IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 7 Ver. II (July. 2015), PP 24-30
www.iosrjournals.org

Nutritional benefit and economic value of feeding hydroponically grown maize and barley fodder for Konkan Kanyal goats

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Abstract : *The experiment was aimed to identify the nutritional benefit and economic values of feeding hydroponically grown maize and barley fodder for Konkan Kanyal goats. The experiment was conducted at the Instructional livestock farm, College of Agriculture, Dapoli-415712, District Ratnagiri (M.S.)-India. Eighteen growing male kids of 3-7 months old with initial body weight of 11.01±0.26 kg were grouped into six treatments (3 animals each) randomly to receive one of the treatment diets viz. T_0-Finger millet straw(FMS)100%; T_1- FMS + hydroponic maize fodder (HMF) 80:20; T_2-FMS + hydroponic barley fodder(HBF) 80:20; T_3-FMS + HMF 60:40; T_4-FMS + HBF 60:40; T_5-FMS + HMF + HBF 60:20:20% for 90 days feeding trial and 7 days metabolic trial period. After completion of 97 days, a significant ($P < 0.05$) improvement in DM intake was observed in T_5 (504.51 g/day) and T_3 (415.36 g/day) than control (317.54 g/day) and feed conversion efficiency was highest in T_3 (12.15%) and T_5 (10.56%) than T_0 (-0.47%) and highest body weight gain in T_3 (61.93g/day) and T_5 (56.70g/day) than T_0 (-1.17g/day) as well as economically profitable in T_3 (1306.10 Rs./goat) than T_0 (-697.71Rs./goat).Therefore, it can be concluded that feeding of hydroponically grown maize and barley fodder for growing goats increased the total DM intake, feed conversion efficiency, body weight gain and economically valid.*

Key words: *Body weight, DM intake, Economics, Feeding, Goats, Hydroponic fodder*

I. Introduction

Fodder production and livestock feeding are the two important aspects for the sustainability of products and productivity in animal husbandry [1]. Goats are very active foragers and voluntarily prefer browsing of tree leaves, brambles (shrubs) and grasses primarily composed of higher levels of plant protein and digestible nutrients during the growing season. Though, some of these consist of non-digestible fibrous matters that prevent utilization of nutrients present in the plants such as cellulose, tannins and hemi-cellulose that significantly inhibit growth and population of rumen bacteria [2]. Goats have an upright selecting and browsing habits along fence lines and the tip of grasses, shrubs and tree leaves isolated by goats are of high nutritional value [3]. India is deficient in 84% (concentrate feed), 88% (green feed), unfertile soil and degraded land holding, fragmented area under fodder cultivation and poor husbandry systems with imbalance feeding of total dry matter and nutrients intake causing inferior production [4]. Feeding goats according to their requirement and avoiding wastage is the basic point in exploiting the production potential for economic growth and sustainability since feed costs are the dominant parts of production that accounts more than 70% [1]. So, to resolve livestock's nutrient deficiency, supplementation of inferior quality roughages with hydroponic green fodder coming up as a practical approach for improving roughages utilization and digestibility. In India, a limited research has been done on feeding value of hydroponic fodder for small ruminants [5].Therefore; the study was aimed to determine the ″ Nutritional benefit and economic values of feeding hydroponically grown maize and barley fodder for Konkan Kanyal Goats″.

II. Materials And Methods

2.1 Fodder Procurement and Selection of Experimental Animals

Green fodder maize and barley were produced at a hydroponic fodder production unit of 30.3 x 8.2 x 6.0 ft length, height and width, respectively with 0.4% slope for adequate removal of excess water at the Dairy farm, Agriculture College, Dapoli, District Ratnagiri (M.S)-India. The racks were prepared by using bamboo stands with three shelves (1 ft^2 distance each) with capacity of 120 plastic hydroponic trays, sized 1.8 ft length × 1.0 ft width × 0.15 ft height equipped with semi-automated sprayer irrigation. The trays with holes at the base were to allow drainage of excess water from irrigation. Water used was tap water free from any additives. The temperature and humidity inside the green house was controlled through micro-sprinklers irrigation to maintain a range of 22 - 270^C temperature and 70-80% relative humidity. African tall Maize variety (Zea mays L.) and Barley (Hordium vulgari L.) were used and soaked for 12 hours in tap water. After 24-36 hours of germination in gunny bag, sprouted seeds were spread on the hydroponic tray at a rate of 500 gram for maize and 350 gram for barley per tray sized 2 ft^2 and 1.5-2 cm layer thickness. After eight days maximum growth period, 8 kg green maize and 9 kg green barley hydroponic fodder were produced per kg of dry seeds. The quality of hydroponic

fodder and biomass production was recorded daily before feeding the experimental animals. Eighteen healthy weaned Konkan Kanyal kids of 3 to 7 months of age were selected from the Instructional livestock farm, College of Agriculture, Dapoli and allocated to six treatments and three replications with comparable body weight of 11.01±0.26 kg using randomized block design experiment and kept for 90 days feeding trial and 7 days metabolic trial period. Kids were de-wormed using Ivermectin injection @1 ml/50 kg body weight and placed in well-ventilated pens disinfected with Cypermethrin-High Cis (0.5%) at the rate of 4 ml per 10 liter of water and surface sterilized using formaldehyde (5 %) for external parasite. A standard creep feed mixture by weight of Maize crumbs (50%), Rice bran (30%), Groundnut cake (10%), Jaggery (7%), Mineral mixture (2%) and Salt (1%) were prepared. According to NRC (1981) standard, the CP level was maintained at 15% and the animals were individually fed @200gm/day to cover their maintenance requirement besides to basal diet. The animals were offered clean drinking water *ad-lib* throughout the 90 days feeding trial. The basal feeds and hydroponic fodder were offered in two equal parts at 8.30 A.M and 15.00 P.M. and feeding treatments were as follows.

T_0- Finger millet straw (100%) ; T_1- Finger millet straw + Hydroponic maize fodder (80%: 20%); T_2- Finger millet straw + Hydroponic barley fodder (80%: 20%); T_3- Finger millet straw + Hydroponic maize fodder (60%: 40%); T_4- Finger millet straw + Hydroponic barley fodder (60%: 40%); T_5- Finger millet straw + Hydroponic maize + Hydroponic barley fodder (60%: 20%:20%). After preliminary feeding of 90 days, 7 days collection of faeces and urine was done using metabolic cages separately. Records of individual water offered, left over, faeces and urine excreted were maintained on 24 hours basis. Experimental feeds were sub- sampled to determine the nutrient composition of each 100g and oven-dried at 100 °C and ground to pass a 1-mm mesh screen sieve and analyzed nutrients content *viz* Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Crude Fibre (CF) and Nitrogen Free Extract (NFE) as per [6]. Data were statistically analyzed by the Randomized Block Design, using General Linear Model (GLM) procedure of SAS [7] and the difference and interaction between treatments were tested for significance using least significance difference (LSD).

III. Results And Discussion

3.1 Chemical Composition Of Feeds

In the present investigation, the total DM content of finger millet straw (FMS) was 92.45%. This value of DM was in close agreement to the results reported by [8] in finger millet straw as 92.5% and higher to results of [9] as 91.2% and [10] as 90.7% in pearl millet straw.

Table 1. Chemical composition of experimental diets (% DM basis)

	Experimental feeds		
Variables	**FMS**	**HMF**	**HBF**
Dry Matter (DM)	92.45	18.48	14.2
Crude protein (CP)	4.22	16.5	14.44
Ether extract (EE)	1.92	4.67	5.67
Crude fibre (CF)	27.41	12.46	13.5
Nitrogen free extract (NFE)	53.77	68.47	64.66
Total ash (TA)	5.8	2.3	3.4
Acid insoluble ash (AIA)	1.6	0.32	0.64
Calcium (Ca)	0.82	0.72	0.68
Phosphorus (P)	0.33	0.64	0.46

FMS: finger millet straw **HMF**: hydroponic maize fodder
HBF: hydroponic barley fodder

The CP content of FMS was 4.22% and in agreement to the findings of [11] as 4.3% in finger millet straw and the EE content of FMS was 1.92% and similar to the reports of [10] as 1.96% in pearl millet straw while CF level was 27.41% similar to the reports of [12] as 27.48% in finger millet straw. The NFE content of FMS was 53.77% and higher than results denoted by [12] as 50.01% in untreated finger millet straw. The TA and AIA of FMS were found as 5.8% and 1.6% and higher to the reports of [9] as 0.7%. The mineral Ca content of FMS was found as 0.82% and this result was in close agreement to the reports of [13] as 0.88% and P value as 0.33% and in line with the results of [10] in pearl millet as 0.33%. The DM content of maize hydroponic fodder was found as 18.48% and in close agreement with data's reported by [14] as 18.30% and higher than [15]in hydroponic barley fodder as 13.3% where as CP content was highly improved due to the increment in enzymatic activities of nutrients found in dry seed and found as 16.5% and agrees with data reported by [17] as 16.54% and higher than [18] as 13.30-13.6%, [16] as 13.57% and [14] as 13.30% in hydroponic maize fodder. The EE content observed in the present study was 4.67% and higher than values reported by [18] of 3.27-3.50%, [16] as 3.49% and [14] as 3.27% in hydroponic maize fodder and CF value was observed as 12.46% and comparable to [18] as 6.37-14.10% and lower than values reported by [16] as 14.07% in hydroponic maize fodder. The nitrogen free extract content of hydroponic maize fodder was found as 68.47% and comparable to

the reports of [18] as ranged from 66.70 to 75.32% and higher than data reported by [16] as 66.72% in hydroponic maize fodder. Value of total ash was found as 2.3% and increased as the maturity of the green fodder increased. This was similar to the reports of [18] as 1.75-3.80% where as AIA content obtained as 0.32% was in line with the findings of [18] as 0.30-0.57 and [16] as 0.33 in hydroponic maize fodder, respectively.The mineral Calcium present in the hydroponic maize fodder during the present investigation was 0.72%. The value was higher than results reported by [19] as 0.65% and 0.06, respectively while Phosphorus content was 0.64% which is higher than results reported by [19] in hydroponic maize fodder grown in potatoes peel waste mixture and date palm leaves as 0.24% and 0.1%, respectively.

The DM content of hydroponic barley fodder was discovered as 14.2% while moisture level was 85.8% and this finding of DM was higher than the reports of [15] in barley hydroponic fodder as 13.3% where as the crude protein content was 14.44% and in agreement with the reports of [20] in sprouted barley fodder as 11.38 - 24.9% and supported by the ideas of [21] stated as sprouting of grains affected the enzyme activity, changes in amino acid profile and increased the total protein which is highly digestible by most animals. The ether extract content observed in the present study was 5.67%. The ether extract content of hydroponic barley fodder was much higher than the values reported by [22], [15], [23] and [24], as 5, 3.86, 3.72 and 3.4%, respectively. The increase in CF (13.5%) content during sprouting of barley might be due to the synthesis of structural carbohydrates [25] and comparable to the results of [26] as 13.2% and at variance with 16.33% [23] and 14.3% [22] in hydroponic barley fodder. In the present investigation, the NFE content of hydroponic barley fodder was found as 64.66% and was higher than findings reported by [23] as 62.12% and [22] as 61.3% in hydroponic barley fodder. The value of total ash (3.4%) was closer to the findings of [24] where they reported 3.6% and Calcium present was 0.68% and higher to values denoted by [15] and [20], in hydroponic barley fodder as 0.36 and 0.17%, where as 0.46% Phosphorus found which is in line with the results of [22] and [26] in hydroponic barley fodder as 0.47% each.

3.2 Dm Intake, Mineral Intake And Water Consumption Rate

As Cleared In Table 2. The Average Daily DM Intake Of Growing Goats Was Highest ($P<0.05$) In T_5 (504.51g/D) And Followed By Fair Values Of T_2, T_1, T_3 And T_4 Than Lowest ($P>0.05$) Values Of T_0 (317.54g/D) While T_2, T_1, T_3 And T_4 Values Were At Par With Each Other. Highest Values Reflected In Treatment Group T_5 (504.51 G/Day) May Due To The Higher Palatability For Mixed Maize And Barley Hydroponic Fodder Followed By Maize Hydroponic Fodder And Barley Hydroponic Fodder Than Control Group T_0(Finger Millet Straw). The Daily Feed Intake Of Animal's Depicted, Complete Use Of Full Mat, White Roots And Green Shoots Since The Sprout Mat Is Completely Edible And Highly Nutritious And Agrees With The Concepts Of [24] Stated The Highest DM Intake Detected By Awassi Ewes Fed Barley Hydroponic Fodder And [27] In Male Calves Fed 22.8% Barley Hydroponic Fodder Supplement In Their Daily Ration Could Be Due To The High Palatability Of Barley Hydroponic Fodder.

The Present Findings Of Intake Per 100 Kg BW (Kg) Was Highest ($P<0.05$) In T_5 (3.33) (Mixed Feed Of Maize & Barley Hydroponic Fodder) Than Other Treatment Groups And Higher Than The Reports Of [14] As 2.05±0.10 In Lactating Cows Fed Maize Hydroponic Fodder. The Average Daily DM Intake Per Kg Metabolic Body Weight ($W^{0.75}$) Was Highest In T_5 (65.66g) Than Remaining Treatment Groups. This Was In Agreement With Findings Of [28] In Indigenous Sheep Fed Variety Of Pearl Millet (SDMV89004), Pearl Millet (NCD 2), Finger Millet (SDFM 63) And Finger Millet (25 C) Residues As 48.8, 66.8, 75.8 And 72.1g/Day, Respectively And Higher Than Findings Of [19] Where They Sprouted Maize On Date Palm Leaves And Potatoes Peel Waste Mixture And Fed To Desert Goats And Reported As 31.19, 29.99, 28.32, 28.5 And 29.75 G/Day In T_1, T_2, T_3, T_4 And T_5, Respectively. The Average Water Intake Was Significantly ($P<0.05$) Higher (564.70 Ml) In Goats Fed 20% Barley Hydroponic Fodder (T_2) Followed By Goats Fed 40% Mixed Maize And Barley Hydroponic Fodder (T_5) And 40% Barley Hydroponic Fodder (T_4) While T_4 And T_5 Were At Par. The Average Water Consumption Trend Of T_3 (440ml) Was Lower Followed At A Great Variance By T_0 (401.86 Ml/Day) And Lowest Value Of T_1 (323.00 Ml/Day). As Cleared In Table 2. The Amount Of Water Intake Was Lower In Treatments Fed 20% Maize Hydroponic Fodder (T_1) Substituted Ration May Be Due To The Animal's Water Recovery Potential From The Hydroponic Green Fodder Since The Maize Hydroponic Fodder Has High (81.52%) Water Content [27].

Table 2. DM intake, Water consumption and Mineral intake of experimental goats

Attributes	Treatments						±SE
	T_0	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	
Average DM intake(g)	317.54^{c}	425.42^{b}	425.97^{b}	415.36^{b}	404.49^{b}	504.51^{a}	16.5
Intake/ 100 kg BW(kg)	2.91^{bc}	3.10^{abc}	3.16^{ab}	2.76^{c}	2.76^{c}	3.33^{a}	0.12
Intake/kg $W^{0.75}$ B.W (g)	52.93^{c}	59.74^{abc}	60.56^{ab}	54.11^{bc}	53.92^{bc}	65.66^{a}	2.28
Water intake (ml)	401.86^{cd}	323.00^{d}	564.70^{a}	440.65^{bc}	494.01^{ab}	496.89^{ab}	27.97
Minerals intake (g/day)							
Calcium	2.70^{c}	3.50^{b}	3.51^{b}	3.39^{b}	3.28^{b}	4.04^{a}	0.14
Phosphorus	1.22^{d}	1.83^{b}	1.65^{bc}	1.82^{b}	1.62^{c}	2.18^{a}	0.06

Means with different superscripts differ significantly ($P<0.05$)

T_0: control (0% hydroponic fodder) T_1: 20% maize hydroponic fodder T_2: 20% barley hydroponic fodder T_3: 40% maize hydroponic fodder T_4: 40% barley hydroponic fodder T_5: mixed 20% maize: 20% barley, hydroponic fodder SE: standard error

Water intake of treatment T_0 (401.86 ml/day) was also depressed may be due to nutrient deficiency and lack of palatability of the basal diet (Finger millet straw) may enhanced lowest water intake of growing goats. The average Nitrogen intake was significantly higher in treatment T_5 (8.48) followed by T_1, T_2, T_3 and T_4 (with no significant difference among themselves) while the lowest value was recorded for T_0 (4.78). The higher Nitrogen intake recorded may due to higher content of crude protein intake and its digestibility in mixed maize and barley hydroponic fodder. This finding was close to the results reported by [10] in pearl millet grain fed to male castrated goats as 8.68 (corn), 9.80(Corn + pearl millet), 11.1(Pearl millet) g/day in 100% grain diet and higher to [29] in barley sprout grown on rice straw and Tamarix fed to growing Barki lambs reported as 2669.9, 2765.2, 3312.8, 3004.8 and 3200 mg/kg BW for T_1, T_2, T_3, T_4 and T_5, respectively. Goats fed T_1, T_5 and T_4 had highest ($P>0.05$) fecal and urinary Nitrogen compared with other groups and the total Nitrogen excreted was found as 1.76 (T_0), 0.82 (T_1), 0.72 (T_2), 0.85 (T_3), 1.12 (T_4) and 1.43 g/day in T_5, respectively. The results noticed by [19] as 26.18, 16.93, 13.22, 13.69 and 11.80 g/day in T_1, T_2, T_3, T_4 and T_5, respectively were higher than the present findings. The gross retention values of T_5 (7.05) was highly ($P<0.05$) significant than other treatment groups. However, difference among T_1, T_2, T_3 and T_4 was insignificant followed by the lowest value of T_0 (3.01). This finding was in line with the results reported by [28] as 4.70, 3.65, 6.76 and 9.23 in indigenous sheep fed variety of pearl millet (SDMV89004), pearl millet (NCD 2), finger millet (SDFM 63) and finger millet (25 C) residues, respectively and [19] as 3.36, 5.99, 5.37, 1.78 and 1.79 g/day in T_1, T_2, T_3, T_4 and T_5, respectively.

The average Calcium intake was significantly highest in T_5 (4.04 g/d) with no difference being observed among T_1, T_2, T_3 and T_4 (at par) and followed by the lowest values of T_0 (2.7 g/d).The average Calcium excreted was 0.95, 0.67, 0.60, 0.69, 0.78 and1.01 g/day in T_0, T_1, T_2, T_3, T_4 and T_5, respectively. Goats fed T_5 and T_1 had highest ($P>0.05$) fecal and urinary Calcium as compared with other treatment groups, where as no significant difference being observed among the results of T_1, T_2 and T_3 followed by T_4. The gross retention of Calcium was highest ($P<0.05$) in T_5 and T_2 followed by T_1, T_3 and T_4 while gross retention of Phosphorus was highest ($P<0.05$) in T_5 (1.39) than other treatments as well as values of T_1 and T_3 were at par followed by insignificant values of T_2 and T_4, consecutively. In conclusion, the intake and gross retention of minerals (N, Ca and P) was highest in T_5 than other treatment groups may due to high nutrients supply observed in mixed maize and barley hydroponic fodder.

Table 3. Intake, digestibility and Nitrogen, Calcium and Phosphorus (g/day) retention of growing goats fed the experimental diets

Attribute	Treatments T_0	T_1	T_2	T_3	T_4	T_5	±SE
Nitrogen utilization g/head/day							
Nitrogen Intake	4.78^{c}	6.85^{b}	6.26^{b}	6.75^{b}	6.58^{b}	8.48^{a}	0.24
Faecal Nitrogen	1.51^{a}	0.61^{c}	0.60^{c}	0.70^{c}	0.77^{c}	1.07^{b}	0.09
Urinary Nitrogen	0.25^{ab}	0.21^{ab}	0.12^{b}	0.15^{ab}	0.35^{a}	0.36^{a}	0.07
Total Nitrogen excreted	1.76^{a}	0.82^{cd}	0.72^{d}	0.85^{cd}	1.12^{bc}	1.43^{ab}	0.11
Nitrogen retention	3.01^{c}	6.03^{b}	5.40^{b}	5.90^{b}	5.46^{b}	7.05^{a}	0.22
Calcium utilization g/head/day							
Calcium Intake	2.70^{c}	3.50^{b}	3.51^{b}	3.39^{b}	3.28^{b}	4.04^{a}	0.14
Faecal Calcium	0.78^{a}	$0.48b^{c}$	0.37^{c}	0.48^{c}	$0.51b^{c}$	0.65^{ab}	0.05
Urinary Calcium	0.17^{b}	0.19^{ab}	0.23^{ab}	0.22^{ab}	0.28^{ab}	0.36^{a}	0.06
Total Calcium excreted	0.95^{a}	0.67^{b}	0.60^{b}	0.69^{b}	0.78^{ab}	1.01^{a}	0.08
Calcium retention	1.74^{c}	2.83^{ab}	2.91^{a}	2.70^{ab}	2.50^{b}	3.03^{a}	0.13
Phosphorus utilization g/head/day							
Phosphorus Intake	1.22^{d}	1.83^{b}	1.65^{bc}	1.82^{b}	1.62^{c}	2.18^{a}	0.06
Faecal Phosphorus	0.39^{b}	0.39^{b}	0.40^{b}	0.44^{b}	0.44^{b}	0.57^{a}	0.04
Urinary Phosphorus	0.15^{a}	0.16^{a}	0.23^{a}	0.20^{a}	0.15^{a}	0.22^{a}	0.07
Total Phosphorus excreted	0.54^{b}	0.55^{b}	0.63^{ab}	0.64^{ab}	0.59^{ab}	0.79^{a}	0.08
Phosphorus retention	0.69^{c}	1.28^{ab}	1.02^{b}	1.18^{ab}	1.03^{b}	1.39^{a}	0.09

Means with different superscripts differ significantly ($P<0.05$)

3.3. Body Weight Gain And Economics Of Experimental Goats

At the commencement of the study, the average initial body weights of animals in each treatment groups were 11.03, 11.01,11.01, 11.01,11.01and 11.03 kg and final body weights at the end of the experiment were denoted as10.92, 14.65,14.38,17.02,15.99 and 16.53kg in T_0, T_1, T_2, T_3, T_4 and T_5, respectively.

Table 4. Treatment wise goat's body weight gain and economic value

Attributes	Treatments T_0	T_1	T_2	T_3	T_4	T_5	±SE
No. of goats/treatment	3	3	3	3	3	3	-
Initial body weight (kg)	11.03^{a}	11.01^{a}	11.01^{a}	11.01^{a}	11.01^{a}	11.03^{a}	0.26
Final body weight (kg)	10.92^{d}	14.65^{bc}	14.38^{c}	17.02^{a}	15.99^{ab}	16.53^{a}	0.49
Total BW Gain (kg)	-0.11^{d}	$3.64b^{c}$	3.37^{c}	6.01^{a}	4.99^{ab}	5.50^{a}	0.48
Daily BW gain(g)	-1.17^{d}	37.56^{bc}	34.74^{c}	61.93^{a}	51.44^{ab}	56.70^{a}	4.93
Total feed intake (kg) /head/97days (DM basis)	42.29^{c}	49.74^{abc}	46.88^{bc}	49.41^{abc}	56.32^{a}	52.09^{ab}	2.69
Feed conversion efficiency (%)	-0.47^{d}	7.32^{c}	7.19^{c}	12.15^{a}	8.83^{c}	10.56^{ab}	0.90
Economics							
Net profit/goat (Rs.)	-697.71	506.05	386.53	1306.10	908.40	1078.48	-
Benefit: cost (B:C) ratio	-0.02	1.6	1.5	2.6	2.1	2.2	-

Means with different superscripts differ significantly ($P<0.05$)

g: gram, %: per cent a,b,c- different superscripts differ significantly.

As clearly described in Table 4, the average daily B.W gain of animals in each treatment groups were -1.17, 37.56, 34.74, 61.93, 51.44 and 56.70 g/day while after the completion of the experiment, the total B.W of goats was recorded as -0.11, 3.64, 3.37, 6.01, 4.99 and 5.50 kg in T_0,T_1,T_2,T_3,T_4 and T_5, respectively. The performance in BW gain was highly significant in T_3 (61.93 g/day) and T_5 (56.70 g/day) than other treatment groups and followed at a significant difference by fair values of T_4 (51.44 g/day) and at variance with T_1 (37.56) and T_2 (34.74) and lowest values of T_0 (-1.17 g/day). The advancement in the BW gain was ranged from 34.74 to 61.93 g/day as compared to goat in control treatment that lost BW at the rate of -1.17 g/day. The impact of supplementation was relatively more pronounced for goats supplemented with higher proportion of maize and barley hydroponic fodder. The higher performance in the BW gain of animals supplemented with 40% hydroponic fodder could be due to the ability of the supplements to supply necessary nutrients. This was in line with the concept of [14] coined out hydroponic sprouts are rich sources of bioactive enzymes and contain a grass juice ingredients that improves the performance of livestock and [30] who reported, the increase in weight gain of lambs received barley sprouts may attributed to enhancing of microbial activity in the rumen. Similar researchers also noticed as, the juice factor in maize hydroponic fodder has been reported to improve the performance of birds and animals up to 8% [31] and [30] reported feeding of hydroponic barley mixed with poor quality hay to drought master steers gained 1.01 kg/head/day as well as [8] in male lambs fed finger millet straw substituted with atella (traditional brewery residue), noug seed (Guizotia abyssinica) cake and mixtures of atella and noug seedcake and reported average daily BW gain as -23.3(T_1), 51.1(T_2), 56.7(T_3), 63.3(T_4) and 60 g/day for T_5, in ascending order.

The present finding was higher than the results reported by [27] in male calves fed hydroponic green fodder and obtained 200 g /day body weight gain and [32] who found no difference in cattle fed sprouted or non sprouted grain. The daily weight gain in treatment T_0 was loss by -1.17 g/day may due to low protein content and less palatability with finger millet straw. This was in agreement with the reports of [9] in pearl millet straw fed for growing goats and depressed by -25.4 g/day and [8] in finger millet straw (Control) fed to lambs loss body weight by -23.3 g/day. The average total feed consumption of each treatment group in the entire 97 days was recorded as 42.29 (T_0), 49.74 (T_1), 46.88 (T_2), 49.41 (T_3), 56.32 (T_4) and 52.09 kg in (T_5) and amount of feed required for 1.0 kg body weight gain (kg) in goats fed 40% maize hydroponic fodder (T_3) was insignificantly minimum followed by T_5 and T_4 and at a great variance with T_0(-44.46 kg) while feed conversion efficiency data shown as -0.47, 7.32, 7.19, 12.15, 8.83 and 10.56% in T_0,T_1,T_2,T_3,T_4 and T_5 treatment group, respectively. Statistically, the data on total feed consumed and feed conversion efficiency described, value of T_3 was significantly higher in both parameters as compared to all other treatment groups and T_5 value was at variance with T_4, T_2, T_1, and T_0, respectively. These findings were in agreement with data coined by [29] in barley sprouts grown in rice straw and Tamarix fed to growing Barki lambs and reported 7.82(T_1), 6.54(T_2), 6.00(T_3), 4.83(T_4) and 6.61%(T_5) as well as [24] in sprouted barley grains with olive cakes fed to ewes were significantly highest ($P<0.05$) in feed conversion efficiency might be due to the higher crude protein and energy contents of supplements in providing absorbed nutrients and by enhancing the treated straw nutrients utilization. The average total cost observed during the experimental period was 684.26, 806.65, 809.52, 828.83, 859.31 and 878.23 Rs. in T_0, T_1, T_2, T_3, T_4 and T_5, respectively. The cost of feeding was higher for the animals received 40% hydroponic green fodder in their daily ration than those received 20% hydroponic green fodder and control (finger millet straw).This may due to the variation in amount of feed intake (palatability) and feed cost. The total net benefit detected during the experimental period (97days) was described as T_3 (1306.10), T_5 (1078.48), T_4 (908.40), T_1 (506.05), T_2 (386.53) and T_0 (-697.71Rs.) in descending order. This clearly indicated that, the total dry matter intake, per cent feed conversion efficiency and total body weight gain were highly integrated and the cost benefit ratio was also noted as 2.6, 2.2, 2.1, 1.6, 1.5 and -0.02 for T_3,T_5,T_4, T_1, T_2 and T_0 in descending order throughout the experimental period. Therefore, feeding of finger millet straw + hydroponic maize and barley fodder at a proportion of 60:40 for growing goats (T_3, T_5, and T_4) was highly beneficial and economically valid. Agreement results were displayed by [19] in sprouted maize fodder fed to desert goats and reported, environmentally friendly as well as reduced cost of feeding and [18] revealed increase in milk yield by 0.5-2.5 litres/animal/day and earned net profit of Rs. 25-50 due to feeding of hydroponic fodder to their dairy animals while superior to the findings of [14] in hydroponic maize fodder feeding to lactating cows and increased digestibility of nutrients and milk production and earning a net profit of Rs. 12.67 per cow daily and [33] gaining net profit of Rs.10/cow/ day. In conclusion, feeding of hydroponic maize and barley fodder to growing goats increased total dry matter intake, per cent feed conversion efficiency, total body weight gain and economically valid.

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