

Berberis microphylla shrub: A Natural Antioxidant Resource with Potential for Sheep Feeding

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Antioxidants are highly desired ingredients in livestock diets because of their regulating role on the excessive production of reactive oxygen species (ROS) [1]. A marked presence of these ROS in the cell membrane causes a cell dysfunction and organic metabolic failure, and ultimately animal pathology associated with inflammation [2]. For example, nutritional muscular dystrophy (stiff lamb disease) is provoked by deficiency of selenium, vitamin E, or both, as they protect cell membranes from the oxidative damage [3]. Antioxidants also improve the quality of the meat, mutton [4], and milk production [5].

Berberis microphylla is a native perennial species from the Patagonia region (South of Chile and Argentina in South America) with high antioxidant capacity compounds [6], as well as antimicrobial, anti-inflammatory, analgesic, and natural vasodilator activity properties [7]. It is a thorny bush growing associated to native temperate forest and water body environments, and the fruit produced (“calafate”) is collected and traded by local communities [8]. The antioxidant activity of *B. microphylla* fruit is exceptional (from 22 to 36 $\mu\text{mol g}^{-1}$, [9]), and the leaves also show a valuable level of 14166 $\mu\text{g TE g}^{-1}$ fresh weight (Ulloa-Inostroza, unpublished data). Our perception through field observations is that sheep and cattle are attracted to the young plant organs of the shrub in the spring season. Therefore, fresh consumption of leaves and their associated properties represent an option for local livestock. Although *B. microphylla* is more populated in the Patagonia region, the domestication of this species [10], which is in progress, could potentially open a global demand and a market opportunity, perhaps as natural supplements.

The Sustainable Development Goals plan for 2030 encourages the use of perennial woody plants in livestock systems (e.g. silvopastoral systems) to mitigate environmental impacts of livestock management. The Patagonian bush *B. microphylla* would fit this requirement, and also has the benefit of being a natural feed resource, instead of manufactured chemical-synthesized products (antibiotics) but, further research is needed. The challenge is to investigate the intake, digestibility, performance, and feeding behavior and how often *B. microphylla* can be included in the sheep diet. Furthermore, research will be needed to understand molecular mechanisms of phenolic compounds in animal cells and metabolic profile, as well as the effects on the animal health, and whether there are any beneficial implications for human health due to the *B. microphylla* consumption by the sheep (through their meat or milk). Research can be conducted to determine the potential contribution of *B. microphylla* to productive grazing systems in South America.

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