In vitro Fermentation Profiles to Characterize Postbiotic effects on Dairy Cow Rumen Fermentation

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Introduction

- The increased consumer concern about safety, quality of animal products, and environmental issues have led to an increased interest in feeding natural additives such as microbiota-modulating dietary supplements.
- Postbiotics have been defined as the preparation of inanimate microorganisms and/or their components that confers a health benefit on the host.
- Postbiotics can help to maintain a healthy gut microbiome in dairy cows by promoting the growth of beneficial bacteria and inhibiting the growth of harmful bacteria. This can help to reduce the risk of digestive disorders and improve nutrient absorption, leading to better overall health and productivity.
- Postbiotics can modify the production of VFAs such as acetate, propionate, and butyrate in the rumen. VFAs are important energy sources for dairy cows, and increased production can lead to improved feed efficiency and milk production.
- Postbiotics can have a selective effect on rumen microbial populations, promoting the growth of beneficial bacteria and inhibiting the growth of harmful bacteria. This can help to improve overall rumen health and function.

Objective

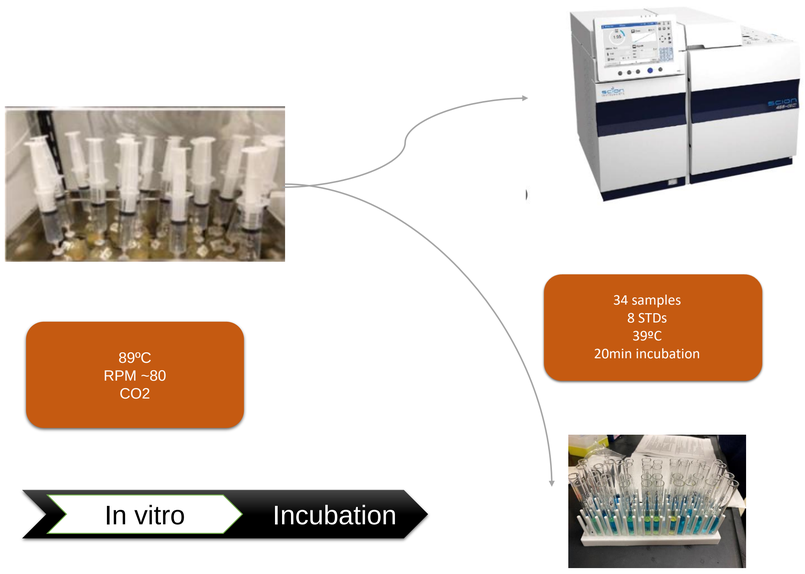
The objective was to evaluate the effects of a postbiotic on rumen environmental factors, including pH, NH3, and VFA concentration profiles that can be relatable to dairy cattle nutrition and feed efficiency.

Materials and Methods

Treatment Bottles →

Comprised of:
- 0 – 0g postbiotic
- 25 – 0.025g postbiotic
- 50 – 0.050g postbiotic
- Each had 1.8g TMR

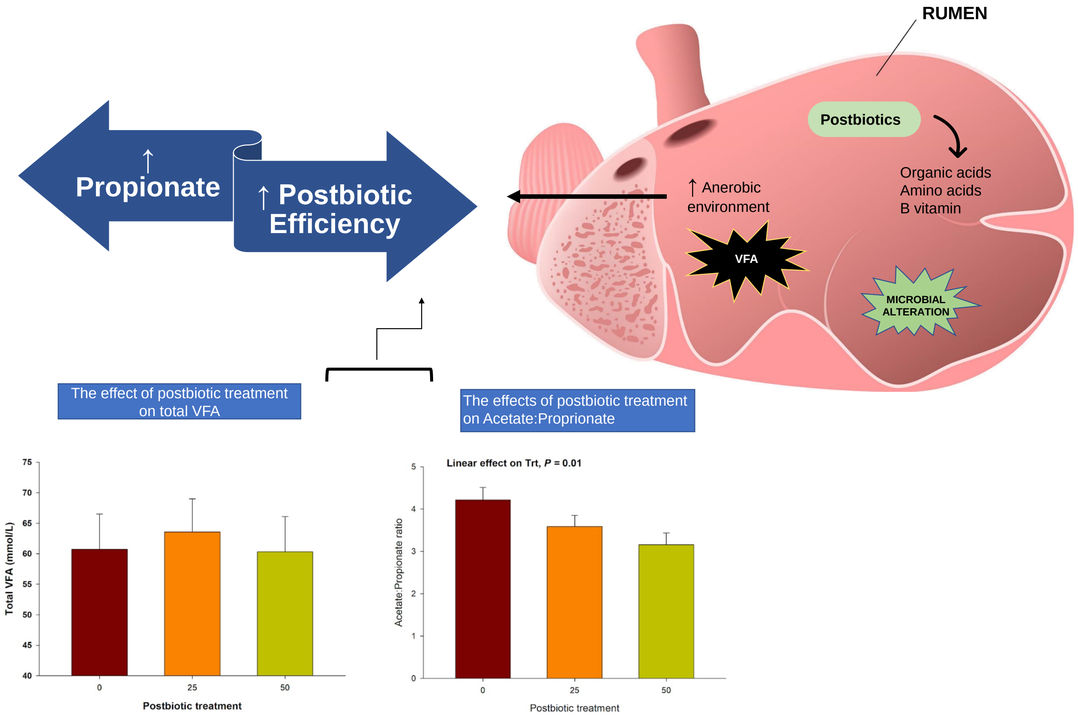
Experimental design: Complete randomized design

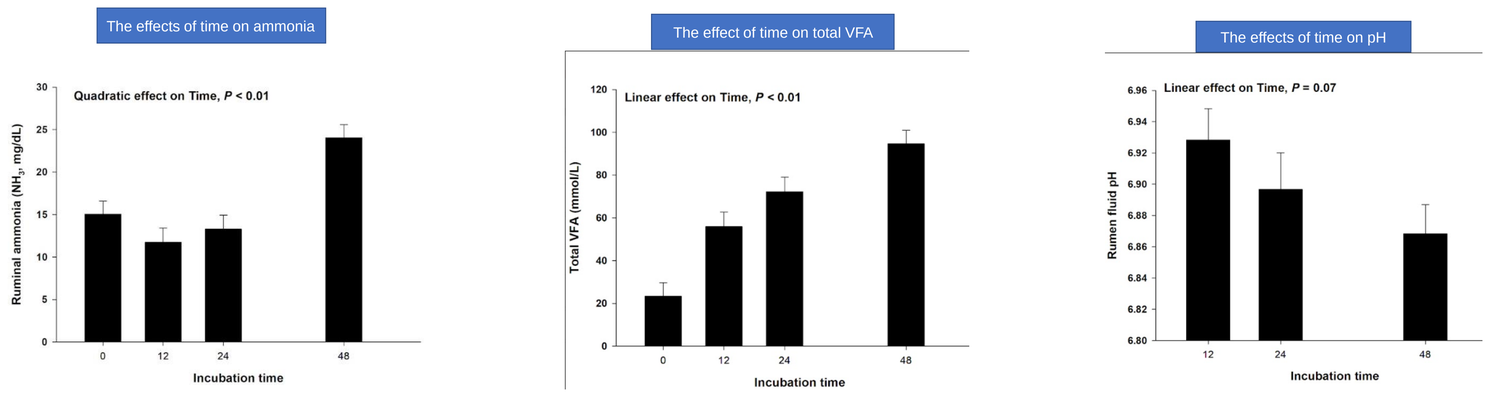


❖ **Treatment parameters:**
- A total of 1.8 g of ground total mixed ration (TMR) was used in each incubation tube in addition to postbiotic treatment

❖ **Rumen fluid collection:**
- Collected once a week for 3 different periods
- Via cannula of transition dairy cow for analysis of volatile fatty acids (VFA) and ammonia-N as well as pH

❖ **Statistical analysis:**
- Complete randomized design utilized for analyzing treatment and time points
- Design included treatment (0, 25, 50), time (12, 24, and 48 hours) and their interaction
- Statistical significance was declared at $P < 0.05$ and trends at $0.05 < P < 0.001$





Results

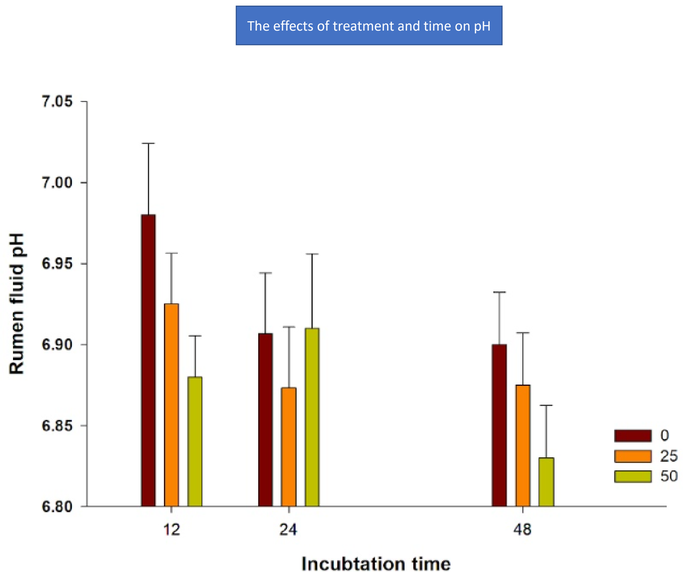
- We could not find any interactions between treatments and time points that showed interaction for any rumen parameters.
- For total VFAs and NH3, there was significant differences in time *(P=<0.001)*.
- A linear increase (*P*=0.04) was observed in propionate was observed as the postbiotic as it was increased from 0 to 50 g dose.
- Isobutyrate tended (*P=0.09*) for time.
- Both the NH3 and VFA results showed that the average was highest at the 48hr time point 24.03mg/dL NH3 and 94.59mmol/L VFA, respectively.
- The pH average results did not show any significant changes.

Ruminal concentrations

Rumen measure	Treatment 0	25	50	SD	P-value TRT	Time	TRT*T
pH	6.92	6.89	6.87	0.022	0.22	0.18	0.74
VFA	60.71	63.55	60.30	5.78	0.90	<0.001	0.98
NH3	15.08	16.53	16.53	1.41	0.71	<0.001	0.95

VFA Performance parameters

Item	Treatment 0	25	50	SD	P-value TRT	Time	TRT*T
Acetate	67.39	67.21	65.07	1.54	0.52	0.17	0.97
Propionate	18.70	19.40	22.38	1.17	0.08	0.36	0.98
Isobutyrate	0.92	1.10	1.19	0.11	0.29	0.09	0.60
Butyrate	10.16	9.50	9.06	0.97	0.72	0.47	0.85
Isovalerate	0.87	0.91	1.01	0.15	0.82	0.56	0.99
Valerate	1.44	1.42	1.54	0.18	0.88	0.19	0.99
Caproate	0.47	0.43	0.43	0.08	0.91	0.59	0.88



Conclusion

These results indicate that postbiotic treatment may increase propionate in the rumen, which is an essential precursor of glucose in dairy cows. In turn, glucose is utilized in the mammary gland to synthesize lactose, the major driver in milk production in dairy cows.