

# Serum protein modulation following jugular low-level laser therapy: Case Reports

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**Abstract:** This case series examined the effects of jugular-applied low-level laser therapy (LLLT) on serum protein profiles in two adult Beagle dogs with chronic Ehrlichiosis. Each received 15-minute sessions of coherent 640 nm LLLT over the jugular vein. Dog 1 for three days and Dog 2 for five days. Serum total protein, albumin, and globulin were measured before and after treatment. Both dogs showed decreased total protein and globulin levels with concurrent increases in albumin, indicating improved systemic protein balance. The composite Directional Improvement Index showed 27% improvement in Dog 1 and 49% in Dog 2, suggesting jugular LLLT may help restore protein metabolism and modulate inflammation in chronic infection.

**Keywords:** Beagle dogs, Ehrlichiosis, low-level laser therapy, serum protein.

## INTRODUCTION

Serum protein analysis, including measurements of total proteins, albumin, and globulins is a cornerstone of veterinary and human medicine for assessing systemic health and disease status. Alterations in these parameters can reflect a wide range of conditions, from chronic infections and inflammatory states to hepatic dysfunction, renal impairment, and immune-mediated disorders. Hypoalbuminemia is commonly associated with impaired hepatic protein synthesis, chronic inflammation, and protein-losing nephropathies, while hyperglobulinemia frequently indicates persistent antigenic stimulation, often seen in infectious or immune-related diseases (Soeters *et al.*, 2019). Elevated total protein levels can therefore be driven by increased globulin fractions, reflecting an ongoing systemic immune response (Hashash *et al.*, 2022). Chronic Ehrlichiosis, caused by *Ehrlichia canis* infection, is a well-documented example of a condition in which these serum abnormalities manifest. Dogs with chronic Ehrlichiosis often present with hyperglobulinemia, hypoalbuminemia, and a low albumin-to-globulin ratio, indicative of chronic immune activation and hepatic compromise. These biochemical imbalances are not only diagnostic markers but also predictors of disease severity,

treatment response, and overall prognosis.

Low-level laser therapy (LLLT) has been investigated for its potential to modulate systemic physiology by acting on mitochondrial photoacceptors and downstream signalling pathways. Jugular-applied LLLT, in particular, offers a novel route for influencing circulating blood components and vascular-associated immune processes. By delivering coherent light over a major venous structure, this approach may entrain systemic effects beyond localised tissue interactions.

The present report describes an observational comparison in two adult Beagles with chronic Ehrlichiosis. Jugular coherent LLLT was applied, with Dog 1 receiving three consecutive days of treatment and Dog 2 receiving five days. Serum total proteins, albumin, and globulins were measured pre- and post-intervention. Improvement was defined as a decrease in total proteins and globulins, accompanied by an increase in albumin. Outcomes were quantified both as absolute ( $\Delta$ ) and percentage (%) changes, and an Improvement Index was developed to integrate these directional shifts into a single metric of response.

**Table 1.** Pre- and post-treatment serum protein changes and Directional Improvement Index in two Beagle dogs following jugular low-level laser therapy (LLLT).

| Parameter             | Dog 1 (3 treatments)   | Dog 2 (5 treatments)   |
|-----------------------|------------------------|------------------------|
| Total Proteins (g/dL) | Pre: 9.30 → Post: 7.40 | Pre: 8.50 → Post: 6.10 |
| Δ TP (g/dL)           | -1.90                  | -2.40                  |
| % Change TP           | -20.43%                | -28.24%                |
| Albumin (g/dL)        | Pre: 2.40 → Post: 3.00 | Pre: 2.10 → Post: 3.40 |
| Δ Alb (g/dL)          | +0.60                  | +1.30                  |
| % Change Alb          | +25.00%                | +61.90%                |
| Globulins (g/dL)      | Pre: 6.90 → Post: 4.40 | Pre: 6.40 → Post: 2.70 |
| Δ Glob (g/dL)         | -2.50                  | -3.70                  |
| % Change Glob         | -36.23%                | -57.81%                |
| Improvement Index (%) | 27.22                  | 49.32                  |

## MATERIALS AND METHODS

This study was conducted as an observational comparison in two adult Beagle dogs diagnosed with chronic ehrlichiosis. Each animal received low-level laser therapy (LLLT) applied over the jugular vein using a 640 nm coherent laser (Erchonia Corp.), which emitted a line beam approximately 5.08 cm in length and 0.2 cm in width, delivering a total fluence of 6.6 J/cm<sup>2</sup> during a 15-minute exposure. Dog 1 received daily treatments for three consecutive days, while Dog 2 received daily treatments for five consecutive days.

Procedures were carried out at the National Centre for Laboratory Animal Production (CENPALAB). Venous blood samples were collected immediately before the first session (baseline) and again after the final treatment. Serum total proteins, albumin, and globulins were measured using standard biochemical assays.

Treatment response was assessed based on predefined improvement criteria: a reduction in serum total proteins and globulins, together with an increase in serum albumin. Both absolute changes (Δ) and percentage changes (%) were calculated. To combine these outcomes into a single metric, a Directional Improvement Index (%) was developed, defined as the average of the percentage increase in albumin (scored as positive) and the percentage decreases in total proteins and globulins (considered positive after sign inversion).

## RESULTS

Serum protein levels before and after jugular-applied LLLT are summarised in Table 1. Both dogs show a decrease in total proteins and globulins, accompanied by increase in albumin, consistent with the predefined criteria for improvement. The table summarises baseline and post-treatment values for total protein, albumin, and globulin in each dog, along with absolute (Δ) and percentage (%) changes. The Directional Improvement Index represents the mean of the percentage increase in albumin and percentage decreases in total protein and globulin,

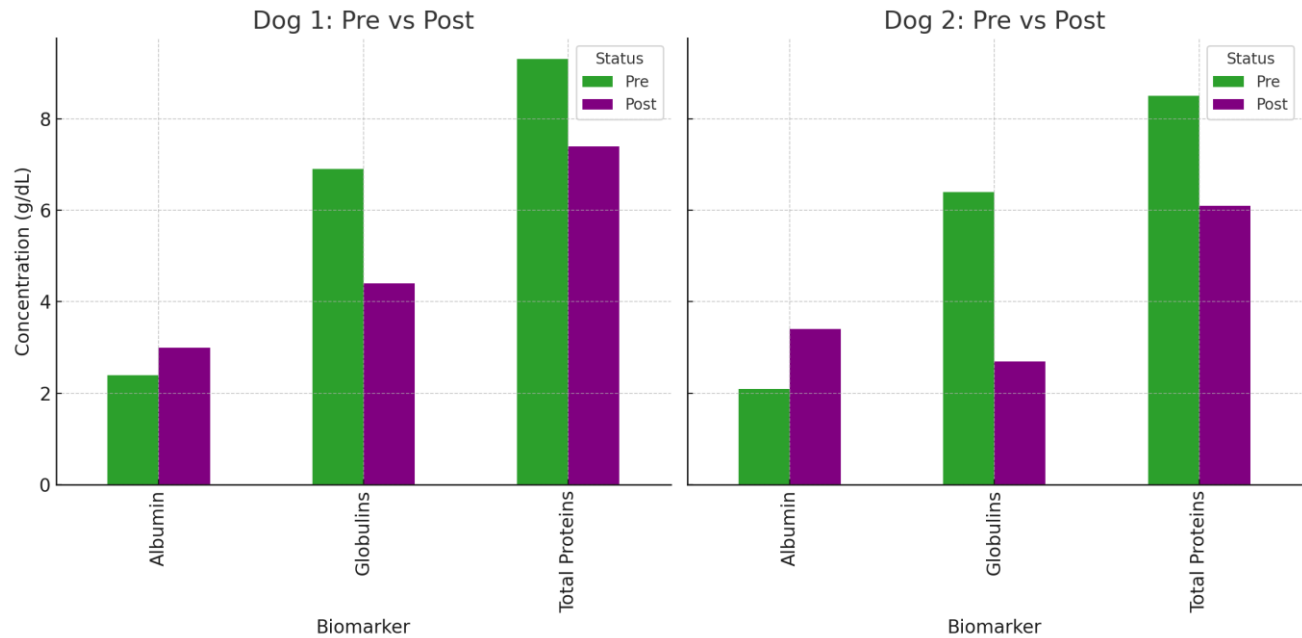
indicating the overall magnitude of improvement in serum protein balance after LLLT.

Dog 1 was treated over three consecutive days, exhibited a 20.4% reduction in total proteins, a 36.2% reduction in globulins, and a 25.0% increase in albumin, yielding a Directional Improvement Index of 27.2%. Dog 2, treated for five consecutive days, showed a larger response, with total proteins reduced by 28.2%, globulins reduced by 57.8%, and albumin increased by 61.9%, corresponding to an Improvement Index of 49.3% (Figures 1 and 2).

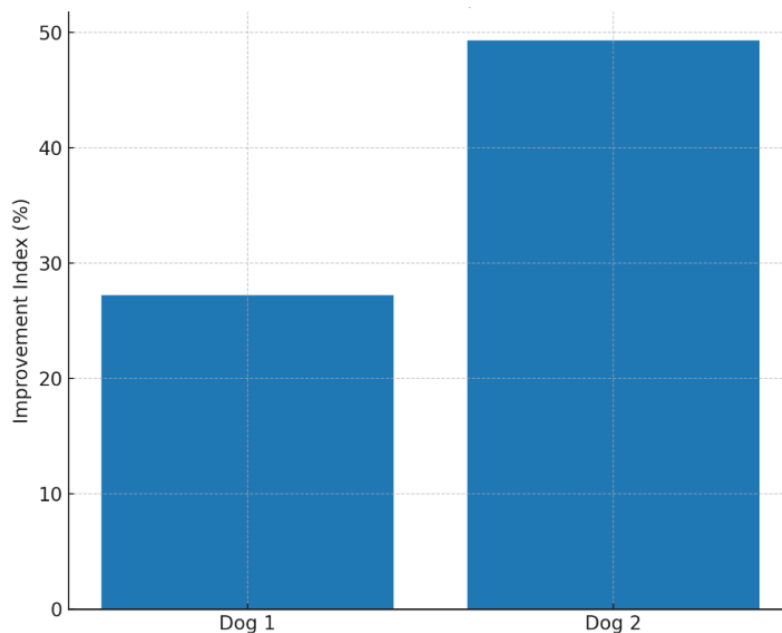
The bars in Figure 1 illustrate total protein, albumin, and globulin concentrations before and after treatment. Both dogs demonstrated decreases in total protein and globulin with corresponding increases in albumin, consistent with improved systemic protein balance following 640 nm coherent laser exposure over the jugular vein. Figure 2 presents the composite index integrating percentage changes in total protein, albumin, and globulin to reflect overall serum protein improvement. Dog 1 (three-day treatment) achieved a 27% improvement, while Dog 2 (five-day treatment) showed a 49% improvement, indicating a greater systemic response with extended treatment duration.

## DISCUSSION

Serum protein concentrations, especially the balance between albumin and globulins, offer vital insights into systemic health, inflammation, and organ function. In chronic infectious diseases like Ehrlichiosis, ongoing antigenic stimulation often leads to hyperglobulinemia, while chronic inflammation and reduced liver synthesis cause hypoalbuminemia. This shift lowers the albumin-to-globulin ratio, a pattern strongly linked to immune dysregulation, metabolic stress, and higher morbidity in both veterinary and human medicine (Wang *et al.*, 2022; Jeffery *et al.*, 2012). The decreases in total proteins and globulins observed in this report, along with significant increases in albumin, indicate a systemic adjustment in protein metabolism and inflammation after jugular-applied



**Figure 1.** Serum protein profiles before and after jugular-applied LLLT in two dogs.



**Figure 2.** Directional Improvement Index (%) by dog.

#### LLLT.

Albumin is more than a marker of hepatic synthetic capacity; it is a multifunctional protein with antioxidant, osmotic, and transport roles (Sun *et al.*, 2019). Restoration of albumin levels, therefore, carries both diagnostic and therapeutic implications. Similarly, reductions in globulin fractions reflect a downregulation of chronic immune activation, which in dogs with Ehrlichiosis may lessen the

burden of immune-complex formation and secondary organ damage. Together, these changes indicate an improvement in overall systemic resilience.

The biological mechanism by which LLLT over the jugular vein might influence these serum proteins is likely connected to mitochondrial bioenergetics. Red laser absorbed by mitochondria can increase energy production and support healthy cell signalling, which may promote

protein formation and reduce inflammation (Blanco-Prieto *et al.*, 2020; Rola *et al.*, 2022; Peplow *et al.*, 2011). An additional emerging mechanism involves circulating free mitochondria, which have been identified in peripheral blood as functional organelles capable of signalling (Trumpff *et al.*, 2021). This vascular delivery route could bypass the limitations of localised tissue irradiation, leading to widespread systemic effects that are observable in serum biochemistry.

## Conclusion

This case series involving two Beagle dogs with chronic Ehrlichiosis showed that jugular-applied LLLT was linked to positive changes in serum protein profiles, including decreases in total proteins and globulins, along with increases in albumin. These biochemical improvements indicate a rebalancing of systemic inflammation and protein metabolism, supporting mechanisms of improved mitochondrial function and vascular-mediated bioenergetic regulation. Larger controlled studies are necessary to confirm these findings and further explore the systemic effects of this innovative delivery method. Future research should include post-intervention follow-up to evaluate the longevity of serum protein changes and monitor clinical and functional outcomes, such as appetite, activity, and energy levels, to correlate with biomarker shifts. Overall, these preliminary results provide a compelling rationale for more extensive trials and highlight the potential of jugular-applied LLLT as an adjunctive strategy to enhance systemic health in veterinary medicine.

## Limitations

This case series is limited by the small sample size and the absence of long-term follow-up, which restricts the ability to assess the durability of treatment effects. Future studies involving larger cohorts, control groups, and extended monitoring periods are warranted to validate and expand upon these preliminary observations.

## CONFLICT OF INTEREST

T.S. is an employee of Erchonia Corporation, the sponsor of this study, and contributed to the study design and provision of the investigational device. I.S.T. conducted the study procedures and data analysis and is an independent researcher and professor affiliated with CENPALAB, with no conflicts of interest to declare.

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