

IgM and IgG Immunoglobulin Obtention in Three Month Llamas (*Lama glama*) against *Sarcocystis aucheniae* in FCAN

Condori-Quispe R^{1*}, Condori, Ramírez S², Gutiérrez Ramírez L³ and Pacari Hualuque M⁴

¹Research Professor of the Department of Animal Science, "FCAN-UTO" -Oruro, Bolivia

²Independent Researcher of the Department of Animal Science, "FCAN-UTO" -Oruro, Bolivia

³Researcher Professor in Camelids of the Department of Animal Science, "FCAN-UTO" -Oruro, Bolivia

⁴Independent Researcher of the Department of Animal Science, "FCAN-UTO" -Oruro, Bolivia

***Corresponding Author:** Condori-Quispe R, Research Professor of the Department of Animal Science, "FCAN-UTO" -Oruro, Bolivia.

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Abstract

The present research was carried out with the objective of obtaining IgM and IgG immunoglobulins in young llamas against *Sarcocystis aucheniae*. In the FCAN and the CEAC - UTO of the Department of Oruro Bolivia, in this study 20 llama babies of 3 months of age were used, the blood samples were obtained from the saphenous vein and these were processed in Pasteur's laboratory with the technique of IDR. Data was analyzed by DCA. IgM production in pre-immunized three month llamas were 5.52 ± 0.23 mg/dL, and in three month llamas immunized with inactivated sarcocystin it was 7.69; 6.26 and 5.72 mg/dL at housed treatment, free grazing treatment and control group management, respectively. The pre-immunized young llamas in free grazing and housed treatments registered values of $3,119.70 \pm 458.60$ mg/dL of IgG. In three month llamas immunized with inactivated sarcocystin in housed conditions, free grazing and control group reported 4,315.20; 3,868.60 and 3,232.20 mg/dL of IgG, respectively. This difference in serum IgM and IgG concentration in three month llamas, with different management systems, can be attributed to the fact that the llamas in housed conditions and immunized with inactivated sarcocystin generate a high concentration of active humoral immunity of IgG, due to the effect of immunogenicity of sarcocystin, in addition, without stress factors the response was better.

Keywords: llama; Sarcocystin; Immunoglobulin; IgM and IgG

Abbreviations

CSA: South American Camelids; CSAD: Domestic South American Camelids; CEAC: Agricultural Experimental Center Condoriri; DCA: Completely Random Design; dL: Deciliter; FCAN: Faculty of Agricultural and Natural Sciences; UTO: Technical University of Oruro; IDR: Radial Immunodiffusion; Ig: Immunoglobulins; IgM: Immunoglobulins M; IgG: Immunoglobulins G; mg: Milligram

Introduction

In the high Andean region of South America, over time, four species of South American Camelids (CSA) came to populate, of which the llama (*Lama glama*) and alpacas (*Lama pacos*) came to be domesticated in pre-times-hispanic; the species *Vicugna vicugna* (vicuña) and *Lama guanicoe* (guanaco) remain wild [1,2].

The fresh or dehydrated meat (charque) of the domestic South American camelids (CSAD), came to have great importance, as it is one of the main sources of protein in the diet of the inhabitants of the high Andean region of the countries of Bolivia, Peru, Chile and Argentina [2,3]. However, its consumption in urban areas is not widely accepted due to social prejudices and the poor appearance of carcasses infected with sarcocysts [4]. Furthermore, many people confuse sarcocystosis with other parasitic diseases of a zoonotic nature such as trichinosis and cysticercosis [5]. This causes great economic losses for peasant families in the highland region [6].

CSAD are intermediate hosts of the protozoa of the genus *Sarcocystis*, mainly of the species *S. aucheniae* and *S. lamacanis* [7], where these parasites carry out their asexual reproduction, beginning with the consumption of sporocysts that give rise to schizonts in the vascular endothelium and bradyzoites in visible cysts in the skeletal muscles and microscopic in cardiac muscles [8,9]. The prevalence of these parasites in CSA can be very high, with reports indicating up to 100% [10].

S. aucheniae generates macroscopic cysts 0.1 to 1 cm long, white in color with the appearance of a compact grain of rice that tend to grow slowly in skeletal muscle fibers. On the contrary, *S. lamacanis* generates cysts of microscopic size but that develop more quickly and are more infective than the previous one, tending mainly to be located in the cardiac musculature [11,12].

Sarcocystosis has a negative impact on the zootechnical indices of CSAD, causing motor difficulty, associated with the action of sarcocystin, a hemolytic and hemagglutinating toxin, released by the parasite, its target being the central nervous system [13], as well as feverish symptoms, including fever death [14], in addition to causing large losses in commercial value of carcasses due to seizures and rejection of meat in the markets [15,16].

Little information is evidenced regarding the specific or acquired immune response from CSAD against *Sarcocystis* infection, this investigation is carried out with the objective of determining the IgM and IgG immunoglobulin obtention in three month llamas (*Lama glama*) against *Sarcocystis aucheniae*.

Materials and Methods

The research was carried out in the Department of Animal Science, belonging to the Faculty of Agrarian and Natural Sciences of the Technical University of Oruro (FCAN-UTO). Sarcocystin inactivation was carried out in the FCAN Animal Health Laboratory, the immunization of three-month-old llamas was carried out at the Condoriri Agricultural Experimental Center (CEAC), of the FCAN-UTO, which is located at 49 Km northeast of the Cercado province of the Department of Oruro and 12 km northeast of the Municipality of Caracollo, whose geographic coordinates are: 17° 31'41" south latitude, 67° 14' 02" west longitude. 3830 meters above sea level.

The research was carried out during the months of April to September 2017, 3-month-old llamas were selected, of which 11 males llamas and 9 female llamas, they were distributed in three groups: in housed conditions, in grazing free and control group. Immunization was by subcutaneous route at day 1, 7, 13, 19 and 25 with a dose of 0.5; 1, 2, 3 and 4 ml respectively, the pre and post immunization blood serum samples were obtained from the saphenous vein on day 0 and 31, they were sent for processing by means of the radial immunodiffusion (IDR) technique [17] to the laboratory of Pasteur of the city of Oruro. The results were analyzed by means of the 2 x 2 factorial arrangement led to the Completely Random Design (DCA).

Results and Discussion

The results that we report in this research work, for the IgM concentration in blood serum of pre-immunized llamas of three months, are 5.52 ± 0.23 mg/dL of IgM. Once immunized with inactivated sarcocystin, the IgM concentration in llamas in housed conditions registered values higher than 7.69 mg/dL, followed by the free grazing group with 6.26 mg/dL of IgM and the llamas of the control group revealed lower values of 5.72 mg/dL of IgM.

The similar concentrations in the production of IgM in pre-immunized three-month-old llamas can be attributed to the ontogenetic peculiarities of the species in the production of IgM [18] and to the management system. The highly significant differences in IgM concentration in three-month-old llamas in housed conditions immunized with inactivated sarcocystin in relation to that in free grazing can be attributed to the fact that llamas in housed conditions responded favorably to the antigenic stimulus, while llamas in free grazing and the control group were exposed to certain environmental factors, which negatively affect the body's immune response.

The serum IgG concentration in pre-immunized three-month-old llamas registered similar ranges of $3,119.70 \pm 458.60$ mg/dL of IgG. Once immunized with inactivated sarcocystin, the IgG concentration in llamas in housed conditions registered values of 4,315.20 mg/dL of IgG, followed by those of free grazing with 3,868.60 mg/dL of IgG and the llamas of the control group, that were not immunized revealed values of 3,232.20 mg/dL of IgG in blood serum.

Studies carried out on the determination of the production time of IgG in baby alpaca (*Vicugna few*) were $3,165,237 \pm 1,060,395$ mg/dL of IgG at 48 hours, where the concentrations were $1,444,935 \pm 506,833$ mg/dL of IgG and from day 90 are comparable with serum concentrations of older animals [19] and there is research that reports that the serum level of IgG (2,679 mg/dl) in llamas of 48 hours of age are slightly higher than those reported by other authors Furthermore, no significant differences were found in the serum IgG concentrations of the offspring due to the origin of the animals (La Raya and Macusani), sex (female: 2,766.00 mg/dl; male: 2,705.00 mg/dl) [20].

Conclusion

It is concluded that the difference in serum IgM and IgG concentrations in three-month-old llamas, with different management systems, can be attributed to the fact that llamas in stable conditions generate a high concentration of active humoral immunity of IgG, this by effect of the immunogenicity of inactivated sarcocystin and also because it is found in environments limited by stressors.

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