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Effect of Garlic Powder (Allium Sativum) on Selected Rumen and Blood Serum Constituents in Sheep

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Abstract

This experiment was carried out to investigate the effect of garlic powder (Allium sativum) on selected rumen and blood constituents. Ten Egyptian native sheep, their ages ranged between 1.5 - 2.5 years, and body weights 30 - 45kg. They divided into two equal groups. The first group (control group) was fed on traditional ration only, the second (experimental group) was given garlic powder (500mg /kg body weight orally) in the morning before feeding for 5 days. In first day rumen juice and blood samples were collected from both groups before feeding (considered 0 hour) and at 2nd, 4th, 6th and 8th hours of supplementation with turmeric. In treated group rumen and blood samples were taken daily before feeding from first day up to fifth day of experiment.

Results generally showed that garlic made significant changes in fermentation pattern in rumen among hours of sampling, while by days it caused marked increased in rumen calcium, serum total protein and albumen, BUN and serum calcium; with decreases in rumen ammonia concentration. On other hand maintained rumen protozoal activity, TPC, pH, VFAs, serum inorganic phosphorus, createnine and GGT within the normal range.

Regarding to fermentation pattern on hours, changes occurred in both rumen and blood serum constituents give a recommendation for using garlic supplementation as 500mg /kg body weight orally for 3-5days in treatment of indigestion and maintenance of normal rumen function. Further investigation should be applied on diseased cases to confirm the effect of garlic as therapeutic agent in such cases.

(Key words: Garlic powder, Sheep, Rumen and Blood Constituents)

Introduction

Medical plants, are eco-friendly and non hazard to both human handlers and animals. They have no side effects and have minimum problem of drug resistance and no residual effects are observed with the use of them. The need of the hour is to get safe, affordable and natural organic supplements to improve efficiency of utilization of available feed resources for ruminants. Natural products with high concentration of secondary metabolite appear to be good for achieving these health objectives (Chaturvedi et al. 2013, Chaturvedi et al. 2014, Chaturvedi et al. 2015). In recent years the interest in the potential use of medical plants, spices and herbs as alternatives to modify rumen fermentation, and improve nutrient utilization (Faniyi et al. 2016).

Garlic, is a specie in the onion genus, Allium. It has been used as a spice and a native medicine since ancient times (Rivlin, 2001). It has contains protein, Fat, crude fiber, Volatile oil, Carbohydrate, moisture, ash, It also contains Vitamin A, vitamin B1 and vitamin C, potassium, phosphorous, selenium, sulphur, magnesium, calcium, sodium, germanium, manganese, iron, and trace amount of iodine (Bhagat and Chaturvedi 2016, Mariam and Usha 2016).

Garlic is a particularly rich source of organo-sulfur compounds, which are thought to be responsible for its flavor and aroma, as well as its potential health benefits (Block, 1985). They act as antibacterial, antioxidant, anthelmintic, anticoccidial and growth promoters (Borck, 2001; Raeesi et al. 2010; Jimoh et al. 2013). In last years ago many studies have focused on potential of garlic to modify rumen fermentation (Busquet et al. 2005, Wanapat et al. 2008, Chaves et al. 2008, Kongmun et al. 2010, Kongmun et al. 2011, Anassori et al. 2011. El-Katcha, 2016). This study was applied to investigate the effect of garlic powder (Allium sativum) on rumen physical, cellular, biochemical constituents and blood biochemical constituents in apparently healthy Egyptian sheep regarding to sampling times (0, 2nd, 4th, 6th and 8th hours and 1st, 2nd, 3rd , 4th and 5th days of supplement).

Material and methods

Animals and experimental design:

A total number of 10 clinically healthy ewes, belong to Department of Medicine and Infectious Diseases, Faculty of Veterinary Medicine, Cairo University, were used in the current study. Their ages ranged from 1.5-2.5 years, and their body weights ranged from 30 - 45kg (mean weight 35.9 kg). Sheep were divided into two equal groups. The first group considered as control group (Gp 1) fed on traditional offered ration included five sheep, the second group (Gp 2) were given garlic powder obtained from a local market, dissolved in a sufficient amount of water; in the morning

before feeding for 5 days. The dose (500mg /kg body weight) was determined after Hodjatpanah, et al. (2010), Anassori, et al. (2011) and Balamurugan, et al. (2014).

Samples:

Rumen fluid and blood serum were collected from each animal. Samples were taken in the morning before feeding (0 hour) and after 2nd, 4th, 6th and 8th hours of treatment. In experimental group (Gp 2), sampling extended up to fifth day of experiment daily in the morning before feeding and treatment.

The rumen juice samples (about 100 ml) were collected by using a rubber stomach tube in dry clean cup and taken to the laboratory for examination. Color, odor, consistency, pH and protozoal activity were examined immediately after sampling, then samples were sieved through a 4 folds of sterile gauze used as 2ml fixed with strong acids to determine volatile fatty acids concentration, 2 ml for determination of ammonia concentration, 2 ml fixed and stained with methylene green formal saline for microscopic examination. A sample of 10 ml of strained rumen juice was centrifuged for 15 minutes at 3000 rpm and the supernatants were collected to determine the biochemical constituents (calcium and phosphorus). The blood samples were collected by puncture of jugular vein, using vacutainers for separation of serum for biochemical analysis (Coles, 1986).

Laboratory examination:

Rumen samples were examined immediately for physical properties include (color, odor, consistency, pH) according to Alonso (1979), Dirksen and Smith (1987) and Radostits et al. (2007), Microscopic examination include protozoal activity according to El-Saifi (1969) and Alonso (1979), Rumen protozoal count according to Ito et al. (1994), Biochemical examination which include total volatile fatty acid (TVFAs) concentration estimated by Macro Kgeldahl steam distillation method as described by Eadie et al. (1967), rumen ammonia nitrogen concentration estimated using specific kits produced by Spectrum Company, Egypt, according to the method of Burtis and Ashwood (1996), rumen Calcium, and Inorganic phosphorus using specific kits produced by Spectrum Company, Egypt, according to the method described by Young (1990), Young (1991).

Blood serum samples examination include estimation of serum total protein by using specific kits produced by Spinreact Company, Spain; according to method described by Young (2001), serum albumin by using specific kits produced by Spectrum Company, Egypt, according to the method described by Tietz (1990), serum globulin level was calculated mathematically by subtracting albumin values from the total serum protein values, albumin and globulin (A /G) ratio calculated by dividing the albumin value by the globulin value, blood urea nitrogen (BUN) according to the method described by Tietz (1990), serum Gamma-glutamyltransferase (GGT) according to the method described by Saw et al. (1983), serum creatinine according to the method of Tietz (1986), serum calcium according to the method described by Young (1990), serum phosphorus according to the method described by Young (1991), all were estimated using specific kits produced by Spectrum Company, Egypt.

Statistical analysis:

Statistical analysis of obtained data was carried out by SPSS program version 21 using k independent samples T test, kruskal- Wallis and one-way ANOVA with Duncan as post hock test. According to Nie et al. 1975 and Levesque, 2007.

Results and discussion

Effect of garlic powder in Gp 2 on physical and cellular constituents of rumen fluid in sheep under effect of sampling times were tabulated in tables 1and 2, showed that their color was ranging between yellowish to brown, odor was aromatic, consistency was slimy to slightly viscous along the experiment, these findings were similar to that observed in control group (Gp1) and that was in agreement with Anderson and Rings (2008), Karapinar et al.(2008).

In first day, no significant difference ($P>0.05$) was occurred in protozoal activity and the highest protozoal activity was occurred at 2nd hour. These findings were similar to that observed in Gp 1. Along the experiment (Gp 2) protozoal activity was within the same ranges: in agreement with that recorded by Pugh and Baird (2012), Orabi (2015) and Saber (2016).

For TPC in first day of sampling, showed significant decrease ($P<0.01$) at 2nd, 4th and ($P<0.05$) at 6th hour after treatment with garlic and returned to normal level at 8th hour. Regarding to days of sampling, no significant differences ($P>0.05$) were observed in TPC. other researchers indicated that garlic supplementation tends to decrease ruminal protozoa populations after supplementation as mentioned by Wanapat et al.

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(2008), Kongmun et al. (2011) and Kumar et al. (2012).

Relative to rumen pH values in first day of sampling, there were high significant decreases ($P<0.01$) at 4th and 6th hours and significant decrease ($P<0.05$) at 2nd and 8th hours after treatment with garlic. While in control group high significant decrease ($P<0.01$) occurred at 2nd, 4th, 6th and 8th hours of sampling when compared with zero time which were similar to that found by Baraka (2012) and Santos et al. (2015). Regarding to days of sampling, there were no marked changes observed, this finding came in agreement with Wanapat et al. (2008), Kongmun et al. (2011), who reported that supplementation of garlic powder showed no significant effect on rumen pH.

Table No. 1. Physical and cellular constituents of rumen fluid regarding to sampling times (0, 2, 4, 6, 8 hours) with and without garlic powder

Variables	Treatment	0 hour	2nd hour	4th hour	6th hour	8th hour
Color	Gp 2	yellowish-brown				
	Gp 1	yellowish-brown				
Odor	Gp 2	Aromatic				
	Gp 1	Aromatic				
Consistency	Gp 2	Slimy- Slightly viscous				
	Gp 1	Slimy- Slightly viscous				
Protozoa activity	Gp 2	2.2±0.37	2.8±0.2	2.4±0.24	2.2±0.37	2.0±0.32
	Gp 1	2.20±0.20	2.60±.025	2.40±0.25	2.40±0.40	2.40±0.25
TPC ($\times 10^4$/ml)	Gp 2	17.6±2.66a	4.2±2.07c*	7.0±0.88c*	9.5±2.75bc	15.2±2.82ab
	Gp 1	28.6±4.67	17.60±4.41	14.6±3.40	16.6±4.51	20.2±5.43
pH	Gp 2	6.92±0.06b	6.7±0.05a	6.62±0.05a*	6.6±0.08a*	6.72±0.08a
	Gp 1	6.92±0.04a	6.60±0.03b*	6.52±0.04b*	6.42±0.07b*	6.52±0.09b*

a,b,c. Mean values have the similar symbol or symbols within the same raw are not significantly different at $P \leq 0.05$.

*. significant at the 0.01 level

Table No. 2. Effect of garlic powder on physical and cellular constituents of rumen fluid regarding to sampling days (1st-5th day)

Variables	1st day (control)	2nd day	3th day	4th day	5th day
Color	yellowish-brown				
Odor	Aromatic				
Consistency	Slimy- Slightly viscous				
Protozoa activity	2.2 ±0.37	1.6 ±0.24	1.8 ±0.37	2.2 ±0.37	2.0±0.32
TPC ($\times 10^4$/ml)	17.6 ±2.66	11.8 ±2.35	13.4 ±3.03	15.6 ±3.55	17.4±1.37
pH	6.92 ±0.06	7.06 ±0.08	7.0 6±0.02	7.08 ±0.04	7.0 ±0.06

Effect of garlic powder on rumen biochemical constituents in sheep under sampling times were summarized in tables 3 and 4. Regarding to rumen TVFA concentration in first day of sampling, there were significant increases $P<0.01$ and $P<0.05$ at 6th hour and 8th hour respectively after treatment with garlic. This finding was similar to that observed in control group as that recorded by Patra et al.(1996), Santos et al. (2015). Regarding to days of sampling, there were mild increase (non-significant) in total VFA at 2nd and 4th day after treatment with garlic. These results indicated that garlic supplementation had no effects on total VFA concentration. These findings were in agreement with Wanapat et al. (2008). Changes in rumen pH and TVFAs can be explained on negative relationship between them (R= -0.428). Depending on values of physical characters of rumen fluid, protozoal activity, TPC, pH, TVFAs it was clear that supplementation of garlic maintained these fermentation parameters within normal range among days, even significant changes observed within hours of sampling.

Regarding to rumen ammonia nitrogen concentration in first day of sampling, there was high significant decrease ($P<0.01$) at 4th, 6th and 8th hours after treatment with garlic, these findings were slightly different to that observed in control group where significant decrease ($P<0.05$) occur at 4th, 6th and 8th hours. This result indicated that garlic supplementation tend to slightly decrease ammonia N_2 after few hours of treatment. Regarding to days of sampling, no significant changes were recorded, the lowest value was at 5th day. This result indicated that garlic supplementation tend to slightly decrease ammonia nitrogen. Castillejos et al. (2006) and Wanapat et al. (2008), reported that garlic had no effects on rumen ammonia nitrogen concentration, while Kongmun et al. (2010), reported reduction in ammonia nitrogen concentration. Changes in

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rumen pH and ammonia can be explained on positive relationship between them (R= 0.348).

Regarding to rumen calcium in first day of sampling, there were significant increases (P<0.01) at 6th hour and significant increases (P<0.05) at 4th and 8th hours after treatment with garlic. These findings were different with that observed in control group where no significant difference (P>0.05) were occurred in rumen calcium between different sampling times. Regarding to days of sampling, significant increase (P<0.05) was occurred in rumen calcium level at 5th day. High negative correlation was observed between rumen pH and rumen calcium (R= 0.724).

Table No. 3. Rumen fluid biochemical constituents regarding to sampling times (0, 2, 4, 6, 8th hour) with and without garlic powder

Variables	Treatment	0 hour	2nd hour	4th hour	6th hour	8th hour
TVFAs (mmol/L)	Gp 2	43.20±3.08a	50.80±5.65ab	50.40±3.88ab	60.50±3.22b*	58.10±1.35b
	Gp 1	37.10±2.49a	40.70±3.13a	44.60±1.56ab	53.20±3.08b*	65.10±6.36c*
Ammonia N_2 (mmol/L)	Gp 2	2.81±0.31a	2.07±0.38a	0.49±0.21b*	0.80±0.25b*	0.46±0.15b*
	Gp 1	0.97±0.19a	0.74±0.34ab	0.19±0.01b	0.19±0.01b	0.32±0.11b
Calcium (mg/dL)	Gp 2	6.75±0.33a	8.39±0.95ab	11.77±0.94bc	12.94±2.01c	11.65±1.50bc
	Gp 1	4.70±.773	7.36±.902	8.88±1.198	9.84±3.36	10.30±2.39
Phosphorus (mg/dL)	Gp 2	43.91±4.89a	38.76±3.92ab	27.23±2.82b	30.19±4.00b	33.45±5.16ab
	Gp 1	50.68±4.07a	36.13±2.10b	27.39±3.42b*	37.03±4.58b	32.75±4.19b*

a, b,c, Mean values have the similar symbol or symbols within the same raw are not significantly different at P≤0.05.

*. significant at the 0.01 level

Significant decrease (P<0.05) was occurred at 2nd day after treatment with garlic. no significant difference at P>0.05 between 2nd day and 3th day, 4th day. These results indicated that garlic supplementation increased rumen calcium after few hours of treatment and the effect extended until 5th day.

Relative to rumen inorganic phosphorus in first day of sampling, there were significant decrease (P<0.05) occurred at 4th and 6th hours after treatment with garlic. These findings were slightly different with that observed in control group where significant decrease (P<0.01) in rumen inorganic phosphorus occurred at 4th, 8th hours and significant decrease (P<0.05) at 2nd and 6th hours of sampling when compared with zero time. no different (P>0.05) occur between 2nd, 4th, 6th and 8th hours sampling in control group. This result indicated that garlic supplementation modified the decrease in rumen inorganic phosphorus. Regarding to days of sampling, no significant difference (P>0.05) was occurred in rumen inorganic phosphorus between zero time and other times after treatment.

Table No. 4. Effect of garlic powder on rumen biochemical constituents regarding to sampling days (1st – 5th day)

Variables	1st day (control)	2nd day	3th day	4th day	5th day
TVFAs (mmol/L)	43.20±3.08	48.3±3.12	42.50±2.09	49±4.65	40.80±1.62
Ammonia N_2 (mmol/L)	2.81±0.31	1.87±0.36	1.78±0.33	1.75±0.58	1.72±0.61
Calcium (mg/dL)	6.75a±0.33	4.45b±0.43	6.24ab±0.52	5.77ab±0.06	8.63c±1.15
Phosphorus (mg/dL)	43.91±4.89	44.82±6.17	40.59±4.76	43.78±6.88	38.98±5.08

a, b,c, Mean values have the similar symbol or symbols within the same raw are not significantly different at P≤0.05.

*. significant at the 0.01 level

Effect of garlic powder on serum biochemical constituents in sheep under sampling times were tabulated in tables 5 and 6. Relative to total serum protein in first day of sampling, there was significant increase (P<0.05) occurred at 6th hour when compared with zero, 2nd and 8th hours. These findings were different with that observed in control group where no significant difference (P>0.05) occurred in total serum protein between zero time and other times sampling.

Regarding to days of sampling, significant increase in serum total protein (P<0.05) occurred at 3th day and 4th day when compared with 2nd day after treatment with garlic and the peak was at 4th day. These results indicated that garlic supplementation increased total serum protein and were in agreement with that recorded by Hassan and Abdel-Raheem (2013), while no effect was reported by Pirmohammadi et al. (2014). In 1st day there was significant increase (P<0.05) in serum albumin at 6th hour after treatment with garlic. While in control group no significant differences (P>0.05) occurred. This finding

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indicate that treatment with garlic increased serum albumin.

Regarding to days of sampling, there were significant increase P<0.05 and P<0.01 occurs at 2nd and 3th days respectively. Pirmohammadi et al. (2014) reported no effect on serum albumin by garlic supplementation. Serum globulin showed that no significant changes (P<0.05) regarding to zero time was occurred in 1st day, while lowest level was at 2nd hour and highest level recorded at 6th hour with significant variation (P<0.05).

Table No. 5. Serum biochemical constituents regarding to sampling times (0, 2, 4, 6, 8th hour) with and without garlic powder

Variables	Treatment	0 hour	2nd hour	4th hour	6th hour	8th hour
Total protein (g/dL)	Gp 2	6.81±0.29a	6.39±0.53a	7.51±0.67ab	8.47±0.36b	6.71±0.56a
	Gp 1	6.24±0.16ab	6.84±0.32b*	6.07±0.21a	6.07±0.19a	6.16±0.07a
Albumin (g/dL)	Gp 2	2.68±0.24a	2.75±0.15a	2.76±0.13a	3.26±0.13b	2.63±0.07a
	Gp 1	2.32±0.02	2.21±0.06	2.32±0.03	2.33±0.07	2.30±0.08
Globulin (g/dL)	Gp 2	4.14±0.51ab	3.64±0.42a	4.75±0.56ab	5.21±0.35b	4.09±0.51ab
	Gp 1	3.93±0.17a	4.62±0.32b	3.76±0.23a	3.75±0.15a	3.86±0.06a
A/G ratio	Gp 2	0.76±0.23	0.78±0.07	0.60±0.05	0.64±0.06	0.68±0.07
	Gp 1	0.59±0.03ab	0.49±0.04a	0.63±0.05b	0.63±0.02b	0.59±0.03ab
BUN (g/dL)	Gp 2	17.95±1.63	17.72±1.79	16.99±3.00	15.23±2.13	13.82±2.99
	Gp 1	20.43±4.84	21.44±4.07	19.23±4.74	14.35±4.28	16.93±5.46
Calcium (mg/dl)	Gp 2	8.75±0.44a	10.79±0.31ab	13.01±1.19b	13.56±2.39b	10.94±0.76ab
	Gp 1	9.37±0.65	9.54±1.17	9.69±0.31	10.50±0.85	10.15±0.62
Phosphorus (mg/dl)	Gp 2	7.59±0.51ab	8.25±0.28a	5.40±0.95c	8.56±0.64a	6.24±0.61bc
	Gp 1	9.41±0.78a	9.62±0.35a	9.32±0.84a	7.75±0.68ab	6.57±1.07b
Creatinine (mg/dl)	Gp 2	1.43±0.17	1.48±0.15	1.33±0.21	1.22±0.11	1.22±0.05
	Gp 1	0.98±0.06	0.92±0.07	0.86±0.05	0.82±0.06	0.84±0.06
GGT (U/L)	Gp 2	34.19±2.87	34.89±3.61	35.28±2.46	31.81±2.04	35.35±2.77
	Gp 1	45.93±3.88	43.23±2.25	46.31±3.11	45.31±2.55	47.01±1.74

a, b,c, Mean values have the similar symbol or symbols within the same raw are not significantly different at P≤0.05.
*. significant at the 0.01 level

Regarding to days of sampling, significant decrease (P<0.05) was occurred at 2nd day and returned to normal levels in rest of experiment days. These results indicated that garlic supplementation had no effects on serum globulin. This result was in agreement with El-Katcha et al. (2016), while Hassan and Abdel-Raheem (2013) reported that raw garlic significantly increased (P<0.05) serum globulin.

High positive relationship (R= 0.82) was recorded between serum total protein and serum globulin.

Table No. 6. Effect of garlic powder on serum biochemical constituents regarding to sampling days (1st – 5th day)

Variables	1st day (control)	2nd day	3th day	4th day	5th day
Total protein (g/dL)	6.81±0.29ab	6.20±0.37a	8.25±0.79b	8.26±0.33b	7.68±0.45ab
Albumin (g/dL)	2.68±0.24a	3.80±0.24bc	3.97±0.39c*	3.31±0.13abc	2.99±0.29ab
Globulin (g/dL)	4.14±0.51a	2.4±0.21b	4.28±0.51a	4.95±0.28a	4.69±0.371a
A/G ratio	0.76±0.23a	1.63±0.15b	0.96±0.10a	0.68±0.04a	0.66±0.09a
BUN (g/dL)	17.95±1.63a	22.92±2.99ab	25.02±2.92ab	22.18±2.78ab	29.13±3.99b
Calcium (mg/dl)	8.75±0.44a	11.54±0.86b*	11.83±0.48b*	12.19±0.63b*	12.51±0.55b*
Phosphorus (mg/dl)	7.59±0.51	8.39±0.52	7.86±0.94	8.42±0.43	8.80±1.26
Creatinine (mg/dl)	1.43±0.17	1.35±0.08	1.21±0.07	1.47±0.10	1.20±0.09
GGT (U/L)	34.19±2.87	36.28±2.56	35.51±3.08	35.43±2.42	37.44±2.56

a, b,c, Mean values have the similar symbol or symbols within the same raw are not significantly different at P≤0.05.
*. significant at the 0.01 level.

Serum A/G ratio showed that no significant different (P>0.05) occurred between hours in 1st day. Regarding to days of sampling, significant increase (P<0.05) was occurred in A/G ratio at 2ed day.

Relative to BUN in first day of sampling, there was no significant difference, while regarding to days of sampling, significant increase (P<0.05) was occurred at 5th day. These results indicated that garlic supplementation tends to markedly increase BUN during treatment. Al-Dosary (2012) showed that administered garlic extract had no significant effect in BUN in Iraqi sheep, while Wanapat et al. (2008) reported slight decrease in BUN when garlic powder was supplemented.

Serum calcium in first day of sampling, showed significant increases (P<0.05) at 4th and 6th hours after treatment. Regarding to days of sampling,

highly significant increase ($P<0.01$) was occur in serum calcium along the experiment and the peak was at 5th day. These findings indicated that garlic supplementation increased highly serum calcium; that can be explained on the basis of positive correlation recorded between calcium in rumen and serum (R= 0.329). Pirmohammadi et al. (2014), Zakeri et al. (2014) reported that raw garlic or fresh garlic bulb had no effect on serum calcium.

Serum inorganic phosphorus in first day of sampling, showed significant decrease ($P<0.05$) at 4th hour after treatment. Relative to the days of sampling, no significant differences were observed, while higher values were at 5thday. This finding indicated that garlic supplementation had no effect on serum inorganic phosphorus. This result was in agreement with Pirmohammadi et al. (2014).

Serum creatinine and GGT regarding to effect of sampling according to hours or days, there were no significant differences obtained. it was obvious that addition of garlic caused no significant effect on liver enzymes activity as it is safe as a medicament (Al-Dosary 2012, Kholif et al. 2012, and Ibrhim 2015).

Conclusion

Garlic made significant changes in fermentation patter in rumen among hours samples, while by days it caused marked increased in rumen calcium, serum total protein and albumen, BUN and serum calcium; with decreases in rumen ammonia concentration. On other hand maintained rumen protozoal activity, TPC, pH, VFAs, serum inorganic phosphorus, createnine and GGT within the normal range. We recommend practice of garlic supplementation as 500mg /kg body weight orally for 3-5days in treatment of indigestion in sheep. Further investigation should be applied on diseased cases to confirm that.

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Conflict of interest

Authors declare that they have no conflict of interest.

References

Al-Dosary , A.W. J. (2012). Study the effect of aquatic extracts of Allium sativum and Zingiber officinate on some physiogical and Biochemical characters of Broiler and Native Iraqi sheep. J. Vet. Sci., 1.(5).

Alonso, A. (1979). Diagnostic Analysis of Rumen Fluid. The Veterinary clinics of North America. Large animal practice, 1(2):363-376.

Anassori, E., Dalir-Naghadeh, B., Pirmohammadi, R., et al. (2011). Garlic: a potential alternative for monensin as a rumen modifier. Livest. Sci. 142:276–287.

Anderson, D.E. and Rings, M. (2008). Current Veterinary Therapy: Food Animal Practice, Elsevier Health Sciences. 715 p.

Balamurugan,N., Sundaram, S. M.,Sivakumar, T., and Rajkumar, JSI.(2014). Effect of Garlic (Allium sativum) Supplementation on the Growth Performance of Crossbred Calves. Animal Production 16(2):78-87.

Baraka, T.A. (2012). Comparative Studies of Rumen pH, Total Protozoa Count, Generic and Species Composition of Ciliates in Camel, Buffalo, Cattle, Sheep and Goat in Egypt. The Journal of American Science, 8(2):655-669.

Bhagat, N. and Chaturvedi, A. (2016). Spices as an Alternative Therapy for Cancer Treatment. Systematic Reviews in Pharmacy.,7(1):46-56.

Block, E. (1985). The chemistry of garlic and onions. Sci Am. 252(3):114-119.

Borck, C. (2001). Antioxidant health effects of aged garlic extract. J.Nutr. (Suppl.3):1010-1015.

Burtis, C.A. and Ashwood, E.R, eds. (1996). Tietz fundamentals of clinical chemistry,4th ed .Philadelphia: W. B. Saunders:755.

Busquet, M., Calsamiglia, S., Ferret, A., Carro, M.D., Kamel, C. (2005). Effect of garlic oil and four of its compounds on rumen microbial fermentation. J. Dairy Sci. 88, 4393–4404.

Castillejos, L., Calsamiglia, S., Ferret, A. (2006). Effect of essential oils active compounds on rumen microbial fermentation and nutrient flow in in vitro systems. J. Dairy Sci. 89, 2649-2658.

Chaturvedi, I., Dutta, T.K., Singh, P.K. (2015). Effect of different herbal feed additives on in vitro rumen fermentation. Journal Of Science, Vol. (1), Issue (1):10-14.

Chaturvedi, I., Dutta, T.K, Singh, P.K., Sharma, A., Kumar, M. (2014). Effect of Herbal Feed Additives on IVDMD, Methane and Total gas Production via in-vitro Study. Journal of Agroecology and Natural Resource Management, 1(2):108-112.

Chaturvedi, I., Singh, P.K. and Dutta, T.K. (2013). Effect of Herbal Feed on Goat Haematological and biochemical Profile. International Journal of Biotechnology and Bioengineering Research, 4(3) 257-262.

ISSN1110-1423

Chaves, A.V., Stanford, K., Dugan, M.E.R., Gibson, L.L., McAllister, T.A., Van Herk, F., Benchaar, C. (2008). Effects of cinnamaldehyde, garlic and juniper berry essential oils on rumen fermentation, blood metabolites, growth performance, and carcass characteristics of growing lambs. Livestock Sci.117, 215–224.

Coles, E.H. (1986). Veterinary clinical pathology. 4th Ed. W.B. Saunders Company, Philadelphia, London and Toronto.

Dirksen, G. and Smith, M. (1987). Acquisition and Analysis of Bovine Rumen Fluid. The Bovine practitioner, 22: 108-116.

Eadie, J.M., Hobson, P. and Mann, S. (1967). A Note on Some Comparisons between the Rumen Content of Barley-Fed Steers and That of Young Calves Also Fed on a High Concentrate Ration. Animal production, 9(02):247-250.

El-Katcha, M.I., Mosaad, A.S., Mohmoud, S.E. (2016). Effect of Garlic Extract Supplementation on Growth Performance, Nutrient Digestibility and Some Blood Serum Biochemical Changes of Fattening Lambs. Alexandria Journal of Veterinary Sciences 48 (2): 124-133.

El-Saifi, A. A. (1969). The Diagnostic Value of Ruminal Juice Examination in Cases of Indigestion in Buffaloes. M.Sc. Thesis, Fac. Vet. Med., Cairo Univ., Egypt, 128 p.

Faniyi, T.O., Prates, E.R., Adewumi, M.K., and Bankole, T. (2016). Assessment of herbs and spices extracts/meal on rumen fermentation: Review. Pubvet, Mai.,V.10, n.5, p.427-438.

Hassan, E.H and Abdel-Raheem, S. M. (2013). Response of Growing Buffalo Calves to Dietary Supplementation of Caraway and Garlic as Natural Additives. World Applied Sciences Journal 22 (3): 408-414.

Hodjatpanah, A.A., Danesh M.M., and Vakili A.R.(2010). Effects of Diets Containing Monensin, Garlic Oil, Turmeric Powder on Ruminal and Blood Metabolite Responses of Sheep. Journal of animal and veterinary advances 9(24):3104-3108.

Ibrhim, I.E. (2015). Effects of dietary herb supplements for ewes On milk contents and some biochemical parameter. G.J.B.B., vol.4 (2): 209-212.

Ito, A., Imai, S. and Ogimoto, K. (1994). Rumen Ciliate Composition and Diversity of Japanese Beef Black Cattle in Comparison with Those of Holstein-Friesian Cattle. Journal of Veterinary Medical Science, 56(4):707-714.

Jimoh, A.A., Ibitoye, E.B., Dabai, Y.U. and Graba, S. (2013). In vivo Antimicrobial Potentials of garlic against Clostridium perfringens and its promotant effect on performance of broiler chickens. Pakistan Journal of Biological Science. 16(25)1978-1984.

Karapinar, T., Dabak, M., Kizil, O. and Balikci, E. (2008). Severe Thiamine Deficiency in Sheep with Acute Ruminal Lactic Acidosis. Journal of veterinary internal medicine, 22(3):662-665.

Khalesizadeh,A., Alireza,V., Mohsen,D.M., and Reza,V.(2011). The effects of Garlic Oil (Allium sativa), Turmeric Powder (Curcuma longa Linn) and Monensin on Total Apparent Digestibility of Nutrients in Baloochi Lambs. Int. J. Biol. Biomolecul. Agricult. Food Biotechnol. Engin. 5 No:11, 791 – 793.

Kholif, S., Morsy, M.T.A., Abdo, M.M., Matloup, O.H., Abu El-Ella, A.A. (2012). Effect of Supplementing Lactating Goats Rations with Garlic, Cinnamon or Ginger Oils on Milk Yield, Milk Composition and Milk Fatty Acids Profile. J. Life Sci. 4(1): 27-34.

Kongmun, P., Wanapat, M., Pakdee, P., Navanukraw, C. and Yu, Z. (2011). Manipulation of rumen fermentation and ecology of swamp buffalo by coconut oil and garlic powder supplementation. Livest. Sci. 135:84-92.

Kongmun, P., Wanapat, M., Pakdee, P. and Navanukraw, C. (2010). Effect of coconut oil and garlic powder on in vitro fermentation using gas production technique. Livestock Science 127: 38-44.

Kumar, S.S., Navneet, G., Mehta, M., Mohini, M., Pandey, P., Shete, S. and Brisketu, K. (2012). Efficacy of garlic, eucalyptus and neem powders on rumen modulation, methanogenesis and gas production kinetics in wheat straw based diet evaluated in vitro. Wayamba Journal of Animal Science –P: 347 - 355.

Levesque, R. (2007): Programming and data management: A guide for SPSS and SAS users, fourth Edition, Chicago, USA.

Mariam, M.Bi. Bi., and Usha Devi C. (2016). Chemical And Shelflife Analysis of dry garlic powder: A Golden Herb. International Journal of Agriculture and Food Science Technology. Volume 7,Number 1 pp. 1-6.

Nie, N.H., Bent, D.H. and Hull, C.H. (1975). Spss: Statistical Package for the Social Sciences, McGraw-Hill New York, . p.

Orabi, M.I. (2015). Some Studies on Effect of Drainage Water on Sheep Health. M.Sc. Thesis, Fac. Vet. Med., Cairo Univ., Egypt, 77 p.

Patra, R.; Lal, S. and Swarup, D. (1996). Biochemical Profile of Rumen Liquor, Blood and Urine in Experimental Acidosis in Sheep. Small Ruminant Research, 19(2):177-180.

Pirmohammadi , R., Anassori, E., Zakeri, Z, Tahmouzi, M.(2014). Effects of garlic supplementation on energy status of pre-partum Mahabadi goats. Vet. Res. Forum. 5(3): 207–212.

Pugh, D.G. and Baird, A.N. (2012). Sheep and Goat Medicine, Elsevier Saunders. 621 p.

Radostits, O., Gay, C., Hinchcliff, K. and Constable, P. (2007). Veterinary Medicine: A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses, 10th. Ed., Elsevier Saunders. 2156 p.

Raeesi ,M., Hoseini- Aliabad, S. A., Roofchaee, A. , Zare Shahneh, A. and Pirali, S. (2010) Effect of Periodically Use of Garlic (Allium sativum) Powder on Performance and Carcass Characteristics in Broiler Chickens. World Academy of Science, Engineering and Technology 68:1213-1219.

Rivlin, R.S.(2001). Historical perspective on the use of garlic. J. Nutr. 131, 951S–954S.

Saber, M.M.A. (2016). Clinical and laboratory evaluation of rumen fermentation pattern of sheep in health and diseases. M.Sc. Thesis, Fac. Vet. Med., Cairo Univ., Egypt, 145 p.

Santos, V., Ferreira, M., Siqueira, M., Melo, T., Silva, J., Andrade, I., Soares, A. and Costa, C. (2015). Rumen Parameters of Sheep Fed Cassava Peel as a Replacement for Corn. Small Ruminant Research, 133: 88-92.

Saw, M., Stromme,J.H., London,J.L., Theodorsen, l. (1983). IFCC method for g-glutamyltransferase [(g-glutamyl),peptide: amminoacidgglutamyltransferase, EC2.3;2.2]. Clin. Chem Acta.135:315F-338F.

Tietz, N.W. (1986). Textbook of clinical chemistry. Philadelphia: WB Saunders. pp 1271- 1281.

Tietz, N.W., ed. (1990). Clinical guide to laboratory tests. 2nd .Ed. Philadelphia: WB Saunders; 26-29.

Wanapat, M., Khejorsart, P., Pakdee, P. and Wanapat, S. (2008). Effect of supplementation of garlic powder on rumen ecology and digestibility of nutrients in ruminants. J. Sci. Food Agric. 88, 2231–2237.

Young, D.S. (1990). Effects of drugs on clinical laboratory tests. AACC press, Washington, D.C.

Young, D.S. (1991). Effects of drugs on clinical laboratory tests. 3ed., AACC press, Washington (DC),1990; supplement No.1.

Young, D.S. (2001). Effects of Disease on Clinical Laboratory Tests. 4th. Ed., AACC.

Zakeri, Z., Pirmohammadi, R., Anassori, E. and Tahmouzi, M. (2014). Feeding Raw Garlic to Dairy Goats: Effects on Blood Metabolites and Lactation Performance. Kafkas Univ Vet. Fak Derg. 20 (3): 399-04.

الملخص العربي

تأثير مسحوق الثوم (اليوم ساتيفوم) على مكونات مختارة في الكرش ومصل الدم في الأغنام

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أجريت هذه الدراسة لاستقصاء تأثير مسحوق الثوم (اليوم ساتيفوم) على مكونات مختارة في الكرش و الدم وذلك على عدد 10خراف مصريه بلديه تراوحت أعمارها بين 1.5-2.5 عاما و أوزانها بين 30- 45 كجم وقسمت إلى مجموعتين متساويتين. الأولى كانت المجموعة الضابطة و التي غذيت على عليقه تقليدية فقط والمجموعة الثانية (التجريبية) أعطيت مسحوق الثوم (500 مجم لكل كجم من وزن الحيوان) عن طريق الفم بالإضافة إلى العليقة التقليدية قبل الإفطار صباحا ولمدة 5 أيام. في اليوم الأول من المجموعتين أخذت عينات من سائل الكرش و الدم قبل الإطعام (الساعة صفر) ثم الساعات 2و4 و6 و8 بعد الإطعام. بدءا من اليوم الثاني وحتى الخامس أخذت عينات سائل الكرش و الدم يوميا قبل الإطعام. أظهرت النتائج عامة أن الثوم أدى إلى تغيرات معنوية في عملية التخمر في الكرش على مدار الساعات بينما على مدار الأيام أدى إلى زيادة واضحة في محتوى الكرش من الكالسيوم و البروتين الكلى في مصل الدم والازوت النيتروجيني في الدم وكالسيوم مصل الدم وأدى إلى خفض مستوى تركيز الامونيا في الكرش وعلى الجانب الآخر حافظ على اتزان نشاط أوليات الكرش و العدد الكلى للأوليات و الأس الهيدروجيني لسائل الكرش و تركيز الأحماض الدهنية الطيارة ومستوى الفوسفور الغير عضوي في مصل الدم وكذلك الكريتينين و أنزيم إلجاما جلوتاميل ترانسفيراز في المستويات الطبيعية. بناءا على نظام التخمر في الكرش على مدار الساعات و التغيرات الحاصلة في مكونات كل من الكرش و الدم فإننا نوصى باستخدام مسحوق الثوم بمعدل 500 مجم لكل كجم من وزن الحيوان في الأغنام ولمدة 3-5 أيام في علاج عسر الهضم في الاغنام و الحفاظ على أداء الوظيفة الطبيعية بكفاءة في الكرش. ونؤكد على الحاجة إلى دراسات متقدمة تطبيقية لتأكيد قيمة استخدام الثوم في علاج الاضطرابات الهضمية تلك.

الكلمات الدالة: مسحوق الثوم- الأغنام- مكونات سائل الكرش و الدم.