SURVEY OF KETOSIS IN LACTATING WADARA COWS


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Abstract
Milk samples collected from 203 lactating Wadara cows at various periods of lactation from April to August, 1999, in Borno State, Nigeria, were negative for ketones by Rothera’s test. The protein, lactose, fat and total solids contents of 30 milk samples were 12.5 ± 6.7mg/ml, 12.3 ± 2.0mg/ml, 3.2 ± 1.2% and 12.9 ± 2.8%, respectively. The milk contents were not influenced by the period of lactation. The milk fat content was higher (p<0.05) at the end of dry season (May) than rainy season (August), but no significant (p>0.05) variations occurred in the milk protein and lactose contents between the two seasons. It was concluded that ketosis was not prevalent among the cows but higher milk fat content at the end of dry season probably suggested under-nutrition associated with increased fat mobilization.

Introduction
The cattle population in the semi-arid Sahel region of northern Nigeria is threatened by inadequate feed supply due to long dry seasons (October to June or July). Inclement weather, inadequate water supply for drinking and intercurrent infections often reduce voluntary feed intake of grazing livestock (Igbokwe, 1997). Supplemental feeding is sometimes provided by few livestock owners engaged in semi-intensive management, but the cost outlay is always not encouraging.

Wadara breed is the most predominant cattle breed in Borno State, Nigeria (Famure, 1985). Although Wadara cows may not compare favourably with most European dairy breeds in terms of milk yield, the milk they produce obviously supplements the protein supply in the foods of rural households. The plane of nutrition of dairy cows is important for optimal milk production. When food intake is reduced, milk yield drops (McDonald et al, 1995). Metabolizable energy intake is the main factor controlling protein content of milk. The milk protein fraction is reduced due to gluconeogenesis from amino acids which maintains the lactose content within narrow limits of variation (Castle and Watkin, 1979). Ketolactia and increased fat content of milk are consequences of low metabolizable energy intake with the associated mobilization of fat metabolism (Castle and Watkin, 1979).

Undernutrition of Wadara cows may predispose them to ketosis, especially during the early period of lactation when prevalence of ketosis has been reported in dairy cows (Anderson and Emmanuelsen, 1985). No report was available to suggest that ketosis ever occurred among Wadara cows. The present research attempted survey for ketone bodies in the milk of Wadara cows as well as evaluate other milk contents.
Materials and Methods

Collection of cow milk samples

Between April and August 1999, samples of fresh cow milk were collected from 203 sedentary, lactating Wadara cows, aged 3-5 years and at various periods of lactation in Maiduguri, Jere and Biu Local Government Areas of Borno State, Nigeria. The cows were milked at 6-8am before the animals were allowed on range or at 4-6pm after grazing. The samples were collected after the calves had stimulated milk let-down by brief suckling.

Biochemical analyses

Rothera's test and quantitative ketone estimation by titration as described by Dumm and Shipley (1946) were carried out on all fresh milk samples. Thirty milk samples (n=9 in May, dry season; n=21 in August, rainy season) were further analysed for milk components. Each sample was cleared by the addition of 5% CaCl₂ solution and centrifuged.

Table I: The lactation periods and the number of cow milk samples tested for ketosis

<table>
<thead>
<tr>
<th>Lactation period (months)</th>
<th>Number of cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1-2.9</td>
<td>70</td>
</tr>
<tr>
<td>3.0-7.9</td>
<td>49</td>
</tr>
<tr>
<td>8.0-12.9</td>
<td>49</td>
</tr>
<tr>
<td>13.0-18.0</td>
<td>35</td>
</tr>
</tbody>
</table>

after which the supernatant was used to determine concentrations of lactose as reducing sugar by Asatoor and King's method (Asatoor and King, 1954), total proteins by Biuret method (Layne, 1959) and fat by Rosse- Gottlied method (AOAC, 1975).

Statistics

The data were summarized as mean ± standard deviations and the differences between means were assessed by the two-way analysis of variance (ANOVA) (Singha, 1992).

Results

All the milk samples (n=203) were negative for ketones and were not titrated for quantitative estimates. Table I shows the number of milk samples (one per cow) tested within various lactation periods. The highest number was tested in the early lactation period.

The composition of the milk in relation to the lactation period is summarized in Table II. The protein, lactose, fat and total solids of the milk did not vary significantly (P>0.05) during the different periods of lactation. Effect of season on the milk composition is presented in Table III. The protein and lactose contents of the milk collected in the dry season (May) did not vary significantly (P>0.05) from those

Table II: Effect of period of lactation on the composition of cow milk

<table>
<thead>
<tr>
<th>Lactation period (months)</th>
<th>No of cows</th>
<th>Protein (mg/ml)</th>
<th>Lactose (mg/ml)</th>
<th>Fat (%)</th>
<th>Total solids (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1-2.9</td>
<td>13</td>
<td>17.1±2.8a</td>
<td>18.3±1.7a</td>
<td>3.4±0.9a</td>
<td>13.1±0.1a</td>
</tr>
<tr>
<td>3.0-7.9</td>
<td>6</td>
<td>13.1±3.8a</td>
<td>15.3±1.6a</td>
<td>2.3±1.6a</td>
<td>14.3±4.7a</td>
</tr>
<tr>
<td>8.0-12.9</td>
<td>6</td>
<td>11.1±2.2a</td>
<td>17.5±2.0</td>
<td>2.7±1.3a</td>
<td>14.3±2.8a</td>
</tr>
<tr>
<td>13.0-18.0</td>
<td>3</td>
<td>13.5±8.5a</td>
<td>18.4±2.5a</td>
<td>4.1±1.0a</td>
<td>12.4±2.2a</td>
</tr>
<tr>
<td>Overall mean</td>
<td></td>
<td>12.5±6.7</td>
<td>12.3±2.0</td>
<td>3.2±1.2</td>
<td>12.9±2.8</td>
</tr>
</tbody>
</table>

a Means are not significantly different (P>0.05).
Table III: Effect of season on the composition of cow milk

<table>
<thead>
<tr>
<th></th>
<th>Season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry (9)*</td>
</tr>
<tr>
<td>Protein (mg/ml)</td>
<td>11.5±4.5a</td>
</tr>
<tr>
<td>Lactose (mg/ml)</td>
<td>17.2±1.6a</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>4.5±1.5a</td>
</tr>
</tbody>
</table>

a, b Means with different superscripts are significantly.

* Number of samples in parenthesis/

collected in the rainy season (August). However, the milk fat content was higher (P<0.05) during the dry season than the rainy season.

Discussion

Ketolactia was not detected in any of the lactating cows, suggesting the absence of ketosis in the animals. Bovine ketosis usually occurs in heavily fed, high producing dairy cows, poorly fed cows (starvation) or in cows with other primary diseases affecting appetite (Baird et al, 1968; Smith et al, 1972; Blood and Radostits, 1989). The absence of ketosis, in this study, might be because the Wadara cows were not heavy milkers. It should be noted that Nigerian breeds of cows (including Wadara) have not been considered dairy cows (Schmidt and Van Vleck, 1974), because of their low milk yield. Moreover, the cows were apparently healthy and not suffering from any primary disease conditions capable of predisposing them to ketosis. Undernutrition that was expected during the dry and early rainy season did not seem to predispose the cows to ketosis.

Evaluation of composition of milk of the cows at various periods of lactation showed no effect of lactation on milk composition. In dairy cows, milk fat content falls, whereas milk lactose content rises until two months after calving, when the fat content increases and the lactose content decreases during the remainder of the lactation period (Castle and Watkins, 1979). The period of lactation did not affect milk contents in this study, because the yield was probably not high enough to influence the milk composition as observed in high producing dairy cows. The high milk lactose content at the early lactation period which is derived from plasma glucose and gluconeogenic metabolism, is the factor responsible for ketotic tendency when dietary metabolizable energy is deficient (Castle and Watkins, 1979). Ketosis was reported to occur most frequently during this early lactation period (3-6 weeks post-calving) (Baird et al, 1968) and prevalence could be up to 8.9% (Anderson and Emmanuelson, 1985). The largest number of samples was tested for ketolactia in the post-calving period, 0.1-2.9 months, when predisposition to ketosis was expected to be highest.

In the dry season, vegetation is sparse and of low quality, and grazing animals are usually undernourished (Igbokwe and Rabo, 1994). When feed intake is reduced, milk fat content rises due to reduced milk yield (McDonald et al, 1995) and mobilization of fats (Castle and Watkins, 1979). This may explain the higher fat content of milk of our cows in the dry than in the rainy season. The milk protein and lactose concentrations were not affected by season. An increase in the plane of nutrition results in increase in milk yield and protein content, but milk lactose content is rarely altered (Schmidt and Van Vleck, 1974; McDonald et al, 1995). Our observation suggested that the increasing plane of nutrition in the early rainy season (with the emergence of green pasture) did not affect milk protein content.
The composition of Wadara cow’s milk was comparable with that of dairy cow’s milk in Europe, at least in fat and solid contents. The milk fat content of European dairy cow breeds was 3.6-4.9% (Castle and Watkins, 1979) whereas the Wadara cow milk has 3.2±1.2% of fat. The mean total milk solids of 12.5% reported for dairy cows in Europe (Castle and Watkins, 1979) did not differ from the total milk solids of 12.9±2.8% in the Wadara cows. Thus, the ability to produce good quality milk, along with the possible trait of resistance to ketosis, may be genetic strength available for exploitation in Wadara cows in breeding programmes.

In conclusion, ketosis was not prevalent among the Wadara lactating cows because of lack of ketolactia, but there was increased milk fat in cows lactating in the dry season.

References


