NUTRACEUTICAL VALUE OF EUCALYPTUS OIL ON THE QUANTITY AND QUALITY OF GOAT MILK.

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ABSTRACT
The objective of the study was to investigate the efficiency of Eucalyptus oil as a feed supplement (on the performance characteristics) in sheep nutrition and effect on the quality and quantity of milk production. Fifteen pregnant sheep were randomized against the experimental diets in a completely randomized design model for 60days. Three different diets were prepared for the study namely; Treatment A (control), Treatment B (containing 1.0g/10kg of Eucalyptus oil) and Treatment C (containing 1.5g/10kg of Eucalyptus oil).The result showed that highest crude protein intake was noted in sheep fed with Treatments C, B and A respectively. The study also showed that there were significant differences in the milk quality and quantity of the experimental sheep due to Eucalyptus oil inclusion at different levels in the diet. The highest milk yield was recorded for Treatment C which was superior to the control while the least was for Treatment B Conversely, Treatment A had the highest butterfat and solids not fat contents. It is interesting to note that there was no significant different in the Total Solids content of the milk. In conclusion, the study revealed that inclusion of Eucalyptus oil in the basal diet of the sheep will improve the quality and quantity of milk.
Keywords: Eucalyptus oil, milk quality and quantity, chemical composition, sheep

INTRODUCTION

Milk is a white liquid produced by the mammary glands of mammals. It is the primary source of nutrition for young mammals before they are able to digest other types of food (Belewu, 2006). Early-lactation milk contains colostrums, which carries the mother's antibodies to the baby and can reduce the risk of many diseases in the baby. It also contains many other nutrients (Pehrsson*et al.*, 2000)

Throughout the world, there are more than 6 billion consumers of milk and milk products. Milk is a key contributor to improving nutrition and food security particularly in developing countries. Improvements in livestock and dairy technology offer significant promise in reducing poverty and malnutrition in the world (Hemme and Otte, 2010)

According to Emma (2010), improving the milk production efficacy, milk quality, and overall health of goats and sheep are important goals for small ruminant dairy producers. One of the ways to reach this goal is to add selected essential oils to the diet. Essential oils have received so much attention as potential alternatives to growth promoters in Animal Production(Salam *et al.*, 2009). Patra(2011) also stated that plants essential oil has antimicrobial properties which can be effective against undesirable rumen microbes. Tentatively, the presence of essential oil or their derivatives could enrich specific organoleptic and nutritional properties of dairy products which could provide an added value to the products (Choin*et al.*, 2010). To date, studies on several essential oils have revealed the potential of these oils to increase milk production efficacy of dairy cows, and many producers have already started to implement essential oils into their feeding programs.

Feeding essential oils to dairy goats and sheep has shown the potential of improving animal health by killing intestinal parasites and worms, increase milk fat and milk protein, milk yield, improved udder health and decrease somatic cell count, reduce body fat mobilization, prevent Ketosis and improve efficiency of nitrogen utilization (Emma, 2010).

Eucalyptus oil is an essential oil found to be expectorant, decongestant, pain relieving, anti-cough, and bacteria killing. The long held traditional uses in recurrent infections suggest Eucalyptus contains immune system stimulating constituents. The multitudinous uses of Eucalyptus oil is exemplified in aromatherapy, sinus relief, microbial purification and it was reported as a preservative agent for cheese (Belewu*et al.*, 2012)

Eucalyptus oil is composed of saturated and unsaturated fatty acids. The oil contains Stearic acid, oleic acid, linoleic acid, linolenic acid, plasmatic acid, myristolric acid pamitoleic acid. Both linoleic acid and linolenic acids aid hormone production in the body such as regulation of blood pressure, blood clotting and so on. If over dose is used the oil causes several side effects (http:/www.natural healing-for-all.com/eucalyptus oil).

Eucalyptus oil is a possible goldmine considering its nutritional composition, relatively cheaper and available.

Hence, the thrust of the study was to evaluate the efficacy of Eucalyptus oil inclusion on milk quality and quantity.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Animal Production Department, Faculty of Agriculture, University of Ilorin,Kwara State of Nigeria

Extraction of oil

Eucalyptus leaves were freshly collected around the University of Ilorin main campus and milled with mortar and pestle. The oil was practically extracted from the milled leaves using petroleum ether (by cold extraction process for 18-24 hours) while the oil was recovered using soxhlet extraction method and later clearly decanted using a muslin cloth.

Preparation of Experimental Diet

The clearly graded oil was included in already formulated diet at different levels by mixing logically with the feed in parts to efficiently ensure accurate mix

Composition of the Experimental Diet

Ingredients	Percentage (%)
Cassava wastes	53.00
Groundnut cake	10.00
Rice husk	35.00
Vitamin premix	1.00
Salt	1.00
Total	100.00

Inclusion of the Oil in the Experimental Diet

Treatments	A	B	C
Diet	Basal	Basal	Basal
Eucalyptus oil	---------	1.0g/10kg	1.5g/10kg

Animal and Management

Fifteen WestAfrican pregnant does obtained from the Teaching and Research Farm of the University were examined thoroughly by visual and palpation inspection to detect any form of abnormalities. The animals were treated against ecto and endo parasites using Ivomec. They were allowed to acclimatize to the experimental diets for about 2 weeks prior to the beginning of the experiment. The does were randomly allocated to three experimental diets with five animals per Treatment replicated five times.Treatment A (Control with no inclusion of oil) while Treatments B and C contained Eucalyptus oil at 1.0g/10kg and 1.5g/kg respectively. Feeding and watering was done *ad-libitum.*

Parameters evaluated

Milk Quantity: This is a measure of the rate at which milk was produced by the animals. In this experiment the animals were milked twice daily {8.00a.m(morning) and 5.00p.m (evening)}.

Milk Quality: This is a measure of the value of milk. Hence, proximate analysis on the collected milk samples was done using Lactoscan machine.

Feed/Diet analysis

The proximate analysis of the feed samples was carried out using the method of AOAC (1990).

Statistical analysis

All data collected were subjected to the analysis of variance using a Completely Randomized Design model (Steel and Torrie, 1960) and means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

TABLE 1: Proximate Composition of the Experimental Diet (% Dry matter)

Parameters (%)	Treatment A	Treatment B	Treatment C
Dry matter	92.80	91.80	92.20
Ash	14.85	12.39	14.75
Crude protein	7.15	7.63	8.88
Ether extract	4.18	4.59	5.53
Crude fibre	40.48	33.60	36.97

The dry matter percentage of Treatment A (92.80%) was the highest followed by that of Treatment C (92.20%) and the least was B (91.80%).Treatment C had the highest crude protein of 8.88% followed by

Treatment B with 71.68% and the least was A (7.15%).The least crude fibre content was recorded for Treatment B (33.60%) followed by C (36.97%) while A had the highest (40.48%).The ether extract was greater for Treatment C (5.53%)> B > A in that order. The highest ether extract content of Treatments B and C could be due to the addition of the oil in these diets. The ash content could not follow any particular trend {14.85 (A), 12.39 (B) and 14.75 (C)}

Table 2: Effect of Eucalyptus Oil on the Milk Quantity and Qualities of West African Dwarf Sheep

Parameters	A	B	C	±SEM
Butter fat	9.98^{a}	7.79^{c}	9.31^{b}	0.67*
Density	45.73^{c}	28.50^{a}	31.20^{b}	0.35*
Conductivity	3.57^{b}	3.80^{b}	2.89^{a}	0.05*
Solid non-fat	14.24^{a}	8.81^{c}	9.81^{b}	0.13*
Protein	5.16^{a}	5.73^{a}	8.64^{b}	0.08*
Lactose	4.72^{a}	2.94^{a}	3.22^{b}	0.04*
Temperature ^{0}C	28.55^{a}	31.90^{b}	34.45^{c}	0.30*
Freezing point ^{0}C	-0.75^{a}	-0.41^{c}	-0.47^{b}	0.00*
Ash	1.35^{c}	0.83^{a}	0.93^{b}	0.00*
pH	6.60	6.49	6.75	0.00NS
Lactic acid	0.20	0.27	0.26	0.00NS
Total solid	15.67	16.00	15.75	0.90NS
Milk quantity (g/d)	124.41^{b}	100.54^{c}	145.06^{a}	5.45*
Dry matter intake (g/d)	821.83	939.17	1010.33	54.08*
Crude protein intake (g/d)	61.72	71.66	89.72	6.72*

Means along the rows with different superscripts are significantly different from each other (p>0.05).
NS = Not significant (p>0.05)

DISCUSSION

The effect of Eucalyptus essential oil in sheep nutrition showed significant differences in the milk quality and quantity of the experimental animal.

The crude protein intake and dry matter intake were significantly higher compared with the control. This could probably be due to the higher content of these nutrient in the experimental diet. The submission supported the findings of Estell *et al* . (1998) who noted that essential oil at low doses may stimulate intake.

The significant difference in the fat content of the experimental animals showed a reduction in the animal fed Treatments B and C compared with the Control. This result contradicts the work of Wall (2010) which showed an increased fat content in the milk of ruminants fed essential oil. Similarly, the work of Santos *et al.* (2010) showed no significant effect in the milk composition of animals fed essential oils. While the work of Frankhauster (1999) and Mech *et al.* (2008) noted a range of 7.02% and 8.0% to 9.6% fat content in sheep milk respectively. However, the result conforms with the work of Jordan and Boylan (1995) which showed a fat content of 5.7% to 7.0% in the milk of sheep.

The result of the solid non fat of this study revealed8.81% for Treatment B and 9.81 %(Treatment C). With the exception Treatment B , Treatments A and C supported the work of Mech *et al.* (2008) which showed a range of 9.48% to 10.1% for sheep milk. Conversely, the oil inclusion contradicts the work of Santos *et al.* (2010) which showed no effect of essential oil in the milk of ruminants.

The result of the milk protein content of the animals fed Treatments B (5.03%) and C (5.64%) agreed with the work of Mech *et al.* (2008) who noted a milk protein content of between 5.7% and 7.74%. The protein content of the milk of this study contradicts the work of Tassoul and Shaver (2009) which showed no effect of essential oil in ruminant milk compared to their respective control experiment.

The lactose content of the resultant sheep milk composition for the animals fed Treatments B (2.94%) and C (3.22%) was in contrast toJordan and Boylan (1995) and FAO (2008) which showed lactose content of sheep milk to be between 4.8 and 4.9% respectively. Also, the result contradicts the work of Santos (2010) which showed no effect of essential oil in the milk composition of ruminants.

The reduction of the lactose content might be due to Eucalyptus oil inclusion which is known to cause a reduction in blood sugar (www. natural-healing for all.com/eucalyptus oil).

The result of the ash content of the animals fed Treatment B (0.83%) and C (0.93%) was in contrast with the work of Santos *et al.* (2010) who reported no effect of oil in the milk of ruminants fed essential oil.

The total solid content reported in this study was lower than the reported value of 17.48 and 19.50%

by Mech *et al.* (2008).However, the result agreed with the work of Santos *et al*. (2010) which showed no significant effect of essential oil inclusion in ruminant diet.

The result of milk quantity (gram/d) of Eucalyptus oil based diets was significantly different from the control. The result was in line with the report of Kung *et al.* (2008) and Wall (2010) which showed increased milk yield in ruminants fed essential oil. Conversely, the work of Tassoul and Shaver (2009) showed no effect in animals fed essential oil.

CONCLUSION AND IMPLICATION

The inclusion of Eucalyptus oil in the diet of Lactating sheep holds a good promise in enhancing the protein and fat contents of milk since milk is sold based on these nutrients. The improvement in milk protein and fat due to the inclusion of Eucalyptus oil (Essential oil) should be encouraged in dairy industry and farmers

CONFLICTS OF INTEREST

The authors declare no conflict of interest in this research study.

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