Potential of starch level and oil supplements to modify enteric gas production and re-partitioning of energy in lactating dairy cows fed high forage diet

Presented by:

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MATERIAL AND METHODS

Four Finnish Ayrshire lactating dairy cows in mid lactation (76 ± 10.4 d) fitted with rumen fistula

4×4 Latin square

Experimental treatments: high forage diets (65:35) containing low or high starch supplemented with 0 or 3 %DM of unsaturated FA (Oil).

MATERIAL AND METHODS- CONTINUE

Enteric gas production was measured using sulfur hexafluoride (**SF_6**) gas as a marker.

The rate of SF_6 release (1.16 ± 0.19 mg/d) was determined during the experiment (20 weeks).

Ruminal gases were collected continuously (2 mL/min) over 5 days into evacuated 5.5 L canisters.

The canisters were connected by tubes to the rumen cannulae.

Collected gases were sampled in triplicate and analyzed for CH_4, CO_2 and SF_6 concentrations by GC.

Table 1. Composition of experimental diets (g/kg DM)

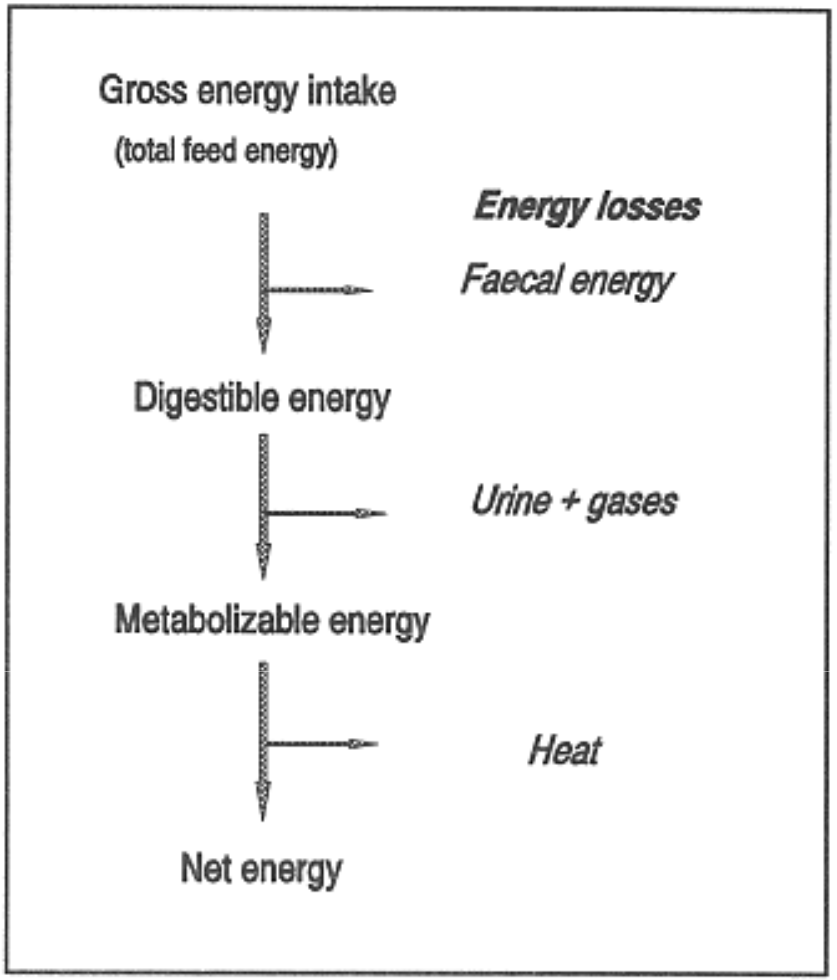
	Low Starch		High Starch	
	0 % oil	3 % oil	0 % oil	3 % oil
Grass silage	550	550	550	550
Rolled barley	0	0	**85**	**77**
Ground wheat	0	0	**255**	**232**
Sugar beet pulp	**255**	**232**	0	0
Barley feed	**85**	**77**	0	0
Rapeseed meal (solv.)	80	80	80	80
Urea	0	1.5	0	1.5
unsaturated FA (Oil)	**0**	**30**	**0**	**30**
Vitamin and mineral premix	30	30	30	30

Table 2. Chemical composition of experimental diets

	Low Starch		High Starch	
	0 % oil	3 % oil	0 % oil	3 % oil
DM (g/kg as fed)	536	539	528	532
OM (g/kg DM)	923	926	938	939
CP (g/kg DM)	150	151	156	156
NDF (g/kg DM)	450	437	364	359
WSC (g/kg DM)	45	42	28	27
Starch (g/kg DM)	**16**	**15**	**202**	**184**
GE, MJ/kg DM	19.5	20.1	19.6	20.3

DE = GE – FE

ME= DE – UE – GasE

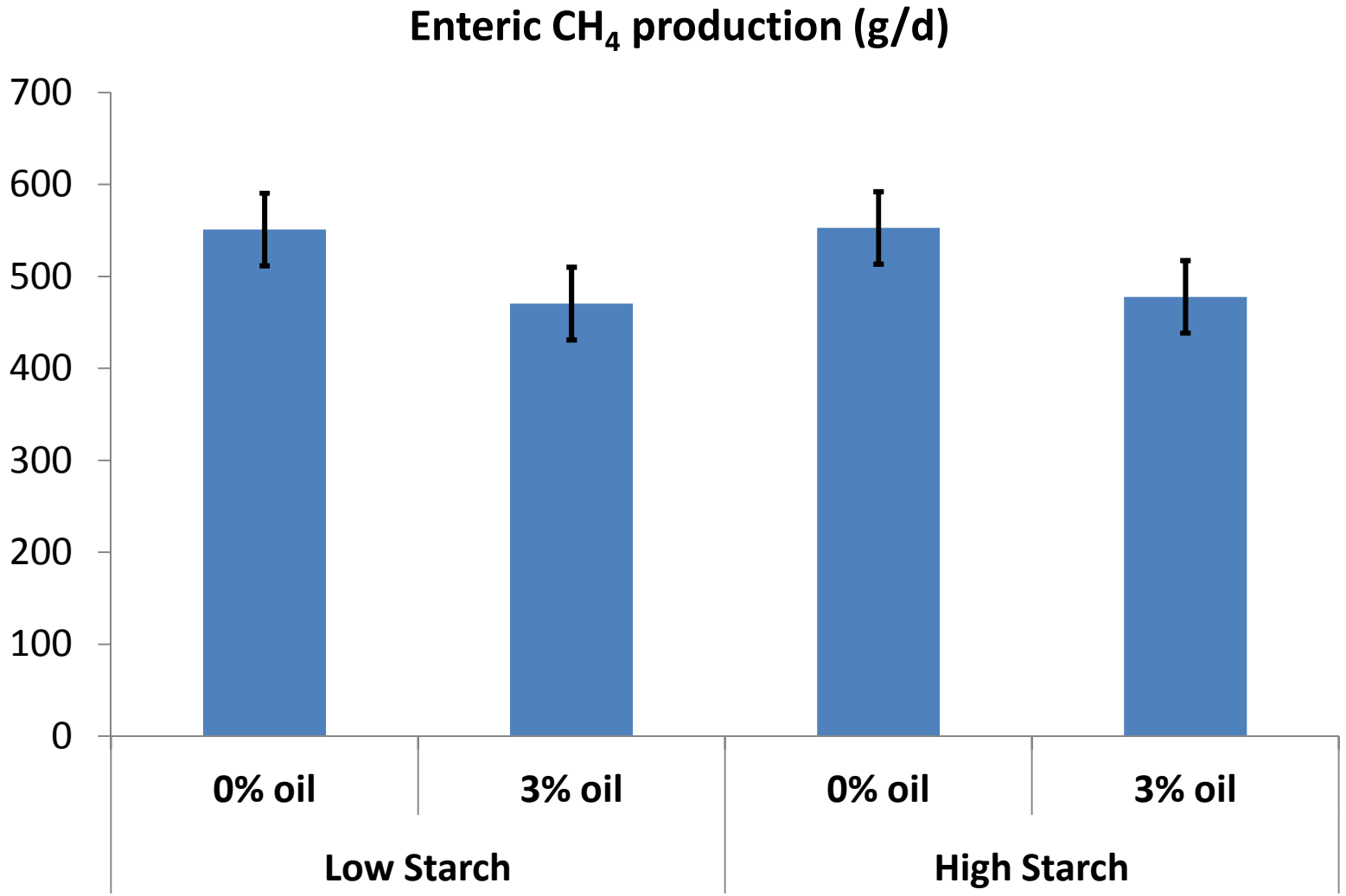


K_l = 0.65

ME_L = milk NE/ K_l

Agnew et al. (2003) Livestock Production Science, 151–162

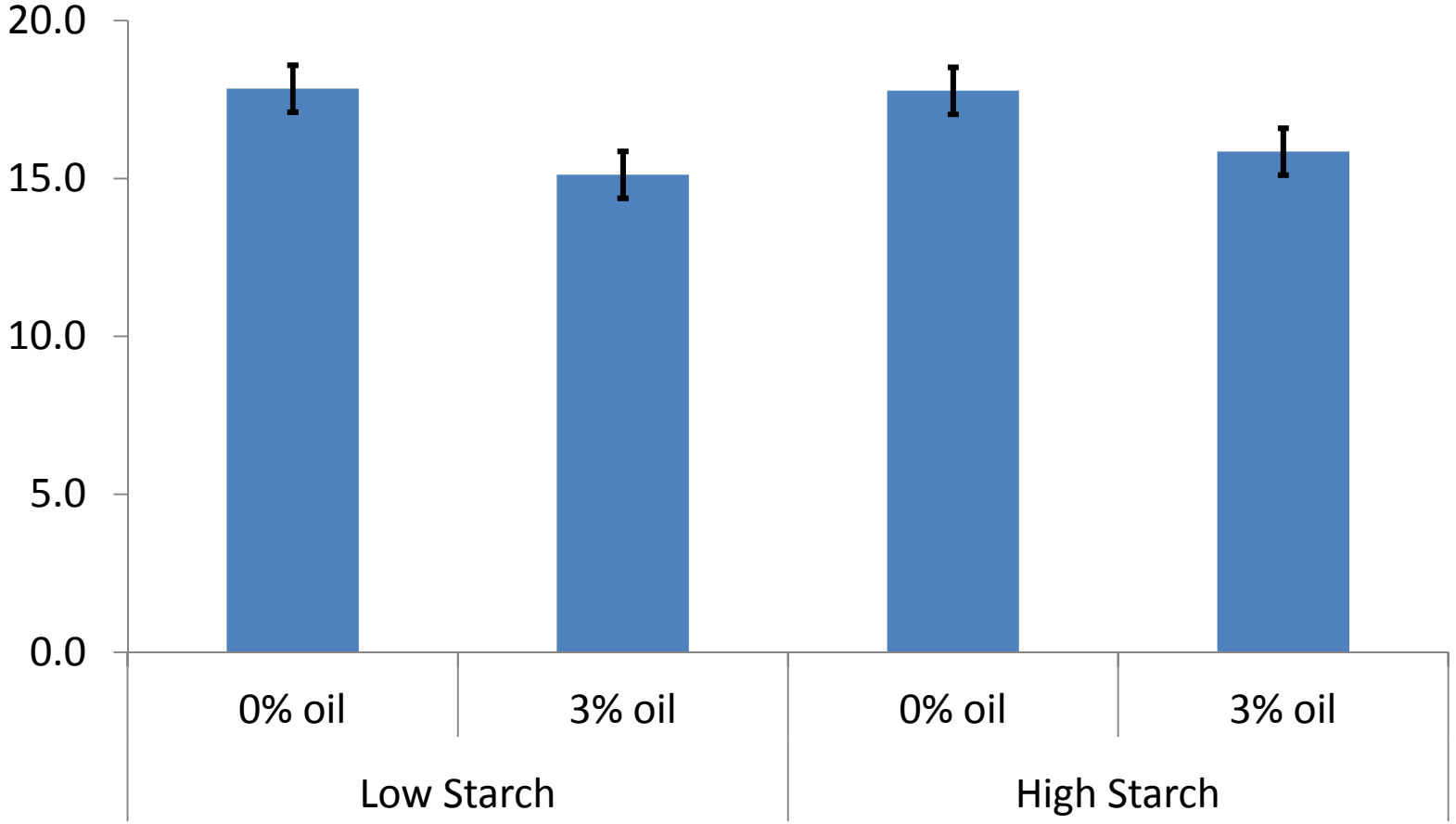
RESULTS



P value		
Starch	Oil	Starch× Oil
0.89	**0.051**	0.93

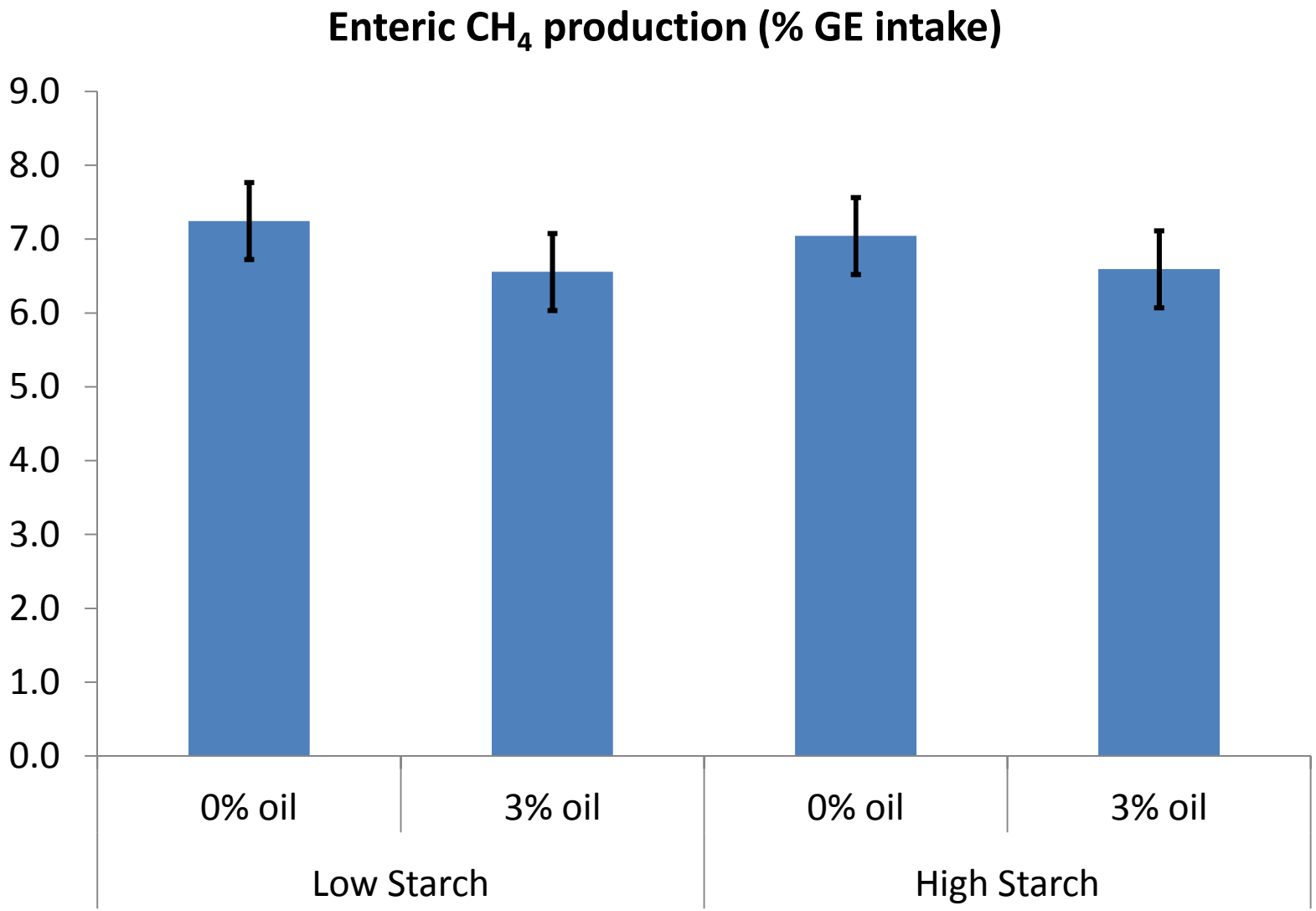
Decrease: 14%

Enteric CH_4 production / Milk yield (g/kg)

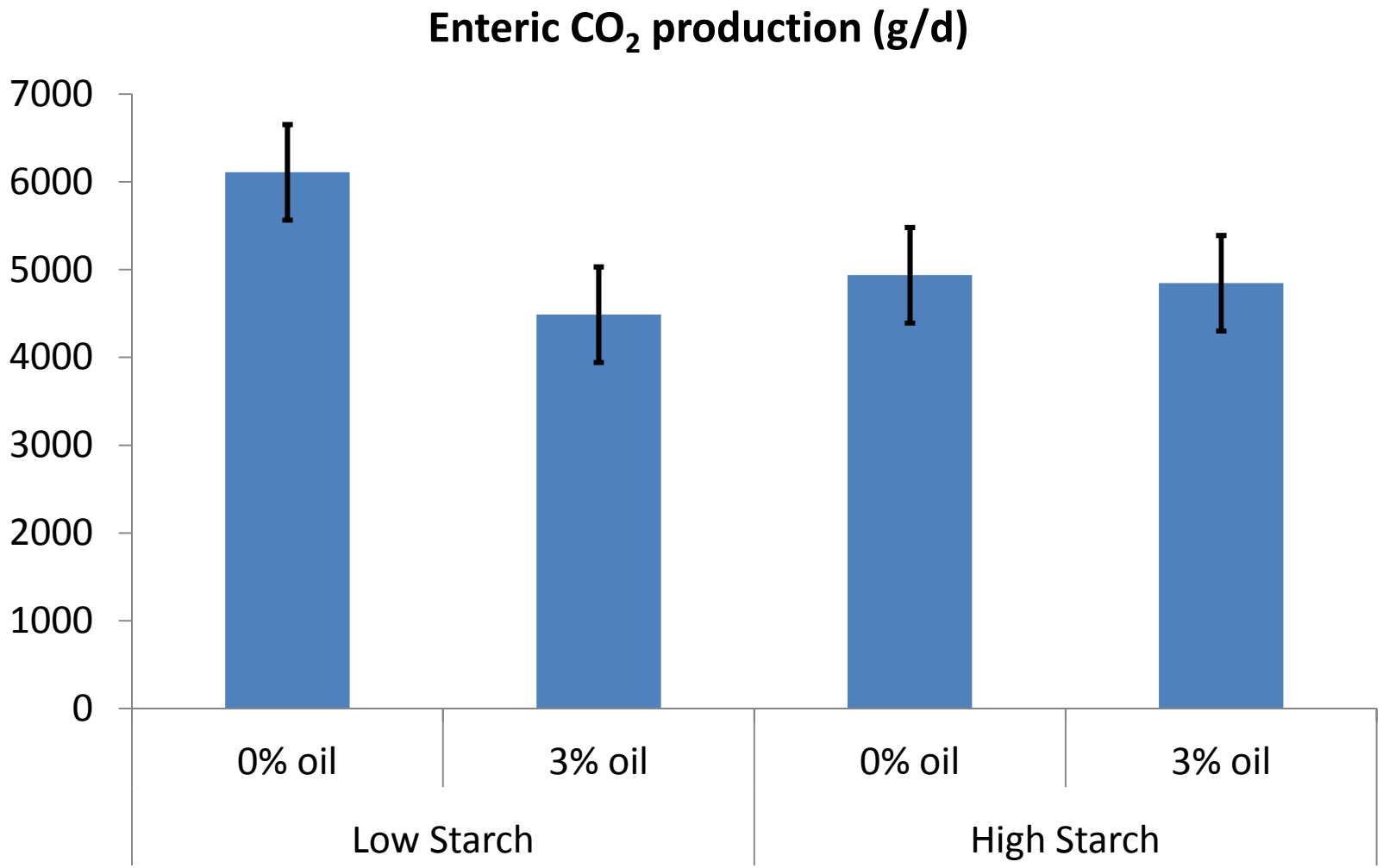


P value		
Starch	Oil	Starch× Oil
0.64	**0.015**	0.58

Decrease: 13%

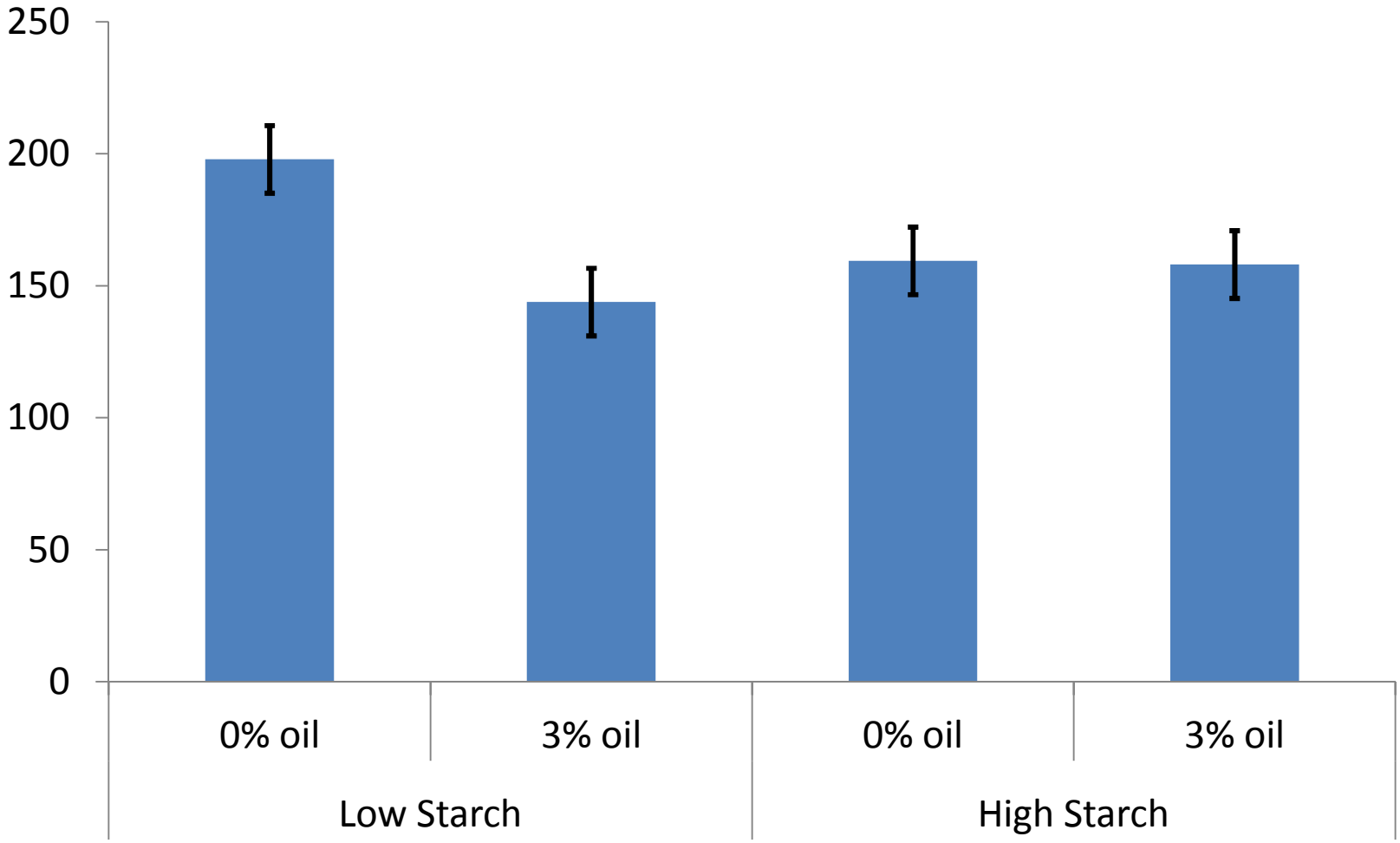


P value		
Starch	Oil	Starch× Oil
0.86	0.26	0.80



P value		
Starch	Oil	Starch× Oil
0.48	0.16	0.21

Enteric CO_2 production / Milk yield (g/kg)



P value		
Starch	Oil	Starch× Oil
0.38	**0.07**	**0.09**

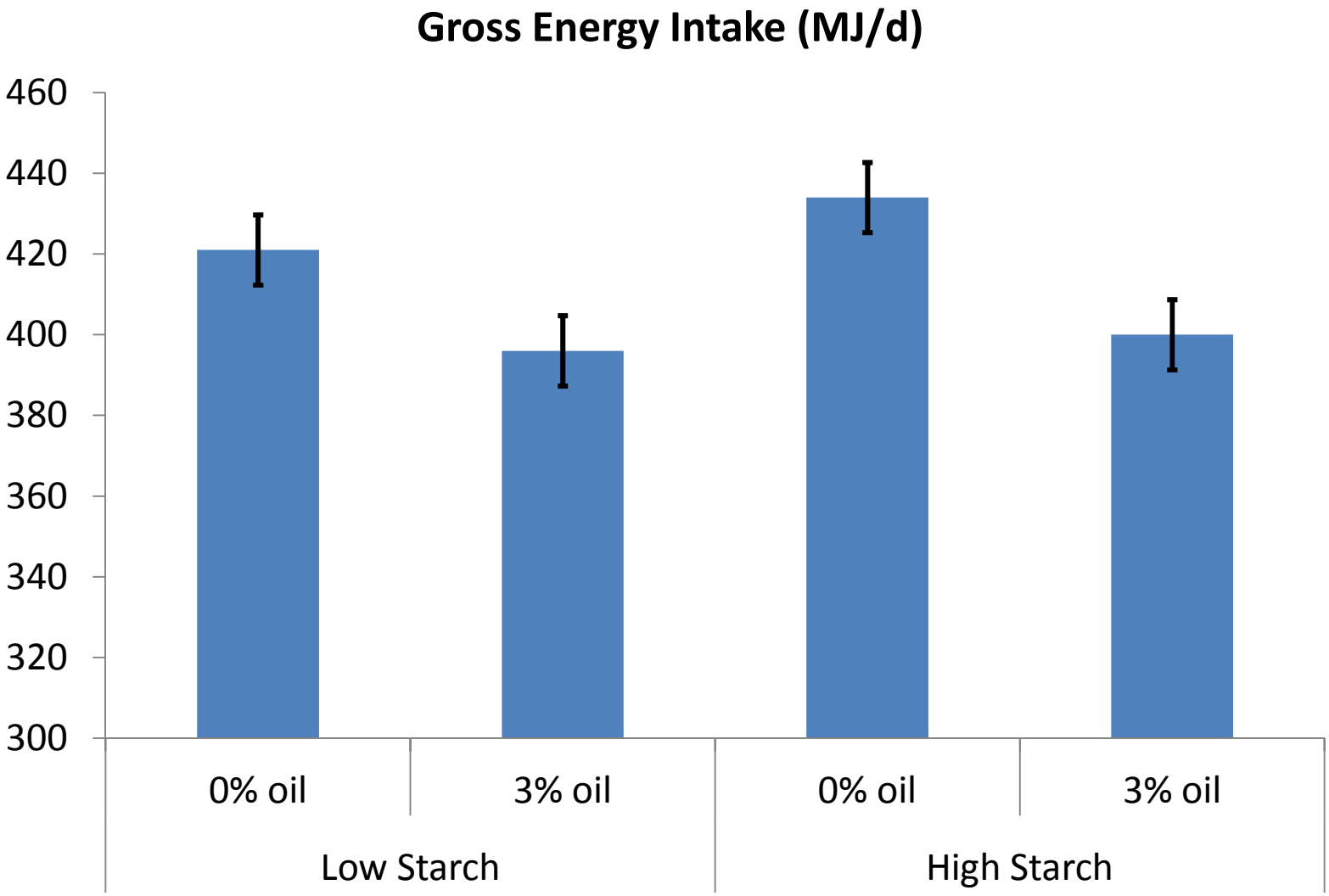
Decrease: 27% for Low starch + Oil

Yan et al. (2012):

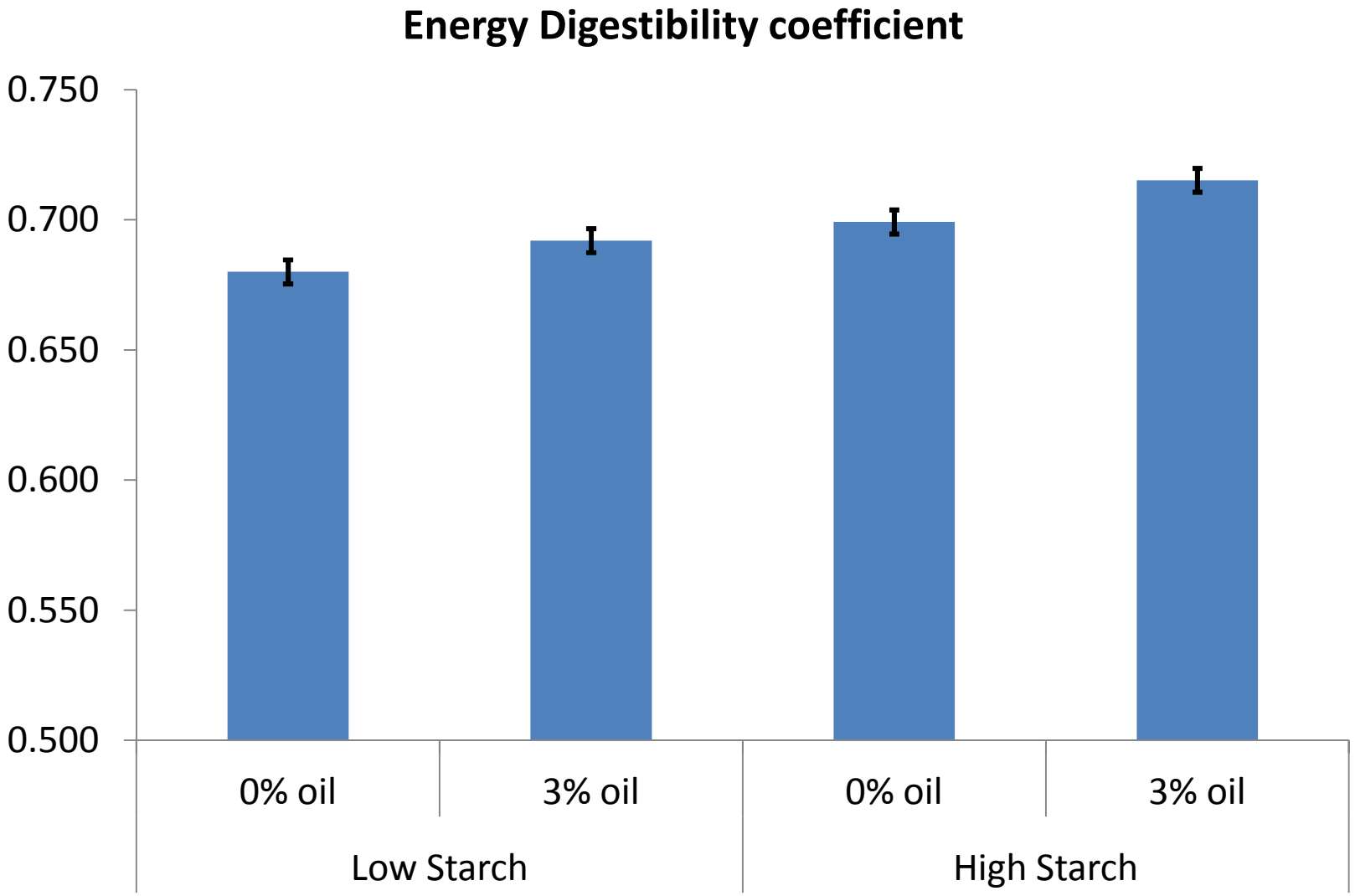
No effect of starch content on CH_4 production.

Yan, T. , Gordon, F.J. , Carson, A.F. (2012). The effect of concentrate starch content on enteric methane emissions of lactating dairy cows. International Symposium on Emissions of Gas and Dusk from Livestock, Saint-Malo, pp 20 , June 2012.

Energy Partitioning

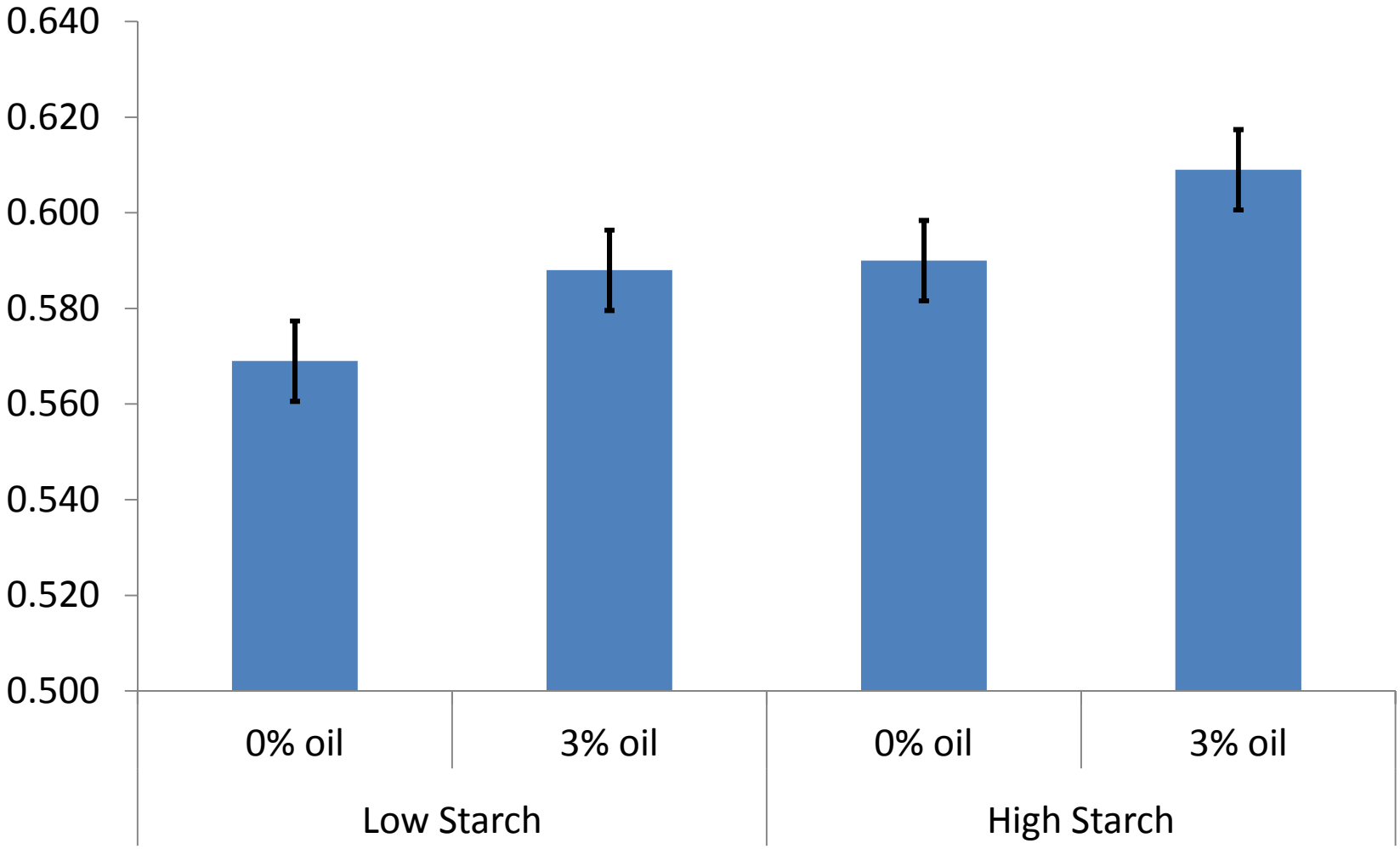


P value		
Starch	Oil	Starch× Oil
0.18	**0.002**	0.42



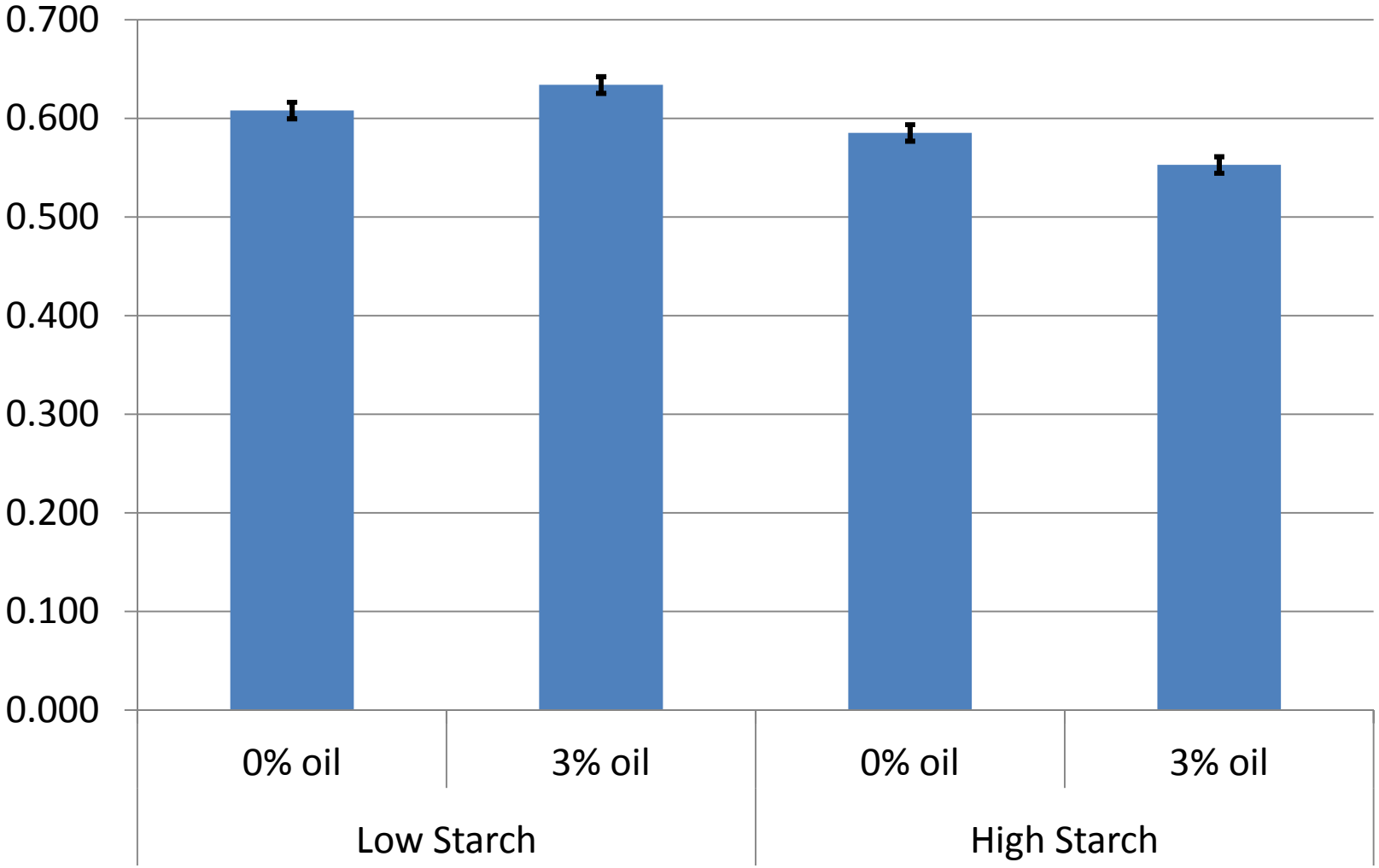
P value		
Starch	Oil	Starch× Oil
0.003	**0.019**	0.67

Energy Metabilisability coefficient



P value		
Starch	Oil	Starch× Oil
0.04	**0.052**	0.96

Repartitioning of ME to milk (ME_L/ME intake)



P value		
Starch	Oil	Starch× Oil
0.09	0.90	0.30

CONCLUSIONS

- Starch level **did not influence the CH_4 production** while oil supplements lowered CH_4 production per unit of milk.
- Both high starch diets and oil supplements **improved energy digestibility and metabolisability.**
- High starch diets tended to have **lower milk ME / ME intake** which can improve the energy balance of the animal.

- Overall, there **wasn't any interaction between starch level and oil supplements** on the gas emissions or energy re-partitioning.

Thank you