DAIRY HERDS STUCTURE AND HUSBANDRY PRACTCES IN DAIRY FARMS IN KHARTOUM STATE, SUDAN*

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المستخلص

صممت هذه الدراسه لمعرفة تركيبة القطيع و نظم الرعايه فى ستين مزرعة ألبان مختلفه بمدن ولاية الخرطوم الثلاثة الخرطوم، الخرطوم بحرى وام درمان (20 مزرعة من كل مدينة). وأعتمد في هذه الدراسة أسلوب الاستبيان المكتوب والمقابلات المباشرة مع اصحاب المزارع.

لوحظ وجود فرق معنوي في المستوى التعليمي لأصحاب المزارع ($P< 0.01$) اذ وضح ارتفاع فى نسبة الأمية لأصحاب المزارع التابعة لمدينة الخرطوم (35%) بينما بلغت في الخرطوم بحري وأم درمان 15% و 30% على التوالي. وقد لوحظ أيضاً عند مقارنة مزارع المدن الثلاث وجود فروقات معنوية ($P< 0.05$) في أعداد الأبقار الحلوب والجافة والعجلات البكر.اوضحت الدراسة أن مزارع الخرطوم بحري تتميز بكبر حجم القطيع حيث وجد أن متوسط العدد الكلي للأبقار فى الخرطوم بحري 72.83±170.25 بينما كان أقل عددا في مزارع الخرطوم (105.71 ±123.10) وأم درمان (29.35 ±92.35). بالرغم من أن 92% من نوع الأبقار كان هجينا بنسبة دم اجنبي غير معروفه.

التصميم المثالي والجيد للمباني وا لإدارة المثلي للقطيع تمارس على نطاق ضيق للغاية بمزارع الالبان فى الخرطوم بحري (30%) والخرطوم (45%). الجملون المصنوع من الزنك والارض الصلبه و المظلات وتغطيس الحلمات فى المطهرات و استخدام ماكينات الحلب الالى تمارس في قليل جداً من مزارع الخرطوم التي تمت دراستها.

خلصت الدراسة الى ان غالبية المزارع رديئة التصميم وان مهارة ادارتها محدودة مما قد يؤدى الى مخاطر صحية و تلوث بيئي.عليه فقد تمت التوصية بتقديم الخدمات الاساسية وخدمات الارشاد فى اوساط المربيين والعمال فيما يلى الممارسات الجيدة و التى تشمل الاسكان وبرامج الحلب و الصحة العامة.

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Abstract

This study showed herd strcuture and husbandry practices in 60 dairy farms at different preurban areas of Khartoum, Khartoum North and Omdurman of Khartoum State (20 farms from each town). Information about dairy management was collected by questionnaire and direct interview with farms' owners. The results indicated that there were significant ($P < 0.05$) differences in education levels of dairy farms' owners. Dairy farms' owners in Khartoum exhibit higher illiteracy level (35%), compared to those in Khartoum North (15%) and Omdurman (30%). Significant ($P< 0.05$) differences were obtained in herds size and herds structure. Moreover, dairy herd numbers were 170.25± 72.83, 123.10± 105.71 and 92.35± 29.23 in Khartoum North, Khartoum and Omdurman, respectively. Breed type revealed non-significant differences between the three cities. However, 92% of the cattle in the studied farms were grade cattle and mainly they were of unknown foreign blood percentages.

Ideal building materials, design and management practices rarely practiced in preurban dairy farms at Khartoum (45%) and Khartoum North (30%). Corrugated iron roof, concrete flour, teats dipping in antiseptics and machine milking were reported to be very rare.

The present study concluded that the majority of farms were poorly constructed and they are with limited management skills. This might create health risk and environemental contaminations. Hence provision of essential services and extension services among dairy farmers, labours and milkers were urgently needed on best dairy faming practices such as housing, milking and general hygiene.

Key words: dairy farms, management, husbandry, production, general hygiene, constraints, Sudan

Introduction

In Sudan, urban milk supply largely comes from village herds and its marketing is by milk venders who distribute raw milk to households as the organized dairy establishments are limited (Elmagli and El Zubeir, 2006). Milk production system in Khartoum State, depend largely on the traditional sector, which produces about 80% of the milk consumed in the state. Other system include dairy co-operative societies, private sector farms and modern dairy farms (Babiker, 2007). The environment (season), location of the farm with regards to marketing points and the availability of means of transportatio are the important factors that influenced milk supply and marketing in Sudan (Mustafa *et al.*, 2011).

Herds predominant at the dairy camps in Khartoum State consist of dairy cross cows (60%) and the cows are mainly Friesian × local breed (El Zubeir and Mahala, 2011). Musa *et al*. (2006) reported that many herdsman have come to understand that the best results are obtained by crossing the best local cattle (usually Kenana and Butana) with exotic breeds (usually Friesian). The Holstein-Friesian is the most widely used exotic dairy breed in all farming in the tropics (Hansen *et al*., 2006).

High quality milk starts with a healthy cow in a clean sanitary environment, which demands overall good management programs (Murphy and Boor, 2000). Goldberg *et al.* (1991) reported that the effect of improved management practices may be suppressed by insufficient hygiene prior to milking. Caraviello *et al*. (2006) reported that biosecurity, employee management, housing, bedding, feed delivery, manure removal, stocking density, animal restraint, heat abatement, and fresh cow management. Bayemi *et al.* (2005) reported that one area needing much attention in dairy farms is record keeping and farmers need intensive training and follow up. El Zubeir and Mahala (2011) reported that lack of records and marketing of milk were also among managemental factors that need correction in dairy farms located in Khartoum State.

Among the costs; feed cost, housing cost labor cost, treatment cost and A.I. charge, except the housing costs all costs were statistically significant ($P<0.01$) between the crossbred and indigenous cows (Ali *et*

al., 2000). Karakök (2007) reported that farmers are extremely focused on producing quality milk for two reasons; the main reason is consumer confidence and the second reason is economics. Moreover he also mentioned that quality control systems aimed at the prevention of defects, rather than their detection.

The present study was carried out to investigate on the herd structure, methods of management and husbandry practices in large scale dairy farms, which produced commercial milk.

Materials and methods

This study includes husbandry practices and general hygienic measurement in 60 dairy farms at different locations in Khartoum, Khartoum North and Omdurman of Khartoum State (Sudan). Twenty farms from each town were selected to evaluate the different practices of dairy farming during the period from August 2003 to January 2004. Information about management was collected by questionnaire and direct interview with farms' owners inorder to describe the constrains and to identify the weakness that need correction.

Results and discussion

In this study the percentage of illiteracy was high among the dairy farms owners in Khartoum (7, 35%) and Omdurman (6, 30%). Moreover, primary, higher and university graduates in Khartoum and Omdurman were found to be fewer among the dairy farms owners than those of Khartoum North (Table 1). El Zubeir and Mahala (2011) reported that higher illiteracy level (36%) was observed among dairy farms owners' in the dairy camps in Khartoum State and that 22% of them had informal education. Bashir and El Zubeir (2013) reported that illiteracy among the cattle herders in Kordofan State was found to be high (25.%), while herders of the cattle with primary and secondary school level certificates were reported to be 35.0% and 27.5%, respectively. However Hossain *et*

al. (2006) reported that the majority of farm owner"s (60%) in Bangladish recived higher secondary education level and the average number of animal per farm was 13.01. This might be due to absence of full certification, untrained employees and absence of technical and training staff. Payne *et al*. (1999) reported that training is an important and useful component of California dairy quality assurance programs. Certification is another solution method for the employee training for a certain interval for dairy farmers (Karakök, 2007).

Cross breed cows represent the highest number (20, 100%) among the breeds in the farms located at Khartoum North (Table 2). This indicated that cross breed cows were best adapted and predominated in the farms of Khartoum State, this supported Tibin *et al*. (1990) findings when studying herd in Kuku dairy project farms whofound 67.2% of the herd were grade cattle, 27.8% were local type and 4.9% constituted other types. Non significant variations were observed by Bhattacharyya *et al*. (2010) in conception rate with respect to breed (70.16% for Jersey), parity (74.10 for third parity), season (73.91% for summer) and time of insemination (at 16±2 hours following onset of behavioral estrus, 73.81%) in crossbred cows reared under agro-climatic condition of Kashmir. El Zubeir and Mahala (2011) also reported that cattle were found as the main milk producing animals and the predominant herds (60%) were cross dairy cows (Friesian and local herd). The number of total herds, lactating cows, dry cows, heifers and calves showed higher numbers for farms in Khartoum North than those in Khartoum and Omdurman (Table 3). This might be due to Artificial Insemination Center in Kuku Project area provided some services. Awadalla *et al.* (2004) reported that Hillat Kuku in Khartoum North is considered as the largest area for milk production in Khartoum State. Moreover, the old relatively big cooperative dairy sector, which contributes to milk production in Khartoum State, was another reason. Since it started to modernize husbandry practices and improve local breed by cross breeding with foreign blood in order to increase milk production to narrow the gab between the production and consumption (Tibin *et al.*, 1990). Furthermore, these are one of the largest areas for the planting green fodders mainly Abu70 and facilities of water supply are found (Mohamed, 1995). Ali *et al*. (2000) reported that the returns (sale proceeds of milk, value of cowdung, value of calf and price of empty gunny bags) of the crossbreds were higher than the indigenous cows.

Table 1: Educational level of the dairy farms owners at Khartoum State

Education / City	Illiterate	Primary school	Intermediate school	Secondary school	Other university graduate	Veterinary graduate
Khartoum	7 (35%)	3 (15%)	5 (25%)	2 (10%)	1 (5%)	2 (10%)
Khartoum North	3 (15%)	4 (20%)	1 (5%)	7 (35%)	4 (20%)	1 (5%)
Omdurman	6 (30%)	11 (55%)	1 (5%)	1 (5%)	1 (5%)	0 (0.0%)
Total	16 (26.67%)	18 (30%)	7 (11.67%)	10 (16.67%)	6 (10%)	3 (5%)
P=0.008**						

**** : Significant (P<0.01).**

Table 2: Types of dairy cattle breed dairy farms at Khartoum State

Breed / City	Cross cows	Kenana	Friesian	Jersey
Khartoum	17(85%)	1 (5%)	1 (5%)	1 (5%)
Khartoum North	20 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Omdurman	18 (90%)	2 (10%)	0 (0.0%)	0 (0.0%)
Total	55 (91.67%)	3 (5%)	1 (1.67%)	1 (1.67%)
P= 0.509^{ns}				

ns= nonsignificant.

Table 3: Comparison of dairy herds size, herds structure and milk yield in the dairy farms in the three towns of Khartoum State

Cities / Measurements	Khartoum			Khartoum North			Omdurman			Level of significant
	Means ± Sd.	Max	Min	Means ± Sd.	Max	Min	Means ± Sd.	Max	Min	
Herd number	123.1±105.74	560.0	66.0	170.25±72.83	386.0	75.00	92.35±29.23	147.0	52.0	0.0076^{**}
Lactating cows	51.8±21.615	125.0	28.0	76.45±24.31	133.0	30.0	45.90±15.83	75.0	24.0	0.00004^{***}
% lactating cows	46.68±9.925	69.767	25.99	45.82±8.49	57.857	22.45	50.07±6.89	66.071	36.67	0.259^{ns}
Dry cows	24.3±34.72	168.0	3.00	31.10±15.20	75.0	11.00	13.65±5.715	24.00	3.00	0.049^{**}
% dry cows	17.179±6.71	34.927	3.093	18.86±9.152	47.059	9.375	15.806±6.717	27.69	3.33	0.45^{ns}
Heifers	20.8±12.71	55.0	5.0	38.25±24.32	119.0	8.0	22.85±11.636	39.00	4.00	0.0031^{**}
% Heifers	18.66±8.931	33.537	4.366	21.242±6.76	34.759	7.5	23.7±8.686	40.21	7.143	0.158^{ns}
Calves	23.5±34.96	167.0	5.0	27.3±26.28	127.00	4.00	9.35±5.99	25.00	2.0	0.072^{ns}
% calves	17.48±10.797	39.175	4.268	13.9±6.73	33.159	4.651	10.43±5.76	23.81	2.381	0.027^{**}
Milk yield (litres)	581.25±248.08	1446.0	302.0	885.15±261.67	1530.0	385.0	517.15±203.14	880.0	286	0.00006^{***}
Total herd number	123.10^{ab}			170.250^{a}			92.53^{b}			
Lactating cows	51.80^{b}			76.45^{a}			45.90^{b}			
Dry cows	24.30^{ab}			31.10^{a}			13.650^{b}			
Heifers	20.80^{b}			38.250^{a}			22.850^{b}			

ns: not significant (P>0.05)
*: (P<0.05)
**: (P<0.01)
***: (P<0.001)
a and b = means in the same row with different superscript letters are significantly different (P<0.05)

Results from this survey demonstrated clear advantages for larger herds in Khartoum North, which provides large amount of milk production (Table 3), which suppored Awadalla *et al.* (2004). Moreover, as stated by Bewley *et al*. (2001) milk production increased as herd size increased. It was mentioned previously that the small farmers by keeping 8-10 crossbred cows could earn a modest living by adopting small dairy farming as a profession (Mureda and Zeleke, 2008). Also Table 3 shows the highest numbers of calves were found in the farms that raise the foreign breed (Dairy Land Farm). These variations might be due to veterinary supervision, level of education and farms management (Table 1 and Table 6). Moreover, the other herds suffer from the lack of planning for herd replacement in addition to the high mortality due to improper management. Mureda and Zeleke (2008) reported that shortage of feed coupled with poor husbandry and herd health management were important factors that contributed to reproductive inefficiency. Hence they suggested that an appropriate feed resource and reproductive herd health management, a reliable AI service and an appropriate level of husbandry could be the management options to reduce or alleviate some of the prevailing problems.

Ideal building material was seldom used in dairy farms in this study (Table 4). Only 10% of the studied farms used concrete floor, corrugated iron roof is used by 6.67% of farms (Table 4). This was the same situation for the herd studied by El Zubeir and Mahala (2011) that the farm constructed materials include available materials and some of dairy units are divided into fences for different age groups of the cows. Yousif and Fadl El-Moula (2006) reported that a traditional housing system constructed from iron bars, corrugated iron sheets and other local materials such as wood and hay is common. They added that the houses are partially shaded to accommodate animals and to protect lactating cows from excessive sun and rain. Similarly Mohamed (1995) reported that the building design helps to reduce environmental stress and provides safe and hygienic conditions to raise the level of production and to cover the additional cost. In Small-scale production systems; which exist in different regions of Jordan, cows are housed in small traditional brick barns, with no protection against solar radiation in the hot summer, or the

cold weather in winter with less management practices (Alqaisi *et al.*, 2009).

Many farms included in this study showed the lack of knowledge about water quality laws. Since it was clear that about half of the farms in Omdurman and 25% of farms in Khartoum used untreated water supplies from bore holes and others sources by donkeys (Table 5). Some of these might be sources of contamination for milk with faecal organisms as reported by Adesiyun *et al*. (1997) that the farm water supply can be a source of microorganisms (especially psychrotrophs) that can seed soiled equipment and or the milk. The present data also showed that storage room for forage were absent in most of the farms in Khartoum State (Table 5). The precence of feeding beside pens might be the cause and source of contamination of raw milk with thermoduric bacteria or heat resistant bacteria as stated by Vaerewijck *et al*. (2001). Various illegal milk containers for milking and transporting the milk were found to be commonly used among most of the farms (Table 5).

Poor records were most commonly observed (Table 5), which supported El Zubeir and Mahala (2011) that the producers at Kuku (Khartoum North) who keep records were 64%, while only 7% keep record at Alrudwan project (Omdurman). Karakök (2007) reported that record keeping is the milestone to get healthy milk from the cows for dairy farmers. Also the absence of records in the farms were considered as serious problems especially for diseased and treated cows, since the treatment with drugs and milking the diseased cow with other cows might create health hazard risk (Sischo *et al.*, 1997; Babiker, 2007). The lack of adequate on-farm treatment records for antibiotic residues are the highest factor followed by deficiencies in understanding how to use antibiotic (Sischo *et al*., 1997). Said Ahmad *et al.* (2008) reported that the higher prevalence of antibiotic residue in milk samples collected from sales points compared to the farms might be due to the adulteration by addition of antibiotic to the milk in order to prolong its shelf life. The presence of penicillin−G above MRLS in some of the samples poses a threat to the consumers (Victoria, 2011). Moreover El Zubeir *et al.* (2006) reported that there is an urgent need to address and assess the anticiotic resistant in dairy farms in order to minize the health risk hazards asociated with. Karakök (2007) reported that good milking routine prevents

contamination of the milk. Also a consistent milking method at regular intervals with fast, gentle and complete milking and sanitary methods during milking are all important aspects. Harding (1999) stated that it is essential that milkers should know exactly which cows have been treated and they should take care with the milk. Also he reported that all treatments of cows should be recorded including identity of the cow, the person giving the antibiotic treatment, type of treatment, dosage given, date and time (or milking) and when cows brought into the herd should be checked before their milk is included for sale.

The present survey indicated that modern technologies for milking cows were rarely used in the dairy farms under the present study. Practices such as milking parlour, dry cow therapy and iodine dip were rarely; used only one out of 60 surveyed farms (Table 6). Also machine milking was used in one farm in Khartoum North, while the rest of the farms used hand milking. This agreed with the findings of Mohamed (1995) who found that milking machine and strip cup were used in 3 farms (3.5%) and teat dipping was practiced in 5.9% of that farms. Milking should be done in the milking barn, stable or parlor and every milker must wear gloves during milking in order to reduce the risk of bacteria as dairy farmers hand can be a primary source of *S. aureus* and various environmental bacteria (Karakök, 2007). Significantly ($P \leq 0.05$) higher *S. aureus* count was obtained in milk samples from cross- bred cows in Khartoum State (Hamid *et al*,, 2012). However in Jordan, Alqaisi *et al*. (2009) reported that small-scale farmers use both hand milking and mobile milking machines.

Cleaning of cow's udder was only practiced in one farm in Khartoum and 2 farms in Khartoum North, also insufficient milkers cleaning and equipment cleaning were noticed and reported during the present survey among the farms in Khartoum State (Table 6). The same findings were noticed by Adesiyun *et al*. (1997) and Chabo *et al*. (2000) who reported that poor milk hygiene is mostly caused by microorganisms which may result from dairy animal or from secondary contamination by either milker or soiled equipment. It was also observed that detergents were not used and no cleaning program and udder wash in all farms under study except Arab Dairy Farm (Dairy Land).

The farms visits revealed that no cooling was applied for milk at production areas in the farms under study (Table 6). Milk was produced and therefore handled in temperature ranges between 30-40º C during summer and 26-39º C during winter season. These temperature ranges, facilitated the growth and multiplication of pathogenic and non-pathogenic bacteria during production, transportation and distribution (El Zubeir and Ahmed, 2007; Mohamed and El Zubeir, 2007). Moreover the number of psychrotrophic bacteria significantly affected by both storage period and incubation temperature (Yagoub *et al*., 2008). Hence the present study recommended the establishment of co-operation among dairy farmers with the purpose of improving their managerial practices and proper marketing of milk. It was also reported that there were some structural problems for dairy farms such as high input prices, lack of cooperation among producers and long marketing chains between producers and retailers. Training and extension are needed in order to improve the husbandry and management practices in dairy farms. Also the initiation of collection centers coupled with cooling and testing facilities would improve the quality of the milk as was suggested previously by El Zubeir and El Owni (2009).

Table 4: Comparison of the building material in some dairy farms at Khartoum State

Cities	Building materials												
	Fence						Floor		Roof				
	Pipes	**Metal**	**Stone**	**Brokencars**	**Thorn**	**Mud**	**Sand**	**Concrete**	**No roof**	**Hasir**	**Corrugated iron**	**Rakoba**	**Trees**
Khartoum	9 (45%)	1 (5%)	1 (5%)	5 25%	4 (20%)	0 (0.0)	17 (85%)	3 (15%)	11 (55%)	7 (35%)	2 (10%)	0 (0.0%)	0 (0.0%)
Khartoum North	6 (30%)	0 (0.0%)	8 (40%)	0 (0.0%)	1 (5%)	5 (25%)	17 (85%)	3 (15%)	0 (0.0%)	15 (75%)	2 (10%)	2 (10%)	1 (5%)
Omdurman	0 (0.0%)	0 (0.0%)	5 (25%)	5 (25%)	0 (0.0%)	10 (50%)	20 (100%)	0 (0.0%)	3 (15%)	17 (85%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	15 (25%)	1 (1.6%)	14 (23.33%)	10 (17.1%)	5 (8.33%)	15 (25%)	54 (90%)	6 (10%)	14 (23.3%)	39 (65%)	4 (6.66%)	2 (3.33%)	1 (1.67%)
Level of significant	0.001^{***}						0.189^{ns}		0.004^{**}				

***: highly Significant (P<0.001), ns= non significant
** = Significant (P<0.01) .

Table 5: Comparison of farms building facilities, water supply, record keeping and milk containers in the dairy farms at Khartoum State

Cities	Water supply		Clinic in the farm		Record keeping		Store		Milk containers		
	Water Pipes	Donkey	No	Yes	No	Yes	No	Yes	Plastic	Aluminum	Stainless steel
Khartoum	15 (75%)	5 (25%)	19 (95%)	1 (5%)	19 (95%)	1 (25%)	11 (55%)	9 (45%)	16 (80%)	3 (15%)	1 (5%)
Khartoum North	19 (95%)	1 (25%)	18 (90%)	2 (10%)	18 (90%)	2 (10%)	7 (35%)	13 (65%)	11 (55%)	7 (35%)	2 (10%)
Omdurman	10 (50%)	10 (50%)	20 (100%)	0 (0.0%)	20 (100%)	0 (0.0%)	10 (50%)	10 (50%)	15 (75%)	4 (20%)	1 (5%)
Total	44 (73.3%)	16 (26.67%)	57 (95%)	3 (5%)	57 (95 %)	3 (5%)	28 (46.67%)	32 (53.33%)	42 (70%)	14 (23.33%)	4 (6.67%)
Level of significant	0.0055^{**}		0.35^{ns}		0.35^{ns}		0.418^{ns}		0.380^{ns}		

**: significant difference (P<0.01), ns: non significant.

Table 6: General hygiene and milking process in some dairy farms at Khartoum State

Cities	Type of milking			Cleaning the udder		Hygiene of milkers		Cleaning of milk utensils		Cooling facilities		Veterinary visits		
	Milking parlour	Milking machine	Hand milking	No	Yes	No	Yes	No	Yes	No	Yes	No visit	Yes daily	Yes weekly
Khartoum	1 50%	0 0.0%	19 95%	19 95%	1 5%	16 80%	4 20%	14 70%	6 30%	19 95%	1 5%	18 90%	2 10%	0 0.0%
Khartoum North	0 0.0%	1 5%	19 95%	18 90%	2 10%	18 90%	2 10%	9 45%	11 55%	20 100%	0 0.0%	16 80%	3 15%	1 5%
Omdurman	0 0.0%	0 0.0%	20 100%	20 100 %	0 0.0 %	20 100 %	0 0.0 %	17 85%	3 15%	20 100%	0 0.0%	20 100%	0 0.0%	0 0.0%
Total	1 1.67%	1 1.67%	58 96.67%	57 95%	3 5%	54 90%	6 10%	40 66.67%	20 33.33 %	59 98.33%	1 1.67%	54 90%	5 8.33%	1 1.67%
Level of significant	0.596^{ns}			0.042^{*}		0.105^{ns}		0.025^{*}		0.36^{ns}		0.20^{ns}		

*: significant different at ($P<0.05$)
ns= non significant

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