

Intake, relative palatability indices and blood parameters of vetch varieties as a component of goat diet

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Abstract

Therefore, the objective of this study was to assess the feed intake, relative palatability indices and blood parameters of vetch varieties as a component of goat diet. The field and palatability study was carried out at the North West University, Molelwane Farm, North West province, South Africa. Ten weaner goats (16 ±2 kg) were used in this experiment. Four feeds (*Vicia sativa* – common & volga vetch), *Vicia villosa* Roth (haymaker plus vetch) and buffalo hay grass were used in this experiment and each goat was exposed to these treatment diets. A cafeteria feeding method was used, allowing goats free access to the diet of their choice. A one-way ANOVA (SAS, 2010) was used to test the feed intake, relative palatability and blood profiles. Haymaker plus and Buffalo grass hay had the lowest palatability index. The diet intake was positively predicted from palatability ($r^2 = 0,661$; $p=0.0001$). Goats that were fed vetch had their RDW levels higher ($P<0.05$) in comparison to goats that were grazing. There were no significant ($P<0.05$) differences in the total protein and albumin concentrations in goats fed vetch and those grazing outside. Based on intake, palatability and blood profiles it shows that goat preferred Volga and common vetch over the Haymaker plus vetch. Supplementing with the vetch legumes showed an improvement to the blood profiles of the goats. Thus, vetch can be used as a protein supplement to low roughage grasses which may bring an overall productivity of these ruminants.

Introduction

Palatability usually designates those characteristics of a feed that invoke a sensory response in the animal and is considered to be the corollary of the animal's appetite for the feed (Dumont, 1997). When only one feed is given to animals fed indoor, palatability can be evaluated by the eating rate at the beginning of the meal. When several feeds are studied, preference tests are most often used to assess palatability. Intake measurements are critical since post-ingestive effects are partly confounded with palatability, but experimental procedures allow these two variables to be separated (Favreau et al., 2010). Behavioural measurements assess motivation for a feed rather than intake. Operant conditioning procedures show how animals maintain their choice for a preferred feed as it becomes increasingly difficult to obtain. Physical characteristics of the feed (particle size, resistance to fracture, dry matter content, height, and density of sward, etc) contribute to the sensory response invoked by the animal (Dumont & Petit, 1995). They influence ease of prehension, and ease of mastication and animals generally prefer the physical form of the feeds they can eat faster. Taste and odour are recognized as of importance in feed palatability; however, effects of the primary tastes depend on the experimental procedures used (Distel et al., 1994). According to Scharenberg et al. (2007) most of the palatability studies are short term with time scales of minutes or hours. In the long term (several days or weeks), feed preferences seem generally to be associated with digestive modifications. Animals use their senses to learn to associate the postingestive effects of the feed with its sensory characteristics (Favreau et al., 2010). Ruminants generally develop preferences for feeds that will provide a high satiety level rapidly. Thus, palatability measured as the sensory response invoked by the feed integrates its nutritive value. However, for a given nutritive value, sensory properties of the feed per se can stimulate or depress hedonic feeding behaviour (Dumont, 1997). The role of hedonic behaviour on intake may be of particular importance in choice situations and for low producing animals. In a first approach, hedonic value of the feed can be assessed by the difference between the observed intake and the predicted intake as affected by the nutritive value (Distel et al., 1994). Therefore, the objective of this study was to assess the feed intake, relative palatability indices and blood parameters of vetch varieties as a component of goat diet.

Methods

The field and palatability study was carried out at the North West University, Molelwane Farm, North West province, South Africa. Planting was done during the 2021- 2022 planting seasons. Haymaker plus vetch, Common vetch and Volgar vetch varieties were used in this experiment and were harvested 40 days after planting. Buffalo grass hay and vetch varieties were cut and dried. A total of ten weaner goats (16 ±2 kg) were

used in this experiment. Five of the weaner goats were housed in individual pens with individual feeders and another five were kept in an outside environment. Goats kept in the outside environment where they were fed buffalo grass hay, raddish tubers and water at *ad libitum*. Each animal was offered all the feeds simultaneously. Animals underwent a 14-day period of adaptation to confinement feeding. The collection period was for seven days. The amount for each feed was adjusted daily so that a 10 to 15 % refusal would be maintained (Kaitho et al., 1996). The order of placement of feeds in the troughs was randomly changed daily to avoid habit reflex. The feeds were offered, and refusals were weighed and recorded daily, and dry matter was determined for each animal. Four feeding troughs were allocated to each goat and each animal had access to all the experimental diets. A cafeteria feeding method was used as outlined by Larbi et al. (1993) therefore allowing goats free access to the diet of their choice. The data collection period was for seven days. Each of the animals was offered 300 g of grass and an additional 300 g of each vetch hay as outlined by Ravhuhali (2010). A one-way ANOVA (SAS, 2010) was used to test the feed intake, relative palatability and blood profiles.

Results and Discussion

Feed intake and relative palatability: Table 1, presents results for the dietary feed intake (g/day/goat), relative palatability indices and blood profile as a component of Boer goats offered vetch cultivars and buffalo grass hay. Goats consumed more ($P < 0.05$) of Common and Volga vetch as compared to the other feeds. Haymaker plus vetch and Buffalo grass hay had the lowest palatability index. The diet intake was positively predicted from palatability ($r^2 = 0.661$; $p = 0.0001$). **Blood profiles (biochemical indices and haematological parameters):** The effect of vetch and non-vetch diets fed to Boer goats was evaluated in this study and results are exhibited in Table 2. The WBC ($\times 10^3 \mu\text{L}$), RBC ($\times 10^6 \mu\text{L}$), MCH (pg), MCV (fL), HGB (g/dL), HCT (L/L) and RDW (%) levels were similar among the treatments. Goats that were fed vetch had their RDW levels higher ($P < 0.05$) in comparison to goats that were grazing outside and not fed vetch. Cholesterol levels were higher ($P < 0.05$) in goats fed vetch as compared to goats grazing outside. There were no significant ($P < 0.05$) differences in the total protein and albumin concentrations in goats fed vetch and those grazing outside.

Table 1 Prediction of feed intake (g/day/goat) and relative palatability index of Boer goats offered vetch cultivars and buffalo grass hay.

| Feed | Intake (g/d) | Palatability index |
|---------------------|---------------------|--------------------|
| Common vetch | 232.47 ^a | 3.83 ^a |
| Buffalo grass hay | 67.72 ^c | 1.00 ^b |
| Haymaker plus vetch | 123.71 ^b | 2.13 ^b |
| Volga vetch | 240.64 ^a | 3.95 ^a |
| SE | 11.83 | 0.56 |

^{a,b,c} Column means with the same superscripts are not significantly different ($P > 0.05$). SE: standard error mean

Table 2 Blood components of Boer goats fed vetch and non- vetch cultivar feed.

| Parameters | Vetch | Non-vetch | SE |
|-----------------------------------|----------------------|----------------------|-------|
| Haematology | | | |
| WBC ($\times 10^3 \mu\text{L}$) | 38.180 ^a | 34.600 ^a | 2.77 |
| RBC ($\times 10^6 \mu\text{L}$) | 14.660 ^a | 11.040 ^a | 3.00 |
| RDW (%) | 19.172 ^a | 14.454 ^a | 1.56 |
| HGB (g/dL) | 65.720 ^a | 57.420 ^a | 3.38 |
| HCT (L/L) | 11.520 ^a | 9.860 ^a | 0.80 |
| MCV (fL) | 61.54 ^a | 54.82 ^a | 9.37 |
| MCH (pg) | 33.680 ^a | 21.100 ^a | 1.25 |
| Metabolites (mmol/L) | | | |
| Urea | 55.200 ^a | 53.600 ^a | 2.98 |
| Glucose | 15.5400 ^a | 14.4600 ^a | 0.59 |
| Creatinine ($\mu\text{mol/L}$) | 14.600 ^a | 10.600 ^a | 2.48 |
| Cholesterol | 14.200 ^a | 10.200 ^b | 1.044 |
| Proteins (g/L) | | | |
| Total protein | 2.35600 ^a | 2.32400 ^a | 0.068 |
| Albumin | 44.00 ^a | 41.600 ^a | 0.96 |
| Enzymes (IU/L) | | | |
| ALT | 0.600 ^a | 0.5200 ^a | 0.035 |

| | | | |
|------------------------------|---------------------|---------------------|-------|
| ALKP | 29.00 ^a | 26.400 ^a | 8.07 |
| Globulin | 27.000 ^a | 22.000 ^b | 1.396 |
| GGT | 197.00 ^a | 164.40 ^a | 26.99 |
| Electrolytes (mmol/L) | | | |
| Phosphorus | 46.80 ^a | 17.00 ^b | 2.04 |
| Calcium | 2.52 ^a | 2.17 ^a | 0.16 |

^{ab}Means with different superscripts within columns (treatments), differ significantly (P<0.05). White blood cell (WBC); Red blood cell (RBC); Haemoglobin (HGB); Haematocrit (HCT); Mean corpuscular volume (MCV); Mean corpuscular haemoglobin (MCH); Red cell distribution (RDW); alanine aminotransferase (ALT)

Discussion In ruminant feeding, palatability has proven to be a determining factor. Volga and Common vetch legumes showed to have a higher palatability and intake, which proves that the vetch can be utilized as a feed material. Increased feed intake indicated that Volga and Common vetch had a positive effect on the goat's rumen environment (Lanyasunya et al., 2007). The palatability of forage legumes is determined by many factors which include taste, sight, odor, smell and absence of contaminants (Dhia, 2012). Feed intake is one of the most important factors for small ruminants for their productivity and performance (Gerbreegziabher, 2016). Blood urea has shown to be an indirect indicator of protein composition of the feed.

Conclusions and/or Implications

Based on intake, palatability and blood profiles it shows that goat preferred Volga and common vetch over the Haymaker plus vetch. Supplementing with the vetch legumes showed an improvement to the blood profiles of the goats. Thus, vetch can be used as a protein supplement to low roughage grasses which may bring an overall productivity of these ruminants.

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