



Effects of wet soya waste supplementation on the intake, growth and reproduction of goats fed Napier grass



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ABSTRACT

This study evaluated the effects of different levels of soya waste on the intake, growth rates, reproduction and feed conversion efficiency of adult goats, as well as the daily body weight (BW) gain of pre-weaning kids. Two experiments were conducted with Boer crossbred (Boer × local) and Jermasia goats. In experiment (Exp.) 1, 20 goats were divided into four groups (A, B, C and D), with five goats in each group. Groups A, B and C were given soya waste at a rate of 0.5, 1.0 and 2.0% of BW/day on a dry matter (DM) basis. Group D received soya waste *ad libitum*. In Exp. 2, 14 Jermasia does were split into a control group and a treatment group, with seven does in each group. The control group was fed pelleted compound feed at a rate of 2.0% of BW/day, and the treatment group was fed soya waste at a rate of 2.0% of BW/day. In both experiments, the animals were offered Napier grass *ad libitum*. In Exp. 1, with the increased dietary level of soya waste, the animals' grass intake declined, but their intake of total DM and nutrients tended to increase. The intakes of DM, crude protein (CP) and metabolisable energy (ME) were higher ($P < 0.05$) in Group C compared to Group A. The digestibility of DM and nutrients also tended to increase with the increased level of soya waste, and the digestibility of DM, organic matter, CP and neutral detergent fibre were higher ($P < 0.05$) in Group C compared to Group A. The average daily BW gain increased ($P < 0.05$) with the increased dietary level of soya waste. In Exp. 2, the DM and ME intakes of the does were the same in the control and treatment groups. However, the CP intake was higher ($P < 0.05$) in the treatment group compared to the animals in the control group. The BW and reproductive performance of the does fed the treatment feed were similar ($P > 0.05$) to those fed the control feed. The birth weight of the kids did not differ ($P > 0.05$) between the control and treatment groups. However, the BW gain of the pre-weaning kids fed the

Abbreviations: BCS, body condition score; BW, body weight; CIDR, controlled internal drug release; CP, crude protein; DM, dry matter; Exp., Experiment; FCE, feed conversion efficiency; ISB, Institute of Biological Sciences; ME, metabolisable energy; MJ, megajoule; N, nitrogen; NDF, neutral detergent fibre; OM, organic matter; SE, standard error; SEM, standard error of mean.

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treatment feed was higher ($P < 0.05$) than that of the pre-weaning kids fed the control feed. Based on this 14-month long feeding study, high levels of soya waste (up to 2.0% DM of BW) did not have detrimental effects on the feed intake, weight gain and reproductive performance of goats, suggesting that soya waste supplementation is a viable replacement for scarce feedstuffs, such as grass, and expensive commercially produced compound feed.

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1. Introduction

Feed is the most significant cost in livestock production, representing as much as 60–70% of production outlays (Strauch and Stockton, 2013). In most developing countries, there are problems with the quality and quantity of feed and forage due to natural calamities, poor soil fertility and lack of natural grasslands, with subsequent effects on ruminant production (Devendra and Leng, 2011). Many hill farmers in South-east Asia do not have enough flat land to produce their own grass, silage or hay and therefore must use imported supplements, which are expensive. Due to successful technology transfer, the livestock sector in Malaysia has grown over the years, especially the poultry and pig sectors (Hassan and Azmie, 2012). However, the ruminant sector continues to lag behind, and it remains underdeveloped, despite considerable scope for expansion (Abdullah et al., 2012). More research is needed, stating changing the type of feed could potentially offer major benefits due to the significant role that feed plays in current production costs.

Alternative sources of energy and protein, such as agricultural and industrial by-products, offer the prospect of novel feeds from new sources. Soya waste is an industrial by-product of tofu, soya milk, soya sauce, soya milk powder, soya flour and soya bean oil production. It is also known as 'soya bean curd residue', 'soya bean-curdlees', 'tofu cake', 'okara' or 'ampastahu'. This product is often considered as waste, which is mostly dumped and burned (Muroyama et al., 2001). Dumping or burning soya waste is a potential environmental problem because it can contaminate the environment by, for example, nitrogen (N) leaching into groundwater and carbon dioxide emissions (Almaraz et al., 2009). One kilogram of soya bean processed into soya milk or tofu produces about 1.1 kg of wet soya waste (Khare et al., 1995).

Malaysia is one of the largest producers of soya drinks in South-east Asia. Hence, there are considerable numbers of soya bean processing factories in the country, which are mostly located in urban and peri-urban areas. Some livestock farmers use soya waste as an inexpensive feed. However, there is a huge amount of unexploited soya waste that could be used as supplementary feed in these areas. Soya waste is a relatively inexpensive source of protein and energy, with well-known nutritional and functional properties (Harjanti et al., 2012; Rahman et al., 2013a). Kim et al. (2012) reported that feeding total mixed rations containing 35% soya waste enhanced the dry matter (DM) intake and growth rate of cattle, without deterioration of meat quality. Ramsey (2012) reported that replacing commercial pellets with up to 20% soya waste in the diet did not compromise the post-weaning growth and performance of crossbred Boer goats.

It is well documented that nutritional supplementation influences the reproductive performance of goats (De Santiago-Miramontes et al., 2008; De Santiago-Miramontes et al., 2009). As the feed intake of goats is affected by soya waste supplementation (Rahman et al., 2014b), further research is needed to investigate the reproductive performance of animals using this agro-industrial by-product. Farmers are also interested in using soya waste as goat feed for long-term feeding, as its nutritive value is superior to that of other feeds (O'Toole, 1999). There is little information on the benefits of soya waste supplementation in goat production, and the eating behaviours of goats are more selective than those of other ruminants (Van Soest, 1982). Van Soest (1980) reported that goats in tropical areas select higher quality diets and have higher intakes than do sheep. In addition, Duncan et al. (1997) reported that the rumen of goats may harbour a microbial population which degrades anti-nutrients (e.g. oxalic acid) more rapidly than that of sheep. Therefore, this study investigated the growth rate response of goats to different proportions of dietary soya waste and the ability of soya waste to replace commercial compound feed without negatively affecting reproduction.

2. Materials and Methods

2.1. Study Site

This study was carried out in the Institute of Biological Sciences (ISB) mini-farm of the University of Malaya, Kuala Lumpur, Malaysia. All procedures and animal handling during the feeding experiments were conducted according to the guidelines of the Institutional Animal Care and Use Committee of the University of Malaya.

2.2. Experimental Procedure (Exp. 1 and Exp. 2)

Two experiments were carried out in this study. In experiment (Exp.) 1, 20 female Boer crossbred (Boer × local) goats weighing 12.1 ± 0.8 kg were used for 130 d. The goats were aged 9–12 months and were assigned at random to four dietary treatment groups according to their body weight (BW) and body condition scores (BCSs) (Russel, 1991). Groups A, B and C received soya waste at a rate of 0.5, 1.0 and 2.0% of BW/d (DM basis), respectively. Group D received soya waste *ad libitum*.

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