Newcastle Disease Control in Singida, Tanzania

A Baseline Study

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Abstract

The main limiting factor to rural poultry production in the Singida district of Tanzania is Newcastle disease (ND). The KYEEMA foundation is implementing a one year project to improve the quality of life of local villagers in Malawi, Mozambique, Tanzania and Zambia by improving the availability of chicken through sustainable vaccination against ND.

This data confirms that the vaccination of chicken against ND has a positive effect on the numbers of chickens owned by villagers. However due to the unstructured and inconsistent application of these vaccinations this positive effect has not lead to a significant difference in chicken numbers. Another factor that has exacerbated the problem of unstructured an inconsistent vaccination is the lack of knowledge about ND vaccination among the villagers.

These same problems can also be seen in the Thyolo district of Malawi despite the extreme differences in population density, geography and environment between the two districts. In both districts when a structured and consistent ND vaccination program is put into place an increase in chicken numbers will be expected.

Introduction

Poultry plays a very important role in rural areas of many developing countries (Alexander *et al.,* 2004; Kitalyi, 1998). Chickens provide people in these areas with meat and eggs which can be consumed by the owners of the chickens or sold or bartered for medicine clothes and school supplies / fees. Chickens also provide pest control, manure and are needed for many traditional ceremonies and festivals (Alders *et al.,* 2005a).
Chickens in rural areas are held in a low yield, low input way. These chickens come from local breeds which are hardy, are able to scavenge for their own feed, are able to run and fly to escape predators and are capable of reproducing to supply replacement stock for the household flock. These village chickens require a minimal of inputs in terms of housing, disease control, management and supplementary feeding. This makes these chickens very valuable to villagers in developing countries (Alders *et al*., 2005a). In these countries approximately 20% of all protein comes from eggs and chicken meat and poultry contributes 70% of the rural production in low-income, food-deficit countries (Branckaert *et al*., 2000).
One of the main limiting factors to rural poultry production is Newcastle disease (Alders and Spradbrow, 2001; Alders *et al*., 2005a; Alexander *et al.*, 2004).
In countries where ND is endemic, outbreaks of this disease regularly result in mortalities of 50 to 100%. In developing countries where ND is not endemic, outbreaks may occur less frequently but potential losses due to the disease make vaccination necessary (Alders and Pym, 2008).
The objectives of Newcastle disease control in rural chicken populations are to improve food security and aid in poverty alleviation in rural and urban families.
A sustainable ND control programme is composed of five essential components:
– An appropriate vaccine, vaccine technology and vaccine distribution mechanisms.
– Effective extension materials and methodologies that target veterinary and extension staff as well as community vaccinators and farmers.
– Simple evaluation and monitoring systems of both technical and socio-economic indicators.
– Economic sustainability based on the commercialisation of the vaccine and vaccination services and the marketing of surplus chickens and eggs.
– Support and coordination by relevant government agencies for the promotion of vaccination programs.
(Alders and Pym, 2008)
Vaccination plays an important role in ND control and management, crucial to this is the use of a suitable vaccine. The two vaccines that are commonly used in these rural areas are the NDV4-HR and I-2 ND vaccines. These vaccines are thermotolerant and are able to be used when accessibility to refrigeration is not available (Spradbrow, 2005). The NDV4-HR is a commercial vaccine and can be bought by countries. For countries that cannot afford this vaccine is the I-2 ND vaccine an option. ACIAR (Australian Centre for International Agricultural Research) provides the I-2 ND master seed free of charge. This vaccine is suitable for use in village chickens to be produced locally (Copland and Alders, 2005). The I-2 thermotolerant live vaccine, which is currently used, has been field tested over many years to prove its vaccinating strength (Alders *et al*., 2005b) and its advantages over the previously used live La Sota thermolabile vaccine (Orsi *et al.,* 2009, Young *et al.,* 2002).
Live vaccines generally must be stored away from excess heat, cold or light to ensure maximum potency. This poses problems in many developing countries such as Tanzania

due to the maintenance of a functional "cold chain" to ensure appropriate conditions for vaccine storage and transport. Conventional ND thermolabile live vaccines such as La Sota, have been used to control of ND in free-range rural scavenging chickens. These vaccines have yielded little success due to problems with their use. These problems include transport difficulties, high ambient temperatures and lack of refrigeration (Dias *et al.,* 2000, Mgomezulu *et al.,* 2005).
The I-2 vaccine is thermotolerant and can be stored outside refrigeration for short periods, using simple methods that are within the resources of community vaccinators (Chicamisse *et al.,* 2005).

"Strengthening rural livelihoods and food security through improving village poultry production in Malawi, Mozambique, Tanzania and Zambia" is a project implemented by KYEEMA Foundation, a non-governmental organisation (NGO). KYEEMA Foundation and its subsidiary entity the International Rural Poultry Centre (IRPC) have been working in Southern Africa in the last fifteen years towards capacity building, community development and poverty alleviation through developing and implementing a sustainable model for Newcastle disease control.

In the KYEEMA ND control project three vaccination campaigns will be carried out per year in January, May and September by community vaccinators. For vaccination the I-2 thermostable vaccine produced by Central Veterinary Laboratory (CVL) will be used and this vaccine will be administered by means of one drop in the eye of the chicken.
The desired effect of this project is to increase poultry flock size and health, to increase the knowledge ND and ND control and here by improving the economic situation and welfare of village inhabitants (KYEEMA foundation project proposal, 2009).
To test if these goals have been reached a participatory rural appraisal to obtain qualitative data and a questionnaire to obtain quantitative data were carried out in November 2009 as a baseline. After one year of vaccination, in November 2010 the same questionnaire and a PRA will be carried out again.
The results from these two tests will be analysed to obtain an estimate of the achievements of the project goals.

Goals

- To evaluate the state of affairs related to the knowledge of Newcastle disease vaccination, nutrition and poultry management during the KYEEMA ND control project in Singida region.

- To assess the influence of population density, geography and environment on the implementation of a cross country ND control campaign. The differences between two countries, Malawi and Tanzania, will be analyzed.

Methods

The questionnaire and PRA were implemented in the Singida district located in central Tanzania (appendix 4). Singida district was selected because it is among the 10 poorest districts of the country and also because it is a high producer of village chicken. Chicken production in Singida has an increasing commercial attitude due to the fact that the district sells chickens and eggs to different urban markets throughout the province and Tanzania. Because of this Singida districts rural chickens contribute greatly to the income of the household (Bagnol, 2009b).

Sampling methodology

The first stage of sampling: Cluster selection

One hundred and fifty households were selected to be interviewed. In the household any family member above 18 can be interviewed so that the male to female ratio of interviewees is 50:50.
Fifteen clusters comprising 10 households were selected. To be able to accomplish this it is necessary to have a complete list of households in each village.
For the selection of the households a two stage sampling technique was used:

The total number of households was divided by the total number of clusters to obtain the interval: The interval is in this case 158

$$\frac{2376}{15} = 158.4$$

A random number between 0 and 158 was selected, in this case 91.
Data from the five sub-villages

Village	Ward	Nº of sub-village	HH	Cum. Nº	Random number	Nº clus.	Nº interv.
Mwakiti	Ilongero	5	495	495	91, 249, 407	3	30
Unyangwe	Ihanja	6	323	818	565, 723,	2	20
Msugua	Sepuka	6	687	1505	881, 1039, 1197, 1355	4	40
Nkuninkana	Puma	4	392	1897	1513, 1671 1829	3	30
Mughanga	Mtinko	6	479	2376	1987, 2145, 2303	3	30
						15	150

Table 1. Cluster determination per village.

Village	Ward	Nº of sub-village	HH
Mwakiti	Ilogelo	5	495
Unyangwe	Ihanja	6	324
Msugua	Sepuka	6	687
Nkuninkana	Puma	4	392
Mughanga	Mtinko	6	479

Table 2. Population of the selected villages.

The second stage of sampling: Individual household selection

Once the number of clusters per village was defined the selection of the households should be selected randomly according to the methodology above, but now selecting the 10 households in the village.

Using this method 150 households were randomly selected. If in a household no one of the correct sex and age (above 18) was available to be interviewed, the household was substituted by the nearest house to the left or right of the selected household.

Data gathering

The questionnaire used was a shortened version of the questionnaire produced for the SANDCP project from 2002 to 2005 (appendix 1).
On the first day interviewers and supervisors were trained in interviewing and the use of the questionnaire. These interviewers were all fluent in English and Swahili as the questionnaires will be conducted in the native tongue of Tanzania, Swahili.
In the following week 150 questionnaires were completed according to the lists created by the two stage random selection procedure in the selected villages in the Singida district Tanzania.
The PRA was completed in the same villages in de Singida district as the questionnaire and the data was compiled into a report. The PRA and the report were completed by the anthropologist Dr Brigitte Bagnol.

Questionnaire analyse

After translation from Swahili back to English the questionnaires were analysed at the KYEEMA offices in Maputo, Mozambique.
For the analysis of the data the Statistical Package for the Social Sciences (SPSS) version 13 was used.
The quantitative variables were tested using the students T-test for the comparison of means for significance and the Pearson chi square for the comparison of frequencies for significance. Linear regression was used to test for direct relationships between quantitative variables.

Results

Identity

Out of the interviewed villagers 48.0% are female and 52.0% male.
Of the owners of chicken 46.2% are female and 53.5% male (table 3).

	Owners		Interviewees	
	Frequency	Percent	Frequency	Percent
Missing	1	0.3	0	0
Female	132	46.2	73	48,0
Male	153	53.5	79	52,0
Total	286	100.0	152	100,0

Table 3. Sex of the owners of chicken and the interviewees.

The mean average of the ages of the interviewees is 41.7 years of age with a standard deviation of 14.1 years. For further analyse of the data, the ages of interviewees and chicken owners were sorted into five age groups as shown below (figure 1 & figure 2). For the interviewees 52.0% of people fall into the category 21-40 years and 32.9% of people fall into the category 41-60 years. Combined these two categories account for 84.9% of all ages of the interviewees.

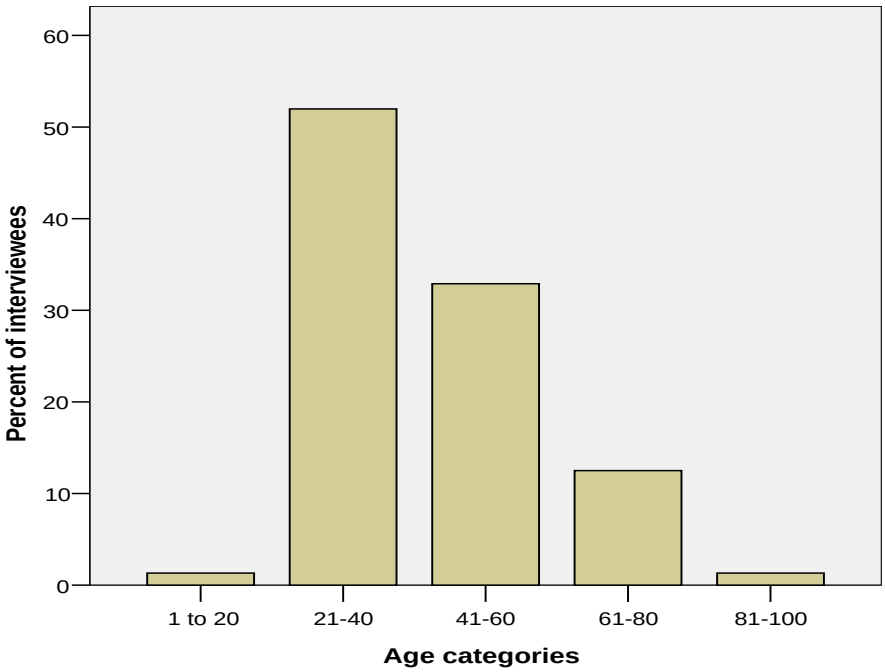

Figure 1. Age categories of interviewees.

The mean age of the owners of chicken is 27.5 years of age with a standard deviation of 18.9 years. For the owners of chicken 40.6% of people fall into the category 1-20 years and 37.1% into the category 21-40 years. Combined this accounts for 77.7% of all ages of the chicken owners. The difference between the ages of the interviewees and the owners is highly significant ($p<0.05$).

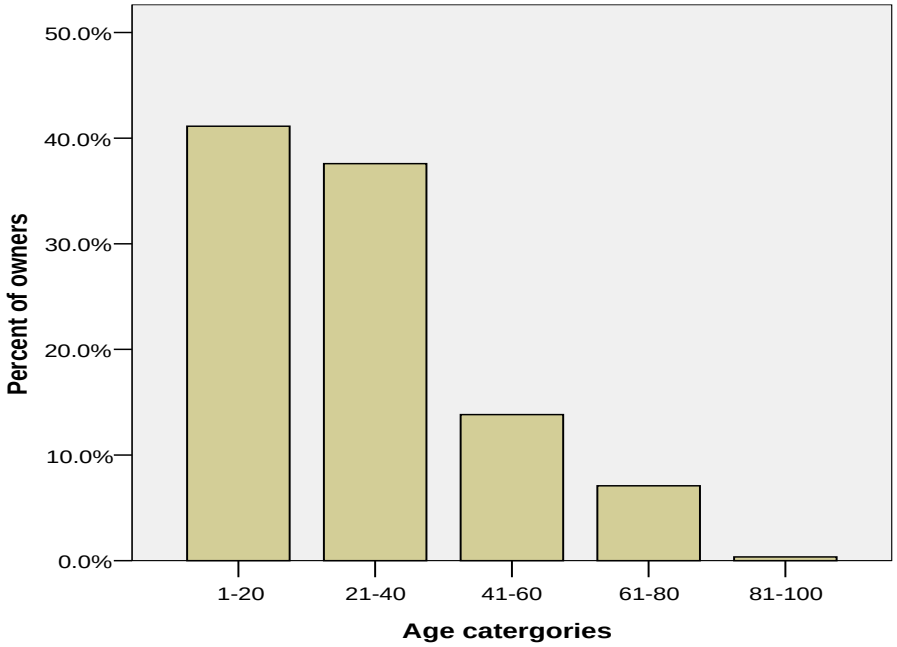

Figure 2. Age categories of chicken owners.

The numbers of chicken

In the villages it can be seen that households that vaccinated their chickens have a higher mean number of chickens that those that did not vaccinate, this is also the case for the totals numbers of chicken (table 4). The mean number of chicken owned per household is 16.1 chickens with a standard deviation of 11.0 chickens (table 4).

Village	Have you ever vaccinated your chickens against Newcastle Disease?	Mean	Std. Deviation	N	Sum
Msungua	No	20.3	12.2	34	690
	Yes	22.3	15.7	8	178
	Total	20.7	12.8	42	868
Mughanga	No	16.4	11.3	21	345
	Yes	22.2	11.2	9	200
	Total	18.2	11.4	30	545
Mwakiti	No	12.7	12.4	15	190
	Yes	13.7	7.5	15	205
	Total	13.2	10.1	30	395
Nkuninkana	No	10.5	7.6	15	157
	Yes	12.7	7.5	15	191
	Total	11.6	7.5	30	348
Unyangwe	No	10.0	9.4	5	50
	Yes	16.3	6.9	15	245
	Total	14.8	7.9	20	295
Average	No	15.9	11.7	90	1432
	Yes	16.4	9.8	62	1019
	Total	16.1	11.0	152	2451

Table 4. Mean number of chickens owned per vaccinating and non-vaccinating household in each village.

		Have you ever vaccinated your chickens against Newcastle Disease?	
		No (n=90)	Yes (n=62)
		Total numbers of chicken (% of total)	Total numbers of chicken (% of total)
Village	Msungua	703 (81%)	165 (19%)
	Mughanga	381 (70%)	164 (30%)
	Mwakiti	197 (50%)	197 (50)%
	Nkuninkana	174 (50%)	174 (50%)
	Unyangwe	74 (25%)	221 (75%)

Table 5. Village chicken totals and percentages vaccinating / non vaccinating.

Female owners have a mean of 8.2 chickens with a standard deviation of 8.5 chickens and male owners have a mean of 9.0 chickens with a standard deviation of 6.9. When analyzed further there is no significant difference found between the number of chickens owned by male and female owners. The mean number of chicken owned by all chicken owners is 8.6 chickens (table 6).

Sex of the owner	Mean	Std. Deviation	N	Sum
Female	8,2	8,5	132	1081
Male	9,0	6,9	153	1370
Average per owner	8,6	7,7	285	2451

Table 6. Mean number of chickens owned

Demography

Out of all the households interviewed 32.2% had a family size of 1-5 and 57.2% had a family size of 6-10.

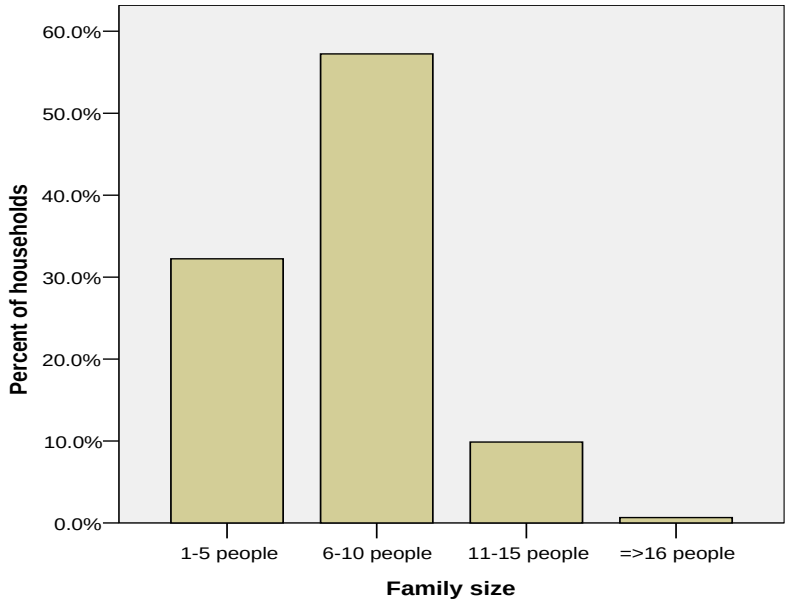

Figure 3. The family sizes of the interviewed households.

In the three household size groups 1-5 people, 6-10 people and 11-15 people it was tested if the bigger households also had more chicken. It was found that the group 11-15 people had significantly more chicken than the group 6-10 people ($p<0.05$).
It was also found that if the household had more chicken then that household would also have greater numbers of cattle, goat and sheep ($p< 0.05$).

Family size categories	Mean	Std. Deviation	N	Sum
1-5 people	16.6	11.0	49	811
6-10 people	15.2	10.9	87	1323
11-15 people	20.7	10.2	15	311
=>16 people	6.0		1	6
Average	16.1	11.0	152	2451

Table 7. The mean numbers of chicken per family size.

Poultry production

The reasons households are raising chickens can be seen in figure 4. The interviewees were asks to rank the three most important reasons for raising chickens. Three points were given to the most important, two to the second and one to the third. The percentages given are that of points given per category divided by the total number of points.
The most important reasons are the selling of chicken and eggs (42.6%) and the use of chicken and eggs for family consumption (36.5%).

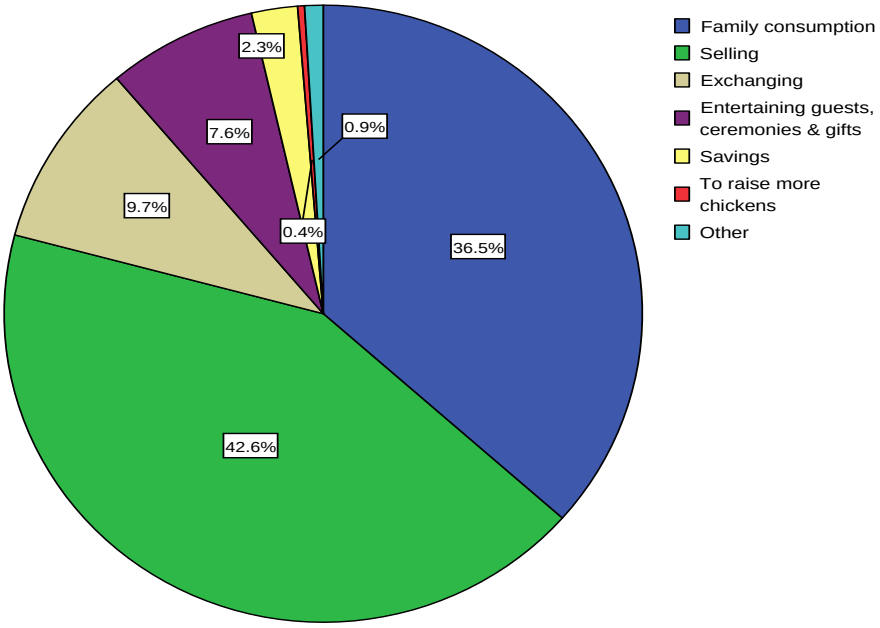

Figure 4. The reasons households are raising chickens.

For the t-test all the ranking points for each reason for raising chicken were added together and divided by the number of people from each category. These means were then compared for significance.
Female interviewees found selling significantly more important than males ($p<0.05$) and male interviewees found family consumption significantly more important than females ($p<0.05$) (table 8).

	Sex of the interviewee	N	Mean	Std. Deviation
Family consumption	Male	79	2.2	0.8
	Female	71	1.9	0.8
Selling	Male	79	2.3	0.8
	Female	71	2.6	0.8
Exchanging	Male	79	0.6	0.8
	Female	71	0.5	0.7
Entertaining guests, ceremonies & gifts	Male	79	0.4	0.6
	Female	71	0.5	0.6
Savings	Male	79	0.1	0.5
	Female	71	0.1	0.4
To raise more chickens	Male	79	0.0	0.0
	Female	71	0.0	0.4
Other	Male	79	0.1	0.3
	Female	71	0.0	0.2

Table 8. The reasons for raising chickens in relation to the sex of the interviewee.

Looking at the structure of the chicken population there is no significant difference between vaccinating and non-vaccinating households and the composition of the chicken flock. There is no significant difference between the categories vaccinating and non-vaccinating households and the total numbers of chicken owned per household (table 9).

	Have you ever vaccinated your chickens against Newcastle Disease?					
	No (n=90)			Yes (n=62)		
	Mean	Std Deviation	Sum	Mean	Std Deviation	Sum
Adults (more than 5 months) [1]	6	5	570	7	5	432
Growers (2-5 months) [1]	4	4	375	5	5	289
Chicks (day old – 2 months) [1]	5	6	492	5	4	305
Total number of chicken [1]	16	12	1402	17	10	1026

([1]$p<0.05$)

Table 9. Chicken population make up in relation to the vaccination against Newcastle Disease.

Sales, consumption and use of chicken and eggs

Villagers were asked in which months of the year they sold, exchanged and used chicken and in which months they ate more chicken. The villagers were also asked in which months of the year ND was more likely to occur (figure 5).The eating of chicken has two main peaks, one in December – January, and another peaking in September coinciding with the peak of ND. The latter has a much slower increase which starts earlier in May – June.

The use, selling and exchanging of chicken also has two peaks one coinciding with the peak of eating chicken in December – January and the other occurring in June – July. The peak of ND occurs in August – September, it starts to become more important in June – July and its importance declines back to zero around January.

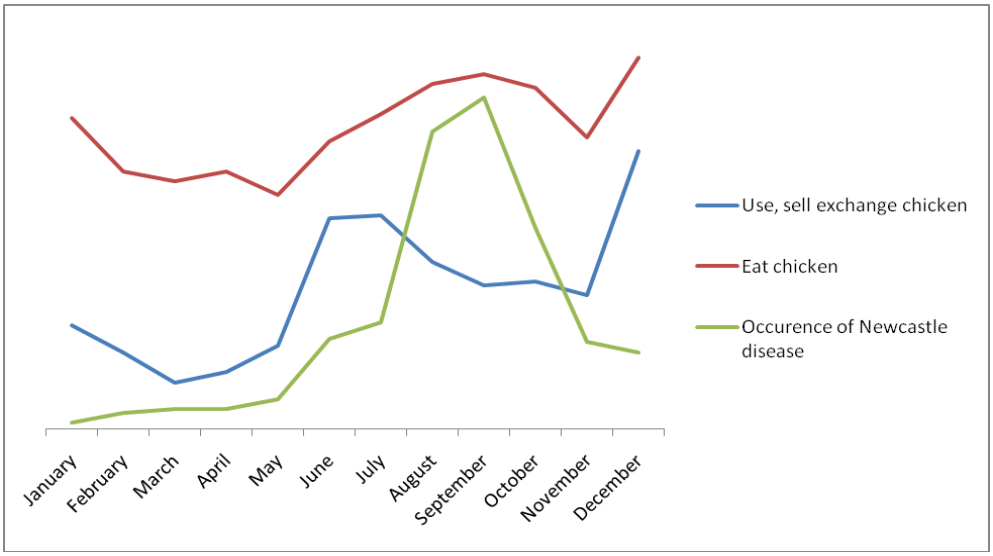

Figure 5. The months of the year when households use, sell of exchange the most chicken, eat chicken and the months of the year when ND is most likely to occur.

There is a positive linear correlation between the number of chickens owned and the eating, exchanging, selling of eggs and chickens ($p<0.05$).
There is no significant difference in the numbers of chickens and eggs sold, consumed or otherwise used in households that vaccinated compared with households that did not vaccinate their chickens against ND (table 10).

In tables 10 & 11 the uses of chickens and eggs can be seen for the period August to October and May to October 2009 (three and six months before the application of the questionnaire).
Selling and eating are the most important uses of poultry. For the use of chicken selling is the most important with a mean of 1.3 chickens sold per month per household. Per household there is a mean of 1.0 chicken eaten per month.
Eating is the most important use of eggs with a mean of 7.6 eggs eaten per household per month. In this same period a mean of 3.0 eggs were sold per household.

	Aug – Oct '09		**May – Oct '09**	
	Sum	Mean	Sum	Mean
Eating	388	2.6	856	5.6
Exchange	178	1.2	377	2.5
Sold	545	3.6	1189	7.8
Gift	150	1.0	266	1.8
Other	35	0.2	59	0.4

Table 10. Use of chickens, three and six months before the application of the questionnaire.

	Aug – Oct '09		May – Oct '09	
	Sum	Mean	Sum	Mean
Eating	3374	22.2	6914	45.5
Exchange	148	1.0	345	2.3
Sold	1264	8.3	2693	17.7
Gifts	113	0.7	249	1.6
Other	20	0.1	49	0.3

Table 11. Use of eggs, three and six months before the application of the questionnaire.

Knowledge about nutrition

The advantages of eating chicken are shown in figure 6. As seen in the graph the main reason for eating chicken is that it helps people to grow, next most important is a varied diet and third is that eating chickens helps to protect against disease. The percentages shown account for the percentage of the total number of times that a reason was stated as important divided by the total number of reasons selected.

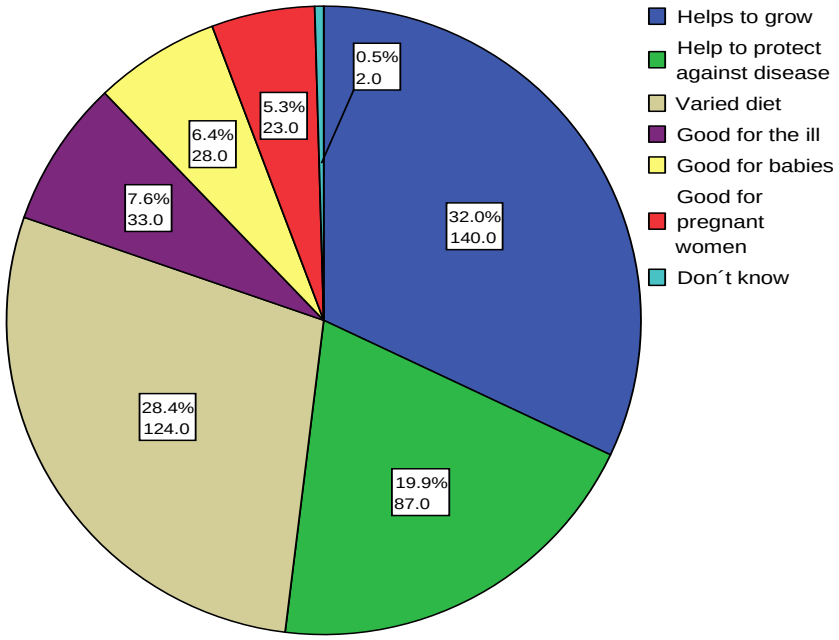

Figure 6. The nutritional advantages of eating chicken, showing the percentage of the total and the sum.

There is no significant difference between vaccinating and non-vaccinating households and the advantages of eating chicken. There is no significant difference between the sex of the interviewee and the reasons for owning those chicken (χ^2, $p>0.05$).

Animal health and mortality

The main reasons for the death of chickens are shown in figure 7. The interviewees were asked to rank the three most important reasons for the death of their chickens. Three points were given to the most important, two to the second and one to the third. The

percentages given are that of points given per category divided by the total number of points.
For the t-test all the ranking points for each reason for the death of chicken were added together and divided by the number of people from each category, male / female or from each village. These means were then compared for significance.
The main reason for the death of chickens is Newcastle disease (47.4%), the second most important reason is predators (25.2%) and the third most important reason for the death of chickens is other (24.7%). Unfortunately the category "other" is not further specified.

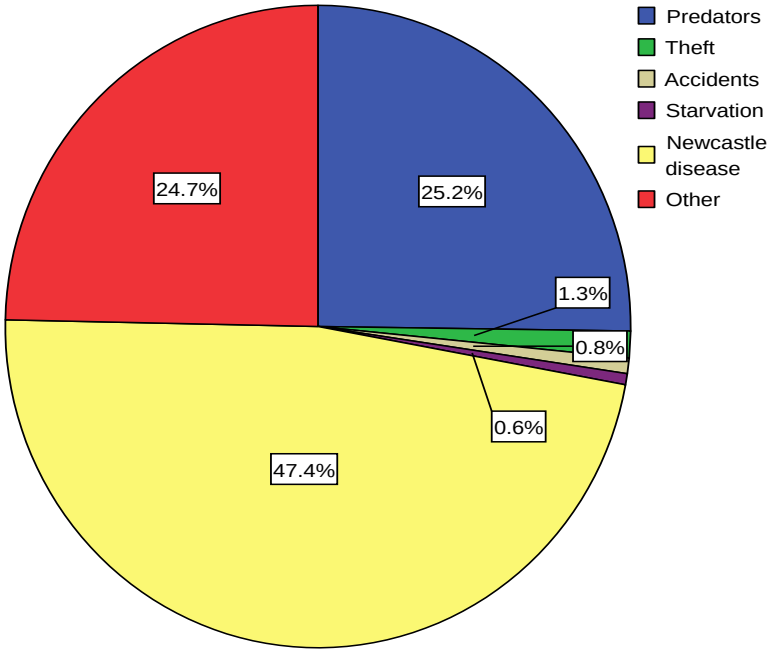

Figure 7. The reasons for the death of chickens

The village that vaccinated the most (Unyangwe) was compared with the village that vaccinated the least (Msungua) (table 5). Households in Unyangwe are more likely to select predators ($p<0.05$) and theft ($p<0.05$) as an important reason for the death of their chickens than households in Msungua.

	Village	N	Mean	Std. Deviation
Predators	Msungua	42	1.4	0.5
	Unyangwe	20	1.7	0.7
Theft	Msungua	42	0.0	0.0
	Unyangwe	20	0.2	0.4
Accidents	Msungua	42	0.1	0.5
	Unyangwe	20	0.0	0.0
Starvation	Msungua	42	0.0	0.0
	Unyangwe	20	0.0	0.0
Newcastle disease	Msungua	42	3.0	0.2
	Unyangwe	20	2.8	0.5
Other	Msungua	42	1.6	0.5
	Unyangwe	20	1.4	0.7

Table 12. The reasons for the death of chickens per village in the Singida region.

Vaccination

Out of all the interviewed villagers in the Singida district 59.2% have never vaccinated their chickens and 40.8% have vaccinated their chickens.

	Frequency	Percent
No	90	59.2
Yes	62	40.8
Total	152	100.0

Table 13. Percent of households that have vaccinated their chickens against ND.

Out of the 40.8% of households that vaccinated their chickens 74.0% have only vaccinated once.
Of vaccinating households 49.2% vaccinated the first time in 2009. The range of the households vaccinating for the first time is from 2000 to 2009.
Of vaccinating households 72.6% vaccinated the last time in 2009. The range of the households vaccinating for the last time is from 2002 to 2009.
Of the interviewees that did vaccinate, 65.6% said that the vaccination resulted in less deaths of chicken and 27.8% said that there was no difference in chicken deaths.
Of the interviewees (n=31) that answered the question "if chickens died after a vaccination campaign where there more deaths, in adult chickens or young birds?" 80.0% said that the deaths were found in chicks younger than 5 months. The way that this question was formulated makes the interpretation of the results impossible (see appendix 3).
In the 62 households that vaccinated their chickens a female owner made the decision to vaccinate in 43.5% of the households, a male owner made this decision in 30.6% of the households.
Out of the 62 interviewees 40.0% selected two people to make the decision to vaccinate the households' chickens. Of the people who selected two people the combination owner female / adult female and owner male / adult male were selected the most with frequencies of 56.0% and 36.0% respectively.

The main reason given for households not vaccinating chickens was a lack of knowledge with 60.0% of non-vaccinating households (n=62) giving this as the reason they did not vaccinate. Of households that selected "lack of knowledge" as the reason for not vaccinating their chicken 53.0% (n=28) came from one village, Msungua. Msungua is the village that vaccinated the least (table 6).

Knowledge of vaccination

To test the villagers' knowledge about Newcastle disease vaccination it was asked how many times per year you should vaccinate your chickens to provide protection against Newcastle disease. In figure 7 it can be seen that 46.7% of interviewees do not know how many times they should vaccinate. Out of the people that gave an answer as to how many times they should vaccinate their chickens the most gave three times as that answer.

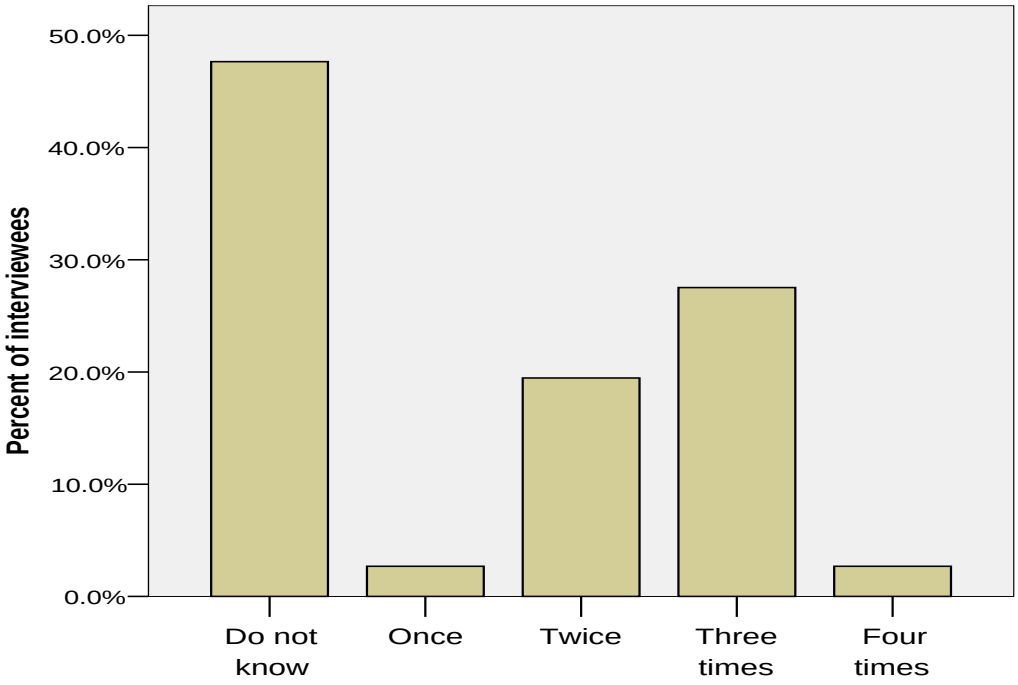

Figure 7. Knowledge of Newcastle vaccination.

Of the 71 interviewees that gave "do not know" as answer to, "how many times you should vaccinate your chickens", 80.0% come from the non-vaccinating group. Forty one interviewees said that they should vaccinate their chickens "three times". The vaccinating group accounted for 71.0% of these interviewees.

The non vaccinating group accounted for 87.0% of the 52 interviewees that did not know if the vaccine should be given to a sick chicken.

More than half (57.2%) of the 152 interviewees said that you should not vaccinate a sick chicken.

There was no significant difference in sex and the answer given to the questions about the general knowledge about the vaccination of Newcastle disease (χ^2, $p>0.05$).

None of the interviewees in the Singida district of Tanzania have ever participated in an interview about Newcastle disease before.

Discussion

Agriculture

Newcastle disease is given as the most important reason for the mortality of chickens in Singida with the second most important reason being predators. These results are collaborated by the results from the PRA.
Selling and consumption are the most important reasons for owning chickens (figure 4). Selling of chicken in Singida contributes greatly to the income of the household due to the fact that the district sells chickens and eggs to different urban markets throughout the province and Tanzania. This is one of the reasons why this district was selected. Per household a mean of 1.3 chickens and 3.0 eggs are sold per month.
Consumption by the family is the other reason that villagers have chickens, per household a mean of 1.0 chicken and 7.6 eggs were eaten per month.
The nutritional benefits of eating chicken according to the villagers are that it helps people to grow, a varied diet and that it helps protects against disease.

Family size

The owning of chickens provides a means of income for households in developing countries (Branckaert *et al*., 2000). Households with more chicken due to their greater income are able to grow in number. The income generated by chickens and their products account for 70% of the total production of households in food-deficient countries as Tanzania (Branckaert *et al*., 2000). Due to this greater income other animals can be bought that are not available to households with a lesser income such as cattle, goats and sheep (Alders, 2004). This is shown by the results gathered from the questionnaire in the Singida region of Tanzania; households that had more chicken were larger and had greater numbers of cattle, goat and sheep.

Age

Villagers believe that the success of keeping animals is dependent on the luck that a person has. This difference in age can be explained when it is understood that in Tanzania 44.2% of the population is less than 15 years of age (Tanzania in figures, 2009). To test this luck children of a very young age are given chicken to own (Bagnol, 2001). This information out of the PRA coincides then with the results gained from the questionnaire (appendix 1).

Gender issues

The quantitative data collected out of the questionnaire shows little difference between the sexes. Both male and female owners of chicken have about the same number of chicken (table 6). Male and female interviewees have the same level of knowledge about nutrition, and vaccination.
The average number of chickens owned per interviewed household is 16.13 chickens (table 4) This was exactly the same as the information which came out of the PRA which is around 16.5 chickens (table 16). This shows the qualitative data strongly correlating with the quantitative data.

Males and females have the same reasons for not vaccinating their chickens against ND and their general knowledge of ND and ND vaccination is similar. This differs from the literature about past ND vaccination campaigns where the knowledge of female respondents before the vaccination project was much lower than that of male respondents (SANDCP, 2005). This difference became less during the SANDCP project of 2005 and at the end of this project the knowledge level of male and female respondents were about equal with no significant difference between the two (Msami and Young, 2005 & Harun *et al*,. 2005). This finding could be a result of other vaccination campaigns having an effect on other regions in Tanzania and therefore increasing the knowledge of female respondents.

There is a difference between the sexes in the use of chickens and eggs. The questionnaire data and PRA information agree that selling is an important use of chickens and eggs for villagers in the Singida district. Male interviewees found family consumption to be more important than female interviewees and female interviewees found selling to be more important than male interviewees. Selling is a common activity carried out by women and is especially important in the Sindiga district (Bagnol, 2009b). This could account for the discrepancy in views between males and females.

Out of the households that vaccinated their chickens a male chicken owner decided to vaccinate in about one third of the households and a female chicken owner decided to vaccinate in 43.5% of households. Before making any conclusions about gender it is important to consider if the household was headed by a male or a female. This is necessary because almost all literature uses male and female headed households as a gender category due to the fact that there is a difference in the economic situation between male and female headed households. Female headed households are usually poorer and more financially unstable than households headed by males (Cramer and Pontara, 1998).

In the current data it is not known if the interviewee came from a male or female headed household. This information was excluded from this questionnaire due to the fact that the notion of head of household is too complex to integrate in this analysis or to even try to deal with it when interviewing people (Bagnol, personal communication).

The effects of vaccination

There was no difference between vaccination and the composition of the flock or the total number of chicken owned by villagers (table 8). However when one looks to the mean numbers of chickens owned per village (table 4), the households that vaccinated their chickens had constantly higher mean numbers of chickens. This shows that, although minimal, the vaccination of chickens against ND has had a positive effect on chicken numbers.

The majority of households vaccinated for the first and last time in 2009. This shows that vaccination is a recent development for the villagers of Singida. It also shows that effects due to vaccination have occurred recently.

In the results gained from our study; in the village that vaccinated the most, predators and theft were becoming more important than in the village that vaccinated the least. These results were also found in the SANDCP project which ended in 2005. When households regularly vaccinate their chickens against ND the disease plays a diminishing role as the main cause of chicken mortality. Other factors such as predators, theft and a lack food become more important as chicken numbers increase and as Newcastle disease plays less of a role in chicken mortality.

The literature supports the fact that the effect of having an unstructured Newcastle disease vaccination campaign is almost the same as not vaccinating at all, which seems to be the case here (Alders *et al.,* 2001).
When households did vaccinate two thirds of interviewees said that this resulted in a diminished mortality of chicken. Yet out of the 40.8% of households that vaccinated their chickens almost three quarters stopped after only one vaccination campaign. It is not clear from the results of our study why so many households stopped vaccinating. Reasons could be linked to the location of the villages, the distance to the vaccine and the local epidemiology of ND.
The information from the PRA supports that there is an unstructured method of vaccinating in Singida, Tanzania saying that "village vaccinators were selected often on the spot and were shown in five minutes how to hold the chickens and carry out the vaccination and that they received no training on Newcastle disease and the management of the vaccine." (Bagnol, 2009b)
The PRA mentions that positive results of past vaccination initiatives were dubious with people complaining about its limited success due poor communication to the villagers and a lack vaccination technique and knowledge of ND vaccination of the community vaccinators (appendix 1).
The main reason given for households not vaccinating their chickens is a lack of knowledge. Lack of knowledge is seems to be a bigger problem for non vaccinating households which account for around 60% of all interviewed households (table 13) than vaccinating households. 80.0% of interviewees that did not know how many times they should vaccinate their chickens did not vaccinate. 87.0% of interviewees that did not know if a vaccine should be given to a sick chicken also did not vaccinate. This shows because the non vaccinators have little knowledge about ND vaccination they cannot make an informed decision of whether to vaccinate or not and the benefits of vaccinating. Of the households where lack of knowledge is the most important reason for not vaccinating, slightly more than fifty percent came from the village that vaccinated the least, Msungua.
Of the interviewees that said that their chickens should be vaccinated "three times" as answer just under three quarters had in the past vaccinated their chickens. Three times per year is the correct number of times that the I-2 vaccine should be used to ensure year long protection against ND (Msami and Young, 2005).
Although non vaccinating villagers did not have an extensive knowledge about the vaccination of ND, the data from the PRA shows that generally villagers are able to recognize the symptoms of ND and have a good understanding of the transmission of ND believing that is related to a natural phenomenon (Bagnol, 2009b). This is useful when trying to promote the use of vaccines because when the aetiology of the disease is related to ancestors or to witchcraft then the belief is that a vaccine will not help (Bagnol, 2001).

Comparison with the Thyolo district, Malawi

The demography of the interviewees in Tanzania is very similar to that of Malawi with similar numbers of interviewees falling into the 21-40 and 41-60 age categories (Van den Ende, 2010).
Malawi has a much higher population density than Tanzania due to this lack of space the households in Tanzania are larger than that in Malawi (World bank report, 2009). In Malawi two thirds of households have a family size of 1-5 people and one third have a family size of 6-10 people (Van den Ende, 2010). In Tanzania one third have a family size of 1-5 people and 57.2% a family size of 6-10.

The mean number of chickens owned per household in Malawi is a lot smaller than that in Tanzania and is 6.9 and 16.1 chickens respectively. This is due to the importance of agriculture in the Thyolo region of Malawi. Because the tea fields encroach on the villages the space for these villages is put under pressure and ultimately decreases, because of this many villagers have been relocated to other, less densely populated areas of Malawi (Bagnol, 2009a).

This lower number of chickens means that families in Malawi eat less chicken and egg than in Tanzania. In Malawi there is mean of 0.5 chickens and 1.8 eggs eaten per household per month (Van den Ende, 2010). In Tanzania this is 1.0 chicken and 7.6 eggs eaten per household per month. For the same reason households in Malawi sell less eggs and chickens than Tanzania. In Malawi there is mean of 0.2 chickens and 0.2 eggs sold per household per month (Van den Ende, 2010). In Tanzania this is 1.3 chickens and 3.0 eggs sold per household per month.

Despite this family consumption and selling are still ranked as the most important reasons for raising chickens in Malawi, the same as in Tanzania.

Households in Malawi do not own great numbers of other animals such as cattle, goat and sheep like that in Tanzania this is a result of the high population density and the resulting lack of space for villagers in Malawi (World Bank report, 2009).

In both countries households with chicken are larger than those without chicken. This shows that owning chicken has a positive effect on the ability of a household to sustain a larger number due to a greater economic stability (SANDCP, 2005).

Newcastle disease is in both countries, by far, the most important reason for the deaths of chickens. The results of vaccination are similar in both countries. When the chickens are vaccinated in around 60.0% of the cases this leads to less chickens dying.

In both countries the ND vaccinations occur without structure and consequence, with the great majority of households only vaccinating once. Half of all households only vaccinated once in Malawi and three quarters of all households vaccinated once in Tanzania (Van den Ende, 2010).

Half of all households in Malawi and 59.2% of households in Tanzania did not vaccinate their chickens. In both countries the number one reason for households not vaccinating is a “lack of knowledge”.

Although the chickens were vaccinated in an inconsistent way, households in Malawi that vaccinated their chickens have an average of 8.6 chickens and non vaccinating households own an average of 5.3 chickens (Van den Ende, 2010). In Tanzania there is no significant difference between vaccinating and non-vaccinating households and the number of chickens owned. However the mean number of chickens per vaccinating village and the mean number of chickens per vaccinating household is consistently higher than that of non vaccinating villages and households.

The trend in both countries is that vaccination may have had a positive effect on chicken numbers.

Conclusions and recommendations

- Vaccination of chickens in this region may have had a positive effect on the numbers of chickens owned by households, but this effect is minimal due to the unstructured application of the vaccine and the low level of knowledge about ND vaccination. By employing a structured vaccination program and increasing the level of knowledge about ND vaccination chicken numbers can be raised per household and this will hopefully lead to better wellbeing and economic security within the villages of the Singida district.
  The emphasis of this project and the countries participating must aim towards sustainable ND vaccination in rural areas. Only with sustainable vaccination can the quality of life of local villagers be improved, long term.
  To achieve this we need to know more about the management and husbandry in rural villages. Newcastle disease control is more than vaccination and knowledge of the way chicken are held and the issues facing villagers and their chickens are essential to ensure sustainable ND control. One of the issues that need to be looked at in the next study is the other reasons for the death of chickens in Singida. In the follow up baseline the question, why so many households have only vaccinated once, needs to be answered.
  This information will give insight into what the important issues are facing villagers and ND vaccination. This will help future vaccination projects to implement the vaccine in a more effective and accurate way and thusly achieving maximal results.

- Despite the great differences in geography and environment between Malawi and Tanzania the rural chicken populations in both countries have the same problems, Newcastle disease and a lack of knowledge about ND vaccination. It has been seen that ND vaccination in both countries may have had a positive effect on chicken numbers. Unfortunately this effect is in the most cases not significant because the vaccinations are applied in an unstructured and inconsistent way. When a structured vaccination campaign is conducted and combined with village education about ND, ND vaccination and the I-2 vaccine a significant increase in chicken numbers will be the result (SANDCP, 2005).

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Appendix 1 PRA results.

(Bagnol, 2009b)

During the PRA in Nkuninkana village women said that chickens are more important than other animals because:

- *Chickens are easy to keep.*
- *Chickens are easy to sell.*
- *It is wide spread, every body has chicken.*
- *Chickens are readily convertible into cash.*
- *Chickens looks for there own food*
- *Chickens provide a very fast source of gravy to eat with maize*

Products	Rank by 10 women
Cattle	38
Goat	8
Sheep	3
Chicken	56

Table 14. List of the importance of animals to the household. Taken from the opinions of 10 women in Nkuninkana Village during the PRA.

Newcastle disease

Chickens belong to different people in the family, usually the man is considered the head of the household and has a say on most of the activities and decision in the household. While goat and cattle are usually under his responsibility chickens are managed and owned by women. Children also own chicken under the supervision of their parents. Families believe that the success of keeping animals is dependent on the luck that one has. To test this luck children of a very young age are given chicken to own.

Problems	Rank by 10 women
Lice	0
ND/Mdondo	42
Flees	14
Fowl pox	5
Continuous watery discharge from the mouth- Infectious coriza	9
Predators	30

Table 15. List of the main problems facing the raising of chickens. Taken from the opinions of 10 women in Nkuninkana Village during the PRA.

As seen in table 14 the main problem facing the raising of chicken is ND and then predators.

When chickens show symptoms of disease people try first to sell the birds. When the disease is too advanced the chickens are eaten, care is taken to bury or burn the feathers and interiors.
Some households try to protect their chickens against ND by using local medicine without, however a great deal of success.

People are able to recognize the symptoms of ND.
"Green diarrhoea or greenish mixed with whitish." "They look sleepy." "They have some lesions on there eyes." "Coughing, death, one by one, every day." (From the PRA from the opinions of 10 women & Survey in Nkuninkana.)
"Sleepiness, yellowish with whitish striped diarrhoea and nasal discharge." "When slaughtered enlarged liver." "Sudden death." "It spread very fast"." In the evening 3 are sick and in the morning 10 are dead." "In a second the whole flock is dead." (PRA, Mwakiti village. Opinions of 16 men and 6 women)
People also tend to have a good understanding of the transmission of ND between animals.
"We are not sure but usually when there is a contact. By example there is a dog that brought the body of a dead chicken there will be transmission." "If you eat a sick or dead chicken and you spit on the floor, the chickens will get the disease." (PRA, Mwakiti village. Opinions of 16 men and 6 women)
"*We believe that transmission is from an infected flock to another through dogs, chickens traders. But wa are not sure of the actual source."* (PRA, Village Mwakiti. Opinions of 16 men 6 women)
"*The wild bird can eat a carcase and can bring the disease here."* (PRA, Mwakiti village. Opinions of 16 men and 6 women)

When asked about the origin of the disease people explain that it is due to the heat or it comes with the wind. This aetiology of the disease is related to a natural phenomenon and is not related to ancestors or to witchcraft.

Agriculture

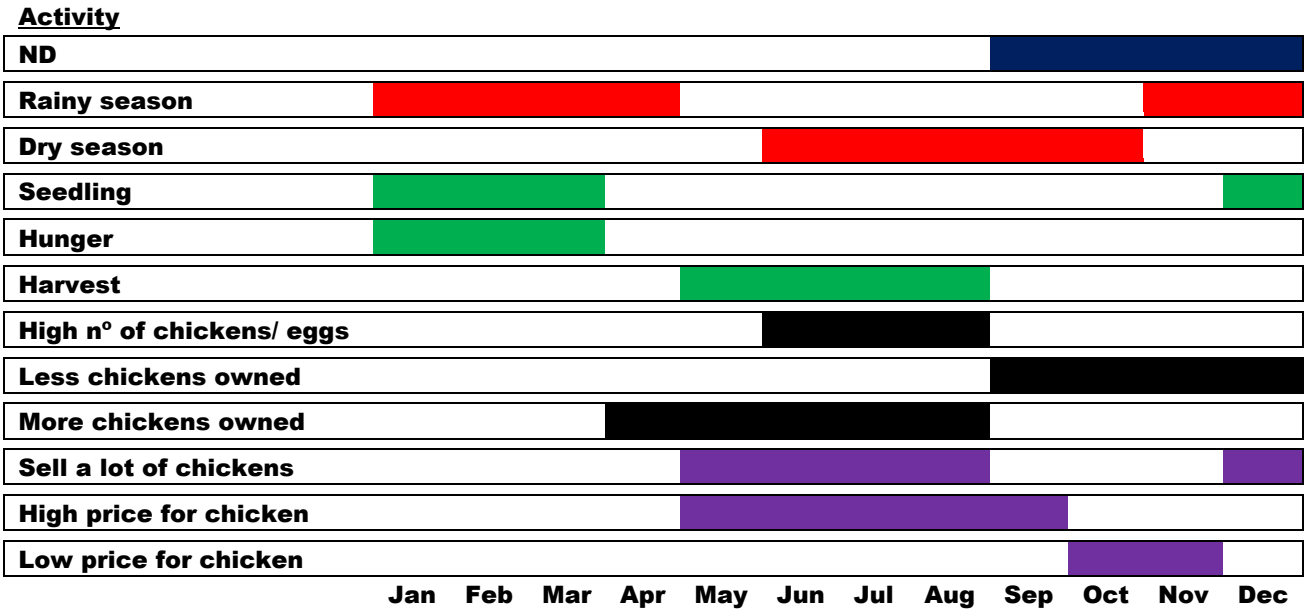


Figure 8. Agricultural and chicken-breeding activity in Singida

There are two seasons, the dry season that is the longest (May to November) and the rainy season (November/December to March/April).
The size of the chicken flock is lowest during the dry season after the ND outbreak in October/November and the size of the flock will continue to decrease until December. This is not only due to disease of lack of food but also due to the fact that chickens are:
"sold because of hunger and because people sell chicken to hire people to work on their land to prepare for seedling. Some also prepare food for the people who come to eat in their field to prepare the land." (PRA, Mwakiti village. The opinions of 16 men and 6 women.)

The flock size starts to increase again in January and reaches its peak during harvest in June/July when chickens have enough to eat.
The price of the chickens also evolves with the harvest and the availability of food for the household. A high price for chicken is paid during the harvest season and a low price during the ND outbreak.

During the PRA in the village, the number of chicken per household was low and was still on the decline.

	10 Women Nukuninkana	15 Men Unyanga	16 Men and 6women in Mwakiti village
Average	**16.5**	**16.8**	**16.2**

Table 16. The current number of chickens owned by the family in November 2009

The average number of chickens per household in November 2009 was 16.5 chickens. In Mwakiti village the average number of chicken was estimated when the flock size was high (June / July). The participants estimated the average number of chicken per household in June / July to be 35.3. The participants from Mwakiti village hope that the flock size after vaccination will increase to 47.0 chickens.

Sale, consumption and use of chickens and eggs

Households have different objectives for raising chickens. The two most important reasons are for sale and for consumption.

The selling of chicken in Singida is made easier due to the fact that chickens are being collected by a medium size trader that transports them to a market in Dar-es-Salaam. The Mungumogi Poultry Association also buys between 2,000 and 2,500 chickens that are transported three times a week by lorry to Dar-es-Salaam.

Sale of eggs is quite a common activity carried out by women. The eggs can be sold in Singida and bought in the villages. Some women trade and sell eggs as a business and make on average more than one trip per week to Sindiga to sell an average of 200 eggs.

In addition to selling people eat a large number of chickens and birds per month. Consumption of eggs is also quite frequent according to the explanation of the interviewees.

Vaccination

In the Singida district vaccination campaigns against ND have been carried out in the past. Village vaccinators were often selected on the spot and were shown how to hold the chickens and carry out the vaccination.
They received no additional information about ND and ND management or any additional information about the management of the vaccine.

These results come from the participatory rural appraisal report from Tanzania written by Dr Brigitte Bagnol for the KYEEMA foundation in November of 2009.

Appendix 2 Questionnaire

1 IDENTITY

Date: _____/_____/_____ _____

Name of the Interviewer: _____ Questionnaire #: _____

District: __ Ward _____ Village: _____

Name of the Interviewee: _____

1.1 Sex of the interviewee: Female ☐ Male ☐

1.2 Age of the interviewee: _____

2 DEMOGRAPHY

2.1. How many people do you live with, including yourself? *(Read the options and tick a box)*

1	1 to 5		2	6 t o 10		3	11 to 15		4	16 and more		

2.2. Which of the following animal species do you have? *(Tick the box)*

Cattle	Goat	Sheep		Donkey		Poultry		Others	

2.3. How many animals per species do you have *(Read the options and tick the box. write the number in the box*
More than one box can be ticked) filled up

Catte	Goat	Sheep	Donkey	Poultry	Others

3 POULTRY PRODUCTION

If you have poultry, please answer the following questions. If you don´t have poultry, please go to question 3.5. *(Read the list and write the number in the boxes.)*

3.1. How many chickens does your family currently have?

3.1.1. Adults (more than 5 months) ☐

3.1.2. Growers (2 - 5 months) ☐

3.1.3. Chicks (day old - 2n months) ☐

3.1.4. Total number of chickens ☐

3.2. How many people in the house own chickens? ☐

3.3. How many chickens does each member of your family own?
(Write a number in each box. The total of the question is 3.1.4)

Person	Gender (M/F)	Age	No. of chickens

3.4. What are the 3 most important reasons your family is raising chickens?
(Rank the three most important by writing the numbers 1 to 3 in the relevant boxes)

3.4.1. Family consumption ☐

3.4.2. Selling ☐

3.4.3. Exchanging (for goods, food and services) ☐ ☐

3.4.4. Entertaining guests (gifts, ceremonies) ☐ ☐

3.4.5. Savings ☐

3.4.6. To raise more chickens ☐

3.4.7. Other ☐ Specify: _____

3.5. *(Only for farmers without chickens).* When was the last time you had chickens?

4 SALES, CONSUMPTION & OTHER USE OF CHICKEN AND EGGS

4.1. How many chickens and eggs did your household dispose of in the last 3 and 6 months?
(Enter numbers in each box. If "other", please state the purpose)

Activity	**No of chickens**			**No of eggs**	
	3 months		6 months	6 months	3 months
Family eating					
Exchanged for goods					
Sold					
Guests, ceremonies,					
and gifts					
Other 1 -					
Other 2 -					

4.2. In which months of the year do you sell or exchange more chickens?
(Read the months and tick boxes. More than one box can be ticked)

4.2.1	4.2.2	4.2.3	4.2.4	4.2.5	4.2.6	4.2.7	4.2.8	4.2.9	4.2.10	4.2.11	4.2.12
January	February	March	April	May	June	July	August	Sept	Octob	Nov	Dec

4.3 In which months of the year do you eat chicken? *(Tick the boxes. More boxes can be ticked)*

4.3.1	4.3.2	4.3.3	4.3.4	4.3.5	4.3.6	4.3.7	4.3.8	4.3.9	4.3.10	4.3.11	4.3.12
January	February	March	April	May	June	July	August	Sept	Octob	Nov	Dec

5 KNOWLEDGE ABOUT NUTRITION

5.1. What is the advantage of eating chicken? *(Tick the boxes. More than one box can be ticked)*

5.1.1 Help to grow (source of protein) ☐

5.1.2 Help to protect against diesease (source of Vitamin A) ☐

5.1.3 Varied diet ☐

5.1.4 Good for sick people ☐

5.1.5 Good for babies ☐

5.1.6 Good for pregnant women ☐

5.1.7 Don't know ☐

6 ANIMAL HEALTH AND MORTALITY

6.1. In your opinion what are the three main reasons for the death of your chickens?
(Rank the three most important by writing the numbers 1 to 3 in the relevant boxes)

6.1.1 Predators ☐

6.1.2 Theft ☐

6.1.3 Accidents ☐

6.1.4 Lack of food ☐

6.1.5 Newcastle diesease ☐
(Green watery feaces, drooping wings, twisted neck, many deaths)

6.1.6 Other disease ☐

6.2. In which months of the year is Newcastle disease more likely to occur?
(More than one month can be ticked)

6.2.1	6.2.2	6.2.3	6.2.4	6.2.5	6.2.6	6.2.7	6.2.8	6.2.9	6.2.10	6.2.11	6.2.12
January	Februar y	March	April	May	June	July	August	Sept	October	Nov	Dec

7 VACCINATION

7.1. Have you ever vaccinated your chickens against Newcastle disease?

7.1.1 Yes ☐ 7.1.2 No ☐

If the interviewee has never vaccinated his/her chickens, go to question 7.8

7.2. When was the first time you vaccinated your chickens?

7.2.1 Month ☐ 7.2.2 Year ☐

7.3. When was the last time they were vaccinated?

7.3.1 Month ☐ 7.3.2 Year ☐

7.4. In which vaccination campaigns did you participate since 2009?
(Tick the boxes. More than one box can be ticked)

Vaccination campaign	**2009**	**2010**
January / March		
May / July		
September / November		

7.5. Who decided that the chickens should be vaccinated?
More than one answer can be given

7.5.1 Owner/male ☐

7.5.2 Owner/female ☐

7.5.3 The family ☐

7.5.4 Adult female ☐

7.5.5 Adult male ☐

7.6. What was the result of the last vaccination ?

7.6.1 No difference ☐

7.6.2 Less deaths ☐

7.6.3 More deaths ☐

7.7. If chickens died after a vaccination campaign, where there more deaths in adult chickens or young birds?

7.7.1 Adult chicken (more than 5 months) ☐

7.7.2 Chicks (less than 5 months) ☐

7.8. If you have never vaccinated your chickens, please explain why? _____

_____

8 KNOWLEDGE OF VACCINATIONS

(Read each statement ony by one and tick ONLY one box)

8.1 How many times per year do you need to vaccinate your chickens against Newcastle disease?

8.1.1 Once ☐

8.1.2 Twice ☐

8.1.3 Three times ☐

8.1.4 Four times ☐

8.1.5 Do not know ☐

8.2. Should the vaccine be given to sick chickens?

Yes ☐ No ☐ Don't know ☐

9 Have you ever participated in an interview about Newcastle disease control in village poultry like this one?

Yes ☐ No ☐

Appendix 3 About the questionnaire

Unfortunately translation errors and language barriers will always be a problem when conducting this kind of research. Sometimes due to the translation into the native tongue, in this case Swahili, questions which should be included are missing.
Question 6.1.7 *"If other please specify?"* this has lead to missing information that could have given great insight into the situation in Singida, Tanzania.
Incorrect translation into and from English has also lead to a loss of useful information in this survey. Question 7.7 *"If chickens died after a vaccination campaign where there more deaths, in adult chickens or young birds?"* this question is that unclear as to its meaning that the interpretation of the results become near impossible.
When the meaning of the information is not known then it is also impossible to interpret the results. In question 8.1 *"How many times per year do you need to vaccinate your chickens against Newcastle disease?"* When we do not know what vaccine the interviewees have been using then we cannot use this information to gather infomation pertaining to the knowledge of vaccination. It would be useful to have an extra question to gather infomation over which vaccine is being used and where.

The interpretation of the results is brought into doubt when the question asked is not clear. In question 4.2 *"In which months of the year do you use, sell or exchange more chickens?"* what is more? This is also the case in question 6.2 *"In which months of the year is Newcastle disease more likely to occur?"* more than what?
The quality of the results is greatly dependent on the type of question one wants answered. In question 7.2 and 7.3 "*When was the first and last time you vaccinated your chickens?"* one should consider than the interviewee between these times may have stopped vaccinating or, in fact, may never have vaccinated at all. A better question may have been, "How many times per year do you vaccinated your chickens, please give dates?"

One should be careful when splitting answers into categories. For example question 2.1 "*How many people do you live with, including yourself?*" When questions are split into categories information and many analyse options are lost. So it should be certain that the information gained in that form answers all possible questions raised.

The questionnaire used in this KYEEMA foundation project is a shorter version of that conducted in the SANDCP project in 2002 until 2005. This questionnaire, to remain cost effective, had to be trimmed down to exclude questions that are no longer necessary. However before this trimming takes place one must first obtain an idea as to what information needs to be gained by this questionnaire and what the quality of that information needs to be to answer the questions asked by the researcher.
For example the exclusion the question that specifies the head of the household has limited the information gained from this questionnaire. It also makes it difficult to analyse other information that is acquired in the questionnaire such as, *"Who decided to vaccinate the chicken?"* Without knowing the role of this person in the family and his / her relationship to the head of the household the use of this information has been decreased. This applies to question 3.3 *"How many chickens does each member of your family own*", without knowing the role of this person in the family and his / her relationship to the head of the household the use of this information is also decreased.

Appendix 4 The project area: Singida

(Msafiri, 2009)

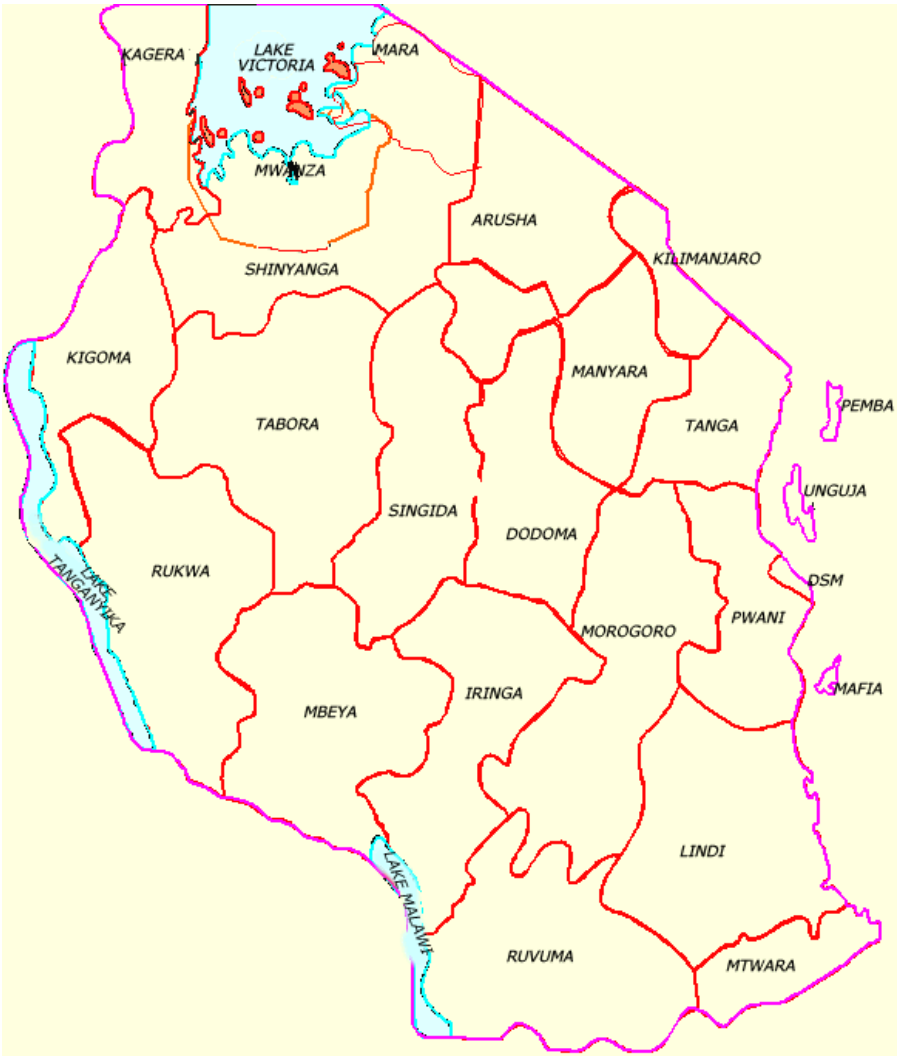
Singida District is bordered by five district councils. The census from 2002 indicates a total of 454,625 people with a growth rate of 2.4%. Women are more numerous (51%) than men (49%). The average number of people per household is between 5 and 6.
The Nyaturu linguistic group represent 90% of the population the remaining being Nyirambva, Sukuma, Barbaing speaking groups.

Singida is among the 10 poorest districts of the country with a per capita income of Tshs 180,000 ($130. – US, as of 11/2009). Malnutrition in Singida district is 3.8%, the infant mortality rate is 131 per 1000 babies born and 65% of the population is literate.

Singida is a semi-arid area with an average rainfall of 600 mm per annum and a temperature between 10ºC and 30ºC.
The land area is mainly highlands of the central plateau (along Mtinko and Ilongero division) while the rest are lowlands and plains to the south.
Singida District council covers an area of 12,164 square kilometres and is divided in agricultural land which covers 43.0% of the total area (5,282 km^2), grazing land 31.0% (3,737 km^2), forest and shrubs 18.0% (2,200 km^2), water in the form of lakes, dams and temporary rivers 0.4% (50 km^2) and mining sites, hills and rocks 7.0% (894 km^2) of the total area.

The major economic activities are farming and livestock keeping. Other activities include fishing, beekeeping, small scale mining, small business, cottage industry and lumbering. Small scale farming constitutes 60% of the economic activities while agro-pastoralists form 40%.
Over reliance on manually cultivating fields, unreliable rains, low soil fertility and poor farming methods contribute to the poverty situation of the district.
Households living in the Singida region are mainly composed of farming families. People live in villages and households which are scattered a long way away from each other.

This data is provided by Msafiri, J. S. Joseph, acting District Agriculture and Livestock Development Officer (DALDO) in Singida.



Map of Tanzania showing the districts of the country