

# SERUM GROWTH HORMONE-BINDING PROTEIN IN DOMESTIC ANIMALS

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## Abstract

This research was conducted to determine if domestic animals have a specific serum growth hormone-binding protein as previously reported for humans and rabbits and, if present, to partially purify the protein from serum of pigs, sheep and chickens. All domestic animal species sera examined were found to contain a protein which specifically bound GH. Concentrations varied considerably both within and among species. Sheep and cattle had the lowest concentrations; pigs, geese and chickens were intermediate; and horses had the highest concentrations. The protein was partially purified from the serum of pigs, sheep and chickens and, at least in the pig, the protein appears to be similar in size and amino acid sequence to that previously reported from rabbits.

**(Key words:** Growth Hormone, Serum Binding-Protein, Domestic Animals)

## Introduction

A protein which specifically binds growth hormone (GH) has been previously reported in serum from rabbits, rats and humans. These observations are important for several reasons: First, because this represents a contradiction to the previously held belief that pituitary hormones were not associated with a binding protein in the blood; second, because this protein may be involved in the action of GH at the level of the cell; and third, because additional knowledge of the chemistry and the functions of this protein could lead to new methods of enhancing animal growth rate and efficiency. In other words, if we can define the mechanism by which GH acts at the tissue level to increase muscle protein growth and reduce body fatness, perhaps we can develop new methods for identifying animals with highest growth potential (to aid in selection of breeding animals) and/or treating animals directly to increase the production of lean body mass at the expense of fat.

This serum protein appears to be chemically related to the cellular receptor for GH. Also, the concentrations of this binding protein in serum vary with age, nutritional status and sex of the animal. It is possible, therefore, that the binding protein (BP) may be involved in the cellular action of GH and/or reflective of amount of GH activity at the cellular level. This study was undertaken to determine if such a BP is present in serum from domestic animals and to partially purify and characterize the protein.

## Experimental Procedures

1. Binding protein concentrations were estimated using a competitive binding assay previously published by others (Amit et al., 1990). With this assay, the amount of BP activity was determined by the ability of a fixed volume of serum to bind  $^{125}\text{I}$ -GH.
2. Serum samples were obtained from normal, disease-free animals from within the research herds/flocks at CIBA-GEIGY Agricultural Research Center by venipuncture or at time of slaughter. These samples were used to estimate the relative concentrations of the serum GHBP in different species.
3. For purification of the GP, serum was obtained from one sheep (wether), one pig (non-pregnant sow) and several chickens (broiler hens) at time of slaughter and frozen. Because of the low concentration of the BP in serum, a minimum of 1 liter of blood serum was needed from each species.
4. The BP was purified from sera using a GH affinity column followed by Sephadex Column Chromatography (Spencer et al., 1988).

## Results and Discussion

The relative concentrations (in % specific binding) in the various species were sheep ( $5.4 \pm 0.9$ ), cow ( $6.9 \pm 2.9$ ), chicken ( $10.0 \pm 0.3$ ), pig ( $15.0 \pm 8.0$ ), goose ( $14.1 \pm 1.9$ ) and horse (26.1, only one sample). In addition, it was observed that yearling ewes had higher ( $P < .05$ ) BP concentrations than either pubertal ewe lambs (4 mo) or older (4 + yr) ewes.

The protein isolated from sera of pigs and chickens appeared to have a molecular weight of 50,000 to 65,000. Furthermore, partial analysis of the amino acid sequence of the protein isolated from pig serum revealed approximately 80% of the amino acids are identical to those previously reported from rabbits (Spencer et al., 1988).

These results indicate that the sera from domestic animal species indeed contain a specific BP for GH and that it is similar to that previously reported from rabbits and humans. The physiological significance of this BP is still unknown. However, because of its apparent similarity to the cellular GH receptor, it could be involved in or reflective of the cellular action of GH and therefore may lead to methods of altering GH action at the cell thereby improving animal growth rate and feed efficiency.

## References Cited

- Amit, T., R.J. Barkey, T. Bick, P. Hertz, M.B.H. Youdim and Z. Hochberg. 1990. Identification of growth hormone-binding protein in rat serum. *Molecular and Cellular Endocrinology* 70:197.
- Spencer, S.A., R.G. Hammonds, W.J. Henzel, H. Rodriguez, M.J. Waters and W.I. Wood. 1988. Rabbit liver growth hormone receptor and serum binding protein. *J. Biological Chemistry* 263:7862.