Dairy production in urban and periurban area of *Extrême-Nord* in Cameroon: milk yield and microbial contamination

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ABSTRACT: Local dairy production plays a very important role in developing countries in order to promote the health status of the population. To determine the weight and the hygiene level of milk products, available in the market of the capital city of the *Extrême-Nord* region, a survey on the milk yield and microbial contamination was developed. Milk samples from 89 dairy farmers in the urban and periurban area of Maroua, divided in 11 groups, matching the *Groupe d'Initiative Commune* (groups of common interest - GICs), were analyzed for yield, pH value, temperature, density and microbial contamination. The belonging to the different groups of farmers had a statistical influence on milk quantity and density, according to the feed availability. As well the season had an influence on all the quality and quantity parameters. The time and season of delivery affected significantly the milk quality, instead no influence was attributed to the microbial contamination. The results of this survey showed an adequate qualitative level of the local milk production, which may be improved with a higher feeding system and with a better organisation of the delivery.

Key words: Tropical dairy production, Milk yield, Milk contamination, Food security.

INTRODUCTION – In developing countries, dairy products play a very important role in food security and food safety. In Africa, many problems have hindered local milk production making dried milk imports from western countries necessary. Milk production should be improved to allow these countries to unburden themselves from their economic ties and to reduce health problems related to the use of dried milk (FAO, 2000). This work is a part of a developing project, called "Support and Implementation Project for the Milk Chain in the Urban and Periurban Area of Maroua, Cameroon", which aims to improve local milk production and milk quality, available in the market of Maroua, the capital city of the *Extrême-Nord* region (Cameroon). The purpose of this survey is the evaluation of the milk yield and microbial contamination to determine the relevance and the hygiene level of local dairy production.

MATERIAL AND METHODS – After a training course carried out to improve the understanding of milking procedures, milk samples from 89 farmers in the urban and periurban area of Maroua were analyzed. Farmers belonged to 11 groups matching the *Groupe d'Initiative Commune* (groups of common interest - GICs) involved in the project; each GIC owned herds with a similar number of milking cows (n=8±10). Every day milk samples were tested for quantity, using a measuring can, and pH value was evaluated with a pH-meter Checker® Hanna Instruments. Furthermore temperature and density was registered daily with the lacto-thermo-densitometry (Colaver™), while microbial evaluation was carried out twice a month (using Petrifilm™ Plates). Samples were incubated for 24h ± 2h at 35°C ± 1°C to estimate the total microbial count (CFU/ml). Samples were collected from the 1st of May to the 31st of August to enable consideration of both dry and rainy season. A statistical analysis of variance was performed using three models. Records on milk quantity and quality (pH value, temperature and density) were evaluated and the effect of each factor was expressed as deviation from the overall mean: $Y_{ijkh} = \mu + \alpha_i + \beta_j + \alpha_i(\beta_j)_k + \varepsilon_{ijkh}$; where μ = estimate of the overall least square means; α_i = fixed effect of the ith GIC (i = 1,2...11); β_j = fixed effect of the jth season (j = 1,2; dry and rainy); $\alpha_i(\beta_j)_k$ = hierarchical effect of GIC nested within season; ε_{ijkh}

= random error. The effect of delivery time on milk quality (pH value, temperature and density) was studied and the effect of each factor was expressed as deviation from the overall mean: $Y_{ijkh} = \mu + \alpha_i + \beta_j{}^*\gamma_k + \varepsilon_{ijkh}$, where μ = estimate of the overall least square means; α_i = fixed effect of the ith GIC (i = 1,2...11); $\beta_j{}^*\gamma_k$ = interaction effect between hour (j = 1,2…9; from 08.00 to 10.00 a.m. divided in classes of 15 minutes each) and month of delivery (k = 1,2…4; from May to August); ε_{ijkh} = random error. Milk microbial evaluation was calculated and the effect of each factor was expressed as deviation from the overall mean: $Y_{ijkh} = \mu + \alpha_i + \beta_j + \alpha_i(\beta_j)_k + \varepsilon_{ijkh}$ where μ = estimate of the overall least square means; α_i = fixed effect of the ith GIC (i = 1,2...10); β_j = fixed effect of the jth season (j = 1,2; dry and rainy); $\alpha_i(\beta_j)_k$ = hierarchical effect of GIC nested within season; ε_{ijkh} = random error. In the last model, 10 on 11 GIC were considered because not enough data was recorded for one of the groups. The GLM procedure of the SAS (SAS/STAT, 2000) statistical package was used. Pearson correlation (SAS/STAT, 2000) was applied to verify pH variation in relation with microbial contamination.

RESULTS AND CONCLUSIONS – Milk quantity showed a high level of significance ($P \leq 0.001$) in relation with the GIC. The farmers living in the urban area (GIC *Findirdè*) had a higher income than the farmers in the periurban area. The GIC *Findirdè* recorded the highest milk yield, as the greater purchasing power of these farmers allowed them to use more qualified integration of the pasture for the animals (Cantàfora, 2006). Milk temperature and pH value were not affected by GIC, while density varied significantly. In fact, the GIC had a significant effect on the milk density ($P \leq 0.01$) (Table 1), according to the differences in quality and quantity of supplementary feed (Ueda, 1999). The integration of the cow's diet affected the milk composition more than other characteristics (Meyer and Denis, 1999). Milk quantity and pH value ($P \leq 0.001$), temperature and density ($P \leq 0.01$) were significantly influenced by the season; the different temperature and the consequent availability of high quality feed for the animals in the two seasons affected the qualitative parameters and the milk yield (Wilson *et al.*, 1987). Considering GIC into season as hierarchical effect, the milk quantity (Figure 1) showed a high level of significance ($P \leq 0.001$): the relation between nutritional levels and milk yield was evident in different seasons and in different GICs (milk production of GIC *Findirdé* was three times higher than the others). The hierarchical effect slightly influenced ($P \leq 0.05$) also the pH value, on the contrary milk temperature and density did not show any differences.

Figure 1. Milk yield (litres/GIC/day) for the different season in 11 GIC.

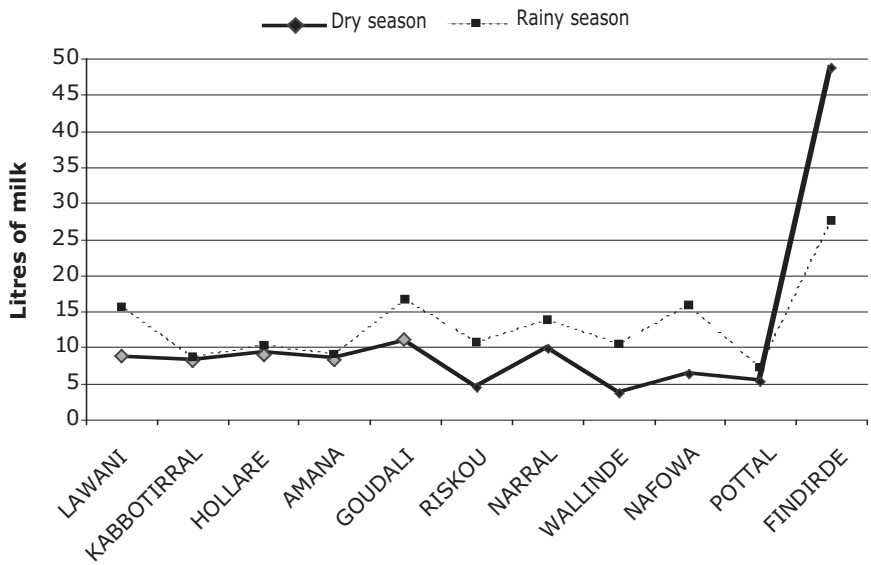
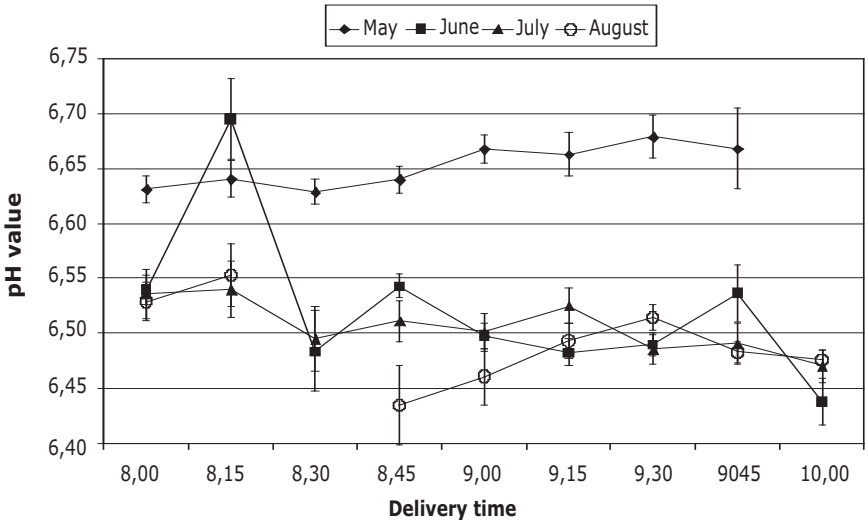


Figure 2. The effect of different hour/month interaction on the pH value (least square means ± SE).



Considering the milk quality in relation to the time and the season of delivery, only pH value was significantly influenced (P£0.001) by GIC and by the interaction between hour and month of delivery (Figure 2).
In this context, the qualitative parameters was significantly influenced by the season, as expected, because of the varied climate and different levels of animal feed availability. In May, the pH value of milk was nearby to the optimal pH value (6.65) and there was no correlation between pH value and delivery time. Regarding June, July and August, at rising delivery time a lower pH value was recorded. Correlation between pH value and microbial contamination did not show a significance (P=0.5030); nonetheless a correlation was observed where at rising microbial contamination levels a lower pH value in milk was recorded. Microbial contamination of milk was not influenced by GIC or season as well as by the hierarchical effect of the GIC into the season. It is important to notice that the milk brought to the laboratory did not need to be rejected, selling it on the market of Maroua. In conclusion, the results of this survey show an adequate qualitative level of the local milk production, which may be improved with a higher feeding system and with a better organisation of the delivery.

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