Some research and development implications for pastoral dairy production in Africa

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Summary

THIS PAPER *examines the relative merits of milk versus meat production by African pastoralists and concludes that development of the pastoral dairy subsector is warranted on the following grounds. While there is rarely a surplus of live animals in pastoral economies, pastoral herds may produce more milk during seasons of high milk production than can either be consumed in the household or exchanged at profit. The second argument in favour of developing pastoral dairying is that many pastoralists are already engaged in a commercial exploitation of dairy produce, but are often constrained by lack of capital, inputs and suitable processing techniques. Lastly, since extensive commercial meat production requires more land per animal unit to achieve economic and energy outputs comparable to those achieved by dairying, the latter can offer a higher income to a greater number of people*.

Introduction

If we are to understand not only how pastoral peoples subsist but how they respond to market and climatic variations, the critical role of milk in pastoral systems must be appreciated. It is argued that while livestock development projects have typically sought to encourage pastoralists to increase only offtake of live animals, this emphasis has rarely been based on prior evaluations of the comparative efficiency, development potential and welfare benefits of dairying as opposed to meat production. Studies of pastoral dairying carried out by anthropologists, economists and nutritionists suggest that dairying makes a significant contribution to some pastoral groups' income and diet, and that the combined milk/meat production strategy pursued by these groups may yield greater output per unit of land than sole concentration on meat production. The conclusion is drawn that further multidisciplinary research on the biological and economic returns of milk versus meat production is required if livestock development planning is to be based on empirically sound grounds.

A fuller understanding of pastoral dairying is called for on several further grounds. Firstly, as pastoralists shift from dairy to meat production systems, there may be negative nutritional effects (Teitelbaun, 1977). Recently, a number of studies have demonstrated the nutritional contribution of milk to pastoralists (Swift, 1984; Wagenaar-Brouwer, 1984; White and Meadows, 1981).

Secondly, compared with sales of live animals marketing dairy produce may offer a more significant and reliable income source than is often realised. The bias towards research on animal offtake therefore needs to be redressed (Sandford, 1983, p. 200). The small but excellent sample of work on this topic in Africa does indeed indicate the importance of dairy

income (Swift, 1979; Swift, 1984; Swift et al, 1982; for pastoral budgets, see White and Meadows, 1981; for agropastoral dairy incomes, see Hesse et al, 1984; Fulton and Toulmin, 1982; Waters-Bayer, 1985).

Thirdly, dairying and dairy product sales are often the responsibility of women, whose economic contribution to pastoral societies has generally been overlooked (Broch-Due et al, 1981; Horowitz, 1981; Oxby, 1983; Tavakolian, 1984). The now dated work of Dupire (1962; 1963) on the Fulani is still one of the best studies on women's participation in the dairying transactions between pastoralists and nonpastoralists.

Fourthly, the development of the traditional dairy sector as an alternative or complement to developing commercial meat production among pastoralists holds great potential for improving pastoral livelihoods and meeting the high demand for dairy products in Africa (Brumby and Gryseels, 1984; Mbogoh, 1984a,b). As Brumby and Gryseels have stressed, "In Africa only a minor fraction of milk production enters the official commercial sector" (1984, p.6), indicating that there is a highly active informal dairy sector towards which development efforts can be directed.

Pastoral dairying and development assistance

The importance of dairy production to the diet and economies of African pastoralists is well documented—notable early studies include Brown (1971), Dupire (1962; 1963), Hopen (1958) and Stenning (1959). Recent research in East Africa and in the Sahelian countries of West Africa has since provided quantified data on the contribution of dairy production, even among the so-called ‘commercial’ Maasai ranchers. Table 1 shows the important subsistence value of milk in terms of pastoral diets, which is hardly surprising given that pastoralists are, by definition, groups of people who live primarily from the products of their herds (Brown, 1971; Toulmin, 1983, p. 5). Much less well recognised is the market or exchange value of dairy produce, which, as Table 1 shows, may also be a significant component of pastoral income.

Table 1. *Subsistence and commercial value of dairy products for Maasai ranchers in Kenya, the WoDaaBe in Niger and the Tuareg and Bella in Mali.*

Group	Value as % of total cash and subsistence income					Total (%)
	Cattle sales and home consumption	Dairy sales	Milk consumed	Smallstock sales and slaughter	Other (wages etc.)	
Individual Maasai ranchers[a]	34	11	14	10	31	100
Maasai group ranchers[a]	51	2	36	6	5	1.00
WoDaaBe[b]	45[b]	2	30	5 + 13[b]	7	100
Group	Value as % of total cash income					
	Livestock sales	Dairy sales			Other	Total
Tuareg[c]	97	0			3	100

Bella[c]	37	38			25	100
Poor Tuareg and Bella	52	28			20	100
Group	Value as % of total kcal/year					
	Milk		Cereals	Meat	Other	Total (%)
Individual Maasai ranchers	51		22	11	16	100
Maasai group ranchers	63		11	7	19	100
WoDaaBe	40		53	–-7[e]–-		100
Rich Tuareg[d]	62		26	12	n. a.	100
Bella	49		36	15	n. a.	100

Sources and Notes:
[a] White and Meadows (1981).
Individual ranchers were wealthier, had larger herds (21 head/individual rancher compared with 12 head/group rancher) and had larger ranches than group ranchers (pp. 14–19).
[b] Swift (1984).
The figures in this table are computed from data given in Swift's study. Since home slaughters were not recorded in the study, the figure in column two refers to cattle sales only. The value of milk is taken to be equivalent to the barter value of milk for grain. Column five includes the value (13%) of sales and slaughters of other livestock.
[c] Swift et al (1982).
The Bella are a dependent group residing with the Tuareg. They own far fewer animals than their Tuareg patrons but receive from them milk cows on loan.
[d] Wagenaar-Brouwer (1984). As in the above case, the sampled Tuareg group are wealthy livestock owners who have Bella dependents living with them and working for them.
[e] Includes meat and other products.

Development assistance to the dairy sector has been focused on the climatically more favourable highland areas of Africa, where higher milk yields are obtained and thus where the greatest potential for full-scale commercial dairying seems to exist (Jahnke, 1980; Mbogoh, 1984a). By contrast, projects concerned with the economic development of the drier, lowland areas where extensive pastoralism is practiced have almost exclusively promoted commercial meat production (Sandford, 1983). Given the importance of dairy production in pastoral economies one should question the appropriateness of this emphasis.

Horowitz has pointed out, along with others (Behnke, 1983; Teitelbaum, 1977), that many development interventions in fact seek to convert a dairy-based economy to one where "the calf has the prime claim on milk .... the calf is a surrogate for the urban consumer of beef", i.e. calves are raised solely as beef-export animals rather than as animals sharing milk with the humans dependent on the herds (Horowitz, 1981, p. 86)[1.]

[1]This general thrust of livestock development projects *is* not confined to Africa; for example, the author of a study among pastoralists of Afghanistan remarks that a World Bank livestock project was seemingly based on the assumption that the pastoral economy of the Sheikhanzai was "sustained primarily by the breeding and marketing of live animals" whereas the author found that the "Sheikhanzai depended far more significantly on the production and exchange of dairy products" (Tavakolian, 1984 p 444). Understandably the Sheikhanzai spurned the efforts to increase their sales of live animals planned to supply urban consumers.

Milk versus meat: the development debate

The consistent emphasis in livestock development projects on promoting beef production has usually been justified by project planners on one or more of the following grounds:

- Superior economic and biological efficiency of commercial beef production over what was viewed as ‘subsistence’ dairy production practised by pastoralists.
- Increasing the welfare and income of pastoralists.
- The removal of ‘surplus’ livestock being inefficiently ‘stored’ by pastoralists, which were exacerbating range degradation.
- Increasing meat offtake from the pastoral sector so as to meet national development objectives, specifically:

    - provision of meat to urban consumers,

    - reduction of meat imports, and

    - generating foreign exchange through meat exports.

Increasingly, each of these justifications has come under scrutiny, and there is now evidence that the first three points (upon which the viability of the fourth point rests) are based on faulty assumptions, as the following review indicates.

Superior economic and biological efficiency of meat production

Pastoral dairy-oriented systems have often been criticised as being both economically and biologically inefficient—the latter including ecologically unsound. One of the strongest early critiques is presented by Brown (1971), whose influential argument underlies many subsequent assertions concerning the advantages of meat production for pastoralists. Brown unequivocally claimed "the ecological undesirability of subsisting on milk in a habitat which is ecologically unsuited to milk production", referring (mostly) to East African pastoralists, and commented that "no rancher in his right senses would attempt to produce milk *commercially* in the type of semi-arid area in which nomadic pastoralists try to *subsist* on it" (p. 97, emphasis added). However, the flaw in this argument is to suggest equivalence between what is ecologically optimal and what is economically viable.

From this basic misconception stems much of the effort to turn African pastoralists into meat-producing ranchers. The valid comparison is whether pastoralists can produce meat only at similar levels of economic and biological efficiency as they currently produce both milk and

meat, holding *all* other factors constant, such as the numbers of people and animals that can be supported per hectare, access to markets and inputs, opportunity cost of the land, and climate. Such comparisons, as Sandford (1983) has noted, are in fact rarely, if ever, carried out. One exception is a recent study of animal productivity per hectare on a Maasai group ranch in Kenya, which found that livestock sales and slaughter yielded on average 11 kg meat/ha/year, valued at KSh 50/ha/year. By comparison, milk produced on the same ranch for subsistence averaged nearly 15 kg/ha/year, valued at KSh 47/ha/year. Thus, in this mixed production system, the productivity of dairy operations was higher than that of meat production, while the economic values of each component were comparable (de Leeuw et al,11984).

With regard to the comparative efficiencies of meat-only versus milk/meat offtake, one comparison of similar ecological areas indicates that the pastoral, mixed milk–meat system outstrips a beef ranching system (Cossins, 1985) if efficiency is measured in terms of gross energy output edible by humans. Using another measure of biological efficiency, that of conversion of feed energy by livestock, King (1983) points out that "there is nothing inefficient about dairy ranching versus beef [ranching]" since conversion of feed energy to milk is more efficient than that to beef (p. 75). The burden of proof lies with those who claim a superior level of biological efficiency from a meat-only production system.

Where it is economically to their advantage to do so, pastoralists have opted for greater commercial meat production, as for example in the cases of Somalia (Holtzman, 1982), Libya (Behnke, 1983) and Niger (Swift, 1984). With respect to biological efficiency, as the new generation of farming systems researchers often remind us, producers are generally much less; concerned with it than are researchers; the, highest and most secure economic returns are usually a producer's principal objective (Collinson,1982).

In the absence of more case studies on the: comparative efficiencies of milk versus meat production, one can nevertheless consider the evidence from general studies. Milk production systems worldwide can support on average about 2.5 times as many people per hectare as could be supported by beef or mutton production systems (Spedding, 1979, p. 130). The greater output per unit land area possible with milk production is due to the fact that humans can ‘harvest’ their food source—milk—at a lower point on the food chain than is the case with meat production. With respect to the; efficiency of resource use (land, labour and capital) in generating calories, Spedding's worldwide review (1979, pp.133–134) shows milk requiring marginally less labour but considerably less money to produce than meat. The efficiencies of product output per unit of feed, and of energy output per hectare, are likewise far higher for milk than beef production systems (generally in the order of between 2 and 3 to 1). Although, as the author cautions, these general relationships encompass a great variety of different production systems operating under widely differing conditions, they serve to emphasise the need for a more careful evaluation of the comparative efficiency between meat and milk production.

Pastoralists' welfare and income

The underlying assumption of governments and donor agencies which encourage increased commercial offtake of live animals is that higher rates of animal offtake will generate more income and greater welfare than *alternative* forms of livestock exploitation, such as dairying. Typically, however, such projects were planned and implemented without any assessment of current or potential economic returns to dairy production relative to live-animal sales. It was instead taken for granted that increased offtake of live animals was economically preferable to existing production systems and would therefore be welcomed by pastoralists.

To give one example, White and Meadows (1981) commented on a long-established ranching scheme among the Kenyan Maasai thus: "The major production objective of the [Ranch Development Programme initiated in the mid-1960s] was to increase the marketed offtake of beef, implying a move away from a predominantly subsistence milk production system..." (p.2). But evaluations carried out 20 years later show that project participants "continued to manage cattle for milk including milk sales rather than beef production" (pp. 2 and 3). An empirical study of both milk and beef parameters for these Maasai herds led White and Meadows to conclude that there was little scope for increasing beef production but that there was an unrealised potential for greater commercial milk production. This is an important conclusion for several reasons: firstly, the longevity of the Maasai ranching project and thus the time that the Maasai had had to respond in the manner intended and secondly, the implication that the objectives of the project were founded on an incorrect assessment of the value of dairy production to Maasai pastoralists.

Others working among African pastoralists have reached similar conclusions: for example, Niamir (1982) observed in a study on the Dinka that one of the reasons that livestock production schemes aimed at increasing beef offtake "have been unsuccessful is precisely because they ignore the importance of milk, and the great reliance of the people [pastoralists] on live rather than dead cattle" (p.120). Large-scale livestock projects have thus proceeded without having first measured dairy offtake rates, the value of subsistence and cash benefits from dairying, or the nutritional impact of decreasing the consumption of dairy products (for other examples, see HTS, 1974, 1976; Teitelbaum, 1977; Behnke, 1985a).

A recently completed, major baseline study of livestock in Niger did not include any measurements of milk offtake from pastoralists' herds in the research on animal production. The only data on dairying in this study were obtained by social rather than animal scientists (Swift, 1984). No study, to the author's knowledge, has yet compared the net income benefits to pastoralists of diverting milk to human consumption (as herd owners now do) versus allowing calves free access to milk (as is recommended by the proponents of meat production). Would the faster and greater weight gain by calves receiving all milk yield equal or greater economic returns than alternative uses of the milk under existing pastoral conditions? Yet without such comparative measures of income from dairying versus live-animal sales, project planners cannot claim that their efforts will *necessarily* increase the income and welfare of pastoralists. Once again, the burden of proof lies with those who assert this, while the responses of pastoralists exhorted to sell more animals and milk them less suggest strongly that they have reason not to share planners' assumptions.

There are several reasons why, under certain circumstances and for particular groups of pastoralists, the welfare and income returns from dairying surpass or equal those from selling animals. These reasons may be summarised as follows:

- The barter value of seasonally surplus milk traded for grain is calorically advantageous to pastoralists, saves them having to sell breeding animals to buy grain during unfavourable seasons, and provides them with a cheaper source of grain than purchasing at retail prices (Dahl and Hjort, 1976; Dupire, 1963; Swift, 1984; Toulmin, 1983).

- The use (consumption) value of milk to pastoralists is higher than its exchange (sale) value in terms of protein equivalents at retail prices. Thus, pastoralists would not be able to match the protein value of milk consumed if they sold the milk and attempted to replace the same amount of protein by purchasing foods with the money obtained from milk sales. There is nearly always

a cost incurred by producers who replace home-produced food with food bought at retail prices. By the same token, the use value of milk will in general exceed the cash returns from selling live animals, in terms of protein replacement, except where interventions (e.g. food subsidies, famine relief etc.) distort the free play of market forces.

- The peak period of milk production (typically in the rainy season) provides milk for home consumption during the season when grain is often least available and most expensive i.e. during the so-called ‘hunger months’ (Swift, 1984; Teitelbaum, 1977; White and Meadows, 1981).

- The sharp drought-induced fluctuations in terms of trade between live animals and grain make total dependence on sales of live animals highly risky for pastoralists (Sutter, 1982; Swift, 1984). For example, in the Sahel drought in the early 1970s, the exchange rate for meat to grain fell to 1:1 by weight — grain having more calories than meat (Touhnin, 1983). Similar ratios were observed in the recent drought affecting Sudan (Behnke, 1985b). By contrast, the exchange ratios between dairy products and grain tend to be more stable, and to favour pastoralists, since milk production falls along with grain output under drought conditions. The cash value of dairy produce is therefore a more predictable source of income in the long term.

- Owners of small herds are often especially reliant on dairy income since they have too few disposable animals to sell in order to meet their cash needs, particularly to buy grain. This has been noted in the case of one group ranch among the Maasai; "where there is a market for milk, the poorer households will sell more than the richer households, both in absolute and relative terms" (White and Meadows, 1981, p. 109). Table 1 (given earlier) shows that poorer households among the Bella and Tuareg of Mali also rely heavily on dairy income, in contrast to wealthier households.

- The social position of pastoral women, who are often primarily responsible for dairy operations and providing family income through the sale of dairy products, may be threatened by a reduction of dairying in favour of animal sales. This can be considered a threat to social welfare, and is evidenced by the resistance frequently shown by women to projects which would reduce their dairy income (Broch-Due et al, 1981; Horowitz, 1981; Tavakolian, 1984; Waters-Bayer, 1985).

Lastly, but most importantly, livestock systems based on dairying can support more people per unit of land than can systems geared to meat production under similar technical conditions on African rangeland. In view of this relationship between land area and output, Toulmin (1983) has warned that "the gradual replacement of traditional pastoral production by meat-producing herds... has serious implications for rural employment and incomes. With the growth of modern production systems, substantial numbers of people will be displaced and will need to find alternative sources of income elsewhere" (p. 43).

The point suggested here is that since meat-production systems can support fewer people per land unit — although at higher returns per individual herd owner (provided markets, transport, price incentives and technical inputs are in place) — not all pastoralists using a given land area will be able to switch from dependence on dairying to meat production. Thus the income and welfare of some pastoralists will be endangered in order that other pastoralists can become fully commercial meat producers.

Removal of surplus livestock

Many livestock development projects in Africa have been based on the belief that animals in excess of subsistence needs were being held by ‘traditionally oriented’ pastoralists for reasons of social prestige, ritual or as a ‘store of wealth’ (see for example Doran et al, 1979). Encouraging greater offtake of these supposedly surplus animals, it was argued, would improve the range, increase pastoralists' welfare and income (see above) and provide urban consumers or export markets with meat.

This view is now unsupportable, as the accumulated quantified data on herd structures have since revealed that pastoralists in general dispose of unproductive females and mature males that are surplus to draught, breeding and transport needs (for pastoralists in Niger, Mali and Sudan, see Swift, 1984, p.104; for the Kenyan Maasai, see White and Meadows, 1981; for Somalia, see Box, 1971; for other East African groups, see Dyson-Hudson, 1974). Pastoral herds are mainly composed of breeding females, for the dual purposes of providing milk and males for sale. Any apparently ‘surplus’ mature males found in such herds are usually present for good reasons: Firstly, holding males until they reach mature weight brings a higher economic return at marginal extra cost than does selling all male calves when young; secondly, in drought-prone regions pastoralists need a reserve to sell in emergency; thirdly, owners may withhold saleable cattle until market prices are more attractive. The widely held conclusion of those who have actually studied the composition of pastoral herds is that animals will be slaughtered or sold when it is either economically advantageous or necessary.

Implications for livestock development policy

Development-oriented research projects among African pastoralists have, in the past, failed in their search for a surplus of saleable animals which could supply outside markets (e.g. in South Darfur, Sudan — Martin Adams, pers. comm.). In pastoral economies there is rarely a surplus of live animals for sale (see for example HTS, 1974; Wilson and Clarke, 1976). However, what is less widely appreciated is that another quite real surplus often does exist. During seasons of high milk production, pastoral herds may produce more milk than herd owners can either consume or exchange at sufficiently attractive terms. Some milk is converted by the women into a semi-preserved form (such as butter oil or cheese) for later exchange or home consumption. Commercial exploitation of dairy produce is, however, often limited by the available processing techniques, by lack of capital or critical inputs, and by undeveloped marketing channels between producers and potential new consumers. It would thus appear that development of the pastoral dairy sector could supply producers with much-needed additional income, by taking advantage of an already existing surplus product from pastoral herds. That surplus is seasonally plentiful milk.

Another compelling reason for encouraging the commercialisation of dairying among pastoralists is that demand for dairy products is presently unmet in Africa. Mbogoh (1984b) has noted in a recent review of dairy development in sub-Saharan Africa that, throughout the region, demand for dairy products has long outstripped supply, with the deficit being made up by imports from Europe and North America. Due to agricultural subsidies in the industrialised West, dairy goods imported by African countries effectively undercut local producer prices which, by contrast, are not supported by African governments.

This has led to the situation in which a two-tiered dairy marketing system operates: a formal market offering producers low, official prices reflecting the competitive: import price, and informal marketing outlets "which tend to be low-cost operations ... in a position to pay higher prices to producers" (Mbogoh, 1984a, p. 8). The informal system handles the bulk of dairy processing and marketing in most African countries. The author further points out that attempts to promote the formal dairy sector have generally been unsuccessful due to low official producer prices and high capital costs of setting up and running modern dairies. Another problem may be the inefficient management of parastatal dairy plants.

Most milk producers prefer to sell through the ‘traditional’ system where they receive better prices for their products. Several case studies have drawn attention to this discrepancy; for example, women in the Kafr Al Bahr area in Egypt refuse to sell milk to local factories since they can obtain far greater returns by making and selling cheese independently (Zimmermann, 1982), while in northern Nigeria women were reported selling milk through the informal market at 5.5 times the price offered by a local commercial milk collection centre (Waters-Bayer, 1985). Similarly, local milk prices in a more arid pastoral area in Kenya were found to be 2.5 times higher than the official prices offered in an adjacent highland area with more rainfall (Lilljequist, 1983). In a survey carried out by ILCA, the ratio between traditional and official dairy prices was found to fluctuate between 1:1 and 3:1 in West and eastern Africa (Mbogoh, 1984b).

The point seems clear: given present official producer prices and capital costs, traditional dairy processing and marketing operations offer higher economic returns to producers than ‘modern’ dairies. The African continent is littered with modern dairies running at far below capacity, or which are simply defunct (Mbogoh, 1984b). Greater recognition is needed of how effectively traditional dairying operations currently meet demand, while further research is required on how this subsector can be assisted for the benefit of both the local producers and consumers.

A case against the commercialisation of pastoral dairying may be made on the grounds that an increase in the commercial value of milk would lead to a decrease in the amount of milk distributed within a pastoral society, either as in-kind payments for services or as gifts to poor dependants. Researchers, in particular anthropologists, who are familiar with the redistributive practices in pastoral societies may therefore argue that as milk acquires a cash value and is more often sold, the welfare of the poorer members of a pastoral society will be adversely affected.

There are several rejoinders to this objection. Firstly, throughout Africa pastoralists have become increasingly oriented towards production of live animals for sale to outside markets. Owners of larger herds, who have potentially the most surplus milk for local redistribution, have already shifted to commercial meat production, in the process deflecting more milk to calf growth (Behnke, 1985b; Solway 1980; White and Meadows, 1981). Consequently it is the owners of smaller herds, who are less able to shift to full-scale commercial meat production, who are most likely to benefit from dairying. Secondly, if milk becomes more valuable, payments for services in kind, in the form of giving milk cows to herders, for example, will be accordingly more valuable to the recipient. Thirdly, the substitution of cash for formerly in-kind transactions had typically followed upon the process of commercialisation. As live animals have acquired a commodity value in pastoral societies, exchanges formerly involving live animals (e.g. bridewealth, herding services, injury and homicide compensation, fines etc.) have gradually been replaced by cash payments (Toulmin, 1983). In the same manner, as milk increasingly becomes a commodity to be bought and sold, we can expect impacts on in-kind transactions

similar to those that accompanied the shift in pastoral economies to commercial meat production.

To summarise the main points, while the development of dairying may well result in less milk being distributed within pastoral societies, a reduction in the availability of milk has already occurred due to the increased commodity value of live animals; dairying offers owners of smaller herds a means of increasing their income; and transactions previously involving the exchange of milk are likely to become monetarised rather than to simply attenuate.

Conclusion

The above discussion of the comparative benefits of commercial meat production versus commercial dairying among pastoralists leads to the conclusion that the development of the pastoral dairy sub-sector is warranted. Unlike the case with increasing offtake of live animals, there may well be a surplus of saleable milk in many pastoral economies; many pastoralists are already engaged in the commercial exploitation of milk, but are often limited by available techniques, inputs and capital. As with meat, there is an increasing demand for dairy produce within Africa. Lastly, given present levels of inputs and technology, extensive commercial meat production requires more land per animal unit to achieve economic and energy outputs comparable to those achieved with dairy production. The development of dairying can therefore potentially offer a higher income to a greater number of pastoralists than could be achieved with commercial meat production on the same area of land.

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