SMALLHODER GOAT PRODUCTION AND INDIVIDUAL FOOD SECURITY: THE CASE OF WOMEN FOCUSED DAIRY GOAT DEVELOPMENT PROJECT IN EASTERN HARARGHE OF ETHIOPIA

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Abstract

A study was conducted between 1996 and 1999 to evaluate the contribution of the Dairy Goat Development Project of FARM Africa in improving the nutritional status, in particular vitamin A status, of project participants in selected *woredas* of southeastern Ethiopia. The study was based on surveys (baseline and formative), nutrition education based interventions and post intervention impact assessment. The baseline survey and the formative data collection were undertaken on 830 and 228 households, respectively, residing in 15 villages. In addition to dietary frequency and anthropometric measurements, other health and nutritional parameters, demographic, socioeconomic and agricultural aspects were included in the study. Findings of the baseline survey and results of the formative data collection show that the health and nutritional, particularly the micronutrient status of women and children, are extremely low, irrespective of the involvement in the Dairy Goat Development Project. This implies that if increased milk production and farm income from livestock development projects is to be translated into improved nutritional and health status of women and children, livestock extension messages need to be complemented with nutritional and health education elements.

1. Introduction - Project Objective

The Dairy Goat Development Project (DGDP) aims at improving the socio-economic and nutritional status of women and children in the heavily populated highland areas of Ethiopia. To achieve its objective, the project has been engaged in identifying women groups, offering them training in better husbandry of dairy goats and then providing them with goats – first local and then crossbred dairy goats. Assessment of the socio-economic impact of the DGDP in eastern Hararghe has underlined the significant increase in milk production and income earned by participant households (Wagayehu and Habtemariam, 1995). But whether this increased income and on-farm milk availability has also led to improvements in the nutritional status of women and children remained unknown. As a result, this study was proposed and implemented between 1996 and 1999 in collaboration with the International Centre for Women through a grant obtained from USAID.

The objective of the study was to evaluate the contribution of the DGDP of FARM Africa in improving the nutritional and, particularly, the micronutrient status of people in southeastern Ethiopia, where the project has been operational for some years. This was done by comparing health and micronutrient status of participant and non-participant households. The experience gained is expected to serve as a case study to determine methods of improving the effectiveness of livestock development projects in enhancing household and individual food security, notably micronutrient status of individuals. In particular, it was hoped that the experiences gained would be used in designing future goat development projects. The lessons learned and the experience gained in designing and implementing a nutrition education based intervention, and its impact on people's awareness about nutrient deficiency diseases, will be the subject of a separate paper. This paper reports the findings of the baseline survey and the formative data collection stages of the project.

2. Materials and Methods

2.1. Description of the Project Area

The study was conducted in East Hararghe Zone of Oromia National Regional State. East Hararghe Zone covers an area of about 90,620 square kilometers with an altitude ranging between 700 and 3,400 meters above sea level, and mean annual rainfall ranges between 315 and 1040 mm. The land holding per household ranges roughly between 0.3 and 1.5 hectares (Zonal Office of Agriculture, 1996). The Zone is known for its *chat (Chata edulis),* sorghum and beef production, but the study area is among one of the food deficit regions of Ethiopia (AUA, 1986). The general prevailing production system is a crop-based mixed farming system. Typical of any mixed farming system, livestock are an integral part, fulfilling the traditional role of providing milk, meat, draft power, and manure, serve as a financial reserve for the rural population, and play vital roles in the society and culture. Often a family possesses 1-2 cattle, a few goats and a donkey (AUA, 1986).

Health problems in the Zone are more or less similar to the national picture as causes of both morbidity and mortality. Nonetheless, it is noteworthy that homicidal injuries, liver cirrhosis and transport accidents are among the top ten causes of mortality. These causes of mortality might be, directly or indirectly, attributed to the chewing of *chat*. Yet, about two-thirds of the total population are believed to have access to some type of health service. The zonal health service coverage rate of 60% is relatively high when compared with the national figure of 44 to 47%. This is partly because the figure includes the city of Harar, which hosts the majority of the hospitals in Eastern Ethiopia. Nevertheless, actual service coverage (immunization programs, antenatal service and assisted deliveries) is surprisingly very low (MOH, 1995; Zonal Health Department, 1996).

East Hararghe is subdivided into 15 *woredas* (CSA, 1996). Gursum and Kombolcha, the study areas, are two of the districts that represent the contrasting features of many of the districts. These *woredas* are the operational areas of FARM Africa where 50% crosses of Anglo-Nubian dairy goats and local goats were distributed to households to improve their income as well as their nutritional status. According to the 1994 National Population and Housing Census, Gursum *woreda* has a total population of 151, 405 (CSA, 1996), with 91% living in rural areas. The mean annual rainfall was 756 mm for the year 1995/96. The average land holding per household is estimated to be approximately 1.5 hectares (Zonal Office of Agriculture, 1996). The *woreda* is well known for its erratic rainfall and frequent crop failures. Kombolcha *woreda* has a population of 82,801 (CSA, 1996). In some areas the population density reaches as high as 250 persons/km^2 (Wibaux, 1986). In the two *woredas*, cereal crop production is dominant. *Chat* is a major cash crop. It is more widely cultivated in Kombolcha than in Gursum.

2.2 Methodology

With regard to the methodology, the practical situation dictated that no biochemical assessments of vitamin A or iron status would be included. Rather, anthropometric measurements to evaluate nutritional status (WHO, 1995) and dietary assessments to examine marginal deficiencies using 24-hour recall for iron intake (Gibson, 1990) and the Helen Keller International (HKI) food frequency for vitamin A intake (HKI, 1993) were used as outcome measures. Dietary assessments were conducted between May and July, during the season of low availability of vitamin A rich foods. The seasonal effects on vitamin A rich food availability were assessed through questionnaires.

The data collection methods used at different stages of the study included: review of secondary data; reconnaissance survey by team members; a largely questionnaire based baseline survey that included a dietary survey and anthropometric measurements; and a questionnaire based formative data collection (with dietary survey and anthropometric measurements) supplemented with semi-structured focus group discussion. A workshop was conducted to share research findings and to design trial intervention strategies. The identified trial intervention strategy was then implemented, and its impact was examined through a post-intervention survey. This paper reports on some of the findings of the baseline and the formative data collection.

2.2.1. The Baseline Survey

2.2.1.1. Sampling Methods

A two-stage stratified random sampling technique was used to select the households. Thus, out of the total 36 Peasants' Associations (PA) in Gursum and 14 in Kombolcha, 4 PA (3 in Gursum and 1 in Kombolcha) were selected on the basis of FARM Africa's involvement. After registration of the households living in these PA and listing households with at least one child under five years of age, 830 households were randomly selected.

2.2.1.2. Data Collection

Data were collected using a structured questionnaire. The questionnaire was first developed in English and then pre-tested. After necessary revisions, the English version was translated to Amharic. On the basis of this final version a manual on how the questionnaire should be filled was prepared for use by enumerators. Variables included demography, socio-economic variables, general health and nutritional status, dietary intake, feeding practices, water supply and waste disposal. The baseline survey was undertaken between the end of February and end of March, 1996. The survey covered a total of 15 villages (10 in Gursum and 5 in Kombolcha) in the vicinity of the three project sites. The required number of households to be studied in order to assess Vitamin A status of a community as per the HKI methodology is 750. But 78 of them were found to have no children under five years of age and replacement households were added. Thus a total of 830 households were surveyed, of which 240 of them were beneficiaries of the DGDP activities of FARM Africa. The survey interview and the weighing and measuring of household members was done after obtaining the consent of prospective interviewees. No household was reported to have refused the interview. Adult members of the households, mainly mothers, were interviewed and whenever the mothers were out of the house, enumerators skipped such households and returned later to conduct the interviews. The time of interview per respondent household averaged about one hour.

The baseline survey also included a dietary survey and anthropometric measurements. For the dietary survey, mothers were asked to provide detailed information on the type and amount of food that the household had consumed during the last 24 hours. The method of preparation and the ingredients used for the preparation of various foods were also noted. The amount of solid and liquid food items eaten during the previous day were estimated and recorded. In addition to the 24-hour recall survey, dietary food frequency information was collected. During the survey households were asked how frequently they consumed these food items and responses were recorded. The questionnaire developed by the HKI (1993) food frequency method to assess community risk of vitamin A deficiency was modified slightly to fit the local situation and was used for the interview of mothers and caretakers. While taking anthropometric measurements, weight was measured to the nearest 100 g using bathroom scales for adults and older children, while hanging scales were used for younger children. Height was measured to the nearest 0.5 cm using a graduated height stick with a moveable headpiece. Length was determined in a supine position using a calibrated measuring board for children who could not yet walk.

The total number of households studied during the baseline survey was 830, with 265 from Kombolcha and 565 from Gursum *woredas*. A total of 4,664 individuals were included in the study. Twenty enumerators, two supervisors and two field nutritionists were involved in the data collection. The field nutritionists recruited, trained and supervised the activities of supervisors and enumerators, in addition to reviewing and checking questionnaires.

2.2.2. The Formative Data Collection

2.2.2.1. Sampling

A total of 228 households were surveyed. The households included 59 crossbred goat recipients (those who have received local and crossbreed goats from DGDP), 103 local goat recipients and 72 control households that do not own livestock. Of the goat recipients, only those who had owned goats for at least a year and half were included. Control households outside the project extension sites were included to eliminate indirect project influences in the answers given to survey questions.

2.2.2.2. Data Collection

The formative survey was conducted between May and July 1996 with the help of the same field nutritionists, field supervisors and enumerators that were utilized in the baseline survey. The survey focused on the selected mother-child pair. The data collection instrument included the following aspects: description of the sample household including demography, selection of reference mother and child, dietary assessment that focused on children between 1 and 3 years of age, anthropometry on reference mother and child, questions on nutrition and agriculture to the mother, 24-hour dietary recall for the whole family, HKI for the reference child, 1-week recall of purchase and sale of food items, 1-year recall of livestock dynamics (additions, disposal, decision making, prices), participation of sample households in the activities of the DGDP, and clinical examination of mothers and pre-school children for signs of vitamin A deficiency and for anemia. Anemia was assessed through the presence of paleness in the lips, tongue and eye. History of night-blindness was also recorded through interviews.

2.2.3. Data Checking, Coding, Entry, Editing and Analysis

Before data analysis, the data collected during the baseline survey and the formative data collection study were thoroughly cleaned and edited. After final checking and coding, data were entered into different data files using the EPI INFO Version 6 computer program. The DEMETER Version 2.05 software was used for the 24-hour dietary recall survey. The values of anthropometric measurements were analyzed using ANTHRO software. The mean frequencies of consumption of vitamin A-rich foods were estimated using the HKI (1993) method.

3. Results and Discussion

3.1. Findings of the Baseline Survey

3.1.1 Family size and illiteracy

The mean family size was 5.2, which is higher than the national figure of 4.5. The overall illiteracy rate was 74.6%, and is slightly higher than the national rate (72%). The illiteracy rate and other rates of educational achievements were very similar in the two *woredas*. In both *woredas* females were more illiterate than males ($P < 0.001$).

3.1.2. Health and Nutrition

3.1.2.1. Antenatal Care and Illness

Antenatal attendance rate was significantly higher ($P < 0.001$) in Kombolcha district (41.6%) than in Gursum (27.8%). The people living in the *woredas* seem to use the nearby health facilities more than in many of the areas of the country as the national antenatal attendance rate is about 20% (CSA, 1992). Concerning illness of the mother, anemia was reported to be high in females during the time of pregnancy (22.7%) as compared with the national level of 17% for all age groups and both sexes (CSA, 1992). However, the prevalence rate of anemia in Kombolcha (17.4%), where a higher rate was expected because of the higher incidence of malaria, was lower ($P < 0.05$) than in Gursum (25.7%). Some studies have indicated that the problem of anemia is also prevalent in other parts of the country (CSA, 1992) and that the problem was not mainly due to nutritional factors but rather to infections (Gebre-Medhin et al, 1976; Hofvander, 1986).

Night blindness seemed be well known in the survey areas. Results indicated that 14.9% of mothers had this symptom of vitamin A deficiency during their last pregnancy. The night blindness rate in Gursum (17.2%) was higher ($P < 0.05$) than the rate in Kombolcha. However, the reporting of night blindness among adults might have been highly underestimated as adults get embarrassed and dishonored if others know that a certain person has night blindness. Even so, the rate of night blindness reported for pregnant women was quite high. The cutoff point for night blindness set by the World Health Organization (WHO) for preschool children is 1% and the rate observed for pregnant women in the current study of 14.9% indicates the extremely high incidence. In the dietary frequency survey it was observed that consumption of both preformed vitamin A and the precursor was extremely low. Mothers have reported that their index

children, who are below five years of age, had night blindness in 5% of the cases. The figure is five times higher than the WHO cutoff point of 1%. This rate of night blindness is so high that urgent action needs to be taken to correct the deficiency problem. One such option is provision of vitamin A capsules to the needy.

3.1.2.2. Dietary Habits and Feeding Frequencies

The staple food in the study area is largely sorghum. Maize and sweet potatoes also play important roles in the daily diets of households. In 83% of the households, sorghum was the primary staple food of the diet, while combinations of sorghum with maize and sorghum with sweet potato were staples in 13 and 4% of the households, respectively. The mean frequency of consumption of these staples per week was 6.6 days. The consumption of animal foods, vegetables and fruits was in general too low (Table 1). The major source of dietary fat is linseed oil, which is usually added to sauces and foods consumed with "injera", a flat bread made from teff (*Eragrostis abyssinica*) flour. Thus, these foods also contribute to the daily energy intake.

In both *woredas,* the mean frequency of consumption of vitamin A-rich foods (in days/week) was found to be 0.7 for animal sources whereas the weighted total amounted to 1.6. Thus, the consumption of both animal and plant sources of vitamin A is very low. The frequency of consumption of animal and plant sources of vitamin A was less than the threshold values recommended by HKI of ≤ 4 and ≤ 6, respectively. Red pepper was the major source of pro-vitamin A in the study area. Based on observations made during the survey period and the findings of the dietary frequency assessment, the intake of preformed vitamin A and that of the vitamin precursor was extremely low, clearly indicating that the population was vitamin A deficient. Results of the 24-hour dietary survey also showed that the intake of vitamin A was low and did not satisfy the daily requirement of the individuals. Thus, introduction of weaning foods from locally available ingredients that contain either vitamin A or its precursor or that are vitamin A fortified could be considered as one intervention option in future.

Table 1. Mean frequency of consumption of various food items

	Food items	Frequency (No. of days/week)				
		Both *woredas*	PA1	PA2	PA3	PA4
1.	Staple diets	6.6	6.8	6.5	6.8	6.4
2.	Spices (red pepper)	2.9	1.8	4.1	4.3	3.0
3.	Dark green leafy vegetables	0.4	0.9	0.8	0.1	0.1
4.	Milk	4.1	3.4	5.0	4.7	4.5
5.	Carrots	0.1	0.3	0.0	0.1	0.0
6.	Ripe mango	0.1	0.0	0.1	0.2	0.2
7.	Dark yellow or orange pumpkin	1.3	0.5	1.9	1.6	1.9
8.	Swiss chard	0.0	0.0	0.0	0.1	0.0
9.	Ripe papaya	0.4	0.0	1.1	1.1	0.4
10.	Spaghetti/macaroni	4.0	4.4	5.4	2.9	3.3
11.	Eggs with yolk	0.5	0.1	1.2	0.7	0.6
12.	Small fish (liver intact)	0.1	0.1	0.3	0.2	0.0
13.	Groundnut	3.0	2.6	3.3	3.6	3.2
14.	Yellow or orange sweet potato	2.8	1.5	3.7	1.9	3.8
15.	Chicken or other fowl	0.1	0.1	0.3	0.0	0.1
16.	Amaranths leaves	0.3	0.8	0.0	0.0	0.0
17.	Any kind of liver	0.0	0.0	0.0	0.0	0.0
18.	Sweet potato leaves	0.3	0.7	0.0	0.0	0.0
19.	Meat (mutton, beef)	0.2	0.2	0.2	0.3	0.1
20.	Butter	0.1	0.0	0.4	0.2	0.2
21.	Fenugreek	3.0	4.4	2.9	2.2	1.8

22.	Cod liver oil	0.0	0.0	0.1	0.0	0.0
23.	Foods cooked in oil	1.1	0.9	2.1	1.6	0.9
24.	Linseed	1.9	2.6	2.7	1.1	0.9
25.	Weaning foods fortified with Vit. A	0.1	0.0	0.1	0.1	0.1
26.	Avocado	0.0	0.0	0.0	0.0	0.0

3.1.2.3. Anthropometry

A total of 1,338 children under 5 years of age were weighed and measured for their height. The standard deviation scores (Z-scores) were calculated with the help of the ANTHRO software developed by WHO and the Center for Disease Control (CDC). The -2.0 standard deviation score was used as a cutoff point for determining undernutrition. Body Mass Index (BMI), which is defined as a measure of body mass relative to height and calculated as weight in kilograms divided by height in meter squared (Wt/ht^2), was also calculated using the same software. For both boys and girls, the Z-score values of weight-for-age (underweight, WAZ), height-for-age (stunting, HAZ) and weight-for-height (wasting, WHZ) are indicated in Table 2.

Table 2. Number and percent of underweight, stunted and wasting in children under five years of age by age group

Age group	Z-score < - 2.00 S.D. from the median						
	WAZ		HAZ		WHZ		Total assessed
(months)	No.	%	No.	%	No.	%	No.
<6	17	14.4	32	27.1	16	13.6	118
6 - <12	86	44.6	117	60.6	30	15.5	193
12 - <24	130	49.4	161	61.2	30	11.4	263
24 - <36	120	46.0	116	44.4	49	18.8	261
36 - <48	77	32.6	101	42.8	33	14.0	236
48 - <60	54	20.2	82	30.7	34	12.7	267
Total	484	36.2	609	45.5	192	14.3	1,338

As shown in Table 2, WHZ or wasting was relatively high. All three parameters were relatively low in infants below the age of 6 months, which is probably due to breastfeeding during this period. As children get older, the rate of malnutrition decreases, which can be explained by the fact that children start to share the family diet and keep up their nutritional status. However, malnutrition was found to be higher during the second half of infancy and the second year of life. This may be attributed to the late introduction and the poor quality of supplementary foods. Besides, feeding specially prepared foods like porridge to small children was not common. These anthropometric results show that undernutrition in all forms was less during the first half of infancy and during the fifth year of life.

The rate of wasting in the survey areas (14.3%) was generally higher than the national rate of 8% (CSA, 1992). On the other hand, rates of underweight (WAZ - 36.2%) and stunting (HAZ - 45.5%) were much less than the national averages of 47.4% and 64.7%, respectively (CSA, 1992). Wasting, which is an indicator of both chronic and acute malnutrition might have been higher due to the fact that the current survey was conducted during the lean season. Both underweight and stunting show a peak during the second year of life, while the peak for wasting was observed during the third year of life. It was also observed that the WAZ score was different between boys and girls ($P < 0.01$), while HAZ and WHZ were not different between the two sexes ($P < 0.38$ and $P < 0.74$, respectively). Thus, more girls were underweight than boys. This might also be attributed to the feeding pattern, where culturally women and girls eat after husbands and boys.

The BMI was assessed on adults over the age of 20 years only (WHO, 1995). BMI values showed that the nutritional status of most adults was reasonably good. The majority of the studied population, 59.6% of both sexes, 57.1% of males and 61.9% of females, were within the normal range. However, the rest of the population, who were outside of the normal range, exhibited varying degrees of thinness and the overweight rate was less than 1%. Although the trend shows that there were more males who were thinner than females, the difference in BMI between the two sexes was not statistically significant (P = 0.076).

3.1.3. Livestock Ownership

Nearly one-third (28%) of the households did not own cattle and 85% of the cattle rearing households owned a maximum of 2 cattle. About 34% of the households did not own goats, and 88% of the goat rearing households owned a maximum of 2 goats. Project beneficiary households owned significantly more goats than non-recipients. However, non-recipients generally had more cattle. This is in line with what would have been expected as the project was designed to serve the poorest stratum of the society. But the number of sheep and chickens did not vary between participant and non-participant families.

3.1.4. Decision Making

Although women were the ones who received goats on credit from the DGDP and were involved to a large extent in their management; it was generally the husbands alone who made decisions on product marketing and use of the revenues generated from goats. This occurred to the extent that money to pay for treatment of sick goats had to come from the husbands. Milk sale is understood to be a women's affair even if the husband reserves the right to stop it. Decisions on the types and number of animals to rear, and on major expenditures with the exception of daily consumables, are largely made by the husband.

3.2. Observations from the Formative Data Collection

3.2.1. Family Size

Average family size for the three groups was 5.5. Family size varied with the level of participation ($P < 0.001$); the controls had the lowest (4.6), local goat recipients were in the middle (5.8) and crossbred goat recipients had highest number of family members (6.1).

3.2.2. Number of Goats

The two participant groups, crossbred and local goat breed recipients, did not vary significantly in the number of goats they own, 2.8 and 3.1 respectively. But the milk production levels of crossbred and local goats were reported to be very different (Wagayehu and Habtemariam, 1995).

3.2.3. Vitamin A Consumption

The mean frequency of consumption of vitamin A from animal sources for all three groups amounted to 2.75 days per week, indicating a very low level of consumption.

3.2.4. Anthropometric Results

The BMI values were generally in line with findings of the baseline survey. Tables 3 and 4 summarize the anthropometric results of the formative data collection. Differences in wasting were not noticeable among groups, while underweight and stunting appeared to be more severe in the control group than in the first two groups owning goats. Even though the highest percentages of stunting and underweight were observed in the control groups, differences were not highly related to project participation levels. The difference between Group One (crossbred goat owners) and Group Two (local goat owners) was not as high as that observed between Group Two and Group Three (no livestock).

4. Conclusion

An attempt was made, using nutritional status measurements, to assess whether the increased milk production and farm income accrued as a result of involvement in the DGDP of FARM Africa was translated into improved nutritional status of women and children. Results showed that in both nutritional and micronutrient status, all of the groups and the community at large exhibited nutritional deficiencies, irrespective of involvement and degree of participation in DGDP. The available methodologies could not detect major differences among groups, even though project participants themselves acknowledged improvements in supply of foods from animal origin. This might be because the deficiency level was already so high or the improvement accrued was relatively low to be properly accounted for by conventional methods. Nutritional status is also a function of the health status of individuals and the exclusion of biochemical analyses in this study may have confounded the results. The information from the focus group study also revealed that most of the milk produced was consumed by adults as *hoja* (traditional tea made of coffee pulp and leaves and preferably drunk with milk) while chewing *chat*, and only a limited amount was left for children and mothers. In addition, communities were not getting any nutrition and preventive health education. Thus, if livestock development projects could be supplemented with health and nutrition education for participants, their impact on the nutritional status of people would be greatly improved.

Table 3. Body Mass Index values for all groups and for each of the three groups.

BMI	Description	All Groups		Group 1		Group 2		Group 3	
		No.	%	No.	%	No.	%	No.	%
< 16.00	Severe thinness	11	4.9	3	6.3	7	6.7	1	1.4
16.00 – 16.99	Moderate thinness	23	10.3	3	6.3	11	10.4	9	12.9
17.00 – 18.99	Mild thinness	56	25.2	12	25.0	29	27.7	15	21.4
18.50 – 24.99	Normal	125	56.0	28	58.2	54	55.2	43	61.4
25.00 – 29.99	Grade 1 over weight	8	3.2	2	4.2	4	4.0	2	2.9
30.00 – 39.99	Grade 2 over weight	0	0.0	0	0	0	0.0	0	0
> 40.00	Grade 3 over weight	0	0.0	0	0	0	0.0	0	0
Total measured		223	100	48	100	105	100	70	100

Table 4. Indicators of nutritional status of all groups, and of each of the gGroups (Z-score < -2.0 S.D.)

Indicator	All Groups		Group 1		Group 2		Group 3	
	No.	%	No.	%	No.	%	No.	%
Wasting (weight-for - height)	29	16.7	5	16.1	12	16.9	12	16.9
Under weight (weight-for- age)	71	40.8	13	41.9	22	31.0	36	50.7
Stunting (Height- for-age)	69	39.7	12	38.7	23	32.4	34	47.9

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