

Effect of multiple births on Jamunapari goat milk quality under field and farm rearing conditions

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Abstract

Milk composition of mammalian species varies widely with reference to genetic, physiological, nutritional factors and environmental conditions. Milk samples were collected from Jakhrana goat under the farm and field rearing condition. Field samples were collected from different villages. A total of 736 milk samples were collected from field and farm rearing condition 191 single (field 42 and farm 149), twins 480 (field 56 and farm 424) and triplets 65 (field 07 and farm 58) milk samples. The results laid down in Table indicated that the specific gravity in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins and triplets birth was found to be 1.0304 ± 0.00042 and 1.0310 ± 0.00035 , 1.0294 ± 0.00036 and 1.0306 ± 0.0004 and 1.0280 ± 0.00038 and 1.0296 ± 0.00038 , respectively. Fat percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins and triplets birth was 4.37 ± 0.049 and 4.52 ± 0.048 , 4.58 ± 0.043 and 4.69 ± 0.044 and 4.70 ± 0.045 and 4.86 ± 0.045 , respectively. Protein percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins, and triplets 3.39 ± 0.026 and 3.25 ± 0.033 , 3.32 ± 0.029 and 3.20 ± 0.035 and 3.28 ± 0.028 and 3.12 ± 0.038 , respectively. Lactose percentage in the milk of Jakhrana goat breed under field and farm rearing samples in single, twins and triplets births was 4.41 ± 0.020 and 4.36 ± 0.012 , 4.50 ± 0.012 and 4.41 ± 0.010 and 4.56 ± 0.015 and 4.49 ± 0.013 , respectively. The results laid down in Table indicated that the ash percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins, and triple birth was 0.76 ± 0.0070 and 0.74 ± 0.0080 , 0.78 ± 0.0072 and 0.76 ± 0.013 and 0.80 ± 0.0079 and 0.78 ± 0.011 respectively. The effect of multiple births on total solid was highly significant at 1% level of significance. Multiple birth effect on solids-not-fat content was significant in all births milk samples under field and farm rearing conditions at 5% level of significance. Multiple births had conspicuous effects on milk quality of goats under study.

Key words : Jakhrana, goats, Effect of season, milk quality, field and farm etc.

Introduction

Goat which was known as "Wet nurse of infant" in the United Kingdom and "Poor man's cow" in India

was the first animal to be domesticated (Zeuner, 1963). Goat milk contains less lactose than cow's milk, so is less likely to trigger lactose intolerance. The milk is naturally homogenized since it lacks the protein agglutinin. The milk also has a more similar makeup (percentage of fats, etc.) to human milk than

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cow's milk. For these reasons, goat milk may be recommended for infants and people who have difficulty digesting cow's milk. It is well established that milk yield in goats is influenced by litter size and lactation number. Milk yield is proportional to the mammary alveolar surface area (Richardson, 1973). According to Hayden et al. (1979) the extent of mammary development depends in part on the number of foeto-placental units and on placental mass. A large proportion of Boer goat kids (90 %) are the result of multiple births which impose further nutritional stress on the ewe. This is evident in the relatively slow growth rates of suckling kids under extensive grazing conditions (Raats, 1982). The aim of this study was to study the influence of age and litter size on the milk production of Boer goat ewes. Multiple kidding generally occurs in goats. Twins and triplets should not be grouped with singles since stronger kids often rob milk from usually smaller multiple-birth kids. Groups should contain kids of similar age. In 2011, there were 8 cases of stillbirth. Most of these stillbirths were due to triplet and quadruplet kidding. This is consistent with a study conducted by some scientists, which showed that type of birth has a significant effect on kid mortality at birth. In single kidding, increase in mortality rates at birth may be due to kidding difficulties. The mortality rate after birth in multiple kidding can also be attributed to maternity capabilities and management practices (Lai et al. 2012) Males grew faster than females, and singles were faster in growth than twins or other multiples, both before and after weaning (Abdullah et al. 2012).

According to the 18th livestock Census 2007, the number of Jakhrana goat in the country is 1,953,046 that are fairly widespread in the states of Rajasthan and Haryana. These goats are comparatively larger than other breeds of goat. Body coat is predominantly black with white spots on the ears, and the muzzle is short and lustrous. The face line is straight with a narrow and slightly bulging forehead. This breed is well known for its milk

potential averaging a daily yield between 2 to 5 liters. The milk has a relatively higher fat content (5.06%), SNF (8.60%) and protein (3.70%) (Verma et al., 2004). These goats show good prolificacy and kidding (up to 90%) during June–July and October–November.

The global goat population currently stands at 921 million, of which over 90% are found in developing countries. Asia is home to about 60% of the total world goat population and has the largest goat breed share of 26%. Goats play a vital socio-economic role in Asian agriculture, particularly for resource-poor people living in harsh environments. Non-cattle milk accounts for approximately 15% of the total milk consumption by humans worldwide. Asia contributes approximately 59% to world goat milk production and Asians demand for animal products, fueled by increasing populations and growing disposable incomes, is increasing at a high rate. In Asia concerted efforts are needed to address issues facing goat farmers and the goat milk processing industry to fully exploit the potential of goats (FAO, 2012). The aim of this study was to study the effect of multiple births on the milk quality under field and farm rearing conditions

Material and Methods

The study was conducted at the central institute for research on goats, Makhdoom, Mathura; under the division nutrition feed resources and products technology for the study of farm rearing condition. Milk samples were collected from Jakhrana goat under the farm and field rearing condition. Field samples were collected from different villages. The Jakhrana breed milk samples were from villages of Mathura and Agra, India (27° 10'N, 78° 00' E and 169 m above MSL). Geologically the Institute is situated under Yamuna river semi arid soil. Temperature ranges between 6° C in winter to as high 45° C in summer. Annual average rainfall is a period of 50 - 60 days. Monsoon arrives in mid July and remains active till mid September Agnihotri and Rajkumar (2007). The methodology used was an adaption from Bourbouze (1995) and Alvarez Funes and Paz Motola (1997).

Experimental goats and management

A total of 736 milk samples were collected from field and farm rearing condition 191 single (field 42 and farm 149), twins 480 (field 56 and farm 424) and triplets 65 (field 07 and farm 58) milk samples.

Sample collection and analysis

Goat milk samples were collected from research farm and field properly at varied environmental conditions and seasons (summer, rainy and winter). The composition was determined by Electronic Milk Analyzer (Lactoscan SA, Milkatronics Ltd. Bulgaria) before the analysis of each sample was thawed at 30°C to melt the fat and then cooled to 20°C.

Statistical Analysis

Data were recorded as means \pm standard deviation to compare and analyze using randomized block design, ANOVA and Fisher's least significant difference procedure in software SAS Institute Inc. (1990). A 95% level of significance was used for all analyses.

Result and Discussion

The results laid down in Table indicated that the specific gravity in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins and triplets birth was found to be 1.0304 ± 0.00042 and 1.0310 ± 0.00035 , 1.0294 ± 0.00036 and 1.0306 ± 0.0004 and 1.0280 ± 0.00038 and 1.0296 ± 0.00038 , respectively. It is observed from table that specific gravity content was significantly greater in farm samples than field rearing samples in all births. The highest specific gravity was recorded in single birth in milk samples either field or farm rearing conditions. The statistical analysis also revealed that the effect of multiple births on specific gravity was significantly different in Jakhrana goat breed milk under field and farm rearing conditions at 5% level of significance.

Fat percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins and triplets birth was 4.37 ± 0.049 and 4.52 ± 0.048 , 4.58 ± 0.043 and 4.69 ± 0.044 and 4.70 ± 0.045 and 4.86 ± 0.045 , respectively. These data suggested that fat content was significantly greater in farm samples than field rearing samples in all

multiple births. The highest fat percentage as recorded in triplets birth in milk samples either field or farm rearing conditions. Analysis of variance for the effect of multiple birth variation on fat percentage in the milk of Jakhrana goat breed under field and farm rearing conditions was also determined. The effect of multiple births was highly significant in milk samples at 1% level of significance.

Protein percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins, and triplets 3.39 ± 0.026 and 3.25 ± 0.033 , 3.32 ± 0.029 and 3.20 ± 0.035 and 3.28 ± 0.028 and 3.12 ± 0.038 , respectively. The statistical analysis revealed that protein content was significantly greater in field samples than farm rearing animal in all multiple births. The highest protein percentage was recorded in single birth either field or farm rearing conditions. The ANOVA Table on these data also revealed that the effect of multiple births on protein content was significantly different in all births for milk samples under field and farm rearing conditions at 1% level of significance. It is further observed that highest protein % was found in single birth under field or farm rearing in the milk samples. Our results on multiple births effect on fat and protein % in the milk of Jakhrana goat breed are in fair agreement with the findings of Ciappesoni *et. al.* (2004) for Czech White Shorthaired goat milk and Olechnowicz and Sobek (2008) for Polish White Improved goat milk. Who has reported average daily milk production was 3.09 kg with 3.72% of fat and 2.84% of protein.

Lactose percentage in the milk of Jakhrana goat breed under field and farm rearing samples in single, twins and triplets births was 4.41 ± 0.020 and 4.36 ± 0.012 , 4.50 ± 0.012 and 4.41 ± 0.010 and 4.56 ± 0.015 and 4.49 ± 0.013 , respectively. Our results further showed that highest lactose content was found in triplet's birth under field as well as farm rearing conditions. It is observed from the ANOVA Table that the multiple birth effect on lactose content was significantly different in Jakhrana goat breeds either field or farm rearing conditions at 1 and 5% level of significance, respectively. The results laid down in

Table 1. Effect of multiple births on the percentage of milk components of Jakhrana goats under field and farm rearing conditions.

| Sl. No. | Component of goat milk | Field | Farm | Overall Average | Test of signific. | Table value (t) 5% 1% |
|---------|---|--|---|--|-------------------------------|-----------------------|
| 1 | Sp. Gravity (i) Single (ii) Twins (iii) Triplets | 1.0304±0.00042 1.0294±0.00036 1.0280±0.00038 | 1.0310±0.00035 1.0306±0.0004 1.0296±0.00038 | 1.0305±0.00038 1.030±0.00038 1.029±0.00038 | 2.031+ 1.0984+ 2.069+ | 1.960 2.576 |
| 2 | Fat (i) Single (ii) Twins (iii) Triplets | 4.37±0.049 4.58±0.043 4.70±0.045 | 4.52±0.048 4.69±0.044 4.86±0.045 | 4.445±0.049 4.635±0.043 4.78±0.045 | 4.364++ 2.601++ 4.687++ | 1.960 2.576 |
| 3 | Protein (i) Single (ii) Twins (iii) Triplets | 3.39±0.026 3.32±0.029 3.28±0.028 | 3.25±0.033 3.20±0.035 3.12±0.038 | 3.32±0.030 3.26±0.032 3.20±0.033 | 4.63++ 3.164++ 5.068++ | 1.960 2.576 |
| 4 | Lactose (i) Single (ii) Twins (iii) Triplets | 4.41±0.020 4.50±0.012 4.56±0.015 | 4.36±0.012 4.41±0.010 4.49±0.013 | 4.385 ± 0.016 4.455 ± 0.011 4.525 ± 0.014 | 2.563+ 4.437++ 3.541++ | 1.960 2.576 |
| 5 | Ash (i) Single (ii) Twins (iii) Triplets | 0.76±0.0070 0.78±0.0072 0.80±0.0079 | 0.74±0.0080 0.76±0.013 0.78±0.011 | 0.745±0.007 0.770±0.009 0.795±0.009 | 1.986+ 1.98+ 2.059+ | 1.960 2.576 |
| 6 | TS (i) Single (ii) Twins (iii) Triplets | 12.95±0.030 13.17±0.032 13.33±0.031 | 12.87±0.036 13.06±0.039 13.24±0.039 | 12.81±0.033 13.115±0.035 13.285±0.035 | 4.312++ 5.219++ 4.443++ | 1.960 2.576 |
| 7 | SNF (i) Single (ii) Twins (iii) Triplets | 8.53±0.052 8.59±0.054 8.63±0.056 | 8.35±0.050 8.37±0.051 8.38±0.052 | 8.44±0.051 8.48±0.053 8.505±0.055 | 8.86++ 11.26++ 12.62++ | 1.960 2.576 |

++=Significant at $p < 0.05$

+=Significant at 5% level of significance

Table indicated that the ash percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins, and triple birth was 0.76±0.0070 and 0.74±0.0080, 0.78±0.0072 and 0.76±0.013 and 0.80±0.0079 and 0.78±0.011 respectively. It is observed from table that ash content was significantly greater in field samples than farm rearing samples in all births. The highest ash percentage was recorded in triplet's birth in milk samples field and farm rearing conditions. The statistical analysis also revealed that the effect of multiple births on ash content was significantly

different in Jakhrana goat breed milk under field and farm rearing conditions at 1% level of significance.

Perusal of laid down in Table indicated that the total solids percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins and triple birth was found to be 12.95±0.030 and 12.87±0.036, 13.17±0.032 and 13.06±0.039 and 13.33±0.031 and 13.24±0.039, respectively. There data suggested that total solids content was significantly greater in field rearing samples than farm rearing samples in all multiple births. The highest total solid percentage was recorded in triplets births either field or farm rearing conditions. It is due to low production performance

of these samples. Analysis of variance for the effect of multiple birth variation on total solids percentage in the milk of Jakhrana goat breed milk under field and farm rearing conditions was also determined in our study. It is further observed from table that the effect of multiple births was highly significant at 1% level of significance.

Solids-not-fat percentage in the milk of Jakhrana goat breed under field and farm rearing conditions in single, twins and triplets birth was found to be 8.53 ± 0.052 and 8.35 ± 0.050 , 8.59 ± 0.054 and 8.37 ± 0.051 and 8.63 ± 0.056 and 8.38 ± 0.052 , respectively. The statistical analysis revealed that the solids-not-fat content was significantly greater in field samples than that of farm rearing samples in all births. The highest solids-not-fat content was observed in triplet's birth samples under field or farm rearing samples. The ANOVA Table on these data revealed that the multiple birth effect on solids-not-fat content was significant in all births milk samples under field and farm rearing conditions at 5% level of significance.

Our results on multiple births effect on milk quality in the Jakhrana goat breed are in fair agreement with the findings of J.G. Raat (1983) who has reported that the differences in average milk yield between single- and twin-suckled ewes were 29 %,

8 % and 4 % for the two-, four- and six- year-old ewes respectively. The corresponding differences between single- and triplet- suckled ewes were 54 % and 18 % for the two- and six- year-old ewes respectively. The effect of litter size on milk production decreased as lactation advanced. This effect was more marked in the old ewes. Although there appears to be a minor trend for the percentages of protein, fat, total solids and lactose to decrease with an increase in litter size, this effect was not significant. The groups of older ewes produced milk with lower protein content and higher percentages of fat and total solids. These differences were also not significant. The group averages for protein, fat, total solids and lactose was ranged between 3, 91 % and 4, 48 %; 6, 38 % and 9, 41 %; 15, 81 % and 19, 20 % and 4, 58 % and 4, 92 % respectively. Estimates of the amounts of milk, protein and fat available to the individual Boer goat kids, based on the present data, are presented in Table. It is clear that the total amount of milk, protein and fat available per kid, decreased with an increase in litter size. There are more nutrients available per kid from the older ewes than from younger ewes with the same number of kids. The total amount of milk available to individual twins and triplets is not more than 65 % and 51 % respectively of that available to single kids.

Table 2. ANOVAs for the effect of multiple births on goat milk under field and farm rearing conditions.

| Contents for the source of variance | Variance ratio | | F- Value table | |
|-------------------------------------|----------------------|----------------------|----------------|-------|
| | Field | Farm | 5% | 1% |
| Specific Gravity | 4.341 ⁺ | 4.082 ⁺ | 3.00 | 4.61 |
| Fat | 7.064 ⁺⁺ | 8.113 ⁺⁺ | 3.00 | 4.610 |
| Protein | 5.366 ⁺⁺ | 6.098 ⁺⁺ | 3.00 | 4.610 |
| Lactose | 4.623 ⁺⁺ | 4.119 ⁺ | 3.00 | 4.610 |
| Ash | 5.916 ⁺⁺ | 6.118 ⁺⁺ | 3.00 | 4.610 |
| TS | 11.325 ⁺⁺ | 14.936 ⁺⁺ | 3.00 | 4.610 |
| SNF | 3.116 ⁺ | 3.214 ⁺ | 3.00 | 4.610 |

The results of the present investigation on fat content of Jakhrana goat breeds are in consonance with the observation of Goonewardene et al., (1999) who has

reported in the first year of investigation, higher daily milk production was recorded and milk in that year was characterized by significantly higher fat and

lactose contents and lower protein content. A decrease in protein content was recorded in milk of goats from multiple births. Milk produced by goats from single and multiple births did not differ significantly in terms of either fat or protein contents. In goats rearing a high number of kids, higher milk protein and lactose contents were recorded. The level of milk yield is influenced by environmental conditions connected with the calendar year. A decrease in the daily milk production with progressing lactation and increasing of fat and protein contents, and a decrease of lactose content in milk were observed. No significant effect of the type of birth of goats, as well as the number of born and weaned kids on qualitative parameters of goat milk yield and the was confirmed. Goats in their fifth and further lactations produce over 15% less milk in comparison with the flock average and the milk contains nearly 67% (Hayden et al. 1979).

Conclusion

The specific gravity and fat percentage in the milk of Jakhrana goat breeds under farm rearing conditions was significantly higher than that of field rearing conditions. Multiple births had conspicuous effects on milk quality of goats under study.

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