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Effect of Feeding Hydroponic Maize Fodder Replacing Concentrate Feed Partially on Milk Yield and Composition in Lactating Tellicherry Goats

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ABSTRACT: Inadequate availability of green fodder is a significant challenge in livestock farming, particularly in regions with limited arable land or during dry seasons. Hydroponic fodder production presents a promising alternative, offering the potential to increase green fodder availability through vertical farming techniques. This study investigated the impact of feeding hydroponically grown maize fodder as a partial replacement for concentrate feed in the diet of lactating Tellicherry goats. A 30-day feeding trial was conducted on twelve crossbred Tellicherry does in their second lactation. The does were randomly divided into two groups (T_1 and T_2) with no significant difference in average body weight (31 kg). T_1 received roughage from conventional green fodder and concentrate feed, while T_2 received hydroponically grown maize fodder replacing 10% of concentrate feed. The results revealed no significant differences (P>0.05) in body weight changes, milk yield (T1 - 889.28 ml/day *vs* T2 - 847.28 ml/day), milk fat content (T1 - 2.35% *vs* T2 - 3.05%), or milk protein content (T1 - 3.37% *vs* 3.32%) between the groups. These findings suggest that hydroponic maize fodder is a viable alternative and can replace up to 10% of the concentrate feed in the ration for lactating Tellicherry does.

Keywords: Goat, Hydroponic fodder maize, Lactation study, Milk yield, Milk composition.

INTRODUCTION

Small ruminants, such as goats, are a vital source of income and livelihood for many rural Indians. The Indian goat production industry has evolved from traditional extensive methods to more intensive systems, driven by market incentives. This trend is evident in the increasing interest among young entrepreneurs in developing expertise in goat farming (NAPG, 2018). However, scarce land and water resources often limit traditional fodder production. Hydroponic fodder production, a vertical farming method, offers a promising solution. It eliminates the need for land and reduces reliance on rainfall, making it particularly suitable for arid regions. Addition of HM instead of maize grains in goats' diet improves the growth performance and body weight gain (Roy *et al*. 2023). Feeding maize and barley hydroponic fodder to goats has improved diets digestibility, performance and growth, and Feed Conversion Ratio (Arif *et al.,* 2023). Goat milk provides various health benefits due to its unique composition of total solids, fat, protein, lactose, minerals, and vitamins. In addition to enhancing the physical and sensory qualities of dairy products, the lipids in goat milk are more easily digestible due to their smaller fat globule size and higher concentration of short- and medium-chain fatty acids (Turkmen, 2017). This study compared the nutritional value of hydroponically grown maize fodder as a partial replacement for concentrate feed in the diet of lactating Tellicherry goats. The objective was to evaluate its impact on goat lactation performance and its milk composition.

MATERIALS AND METHODS

The study was conducted for nutritional evaluation of hydroponic fodder maize replacing 10% of the concentrate feed of Tellicherry goats. The experiment was carried out at the Sheep and Goat Unit, Post Graduate Research Institute in Animal Sciences, Tamil Nadu Veterinary and Animal Sciences University following the standard ethical guidelines. Twelve cross-bred Tellicherry does, in the second lactation, having a mean body weight of 31 kg were selected for the experiment. The does were randomly distributed into two treatments (T_1 and T_2) in such a manner that each treatment group had six does with no significant variation in the mean body weight of does between the groups. The does were housed individually with standard floor, feeder and watering space. All the

animals were dewormed and dipped before the start of the experiment. The experiment was for 30 days. The does in T_1 were offered conventionally grown fodders (CO5 Hybrid Napier grass) as roughage whereas the does in T_2 were offered hydroponically grown fodder maize replacing 10 % of concentrate feed. Samples were analysed for crude protein, crude fibre, ether extract, total ash and nitrogen free extractives (AOAC, 2012). Milk compositions were measured using a milk analyser (Rai and Adhikari 2022). Data collected were analyzed using analysis of variance (ANOVA) using IBM SPSS statistics 20.

RESULTS AND DISCUSSION

Chemical composition of feed and fodder. The proximate composition (% DMB) of hydroponic maize fodder, conventional fodder and goat concentrate feed are presented in Table 1. The nutritive value of hybrid Napier CO(CN)5 grass was in agreement with the hybrid Napier grass harvested at 75 days as reported by Ramya *et al*. (2017). Mynavathi *et al*. (2021) reported moisture (%), CP (%), EE (%), CF (%), TA (%), NFE (%) as 79.24±2.77, 10.31±0.62, 1.54±0.11, 29.68±2.36, 17.23±1.08, 41.24±1.52 respectively of Co(BN)5 grass. The results are similar to that of the current research.

The nutritive values of hydroponic maize fodder were in accordance with the results of Rachel *et al*., (2020) and Borah *et al*. (2023). In the present study, the dry matter content of hydroponic maize fodder was found to be 20.82 per cent, this value was in agreement with results reported by Naik *et al*. (2014) as 18.30 per cent and lower than values reported by Thadchanamoorthy *et al*. (2012) as 26.07 per cent in hydrophonic fodder maize. The present value of crude protein was 11.73 per cent lower than findings reported by Thadchanamoorthy *et al*. (2012) as 16.54 per cent, Naik *et al*. (2013) as 13.30-13.6 per cent, Singh (2011) as 13.57 per cent and Naik *et al*. (2014) as 13.30 per cent in hydroponic maize fodder.

Lactation study in does. The milk yield and milk composition of does as influenced by feeding conventional fodders, hydroponic fodder maize and goat concentrate feed is presented in Table 2. In milk yield, there is no significant difference between the two treatment groups (conventional fodder + concentrate *vs.* conventional fodder + hydroponic maize + concentrate). This suggests that both diets can support similar milk production in lactating goats. In milk fat, the group fed a diet with hydroponic maize had a higher milk fat content (3.05%) compared to the control group (2.35%), this indicates that hydroponic maize might contribute to increased milk fat production. There was no significant difference in milk protein content between the two groups. The group fed hydroponic maize had a slightly higher milk carbohydrate content (2.96%) compared to the control group (2.53%), but the difference is not statistically significant. The group fed hydroponic maize had a lower milk ash content (0.58%) compared to the control group (0.75%). This might be due to the lower mineral content in hydroponic maize compared to conventional fodder. The group fed hydroponic maize had a significantly ($P<0.05$) higher energy value in their milk (52.57 Kcal) compared to the control group (44.63 Kcal). This aligns with the higher milk fat content observed in the hydroponic maize group.

Bhalerao *et al.* (2019) suggested that Osmanabadi goats fed a diet containing 40% hydroponic maize fodder exhibited the highest growth rates in terms of body weight gain, body length, chest girth, and wither height. Soniya *et al.* (2018) replaced concentrate feed in goats to an extent of 25% and 50% by hydroponically grown maize fodder. They reported that the dry matter intake, average daily gain and feed conversion efficiency did not show significant variations between the groups. Abd Rahim *et al.* (2015) found that supplementing dairy goats and sheep with barley green fodder resulted in a slight improvement in milk protein, milk fat and total solids. However, these improvements were not statistically significant in sheep.

Table 1: Proximate composition (% DMB) of hydroponic fodder maize, conventional fodder and goat concentrate feed (Mean* ± SE).

Proximate composition (% DMB)	Hydroponic fodder maize	Conventional green fodder	Goat concentrate feed
Dry matter	20.82 ± 0.06	21.05 ± 0.09	91.6 ± 0.24
Crude protein	11.73 ± 0.07	9.02 ± 0.07	14.20 ± 0.14
Crude fibre	10.86 ± 0.09	27.12 ± 0.23	6.15 ± 0.09
Ether extract	3.78 ± 0.04	2.15 ±0.08	3.12 ± 0.03
Total ash	2.94 ± 0.01	6.12 ±0.06	5.45 ± 0.18
Nitrogen free extract	70.69 ± 0.12	55.59 ± 0.13	71.08 ±0.43

*Mean of six replications

Table 2: Milk yield and milk composition of lactating does (Mean* ± SE) as influenced by feeding conventional fodders, Hydroponic fodder maize and Goat concentrate feed.

Sr. No.	Parameters	Conventional green fodders + Goat concentrate feed - T_1	Conventional green fodders + Hydroponic fodder maize + Goat concentrate feed - T_2
1.	Milk yield (ml/day) ^{NS}	889.28 ± 51.61	847.28 ± 51.09
2.	Milk Fat (%) ^{NS}	2.35 ± 0.29	3.05 ± 0.19
3.	Milk protein (%) ^{NS}	3.37 ± 0.30	3.32 ± 0.10
4.	Milk carbohydrate (%) ^{NS}	2.53 ± 0.73	2.96 ± 0.47
5.	Milk ash (%) ^{NS}	0.75 ± 0.23	0.58 ± 0.10
6.	Energy value (Kcal)	44.63^{a} ± 1.66	52.57^{b} ± 1.80

*Mean of six replications; NS - Non-Significant

CONCLUSIONS

This study investigated the potential of hydroponically grown maize fodder as a partial replacement for concentrate feed of goat. Based on the above findings, both feeding strategies offered similar milk yields. The hydroponically grown maize fodder can be effectively incorporated into the diets of lactating goats without compromising their milk production potential. There were no significant differences observed in milk yield, milk fat and milk protein content between goats fed hydroponic maize as a partial replacement (10 %) of concentrate feed. These results suggest that hydroponic fodder can be a valuable addition to livestock feeding strategies.

FUTURE SCOPE

Feeding studies in goats with other hydroponic fodders can be studied for feeding during feed scarcity.

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Conflicts of Interest. None.

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