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Self-DNA Effects on Growth, Oxidative Stress, and Nutritional Quality of Lemna perpusilla: In Vitro

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Duckweed (Lemna sp.) is a promising alternative ruminant feed due to its rapid growth and high protein content. However, extracellular self-DNA released from plant tissues may exert species-specific inhibitory effects on microbial activity, a phenomenon remaining unexplored in rumen systems. This study evaluated the effects of Lemna supplementation and Lemna-derived self-DNA on in vitro rumen fermentation characteristics. Five dietary treatments were evaluated: P0 (basal diet: 60% forage, 40% concentrate); P1 (60% forage + 36% concentrate + 4% Lemna self-DNA); P2 (60% forage + 36% concentrate + 4% Lemna control); P3 (50% forage + 30% concentrate + 20% Lemna self-DNA); and P4 (50% forage + 30% concentrate + 20% Lemna control). Rumen pH, NH_3-N, total volatile fatty acids (VFA), and VFA profiles were determined post-in vitro incubation. Rumen pH and NH_3-N concentrations were not significantly affected by treatments ($P > 0.05$). Conversely, total VFA production and composition were significantly altered ($P < 0.05$). The highest total VFA concentration was observed in P3, followed by P2 and P1, indicating enhanced fermentation with higher Lemna inclusion. Notably, treatments containing self-DNA tended to produce lower fermentation responses than their respective controls, suggesting a potential inhibitory effect on microbial activity. Additionally, acetate proportion decreased while propionate and butyrate increased, shifting toward more efficient fermentation pathways. In conclusion, while Lemna nutrients stimulate rumen fermentation, its self-DNA partially modulates microbial activity through inhibitory mechanisms, highlighting the importance of considering both nutritional and molecular factors in plant biomass evaluation.

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References

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