



Effects of partial replacement of dietary protein by a leaf meal mixture on nutrient utilization by goats in pre- and late gestation

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Abstract

This study examined the comparative nutrient utilization of indigenous non-descript goats ($n = 12$) maintained on a basal diet of wheat straw supplemented with a concentrate based on either soybean meal (SBM) or *Leucaena leucocephala*–*Morus alba*–*Azadirachta indica* (2:1:1) leaf meal mixture (LMAM) prior to conception (pre-gestation), and during gestation ($n = 8$) in a completely randomized design. Concentrate represented 42% and 72% of DM in diet before and during pregnancy, respectively. Therefore, the plane of nutrition and nutrient density in terms of digestible CP and TDN of composite diets offered to does during late gestation were significantly higher relative to non-pregnant does. Intake of DM was significantly higher ($P < 0.001$) in does during late gestation as compared to their intake during pre-gestation. The digestibility of nutrients and N balance data were comparable ($P > 0.05$) among goats irrespective of dietary supplements. However, does in late gestation had higher ($P < 0.001$) nutrient digestibility of DM, OM, and CP and lower digestibility of NDF, ADF, and cellulose as compared to non-pregnant does due to higher dietary ratio of concentrate. Similarly, pregnant does had significantly higher ($P < 0.001$) intake, excretion and retention of N during late gestation irrespective of diets. The nutritive value of composite diets and plane of nutrition of does were similar ($P > 0.05$) irrespective of dietary treatments. Apparently, the supplementation of wheat straw either with LMAM or commercial type concentrate containing soybean meal resulted in similar performance of does; the leaf meal mixture could contribute up to 36% of the total DMI in gravid does without any adverse effect on their general health and reproductive performance.

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1. Introduction

Goat keeping in many tropical countries is undergoing a transformation from the traditional extensive browse-based feeding system to intensive stall feeding system because of many reasons inclusive of intensification of agriculture, shrinkage of grazing lands

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and reclamation of fallow lands for alternative use. Hence, cereal straws are increasingly being used as basal feeds for goats in the arable areas of the tropics. Utilization of these poor quality roughages could be effectively maximized by supplying deficient nutrients like N and other micronutrients to animals (Prasad et al., 2001). In this context, the role of fodder trees and shrubs in the diet of animals is considered particularly important in countries like India, where small land holdings and large ruminant densities result in an especially severe problem of feed availability from more conventional sources like oil cakes and bran. A wide variety of multi-purpose tropical trees grown by farmers can be used as N sources in supplementary feeds (Devendra, 1990; Topps, 1992; Ondiek et al., 2000). The leaves of *Leucaena leucocephala*, *Morus alba* and *Azadirachta indica* are potential N supplements (Mahanta et al., 1999; Anbarasu et al., 2001; Liu et al., 2001). These tree forages not only provide a cheap source of N, energy and micronutrients, but have also many other advantages like their wide spread on-farm availability and easy accessibility to farmers, and above all the scope of adding variety to the diet. The tree leaves can be harvested, sun-dried and used in compounded protein supplements. The replacement of conventional ingredients by tree leaves will make such supplements cheaper than the commercial concentrates (Ondiek et al., 2000). However, the presence of anti-nutritional factors like mimosine in *L. leucocephala*, triterpenoid derivatives (azadirachtin, nimbidin) in *A. indica* and phenolics in most of the leaves limit their use as sole animal fodder. Farmers usually minimize and overcome these problems by feeding different leaves in mixtures in smaller quantities, which not only dilutes and reduces the problem of palatability and toxic effects (Lowry, 1990) but also extends feed base for animals. In earlier experiments (Yusran and Teleni, 2000; Anbarasu et al., 2001), a mix of fresh leaves (*Gliricidia sepium*–*L. leucocephala*–*Calliandra calothyrsus*) or a leaf meal mixture (*L. leucocephala*–*M. alba*–*Tectona grandis*) were successfully used as strategic supplements in the diet of cows and goats, respectively. However, an adherence to a fixed composition of leaf mixtures is not practicable because of area specific distribution and seasonal availability, and accessibility of various plant species to the farmers. Hence, long term studies are required involving production responses and reproductive performance of animals to

test different potential sources and/or combinations of tree leaves to broaden the base of alternative quality feed resources for the feeding of livestock across different physiological states as it may affect consumption and utilization of nutrients. Keeping this background in view, the experiment was undertaken to scrutinize the effects of long term feeding of *L. leucocephala*–*M. alba*–*A. indica* leaf meal mixture as a partial substitute to soybean meal in the diet on nutrient utilization and BW changes of dry and gravid goats.

2. Materials and methods

The experiment was conducted at Indian Veterinary Research Institute, Izatnagar in Uttar Pradesh, India. It is located at 170 m a.s.l. (28°22'N and 79°24'E) in the northern upper Gangetic plain, having an annual rainfall of 900–1200 mm. It is the region of the deepest soil in India with hardly any variation in relief and suitable for growing various types of subtropical crops and trees. Cereal straws such as wheat and rice form the basal diet of ruminants in the area.

2.1. Animal management and rations

Twelve local non-descript maiden does, approximately 2-year old with an average initial BW of 14.6 (± 0.69) kg, were randomly allotted to two dietary treatments, each consisting of six does, in a completely randomized design. Local goats of the area are unimproved indigenous medium sized goats with variable coat colours ranging from black, brown and white and combination of the three colours, and are kept primarily for meat. The does were penned individually in a well-ventilated shed with free access to fresh water. They were offered a basal diet of wheat straw for ad libitum intake and either of the two concentrate mixtures (Table 1). The control diet (SBM) was representative of a commercial concentrate and contained mechanically expelled soybean meal as the principal protein source while, in the test concentrate (designated as LMAM), a leaf meal mixture replaced 50% protein of the control concentrate.

The leaf meal mixture component of LMAM concentrate contained sun-dried ground leaves of *L.*

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