

# The role of milk in a pastoral diet and economy: The case of South Darfur, Sudan

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## Summary

*MILK IS one of the main products in most pastoral systems in Africa, yet the contribution of dairying to pastoral economies is often overlooked. This study of the nomadic pastoral system in South Darfur shows that milk not only meets 25% of a pastoral family's caloric requirements, but also has an important exchange value. Bartering dairy produce enables pastoralists to grow less crops and concentrate on herd management, while the cash generated through dairy sales is partly used to purchase food grains, thus helping to forestall sales of live animals until the late dry season, and in drought years, to avert the depletion of the breeding stock. The author concludes that the role of milk as a source of income in pastoral economies can be enhanced by introducing more advanced milk processing techniques such as cheese-making, which would allow seasonally surplus milk to be used more efficiently.*

## Introduction

Since most African pastoralists neither subsist entirely on the products of their herds (Bates and Lee, 1977; Little, 1980; Toulmin, 1983) nor grow sufficient crops to meet their food grain needs, they must sell or exchange livestock and their products to supplement domestic food production. They are therefore subject to seasonal and longer-term shifts in terms of trade between the main local commodities of live animals, dairy products and food grains, which fluctuate in absolute terms and relative to each other. Pastoralists take advantage of these shifting exchange values by entering or withdrawing from the market, depending on whether the terms of trade are in their favour. However, their options are limited in part by the seasonal availability of one of their main products, namely milk. The seasonal shortages and surpluses of milk therefore form the axes about which pastoral exchange and sales tactics revolve.

The case presented here, that of South Darfur, Sudan, illustrates the extent to which dairy production and dairy sales permit pastoralists to adjust to climatic and extrinsic market forces. The pastoralists in this area alter their diet and exchange patterns according to the two overriding factors of seasonal milk fluctuations and shifts in terms of trade. While dairying thus accords pastoralists some degree of flexibility in responding to their physical and economic environment, the fact that milk is perishable, unless adequately processed, limits the present capacity of pastoralists to take greater advantage of seasonal milk surpluses. It is therefore argued that development efforts which increase pastoralists' ability to preserve and sell surplus milk would reduce their vulnerability to unfavourable terms of trade both seasonally and annually, as well as immediately increasing pastoral incomes. Furthermore, developing the pastoral dairy sector could well be a more feasible, efficient and equitable method of generating more value from pastoral herds than encouraging greater offtake of live animals (Kerven, 1986).

This paper describes the characteristics of dairy production and processing in South Darfur and provides an analysis of the way in which pastoral families vary their diets according to seasonal food shortages and shifting terms of trade between milk and food grains. However, dairying in South Darfur provides more than food to pastoral families. The fact that milk is available for home consumption and for barter or sale is of critical importance for livestock sales and their pattern, and thus in buffering pastoralists against adverse terms of trade between food grains and live animals. This is particularly noticeable given the 3 years of drought recently experienced in the area. Dairying also permits pastoralists to concentrate on livestock husbandry, since the income in kind and cash generated by dairying reduces their need to grow cereal crops. Finally, dairy income makes a significant contribution to overall pastoral incomes, without which pastoralists would probably be forced to sell more live animals and possibly endanger the viability of their herds.

## The study area and production system

The study area comprises the western part of Sudan's South Darfur region, through which Baggara and Fulani (locally known as Fellata) nomadic pastoralists move northwards towards the regional capital Nyala during the rains and retreat southwards to permanent water sources in the dry season. The area is characteristic of the Sahelo-Sudanian zone of savanna grasslands and woodlands, in which rainfall isohyets run on an east–west axis, with rainfall decreasing to the north. During the study period, South Darfur was experiencing its third year of below-normal annual rainfall, which seriously affected the pastoral economy of the region.

The economy and cyclical migration patterns of the Baggara and Fellata in South Darfur are in many respects similar to those of pastoralists further west (see, for example, Swift et al (1982) for Mali and Swift (1984) for Niger). These similarities include the seasonal movement north to better grazing, during which families may subsist largely on milk; bartering of dairy produce for grain produced by settled groups; and the degree to which livestock are regularly sold in order to obtain grain.

Both the Baggara and Fellata specialise in cattle husbandry, but also keep sheep, goats and camels (the latter principally for transport, though they are increasingly being used to provide draught power). Crops (mainly sorghum and millet) are grown by many nomadic families, who prepare and plant their fields at the beginning of the rains on their migration north and return to them on their way southwards, to protect and later harvest the grain. The Fellata pastoralists appear to be generally more dependent on their herds and to cultivate less and less frequently. This observation is borne out by the characterisation of the Fellata as *rohal* (nomads who rely solely on their herds) by the Baggara.

## Dairy production and processing

Interviews were carried out in the late rainy and early dry seasons (September 1984 to January 1985), at 35 different nomadic camps. Seventy-one individuals (pastoralists, agropastoralists, traders and officials) were interviewed. Numerous group interviews were also conducted. Data on milk production were collected by measuring the twice-daily milk offtake from 15 cattle herds belonging to the nomadic camp groups. The measurements were taken over 2- to 3-day periods at three intervals over 4 months. Milk offtake was measured immediately after the morning and evening milkings, for every cow in the herd which had been milked. A total of 142 samples of

milk offtake was obtained. No attempt was made to measure the amount of milk consumed by calves.

Peak milk production starts with the rains (*rushaash*) in June/July, following the main calving period in April/May (Wilson and Clarke, 1976). This conforms to the pattern across the Sahelian zone (Swift, 1984, p.111). Milk offtake during the rainy season could not be measured in this study, but according to the pastoral women interviewed a lactating cow in a South Darfur herd yields about 3.5 litres/day during that season. Peak production continues until the end of the rains (September/October), when most cows conceive (Wilson and Clarke, 1976). Milk yields start to decline at this time: the average milk offtake measured in October 1984 was 2.8 litres/cow/day. By November daily milk offtake had decreased to 1.4 litres/cow/day, and by the middle of January 1985 average measured offtake was 0.6 litres/cow/day. (All measured yields excluded milk consumed by calves.)

These milk offtakes are similar to those reported for zebu cattle in other parts of the Sahel. For example, milk offtake from the WoDaaBe cattle herds in Niger was reported to be 2.35, 1.35 and 0.6 litres/cow/day during the rainy season, after the rains (November) and in the mid-dry season (February) respectively (cited in Swift, 1984). The lower rainy-season milk yield for central Niger is no doubt associated with the lower annual rainfall (<350 mm) in that area compared with the 350 to 550 mm/year recorded in South Darfur during the 1981–84 period. Swift (1979) reported that during a year of 'medium–good' rainfall and pasture, Tuareg cows in Mali yield 2 litres of milk per cow per day for the first 2 months of lactation, with offtake dropping to 0.5 litre/cow/day in the sixth month (p. 238). A general figure of between 1.5 to 3 litres milk/cow/day is given for cattle kept by the Fulani in Senegal (Redon, cited in Teitelbaum, 1977). Data on milk offtake from Fulani, Maasai and Boran cattle are also given by Nicholson (1984), who notes that "only recently have animal scientists begun recording milk" (p. 23).

By harvest time in South Darfur (October–November) about half of all nomadic cows are 4 to 6 months pregnant and according to owners, most cows stop giving milk when 6 months pregnant (see also Swift et al, 1982; Swift, 1984). A cow which has not conceived earlier in the year may continue giving milk for 10 or even 12 months, but her milk output will decline as the dry season advances. With a calving rate of about 65% (Wilson and Clarke, 1976), herd owners in South Darfur can expect to milk two-thirds of their cows over 6 months each year.

The system of dividing milk for calf and human consumption varies according to the number of milk cows in the herd, as well as the livestock wealth and overall wealth of the herd owner. When a herd's milk output is not greater than can be handled by available labour, the usual practice is to allow the calf to take all the milk for the first 10 days of its life and thereafter to milk two of the cow's four teats until the calf is several months old. The calf will then be allowed to suckle only one teat until it is about 6 months old, after which almost all the milk will be taken for human use. Calves are tethered when the herd is in camp, and taken to pastures and water separately from the adult herd, to control their milk consumption. An exception will be made for a male calf intended to be raised as a stud bull, which will be permitted to take all its dam's milk. However, Baggara livestock owners who have more than enough milk cows to satisfy family requirements will often allow all male calves that have been selected for sale unlimited access to milk. This practice, termed *matrucca*, ensures the calf's quick growth and readiness for sale at a much younger age than its cohort members.

Owners of larger herds tend to practice *matrucca* in addition to extracting milk from some of the dams for human use, while owners of small herds almost never practice *matrucca*. The same

relationship between herd size, wealth of owners and milking practices has also been observed among the Maasai (White and Meadows, 1981) and the Somalis (Behnke and Kerven, 1984), and is reported for pastoralists in Mali and Niger (Wagenaar et al,1986).

During the seasons when milk is relatively plentiful, Baggara women process part of the milk extracted from their cows into buttermilk (*roob*) and clarified butter or ghee (*samin*). Cheese is not produced domestically, although there are a few small-scale commercial cheese manufacturers in the rural areas of South Darfur who use milk from pastoral herds. In the neighbouring Kordofan region there is a thriving commercial cheese industry processing milk from pastoral herds.

A woman will normally divide the milk from all the cows she is milking into a portion reserved for processing into buttermilk and ghee, a portion for her family to consume as fresh milk, and a portion for guests and men's communal meals. The ratio depends on the number of milk cows she has under her management in each season, the number of her children that must be fed, and her capacity to process and sell surplus milk. A typical division of milk from 10 milk cows is: milk from five cows made into buttermilk and ghee (most of which will be sold); milk from two cows given to children and used for tea-making; and milk from three cows used for guests and men's meals.

As the dry season begins and milk yields decline, the proportion of total milk output made into buttermilk and ghee also decreases; measurements of the processed/raw milk ratio in November 1984 showed that just over a quarter of the milk output was set aside for processing in that season (Table 1). By the middle of the dry season, milk production in most herds has declined to the point where it is no longer worthwhile processing the milk. At this time of the year, all milk is directly consumed by the family; however, families with large herds may still have surplus milk available for processing and sale. By the end of the dry season, most cows will have virtually stopped giving milk.

**Table 1.** Seasonal terms of trade between dairy products and grain, South Darfur, 1984–85.

Season	Buttermilk (£ Sud/litre) <sup>a</sup>	Clarified butter (£ Sud/litre) <sup>a</sup>	Millet (£ Sud/kg) <sup>b</sup>	Buttermilk: grain ratio <sup>c</sup>
Early rains (June 1984)	0.90	2.50	1.40	4:1
Main rains (July–Sept 1984)	0.30	2.70	1.60	4:1
Harvest (Oct–Nov 1984)	0.40	2.70	1.30	1:1
Dry season (Dec 1984–Feb 1985)	0.90	2.70	1.30	1:4

<sup>a</sup> Rural and urban price.

<sup>b</sup> Retail price.

<sup>c</sup> Rural barter ratio by volume

Source: Interviews with grain traders and pastoral women managing dairy cows.

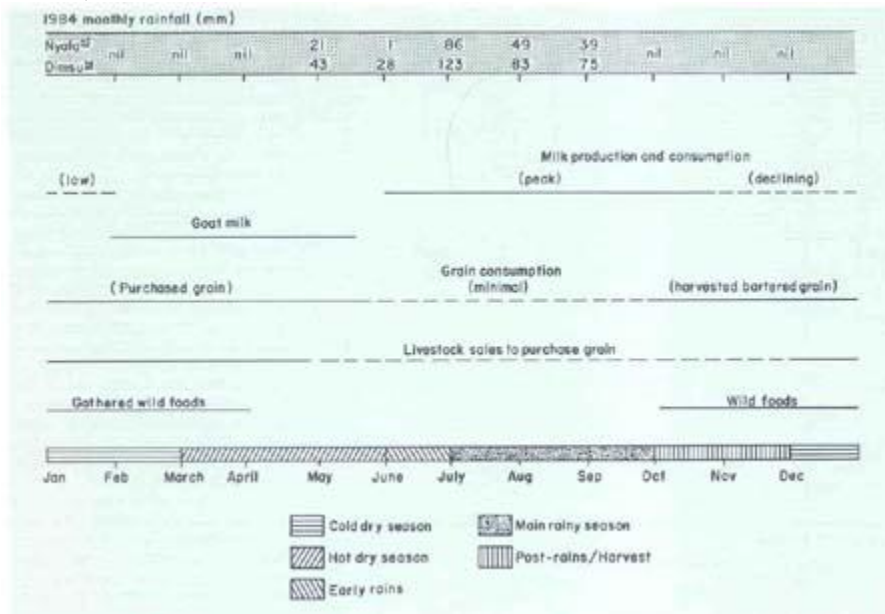
In a year with normal rainfall, a married woman will process and sell dairy products every day for about 4 to 6 months from the beginning of the rains. In 1984, when the rains were poor, most women managing fewer than six milk cows generally stopped daily milk processing and dairy sales after 5 months. However, some women with smaller families and larger herds continued to process and sell dairy products in the middle of January, 8 months after the rains began (Table

1). During the 3 months of the main rainy season, six cows will yield approximately 21 litres of milk a day; half of this is set aside for churning in a gourd (*bohksa*) which every married woman possesses. The volume of a *bohksa* averages 12 litres. A woman can churn only one *bohksa* a day, and in the rainy season this is the usual quantity of milk a woman processes and sells daily. As milk yields begin to fall by the early dry season, women will churn milk only every second or third day, and perhaps sell the produce only once a week instead of daily as in the peak milk production season.

## The role of milk in the pastoral diet

The diets of pastoral families in South Darfur vary by season, depending on the availability and relative exchange value of the staple items—grain, milk and meat (Figure 1). A family's food consumption patterns are finely tuned in order to obtain maximum caloric and economic advantage from its resources at each point in the annual cycle. These patterns are described here for the drought years of 1984 and 1985, in which the value of live animals had fallen drastically relative to the price of grain. The seasonal dietary patterns during this period were modified but not radically altered. The main resources consisted of the number of milk cows in the family herd, surplus animals available for sale, and home-produced grain. Additionally, wild foods may be gathered at certain seasons and form a significant source of food (see also Haaland, 1980).

**Figure 1.** Seasonal food sources of nomadic pastoralists and monthly rainfall at Nyala and Dimsu, 1984.



Notes: <sup>a</sup>Nyala is the northern point on most transhumance routes of South Darfur pastoralists. <sup>b</sup>Dimsu is located in the mid-section of South Darfur.

Ranked according to their caloric contribution, grain, milk and meat, in that order, are the most important staple foods in the diet of most pastoralists in South Darfur. It is estimated from the data collected in this study that 25% of caloric needs are met by milk, between 30 and 50% by food grains and the remainder by meat. The main cereal consumed is bulrush millet, followed by

sorghum and rice. Raw milk, buttermilk, butter and clarified butter are all consumed regularly when available, while fresh meat from home-slaughtered animals is eaten only on special occasions (*karama*) such as funerals and religious festivals. Other important foods include dried tomatoes, onions, okra, chili peppers and dried, pounded meat, all of which are used to make relishes for the staple cereal. Sugar and tea are cherished commodities, essential for social life and often a major cash expense.

Dairy products and meat are obtained from the family's herd, while food grains can be obtained by cultivation, by bartering or selling dairy produce and by selling livestock. Each method of obtaining grain has certain implicit costs: cultivation competes with livestock husbandry for family labour, conversion of milk into grain for the family affects calf growth, while selling livestock to purchase grain may be a process of disinvestment, particularly under drought conditions such as those prevailing at the time of the study. Pastoral families therefore balance their consumption of dairy and cereal products in the light of these costs and according to their productive assets.

The composition of the human diet is decided by the women, who are responsible for adjusting the ratio of milk to grain consumed by the family in each season. The husband and master of the household has the prerogative of deciding when to sell or slaughter an animal for a *karama*.

The seasonal patterns of the pastoralists' diet in South Darfur can be described in general as follows. In the rainy season, when milk is plentiful, families with more than five milk cows try to live as much as possible on a pure milk diet. They may not eat millet or sorghum for a period of 6 weeks up to 4 months. In 1984–85 most families lived on milk for about 3 months. Any cereal consumed during the rainy season is likely to be imported rice, which is much cheaper at this time of the year than the scarce local millet or sorghum. Rice and relish ingredients are bought by selling buttermilk and clarified butter, which are made by the women every day during the rainy season.

Larger families having fewer than five milk cows pursue a different strategy for obtaining food in the rainy season, if their grain harvest from the previous year has run out. Unable to withdraw entirely from the grain market, since the milk from their herd will not meet all their food requirements, they convert part of the milk into higher-calorie grain, by selling or bartering buttermilk for millet or sorghum (Table 1). The barter ratio of buttermilk to grain in the rainy season is typically 4:1 by volume. One litre of buttermilk weighs 1.1 kg and is equivalent to approximately 400 cal. A volume measure of 1 litre of millet weighs 0.84 kg and is equivalent to approximately 2850 cal. Thus, at a barter ratio of 4:1 per volume unit of buttermilk to millet, the buttermilk equivalent of 1600 cal can be exchanged for 2850 cal (nutritional data from FAO, 1968).

Buttermilk is bartered for grain in the rainy season only by those pastoral families whose milk and grain production will not meet the family's caloric needs. For pastoral families with enough milk, the terms of trade between buttermilk and local grain in the rainy season are not attractive enough to engage in barter. Women from these families will sell surplus buttermilk and clarified butter to buy other foods, such as imported rice and relish ingredients, as well as non-food items.

The harvest period (October–November) coincides with the onset of declining milk yields; for the pastoralists, the terms of trade between grain and dairy produce improve as new grain becomes available while dairy products become scarcer. Local millet and sorghum gradually replace milk

as the staple in the pastoralists' diet. Pastoral families that have harvested their own crops begin consuming them, while those that still have surplus milk can exchange buttermilk for grain at vastly better barter ratios (typically 1:1 by volume) than those prevailing in the rainy season. If a family's crops have failed (as happened to many in the 1984 cropping season), and it has fewer than five milk cows, the family must begin to sell livestock at the beginning of the dry season to buy grain, since the milk supply will no longer suffice either in terms of barter or home consumption.

The post-harvest shift in terms of trade between dairy products and grain encourages pastoral women to continue bartering buttermilk and clarified butter for as long as possible into the dry season (Table 1), even if they have harvested grain from their own fields. By the middle of the dry season, the barter ratio of buttermilk to grain becomes 1:4, the reverse of that in the rainy season. Settled farming women have a high demand for both buttermilk and butter during the dry season, since their own small dairy herds are dry. Butter is generally considered an essential food for very young children, and buttermilk is valued as food for older children. Many pastoral women try to reserve more milk for processing into buttermilk, as the barter rates at this time of the year are very much to their advantage. A litre of buttermilk containing solid butter can be exchanged for grain at fourteen times its caloric value in the dry season.

As the dry season advances, goat milk often replaces cow's milk, especially in children's diets and in the tea drunk by men. Goats have two peak kidding periods, at the beginning of the rains and during the harvest season, so that their second period of milk production coincides with the period of declining output of cow's milk (Wilson and Clarke, 1976). Goat milk is not processed and sold, and its use is limited to families with no source of cow's milk in the dry season. Sheep are not milked generally.

To summarise the main points, milk has both a direct consumption value, providing perhaps a quarter of the pastoral family's caloric requirements, and an exchange value. The latter allows pastoralists to grow less grain and concentrate on optimal herd management, as well as partly replacing grain purchases at high retail prices, which must be funded through sales of live animals. It is this latter contribution of dairying to the pastoral economy which is considered in the following section.

## **The role of milk in the pastoral economy**

In the debate on whether dairy or meat production is in pastoralists' best economic interests, proponents on both sides tend to equate milking with pastoralists' subsistence goals as opposed to the commercial objective of producing animals for slaughter. The dairying subsector is thus relegated to the category of 'subsistence systems of production', which, some argue, should be replaced by a truly 'commercial' livestock economy devoted to meat production. This categorisation is not only inaccurate but also unfortunate, since in the process little attention is paid to the flourishing trade in dairy products engaged in by many pastoral groups and thus to the important contribution of the dairy exchange economy to pastoral incomes.

Although its existence is often recognised, if the contribution of dairy marketing is considered at all in the analysis of pastoral economies, it is accorded a minor and peripheral status—of the order of 'women's pocket money'—comparable to that of poultry-keeping and handicraft sales. However, it is argued here that, at least in the case of South Darfur, and therefore possibly in other similar pastoral economies, dairy exchanges and sales are a major pastoral objective and activity, yield significant income in cash and in kind, and are essential to the continued

maintenance of a nomadic pastoral production system under unstable climatic and market conditions.

The role of dairying in the pastoral economy of South Darfur can be examined in terms of the following:

- The variations and limitations in pastoralists' crop–livestock production strategies;
- The volatile annual terms of trade between live animals and grain, which result in unpredictable prices;
- Livestock disinvestment caused by periodic droughts;
- The seasonal shifts in terms of trade between dairy produce and grain, which create a more predictable exchange economy; and
- The relative contribution of dairying to total income.

### **Crop–livestock production strategies and limitations**

The livestock-keeping families of South Darfur range from pastoralists, to agropastoralists, to settled farmers, and the degree to which individual families depend on milk from their herds varies accordingly. Whether they be pure pastoralists who grow no crops or farmers with a few milk cows, South Darfur families are limited by certain production thresholds which set the level of their reliance on milk and grain in any season or year. Ultimately, it is the size of a family's herd and the extent to which a family grows crops relative to its size and labour availability that determine the importance of milk in the household economy.

The interviewed pastoralists estimated that for a family to be entirely dependent on milk and sales of cull animals to buy grain, it would need a minimum of 10 to 15 milk cows in a total herd of around 50 head. This estimate is consistent with the data on herd compositions in South Darfur (Wilson and Clarke, 1976) which show that breeding females comprise 40% of nomadic herds, of which about 65% will calve and therefore yield milk in any year. A family with 10 to 15 cows in milk per year has no need to grow crops and its members are typically *arab siyaara* (pure nomads). However, informants stress that up to 100 head of cattle may be necessary to maintain this production threshold, due to enforced sales of livestock in drought years in order to purchase grain at inflated prices.

Among the nomadic pastoralists interviewed, the mean number of milk cows managed by a woman in the rainy season is 6.5 in the range of 4 to 10 milk cows. This figure drops to an average of 3 milk cows in the late harvest and early dry seasons, as pregnant cows cease giving milk. There is an upper limit to the number of milk cows a woman can exploit efficiently: both men and women state that 10 is the maximum number of cows that a woman can manage. This stated limit is supported by field observations on the time taken to milk, process milk and sell dairy products. The extent to which a family can depend on milk from its herd is therefore limited by labour availability.

At the same time, the degree of dependence on milk is moderated by the extent to which a family is self-sufficient in food grains. According to pastoralists, grain self-sufficiency is erratic in the long term, and a glance at the variation of rainfall rates given in Figure 1 lends support to their statements. Data on pastoralists' grain production in 1983 show that in that year the average pastoral family would have harvested less than 600 kg of grain (WSDC, 1983). According to the pastoralists interviewed in 1984–85, an average family *consumes* an estimated 950 kg of grain annually. In 1983, therefore, pastoralists would not have been able to meet their



food grain needs from their own production, and would have had to make up the shortfall of about 400 kg by purchase or barter. However, in 1981 and 1982 it is more likely that the average pastoral family would have met its annual grain needs from its own crops (WSDC, 1984; WSDC, unpublished data). It should be stressed that the stated annual food grain need of a family is not based on daily grain consumption over the whole year, since during the rainy season milk largely replaces grain in the pastoral diet. If a family of eight were to depend year-round on grain for subsistence, it would need approximately 1500 kg of grain (FAO, 1968; WSDC, 1983).

The maintenance of production thresholds and a family's decision to alter its production emphasis from livestock to grain or vice versa therefore depend on several variables. Families with large herds can comfortably subsist on dairy produce throughout the rainy season even in a drought year. But if they do not cultivate much, under drought conditions they will be forced to disinvest larger portions of their herds than in normal years, as they must purchase grain at greatly inflated prices. Only families with very large herds can withstand high levels of disinvestment for more than a couple of consecutive years. There are, therefore, strong incentives even for owners of large herds to grow some of their own grain in addition to depending on milk consumption and sales of dairy produce and live animals.

There is, however, a price to pay by the pastoral family seeking to diversify from a purely dairy and animal sales production strategy to crop production. Successful rearing of healthy, productive animals within the ecology of South Darfur depends on mobility: mobile herds have higher calving rates, lower calf mortality rates and higher meat production than their sedentary counterparts kept by Darfur farmers (Wilson and Clarke, 1976). Flexibility in moving livestock around the landscape is to some extent incompatible with intensive crop production, which demands a higher and more constant labour input than many nomads can provide. So for the owners of larger herds increasing crop production to make up dry-season food deficits (when milk is scarce), and to avoid selling too many animals, must be balanced against the loss of herd performance resulting from less flexibility in herd movement.

Given the limitations inherent in each production strategy, the variations in crop–livestock mixes are many and complex. All, however, revolve around two aims: to maintain the health and productivity of the herd while lessening dependence on purchased grain in the dry season.

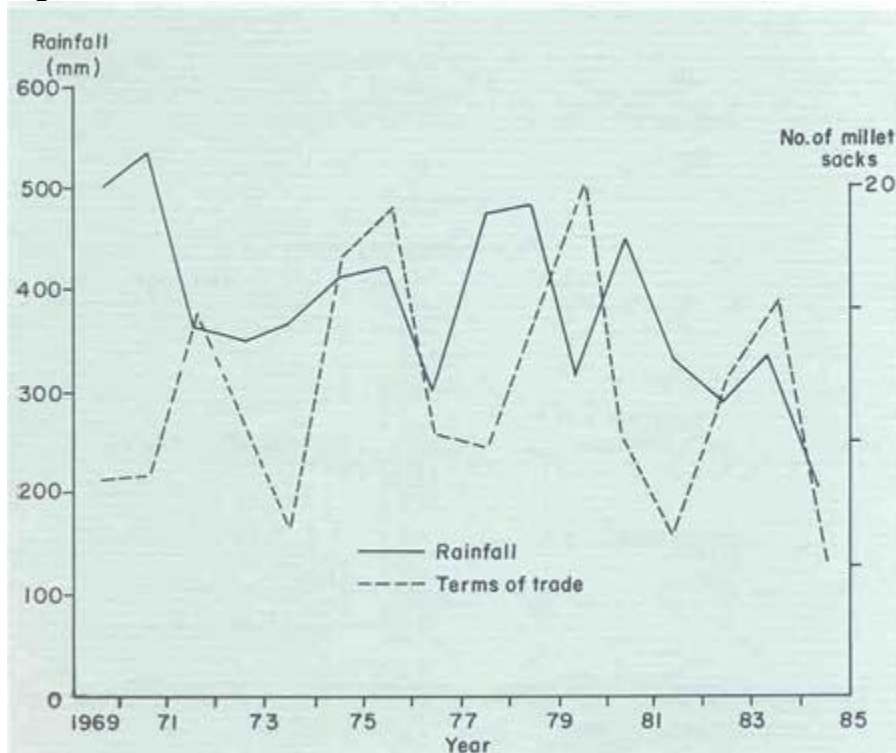
### **Shifting annual terms of trade**

Milk for family consumption and sale plays a critical role in the household economy by providing a buffer against the shifting annual terms of trade between the two other commodities exchanged in South Darfur, namely grain and live animals. Pastoralists' emphasis on dairying rather than production of live animals for sale can therefore be understood in terms of their need to balance dietary and income sources when confronted with unpredictable climatic and economic conditions.

The supply and demand of cattle and grain are in constant flux from year to year and from one season to the next. This is due mainly to variations in rainfall but also to other factors such as government pricing policies, hoarding, provision of food aid etc. Grain is a dietary staple for all Darfuris—farmers and pastoralists—and therefore is in constant demand. The supply and price of slaughter cattle are largely dependent on current grain supplies and prices, which in turn are affected by climatic conditions. As grain supplies dwindle and grain prices rise, the exchange value of cattle sold declines relative to the price of grain. This pattern is illustrated in Figure 2

which shows the shifting cattle-to-grain terms of trade in response to variations in annual rainfall over the 1969–84 period. Years with good annual rainfall are followed by lower grain prices and more advantageous terms for pastoralists selling cattle to buy grain. The effect is lagged or shadowed, as Figure 2 shows. In years with little rainfall, pastoralists can buy less grain for the animals they sell, and so are forced to sell more animals, often at a lower price.

**Figure 2.** Annual rainfall and terms of trade<sup>a</sup> between millet and cattle, South Darfur, 1969–84.



<sup>a</sup> Number of millet sacks that could be bought with the proceeds from the sale of 1 bule; 1 sack contains 45 kg of millet.

Sources: Rainfall data from WSDC (1984). Livestock and millet prices based on unpublished data collected by WSDC.

Given the unpredictability of annual terms of trade between grain and livestock, milk from pastoral herds serves two purposes: firstly, it allows families to reduce their dependence on grain and secondly, it provides a source of income, additional to that from livestock sales, to purchase grain when needed. Except in disastrous drought years, milk offtake allows pastoralists to plan their livestock sales in accordance with sound herd management and commercial practice, i.e. to sell cull females and mature males when the price is favourable. Evidence available from studies of nomadic herds (Wilson and Clarke, 1975; 1976; HTS, 1976) indicates that this is exactly what pastoralists in South Darfur do, when conditions permit.

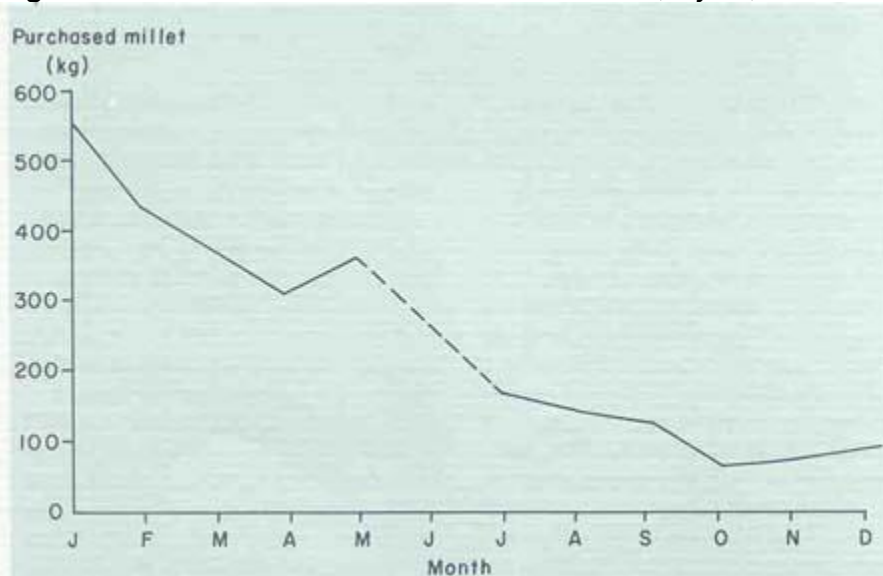
## Drought and herd disinvestment

In years with 'normal' rainfall, most owners of small and medium-sized herds expect to rely during the dry season on sales of smallstock, as well as cull females and mature male cattle, to make up food and income deficits caused by the decline in milk production. However, evidence from other studies in the area suggests that during the 3 drought years prior to this study, livestock sales from average herds could provide cash income *only* at the cost of depleting the

breeding stock (WSDC, unpublished data). An analysis of a survey of nomadic herds carried out by WSDC in 1983 indicated that, given the mortality and calving rates found, no natural replacement of mature breeding females was occurring. At the same time as herd size was declining at a rate of 19% per annum, sales were still taking place. This occurred presumably in order to enable pastoral families to meet their recurrent food grain requirements. Families with no other option but to continue selling under these conditions would soon have no breeding stock left. By 1984–85 it was clear that this pattern was continuing, although no data on herd productivity and offtake rates in the area are available after 1983.

The increasing pressure to sell livestock is well illustrated in Figure 3 which documents the effects of South Darfur's last and worst year of the recent drought. A mature bull sold in Nyala at the beginning of 1984 (when many if not most pastoral families still had grain from the 1983 harvest) would have realised the equivalent of 545 kg of millet. By December 1984 (when most harvests had failed due to lack of rainfall in that year) the cattle markets were flooded, the price of grain was 2.5 times higher than that at the beginning of the year, and a bull sold then would have realised the equivalent of only 90 kg of millet. Families that could not have relied on milk for several months in the rainy season, and that could not obtain some grain by exchanging dairy products, would be bereft of their herds by the end of the 1985 dry season, given the prevailing terms of trade between grain and livestock.

**Figure 3.** Terms of trade<sup>a</sup> between millet and cattle, Nyala, South Darfur, 1984.



<sup>a</sup> Expressed as kg of millet obtainable with the proceeds from the sale of one 4-year-old bull. Source: WSDC Project Monitoring and Evaluation Unit (unpublished data, courtesy of J. Morton). Data for May and June not available.

### Shifting seasonal terms of trade

The terms of trade not only alter unpredictably from year to year, but also reverse, more predictably, from season to season. As can be seen in Table 1, the *barter* rate between buttermilk and grain reverses from the wet to the dry season, while the *retail price* of grain drops only marginally following the harvest.

The pastoralists adjust their diet and exchange patterns accordingly, drinking as much milk as possible in the wet season when grain is least available and most expensive. They exchange as much dairy produce for grain as possible after the harvest, when grain supplies increase, milk supplies decrease and barter rates improve. It is only in the dry season that they depend on selling livestock in order to buy grain. As one pastoralist described this strategy, "In *khariif* (rains) there is plenty of milk, so a good wife can use this milk in many ways to get money for the family. But in *saif* (dry season), a man must look for a way to get money and has to sell animals."

Another function of milk production and dairy sales is therefore to allow pastoralists to disengage partially from the exchange economy when the terms of trade are against them, and to re-enter when the exchange values of dairy produce, grain and slaughter livestock have shifted in the pastoralists' favour.

### The contribution of dairy trading to pastoral incomes

The role of dairying has been considered in terms of its substantive contribution to pastoral household economies. Its contribution can also be measured in terms of direct income benefits, as shown in Table 2 which gives the estimated seasonal cash income obtained per woman in charge of a family's milk cows. This income is therefore per family unit or *beyt* (tent), not per herd, since a man's herd of milk cows can be divided between several wives and other female kin.

**Table 2.** *Estimated seasonal cash income from a woman's dairy sales, South Darfur, 1984–85.*

Year Month	No. milk cows/family	Milk yield		Quantity sold		Value		Total dairy income (£ Sud)
		cow/day	total/day	buttermilk	ghee	buttermilk	ghee	
		(litres)		(litres)		(£Sud)		
1984								
June	6.3	2.8	17.6	6	0.53	5.4	1.3	201.00
July–Aug	6.3	3.5	22.0	8	0.45	2.4	1.2	216.00
Sept–Oct	6.3	2.8	17.6	4.4	0.25	1.75	0.68	146.00
Nov–Dec	4.0	1.4	5.6	1.6	0.09	0.64	0.24	53.00
1985								
Jan–Feb	3.0	0.6	1.8	0.45	0	0.41	n.a	25.00
March–May		negligible		–	–	–	–	–
Annual cash income/family								£ Sud 641.00

Notes: Data were obtained from interviews with pastoral women managing dairy cows. Milk yields from June to August are based on producers' and traders' estimates. Milk yields from October to January were measured.

Several points should be stressed in relation to income from dairy trading: firstly, even in drought years dairy income can be obtained *without* depleting the breeding stock. Secondly, milk offtake, whether for home consumption or for barter and sale, occurs at the cost of optimal calf growth. Since pastoral herd managers know this, their decision to consume milk or convert milk into grain, thus lowering the market value of their calves, presumably reflects their estimation of the relative returns to calf growth versus milk offtake. Thirdly, given the mean retail prices for millet in 1984, the average, seasonal dairy incomes shown in Table 2 could have purchased 530 kg of millet, which is more than the probable grain deficit (400 kg) per family resulting from the previous year's poor harvest. In fact, not all dairy cash income is used to make up grain deficits, since non-grain foods and other commodities, such as salt, tea, sugar, vegetables, clothing and household items, are required. In the dry season, grain deficits are partly covered by sales of live animals.

No data were collected in this study on pastoralists' income from livestock sales. However, other sources on pastoral sales rates in the same study area indicate that at 1984–85 prices, a pastoral family could have obtained an estimated £ Sud 800 by selling cattle and, for the 30% of families also owning sheep, a further £ Sud 200 from selling sheep (WSDC 1983; 1984; and unpublished data on Nyala sheep and cattle prices). These figures suggest that dairy income could be providing between 40 and 44% of a family's annual income, and that it constitutes a significant part of family budgets.

## Pastoralists' production goals

Except for the owners of very large herds, the Baggara and Fellata pastoralists raise cattle primarily for milk production, and only secondarily for sale. This was recognised in definitive study of cattle production in western Sudan, whose authors (Wilson and Clarke, 1975) noted that, "Western Baggara cattle are used principally for milk production: males are used as pack animals and also as riding animals ... Beef production is a tertiary activity" (Part 1, p. 171).

Unfortunately, the economic and biological indices of milk production in the nomadic Baggara herds were not investigated in the study, which, however, provided detailed analysis of other herd performance indices, in particular of beef offtake. This bias is representative of most development-oriented research among pastoralists in Africa, as is discussed by Kerven (1986).

Although dairy production is the principal concern of most pastoralists in South Darfur, they are well aware of the biological and economic trade-offs between dairy and beef production. This concern is reflected in their herd management decisions regarding how animals are to be raised and which are to be sold. The pastoralists studied are aware of the slower calf growth resulting from the deflection of milk to human consumption, and can cite precise size-for-age gradations between those calves intentionally allowed free access to milk (under the *matrucca* system described earlier) and those whose milk intake is controlled to provide milk for human consumption. The same pastoralists are also aware of the monetary benefits resulting from selling cattle—certain cattle at the right time. Herd compositions show that less than 4% of nomadic herds in South Darfur consisted of mature males, and as Wilson and Clarke (1975) commented, "There is no vast untapped source of male animals awaiting a market outlet" (Part 1, p. 173).

The reason why pastoralists in South Darfur do not raise more and bigger animals for marketing lies not in some perverse rejection of market opportunities but is instead due to their assessment of the particular biological and economic efficiencies of dairying, complemented

with a strategy of selling surplus animals as and when necessary. A recent study which measured milk offtake for human consumption and calf growth in Fulani herds in Mali found that, despite high milk offtake, calves did not lose weight (Wagenaar et al, 1986). As the authors of this study point out, it is thus likely that pastoralists who are highly dependent on milk for subsistence are able to divide milk output between the household and the calves in such a way so as to reduce retardation in calf growth.

## The value of dairying to the pastoral economy

Conclusions about the relative value of dairying versus beef production cannot be reached without a longer-term, more comprehensive study of the economic costs and returns to each. However, the data available from this case study, which was limited both in time and scope, suggest some reasons why most pastoralists in South Darfur might choose to depend heavily on milk production rather than emphasising beef production.

Firstly, there are strong economic incentives for owners of small and middle-sized herds to rely on milk from their herds for as long and as much as possible. Both in terms of direct milk consumption and in terms of dairy sales, milk is a replenishable item which can be continuously harvested without diminishing the means of production—the breeding stock itself. The force of this incentive is even more evident under drought conditions: under the unfavourable terms of trade imposed by drought during the study period, less well-off herd owners were obliged to sell off part of their breeding stock *in addition* to the cull females and mature males normally sold to cover cash needs.

Secondly, dairy production and sales provide pastoralists with a means of adjusting their diets and income sources to the vicissitudes imposed by the climate and local economy. Milk therefore has a dynamic role in relation to the changing exchange values of grain versus slaughter cattle. This dynamic function may be disguised in a quantitative assessment of the value of milk at any one point in time. Pastoral economies are neither internally stable nor exempt from external forces. Not only are herds themselves subject to change over time, but the value which can be derived from the herd is affected by market and climatic changes. It is thus the *relative exchange value* of pastoral products in relation to other commodities routinely required by pastoral families which is the key to understanding the contribution of dairying versus animal sales.

Lastly, by selling dairy produce, pastoral women are able to forestall dry-season livestock sales, thus conserving the core of the herd which will supply the family with milk in the future and through reproduction allow the family to sell surplus stock when grain supplies have run out. The contribution to household food supplies generated through dairy sales is essential to a pastoral production system, since high herd productivity cannot be achieved by families which rely greatly on cropping or selling breeding stock to make up grain deficits. Women's dairy income, either in kind (bartered grain) or in cash which allows them to buy grain, therefore permits pastoral families to produce less grain than they consume, and to sell fewer animals than would otherwise be necessary. Dairy income thus underpins the maintenance of a pastoral production system, since it bridges the 'grain gap' that pastoralists can only otherwise overcome by compromising the efficiency of their livestock operation and possibly jeopardising their whole pastoral enterprise.

## Development of the pastoral dairy subsector

The case study reported in this paper has indicated that pastoralists in South Darfur rely on milk not only for subsistence but also as a marketable commodity which, when processed, provides an important source of income. By consuming and processing a portion of the plentiful milk available in the rainy season, it may be that pastoral families can extract greater value from the milk than if it was entirely devoted to calf growth. The conversion of milk into butter oil is a way of preserving an otherwise perishable item as well as adding value through the labour involved in processing. However, pastoral women are limited in their ability to extract more value from milk, for two reasons: firstly, further preservation in the form of butter oil is restricted by the availability of female labour in a family, and secondly, indigenous milk processing techniques do not include cheese-making, which would allow a greater volume of whole milk to be processed and preserved. The present processing system results in a seasonal glut of buttermilk, with an accordingly depressed exchange value in the rainy season. Women therefore either have to trade buttermilk at very low prices or, in the case of those managing larger dairy herds, simply throw away surplus buttermilk rather than expend the time and labour to market a low-value commodity.

The existence of seasonally surplus milk at low prices has prompted several entrepreneurial merchants to set up small-scale rural cheese-making plants which offer women higher prices for whole milk than they could otherwise obtain for buttermilk. The potential for expanding the number of such dairying plants is present in the form of an ample supply of milk in the rainy season and a demand for cheese among local urban residents. Impediments to the development of cheese-making in this area are undoubtedly the lack of good transport facilities, lack of capital and absence of critical inputs such as rennet. No attempt has been made to promote producers' dairy cooperatives, or to assist private entrepreneurs in developing cheese production.

Developing the dairy subsector in the pastoral economy of South Darfur as well as in other areas with similar production systems could have several important effects: the more efficient use of an existing surplus; generation of increased income for pastoral families; substitution of locally manufactured products and lastly, supplying an existing national demand for dairy products. The potential for small-scale dairying among pastoralists deserves further research and policy initiatives.

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## References

Bates D and Lee S. 1977. The role of exchange in pastoral specialization. *American Anthropologist*. 79: 82–41.>

Behnke R and Kerven C. 1984. *Herd management strategies among agro-pastoralists in the Bay Region, Somalia*. Department of Sociology, University of Wyoming, Laramie, USA.

FAO (Food and Agriculture Organization). 1968. *Food composition table for use in Africa*. >FAO, Rome.

Haaland G. 1980. Social organization and ecological pressure in South Darfur. In: G Haaland (ed.), *Problems of savannah development: The Sudan*. Department of Social Anthropology, African Savannah Studies No. 19, University of Bergen, Bergen, Norway.

HTS (Hunting Technical Services). 1976. Savannah Development Project Phase II Annex 3. Hunting Technical Services, Borehamwood, UK.

Kerven C. 1986. Some research and development implications for pastoral dairy production in Africa. *ILCA Bulletin* 26: 29–35.

Little M. 1980. Designs for human biological research among savanna pastoralists. In: *Human ecology in savanna environments*. Academic Press, New York.

Nicholson M J L. 1984. Pastoralism and milk production. *ILCA Bulletin* 20: 23–28.

Swift J. 1979. The economics of traditional nomadic pastoralism: The Twareg of the Adrar in Iforas (Mali). Ph.D. dissertation, University of Sussex, Falmer, UK.

Swift J (ed.). 1984. *Pastoral development in central Niger; Report of the Niger Range and Livestock Project*. Ministère du Développement Rural, République du Niger and United States Agency for International Development, Niamey.

Swift J, Winter M and Fowler C. 1982. Production systems in central Mali: The pastoral Twareg of the inner Niger delta. Unpublished draft presented to the International Livestock Centre for Africa, Addis Ababa.

Teitelbaum J. 1977. Human versus animal nutrition: a 'development' project among Fulani cattle keeper of the Sahel of Senegal. In: T Fitzgerald (ed.), *Nutrition and anthropology in action*. van Gorum, Assen, Amsterdam.

Toulmin C. 1983. *Economic behaviour among livestock-keeping peoples: A review of the literature on the economics of pastoral production the semi-arid zones of Africa*. School of Development Studies, Development Studies Occasional Paper No. 25, University of East Anglia, Norwich, UK.

Wagenaar K T, Diallo A and Sayers A R. 1986. *Productivity of transhumant Fulani cattle in the inner Niger delta of Mali*. Research Report 13. ILCA, Addis Ababa.

White J M and Meadows S J. 1981. *Evaluation of the contribution of group and individual ranches in Kajiado istrict, Kenya, to economic development and pastoral production strategies*. Ministry of Livestock Development, Nairobi.

Wilson R T and Clarke S E. 1975. Studies on the livestock of South Darfur, Sudan, Part 1: The ecology and livestock of the area. *Trop. Anim. Health Prod.* 7(3): 165–184.



Wilson R T and Clarke S E. 1976. Studies on the livestock of South Darfur, Sudan, Part 2: Production traits in cattle. *Trop. Anim. Health Prod.* 8(1): 47–58.

WSDC (Western Savannah Development Corporation). 1983. *Annual Report, July 1982–June 1983*. WSDC, Nyala, Sudan.

WSDC. 1984. *Annual Report, July 1983–June 1984*. WSDC, Nyala, Sudan.