

## ANALYSIS OF PROTEINS CONTENT FROM BLOOD PLASMA OF HERBIVOROUS AND CARNIVOROUS ANIMALS

### ANALIZA CONȚINUTULUI DE PROTEINE DIN PLASMA SANGUINĂ A ANIMALELOR ERBIVORE ȘI CARNIVORE

CAZACU Ana<sup>1</sup>, OANCEA Servilia<sup>1</sup>, BODALE I.<sup>1\*</sup>

\*Corresponding author e-mail: ilie.bodale@uaiasi.ro

**Abstract.** *This paper focuses on determining the concentration of blood plasma proteins for different domestic animals to highlight the link between diet and proteins content. Blood plasma from two categories of animals, herbivores and carnivores (horse, cow, goat, sheep and dog) was used for this study, the protein content being compared to that found in human and turkey blood (omnivorous). Our results showed that the samples of blood taken from dogs have the lowest proteins content, although they consume food rich in proteins. The highest value of proteinemia is found in horse blood, even if it is an herbivorous animal that consumes food rich in fibbers and vitamins. The hypothesis that herbivores have a higher content of proteins in blood than carnivores is supported by the results obtained for samples of cow, goat and sheep blood.*

**Key words:** blood plasma, nutrition, protein content, diet

**Rezumat.** *Această lucrare urmărește determinarea concentrației de proteine din plasma sanguină pentru diferite animale domestice pentru a evidenția legătura dintre alimentație și conținutul de proteine. Pentru acest studiu s-a folosit plasmă sanguină de la două categorii de animale, erbivore și carnivore (cal, vacă, capră, oaie și câine), conținutul de proteine fiind comparat cu cel din sângele de om și curcan (omnivore). Rezultatele noastre au arătat că probele de sânge prelevate de la câine au conținutul cel mai mic de proteine, deși consumă alimente bogate în proteine. Valoarea cea mai mare a proteinemiei se găsește în sângele de cal, chiar dacă este un animal ierbivore care consumă alimente bogate în fibre și vitamine. Ipoteza că erbivorele au un conținut mai mare de proteine în sânge decât carnivorele este susținută de rezultatele obținute pentru probele de sânge de vacă, capră și oaie.*

**Cuvinte cheie:** plasma sanguină, alimentație, proteinemie, dietă

## INTRODUCTION

Blood is a suspension of white and red blood cells in a homogenous liquid called plasma, red blood cells containing hemoglobin, and plasma containing fibrinogen, globulins and albumins (Agre, 1989). The remaining liquid after removing the globules and fibrinogen is called the blood serum. Plasma proteins are a very important biophysical parameter that highlights the normality or pathology of humans and animals. These, in addition to the role of transport, play

---

<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

an important role in protecting the body through the immune system, in the blood clotting process, acts like a buffer in maintaining a constant pH and maintaining a constant osmotic blood pressure (Oancea, 2001; Râpă, 2006). Except immunoglobulins, most plasma proteins are synthesized in hepatocytes.

Most studies on the peculiarities of blood were carried out on human samples. Although many are known about the composition and characteristics of human blood, there is much less information about most animals. Proteins are the main constituents of the animal body, fulfilling a wide variety of functions, and having very different compositions (Dimofache, 1996). The most important characteristic of proteins is the specificity. Vegetable and animal proteins of various species differ one from another, with differences even between the proteins of individuals belonging to the same species. It is estimated that in an animal organism there are about 100,000 specific proteins. Each protein macromolecule is composed of 50 to 10,000 units of  $\alpha$ - amino acids linked by peptide bonds (Wang, 2006).

The study of protein content in different animal species in relation to their normal state and pathological conditions is one of the most approached areas, due to the increase in the sensitivity of the techniques used (Solcan, 2005). In the present study, different protein content for the investigated animals was observed. The blood protein content of some domestic species (horse, cow, goat, dog and turkey) was analyzed by refractometry.

## MATERIAL AND METHOD

The materials used in this study are blood samples from the following species: horse, cow, goat, sheep, dog, turkey, human; which were collected in 6 ml vials with EDTA as anticoagulant. The samples were centrifuged for 3 minutes at 5000 rpm, performing two centrifugations for each sample. Plasma was then isolated in 6 ml Vacutest K3 EDTA vials, at a temperature of 28°C. Using an Abbe refractometer, the refractive index of the plasma samples was determined.

## RESULTS AND DISCUSSIONS

In a first refractometric analysis, the refractive index of blood plasma was determined for the following animal species: cow, goat, and horse (tab. 1 and fig. 1).

Table 1

**Refractive index of the blood plasma of the investigated animals**

Species	Refractive index	Protein concentration (g/dl)
Cow	1.3492	7.69
Goat	1.3467	6.34
Horse	1.34470	5.03

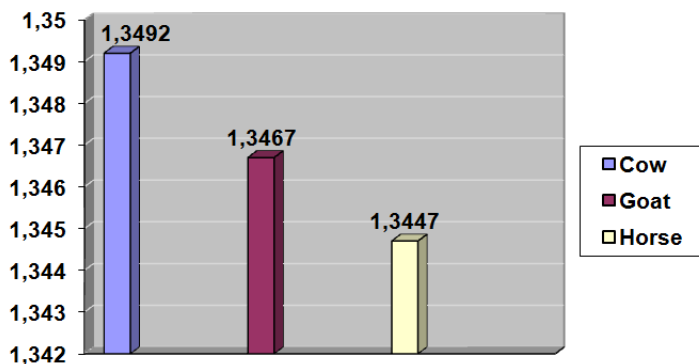


Fig. 1 Refractive index of the plasma for different animals

The above data show the following:

- the refractive index and, therefore, proteinemia is lower for the horse, showing a poor nutrition;
- the proteinemia of the goat is lower than the one of the cow.

Later, plasma proteinemia from the blood of animals (horse, cow, goat) and a bird (turkey) was analyzed. The refractometric determinations were carried out in two different periods of the year. The obtained values of the refractive indices for each individual species are presented in table 2 and figure 2 (for the first period) and in table 3 and figure 3 (for the second period).

Table 2

Refractive index of the blood plasma during the first period

Species	Refractive index	Protein concentration (g/dl)
Horse	1.3494	7.85
Cow	1.3490	7.69
Goat	1.3488	7.42
Turkey	1.3440	4.81

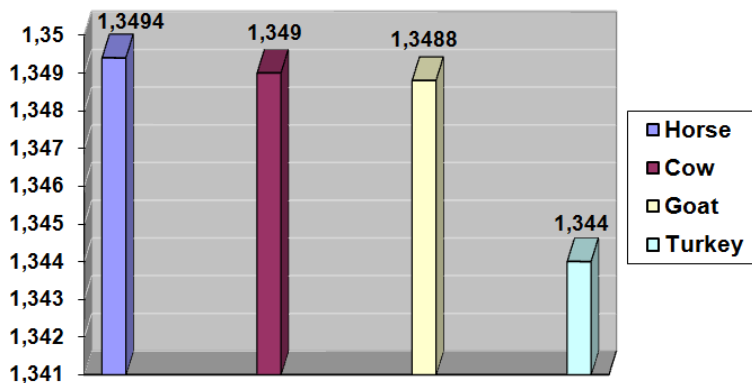
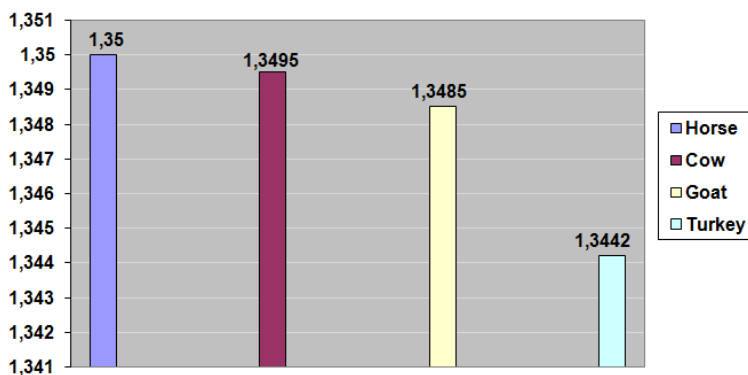


Fig. 2 Refractive index of the plasma for different animals (first period)

Table 3

**Refractive index of the blood plasma during the second period**

Species	Refractive index	Protein concentration (g/dl)
Horse	1.3500	8.22
Cow	1.3495	7.85
Goat	1.3485	7.2
Turkey	1.3442	4.81

**Fig. 3** Refractive index of the plasma for different animals (second period)

Analysing the data presented above it can be observed that:

- the lowest value of the plasma refractive index and proteinemia, respectively, corresponds to the sample of turkey blood;
- close values for cow and goat were obtained;
- the highest value was obtained for horse.

Additionally, a comparison was made with proteinemia in human blood. Thus, blood samples were collected both from a few animal species (cow, horse, sheep, and dog) and from humans (tab. 4 and fig. 4).

Table 4

**Refractive index of the blood plasma of the investigated species**

Species	Refractive index	Protein concentration (g/dl)
Cow	1.3462	5.9
Horse	1.3475	6.77
Sheep	1.3451	5.25
Dog	1.3415	3.28
Human	1.3474	6.77

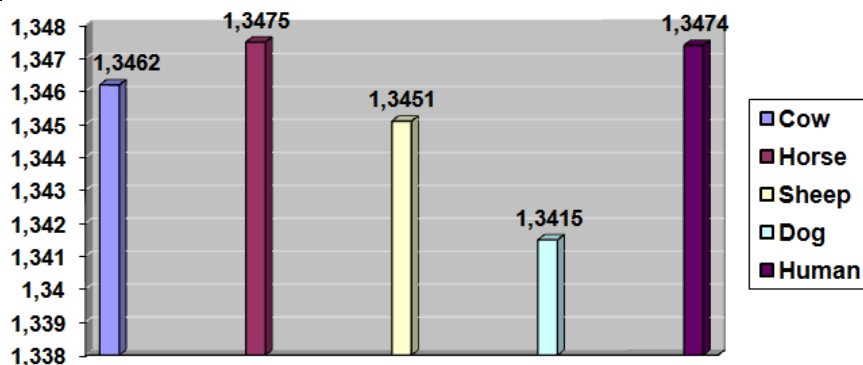


Fig. 4 Refractive index of the plasma for different species

From table 4 it can be noted that:

- the lowest value of protein content, which is correlated with the refractive index, is for the dog;
- proteinemia for humans is equal to that of the horse;
- sheep and cows have similar protein levels;
- the sheep has lower proteinemia, however, compared to cow and goat.

Our results are comparable to those obtained by other authors (Marquez, 2005).

## CONCLUSIONS

We performed comparative refractometric measurements of the protein content of the blood plasma for different domestic animals during four periods in two consecutive years.

The lowest value of the plasma refractive index and proteinemia, respectively, corresponds to the blood sample of turkey, followed by that of the dog blood sample.

The highest value of plasma and protein refractive index corresponds to horse blood sample.

For goat and sheep were obtained close values, which are comparatively lower than the value for cow.

Plasma proteinemia values for horse blood samples were close to those obtained for plasma samples of human blood.

The results obtained in this paper are consistent with those reported by Marquez et al. (Marquez, 2005). For cow, an average proteinemia of 6.8 g/dl was obtained, and in literature, for cattle, it is found a value of 7.21 g/dl. For turkey, a proteinemia of 4.8 g/dl was obtained, while in literature, for poultry, a value of 3.21 g/dl was noted.

The results on proteinemia show that it does not depend on the animal's nutrition, i.e. on the protein content of the food. Thus, although the horse is an herbivorous animal and the dog or the birds are omnivorous, the protein content

for the horse is very high as compared to the dog or the birds. By contrary, when we compare horse and human blood, the results have equal values, despite the fact that the nutrition is quite different.

**Acknowledgments:** This work was supported by the CNCS-UEFISCDI, PN-III-P1-1.1-TE-2016-2336 project.

## REFERENCES

1. **Agre P., Parker J.C., 1989** - *Red blood cell membranes: Structure, Function, Clinical Implications*, Ed. Marcel Dekker, New York and Basel, ISBN 0-8247-8022-1.
2. **Dimofache C., Herman S., 1996** - *Biofizică medicală*, Ed. Cerma, Bucuresti.
3. **Marquez E., Bracho M., Archile A., Rangel L., Benitez B., 2005** - *Proteins, isoleucine, lysine and methionine content of bovine, porcine and poultry blood and their fractions*, Food Chemistry, 93(3), pp. 503–505.
4. **Oancea S., 2001** - *Elemente de Biofizică medicală comparată*, Ed. Tehnopress, Iași, ISBN 973-8048-50-8.
5. **Râpă A., Oancea S., 2006** - *Hemoreologie comparată*, Ed. Tehnopress, Iași.
6. **Solcan Gh., Boghian V., Rollin F., 2005** - *Patologie si clinica medicala veterinara*, Ed. "Ion Ionescu de la Brad", Iași, ISBN 978-973-7921-61-5.
7. **Wang J., Li D., Dangott L.J., Wu G., 2006** - *Proteomics and its role in nutrition research*, Journal of Nutrition, 136(7), pp. 1759-1762.