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Socio-economic determinants of keeping goats and sheep by rural people in southern Benin

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Abstract An understanding of factors influencing the decision of rural people to keep sheep and/or goats is crucial when formulating technologies and policies that support village-based small ruminant production. The knowledge of such factors will also improve assessment of impact intervention strategies on the livelihoods of rural people. Structured questionnaires administered in 228 households were used to study the ownership patterns of small ruminants in southern Benin. The ownership of goats was higher (91%) than sheep (35%) because goats are not affected by any ethnic or cultural restrictions. Goats are also perceived to be a less risky to invest into compared to sheep. Women represented 71% of the keepers of goats. Predictive models of ownership were developed using logistic regression. The results showed that younger household members ($p < 0.05$) especially young women (60%) are more likely to own small ruminants. Owners of small ruminants are less likely to be involved in off-farm activities and would often have no access to credit facilities. Gender, ethnicity, and perception of risk associated with species are the major factors affecting people's choice of species. These findings highlight the financing and insurance roles that small ruminants, particularly goats, are playing in the study area. In order to develop suitable technologies and formulate policies to improve productivity and enhance livelihoods, the constraints to goat production need to be identified, and the local knowledge of the keepers should be investigated.

Keywords Goat · Ownership patterns · Rural development · Sheep · Smallholder · Socio-economics

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Introduction

Small ruminants are an important component of smallholder farming systems in southern Benin (D'Orgeval et al. 1988; Remy 1988; Kirk 1996). As human population increases in this part of the country, the access of rural families to land, capital, and labor diminishes while opportunities for income from off-farm activities become scant (Floquet 2000; Edja 2001). As a result, households are often forced to enter sharecropping agreements and face consumption and income shocks (Schlauderer 1997; Abiassi 2002). In addition, the rural families do not have the financial means to participate under the present "savings before credit" conditions for access to credit. Such a scenario leads to low investment in agricultural activities, low productivity, low income, and consequently a vicious cycle of poverty and environmental degradation (World Bank 1994; Igue et al. 2000; Manyong and Houndekon 2000). In these situations, where formal financial and insurance institutions are absent, small ruminants are "easy to cash" assets. Small ruminants are also important in a

diversification strategy that aims to reduce market and climatic risks and optimize the use of available resources (Valdivia and Nolan 1996). In southern Benin, the roles of small ruminants in the livelihoods of rural households have not been comprehensively investigated. It is important to understand why certain households do keep small ruminants and others do not.

Empirical evidence shows that household composition and the allocation of responsibilities to different family members affect farm management decisions (Guyer 1986; Haddad et al. 1997; Ellis 1998). Previous research has also shown that the head of household is not always the main decision maker and that gender partially determines how resource allocation decisions are made in a household (Handa 1994; Doss 1996, 2001; McPeak and Doss 2006). Curry (1996) further argues that in order to improve the welfare of resource-limited farmers via technical innovations, these intrahousehold differences *vis-à-vis* gender roles in production need to be recognized.

In Benin, it was shown that household members such as husbands and wives have separate incomes that are not pooled together (Dagnelie and LeMay 2005; LeMay 2006). In Ivory Coast, Duflo and Udry (2003) observed a similar scenario in which households' different sources of income are used differently depending on who earned it and the source. In such cases, individuals tend to make decisions with respect to their personal preferences and level of income and bargain over how much to contribute towards expenditures on shared household goods (Doss 1996; Quisumbing and Maluccio 2000). This implies that individual's access to income is important in determining their power in the bargaining process.

The age and gender of the farmers are important factors to consider when examining livestock ownership patterns, particularly among African smallholder farmers (Roberts 1996). In Gambia, Jaitner et al. (2001) found that small ruminants are non-pooled household resources and are independently owned and managed by household members who are often women. Similar observations were made in Nigeria (Okali and Sumberg 1986; Ajala 1995). It has been shown that women are often resource-poor farmers, because in many cases they do not hold rights to land and have less opportunity for off-farm work.

Accordingly, most of the studies on gender and livestock production have focused on male-female differences in patterns of labor allocation and resource use and control (Curry 1996).

However, comprehensive studies relating the socio-economic conditions of household members to their decision to keep small ruminants are lacking. In order to come up with recommendations for specific strategies of improved management of small ruminants and to predict the effect of improved production systems on the livelihoods of livestock keepers, it is important to first understand the socio-economic factors driving household members' decision to independently own these livestock species.

Livestock statistics (FAOSTAT 2003) suggest that goats outnumber sheep three to one in southern Benin. The reasons explaining this discrepancy have never been investigated. El Aich and Waterhouse (1999) argue that, unlike sheep, keeping goats does not require high capital while empirical studies have revealed that cultural factors, including religion and ethnicity, affect the ownership of certain types of livestock by the household (Okali and Upton 1985; D'Orgeval et al. 1988) and/or by certain household members (Bierschenk and Forster 1987). In addition to cultural factors, Okali and Upton (1985) reported that sheep are less popular and thus less numerous than goats in southwestern Nigeria because of their destructive grazing habit. Rural people, particularly smallholder farmers also consider the risks associated with a farming activity (Ellis 1988). Risks in livestock keeping arise from uncertainty about outbreak of diseases, death or theft of the animals. The attitude of livestock keepers towards risk may affect their perception on the benefits associated with keeping particular livestock species.

The objectives of the study were to investigate the socio-economic factors affecting the decision of households and individual household members to keep small ruminants and to establish a better understanding of the rationale behind keeping of particular species. The following research questions were formulated: Which socioeconomic characteristics affect the decision of a rural household to keep small ruminants? Which socioeconomic characteristics affect the decision of an individual household member to own small ruminants? Which factors determine the preference of keepers for a given species of small ruminants?

Conceptual framework

The conceptual framework for this study was mainly based on the theory of rural household decision making reviewed in Udry (1996) and on empirical literature. There is a general consensus that differences between households in asset endowment, especially land and the control over it, within households are the principal factors that affect household or individual decisions to participate in different livelihood activities (Reardon et al. 1992; Dercon 1998; Ellis 2000; Barret et al. 2001). Rural people without access to land or with smaller land plots have lesser chances to increase agricultural crop productivity (Feder 1985; Dorward 1999) and are expected to be more likely to diversify their livelihood strategies (Barett et al. 2001), for example by acquiring livestock in addition to crop

production. Hence, household or individual land ownership and farm size were expected to be inversely related to the decision to keep small ruminants.

Furthermore, inadequate access to financial markets, such as savings, credits, and insurances, hinders the ability of rural people to invest in activities that are important to them and determines an individual or household's decisions to engage in other income generating activities (Feder 1985; Binswanger and Rosenzweig 1986; De Janvry et al. 1991). Where formal financial markets for rural households are poorly developed, keeping livestock represents a means of finance and self-insurance and thus a risk-coping strategy for many rural people (Rosenzweig and Wolpin 1993; Barett et al. 2001; Katsushi 2003). Because small ruminants are liquid assets that can easily be converted into cash (Dercon 1998), it was expected that households or individual household members lacking access to formal credit are more likely to decide to keep these species. However, even where some credit markets exist in southern Benin, land and off-farm income are important collaterals (Hoffman and Heidhues 1993; Neef and Heidhues 1994). Therefore, it was expected that large land holding and participation in off-farm employment increase access to credit and affect negatively household or individual's decision to keep small ruminants.

Generally in rural sub-Saharan Africa (Smith 2000) and more specifically in the farming system of southern Benin (Floquet 2000), younger farm household heads are more likely to migrate in search for non-agricultural wage jobs, and older farm household heads are less likely to be working off-farm. Therefore a positive and significant relationship between the age of the head of household and the decision of the household to keep small ruminants as strategies of farm diversification was expected.

Rural African women generally have limited access to household's land and receive limited land use rights from their husbands (Neef and Heidhues 1994; Quisumbing et al. 2001). In addition to their heavy domestic chores and child care, they have to work in their husband's farm plots and have therefore very little time and opportunity for off-farm employment (Roberts 1996; Abdulai and Delgado 1999). This implies that they may have more restricted access to credit than men. However, Udvardy and Cattel (1992) found that mature farm wives usually have more control over household assets and less domestic workload and childcare responsibilities and are more likely to be involved in off-farm activities than younger ones. This implies that they may have more access to formal credit. Therefore one can expect that they are less likely to own small ruminants. In other words, the likelihood of a female household member to own small ruminants was expected to be negatively associated with age.

Many studies (Feinerman and Finkelshtain 1996; Dercon 1998; Ghadim and Pannell 1999; Beckford 2002) have provided evidence that individual household members' risk preferences and their perceptions of the benefits, costs, and riskiness play a significant role in the choice of different livelihood alternatives available to them. Therefore, the individual decision to keep a given species of small ruminants was expected to be strongly affected by the risk preferences and perceived benefits associated with each species. Sometimes, species that are associated with better profits are also perceived to be riskier. In such cases, differences in risk-averse between individual decision makers may explain their choices of species to own (Dercon 1998).

Additionally, household or individual decision-making process is also influenced by the culture of the community (Reijnjtes et al. 1992). In many African societies, keeping some livestock species is not compatible with certain cultures and traditions (Weissenborn 1906; Thurnwald 1929). Therefore, it was expected that the cultural background (i.e., ethnicity and religion) of a household or individual household member affects the decision to keep a given species of small ruminants.

Material and methods

Study area

The study was carried out in southern Benin, West Africa. Among the rural activities, rainfed agriculture is the most important, followed by livestock keeping and off-farm activities. The main food crops are maize, cassava, and cowpea while oil palm and groundnuts are major cash crops. Poultry, small ruminants, and pigs are the main livestock species kept. Off-farm activities include petty trade, processing of cassava, production of palm oil, and distillation of palm wine. Predominant land tenure systems are inheritance, purchase, and borrowing (Kirk 1996). The climate is characterized by a long dry season from November to the end of March, a first rainy season from April to July, a short dry period in August and a second rainy season in September and October. Precipitation varies from 900 to 1,300 mm per year. The annual average temperature is about 26.5°C with a relative humidity of 75%. The vegetation is dominated by mosaic of culture and fallows of moist woodland and shrubby savannas. The research area was located between 6°30′ and 6°45′ North latitude and between 1°35′ and 2°45′ East longitude and encompasses three agro-ecological zones: the zone of Pêcheries, the Dépression zone and the zone of Terre de Barre (MDR 1998). These three major agro-ecological zones were described by MDR (1998) as follows: (1) The zone of Pêcheries corresponds to low-lying and sandy

coastal plain. It is marshy and dotted with lakes and lagoons communicating with the ocean. The soil is poor in organic matter and has a low fertility. (2) The zone of Terre de Barre is a plateau zone. The soils are acrisols with sandy topsoil and clay subsoil. Physically homogenous, they are chemically poor. (3) The zone of Dépression separates the various plateaus. The clay soils are rich in nutrients and are often waterlogged.

Sampling procedure and data collection

Data were collected through a two-stage survey in 2002. Two rural administrative units (communes) were randomly selected in each of the three agro-ecological zones of southern Benin (Fig. 1). Two villages were randomly selected in each commune. A total of 12 villages were selected. In each village, a list of households, used as primary sampling frame, was obtained from the publications of the 1992 agricultural census (MDR 1993) and the 1992 population census (INSAE 1994). This list was updated in conjunction with the local authorities, and the complete list of households per village was used as sampling frame. Subsequently a random sample of 240 (20 per village) households was drawn.

In the first stage, a total of 228 willing households out of the 240 were surveyed. During this stage, only the household heads were interviewed using a structured questionnaire. The questionnaire asked for general household information including household demographic data, land ownership, household farm and non-farm activities, saving opportunities, access to credit, and ownership patterns of small ruminants and other livestock. Out of the 228 households surveyed, 178 kept small ruminants and 50 did not. Other livestock species commonly raised were chicken

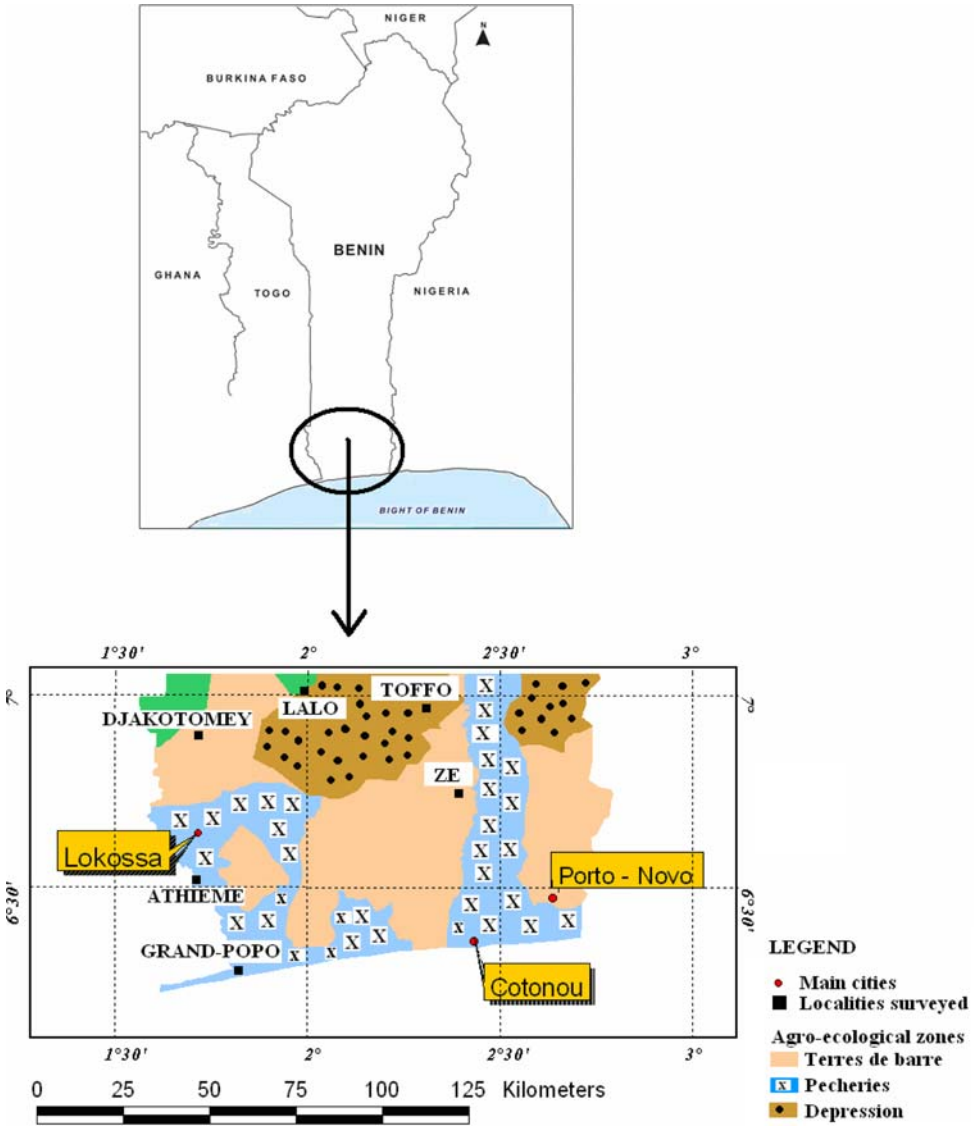

Fig. 1 Agro-ecological zones of southern Benin and locations of the study

(179 households) and pigs (14 households). In the second stage, only those 178 households who kept small ruminants were visited. In each of these households, every adult household member present the day of this second visit was interviewed with a structured questionnaire. In total, 358 individual household members were interviewed, of which 222 were owners of at least one goat and/or sheep and 136 were non-owners. Information on the motivation for keeping the animals and the perception of sheep versus goats with regard to economic benefits and risks were recorded.

Statistical analysis

The variables tested for each research question are summarized in Table 1. The data were analyzed with the Statistical Package for Social Sciences SPSS-PC Version 9.0 (SPSS Inc. 2001). First bivariate analyses of the variables were carried out using Chi-square analysis and t-test. Then the logistic regression procedure applying the backward likelihood-ratio (LR) test was used to investigate the set of socio-economic variables that affect the decision to keep small ruminants and the choice of species at household level as well as at individual household's member level.

Logistic regression allows the prediction of group membership from a set of categorical and/or continuous variables (x). Generally, the dependent variable is dichotomous and can take the value 1 (member of the group) with a probability of success y, or the value 0 (non-member) with probability of failure $1 - y$. The relationship between the dependent and independent variables is not a linear function. Instead, the logistic regression function is used, which is the logit transformation of y:

$$\text{Logit } [y(x)] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_i x_i$$

where $\alpha =$ the constant of the equation and $\beta =$ the coefficient of the independent variables.

In the Backward stepwise logistic regression, the analysis begins with a full model that includes all predictor variables. Then, variables that are not useful in predicting the dependent variable are eliminated from the model in an iterative process. The analysis is completed when no variables can be eliminated from the model. The positive or negative sign of the coefficient β indicates the direction of the relationship between a given independent variable (x) and the dependent variable while the odds ratio gives the magnitude of the change in the odds of having the dependent variable event for a one unit change in the given independent variable. An odds ratio of 1 indicates that the given independent variable has no effect on the dependent variable. An odds ratio below 1 means increasing the given independent variable decreases the odds that the dependent variable equals 1 by a factor of the odds ratio when other variables are controlled. An odds ratio above 1 means increasing the given independent variable increases the odds that the dependent variable equals 1 by a factor of the odds ratio when all other independent variables are controlled. For each test the best model was selected by goodness-of-fit, comparing maximum likelihood, significance of model-coefficients, and number of cases predicted correctly.

Table 1 Description of variable codes

Variable code	Description
AEZ	Agroecological zones: (Pêcheries-Dépression and Terre de Barre)
SEX	Sex of household head or owner or non-owner at testing: (male – female)
AGE	Age of household head or owner or non-owner at testing (in years)
HHSIZE	Number of persons living in the household (heads)
NINCOME	Number of member of household earning income (heads)
EDU	Formal education categories of head of household, owner or non-owner: (none–some primary–some secondary)
PRINCOM	Main source of income of head of household, owner or non-owner: (cropping–other)
OFFARM	Off farm employment of head of household, owner or non-owner: (yes–no)
CREDACCS	Access to credit for formal source in the last two years of head of household, owner or non-owner: (yes–no)
SAVING	Subscription to a formal saving and credit institution of head of household, owner or non-owner: (yes–no)
LANDSZ	Land size cultivated by the household in ha
LANDPLOT	Land plot cultivated independently by owner or non-owner (in ha)
ETHNIC	Ethnic groups: (Aizo–Kotafon–Mina–Adja–Other)
RELIGION	Religion of head of household, owner or non-owner (Christian–Muslim–Traditional)
RISKSP	Perception towards risk associated with species of the owner or non-owner: (goat riskier–sheep riskier–equal)
HPROFSP	Perception towards the profit associated with species of the owner or non-owner: (goat more profitable–sheep more profitable–equal)

Results

Characteristics of household keepers versus non-keepers of small ruminants

The bivariate analysis (Table 2) showed that the frequency of household keeping small ruminants varied significantly ($p < 0.001$) with the head of household's access to credit in

Table 2 Association between socio-economic characteristics of head of households keepers and non keepers of small ruminants ($n = 228$)

Variable code	n	Households non-keepers ($n = 50$) (%)	Households keepers ($n = 178$) (%)	χ^2	Significance
AEZ				3.56	n.s.
Pêcheries	76	21	79		
Dépression	77	29	71		
Terre de Barre	75	16	84		
SEX				1.97	n.s.
Male	185	24	76		
Female	43	14	86		
EDU				2.38	n.s.
None	134	24	76		
Some primary	66	23	77		
Some secondary	28	11	89		
PRINCOM				0.04	n.s.
Cropping	194	22	78		
Other	34	21	79		
OFFARM				9.16	***
Yes	156	28	72		
No	72	10	90		
SAVING				6.91	***
Yes	142	31	69		
No	86	16	84		
CREDACCS				15.78	***
Yes	67	39	61		
No	161	15	85		
ETHNIC				5.24	n.s.
Aizo	35	20	80		
Kotafon	113	27	73		
Mina	24	12	88		
Adja	39	13	87		
Other	17	23	77		
RELIG				0.16	n.s.
Christian	73	21	79		
Muslim	10	20	80		
Traditional	145	23	77		

*** $p < 0.001$, n.s. not significant

the last two years, involvement in regular off-farm activities, and membership to formal saving and credit institutions. In addition, the age of the heads of households that kept small ruminants averaged 46 years and was greater ($p < 0.001$) than the average of 42 years of those heads whose households did not keep small ruminants (Table 3). The logistic regression confirmed that the decision of a household to keep small ruminants is influenced ($p < 0.001$) by the head of household's age, involvement in regular off-farm activities, and access to credit facilities (Table 4). Overall, the model was able to correctly assign 79% of the households to their actual groups. However, while it identified correctly 95% of the households keeping small ruminants, the classification of households that did not keep small ruminants was poor (16%).

Characteristics of household member: owners versus non-owners of small ruminants

In 40% of the households keeping small ruminants, animals were owned by a household member different from the head of household. In the bivariate analyses, statistically significant differences ($p < 0.01$) were observed in ownership of small ruminants between household members who had a regular off-farm occupation and those without. The latter were more likely to own small ruminants.

Table 3 Descriptive statistics and significance of numerical explanatory variables used in the comparison of households keepers with non-keepers of small ruminants

Variable code (Head of household characteristics)	Households not keepers of small ruminant			Households keepers of small ruminant			Significance (*t*-test)
	n	Mean	SD	*n*	Mean	SD	
AGE	50	41.72	10.03	178	46.13	12.15	***
HHSIZE	50	6.04	3.45	178	6.53	3.38	n.s.
NINCOME	50	2.38	1.01	178	2.18	0.79	n.s.
LANDSZ	50	2.48	2.89	178	2.25	2.94	n.s.

*** $p < 0.001$, n.s. = not significant

Table 4 Logistic regression predicting household decision to keep small ruminants by household head socio-economic characteristics

Predictor	β (Coefficient)	SE of β	Wald's χ^2	df	*p*	e^{β} (odds ratio)
Constant	−0.155	0.990	0.025	1	0.875	0.856
CREDACCS (1 = yes, 0 = no)	−1.252	0.364	11.859	1	0.001	0.286
OFFARM (1 = yes, 0 = no)	−1.497	0.488	9.396	1	0.002	0.224
AGE	0.042	0.017	5.960	1	0.015	1.043
PRINCOM (1 = cropping, 0 = else)	1.398	0.594	5.549	1	0.018	4.048
Test			χ^2	*df*	*p*	
Overall model evaluation (Model χ^2)			31.038	5	0.000	
Goodness-of-fit test (Hosmer and Lemeshow)			9.762	8	0.282	
−2 Log-Likelihood = 208.826						
Cox and Snell $R^2 = 0.127$						
Nagelkerke $R^2 = 0.196$						

Household members for whom crop-farming was not the main source of income were more likely to own small ruminants ($p < 0.05$). Furthermore, owners of small ruminants were significantly ($p < 0.05$) younger (43 years) than the non-owners (47 years). However, the logistic regression analysis did not retain the main source of income as predictor of the decision of a household member to own small ruminants. As shown in Table 5, the model that explained best the likelihood of a household member to own small ruminants included four variables which were the sex of the individual, the access to credit in the last 24 months, age, and involvement in regular off-farm activities. This model had an overall accuracy of 80%. It was able to predict correctly 95% of owners but only 30% of non-owners. The main motivation of the majority (98%) of these individual members to keep small ruminants was to obtain extra income from sales. This income was mainly used to buy staple foods and clothes (36% of owners), to pay school fees for children (12%), and to finance farm (11%) or subsidiary activities (11%).

Factors affecting the choice of small ruminants

Among the 222 individual household members owning small ruminants, significantly ($p < 0.001$) more persons (91%) owned goats than sheep (35%). Of the 222 individuals, 65% owned goats only, 9% owned sheep only while mixed flocks of goat and sheep were kept by 26%. There was a significant ($\chi^2 = 7.719$, $p = 0.021$) relationship between the agro-ecological zone and the keeping of sheep. A bias against sheep was more acute in the Pêcheries and Dépression agro-ecological zones than in the Terre de Barre agro-ecological zone. It was believed, in two surveyed villages in the zone of Pêcheries, that the presence of sheep in a household adversely affects women's fertility in such a way that, when a woman and a ewe are pregnant at the same time, the woman is accursed resulting in stillbirth while the lamb is born alive. The chi-square analysis also showed a systematic relationship between the sex of the owner and the species owned ($\chi^2 = 24.994, p = 0.000$). About 64% of sheep owners were males while 71% of goat owners were females. The personal perception of owners towards the risk associated with each species was strongly related to their choice of species ($\chi^2 = 16.781$, $p = 0.000$). Although 70% of respondents ranked sheep as the species that provides higher financial returns, 43% mentioned that sheep presents more risks than goats, mainly because they have a strong herd instinct to walk away from the homestead and are more likely to destroy cultivated crop fields. In addition, sheep were considered to be more adversely affected by feed shortages by 62% of the respondents. The bivariate analysis showed a strong relationship between the decision to own sheep and the cultural

Table 5 Logistic regression predicting the decision of a household's member to own independently small ruminants

Predictor	β (Coefficient)	SE of β	Wald's χ^2	df	p	e^{β} (odds ratio)
Constant	5.034	0.842	35.729	1	0.000	153.576
SEX (1 = male, 0 = female)	−1.995	0.400	24.927	1	0.000	0.136
AGE	−0.035	0.014	6.295	1	0.012	0.965
OFFARM (1 = yes, 0 = no)	−0.959	0.384	6.238	1	0.013	0.383
CREDACCS (1 = yes, 0 = no)	−0.885	0.375	5.561	1	0.118	0.413
Test			χ^2	df	p	
Overall model evaluation (Model χ^2)			50.336	4	0.000	
Goodness-of-fit test (Hosmer and Lemeshow)			9.145	8	0.330	
−2 Log-Likelihood = 231.615						
Cox and Snell $R^2 = 0.175$						
Nagelkerke $R^2 = 0.265$						

background of the owner, for instance the ethnic origin ($\chi^2 = 23.406$, $p = 0.000$) and the religion ($\chi^2 = 9.983$, $p = 0.007$). The land size of individuals owning sheep (1.45 ha) was also significantly larger ($F = 9.99$, $p = 0.002$) than that of individuals owning goats only (0.89 ha). The results showed that the proportion of people owning sheep only and those with mixed flocks of sheep and goats increased significantly ($p < 0.05$) with the size of personally cultivated land. However, the size of individually cultivated land was also strongly related to gender, women having significantly ($F = 71.665$, $p = 0.000$) smaller plots than men. Only those variables related to owning sheep that were significant at the 5% level were included in the logistic model. The results of the logistic regression predicting owning or not sheep are presented in Table 6. The model included three variables which were sex of individual household member, ethnic group, and perception towards risk associated with species. This model was able to correctly identify 50% of those who owned sheep and 91% of non-owners of sheep with an overall accuracy of 77%.

Discussion

The majority (78%) of surveyed households were keeping small ruminants, which confirms the important role of goats and sheep in the livelihood strategies of rural families. A household was more likely to keep small ruminants when its head had relatively fewer economic options as was the case of households with no off-farm income and no access to formal credit. These results indicate clearly the financial role of these animals in the household livelihood. In the study area, the majority of the household heads were involved in rainfed agriculture. They had very few off farm and credit opportunities and thus resort to auxiliary sources of income through the possession of a few goats or sheep. The older the head of household, the higher the likelihood that the household decides to keep small ruminants. This is probably because younger household heads are more likely to offer their labor and to take part-time jobs in the neighboring peri-urban area, while older ones remain on the farm. However, although the logistic regression model achieved an overall success of 78% with a sensitivity of 95%, its low specificity (16%) limits the statistical power of the logistic model to predict a household's decision to keep small ruminants based on the socio-economic characteristics of the head of household.

The prediction of the decision of an individual household member to become owner of small ruminants as a function of his/her individual socio-economic characteristics resulted in a better specificity (30%). The results confirm that small ruminants are non-pooled household resources in southern Benin and individual owners are independent decision-makers who have different socio-economic characteristics and also different objectives and preferences. These findings are in agreement with the results of previous studies (Okali and Sumberg 1986; Jaitner et al. 2001). In the study area, household income was not pooled, and household members often had separate, culturally designated obligations to meet different sets of needs within and beyond the household. The family unites to work together on the farm but then splits up to work separately off-farm. As observed for the household head, the likelihood of an individual household member to own small ruminants decreased with the ability to find off-farm employment and access credit from formal sources. This confirms the role of small ruminants as saving or living banks for the resource-poor rural people. Female household members were more likely to own small ruminants than males, and younger females more likely than older ones. Similar results were reported by Jaitner et al. (2001) in Gambia and by Okali and Sumberg (1986) in southwest Nigeria. Women are more likely to own small ruminants probably because of their determination to

Table 6 Logistic regression predicting decision to own sheep

Predictor	β (Coefficient)	SE of β	Wald's χ^2	df	p	e^{β} (odds ratio)
Constant	−2.549	0.957	7.101	1	0.008	0.078
SEX(1 = male, 0 = female)	1.657	0.402	16.976	1	0.000	5.244
ETHNIC	N.A.	N.A.	17.711	4	0.001	N.A
ETNNICG 1 (1 = Aizo, 0 = else)	0.313	0.848	0.136	1	0.712	1.367
ETHNICG 2 (1 = Kotafon, 0 = else)	−1.535	0.824	3.466	1	0.063	0.216
ETHNICG 3 (1 = Mina, 0 = else)	−2.254	1.004	5.043	1	0.025	0.105
ETHNICG 4 (1 = Adja, 0 = else)	−1.650	0.837	3.887	1	0.049	0.192
RISKSP	N.A.	N.A.	12.588	2	0.002	N.A.
RISKSP1 (1 = goat is the riskiest, 0 = else)	3.007	0.887	11.843	1	0.001	20.217
RISKSP2 (1 = sheep is the riskiest, 0 = else)	2.215	0.887	6.233	1	0.013	9.159
Test			χ^2	*df*	*p*	
Overall model evaluation (Model χ^2)			63.097	7	0.000	
Goodness-of-fit test (Hosmer and Lemeshow)			1.304	7	0.988	
−2 Log-Likelihood = 164.464						
Cox and Snell $R^2 = 0.298$						
Nagelkerke $R^2 = 0.410$						

N.A. = not applicable

increase their economic autonomy and their bargaining power within the household. Thus owning small ruminants contributes to their empowerment. More often, despite their significant labor activity, women in the study area economically depended on the household head and only disposed of a relatively small share of individually attributable household economic resources. Moreover, they generally have less opportunity for off-farm work, other than that of processing and marketing farm products and have little access to financial, natural, or technical resources. An investment in goats and/or sheep would therefore enable them to earn extra-income to meet their personal requirements, enhance the household's capacity to cope with shocks (i.e., to purchase staple foodstuffs), and continue the enrollment of children into primary education.

As expected goat owners significantly outnumbered those of sheep. The predictors employed in the logistic model achieved an overall success rate of 77%, while sensitivity was 50% and specificity was 91%. The ability of the model to correctly identify owners from non-owners of sheep could therefore be considered satisfactory. The sex of livestock owners, their ethnic background, and perception of risk associated with each species significantly affected the choice of small ruminant species. Women were found to be particularly more inclined towards goats while men were more likely to own sheep. This is in consistence with studies conducted in southwest Nigeria (Koper and Aderibigbe 1992), in Gambia (Jaitner et al. 2001) and in Kenya (Valdivia 2001). The fact that women spend more time at home than men and that goats, unlike sheep, mostly forage near the homestead and can be easily fed with household wastes (Okali and Sumberg 1986) might be a probable reason to explain this gender bias in species ownership. In addition, sheep were found to be more associated with land than goats and the larger the personal plot of land cultivated, the larger the likelihood to own sheep. In general, men had more access to land than women. These differences in the access to land by gender could explain why most women owned goats while men were associated with more sheep.

The results also highlighted a strong ethnic bias against sheep keeping in the study area. Social norms or moral standards prevailing within the Kotafon ethnic groups in the Pêcheries and Depression zones, the Mina ethnic group in the Pêcheries zone, and within the Adja ethnic group in the Terre de Barre zone discourage keeping sheep. Sheep are associated with a negative social valuation and the decision of people not to keep sheep can be explained by their objective to not be excluded from the society and to maintain their social status (Birner 1999). These findings are similar to those of earlier studies in the northwest Province of Cameroon (Ndamukong et al. 1989) and in many communities in southern Nigeria (Okali and Upton 1985). Such findings indicate a need to clearly understand the traditional beliefs associated with each livestock species, particularly when planning for a livestock development program in a community. In the case of the study area it is possible that the traditional belief is associated with past undetected and non reported occurrence of sheep brucellosis. Sheep brucellosis caused by *Brucella melitensis* results in abortion in infected pregnant animals and also in humans (Corbel 1997; Garin-Bastuji et al. 1998). Therefore, a validation study

should additionally include hygiene and disease related variables. However, it is also possible that the observed cultural prohibition of keeping sheep is simply due to superstitious motives. For example, Kossi (1993) observed that the Xweda people, who are also well represented in southern Benin and in Togo, do not eat sheep-flesh because they strongly believe that it would cause leprosy. Sacrificial usages among certain ethnic groups could also explain the popularity of goats. In the study area, where more than half of the households interviewed adhere to traditional indigenous religions, goats are imperative for the proper performance of rituals and ceremonies in which they are sacrificed for the fetishes. Weissenborn (1906), for example, observed that sheep were never sacrificed by the Mina people for their fetish Nanyo. The purpose of such rituals is to make contact with spirits, to gain their favor, to obtain help in the form of more abundant food, higher standard of living, and improved health. Webb and Mamabolo (2004) recorded similar ritual reasons for the popularity of goats over sheep in rural areas in South Africa.

This study also reveals that the perception of people towards risks associated with each small ruminant species significantly affects their decision to own a particular species. People who considered goats as less risky than sheep were more likely to own goats, even though sheep were ranked as the species that provided higher returns. Sheep were frequently blamed for grazing in herds away from the homestead. This exposed them to the risk of being beaten or killed when they trespass onto other households' crop fields. Hence, by preferring goats to sheep, people forego some income while securing their investment.

Goats offer a strong opportunity for development programs to enhance women's economic autonomy and to empower them. There is a recent empirical evidence that targeting development programs to women, increases their assets, raises investments in children's education, and benefits the whole household (Meinzen-Dick et al. 2003; Quisumbing and de la Bière 2000; Quisumbing and Maluccio 2000; Smith and Haddad 2000; Smith et al. 2003).

Conclusion

This study confirms the financial role of small ruminants for poor rural households that have no access to credits and have few opportunities for off-farm income. Increasing individual income, financial independence, and bargaining power while overcoming financial bottlenecks within the family are the obvious benefits expected from keeping small ruminants by individual household members, in particular women.

Women were more inclined towards goats than men. This is because goats present low risk in investment and are easier to keep. There is also a cultural bias against sheep in some ethnic groups. The potential of small ruminants, especially goats, as an effective and feasible way of enhancing livelihoods of the resource-poor people is still under-exploited. During the last decades, a considerable number of research projects have studied the farming systems in southern Benin. These studies have mainly concentrated on improving the crop component of the farming systems while neglecting the livestock component. As a consequence livestock assets, especially goats and sheep, have not yet received the attention they deserve in the poverty reduction strategy developed by the government of Benin.

The identification of constraints to goat productivity and the inclusion of women in the development of need-based technologies and training programs are key factors in an effort to achieve improved goat production, increase food security, and enhance rural livelihoods.

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