

**DAIRY PRODUCTION: A NUTRITION INTERVENTION IN A SUGARCANE  
GROWING AREA IN WESTERN KENYA**

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**Dairy production: a nutrition intervention in a sugarcane growing area in Western Kenya**

**Abstract**

A study to assess the impact of dairy production on the nutritional status of preschool children aged between 24 and 59 months in Mumias Division a predominantly sugarcane growing zone of Western Kenya was undertaken between 1997 and 1998. Nutritional status was assessed by taking height, weight and age of the study children and comparing this with the height and weight of well fed children of the same age using the WHO/NCHS growth reference standards. Height-for-age, weight-for-height and weight-for-age indices for each child were determined. Measures of disparity were also calculated to determine the extent of malnutrition in this study area. Children falling below the cut-off point ( $<-2SD$ ) from the median of the reference population were classified as stunted, wasted and under-weight. The influence of dairy production and a select number of household characteristics on the children's nutritional status was evaluated.

Up to 44.7% of preschool children were stunted, 10.4% were wasted and 27% were under-weight. Stunting was more prevalent (26.1%) among children from households whose main enterprise was sugarcane farming and where men controlled income from this enterprise. Children from households keeping dairy cattle as an additional farming activity had lower stunting prevalence. Such households were better off in terms of food security, increased milk consumption and improved nutritional status especially of the young children.

Appropriate policies to improve dairy production and household food security are crucially needed. Such policies should encourage the diversification of farming activities to incorporate both food and cash crops. Dairy production is clearly a positive activity in a food security program.

**Key words:** intervention, dairy production, preschool children, nutritional status.

## **Introduction**

Malnutrition is a multifaceted problem particularly in early childhood. Any nutritional deficiencies experienced during this critical period could lead to growth retardation and other adverse effects in future. In rural areas like the Mumias division of Western Kenya, most nutrition problems stem from food insecurity, poor complementary feeding practices and poverty. The agricultural sector presents the greatest potential for achieving sustained improvement in the nutritional status of the rural poor. In Mumias division, intervention programs to diversify agricultural production activities with the introduction of dairy farming have been tried by Government and Non Governmental Organizations (NGO's).

The role of agriculture in improving health and nutrition particularly that of preschool children has been the subject of much concern and debate over the years [1, 2]. The core of the debate has been whether to promote the growing of subsistence crops or cash crops for domestic and export market. Whereas cash crops can increase rural incomes, they tend to reduce diversity of crop mix [3, 4]. This is often associated with increased risk of food insecurity and malnutrition [5, 6].

Studies on the effect of mixed farming on income, food security and nutritional status show that a mix of subsistence, cash crops and livestock production are likely to result in increased food availability, thereby improving nutrition of rural farming communities [7, 11]. In an evaluation of crop based farming systems in Sri-Lanka, Bogahatte recommended that greater emphasis be placed on the expansion of rural livestock industry in addition to crop production due to the high level of malnutrition among rural children [12]. Study findings suggest that efforts for income generation should be directed to mixed farming (mixed cropping and livestock) [13]. While evaluating Nepal's agricultural policy Sisler [14] concluded that the practice of keeping livestock in addition to crop production was economically rational and a constituted shift from mixed farming to specialized crop production lowered net income.

Findings from past five child nutrition surveys carried out in Kenya indicate that Western Province is one of the three provinces with the highest levels of nutritional stunting [15-19]. In 1996, Mumias division had stunting prevalence of 25% [15]. Malnutrition in this area has been associated with food insecurity due to cultivation of sugarcane at the expense of food crops and livestock production [20].

In 1971, the Kenya Government signed an agreement with Booker Agricultural Holdings (BAH) for the Implementation of the Mumias Sugar Scheme [21,22]. This is a British firm charged with the responsibility of providing professional expertise to Mumias Sugar Company. "Aims of the scheme were to" increase the incomes of smallholders around Mumias; and to provide employment especially for the unskilled labour force and to produce sugar that would substitute imports thereby conserve foreign exchange [23]. At the time of the study, most of the fertile land in the area had been put under sugarcane, a cash crop with irregular incomes, which are often controlled by men. As a result, most of the households in the scheme were experiencing chronic food shortage and other socioeconomic problems [24,25].

To address the problem of food insecurity and malnutrition, the Kenya government in collaboration with a number of non-governmental organizations (NGOs) introduced a dairy intervention program in the study area in 1990. The programme aimed at achieving its

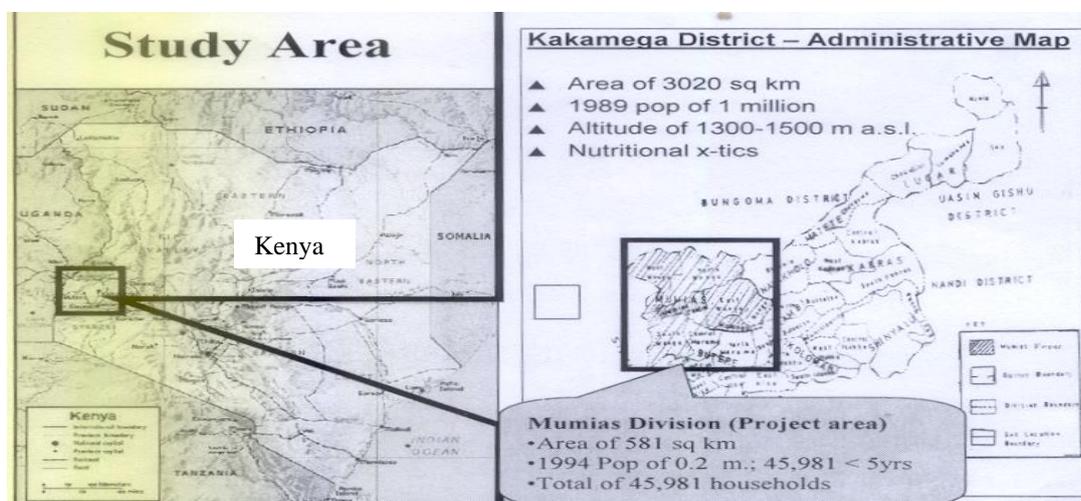
objectives by (i) giving loans and grants to farmers for the purchase of grade cows, (ii) construction of zero grazing units, (iii) provision of artificial insemination services particularly by Mumias Outgrowers Company (MOCO) (iv) advising farmers on all aspects of intensive dairy farming (zero grazing) and (v) supplementing extension services offered by the Ministry of Agriculture and Livestock Development. The program was geared towards providing milk and income that could be used to purchase food and other household goods. Increased milk production and consumption were intended to contribute to improved nutritional status. The projects and NGOs that implemented the intervention included: MOCO, Livestock Development Project (LDP), Heifer Project International (HPI), Christian Children's Fund (CCF), Child and Family Program (CFP), National Dairy Development Project (NDDP).

Although many food security and nutrition intervention programs have been implemented in various parts of the country, very few studies are undertaken to determine the impact of such programs measured against the objectives of the intervention. This study was undertaken to evaluate the impact of the intervention on the nutritional status of preschool children in a predominantly sugarcane growing area. The main objectives of the study were to: assess the association between nutritional status of pre-school children and a dairy production program in a sugarcane growing area, determine the contribution of dairy to food security and the socio-economic status of households surveyed.

## Methods

### Study Site

Data was collected between 1997 and 1998 in the twelve villages of Isongo sub-location, Mumias division, and Kakamega district Western Province. Mumias division borders Bungoma District to the north, Lurambi and Navakholo divisions to the west, Siaya district to the east and Butere division to the south as illustrated in Figure 1. The division covers 581 sq. Km. By 1994, the division had a population of about 206,456 people. Out of these, 59,782 were children below five years of age. The *Wanga*, one of the seventeen (17) sub-tribes of the Luhya, occupies the division, which has approximately 45,981 households.



**Figure 1: Map showing Kakamega District Mumias Division**

The division falls into two distinct zones: lower midland zone, which is wet, and the marginal sugarcane zone, which is dry. It lies at an altitude of between 1300-1500 metres above sea

level. Annual temperature ranges between 22.0 and 20.8 °C. The flat topography of the area makes it suitable for sugarcane growing. More than 80% of the land is arable. The division has two rain seasons with an annual average rainfall of 1579 mm. The long rains start in March and end in June. The short rains start at the end of July and end in November. December, January and February are dry months.

The land tenure system is freehold with owners having title deeds. The average size of farm holdings is two hectares (approximately 5 acres). Maize, beans, groundnuts, simsim monkey-nuts, sorghum, sweet potatoes, cassava and green vegetables are the main food crops grown in the area. The crops occupy the least hectares of land as most of the land is set aside for sugarcane cultivation.

Sugarcane is the main cash crop and a major source of income in this area. Apart from growing cane for sale, some farmers supplement their incomes by leasing out land for sugarcane cultivation. Both local and exotic breeds of cattle are reared in the area. A few households keep poultry mainly for home consumption and for the supply of eggs, which are sold to meet household needs. The division does not have regular food supply and it is a net importer of food almost throughout the year due to over-reliance on sugarcane. Whereas most of the farmers in the sugarcane zone have higher cash income than the rest of the farmers in the district, malnutrition in the area still remains high. Prevalence of malnutrition in the district includes cases of under-weight, kwashiorkor, maramus, anaemia and vitamin A deficiency [20].

### **Sample Size and Sampling**

To determine preschool children in the sample, a door-to-door survey was conducted. One thousand, five hundred and ninety six (1,596) pre-school children were identified. Of these, 943 (59%) were between 24-59 months. Children of this age group were considered to eliminate possible effects of breastfeeding, as it was not possible to quantify the caloric contribution of breast milk. Two percent of the children who were twins were excluded from the study due to their different growth patterns [26]. Five children (0.5%) who could not stand probably as a result of having suffered from polio and other malformations that were likely to interfere with anthropometric measurements were also excluded from the study. Three children who had died due to malaria (according to the mothers) two months before the study were not considered in the sample. Seventy six (8%) of the children who had no proper records of birth (ie no birth certificates, no clinic card, mother could not remember) were also excluded from the study. Finally, only 746 (79.%) of the initial number of children aged between 24-59 months were eligible for the study. Calculation of the required sample size was based on previous studies in a similar area. Using the national prevalence rate of stunting of 34%, a sample size of 172 preschool children was arrived at as outlined here [15].

$$N = z^2 pq / d^2$$

Where: n= sample size

z= desired confidence level

d= precision desired

p=proportion of children not malnourished

q= proportion of children not malnourished

Hence: p=34%

d=0.1

z=1.96

q=1-p=100-34

Therefore:  $n = 2 (1.96^2 * 0.34 * 0.66 / 0.1^2) = 172$

We considered the nutritional status of young children in this study, as it is a sensitive indicator of health status and food availability in a given community. It gives the current status of the child in terms of immediate (acute) factors such as current inadequate food intake, childhood diseases and diarrhea leading to wasting while accumulated impact of chronic deprivation leads to stunting. Monitoring child nutrition provides an early indicator of distress and ill health within a community [15]. The unit of analysis was the preschool child in the household, whereas the household was the unit of observation.

Whereas dairy was the main enterprise in this study, we also compared the nutritional status of children in households of different major enterprises. In this sample of 172 households, there were four comparison groups: households growing sugarcane alone, those growing sugarcane and keeping dairy, those with dairy alone and those without any of these enterprises.

In examining household food availability and security, production of food and availability of income to buy food at the time of the survey were used.

### **Data Collection**

The children's weight was taken in light clothes and without shoes using a Seca electronic bathroom scale with (accuracy of  $\pm 100$  gm). Children's stature was measured using Shorr length boards (cm accuracy of  $\pm 1$  mm). For each sample two readings were taken, the mean of which was used in the analysis. The age of the children was determined from the dates of birth provided by the mother and from the clinic and baptism cards. Children falling below the cut-off point ( $< -2SD$ ) from the median of the reference population were classified as stunted, wasted and / or under-weight.

Data on household and child characteristics were collected using questionnaire-interview. Additional information on past and present aspects of food production, dairy development and sugarcane cultivation were obtained by interviewing household heads and holding discussions with key informants in the study area. This included civil servants from various government ministries and departments, community, youth and church leaders, officials of MOCO and the Mumias Sugar Company.

### **Data Analysis**

The data was analyzed using the *Epi-Info Version 6.02* program. Measures of disparity were calculated to determine the extent of malnutrition in the community with reference to the different household enterprises. Descriptive statistics were also used to determine the influence of dairy production and a select number of household characteristics on the children's nutritional status. To capture the relationship between children's nutritional status selected household and child characteristics, the Pearson chi-square model was employed.

### **Results**

#### **General household characteristics**

A total of 172 households were sampled. The mean household size in the study area was 6.7 with one third (33.7%) of the households having 4-5 members. Nearly two thirds (65%) of the households grew sugarcane and 44.7% of all the households had introduced dairy cows. The average herd size at the time of the study per family was two. Households whose main enterprise was sugarcane had most of their land under sugarcane and had little or no land set-aside for dairy cattle.

#### **Milk production, sales and expenditure**

The average milk output per cow per day was estimated to be 5 litres with an average of 6.5 litres of milk in most of the households. Most of the milk was sold to supplement family income. At the time of the study, a litre of milk was selling at Kshs. 24 (US\$0.36). Estimated earnings from the sale of milk ranged between Kshs. 500-2000 (US\$ 6.38-25.54) per month, with average earnings of Kshs.700 (US\$ 8.93). A third of the households (26.2%) spent at least Kshs. 1000 or more (US\$12.77) per month on milk purchases as indicated in (Table 1). Households owning dairy cows did not spend money on milk unless under special circumstances, for example, when the cows are dry.

#### **Consumption of milk**

All households in the study area consumed milk with 55% of the households consuming only half to one litre of milk per day. Table 1 shows average milk consumption by the different household types. Households with dairy cows consumed more milk than the rest of the households. On average two litres of milk was reserved for home consumption by those who kept dairy. Households that kept dairy cows and grew sugarcane showed higher milk production overall. Only 7.5% of the households consumed 2.5 to 3 litres of milk per day. Most of the residents indicated that buying milk from neighbours was more reliable than from hawkers bringing milk from neighbouring divisions and districts. Almost half (51%) of the households indicated that the milk bought was not sufficient for the family's use.

#### **Milk consumption by children**

The majority of the households (83.7%) reported giving milk to their children either as plain milk, in porridge or in tea (Table 2). Only 23.3% of the households reported giving plain milk to their children. Twenty percent of the households indicated that they would have

liked to give more milk to the children but could not afford it.

### **Nutritional status of children in Mumias division**

Nearly half (44.7%) of the children were stunted with 29.6% being severely stunted. Using the NCHS reference standards, 10.4% of the children were wasted while 27.9% were under weight. An examination of the association between households with sugarcane, dairy, sugarcane and dairy and neither of these enterprises showed significant differences ( $P < 0.05$ ) in the nutritional status of children between the different household types. Children from households that had a combination of sugarcane and those that kept dairy cows only had better measures of nutritional status than those that cultivated sugarcane only. This was particularly so with respect to stunting as shown in (Table 3).

### **Income, expenditure pattern and nutritional status**

On the whole, sugarcane-growing households had more income than the rest of the households. Findings on household monthly income from farm produce indicate that sugarcane had the highest income followed by dairy. Dairy keeping households had an average monthly income of Kshs. 1,100 (US \$ 14.04), which was continuous.

Stunted, wasted and underweight children were linked to the income and expenditure patterns of the households they belonged to. Almost two thirds (64%) of the stunted children were from households with monthly incomes between Kshs. 0-3,999 (U.S\$51.26). The rest (36%) of the stunted children were from households earning Kshs. 4,000 (U.S\$51.28) and above. The size of the income seemed to influence nutritional status of children when all measures of growth are considered. The expenditure pattern seemed to follow a similar trend, as there were differences in the nutritional status of children from households that spent Kshs.3,999 (U.S\$51.26) and less and those from households that spent Kshs.4,000 (U.S\$51.28) and above. This indicates that the income and expenditure patterns do not predict nutritional status outcomes especially weight- for -height and weight- for- age.

### **Food availability and security**

On the whole, 62 (36%) of the households in the study area were food insecure (these were households that had either no food or no money to purchase food at the time of the survey). Majority 58 (33.7%) of these households did not keep dairy cows. It may be possible the regular income from the milk sales may have been used to purchase food.

### **Discussion**

In Mumias division, stunting prevalence of up to 28% has been reported. This is mainly due to food insecurity since many farmers emphasize the cultivation of sugarcane at the expense of food crops and livestock production. So far, no studies had been undertaken to evaluate the dairy intervention program that had been introduced in this area.

### **Milk production, consumption, sales and expenditure**

Although the average milk production (5- 6.5 litres) per cow per household was respectively low in dairy keeping households, it had significant implications on the household's food security, nutritional status and overall expenditure patterns. The consumption of milk in the dairy keeping households was higher than those that produced sugarcane alone. These findings are consistent with the findings from India and other parts of the world [11,27, 28]. The higher consumption of milk in the dairy-keeping households was probably due to the availability of milk within these households.

In addition to a steady regular supply of milk in the households that kept dairy cattle, a larger proportion of the milk produced was sold to supplement family incomes. Indeed, dairy provided the next highest average monthly income after sugarcane and for 20% of the households, dairy was the main source of income. The extra regular income may have been used for procurement of food (as these were more food secure households) and other household needs. Although the observations in Mumias are in contrast with an Indian study in which income did not significantly affect the participating farmers they concur with those of a study in the Coast province of Kenya [10,29]. The difference in the findings of the Indian study and the two Kenyan studies may be attributed to the difference in the program objectives. Whereas the Indian program was implemented among farmers who had had dairy cows for along time, the Farming Systems Kenya (FSK) and the Mumias programs targeted households that had just implemented the dairy programs. On the other hand, the amount of income in a household does not always translate into food and improved nutritional status.

### **Dairy production, food consumption and household food security**

A significant finding was the fact that women controlled income from dairy production in most of the households sampled. These households were reported to be food secure as women used part of this income to buy food. Whereas the Nakuru study did not consider income control, households participating in the FSK program were more food secure than the non-FSK households [28]. Further, although household food intake was not considered, the findings on food availability are similar to the findings of the Indian study in which total food intake was a function of income [27]. Milk sales are a very handy source of income given that the sales may be continuous throughout the year.

### **Nutritional status**

Although a number of factors within a household may contribute to improved nutritional status consumption of milk by both children and adults is likely to contribute to their health and well being due to the high protein efficiency ratio and the nutritional importance of milk in the human diet.

In considering policy implications of these results, it is clear that whereas cash crop production should be promoted, there is need to emphasize the growing of food crops and keeping of livestock as well. Where possible, nutrition education and financial management should be incorporated in agricultural development programs or projects.

It is evident that increased cash cropping may have positive, negative or neutral effects on national and household food availability and the children's nutritional status. The outcome depends on whether the government policies are directed towards improving productivity in both income from sugarcane and the staple foods. It would therefore, be ideal to promote both instead of promoting cash crops only at the expense of subsistence crops and dairy production. Emphasis on traditional food crops such as millet, sorghum and root crops would improve food security among the small-scale farmers in the area, while diversification of agricultural production would be a desirable component of household, national and regional food security.

Increasing opportunities for women to earn or control income will ensure household food security and this is likely to be beneficial to the children's nutritional status. Although landlessness was not predominant in the study area, most households had put most of their

land under sugarcane and for them, alternative income generating projects would provide important sources of regular income.

In addressing the problem of malnutrition, in this and any other community, a multifaceted approach embracing food, health, sanitation and health caring practices is necessary.

### **Conclusions**

Dairy production is an important source of income for families as it provides useful reprieve for food and other household needs. It is possible that the better nutritional status for children from households keeping dairy animals may be an indication that the intervention program by the Government and NGOs was achieving its objectives and that many more farmers should be encouraged to keep dairy animals so as to supplement their income.

### **Suggestions for further research**

In view of the findings of the present study, it is suggested that additional work to determine to what extent milk consumption is responsible for better nutritional status be undertaken. Although the findings of the present study were comparable to other studies, there is need for further research to explain the short-term and the long-term implications of agricultural policies and projects on the nutrition and health status of children in the rural areas.

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**Table1: Household expenditure patterns on milk purchases per month (n=172)**

Expenditure Kshs.	Sugarcane HH		Non-sugarcane HH		Totals	
	No.	%	No.	%	No.	%
100-500	23	13.3	18	10.4	41	23.8
501-1000	6	3.5	3	1.7	9	5.2
1000+	30	17.4	15	9.8	45	26.2
N/A*	42	24.4	32	18.6	77	<b>44.8</b>
Totals	101	58.7	68	39.5	172	100

\*These were households owning dairy cows.

**Table: 2 Average milk consumption by households (n=172)**

Milk in litres	Sugarcane		Mixed*		Dairy		Others		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%
0.5-1	25	14.5	40	23.2	15	8.7	15	8.7	95	55.2
1.5-2	15	8.7	16	9.3	22	12.7	2	1.1	55	31.9
2.5-3	3	1.7	7	4.0	6	3.4	1	0.5	13	7.5
3.5-4	1	0.5	3	1.7	1	0.5	1	0.5	6	3.4
>4	-		2	1.1	-	-	-	-	3	1.7

- Households growing sugarcane and keeping dairy. The percentages cannot add to 100% as some of the households fall in both categories.

**Table: 3 Average milk consumption by children according to household types**

		Sugar		Dairy		+Mixed		Others		Totals n=172	
Form	mls*	No.	%	No.	%	No.	%	No.	%	No.	%
Plain	0.35	4	2.3	16	9.3	13	7.6	7	4	40	23.3
Porridge	0.25	13	7.6	30	17.4	17	9.9	10	5.8	70	40.7
Tea	-	13	7.6	9	5.2	7	4	5	2.9	34	19.7
None	-	9	5.2	3	1.7	5	2.9	11	6.3	28	16.3
Totals	-	39	22.7	58	33.7	42	22.4	33	19.2	172	100

\* per child

+ Mixed = households that were growing sugarcane and keeping dairy cattle.

**Table: 4 Household enterprises by Z scores for Nutritional Status**

H/H Types	Height-for-Age		Weight-for-height		Weight-for-age	
	Below-3SD	Below-2SD	Below -3SD	Below-2SD	Below-3SD	Below-2SD
Sugarcane	21 (12.2)	14 (8.1)	2 (1.6)	6 (3.4)	6 (3.4)	12 (6.9)
Dairy	6 (3.48)	5 (2.9)	-	-	2 (1.16)	4 (2.3)
Sugar&Dai	8 (4.65)	3 (1.7)	1 (0.5)	5 (2.9)	1 (0.5)	8 (4.6)
Others	16 (9.3)	4 (2.3)	-	4 (2.3)	3 (1.7)	12 (6.9)
<b>Totals</b>	51 (29.6)	26 (15.1)	3 (1.7)	15 (8.7)	12 (6.9)	36 (20.9)
<b>Total maln.</b>	<b>77 (44.8%)</b>		<b>18 (10.4%)</b>		<b>48 (27.9%)</b>	

$\chi^2$  Value 78.72985 DF 3 Significance .00000

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**Word count**

- (a) **Abstract:** 300-400 for original articles: Yes
- (b) **3000-4000** for original articles excluding (abstract and references): Yes
- (c) No more than 1000 for personal communication:
- (d) Not exceeding 500 for letter to the editor

**References**

- (a) Numbered correctly as cited within the text and in square brackets: Yes
- (b) **In-text and end-** text citation consistent: Yes
- (c) Between 40-60 for review articles:
- (d) **Not exceeding 30 for** original articles Yes
- (e) Not exceeding five for letters to the Editor:
- (f) Key words not exceeding five:

**Figures and tables**

- (a) Cited consecutively in the text: Yes
  - (b) Are captions appropriate?: Yes
  - (c) Tables placed at the end, but part of the text: Yes
  - (d) Figures placed within the text: Yes
  - (e) A maximum of eight figures for review/original articles: Yes
  - (f) A maximum of eight tables for original/review articles: Yes
  - (g) Definitions of abbreviations that appear on the tables and figures provided: Yes
  - (h) Symbols and numbering clear and large enough: Yes
- Category of article clear (original or review article, Letter to the Editor, personal communication, commentary):