



Nutritional Potential of White and Yellow Ginger Varieties as Supplementary Feed for Ruminants Animals

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Abstract

This research was conducted to examine the nutritional potential of two ginger varieties as feed additives (White and Yellow) in ruminant diet. Two varieties of ginger were purchased, sorted, washed, air dried and grinded into powder form. The powdered gingers were analyzed for proximate composition, fibre fraction, antinutritional factors and mineral composition. The results show the proximate composition and fibre fraction of the two ginger varieties were not significantly different. The crude protein recorded in white ginger was 8.75% while yellow ginger recorded 9.40%. Other parameter examined includes crude fibre (CF) 4.19% and 5.2%, Ash 5.44% and 6.13%, Ether extract (EE) 4.00% and 4.70%, moisture 5.10% and 7.50%, Dry matter 90.85% and 91.28%, Acid detergent fibre (ADF) 2.48% and 3.10% and Acid detergent lignin (ADL) 7.00% and 7.10% for white and yellow ginger respectively. The results also indicated that the phytochemicals in the two varieties of ginger were in moderate quantity which includes saponin, phlobatanin, glycoside general alkanoid, flavonoid, tannin and steroid. The minerals composition examined includes calcium, magnesium, sodium, potassium, phosphorus and iron. The composition of these minerals in the two varieties of ginger examined was not different significantly. From the results, white and yellow ginger contains nutrients that are available in the proportion that meet the nutritional requirement of small ruminant with essentials minerals and moderate anti nutritional factors. As such it could be used as feed materials inform of additive to feed ruminants with maximum performance for profit maximization.

Key words: Ginger, ruminants, additive, phytochemicals

Introduction

Herbs and spices are known to have health benefits such as appetite and digestion stimulants, anti-microbial action, anti-inflammatory action, anti-oxidative action and immune stimulant function on animals when used as feed additives in animal nutrition. For effective use of herbs and spices, it can be added to feed as dried plants or extracts. Ruminants have been adapted to fill an important ecological niche because of their specially adapted digestive tract that allows them to survive on fibrous feeds. (Faniyi *et al*, 2016). Artificial growth promoters in animal feeds have transmissible resistance factors that may compromise the use of therapeutic antibiotics in humans (Polasa *et al*, 2007).

Livestock farmers are generally faced with challenges of improving livestock performance in order to ensure more net returns (El samarany, 2015,). Modification of rumen fermentation using feed additives, such as organic sources like spices has proved to be a

useful strategy for improving production efficiency in ruminants (Khattab. *et al* 2016). The use of ginger as feed additive is a useful tool in reducing energy and nitrogen losses by ruminants. Manipulation of rumen microbial ecosystem for enhancing fibrous feed digestibility and reducing nitrogen excretion to improve animal performance are some of the most important goals of animal nutritionists (Khattab. *et al* 2016). This work was designed to evaluate the comparative nutritional potentials of white and yellow ginger varieties as a supplementary feed for ruminant animals and also to determine the nutrients composition of the two varieties of ginger as a dietary ingredient in ruminant feed formulation

Materials and methods

Preparation of ginger sample

Fresh ginger rhizome (yellow and white types) were purchased at Towobowo market Igboora. The ginger rhizome was washed, shopped and air dried for seven (7) days. The dried ginger rhizomes grinded using mortar and



pestle to a powdered form. The ginger powdered was taking to the laboratory for proximate, fiber, phytochemical and mineral composition analysis.

Proximate and fibre fraction Analysis of yellow and White ginger

Proximate composition of the two varieties of ginger (Yellow and the white varieties) were analyzed for Crude Protein (CP), Nitrogen free extract (NFE), Ether Extract (EE), Dry Matter (DM) and ash in the laboratory and Percentage fibre fractions composition examined includes Neutral Detergent Fibre (NDF), Acid Detergent Fibre(ADF), and Acid Detergent Lignin

Proximate composition

The Dry Matter (DM), Crude Protein (CP), Ether Extract (EE) and Ash contents of the grinded yellow and white ginger were determined using the procedure described by A.O.A.C., 2000. Non-fibre carbohydrate was calculated as $NFC = 100 - (CP + Ash + EE + NDF)$. Fibre fraction analysis which include Neutral detergent fibre (NDF), Acid detergent fibre (ADF) and Acid detergent lignin (ADL) of grinded yellow and white variety of ginger samples were determined with the procedure of Van Soest *et al.* (1991). Cellulose content was taken as the difference between ADF and ADL while hemicellulose

content was also calculated as the difference between NDF, ADF and Total Digestible Nutrient (TDN)

The following parameters were calculated using formula describe by Montana, 2012

$$NFE = 100 - (\text{Moisture} + CP + CF + EE + ASH)$$

$$TDN = 96.35 - (ADF \times 1.5)$$

$$ME = 0.0362 \times TDN$$

$$CELL = ADF - ADL$$

$$HEM = TDN - NDF + ADF.$$

Mineral Elements Analysis

The mineral elements were determined using the method described by Osabor *et al.*, 2010. Sodium and potassium were determined by flame photometer (Gallenkamp). Iron, copper, zinc, calcium, manganese, chromium and cadmium were determined by Atomic Absorption Spectrophotometer method adopted by A. O. A. C (2000)

Statistical Analysis

All data obtained were subjected to one-way analysis of variance using (SAS institute software 1999). Statistical test was performed on nutrients and mineral composition of two varieties of ginger (White and Yellow), comparism between the parameters examined were done using Duncan multiple range test (Duncan, 1955).

Results and discussion

Table 1: Qualitative anti- nutritional value of two varieties of ginger (Yellow variety and White variety)

Parameters	White ginger variety	Yellow ginger variety
Saponin	+	+
Phlobatanin	+	+
Glycoside general	+	+
Alkanoid	+	+
Flavonoid	+	+
Tanning	+	+
Steroid	+	+

KEY:

+ Moderately present

++ Present in high quantity

-Not present



Table ii: Proximate and fibre composition (%) of two varieties of ginger (Yellow and White varieties)

Parameters (%)	White ginger	Yellow ginger	SEM	P-Value
NDF	35.00	33.34	0.64	0.25
ADF	31.63	31.60	0.31	0.95
ADL	7.00	7.00	0.09	0.96
Hemicellulose	44.74 ^b	47.40 ^a	0.77	0.00
Cellulose	24.45	28.48	2.40	0.64
Dry matter	91.27	90.85	0.74	0.83
Moisture	7.50	5.10	0.81	0.15
ASH	6.13	5.45	0.30	0.35
Ether extracts	4.00	4.70	0.24	0.15
Crude fibre	5.20	4.19	0.51	0.43
Crude protein	9.40	8.75	0.29	0.35
NFE	66.87 ^b	72.90 ^a	1.83	0.04
ME(Mkal/kgDM)	1.68	1.79	0.61	0.48
TDN	46.48 ^b	49.48 ^a	0.68	0.00

Means on the same row with different superscript are significantly different (P< 0.05)

KEY: NDF –Neutral deterget fibre
ADL- Acid deterget lignin
NFE- Nitrogen free extract
ME-Metabolized energy
NFE- Total digestible nutrients

Table iii: Mineral composition of two varieties of ginger

Parameters	White ginger(mg/100g)	Yellow ginger(mg/100g)	SEM	P-Value
Calcium	0.67 ^a	0.51 ^b	0.03	0.01
Magnesium	0.97 ^a	0.67 ^b	0.04	0.00
Sodium	0.40 ^a	0.27 ^b	0.04	0.03
Potassium	1.35	1.13	0.07	0.42
Phosphorous	0.53	0.36	0.15	0.35
Iron	0.34	0.17	0.07	0.09

Means on the same row with different superscript are significantly different (P< 0.05)

Results and discussion

From the results obtained, it was observed that both white and yellow ginger contained nutrients that are available in the proportion that met the nutritional requirements of small ruminant with essentials mineral and moderate anti nutritional factor. Phytochemical screening of the two varieties of ginger (Yellow and White ginger) are represented in Table i. from the table, that all phytochemicals presents in yellow ginger are also presents in white ginger in the same quality and quantity. The results of anti nutritional factors of the two varieties of ginger (white and yellow) indicated the presence of saponin, phlobatanin, glycoside general, Alkanoid, Flavonoid, Tanin and Steroid in moderate quantity. Flavonoid posses' antioxidant properties that ensured proper blood circulation and, strengthened blood capillaries wall (Raham 2010). Odetola *et al.*,(2012) reported tannins have been reported to be responsible for decrease in feed intake, growth rate ,feed efficiency ,net metabolizable energy and protein digestibility when present in high level. Barry and McNabb (1999) also reported that 2- 4% Tannin in a

diet protected protein from the rumen degradation and increase absorption of essential amino acid. Essien *et al.*, (1983) also reported, that Tannin increase efficiency of protein utilization, reduction of parasite burden, reduction of proteolysis during silage production, prevention of strength blood capillaries wall. Tadele (2015) explained that Saponin can affect performance and metabolism through erythrocyte hemolysis, reduction of blood and liver cholesterol, depression of growth rate, inhibit nutrients absorption and smooth muscle activities when present in higher concentration.

The percentage of fiber fraction and proximate composition of two varieties of ginger were also examined and represented in table II. Some of the parameters examined were statistically different across the treatment with exception of few. State the hemicullose in white ginger significantly had higher value (47.40%) compared to yellow ginger that had (44.74%) and Neutral deterget fibre (NDF) that was statistically higher in white ginger (72.90%) yellow ginger that had 66.97%



($P < 0.05$). The neutral detergent fibre of both yellow and white ginger rhizome were below 60% which had been reported as the threshold level of NDF in tropical plants beyond which feed intake of ruminants is affected (Meissner *et al.*, 1997). Total digestible nutrients (TDN) were significantly higher in white ginger compared to yellow ginger ($P < 0.05$) with respective values of 49.48% and 46.48. %. The neutral detergent fibre ranges from 33.34% -35.00 % in yellow and white ginger respectively. Acid detergent fiber recorded 31.63 % in yellow ginger while 31.60% was recorded in white ginger. The Acid detergent lignin are not statistically different in both yellow and white ginger with respective values 7.01% and 7.00%. values respectively. The neutral detergent fiber (NDF) is the best indicator for fodder quality prediction, as it is related to feed intake potential and energy level. The moisture content of the White and yellow ginger examined in this work was 7:50 for the yellow and 5:10 for the white ginger, these values were higher than the values recorded in the finding of Yusuf and Lasis 2006 for soybean. This result indicates that both white and yellow ginger have better shelf life and can be store for a reasonable time. It is very essential to determine the protein content as it is widely used in analytical measurements in processing and lasting quality of feed. Crude protein (CP) content record for both white ginger 8.75% and yellow ginger 9.40% indicate that both have good nutritive value as it is above 6%. Norton (1994) reported that feed with less than 6% CP level are unlikely to provide the minimum level of ammonia required for ultimate microbial growth in the rumen. The carbohydrates content recorded for white ginger 90.85% dry matter (DM) and yellow ginger 91.28% Dm. This is higher than those reported for water spinach leaves (54.67%), Tribulus terrestris leaves (56.67%) but similar with the value recorded for corchoru stridax 92.8% (NRC 1989). Carbohydrates and fat are principal energy source, the result obtained from this research indicative that both white and yellow ginger are good source of energy apart from this, carbohydrates are also needed for biochemical reactions that are not directly related with the energy metabolism. The Ash content 6.13% for yellow ginger and 5.44% for white ginger, Ether extract 4.70% for yellow ginger and 4.00% for white ginger. Crude fibre 5.20% yellow ginger and 4.19% for white ginger are statistically similar though

with different numeric values. The crude protein content recorded ranges from 8.75% to 9.40% for white ginger and yellow ginger respectively which are not different significantly. The ash content of yellow ginger (6.13%) is higher than white ginger (5.14%). This result was higher than 4.20 % reported by Osabor *et al.*, (2015). The Ash content is an indication of the total inorganic minerals element content. The crude fibre recorded from the research for both white and yellow ginger 4.11% and 5.20% respectively is lower than the value recorded by Isabor *et al.*, 2015 that recorded 10.60%. This is in contrast with the report of Olubunmi *et al.*, 2013 who recorded 21.9% for yellow ginger and 8.30% for white ginger. The Esther Extract (EE) value which represented the crude fibre content was not different significantly in the two varieties of ginger. The value of EE obtained is sufficient to maintain good healthy and reduce risk of disease and aging caused by excess consumption. Feed stuff having crude fat within the range of 1-2% is better (sowande 2013). The acid detergent lignin (ADL) is lower in both white and yellow ginger compared to value obtained in leaf, back and fruit of *Gmelina arborea* plant as reported by Adebisi ,2019. Also fell in agreement with the report of chaves *et al.*, (2012) that reported that lignin is present in high proportion in stem and leaves. Mineral composition of the two varieties of ginger was presented in table III. The highest calcium content was recorded in yellow ginger 0.67mg/100g that was significantly higher ($P < 0.05$) than 0.51mg/100g recorded for white ginger. Magnesium content was also higher in yellow ginger (0.97mg/100g) compared to white ginger (0.67mg/100g) statistically. Sodium result ranges from 0.27 - 0.40mg/100g for white and yellow ginger respectively. Blood mineral increase metabolic activities as an antioxidant source. It also enhances maximum nutrient absorption and utilization which may support growth in animals (Imaseun *et al.*, 2018).

Conclusion and Recommendations

From the results, it can be established that the two varieties of ginger (yellow and white) were reached in crude protein, low in anti-nutritional content and provide adequate fibre and mineral that can be tolerated by the small ruminants like sheep. However, the two varieties had good potential as feed materials that can serve as additives in ruminant's diets.



Recommendation

Further research is advocated on processing of ginger both white and yellow so as not to acquire the nutrients potential of this spice. More work needed to be done on the anti nutritional factor to ascertain other phytochemical present in ginger and how to reduce their effect on the use of nutrients available in ginger. However, the Cost implications of the inclusion of ginger in animal feed need to be evaluated to consider the economic impact of using ginger in the diet of ruminants.

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