglutination. It appears that a change in location and the native form of the antigen were responsible for such a difference.

Table 1 reveals an increase in serum cholesterol and bilirubin at various DPI. The former could be due to decreased excretory function of the liver\textsuperscript{11}. It is postulated that the organisms caused damage to hepatic parenchyma resulting in a decrease in the volatile and higher fatty acid uptake by liver for glucogenesis which entered the circulation to cause hypercholesterolemia. Increase in the bilirubin concentration was again suggestive of the damage of liver parenchyma which caused a decrease in excretion of bilirubin. Abnormally high values of AST and ALT were observed from 14th DPI onward. An increase in the liver enzymes due to hepatic damage has been observed in different farm and laboratory animals\textsuperscript{12,13}. A two to three-fold increase in AST and ALT values after \textit{hardjo} administration indicated a significant damage to hepatic cells. All these findings were thus indicative of liver damage. Virulent leptospires have predilection for parenchymatous organs such as liver\textsuperscript{14}, spleen, kidney, etc. subsequently causing local damage. The present study suggests that in goats liver is affected. However, the use of several strains is suggested to see whether other organs are also involved.

\textsuperscript{1} Tripathy, D. N., Hanson, L. E., Mansfield, M. E. and Thistlethwaite, J. P., \textit{Am. J. Vet. Res.}, 1983a, 46, 2512.

\textbf{Acknowledgement}. We are grateful to Dr S. A. Walkins, Director, PHLS, Hereford, U.K. for providing the leptospira culture.

\textbf{13 October 1988; revised 23 June 1988}

\section*{Insulin tolerance in lean and obese hens}

S. P. S. Gill, S. S. Sikka, S. P. S. Singh*, M. S. Sethi* and P. J. S. Rattan*

Departments of Animal Sciences and *Veterinary Physiology, Punjab Agricultural University, Ludhiana 141 004, India

Insulin caused significant decline in blood glucose levels within half an hour after injection in breeder hens. Rate of decline, however, was much lower in heavier birds than in lighter ones. Plasma cholesterol and free fatty acid levels did not differ significantly. Plasma VLDL+LDL levels were altered significantly, but the pattern of change among high-, medium- and low-body-weight birds was opposite to that of blood glucose. VLDL+LDL levels were highest in heavier birds and remained elevated longer than in lighter birds. The response of lean and obese individuals to insulin appears to be different and could be one of the reasons for obesity.

The mechanisms, involved in the abnormal insulin secretory dynamics, associated with obesity are unclear. Although insulin resistance is associated with obesity, it is not clear whether obesity regulates insulin levels or whether insulin levels lead to obesity\textsuperscript{1}.

Glucose-insulin imbalance was earlier considered to be one of the possible reasons for obesity in high body fat depositing individuals\textsuperscript{2}. Lower levels of plasma glucose in high abdominal fat depositing individuals have been observed\textsuperscript{3}. As in humans, over 90% of the total body lipogenesis occurs in the avian liver\textsuperscript{4}. An experiment was conducted to study the effect of exogenous insulin injection on carbohydrate-lipid interactions in high and low body weight birds used as model for humans.

Thirty-six adult broiler breeder hens were divided into three groups of 12 birds each on the basis of their body weight. The average body weights in the high, medium and low body weight groups were 3.76±0.75,