

Effect of feeding Ginger (*Zingiber officinale*) powder on nutrient digestibility of Konkan Kanyal kids

Abstract:

The present study aimed to determine the Effect of feeding Ginger (*Zingiber officinale*) powder on nutrient digestibility of Konkan Kanyal kids. antibiotics were commonly used in animal diets to promote growth. However, due to the search for alternative additives and restrictions in many countries on using antibiotics to increase feed value, feed expenses now make up a significant part of the total cost of goat production. An experimental trial was conducted to evaluate the effect of feeding Ginger (*Zingiber officinale*) powder on body weight of Konkan Kanyal kids. Twenty Konkan Kanyal kids were selected and classified in five treatments by using Randomized Block Design (RBD). Each treatment was subdivided into four replications. All the animals were fed with complete feed having mulato grass, jowar kadabi and concentrate mixture. In treatment T₁ no ginger powder was supplemented while in treatment T₂ 3.0 g ginger powder, in treatment T₃ 6.0 g ginger powder, in treatment T₄ 9.0 g ginger powder and in treatment T₅ 12.0 g ginger powder was supplemented. The duration of experimental trial was 90 days. The study showed that ginger inclusion in the diet improved digestibility thus 12g ginger can be included in diet of konkan kanyal kids for better performance. The crude protein (CP) digestibility indicated that the animals effectively utilized dietary protein. This could be attributed to certain phytochemicals in ginger, such as tannins and saponins, which help prevent protein degradation in the rumen, allowing for better digestion in the abomasum and small intestine.

Key words: Ginger powder, Konkan Kanyal kids and Nutrient digestibility.

Introduction:

In animal husbandry, feed plays a crucial role and has become a focus for improving animal performance. Numerous studies have explored how adding various feed additives can boost feed intake. In the past, antibiotics were commonly used in animal diets to promote growth. However, due to the search for alternative additives and restrictions in many countries on using antibiotics to increase feed value, feed expenses now make up a significant part of the total cost of goat production. The two primary objectives for increasing profitability on goat farms are to lower feed costs and to optimize the quality of animal products. In the Konkan region of Maharashtra, the Konkan Kanyal goat breed is highly recognized. Konkan Kanyal goats are raised for meat by small farmers and landless people in the Konkan region. The goat needs the right nutrition in order to increase its productivity. Supplementing goat feed with ginger powder encompasses various potential benefits for the animals and their owners (Duwa et al., 2020; Sa'aci et al., 2018; Ikyume et al., 2020). Ginger, known for its medicinal properties, could offer improved digestion, immunity and overall health for goats. Goat owners may try to

lower their goat's risk of digestive problems like diarrhoea and bloating, strengthen their immune systems and even increase weight gain or milk production by adding ginger powder to their diet. Ginger is rich in essential micronutrients such as potassium, magnesium, copper, manganese and silicon. Potassium and manganese support disease resistance and help protect the heart, blood vessels and inner lining of the urinary tract. When used as a feed additive, ginger can help manage the rumen microbial population, decreasing rumen ciliated protozoa (fauna loss), reducing protein degradation and lowering methane production. (Faniyi et al.2016).Ginger saponins reduced gas production while increasing microbial protein levels with no impact on true digestibility (Srinivasan et al., 2003) Spices and flavors offer medicinal benefits when used as feed additives, acting as appetite and digestion stimulants, antimicrobial agents, anti-inflammatory agents, antioxidants and immune boosters in animals.Recently, modern physicians have increasingly utilized the rhizome of *Zingiber officinale* (ginger), which contains active compounds like gingerol, shogaols, gingerdiol and gingerdione, along with volatile oils that have medicinal properties. Ginger has demonstrated antioxidant, antiulcer, anti-inflammatory, anticancer, carminative, diaphoreticand gastroprotective effects. When used as a feed additive, *Z. officinale* has been shown to improve the health, performance and productivity of various farm animals.

Methodology:

A growth trial of 90 days was conducted on 20 Konkani Kanyal goat kids of same average body weight and divided in five groups of four kids in each treatment which were selected randomly from the goat unit of the Instructional Livestock Farm of Department of Animal Husbandry and Dairy Science, College of Agriculture, Dapoli, to conduct the experiment. The goats were randomly assigned to five treatments comprising of four replications and each replication has one animal per replicate. The animals were raised in individual compartment under confinement. The experimental design used was the Randomized Block Design (RBD) with four goats per treatment.

Metabolism Trial:

Twenty (20) Konkani Kanyal kids from the feeding trial were used for metabolism trial. They were housed in individual metabolism cage with facilities for collection of feces and urine. Each buck was individually fed the same experimental diet used in the feeding trial to evaluate the digestibility of the diet. Samples for all the seven days period of collection in metabolic trial were preserved. At the end of collection period, the preserved faeces in the bottles were mixed properly and representative samples were used for chemical analysis.

Chemical Analysis:

The faeces samples collected during the metabolic trial were analyzed for proximate principles, including dry matter, crude protein, crude fiber, ether extract, nitrogen-free extract, and total ash (AOAC, 1995).

Nutrient digestibility

Nutrient digestibility was calculated by using following formula

$$\text{Nutrient digestibility} = \frac{(\text{Nutrient intake} - \text{Nutrient outgo}) \times 100}{\text{Nutrient outgo}}$$

Statistical analysis

The collected data was analyzed by using statistical method know as 'Analysis of variance' (ANOVA) appropriate for the Randomized Block Design. The standard errors (SE) and critical differences (CD) at 5 per cent level of significance were worked out for comparison of treatments and presented in the respective tables. (Snedecor and Cochran, 1994).

Treatment details:

T₁ (control): Basal diet without ginger powder, T₂: Basal diet + 3.0 g ginger powder, T₃: Basal diet + 6.0 g ginger powder, T₄: Basal diet + 9.0 g ginger powder, T₅: Basal diet + 12.0 g ginger powder. Ginger powder was given along with concentrate.

Results and discussion:

Table 1: Average intake of nutrients in experimental kids (DM basis)

Treatments	Nutrients intake (g/d)					
	DM	CP	EE	CF	NFE	Ash
T ₁	746.58 ^c	144.85 ^c	27.26 ^c	261.34 ^c	619.83 ^c	106.31 ^c
T ₂	763.95 ^a	148.04 ^a	27.92 ^a	266.96 ^a	634.11 ^a	108.53 ^a
T ₃	759.35 ^{ab}	146.96 ^b	27.78 ^{ab}	264.91 ^b	630.15 ^{ab}	107.62 ^b
T ₄	736.30 ^d	142.32 ^{cd}	26.97 ^d	256.44 ^d	610.88 ^d	104.11 ^d
T ₅	731.23 ^{de}	141.16 ^e	26.81 ^{de}	254.25 ^e	606.54 ^{de}	103.15 ^e
SE ±	1.79	0.35	0.07	0.62	1.49	0.25
CD (5%)	5.52	1.07	0.20	1.93	4.58	0.78

Numbers having different superscripts differed from each other

Intake of nutrients in experimental kids on DM basis are explained on the basis of DM, CP, EE, CF, Ash and NEF. Dry matter intake (g/day) in T₁, T₂, T₃, T₄ and T₅ was 746.58, 763.95, 759.35, 736.30 and 731.23 respectively. CP intake (g/day) for T₁, T₂, T₃, T₄ and T₅ was 144.85, 148.04, 146.96, 142.32 and 141.16 respectively. EE intake for T₁, T₂, T₃, T₄ and T₅ was 27.26, 27.92, 27.78, 26.97 and 26.81 (g/day) respectively. Crude fiber intake for treatment T₁, T₂, T₃, T₄ and T₅ was 261.34, 266.96, 264.91, 256.44 and 254.25 (g/day) respectively. Ash intake for T₁, T₂, T₃, T₄ and T₅ was 106.31, 108.53, 107.62, 104.11 and 103.15 (g/day) respectively. NEF intake for treatment T₁, T₂, T₃, T₄ and T₅ was 619.83, 634.11, 630.15, 610.88 and 606.54 (g/day).

Table 2: Average outgo of nutrients in experimental kids (DM basis)

Treatments	Nutrients outgo (g/d)					
	DM	CP	EE	CF	NFE	Ash
T ₁	139.25 ^a	36.21	10.57 ^a	56.00 ^a	249.75 ^a	31.05 ^a
T ₂	134.00 ^b	34.78	10.23 ^{ab}	55.00 ^{ab}	242.75 ^b	29.46 ^b
T ₃	129.50 ^c	32.98	9.85 ^c	51.93 ^c	238.50 ^{bc}	27.28 ^c
T ₄	123.25 ^d	31.28	9.50 ^{cd}	48.58 ^d	225.75 ^d	25.48 ^d
T ₅	116.25 ^e	30.35	9.23 ^e	45.38 ^e	218.25 ^e	22.73 ^e
SE ±	1.06	1.59	0.15	0.65	1.88	0.41
CD (5%)	3.25	NS	0.46	2.01	5.79	1.26

Numbers having different superscripts differed from each other

The Dry matter outgo (g/day) in T₁, T₂, T₃, T₄ and T₅ was 139.25, 134.00, 129.50, 123.25 and 116.25 respectively. CP outgo for T₁, T₂, T₃, T₄ and T₅ was 36.21, 34.78, 32.98, 31.28 and 30.35 respectively. EE outgo for T₁, T₂, T₃, T₄ and T₅ was 10.57, 10.23, 9.85, 9.50 and 9.23 respectively. Crude fiber outgo for treatment T₁, T₂, T₃, T₄ and T₅ was 56.00, 55.00, 51.93, 48.58 and 45.38 respectively. In T₁, T₂, T₃, T₄ and T₅ ash outgo was 31.05, 29.46, 27.28, 25.48 and 22.73 respectively. NEF outgo for treatment T₁, T₂, T₃, T₄ and T₅ was 249.75, 242.75, 238.50, 225.75 and 218.25. Thus, the treatment T₁ had higher amount of outgo in DM, CP, EE, CF, Ash and NFE and lowest amount of outgo was observed in T₅.

Table 3. Average digested nutrients in experimental kids (DM basis)

Treatments	Nutrients digested (g/d)					
	DM	CP	EE	CF	NFE	Ash
T ₁	607.33 ^c	108.65	16.69 ^d	205.34 ^c	370.08 ^b	75.26 ^d

T ₂	629.95 ^a	113.26	17.70 ^{ab}	211.96 ^a	391.36 ^a	76.60 ^d
T ₃	629.85 ^a	113.98	17.93 ^a	212.99 ^a	391.65 ^a	79.89 ^c
T ₄	613.05 ^b	111.04	17.47 ^c	207.86 ^b	385.13 ^a	82.11 ^b
T ₅	614.98 ^b	110.81	17.58 ^{ab}	208.87 ^b	388.29 ^a	85.89 ^a
SE ±	2.09	1.75	0.13	0.84	2.40	0.53
CD (5%)	6.43	NS	0.41	2.59	7.39	1.64

Numbers having different superscripts differed from each other

Dry matter digested (g/day) in T₁, T₂, T₃, T₄ and T₅ was 607.33, 629.95, 629.85, 613.05 and 614.98 respectively. CP digested for T₁, T₂, T₃, T₄ and T₅ was 108.65, 113.26, 113.98, 111.04 and 110.81 respectively. EE digested for T₁, T₂, T₃, T₄ and T₅ was 16.69, 17.70, 17.93, 17.47 and 17.58 respectively. Crude fiber digested for treatment T₁, T₂, T₃, T₄ and T₅ was 205.34, 211.96, 212.99, 207.86 and 208.87 respectively. Ash digested for T₁, T₂, T₃, T₄ and T₅ was 75.26, 76.60, 79.89, 82.11 and 85.89 respectively. NFE digested for treatment T₁, T₂, T₃, T₄ and T₅ was 370.08, 391.36, 391.65, 385.13 and 388.29.

Table 4: Average nutrient digestibility in experimental kids (%DM basis)

Treatments	Nutrients digestibility					
	DM	CP	EE	CF	NFE	ASH
T ₁	81.35 ^e	75.01 ^b	61.23 ^c	78.57 ^e	59.71 ^e	70.79 ^e
T ₂	82.46 ^d	76.51 ^a	63.38 ^b	79.40 ^d	61.72 ^d	72.85 ^d
T ₃	82.94 ^{bc}	77.56 ^a	64.55 ^a	80.40 ^{bc}	62.15 ^{bc}	74.65 ^{bc}
T ₄	83.26 ^b	78.01 ^a	64.78 ^a	81.06 ^b	63.04 ^b	75.53 ^b
T ₅	84.10 ^a	78.50 ^a	65.59 ^a	82.15 ^a	64.02 ^a	77.97 ^a
SE ±	0.15	0.98	0.51	0.25	0.32	0.40
CD (5%)	0.46	3.03	1.59	0.76	0.97	1.23

Numbers having different superscripts differed from each other

The average digestibility of DM observed in treatment T₁, T₂, T₃, T₄ and T₅ was 81.35, 82.46, 82.94, 83.26 and 84.10 per cent, respectively. The average digestibility of CP observed in present investigation was 75.01, 76.51, 77.56, 78.01 and 78.50 per cent in treatment T₁, T₂, T₃, T₄ and T₅, respectively. The average digestibility of EE observed in treatment groups T₁, T₂, T₃, T₄ and T₅ was 61.23, 63.38, 64.55, 64.78 and 65.59 per cent, respectively. The average digestibility of CF observed was 78.57, 79.40, 80.40, 81.06 and 82.15 per cent in treatment T₁, T₂,

T₃, T₄ and T₅, respectively. The average digestibility of NFE observed in treatment T₁, T₂, T₃, T₄ and T₅ was 59.71, 61.72, 62.15, 63.04 and 64.02 per cent, respectively. The average digestibility of ash observed in treatment T₁, T₂, T₃, T₄ and T₅ was 70.79, 72.85, 74.65, 75.53 and 77.97 per cent, respectively

The results of this experiment are in agreement with the results of Ibrahim et al. (2022), who conducted study to evaluate the effect of inclusion levels of ginger on performance of Red Sokoto bucks (RSB) where he showed digestibility for DM at 0, 250, 500 and 750 g /100 kg was 80.14 ± 0.56 , 81.94 ± 0.56 , 81.27 ± 0.56 , and 82.71 ± 0.56 respectively. Crude protein at 0, 250, 500 and 750 g /100 kg was 77.02 ± 0.77 , 78.32 ± 0.77 , 77.27 ± 0.77 and 79.57 ± 0.77 per cent, respectively. digestibility for Ether extract for 0, 250, 500 and 750 g /100 kg was 61.71 ± 2.37 , 67.00 ± 2.37 , 60.15 ± 2.37 , and 67.53 ± 2.37 respectively. Ash for 0, 250, 500 and 750 g /100 kg was 74.14 ± 0.86 , 77.10 ± 0.86 , 75.88 ± 0.86 and 78.43 ± 0.86 respectively.

Ginger supplements enhance saliva production, leading to greater secretion and activity of digestive enzymes. This improvement in the digestive process is achieved by increasing the population of cellulolytic bacteria. (Ebeid *et al.*, 2020).

The crude protein (CP) digestibility indicated that the animals effectively utilized dietary protein. This could be attributed to certain phytochemicals in ginger, such as tannins and saponins, which help prevent protein degradation in the rumen, allowing for better digestion in the abomasum and small intestine. This mechanism may also explain the higher digestibility observed for dry matter (DM), organic matter (OM), crude fiber (CF), crude protein (CP), ether extract (EE), ash, neutral detergent fiber (NDF), and acid detergent fiber (ADF). Additionally, CP intake and digestibility can influence the digestibility of other nutrients. (Muhammad et al., 2011)

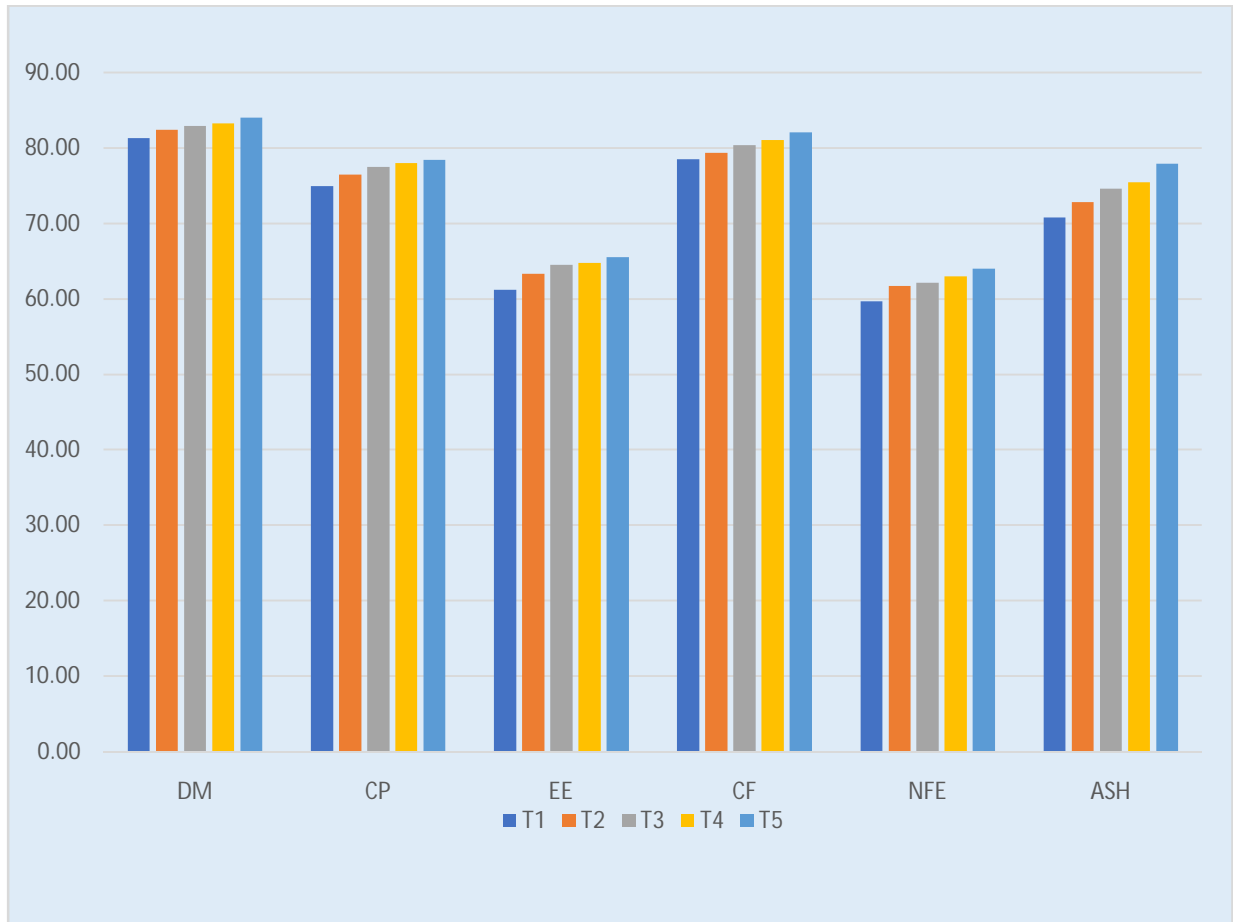


Fig 1: Average nutrient digestibility in experimental kids(% DM basis)

Conclusion:

Ginger has demonstrated antioxidant, antiulcer, anti-inflammatory, anticancer, carminative, diaphoretic and gastroprotective effects. When used as a feed additive, *Z. officinale* has been shown to improve the health, performance and productivity of various farm animals. Based on the current investigation, it can be concluded that treatment group T₅, supplemented with 12 g of ginger powder, showed a significant increase in nutrient digestibility among the goat kids.

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