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# MILK YIELD, NUTRIENT COMPOSITION AND ACCEPTABILITY OF MILK FROM WEST AFRICAN DWARF (WAD) GOAT (*Capra Hircus*)

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**Target Audience:** Ruminant nutritionists, dairy farmers, research scientists

## ABSTRACT

**The yield, nutrient composition and acceptability of milk from free-range lactating West African Dwarf (WAD) goats were investigated. Results indicated mean milk yield per 12 hour day/doe to be 0.14kg, equivalent to 0.3 litre. Nutrient composition (%) was moisture 82.5, protein 4.6, fat 5.0, lactose 6.9, total solids 17.5, solids non-fat 12.0 and ash 0.66. Sensory evaluation showed equal acceptability rating between goat milk and reconstituted full fat cow milk, served traditionally in pap. The results reflected goat milk as an acceptable, nutritious and easily affordable food supplement.**

**Key words:** Goat, milk, composition.

## DESCRIPTION OF PROBLEM

Protein malnutrition is an evasive public health problem in Nigeria. Clinical report (1) showed that a close relationship exists between nutrition and infection. Poor nutritional status lowers the body's resistance to infection. The level of malnutrition occasioned by lack of, or insufficient protein in the diet of Nigerians is growing rapidly and is a major problem facing the country. Cow milk is exorbitant and often unavailable to the average, resource -poor Nigerian family whose bulk of diet comprises carbohydrates. Goats which are commonly reared, particularly in smallholdings as meat animals, could provide milk to supplement the diets of adults and especially children, who are most vulnerable to the ravaging effects of malnutrition.

Although the milk composition of the Red Sokoto goat (2) as well as the confined West African Dwarf goat (3) has been determined, there is paucity of data regarding milk from the free-range West African Dwarf (WAD) goats.

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The aim of this study was to provide some information on the yield, nutrient composition and acceptability of milk from free-range WAD goats.

## MATERIALS AND METHODS

### Animals and Husbandry

Five adult does carrying advanced pregnancies (adjudged to be about 4-4½ months) were purchased from a herd of goats resident at Chokocho village and transported to the University Teaching and Research Farm. Aged 2 to 2½ years, each of the animals weighed about 25kg. As free-ranging goats, they had no specific feeding regimen except that they were allowed out to graze and to scavenge domestic wastes during the day. They were kept indoors at night and presented some common browses such as *Alchomea Cordifolia* and *Costus after*, as well as plantain leaves and cassava peels. At the University, the does were kept in individual pens measuring 3.0m x 5.4m with 2m concrete half wall. Cotton twines about 0.5cm thick carrying browses and forages were tied to the roof structures at positions deemed to be suitable and attainable by all the goats. Towards the end of the presumed gestation length, the does were watched more closely for signs of parturition. Milk collection was started the day after parturition up to week (wk) 6.

### Milk Procedure

The kid was separated from the doe prior to milk collection at 0800h each day. All milking utensils, hands of the milker and udders were thoroughly washed with clean warm water and then with dried and clean towels. Each doe was hand-milked for about 20 minutes by expressing milk from the teats into a clean plastic cup. Thereafter, the kids were allowed access to their mothers. Colostrum was collected during the first six days after parturition. The milk collected from each doe was bulked and stored in a cabinet at -18°C till required for analysis. Each bulked sample was warmed to 40°C to melt the butterfat and then cooled to 20°C for chemical analysis. Milk sample for microbiological analysis was taken directly to the laboratory as soon as obtained.

### Milk Yield Estimation Using Traditional Method

Milk volume was measured once weekly from the second week, using a clean sterile milk can of 125ml capacity which weighed 170g when filled with milk. The kid was separated from the doe from 020h the previous day till 008h to allow milk build-up. Milking was done by manual expression of the udders until they became decongested and limp. The kid was then re-united with the doe and let off for the day.

### Traditional Method of Milk Pasteurisation

The simulated traditional method of milk pasteurisation did not require the use of hot water bath, thermometer, test-tubes and other standard laboratory equipment but rather utilised locally obtainable materials such as tripod,

aluminium cooking pots, water, aluminium bowls, firewood and silver coated kitchen spoon. The filtered milk (using a clean calico cloth) was poured into clean aluminium bowls with lids and then steamed in a pot of boiling water. The milk was continuously stirred and as it became hot and creamier with large bubbles, the firewood was dispersed and the pot tightly covered with its lid for a brief period to allow sufficient heat penetration into the milk. Part of the pasteurised milk was removed for microbiological test and analysis of nutrient composition.

**Analytical Procedure**

Protein (N x 6.38), fat, ash, and moisture were analysed according to standard methods (4), while carbohydrate (lactose), total solids and solids-non-fat contents were calculated by difference.

**Sensory Evaluation (Scale Response Method)**

A panel of twenty (20) untrained judges made up of farmers and school children was constituted. A preference test was carried out for goat milk and cow milk served differently in sweetened pap, using a five point hedonic scale. Means were computed and separated by the least significant difference test and the statement of significance made at the 5% probability level.

## RESULTS AND DISCUSSION

Table 1 shows the mean milk yield of 0.14 kg (0.3*l*) per doe per 12 h day and 1.01 kg (2.2*l*) per doe per week for the five goats. The general notion that the West African dwarf goat is a poor dairy animal is supported by the low milk yield observed in the present study. Although this small volume of milk output is comparable to that of the Red Sokoto goat (0.5kg per doe/day) found in the northern part of Nigeria (5), it is far below the daily production rates of temperate goat breeds such as the Saanen and the British Alpine which produce as much as 4.2kg and 4.7 kg/doe/day respectively (6).

The very poor milk yield of the WAD goats is not the least surprising since no concerted efforts have been made to confine and improve the genetics, feeding and health status of these free - ranging animals (7). On the other hand, the temperate breeds have been highly selected over time and systematically improved as dairy goats (8). In order to ameliorate the milk yield of WAD goats raised under the free-range system, it would be necessary to provide supplemental feeding of concentrates every morning before the animals are let out to graze, and at night when they are usually kept indoors. Certain local herbs are believed to have lactogenic properties (9), therefore some traditionally identified browse plants are currently being tested in this regard (7). The amount of milk produced seemed to increase linearly with advancing lactation. Although the increase was not significant ($p > 0.05$), it was observed until the 5th week when it began to decline.

**Table 1: Milk Yield of Free - range WAD Goats (Capra hircus) with Advancing Lactation**

| Period | Mean Weekly Yield | |
|---|---|---|
| | Kg | Litre |
| 2nd Week | 0.96 | 2.8 |
| 3rd Week | 0.98 | 2.1 |
| 4th Week | 1.19 | 2.6 |
| 5th Week | 0.99 | 2.1 |
| 6th Week | 0.97 | 2.6 |
| Mean Weekly Yield | 1.02±0.04 | 2.4±0.14 |
| Mean (12 h) Daily Yield | 0.14±0.01 | 0.3±0.03 |

The values for moisture, protein, fat, carbohydrate (lactose), total solids, solid-non-fat and ash of goat milk are shown in Table 2. The values showed a gradual decrease with advancing lactation, while moisture content showed a slight increase. Based on the observations of this study, the WAD goat milk protein is relatively higher (4.8%) than cow milk protein (3.5%) as well as the milk protein of some temperate breeds of goats (10). The finding would constitute a rich attraction of toddlers, pregnant and lactating mothers whose protein requirements exceed those of the average healthy adult, if the WAD goats could produce sufficient quantities of milk. Another special attribute of goat milk is its high proportion of smaller fat globules which are more readily digested that cow milk (10).

**Table 2: Nutrient Composition of Milk from Free-Range WAD Goat (Capra hircus)**

| | Moisture % | Protein | Fat | Lactose | TS | SNF | Ash |
|---|---|---|---|---|---|---|---|
| | Gram per milk sample | | | | | | |
| Colostrum | 82.0 | 6.1 | 6.5 | 4.7 | 18.0 | 11.5 | 0.70 |
| 2nd Week | 81.2 | 5.6 | 6.3 | 5.5 | 18.1 | 11.8 | 0.68 |
| 3rd Week | 81.7 | 5.3 | 6.0 | 6.3 | 18.3 | 12.3 | 0.68 |
| 4th Week | 81.6 | 4.3 | 5.5 | 8.0 | 18.4 | 12.9 | 0.67 |
| 5th Week | 83.0 | 4.0 | 5.5 | 7.3 | 17.0 | 12.0 | 0.65 |
| 6th Week | 84.1 | 3.6 | 4.9 | 7.2 | 15.9 | 11.0 | 0.61 |
| | 82.3±0.44 | 4.8±0.37 | 5.8±0.24 | 6.5±0.51 | 17.6±0.40 | 11.9±0.27 | 0.67±0.01 |

TS = Total solids
SNF = Solid -not-fat

The results of sensory evaluation are shown in Table 3. There was no statistically significant difference in acceptability between pap served with goat milk or cow milk (reconstituted, full fat). However, the test between pap served without any milk and either of the two sources of milk showed a

significant difference at the 5% level. The sensory panel result showed equal ratings for the goat milk and instant commercial cow milk served in pap. Goat milk can therefore replace cow milk without any resentment of taste.

Table 4 summarises the bacterial count of the milk from the free range WAD goats. Pasteurisation resulted in an effective decrease of the counts from 6222 cfu/ml to 193 cfu/ml. The decrease in microbial counts from an initial 6222 cfu/ml to 193 cfu/ml following pasteurisation suggests that the traditional method of milk pasteurisation is equally effective (12). This would provide a safe nourishing food supplement for especially resource-poor families who cannot afford the "luxury" of sophisticated industrial pasteurisation.

**Table 3: Sensory Evaluation of Milk from the WAD Goat**

| Samples | Taste | General acceptability |
|---|---|---|
| Goat milk with pap | 2.5[b] | 2.3[b] |
| Cow milk with pap | 2.1[b] | 2.1[b] |
| Pap without any milk | 3.6[a] | 3.8[a] |

Taste panel scores were 1 to 5 where:

1 - excellent
3 - borderline
5 - very poor
a,b - means followed by different superscripts on the same vertical column are significantly different.

**Table 4: Bacterial count of WAD goat milk pasteurised by the traditional method (cfu/ml)**

| Plate Number | Bacterial Count | |
|---|---|---|
| | Raw Milk | Pasteurised Milk |
| 1 | 6,800 | 192 |
| 2 | 5,980 | 199 |
| 3 | 5,886 | 190 |
| Mean values | 6,222±38.1 | 193±1.18 |

SEM ± Standard error of mean

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