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The Contribution of Dairy Cєommercialisation to Household Food Security *A case of Gisambai Dairy Commercial Village in Hamisi, Vihiga Kenya*

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Abstract This case study assesses the contribution of a Dairy Cow Commercialisation Project (DCCP) at Gisambai Dairy Commercial Village in Hamisi Sub County, in Vihiga, Kenya on household food security of its beneficiaries using qualitative research strategy. To meet the above objective 20 households in 20 villages were interviewed. One household was randomly selected to represent a village resulting in 10 beneficiary and 10 non beneficiary respondent households. Two Focus Group discussion (FGD) were held; one with the DCCP beneficiary households and the second with non-beneficiary households. The FGD comprised of 20 and 13 stakeholders respectively. In addition four key Informant Interviews (KII), were carried out to gain more insight. The data was collected using a topic list, semi structured interviews and Food Consumption Scores (FCS) and analysed in the context of the Sustainable Livelihood Framework (SLF). The findings showed that the dairy cow commercialisation project has contributed to improved household food security by strengthening farmers' productive assets. The social assets were increased too because of belonging to commercial villages and Passing of "gift" calves in DCCP increased trust among beneficiaries and promoted social inclusion of the vulnerable members in the community. Further findings indicated that the use of dairy commercial villages has transformed the rural villages into a business hub through access to markets. The study established that the non-beneficiary households were experiencing food insecurity and lack of productive assets. The knowledge on food utilisation among both beneficiary and non-beneficiary households was low. Based on the findings the study recommends that Vihiga County could upscale the project to households that are yet to benefit. The study further recommends the Ministry of Agriculture, Livestock, and Fisheries & Cooperatives in Vihiga County to develop and incorporate food utilisation manuals in the farmer training programmes.

Keywords: *food security, household, commercial villages, dairy commercialisation*

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1. Introduction

1.1. Background of the Study

Kenya's commitment to attain SDG goal two has been observed in its development policies such as the vision 2030 and the agricultural sector development strategy which enforce food security policies such as distribution of government subsidized farm inputs, such as fertilizers and breeding stock to farmers, and commercialisation of the agriculture sector.

In the 2016 global food security index ranking, Kenya was ranked at position 87 out of the 113 ranked countries with a score of 42.7 per cent (World Food Program (WFP), [1]) which showed that food availability, accessibility, quality and safety are still low in Kenya [1,2]. Agricultural mandate has been devolved Government of Kenya, this calls for county government to promote food security for all. Vihiga county government has worked towards this goal through various agricultural projects; Dairy Cow commercialisation Project (DCCP) being one of them.

Vihiga County is located in the Western part of Kenya (KNBS, 2010). It experiences a tropical climate with an estimated rainfall of 1900 mm per year. It has a temperature range between 14°C - 32°C, with a mean of 23°C. This climatic condition favours both crop and livestock farming (Agriculture Sector Development Support Program (ASDSP), [3]). Agriculture is the main economic activity in the area [3], but land size is becoming increasingly small due to the high population growth. Current population is about 554,622 [31].

The reduced land size has resulted in low crop yields that can only sustain a household for a period of two months [4] after harvesting. The county was classified as

food insecure according to the Kenya agro ecological region food security survey (Wanjiku, Wanjiru, & Wakabi, 2015). About 90% of the residents in Vihiga County derive their livelihood from crop farming and livestock keeping as way forward by [3] with maize being a staple food.

Further findings by Nyangweso,et al. [5] showed that households in Vihiga face vulnerabilities of low access to adequate food due to lack of productive assets. These brought forth a need to adopt a farming system that could promote increased agricultural production and improved income throughout the year to enable the households to access adequate food. This led to the launch of the Dairy Cow Commercialisation Project (DCCP) in 2013. Dairy farming has been identified as one of the economic pillars to drive agriculture sector growth. An improved dairy cow has about 240 lactating days per lactating period. Milk can be consumed and the remaining is sold for income which gives the households an opportunity to access food through purchase.

DCCP is a joint development project between the county government and development partners; Western Kenya Community Driven Development/Flood Mitigation Program (WKCDD/FMP), and Agriculture Sector Development Support program (ASDSP). The project is being implemented by Vihiga County government in the department of Livestock Production Services (LPS) to improve livelihoods. It was launched in 2013 [6] and ends in 2018. The project aims at improving household food security by strengthening farmer's assets through distribution of improved breeds of dairy cows, farmer capacity building, provision of free extension services and strengthening of partnership linkages.

DCCP involves distribution of improved in calf dairy cows to low income households in dairy commercial villages. The beneficiary households either kept crossed zebu cows (Pool) or a local Zebu cow while some did not have a cow at all. Commercial Village (CV) is a model developed by Farm Concern International (FCI) in implementing its livelihood programs [7].

A dairy cow beneficiary household returns two female calves, giving them to the next beneficiary households. The male calves are sold by the CV and the money is saved for purchase of veterinary supplies. The calves are locally referred to as the 'gift' since the community believes keeping the promise of giving a calf by the first beneficiary is a sign of trust among themselves. The passing of gifts has improved community cohesion and dependence on one another. This has enabled the smooth social inclusion of vulnerable households into the community development strategies. Passing on of the calves was adopted so that by the end of the program in 2018 many household will have received improved dairy cows [6]. A similar project has been implemented in Busia County in Western Kenya by Heifer international using farmer self-help groups [8].

A Commercial Village is "a hybrid model through which typical social administrative villages are designed and systematically graduated into commercialised competitive market - led agricultural production units" [7]. According to [9], "commercial villages are farmer groups clustered together to form one large group called a "commercial village" with the aim to benefit from economies of scale in extension work, input sourcing, production and marketing activities". However in this study I seek to define a commercial village in the context of Vihiga County as "a group of individual smallholder farmers from a local administrative unit who come together with an aim to produce, market and accesses social services". Social services are support systems that trigger long term pro poor social and economic change [10]. The farmers have been able to establish milk collection centres, community agro vets and have also trained youths to carry out artificial insemmination at Ward level. This has made access to services easier.

Milk access to markets creates a sustained source of income for the rural households (Steven, Hazell, & Reardon, 2007). This is achieved through the dairy commercial villages at Ward level. Developed market linkages are the key to economic growth of smallholder dairy farmers (IFAD, 2011). This has been observed in the entire Vihiga County which has developed milk collection centres. From earned income the farmers are able to access adequate food through purchasing.

Measurement of household food security

The term food security (FS) has undergone timeline changes in definition starting with the definition of World Food Conference of 1974 on food security which focused on the problem of global production, trade and stocks thus food security meant an adequate supply of food and stability of supplies through food reserves [11]. This need resulted in green revolution movement in 1970s which used technology to increase food security.

In 1980 food access was considered an important element of food security [11] thus food security meant adequate supply and access. In 1990 food utilisation which focuses on sanitation, water and body health was incorporated in the definition of food security [12]. Food security is measured using different tools such as Household Economy Approach (HEA), Household Food Insecurity Access Scale (HEFIAS) and Dietary Diversity (DD) [13]. The author adopts the use of dietary diversity in analysing of household food security. The study therefore focused on the pillars of food availability, accessibility and utilisation

Food security could be measured using Dietary diversity Score (DDS). Dietary diversity is a qualitative measure of food consumption which reflects household access to a variety of foods. It's also a proxy of the nutrient adequacy of the diet for individuals within a household [14]. The dietary diversity score (DDS) reflects, a true picture of the economic ability of an individual or a household to consume different food groups. DDS is measured using either Household Dietary Diversity (HDDS) score of 24 hours recall period or Food Consumption Score (FCS) [13] which has a recall period of 7 days. The pillars of food security (availability, access and utilisation) are reflected in dietary diversity [11].

The study used the FCS as a proxy for consumption since it shows dietary diversity. FCS is used to measure access to food [13]. The Frequency of meals eaten in a day was also used in the study to establish the contribution of DCCP to household food security since it is also a proxy of income. The author further added the sources of food to ascertain the availability of food in the area and means through which households acquired food. The FCS are analysed by summing up the weights of food groups consumed in a household for the last seven days.

B, Household

A household is a social group of people who live in the same place, same roof, share meals and make joint decisions over allocation of resources and pull their incomes together to achieve a livelihood [15]. This study adopted the definition by Ellis [15]. Household food security exists when "all of its members have at all times, physical and economic access to adequate food according to their preferences consistently for an active and healthy life" [16]. These will be measured using FSC [13].

1.2. Research Problem

Vihiga county government is committed to improving food security to all her residents to attain Sustainable Development Goal number two [17]. It has funded Dairy Cow Commercialisation Project in collaboration with development partners since 2013 [6] through the department of livestock production services (LPS). However after three years of implementation of DCCP the Livestock Production Services (LPS) department lacks knowledge on the contributions of DCCP on the household food security of its beneficiaries. This raised the need to carry out an assessment to establish this contribution and make recommendations and inform the policy makers on contributions of dairy cow commercialisation to food security.

1.3. Research Objective

To gain insight in the contribution of Dairy Cow Commercialisation Project to household food security; availability, accessibility and utilisation by comparing food security status of DCCP beneficiary household to non-beneficiary households in Gisambai ward, of Hamisi Sub County in Vihiga, Kenya.

1.4. Conceptual Framework

Sustainable Livelihood Framework (SLF)

The study applied the SLF (DFID, 1999) in analysing the contribution of DCCP to livelihood of the beneficiaries as shown below in figure1. Sustainable Livelihood Framework (SLF) is a food security analysis tool developed by Department for International Development (DFID, 1999), [11]. SLF tool is used to increase the understanding of development organisations and governments regarding the livelihood of the poor [18]. It's also used in planning new development interventions. It's further applied in reviewing and evaluating the on-going interventions contribution to livelihood sustainability. DCCP is an intervention that is on-going and needs to be evaluated.

The author SLF framework has been used by other development organisations to assess the contributions of the livelihood programmes they have implemented in Vihiga County [19]. SLF further has been used by Swedish International Development Cooperation Agency (Sida) in assessing its livelihood programmes [20]. Some of the programmes which have been implemented by Sida in Vihiga County are; National Agriculture and Livestock Extension Programme (NALEP) [19] and Agriculture Sector Development Support Programme [3]. The conceptual framework for our research project is illustrated in Figure1 below.

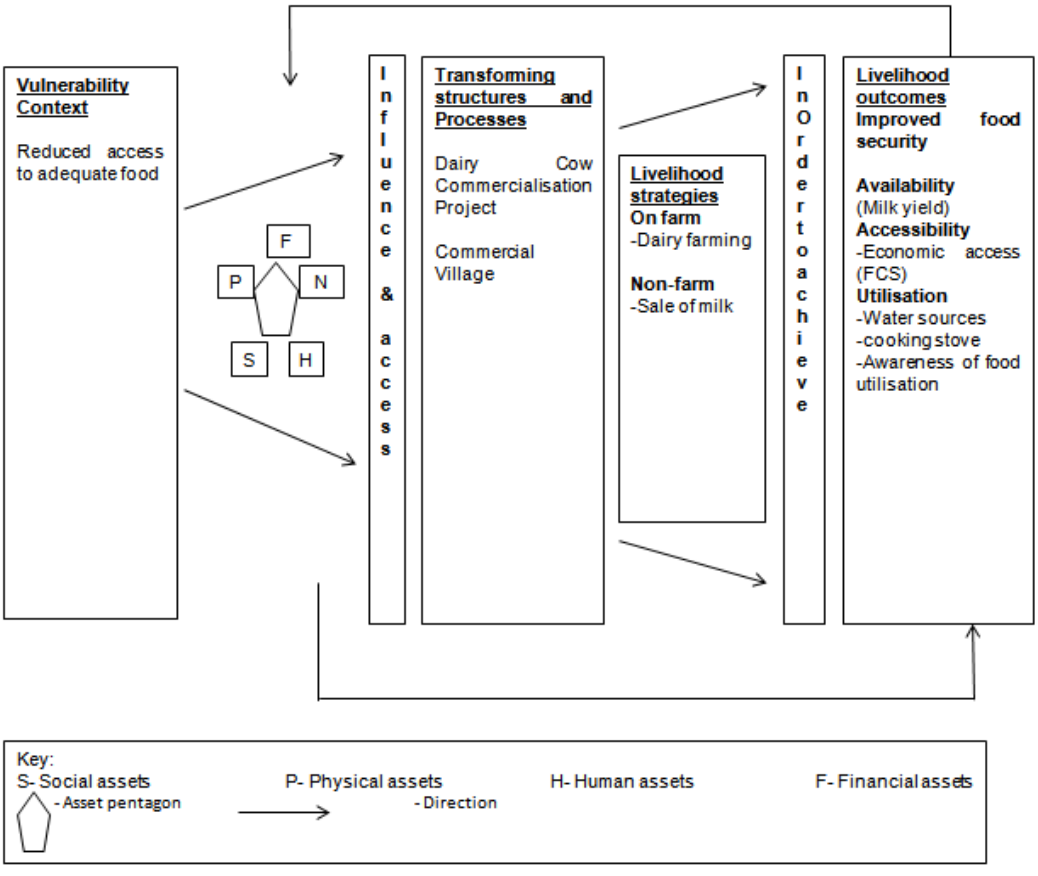

Figure 1. Conceptual framework used in the study (Source: Adopted by author from [18])

Households in Vihiga County experience reduced access to adequate food due to increased population that has resulted in reduced land size thus low harvests that cannot sustain a household daily food demand. The transforming processes in which respondents operate include; food security policies, projects and support from the Non-Governmental Organisations (NGOs). In this case we have the DCCP project. These components influence the access of the households to productive livelihood assets such as improved dairy cows, income from sell of milk, natural resources, commercial villages and use of labour as human capital. Dairy farming was explored as the on farm strategy which results to improved access to adequate food through improved milk yields and income from sale of milk.

2. Methodology

2.1 Research Design

The study used a case study research design based on secondary information and data collected in the field during the study. The author adopted qualitative research design to interact with the respondents as they share their stories on contributions of DCCP on their Food security [21]. The case study design also offered the researcher an opportunity to gain profound insight into several objects that were restricted in space and time [22] such as livelihoods of Gisambai Dairy Commercial Village (GDCV) members and the Non -beneficiary.

2.2. Sampling of Target Population

In the study the ten DCCP beneficiary households were compared to ten non-beneficiary households. Each household represented a village. One household was randomly selected to represent a village resulting in 10 beneficiary and 10 non beneficiary households to participate in the household interviews. The reason for comparison was because of lack of baseline survey data on food security (FS) in Vihiga County. FS case studies have been done but none has undertaken a baseline survey. The livelihood vulnerabilities being experienced by the non-beneficiary currently were the same felt by DCCP beneficiaries before however on a varying degree. This was the second reason for using the non-beneficiary households.

One focus group discussion was held in both beneficiary and non-beneficiary group. In addition four Key Informant Interviews were held. The results from focus group discussions and key informant interviews were used to validate and clarify the information given from the household interviews. Overall, all information collected from the household interviews, FGDs and key informants was synthesised to gain insight in contribution of DCCP to household food security.

2.3. Data Collection Tools

Data was collected through semi-structured interviews using a topic list. Ten household interviews were carried out in both DCCP beneficiary and non-beneficiary respondents homestead to make them feel comfortable and relaxed. The use of semi structured interview tool gave the researcher an opportunity to probe further on the respondent's household food security.

Additional data collection tools used in the study was FGD, KII, and Participatory Observation (PO). These methods were used in order to gain in-depth understanding. Key informant interviews were carried out to collect the information that may have been left out during FGD and household interviews.

Focus group discussions (FGD) were done with whom? to validate the findings from household and KII interviews. Participatory observation enabled the researcher and the respondents to assess their FS and other livelihood outcomes through use of observable indicators such as the number of dairy cows in the homestead and food preparation methods.

The Food Consumption Score and frequency of meals eaten in a day were used to measure households ability to access adequate food due to DCCP project. The results were compared to the FCS of the nonbeneficiary households. The author modified the FSC scale by adopting a scale of 28 and 42.This is because a majority of households in Vihiga County take tea with sugar. This was done to accommodate scores of other food groups. The modification of FCS scale is supported by WFP [13] which states that " in populations that have high frequency of conumption of sugar and oil the alternate cut offs of 28 and 42 may be more appropriate". High scores may result from sugars consumption. The sources of food were established to ascertain the food availability of food in the area. The food group list and weight per group is attached as Appendix 1.

2.4. Data Analysis

Data collected was revisited on the same day of collection and organised according to the themes as shown in the topic list attached as Appendix 5. The data was interpreted and synchronized with the secondary information sources and presented using descriptive analysis. Milk yields and food consumption score were analysed using Microsoft excel and findings presented in tables and bar graphs.

Descriptive and thematic approaches were applied to get an in-depth understanding of the responses given by the interviewees carried out in households whereas the FGD and KII findings were analysed by reference to questions and presented descriptively. In Microsoft excel households were coded using numbers per beneficiary group; 1 to 10 to represents household 1 to 10 respectively to guarantee anonymity.

3. Results and Discussion

3.1. Contribution to Food Availability

This was measured using milk yield levels for the year 2015 and 2016. The year 2014 was not considered because most of the cows were still in calf. The results from beneficiary households were compared to non-beneficiary households as summarised in Table 1 below. Details are found in Appendix 3.

Table 1. Comparison of milk yields for beneficiaries to non-beneficiary

Year	Beneficiary		Non Beneficiary	
	Total yield Production	Range (low – highest)	Total yield production	Range (low-highest)
2015	21,150	3,600	4,860	1,080
2016	22,500	5,040	4,790	1,170
Total yield in 2yrs	43,650		9,650	

Source: Author

The beneficiary households had a higher total milk yield than the non-beneficiary households. The beneficiary household milk yield increased with more than 1000 Litres in a year while the non-beneficiary increment was minimal with an increase of 90 litres only. Therefore the beneficiaries had high access to milk and milk nutrients than the non-beneficiaries. This improved their food availability in terms of milk yield. The high milk yield in DCCP beneficiary households was due to improved dairy herd unlike the non-beneficiary who still kept local Zebu cows.

The source of food available to a household indicates whether a household is able to access adequate food. Households acquire food through own production, purchase or use other strategies of accessing food. From in-depth interaction with the respondent households the study established the findings as illustrated in Table 2 below.

Table 2. Sources of food for beneficiary and non-beneficiary households

Sources of food	Beneficiary		Non beneficiary	
	No. of HH	Percentage	No. HH	Percentage
Purchase	10	100	10	100
Own Production	10	100	10	100
Gifts	2	20	4	40
Other (Wild hunting	1	10	3	40

Source: Author

The main sources of food that were available for both households were from purchasing and own production. Through further probing the study established that majority of non DCCP beneficiaries received food as gifts and also practiced wild hunting. This is an indication that their households' own food production could not sustain them throughout the year thus lack access to adequate food. This coincides with the findings by [4,23], that harvested food stocks lasts for about 2 months in a year in Vihiga County leaving some households to explore the strategy of receiving food as gifts .

3.2. Food Accessibility

Food Consumption Scores

FCS is a proxy for measuring consumption [13]. The author used descriptive tags such as poor, borderline, and accepted diet diversity to classify the FCS. Borderline score means that the household is food insecure, while poor FCS scale shows the house is experiencing low food security while an acceptable scale shows a household is food secure. Detailed calculations are presented in Appendix 4.

Table 3. Food consumption score clusters

FCS Clusters	DCCP beneficiary	Percentage	Non beneficiary	Percentage
Borderline (0- 28)	1	10	0	0
Poor (28.5 – 42)	2	20	6	60
Accep Table (≥42)	7	70	4	40
Total Household	10	100	10	100

Sources: Authors

From Table 3 above, the FCS results indicate that DCCP has contributed to food security of the beneficiary household because 70 per cent had an FCS of 42 or more which is an indicator of acceptable food accessibility. However, a majority of non-beneficiary respondents had FCS scores of <42, which implied that they had low food security.

Frequency of meals consumed in a day

The number of meals eaten by a household is a proxy for income. Income determines households' access to food. This confirms the findings that DCCP beneficiary households had more access to adequate food than the non-beneficiary households as shown in Table 4 below.

Table 4. Frequency of meals consumed in a day

Beneficiary			Non beneficiary			FCS cluster obtained
No. of meals eaten/day	No. of HH	Respondent Percentage	No. of meals eaten/day	No. of HH	Respondent Percentage	
1	1	10	1	0	0	Borderline (28.5-42)
2	2	20	2	6	60	Poor (28.5-42)
3	6	60	3	4	40	Acceptable (> 42)
≥3	1	10	>3	0	0	Acceptable (> 42)

Sources: authors own

Seventy per cent of DCCP beneficiary households consumed 3 meals a day against only forty per cent of the non-beneficiaries. The high frequency of consumption in DCCP beneficiary households was due to improved income generated from sale of milk which gave the beneficiary households' ability to access more food. The contribution of dairy to increased number of meals eaten in a day was also observed among Tanzanian smallholder dairy beneficiary households [24]. This finding shows that the high frequency of taking meals in a household corresponded with high FCS [13,25]. This enabled the researcher to validate the FCS for both beneficiary and non-beneficiary. However the study also established that 10 per cent representing one households of the beneficiary was at the borderline. This is because the cow was not lactating so the household dependent on other strategies of attaining food security (see Appendix 2, Appendix 3 and Appendix 4).

3.3. Food utilisation

Clean sources of water and knowledge of food preparation affects a household's food utilisation [12].

Table 5. Source of water and food preparation knowledge awareness

Sources of food	Beneficiary		Non beneficiary	
	No. of HH	Percentage	No. HH	Percentage
Treated water source	10	100	10	100
Aware of food preparation	3	30	2	20
Owned Improved jiko (cooking stove)	4	40	1	10

Sources: Author

The findings above illustrates that both DCCP beneficiary and non-beneficiary households had access to clean water sources treated with chlorine (see Table 5). DCCP also involved clean water provision by installing rain water harvesting tanks and protecting community springs to attain food utilisation component. Post-harvest treatment of food affects the quality and availability of nutrients in the food [26]. This was observed in households with milk who did not boil it before fermenting in believe that boiled milk doesn't ferment properly (its light) while in the process they compromised the quality of milk.

The awareness of food post-harvest, handling and preparation knowledge was low in both household types. A majority of beneficiary and none beneficiary respondent households lacked knowledge and awareness of food preparation and lacked improved *Jiko* (cooking stoves) which provides a clean cooking environment.

From the FCS data (Appendix 4) many households did not consume meat products, not even the poultry which each homestead had. They believed that it's a waste of resources to consume eggs or chicken. The poultry were reared mostly for financial use and not consumption. This confirms the findings by Slingerland et al., [26] that rural households rarely consumed meat products because they believed it is expensive. However in both beneficiary and non beneficiary households sugar and cooking oil were purchased because they considered the products to improve food taste.

4. Conclusions

DCCP beneficiary households accessed adequate food more than the non-beneficiaries as observed in FCS clusters where majority of the beneficiary households scored acceptable scores unlike the non-beneficiary. Additionally the beneficiary households had high access to more than three meals in a day, due to improved income from sale of milk. Thus the author concludes that DCCP has contributed to improved income and access to food in beneficiary households as compared to non-beneficiaries. However, from the findings on food utilisation the author concludes that food utilisation in both beneficiary and non-beneficiary households were low since both households had little knowledge on the subject.

The adoption of Commercial Village extension approach by the department of livestock increased access to milk markets by producing smallholder dairy farmers. Therefore CV could be scaled up to other value chains in the county. Commercial villages also made the delivery of extension services to be efficient since many farmers are reached in groups. The commercial villages have also improved participation thus promoting social inclusion of the vulnerable members in the community.

Overall DCCP has contributed to improvement in food security of the beneficiary households. The non DCCP beneficiary household are still vulnerable to food insecurity due to lack of access to adequate food. This project confirms findings by [5]. That majority of households in Vihiga County lacked productive assets that could enable them to access adequate food. Therefore Dairy Cow Commercialisation Project has improved households access to adequate food in Vihiga County.

5. Recommendations

The dairy cow commercialisation project could be up scaled to cover the households that are yet to benefit from the project in order to improve households' access to adequate food. The adoption of commercial village extension approach is promoting growth of agricultural value chains through access to markets thus CV could be adopted in all the agricultural development projects which support livelihoods. This could be implemented through agricultural policies at the county level. The study thus recommends that the county policy makers could prioritize food utilisation campaigns and capacity building to create awareness in the community. Finally further research could be done to explore the contributions of the dairy sector to food security in the global arena.

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Statement of Competing Interests

I declare that; I have no significant competing financial, professional or personal interests that may have influenced the writing and publication of the work described in this article.

List of Abbreviations

DCCP: Dairy Cow Commercialization Project
FGD: Focus Group Discussion
KII: Key Informant Interview
FCS: Food D Consumption Score
CV: Commercial Village
HH: Household

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Appendices

Appendix 1: List of food groups and weight factor for FCS.

Table 6. Food consumption score sheet

Food Item	Days Eaten In past Week (0-7days)	Source of food	
		primary	Secondary
Maize			
Rice, Green bananas			
Bread/Wheat			
Tubers			
Groundnuts & Pulses			
Fish (eaten as main food)			
Fish Powder(used for flavour only)			
Red meat(Beef, Sheep & goat)			
White meat (Poultry, Rabbit, pork)			
Vegetables (including Leaves)			
Vegetable oils, fats			
Eggs			
Milk in tea in small amounts			
Milk and dairy products (Main food)			
Fruits			
Sweets & sugars			

Table 7. Standard weight per food item

S/No	1 Food item	Food groups	Weight
1	Maize, maize porridge, Maize ugali, rice, sorghum, millet, pasta, bread and other cereals	Main staple	2
	Cassava, potatoes, sweet potatoes, cashew nuts, arrow root, yams, Plantains and other tubers		
2	Beans, peas, groundnuts and cashew nuts	Pulses	3
3	Vegetable, leaves	Vegetable	1
4	Fruits((Pawpaw, mango, oranges, melons, bananas, avocado, Loquats, Guavas and others)	Fruits	1
6	Beef, goats, Sheep, Rabbit, chicken, Pork, quail, turkey, ghee and duck ,eggs and Fish	Meat and fish	4
7	Milk , yoghurt, Mala(sour milk) and other	Milk	4
8	Sugar and sugar products, honey	Sugar	0.5
9	Oils, fats, coffee, salt, fish powder, small amounts of milk in tea	Condiments	0

Source: (WFP, 2008)

Appendix 2: Comparison of income for beneficiary and non-beneficiary

Table 8. Income from sale of milk

HH	**Beneficiary**					**Non beneficiary**				
	Milk yield /litres/year		Cost / litre / Ksh	Total income in 2yrs/Ksh	**income in USD**	Milk yield /litres/year		cost/litre /ksh	Total income in 2yrs/Ksh	**Two year earnings USD**
	2015	2016				2015	2016			
1	2,880	3,240	50	164,880	**1,649**	0	1,170	50	58500	**585**
2	2,160	1,800	50	92,160	**922**	1,260	1,640	50	83260	**832.6**
3	3,600	2,340	50	120,600	**1,206**	0	0	50	0	**0**
4	2,160	1,440	50	74,160	**742**	0	0	50	0	**0**
5	2,340	1,080	50	56,340	**563**	810	0	50	810	**8.1**
6	2,340	2,880	50	146,340	**1,463**	0	0	50	0	**0**
7	270	1,800	50	90,270	**903**	360	0	50	360	**3.6**
8	3,600	5,040	50	255,600	**2,556**	1,080	360	50	19080	**190.8**
9	1,800	2,880	50	145,800	**1,458**	0	0	50	0	**0**
10	0	0	50	0	**0**	1,350	1,620	50	82350	**823.5**

Assumptions; Ksh 100 = 1USD
Price of I litre of milk KSH. 50
Income (USD) = total milk yield in 2yrs Ksh. 50/100
Cow production in 2016 will remain the same up to the end of the year

Appendix: 3 Milk yields for DCCP beneficiary compared to non-beneficiary

Table 9. Comparison of milk yields for beneficiaries to non-beneficiary

HH	DCCP beneficiary			Non Beneficiary		
				Milk yield levels /2yrs		
	2015	**2016**	**Production trend**	**2015**	**2016**	**production trend**
1	2,880	3,240	360	0	1,170	1,170
2	2,160	1,800	-360	1,260	1,640	380
3	3600	2,340	-1,260	0	0	0
4	2,160	1,440	-720	0	0	0
5	2,340	1,080	-1,260	810	0	-810
6	2,340	2,880	540	0	0	0
7	270	1800	1,530	360	0	-360
8	3,600	5,040	1,440	1,080	360	-720
9	1,800	2,880	1,080	0	0	0
10	0	0	0	1,350	1,620	270
Total yield/yr	21,150	22,500		4,860	4,790	

Appendix 4: FCS for beneficiary compared to non-beneficiary households

Table 10. Food consumption scores for DCCP beneficiary

HH	Cereal & Tubers	Groundnuts & Pulses	Vegetables	Fruits	Meat & Fish	Milk	Sugar	Condiments	**FSC**	No. of meals/day	Classification	Sources of Food
1	7	2	7	5	2	2	7	7	**51.5**	3	Poor	1, 2
2	7	0	7	2	4	0	7	7	**42.5**	3	Acceptable	1,2
3	7	1	7	7	6	3	7	7	**77.5**	4	Acceptable	1,2
4	7	3	7	5	6	0	7	7	**62.5**	3	Acceptable	1,2
5	7	1	7	1	2	0	7	7	**36.5**	2	Poor	1,2,5
6	7	1	7	1	5	0	7	7	**48.5**	3	Acceptable	1,2
7	7	2	7	7	0	0	7	7	**37.5**	2	Poor	1,2,5
8	7	1	7	1	4	0	7	7	**44.5**	3	Acceptable	1,2
9	7	2	7	3	6	2	7	7	**65.5**	3	Acceptable	1,2
10	4	0	3	3	2	0	7	7	**25.5**	1	Borderline	1,2,5,6

Table 11. Food consumption score for non-beneficiary respondent households

HH No	Cereal & Tubers	Groundnuts & Pulses	Vegetables	Fruits	Meat & Fish	Milk	Sugar	Condiments	**FSC**	No. of meals/day	Classification	Sources of Food
1	7	0	7	7	3	0	7	7	**47.7**	3	Acceptable	1, 2
2	7	1	7	1	2	0	7	7	**36.5**	2	Poor	1,2
3	7	2	7	0	0	0	7	7	**38.5**	2	Poor	1,2,5
4	7	2	7	2	4	0	7	7	**48.5**	3	Acceptable	1, 2
5	14	1	7	1	3	0	7	7	**40.5**	2	Poor	1, 2
6	7	1	7	1	0	0	7	7	**28.5**	2	Poor	1, 2
7	7	2	7	5	4	0	7	7	**51.2**	3	Acceptable	1, 2
8	7	0	7	1	1	0	7	7	**29.5**	2	Poor	1, 2
9	7	0	7	1	3	0	7	7	**37.5**	2	Poor	1, 2
10	7	0	7	0	7	0	7	7	**52.5**	3	Acceptable	1, 2

Appendix 5: Research topic list

1. Food availability through own production (Milk yields, sources of food)
2. Food accessibility; Dietary diversity measured using Food Consumption Score (FCS) and frequency of meals eaten in a day
3. Utilisation (Conditions of food preparation and water sources)
4. Commercial Villages (Benefits of commercial villages)

Appendix 6. Food consumption score questionnaire

WFP'S Food Consumption Score

Food Consumption data collection Module County adopted to Vihiga context.

Consent for interview; the researcher is a student at Van Hall Larenstein University, she is collecting data to analyse household food security in Vihiga County with reference to contribution of DCCP to household food security. The data will be used for writing her MSc thesis. The recommendations from the findings will be used by the department of livestock for further intervention. And the thesis information may be used by other authors through the permission of Van Hall Lareinstein University library in The Netherlands in their studies.

Interviewer: I would like to ask you about the food consumed by your household members over the last 7 days.

Household number …… Village……..... Respondent Position in the HH……

Table 12. Food consumption score sheet

Food Item	Days Eaten In past Week (0-7days)	Source of food	
		primary	Secondary
Maize			
Rice, Green bananas			
Bread/Wheat			
Tubers			
Groundnuts & Pulses			
Fish (eaten as main food)			
Fish Powder(used for flavour only)			
Red meat(Beef, Sheep & goat)			
White meat (Poultry, Rabbit, pork)			
Vegetables (including Leaves)			
Vegetable oils, fats			
Eggs			
Milk in tea in small amounts			
Milk and dairy products (Main food)			
Fruits			
Sweets & sugars			

Food sources codes

Purchase = 1 Own production = 2 Borrowed= 3

Traded goods/services = 4 Received as a gift = 5 Others =6

Food consumption group

FSC is a proxy for measuring consumption as shown in Table 13 below. It uses descriptive such as poor, borderline, and accepted diet diversity. The scale was modified by adopting a scale of 0- 28 to 42 because majority of residents in Vihiga take tea with sugar. This was done to accommodate high scores that may result from sugar consumption [13].

Table 13. Food Consumption Group representing threshold values

Food Consumption Score	Profile
0 - 28	Borderline
28.5- 42	poor
> 42	Acceptable

The food standard group and current standard weights used in analysis is shown in Table 3 below

Table 14. Standard weight per food item

S/No	1 Food item	Food groups	Weight
1	Maize, maize porridge, Maize ugali, rice, sorghum, millet, pasta, bread and other cereals	Main staple	2
	Cassava, potatoes, sweet potatoes, cashew nuts, arrow root, yams, Plantains and other tubers		
2	Beans, peas, groundnuts and cashew nuts	Pulses	3
3	Vegetable, leaves	Vegetable	1
4	Fruits(Pawpaw, mango, oranges, melons, bananas, avocado, “Maparapandi” Guavas and others)	Fruits	1
6	Beef, goats, Sheep, Rabbit, chicken, Pork, quail, turkey, ghee and duck ,eggs and Fish	Meat and fish	4
7	Milk , yoghurt, Mala(sour milk) and other	Milk	4
8	Sugar and sugar products, honey	Sugar	0.5
9	Oils, fats, coffee, salt, fish powder, small amounts of milk in tea	Condiments	0

Calculation of Food Consumption Score (FSC) per respondent household

The Food Consumption Score (FSC) per respondent household will be summed up to get the weights of each food group as shown in Table 15 below.

Table 15. The Food Consumption Score (FSC) per respondent household

S/No	1 Food item	Food groups	Weight (a)	Sum of consumption (b)	Food group scores (a *b)
1	Maize, maize porridge, Maize ugali, rice, sorghum, millet, pasta, bread and other cereals Cassava(ugali), potatoes, sweet potatoes, cashew nuts, arrow root, yams, Plantains and other tubers	Main staple	2		
2	Beans, peas, groundnuts and cashew nuts	Pulses	3		
3	Vegetable, leaves	Vegetable	1		
4	Fruits(Pawpaw, mango, oranges, melons, avocado, “Guavas and others)	Fruits	1		
6	Beef, goats, Sheep, Rabbit, chicken, Pork, quail, turkey, ghee and duck ,eggs and Fish	Meat and fish	4		
7	Milk , yoghurt, Mala(sour milk) and other	Milk	4		
8	Sugar and sugar products, honey, sugar cane	Sugar	0.5		
9	Oils, fats, coffee, salt, fish powder, small amounts of milk in tea	Condiments	0		
	The food Consumption Score (Total sum of column c)				