The effect of PPR control and dipping on village goat populations in southwest Nigeria

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SUMMARY

GOATS IN SEVEN *villages in southwest Nigeria were divided into three treatment groups: dipping plus vaccination against* peste des petits ruminants *(PPR), dipping only, and control. Over a 2-year trial period, animal numbers in the first two groups increased by 86 and 162% respectively, compared with a 46% increase in the control group. Both kidding rate and purchase of young animals were highest in the dipping plus vaccination group. Compared with the control, exits in the dipping group were markedly lower, the mortality rate for young animals decreasing by 54% and the overall levels of sales and loans-out dropping. Young stock mortality in the dipping plus vaccination villages was 24% lower than in the control villages, but other exit rates were similar.*

INTRODUCTION

ILCA introduced a long-term health package for village goats in southwest Nigeria in 1982. The package consisted of annual vaccination against *peste des petits ruminants* (PPR) with tissue culture rinderpest vaccine (TCRV), and monthly dipping against sarcoptic mange using gamma benzene hexachloride.

The preliminary results reported in ILCA (1985) suggested that goat mortality rates were greatly reduced by the health package, and that animal numbers in the villages increased. However, changes in the birth and mortality rates may not have been the only reason for the observed population changes. To clarify the effects of the health package tested, the data were re-analysed and the results of the analysis are discussed in this paper.

METHOD

Seven villages near Fashola, Oyo State, were visited monthly between December 1982 and November 1984. At the start of the survey all goats in the study villages were divided into three groups[1]: the dipping plus vaccination group (D + V), which comprised animals from three villages, the dipping group (D) and the control group (C), the last two each comprising goats from two villages (Table 1). All animals in the groups were tagged. The treatments were monthly dipping in acaricide in groups D and D +V and annual vaccination with TCRV in group D + V.

[1]The original design included a fourth group in which goats were only vaccinated against PPR, but these animals were withdrawn by their owners soon after the start of the trial, and are not therefore included in the analysis.

Table 1. *Human and goat populations in seven villages in Oyo State, southwest Nigeria, 1982–84.*

	Dipping and vaccination	Dipping	Control
Total households	29	48	26
Total adult humans	68	113	55
Males	37	53	22
Females	31	60	26
Number of animals			
December 1982	129	81	65
November 1984	240	212	95
Villages	Apologun, Iporin-Shangodeyi and Temidire- Egbejoda	Igbonla and Onduagbon	Arowona and Mogaji-Oluewu

Entries into the herds (including births, purchases and animals accepted for caretaking) and exits (deaths, sales, loans-out, gifts, ceremonial slaughters and animals returned to owners after caretaking) were recorded monthly and tags allocated as appropriate. Births were recorded as singles, twins, triplets or quadruplets, the records showing also the sex of the offspring, the month of birth and dam number. Kidding interval was determined from records of dams that had more than one parturition during the 24 months of the trial.

For the purposes of data analysis, the dividing line between young and adult animals was set at 12 months of age. Kidding rates were expressed as kids born during the trial, multiplied by 12 and divided by the sum of adult female goats present in each month. Monthly entries other than births and exits were expressed as entry or exit divided by the total goat population in that month.

RESULTS

Overall numbers. During the 24 months of the trial, the number of goats present in the herds increased in all treatment groups (Table 2): the highest increase was recorded for group D (162%), followed by group D + V (86%) and group C (46%). In group D + V the number of adult goats increased more sharply than that of young stock, while in the control villages both age groups increased by a similar amount, and in group D the number of young stock rose faster than that of adult goats.

Table 2 . *Herd structure at the start (December 1982) and end of the trial (November 1984) and changes in goat numbers over 1982–84, southwest Nigeria.*

		Dipping and vaccination		Dipping		Control	
		n	%	n	%	n	%
December 1982							
Male	Young	28	21.7	10	12.3	17	26.2
	Adult	4	3.1	0	0	0	0
Female	Young	40	31.0	19	23.5	9	13.8
	Adult	57	44.2	52	64.2	39	60.0
Total number		129		81		65	
November 1984							
Male	Young	47	19.6	34	16.0	19	20.0
	Adult	30	12.5	21	9.9	13	13.7
Female	Young	49	20.4	52	24.5	22	23.2
	Adult	114	47.5	105	49.5	41	43.2
Total number		240		212		95	
Changes in herd numbers							
	Young	28	41.2	57	196.6	15	57.7
	Adult	83	136.1	74	142.3	15	38.5
	Overall	111	86.0	131	161.7	30	46.1

Herd structure. The proportion of adult males increased over the trial period by about 10 percentage units across all groups (Table 2). The proportion of adult females changed little in group D + V, and decreased in groups D and C.

Entries. Total entries (expressed as percentages of total animal months) were similar for all treatment groups (Table 3). The entry rate for young stock was lowest in group D (139%), compared with about 155% for group C and 152% for group D+V.

Table 3. *Entries and exits as percentages of goats present in each category, southwest Nigeria, 1982–84.*

Type of entry or exit	Animal Category	Dipping and vaccination		Dipping		Control	
		n	%	n	%	n	%
Entries							
All entries	Young[1]	305	152.0	242	139.2	123	154.8
	Adult[2]	16	7.7	11	6.6	4	4.1
	Overall[3]	321	79.0	253	74.7	127	71.7
Purchase	Young	48	23.9	37	21.1	17	21.2
	Adult	12	5.8	11	6.6	4	4.1
	Overall	60	14.7	48	14.1	21	11.8
Exits							
All exits	Young	140	69.6	82	46.8	67	83.7
	Adult	71	34.4	42	25.3	31	31.5
	Overall	211	51.7	124	36.3	98	54.9
Deaths	Young	38	18.9	20	11.4	20	25.0
	Adult	14	6.8	4	2.4	3	3.0
	Overall	52	12.8	24	7.0	23	12.9
Sales	Young	48	23.9	21	12.0	22	27.5
	Adult	23	11.1	7	4.2	12	12.2
	Overall	71	17.4	28	8.2	34	19.0
Loans-out	Young	45	22.4	31	17.7	20	25.0
	Adult	30	14.5	26	15.6	14	14.2
	Overall	75	18.4	57	16.7	34	19.0

Offtake[4]	Young	102	50.7	62	35.4	47	58.7
	Adult	57	27.6	38	22.9	28	28.4
	Overall	159	39.0	100	29.3	75	42.0

1 Young = sum of young animal months divided by 12.
2 Adult = sum of adult animal months divided by 12.
3 Overall = sum of total animal months divided by 12.
4 Offtake (all exits minus deaths) = sum of total animal months in the respective category divided by 12.

Births. Details on the reproductive performance of goats in the seven study villages during 1982–84 are given in Table 4. Birth rate was highest in group D + V (1.5 kids/ dam/year, compared with 1.4 and 1.3 kids/ dam/year in groups D and C respectively), but mean litter size was lowest (1.5 vs 1.6 and 1.7-kids/parturition). Kidding interval differed marginally between groups, the lowest having been calculated for group D (7.6 months) and the highest for group C (8.4 months).

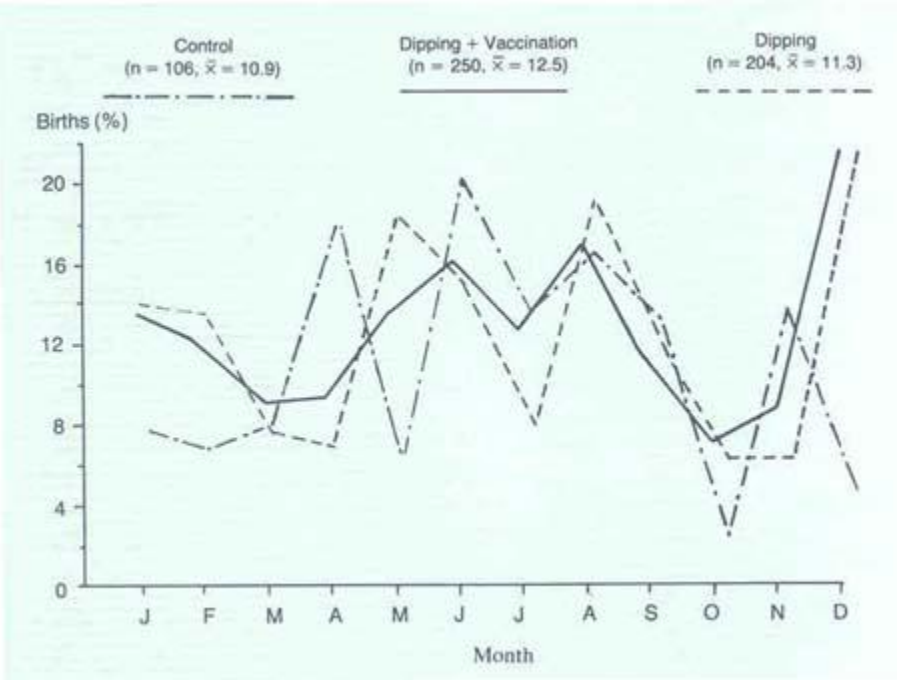
Table 4. *Reproductive performance of village goats, southwest Nigeria, 1982–84.*

	Dipping and vaccination		Dipping		Control	
	Number	Mean	Number	Mean	Number	Mean
Kidding rate (kids/dam/year)	250	1.5	204	1.4	106	1.3
Kidding interval(months)	62	8.2	53	7.6	27	8.4
Litter size(kids/parturition)	163	1.5	126	1.6	63	1.7
		—%—		—%—		—%—
Type of birth						
Singles	85	34.0	54	26.5	23	21.7
Twins	140	56.0	132	64.7	74	69.8
Triplets	21	8.4	18	8.8	9	0.0
Quadruplets	4	1.6	0	0.0	0	0.0

The proportion of multiple births was lower in group D + V (66%) than in the other two groups (75%). In group C, a lower proportion of births occurred in the months of December, January

and February, indicating that conception rates were lower during the rainy period of July – September (Figure 1).

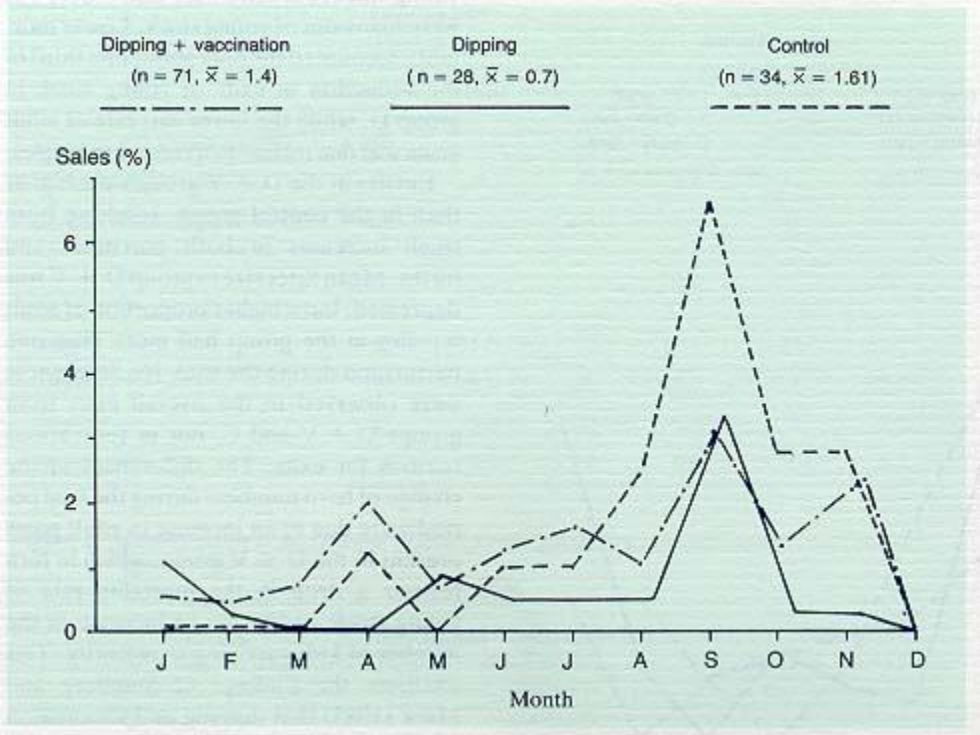
Figure 1. *Monthly births as percentages of adult female goats present in each month, southwest Nigeria, 1982–84.*



Twenty-two females born into the trial were observed to have a mean age of 12.5 months at first parturition. Ten observations each were made in groups D + V and D, and the remaining two in group C. However, only 20% of the females which were born into the trial and were older than 12.5 months by November 1984 had given birth in groups D + V and D, and only 15% in group C. Thus over 80% of females older than 12.5 months had not given birth by the end of the trial.

Purchases. About 12–15% of animals entering the herds were purchased, with young animals comprising over four fifths of the purchases (Table 3). Mean monthly purchases for February to July were similar in all groups (1.5–1.6%), but in the remaining 6 months of the year the mean for group C was lower (0.4%) than for the other two groups (0.9%) (Figure 2).

Figure 2. *Monthly purchases as percentages of all goats present in each month, southwest Nigeria,* 1982–84.

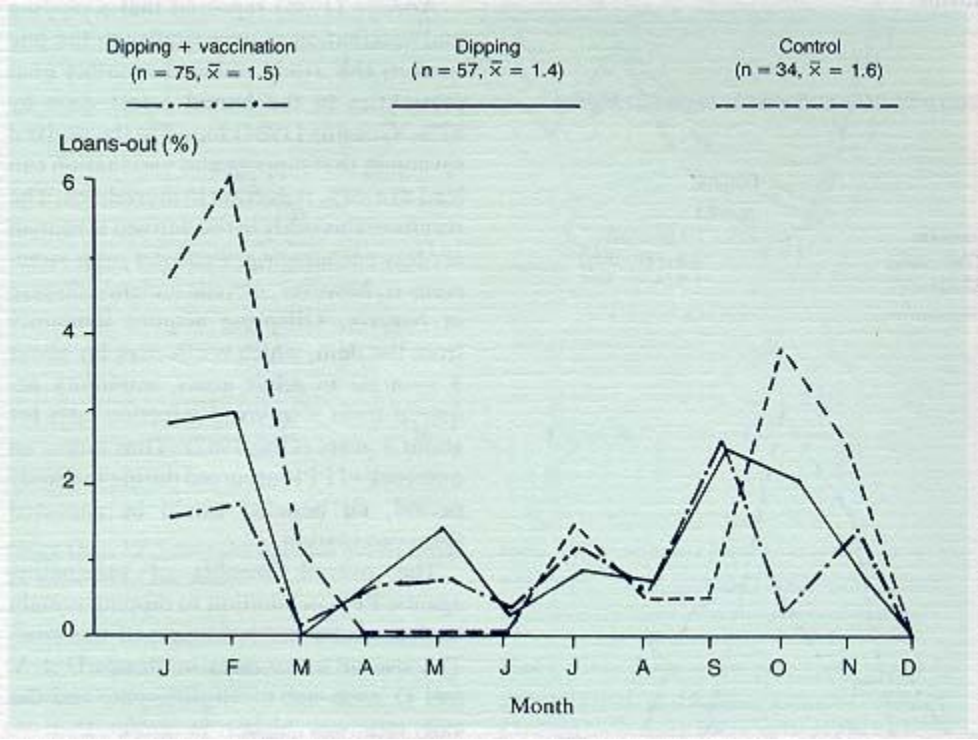


Loans-in. Few cases of loans-in were recorded during the study period, accounting for 2.3% of animals present in group D + V and for 0.3% in group D. No animals were received on loan into the control group.

Exits. Exit rates were generally lower in group D than in the other groups (Table 3). Overall exits were twice as likely to be from young stock than from adults.

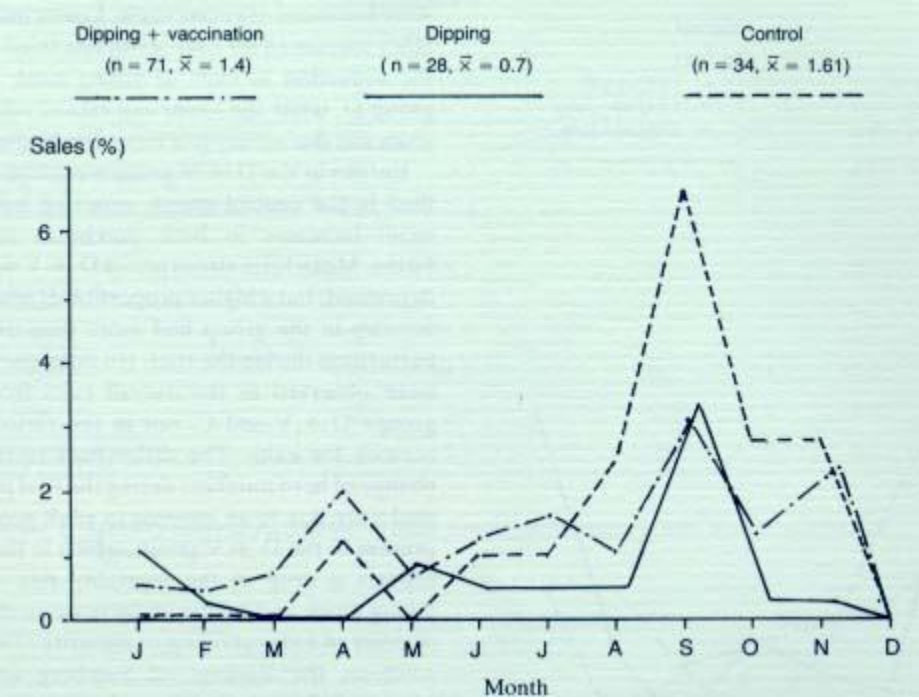
Deaths. The overall mortality rate (Table 3) was lower in group D (7%) than in the other groups (about 13%). Across all groups, mortality among young stock was much higher than among adult goats, the difference being most marked in group C where young-stock and adult mortalities were 25 and 3% respectively. In all groups, mean monthly mortality rates were lower during February to July than during August to January. This difference was again most marked in group C, where the mean monthly mortality for August to January was 1.8%, twice as high as in group D for the same period (Figure 3).

Figure 3. *Monthly mortalities as percentages of all goats present in each month, southwest Nigeria,* 1982–84.



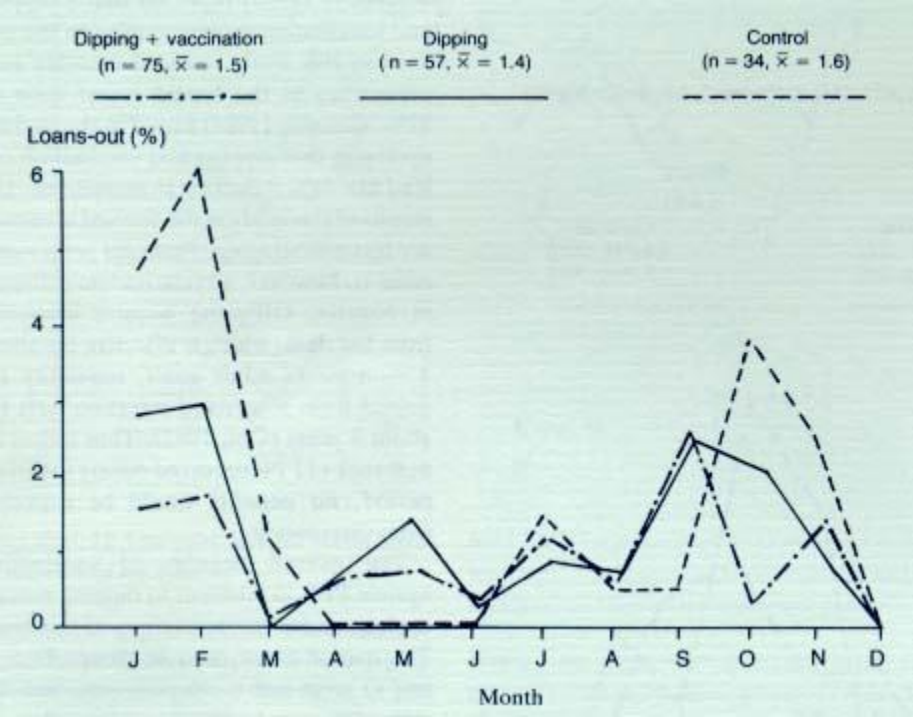
Sales. The proportion of animals exiting through sales (Table 3) was over twice as high in groups D + V (17%) and C (19%) as in group D (8%). Compared with sales of adults, twice as much young animals were sold from groups D + V and C, and almost three times as much from group D. Sales from all groups peaked in September (Figure 4), coinciding with the Muslim festival *Id-el-Kabir.*

Figure 4. *Monthly sales as percentages of all goats present in each month, southwest Nigeria, 1982–84.*



Loans-out. The proportions of animals exiting the village herds on loan were similar in all treatment groups (Table 3). Young goats were given out on loan more often than adult goats, particularly in groups D + V and C. In all treatment groups, loans-out were high in January and February, with a further peak during August to October (Figure 5).

Figure 5. *Monthly loans-out as percentages of all goats present in each month, southwest Nigeria, 1982–84.*



Other exits. These accounted for only 24 out of a total of 433 exits, with ceremonial slaughter being the most important reason (20 cases).

Offtake. Total offtake (all exits minus deaths) was highest in group C (42%), followed by group D + V (39%) and group D (29%). In group D, the lowering of offtake of young stock was more marked than that for adults (Table 3).

DISCUSSION

Animal numbers in the treatment villages increased faster than in the control villages, but these population changes were due to a combination of factors, some of which may not be directly attributable to the treatment applied.

The overall entry and birth rates in the villages where goats were dipped were not much different from those in the control group. Fewer adult females in group D completed more than one reproductive cycle during the trial period, but their kidding interval was shorter than in the other two groups. Compared with the control, total exits in group D were reduced: this was partly due to a lower mortality among young stock, but sales were also reduced as were loans-out of young stock. Lower mortality accounted for only about one third of the reduction in exits of young stock in group D, while the lower exit rate of adult goats was due mainly to a reduction in sales.

Entries in the D + V group were higher than in the control group, resulting from small increases in both purchases and births. Mean litter size in group D + V was depressed, but a higher proportion of adult females in the group had more than one parturition during the trial. No

differences were observed in the overall exits from groups D + V and C, nor in the various reasons for exits. The differences in the change of herd numbers during the trial period were due to an increase in adult goats present in the D + V group, which in turn reflects a drop in the mortality rate of young stock and hence an increase in the number of kids surviving to maturity. This confirms the findings of Sumberg and Mack (1985) that dipping and vaccination improves survival rate to weaning, and to 12 months of age.

Adeoye (1985) reported that a dipping and vaccination regime similar to the one used in this study reduced monthly goat mortalities in the humid forest zone by 87%. Opasina (1984) found in the derived savannah that dipping and vaccination can lead to a 40% reduction in mortalities. The results of this study in the derived savannah are less encouraging. *Peste des petits ruminants* is, however, a cyclic endemic disease in Nigeria. Offspring acquire immunity from the dam, which is effective for about 3 months; in adult goats, immunity acquired from a survived infection lasts for about 3 years (Obi, 1982). Thus unless an outbreak of PPR occurred during the study period, no benefits would be expected from vaccination.

The overall benefits of vaccinating against PPR in addition to dipping remain unclear under the conditions of this trial. The overall entry rates in groups D + V and D were not much different, and the exit rate was higher in group D + V. About one third of the difference in exits was due to a higher mortality rate in group D + V and the remaining two thirds to a higher sales rate. Thus the change in herd numbers over the period of the trial was less in group D + V than in group D, but the cash income that farmers derived from their herds was higher.

Birth rate in the early dry season (December – February) was higher in groups D + V and D than in the control group, indicating a higher conception rate during the mid- to late rainy season (July – September). The highest mortality rate was recorded in September for group C, confirming previous observations on village goats (Mack, 1982; Sumberg and Mack, 1985; Adeoye, 1984).

Age of the dam affects litter size (Sacker and Trail, 1966; Wilson and Durkin, 1988). In West African Dwarf goats, litter size increases up to a dam age of 48 months (S.A.O. Adeoye, ILCA, Ibadan, Nigeria, personal communication). The age of dam was not recorded in this study, but groups D and C had a higher proportion of adult females than group D + V at the start of the trial, and this may have affected litter sizes.

Mack (1982), who studied sheep and goats in a similar village environment in southwest Nigeria, reported purchases accounting for 4% of total entries and sales accounting for 7% of total exits. These values are considerably lower than the 18% of purchases and 22–33% of sales recorded in this study.

Group D farmers sold fewer animals than farmers in the other groups, sacrificing immediate cash income for the longer-term benefits obtainable from additional breeding animals. Farmers will sell a sick animal in the market rather than wait for it to die. This may explain the high sales offtake in group C compared with group D, but not why sales from group D + V should also be high, since breeding animals in particular are rarely sold when in good health (Sempeho,1985).

Loans-in and loans-out in Mack's study were roughly equal at around 9% of total entries and exits, but in this investigation loans-in were negligible (1%) and loans-out accounted for 40% of

total exits. Farmers have a social obligation to provide animals on loan if requested, and those asking for loans may have believed that the goats in the trial were in better health than those available from other sources. The offspring of animals on loan are usually shared between the caretaker and the owner. In this study, however, farmers rejected caretaking as an option for increasing their own herds, favouring instead outright purchase.

The health package tried had no effect on the number of goats slaughtered for home consumption directly or after ceremonial slaughter. This indicates that in the study area, goats are not an important source of meat for the farm household. Improvements in productivity could increase cash income, and indirectly improve household nutrition as a result of more cash being available to buy food, but there is no evidence from this trial that home consumption of small ruminant meat will increase.

Working in the same area of Oyo State, Matthewman (1977) reported that 91% of the livestock owners surveyed mentioned financial gain as the main reason for keeping small ruminants, and only 5% placed priority on food. The offtake rate of weaned kids was 74%, and that of adult goats 24%, excluding females that had not kidded. These rates are similar to the control offtake rates in this trial, if allowance is made for young stock which died before weaning.

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