

NUTRITIONAL EFFECT OF MULBERRY (*MORUS ALBA*) LEAVES AS SOLE RATION OF ADULT RABBITS.

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SUMMARY : Nutritive value of mulberry leaves as a sole ration for adult rabbits was determined by feeding mulberry leaves to 10 New Zealand White rabbits (1540 ± 62g, 35 weeks old). In DM mulberry leaves had CP 22.13, EE 3.90, CF 5.90, Ash 13.35, NFE 54.72, NDF 36.35, ADF 31.52, Ca 3.30 and P 1.43 %. Except EE, all nutrients had fairly good digestible coefficients. The DM intake was 68.52g/day, 5.30g/100g body weight and

59.1g/kg W^{0.75}. Average daily intake of digestible crude protein (DCP) (11.2 g) and of digestible energy (175 kcal) was adequate for maintenance of body weights of rabbits. In each 100g DM, mulberry leaves had 16.38 ± 0.45g DCP for rabbits. Calculated DE/kg DM was found to be 2580 kcal. The results suggested that the mulberry leaves can be used as single feed for adult rabbits and may help in economic rabbit production.

RESUME : Valeur nutritive des feuilles de mûrier (*Morus alba*) employées comme seul aliment chez le lapin adulte.

La valeur nutritive des feuilles de mûrier comme seul aliment pour des lapins adultes a été étudiée en nourrissant avec ces feuilles 10 lapins Néo-Zélandais Blancs d'un poids vif moyen de 1540 ± 62g, âgés de 35 semaines. La matière sèche des feuilles de mûrier était composée de Protéines 22,13 , Matières grasses 3,90 , Cellulose brute 5,90 , Cendres 13,35 , ENA 54,72 , NDF 36,35 , ADF 31,52 , Calcium 3,30 et Phosphore 1,43 % . Hormis les matières grasses tous les composants avaient un excellent coefficient de digestibilité.

La matière sèche ingérée par jour était de 68,52g, soit 5,30g pour 100g de poids vif et 59,1g/kg de poids métabolique. L'ingéré moyen journalier de protéines digestibles (11,15 ± 0,52g) et d'énergie digestible (175 kcal) étaient capables de couvrir les besoins d'entretien des lapins. Dans 100g de matière sèche de feuilles de mûrier les lapins ont trouvé 16,38 ± 0,45g de Protéines brutes digestibles. L'énergie digestible par kilo de matière sèche a été estimée à 2580 kcal. Ces résultats permettent de penser que les feuilles de mûrier peuvent être utilisées comme seul aliment pour des lapins adultes et contribuer à un production économique de lapins.

INTRODUCTION

Rabbitry is a developing enterprise in India and is attracting the attention of farmers and scientists. It is established fact that rabbits are good converters of fibrous plant material into lean meat and they certainly can tolerate substantial fibre level in their diet (CHEEKE, 1987). It has been shown by LALL *et al.* (1985), that the use of different leaf meals helps to curtail the costly items such as cereal grains and protein concentrate from diet of rabbits. It is indicated that the nutrient supply, (at least for maintenance of rabbits), can be managed by offering good quality forages as a single food. Mulberry (*Morus alba*) grows on variety of soils and its production in India has been increased largely due to sericulture. Thus, mulberry leaves are available abundently. Nutritive value of mulberry leaves for ruminants is known (MAYMONE *et al.*, 1960 ; JAYAL and KEHAR, 1962). Mulberry leaves are readily eaten by rabbits and few reports on use of mulberry leaves as supplement to the rabbit diets are

also available (SINGH *et al.*, 1984 ; SINGH and NEGI, 1986). However, their nutritive value for rabbits is not known except that determined by difference. The present investigation, was therefore, undertaken to evaluate nutritive value of mulberry leaves for rabbits as a sole ration.

MATERIALS AND METHODS

Ten adult New Zealand White rabbits of laboratory strain, thirty five weeks old, weighing 1335 to 1670g with an average of 1540 ± 62g of body weight maintained on balanced concentrate diet, were housed individually in separate metallic cages having arrangements for feeding, watering and feces collection. The November lapped, fresh tender mulberry leaves were collected daily at 8.00 hours and offered to the experimental rabbits for *ad libitum* consumption. A digestion trial of 6 days duration was

Table 1 : Proximate and % digestibility of mulberry leaves (Dry matter basis).

	Chemical composition		Digestibility coefficients		
	Offered	Residue	Range	Means	± SE
Dry matter	33.6	55.35	54.74 - 70.85	63.93	2.63
Crude protein	22.13	15.26	67.62 - 80.11	74.03	2.05
Ether extract	3.90	3.65	2.22 - 8.56	5.96	1.28
Crude fibre	5.90	6.70	48.90 - 68.67	59.11	3.23
NFE	54.72	61.25	60.95 - 79.51	70.17	3.01
Ash	13.35	13.14	-	-	-
NDF	36.35	29.42	32.22 - 57.90	45.45	4.35
ADF	31.52	26.12	36.56 - 63.70	51.83	4.64
Hemicellulose	4.83	3.30	-	-	-
Calcium	3.30	3.45	-	-	-
Phosphorus	1.43	1.45	-	-	-

conducted at the end of four weeks of experimental period. Representative samples of mulberry leaves fed, residue left and feces were collected and analysed for proximate principles per AOAC (1985) and cell constituents were determined according to GOERING and VAN SOEST (1970).

RESULTS AND DISCUSSION

The experimental rabbits readily consumed mulberry leaves and leftovers were very little indicating that the leaves were highly palatable. Rabbits preferred biting the leaf stalk first and continued to eat remaining whole leaf. The interesting feature observed during this experiment was reduced size and darker color of fecal pellets compared to that observed during maintenance of those rabbit on balanced concentrate diet. The chemical composition (Table 1) of leaves offered and residue left was more

or less similar indicating that there was not much of the selective feeding. The crude protein (CP) and NFE contents were higher and ether extract (EE), crude fibre (CF) and ash were lower than those reported by SINGH *et al.* (1984). The higher and lower value respectively for CP and CF observed in this experiment was due to use of tender leaves.

The CP and NFE digestibilities (Table 1) were quite high. The former being responsible for a fairly high value for digestible crude protein (DCP). An unusually low digestibility (6%) of EE was a striking feature. This might be attributed to the larger proportion in mulberry leaves of ether extractable matter such as chlorophyll and other pigments of which the nutritive value is questionable. Secondly, it has been shown by MAYNARD and LOOSLI (1956) that herbivorous animals digest the fat less completely owing primarily to the protective action of cellulose surrounding fat which serves as a barrier against digestive action. Similarly reduced digestibility of

Table 2 : Body weights, plane of nutrition of rabbits and nutritive value of mulberry leaves.

	Range	Means	± SE
Initial body weight (kg)	1.30 - 1.60	1.44	0.04
Final body weight (kg)	1.33 - 1.67	1.54	0.06
Metabolic body size (kg W ^{0.75})	1.21 - 1.46	1.38	0.04
Dry matter intake (g/day)	59.00 - 76.71	68.52	4.41
Dry matter intake/100g body weight (g)	4.76 - 6.47	5.30	0.31
Dry matter intake/kg W ^{0.75} (g)	53.0 - 69.5	59.1	0.28
Crude protein intake (g/day)	13.97 - 17.42	16.04	0.75
DCP intake (g/day)	9.93 - 12.46	11.15	0.52
<i>Nutritive value (% Dry matter basis) of mulberry leaves :</i>			
Digestible Crude Protein	14.96 - 17.72	16.38	0.45
Digestible energy (Mcal/kg DM)*	2.29 - 2.82	2.58	-

* Calculated as per FEKETE (1985)

crude fat due to high contents of waxes, resins and other similar substances in crude fat of foliage is a common phenomenon. Very low digestibility (4%) of EE from mulberry leaves have also been reported in ruminants by SEN *et al.* (1978). The overall digestibility values observed for various nutrients except EE were similar to the values reported by SINGH and NEGI (1986) in Angora rabbits fed mulberry leaves as supplement to concentrate based diets.

The daily average intake of DM and DCP (Table 2) was more than the recommendations for tropical climate (DESHMUKH *et al.*, 1990, 1991). The nutrient requirement tables suggested by CHEEKE (1987) indicate that, for maintenance purpose, the diet of rabbit should contain 12 to 13 % CP and 2100 to 2200 kcal of DE/kg. Thus, if we consider a rabbit of 1.50kg body weight consuming about 100g of daily feed, it will need 12 to 13g CP and 210 to 220 Kcal. of DE for maintenance. In the present study the daily average intake of 16g CP seemed to be quite adequate. However, the daily DE intake works out to be 175 kcal. This indicates slightly lower intake of energy than recommendations by CHEEKE (1987). Nevertheless, adequate intake of nutrients was indicated by maintenance of body weight (Table 2). Moreover, slight increase in body weight by about 0.1kg during experimental period *i.e.* 3.57g/d, confirms that the energy intake was sufficient. Secondly, the recommendations of CHEEKE (1987) are more suitable for temperate zone. Therefore, those requirements might be higher than actually needed for tropical climate.

The nutritive value of mulberry leaves for rabbits in terms of digestible crude protein and digestible energy was fairly good and was comparable to other good quality forages such as lucerne and berseem.

Thus, this short study indicated that the use of mulberry leaves as sole ration for adult rabbits can supply adequate nutrients for maintenance in tropical climate and may be helpful for growth and other productive purposes. However, long term feeding trials are needed to concrete recommendations. The mulberry leaves do have potential to replace concentrate part of the rabbit diets and are definitely helpful in economic rabbit production.

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