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THE IMPACT OF RED ASPARAGOPSIS OIL ON THE EATING QUALITY OF MID-FED CATTLE

N. R. Sarker[1*], E.E.M.Lynch[1], P. McGilchrist[1]

[1] University of New England, School of Environmental and Rural Science, Armidale 2350, New South Wales, Australia.

*Corresponding author email: nsarker4@une.edu.au

I. INTRODUCTION

Livestock primarily emits greenhouse gases (GHG) in the form of methane (CH_4) from the rumen [1]. Australian feedlot industry contributed 5.8% of total GHG greenhouse gases and processing contributed another 2.1% [2]. Technologies targeting direct abatement of methane through additives have become increasingly important. Previous research has shown that bromoform, an extract of the bioactive derived from the seaweed *Red Asparagopsis* in a vegetable oil carrier, can reduce methane (CH_4) yield of 54.5 – 95.0 % in short-fed finishers [3]. While effective in methane mitigation, its impact on cattle performance, carcass value, and cost remains uncertain, particularly under Australian commercial conditions. Understanding how red asparagopsis supplementation relates to rumen fermentation and its effect on animal performance may lead to novel strategies for reducing greenhouse gas emissions while improving animal productivity. This study evaluates red asparagopsis oil (Asp-Oil) in total mixed rations for its effect on mid-fed (150 days) beef eating quality.

II. MATERIALS AND METHODS

This study evaluated the effect of Asp-Oil inclusion in a finisher total mixed ration (TMR) on meat-eating quality using two dietary treatments: a control and a diet supplemented with Asp-Oil for the final 100 days of their finishing period. The trial design followed a randomised block design with two treatments and three blocks per treatment, stratified by days on feed (DOF). This experiment utilised 600 mid-fed (150 DOF) Angus or Angus crossbred cattle allocated to a treatment group based on vendors and induction weight to ensure an equal distribution between treatments. These cattle were fed in 3 blocks (n = 200 head per block), initially fed in pens of 200 for the first 50 days to acclimate to feedlot feeding and ration composition before being reallocated into treatment pens (n = 100 head per pen). The treatment diets were isoenergetic and isonitrogenous, formulated as equivalent mid-fed rations with Asp-Oil or without (Control). The mean inclusion of Asp-Oil in the ration prepared on a daily basis was 1.1% by weight to deliver 25.6 mg/kg Bromoform per kilogram of feed. Samples selected for eating quality assessment were collected from the Striploin (*Longissimus lumborum*), Oyster Blade (*Infraspinatus*), and Eye Round (*Semitendinosus*) of carcases with approximately 112 to 136 days on Asp-Oil. Across the three kill groups, cuts were obtained from 72 treated and 72 control cattle (n = 144), ensuring similar means and standard deviations for MSA marbling, ossification and hot standard carcase weight. Five steak samples were processed from each cut x ageing period and were assessed by 10 untrained Australian consumers utilising MSA protocols for the grill cook method [4]. A total of 720 steak samples were evaluated, with anterior Striploin (STR045) and Eye Round (EYE075) aged for 7 and 28 days, while Oyster Blade (OYS036) was aged for 7 days. A total of 1860 consumers each received a starter steak, followed by 6 test samples, which were randomised using a 6 × 6 Latin square design to balance presentation order. Each consumer scored for tenderness, juiciness, flavour and overall liking using a 100 mm line scale, which were weighted by 0.3, 0.1, 0.3 and 0.3, respectively and used to calculate a meat quality score (MQ4). Statistical analysis was conducted using linear mixed-effects models in R (Bates, 2014), with treatment, cut, ageing included as fixed effects, and adjusted for marbling, hump height, and hot standard carcass weight (HSCW). Animal within block was included as a random effect.

III. RESULTS AND DISCUSSION

No significant differences (P>0.05) were found for MQ4 between the treatment and control groups (Table 1), suggesting any observed changes were likely due to random variation rather than the treatment. This finding aligns with previous research on meat taste assessment, which also found no differences between beef cattle supplemented with *Asparagopsis spp.* and the control group [5, 6]. The MQ4 scores were 32.8 and 27.0 points higher for OYS036 and STR045 than EYE075, possibly due to differences in fat distribution, tenderness, or other intrinsic quality factors (Figure 1). Additionally, MQ4 significantly increased with ageing up to 28 days, rising by 4.1 points on average across cuts. The improvement of sensory qualities of all cuts with ageing is attributed to proteolysis, connective tissue changes, development of complex flavour compounds, and changes in fat and water distribution, which improve tenderness and overall meat quality, particularly noticeable in cuts with higher connective tissue content. Weight-bearing muscles and those used frequently contain more collagen, while cuts

with higher fat content tend to exhibit greater tenderness due to reduced muscle use. While there were variations in sensory properties across different cuts, both the treated and control groups showed improvement with ageing. This indicates that the presence of Asp-Oil does not impact the ageing process for these cuts.

Table 1 – Estimated Marginal Means (±SE), confidence intervals (CI) for MQ4 by treatment, cut, and ageing period

Predictors	Effect	Emmean ± SE	lower.CL	upper.CL	F value
Treatment	ASP-Oil	59.1 ± 0.8	57.3	60.8	0.27[a]
	Control	59.6 ± 0.8	57.8	61.4	0.27[a]
Cut	Eye Round, EYE075	39.4 ± 0.6	37.8	40.9	1170.78[a]
	Striploin, STR045	66.4 ± 0.6	64.8	67.9	1170.78[b]
	Oyster Blade, OYS036	72.2 ± 0.9	70.2	74.3	1170.78[c]
Ageing (days)	7	57.3 ± 0.6	55.9	58.6	40.69[a]
	28	61.4 ± 0.7	59.8	63.0	40.69[b]

*Superscript letters (a, b, c) are significantly different (P < 0.05) according to pairwise comparisons.

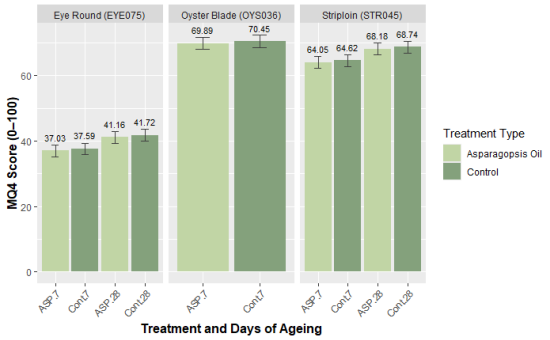


Figure 1. Effect of treatment and ageing on MQ4; error bar represents confidence intervals (CI) around the EMMEANS

IV. CONCLUSION

This research is one of the largest commercial trials of *Asparagopsis* products conducted in Australian feedlot conditions, providing valuable data for integrating Asp-Oil into extended feeding programs. The results indicate that the Asp-Oil treatment doesn't affect eating quality attributes, ensuring consumer satisfaction and industry standards. These findings support the economic feasibility of incorporating Asp-Oil into extended feeding programs. However, future research is needed to optimise feeding programs for Asp-Oil supplements, including feeding strategies and exploring different Asparagopsis varieties and synthetic formulations.

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