THE EFFECTS OF DIFFERENT COMPOUNDS OF SOME ESSENTIAL OILS ON *IN VITRO* GAS PRODUCTION AND ESTIMATED PARAMETERS

Unal KILIC[1], Mustafa BOGA[2], Murat GORGULU[3], Zeynep SAHAN[3]

[1]University of Ondokuz Mayis, Faculty of Agriculture, Department of Animal Science, Samsun/TURKIYE
[2]University of Nigde, Bor Vocational School, Nigde/TURKIYE
[3]University of Cukurova, Faculty of Agriculture, Department of Animal Science, 01130 Adana/TURKIYE

Introduction

The aim of this study was to determine the effect of essential oils of Oregano; ORE (Origanum vulgare), black seed; BSD (Nigella sativa), Laurel; LAU (Laurus nobilis), cummin; CUM (Cumminum cyminum), garlic; GAR (Allium sativum), anise; ANI (Pinpinella anisum) and cinnamon; CIN (Cinnamomum verum) on in vitro gas production and gas production kinetics of barley, wheat straw and soybean meal.

Conclusion

The findings of the present study indicated that essential oils, doses and essential oils x doses interaction were significant . Dose treatment of essential oils had no effect on incubation pH of all three feedstuffs.

In conclusion, CUM could be used to improve nutrient digestibility and energy content and ORE could be used to control degradation of highly degradable starch and protein sources.

Material and Methods

In this study, seven essential oils (oregano, black seed, laurel, cummin, garlic, anise and cinnamon) were used. Samples of essential oils (plant extracts) were provided from a manufacturer in Hatay province of the Republic of Turkiye. Wheat straw, soybean meal and barley were used as feedstuffs (substrates for incubation). Barley (highly degradable starch), soybean meal (highly degradable protein) and wheat straw (fiber sources) were chosen to evaluate the effects of essential oil on starch, protein and fiber degradation in the rumen. In vitro gas productions and gas production kinetics were determined in in vitro gas production technique.

Completely Randomised Design was used to compare gas production, gas production parameters, ME, NE_L and OMD values using General Linear Model (GLM) of SPSS (SPSS version 10.0) package programmes. Significance between individual means was identified using the Duncan's multiple range tests.

Rumen fluid was obtained from the three infertile fistulated Holstein cows which fed twice daily (08.30-16.30) with a diet containing corn silage (%60) and concentrate (%40). The study was carried out in a completely randomised design in 7 (essential oil) x 4 (dose) factorial arrangement. Barley, soybean meal and wheat straw were incubated for 3, 6, 9, 12, 24, 48, 72 and 96 h. 0, 50, 100, 150 ppm doses were tested for all essential oils. in vitro gas production kinetics were described using the equation
$y = a+b(1-exp^{-ct})$.

Results and Discussion

Each essential oil, each incubation time and each feedstuff responded differently to dose treatment (Table 1). The addition of CUM resulted in the highest in vitro gas production values in barley, soybean meal and wheat straw, whereas the addition of ORE-150 caused the lowest values. Doses of BDS or CUM additions did not affect in vitro gas production pattern of all three feedstuffs (P>0.05). Highest OMD, ME and NEL values were determined when barley, soybean meal and wheat straw were provided with CUM (P<0.05). Dose treatment of essential oils had no effect on incubation pH of all three feedstuffs (P>0.05).

Table 1. The effects of essential oils on in vitro gas production and gas production kinetics of wheat straw, soybean meal and barley

		Barley						Soybean Meal						Wheat Straw					
Treatment		GP24	GP96	c	a+b	OMD	ME	GP24	GP96	c	a+b	OMD	ME	GP24	GP96	c	a+b	OMD	ME
Control		55.8^{cde}	68.2 ^{bcde}	0.11 ^{bcde}	65.8 ^{bcde}	73.3 ^{cde}	11.0 ^{cde}	36.6 ^{bc}	43.9 ^{bcd}	0.10 ^{bcd}	43.0 ^{bcd}	78.9^{bc}	10.4 ^{bc}	25.2^{bc}	41.0^{c}	0.04 ^{bcd}	42.5 ^{ef}	43.7 ^{bc}	5.9 ^{bc}
BSD-50		57.7^{bc}	68,5^{bcde}	0,12^{ab}	66,0^{bcde}	74,7^{bc}	11,3^{bc}	38.2^{b}	46.3^{bc}	0.09^{cdef}	45.1^{bc}	80.1^{b}	10.6^{b}	25.6^{bc}	39.6^{c}	0.04^{bc}	40.5^{f}	44.0 ^{bc}	5.9 ^{bc}
BSD-100		58.0^{bc}	69,7^{bc}	0,12^{abc}	66,9^{bcd}	75,0^{bc}	11,3^{bc}	36.6^{bc}	45.7^{bc}	0.07^{efg}	45.0^{bc}	78.9^{bc}	10.4^{bc}	25.8^{b}	40.4^{c}	0.04^{ab}	41.1^{ef}	44.2^{b}	5.9^{b}
BSD-150		55.6^{cdef}	67,7^{bcde}	0,11^{abc}	65,0 ^{bcdef}	73,1^{cdef}	11,0^{cdef}	36.1^{bc}	43.8^{bcd}	0.09^{cdef}	42.7^{bcd}	78.5^{bc}	10.3^{bc}	24.4^{bcd}	41.9^{bc}	0.05^{bcd}	43.6^{def}	42.9^{bcd}	5.7^{bcd}
ORE-50		52.7^{cdefg}	67,7^{bcde}	0,08^{fg}	65,8^{bcde}	71,0^{cdefg}	10,5^{cdefg}	35.6^{bc}	43.6 ^{bcde}	0.08^{cdef}	42.8^{bcd}	78.1^{bc}	10.2^{bc}	25.0^{bc}	42.0^{bc}	0.04^{bcde}	44.0^{cdef}	43.5^{bc}	5.8^{bc}
ORE-100		48.0^{gh}	63,1^{ef}	0,07^{g}	61,5^{defg}	67,4^{gh}	9,8^{gh}	32.0^{cd}	42.0^{cde}	0.08^{defg}	41.0 ^{bcde}	75.4^{cd}	9.6^{cd}	20.8^{def}	39.3^{c}	0.03^{ef}	43.6^{def}	39.7^{def}	5.3^{def}
ORE-150		32.0^{i}	47,1^{g}	0,05^{h}	46,0^{h}	55,3^{i}	7,3^{i}	7.4^{e}	25.5^{g}	0.01^{h}	40.5^{cde}	56.7^{e}	5.8^{e}	6.8^{h}	20.1^{f}	0.01^{hi}	30.8^{g}	27.3^{h}	3.4^{h}
LAU-50		58.0^{bc}	69,5^{bc}	0,12^{ab}	66,9^{bcd}	75,0^{bc}	11,3^{bc}	39.2^{b}	46.0^{bc}	0.11^{bc}	44.9^{bc}	80.8^{b}	10.8^{b}	23.3^{bcd}	42.0^{bc}	0.03^{de}	45.1^{bcdef}	41.9^{bcd}	5.6^{bcd}
LAU-100		58.0^{bc}	69,9^{bc}	0,11^{abcd}	67,7^{bc}	74,9^{bc}	11,3^{bc}	36.1^{bc}	44.7^{bc}	0.10^{bcde}	43.4^{bcd}	78.5^{bc}	10.3^{bc}	21.8^{bcde}	41.9^{bc}	0.03^{ef}	46.0^{bcdef}	40.6^{bcde}	5.4^{bcde}
LAU-150		58.2^{bc}	71,2^{b}	0,12^{abc}	68,2^{b}	75,1^{bc}	11,4^{bc}	37.4^{b}	46.9^{b}	0.09^{cdef}	45.6^{b}	79.5^{b}	10.5^{b}	17.7^{f}	41.4^{c}	0.02^{fg}	48.7^{bcd}	37.0^{f}	4.8^{f}
CIN-50		57.4^{bcd}	69,1^{bc}	0,11^{abc}	66,9^{bcd}	74,6^{bcd}	11,3^{bcd}	38.4^{b}	44.6^{bc}	0.10^{bcd}	43.6^{bcd}	80.2^{b}	10.6^{b}	25.4^{bc}	40.8^{c}	0.04^{bcd}	41.7^{ef}	43.8^{bc}	5.9^{bc}
CIN-100		57.3^{bcd}	68,7^{bcd}	0,11^{abc}	66,3 ^{bcde}	74,4^{bcd}	11,2^{bcd}	39.7^{b}	46.1^{bc}	0.10^{bc}	45.2^{bc}	81.3^{b}	10.9^{b}	25.7^{bc}	42.2^{bc}	0.03^{bcde}	43.3^{def}	44.0^{bc}	5.9^{bc}
CIN -150		56.6^{bcd}	68,6^{bcd}	0,11^{abc}	65,9 ^{bcde}	73,9^{bcd}	11,1^{bcd}	35.2^{bc}	43.9^{bcd}	0.10^{bcd}	42.3^{bcd}	77.9^{bc}	10.2^{bc}	23.0^{bcd}	39.0^{cd}	0.04^{bcd}	41.0^{ef}	41.7^{bcd}	5.6^{bcd}
GAR-50		52.1^{defg}	64,6^{cdef}	0,10^{cde}	62,3^{cdefg}	70,5^{defg}	10,4^{defg}	34.9^{bc}	40.1^{def}	0.11^{bc}	39.4^{de}	77.6^{bc}	10.1^{bc}	20.8^{def}	37.5^{cd}	0.03^{cde}	39.9^{f}	39.7^{def}	5.3^{def}
GAR-100		50.7^{efgh}	64,3^{cdef}	0,09^{def}	62,2^{cdefg}	69,5^{efgh}	10,2^{efgh}	35.9^{bc}	43.5^{bcde}	0.09^{cdef}	42.5^{bcd}	78.4^{bc}	10.3^{bc}	21.5^{cdef}	38.7^{cd}	0.03^{ef}	41.6^{ef}	40.3^{cdef}	5.4^{cdef}
GAR-150		45.7^{h}	62,3^{f}	0,08^{fg}	59,2^{g}	65,6^{h}	9,4^{h}	31.8^{cd}	40.1^{def}	0.07^{fg}	39.6^{de}	75.2^{cd}	9.6^{cd}	5.4^{h}	30.3^{e}	0.01^{i}	61.4^{a}	26.0^{h}	3.2^{h}
CUM-50		62.0^{ab}	72,7^{ab}	0,12^{abc}	70,4^{ab}	78,1^{ab}	12,0^{ab}	45.0^{a}	50.9^{a}	0.12^{b}	49.8^{a}	85.3^{a}	11.7^{a}	33.0^{a}	47.1^{ab}	0.05^{a}	47.1^{bcde}	50.6^{a}	6.9^{a}
CUM-100		66.6^{a}	77,4^{a}	0,12^{ab}	75,2^{a}	81,5^{a}	12,7^{a}	45.8^{a}	51.8^{a}	0.15^{a}	50.2^{a}	85.9^{a}	11.8^{a}	34.2^{a}	49.0^{a}	0.05^{a}	48.8^{bcd}	51.6^{a}	7.1^{a}
CUM-150		66.9^{a}	76,9^{a}	0,12^{a}	74,6^{a}	81,7^{a}	12,7^{a}	48.0^{a}	54.4^{a}	0.14^{a}	52.8^{a}	87.6^{a}	12.2^{a}	35.4^{a}	50.2^{a}	0.05^{a}	50.0^{b}	52.7^{a}	7.2^{a}
ANI-50		50.8^{efgh}	63,2^{def}	0,10^{bcde}	61,2^{efg}	69,5^{efgh}	10,2^{efgh}	29.2^{d}	37.6^{f}	0.09^{cdef}	36.7^{e}	73.2^{d}	9.2^{d}	17.9^{ef}	31.8^{e}	0.03^{cde}	34.3^{g}	37.2^{ef}	4.9^{ef}
ANI-100		50.2^{fgh}	61,8^{f}	0,10^{bcde}	60,0^{fg}	69,1^{fgh}	10,1^{fgh}	30.1^{d}	37.0^{f}	0.09^{cdef}	36.4^{e}	73.9^{d}	9.3^{d}	12.2^{g}	34.0^{de}	0.02^{fg}	42.0^{ef}	32.1^{g}	4.1^{g}
ANI-150		50.1^{fgh}	63,1^{ef}	0,09^{ef}	61,3^{defg}	69,0^{fgh}	10,1^{fgh}	28.4^{d}	39.4^{ef}	0.06^{g}	39.0^{de}	72.6^{d}	9.1^{d}	11.9^{g}	38.2^{cd}	0.02^{gh}	49.8^{bc}	31.8^{g}	4.0^{g}
SEM		0.68	0,59	0,002	0,571	0,515	0,107	0,68	0,52	0,003	0,421	0,520	0,107	0,62	0,54	0,001	0,512	0,550	0,084
EFFECTS	EO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dose	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	EO x Dose	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00