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Contributions of irrigation activities in vegetable farms to cases of Malaria infections in Lagos, Nigeria

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Abstract

This study seeks to examine the contributions of irrigation activities in vegetable farms to cases of malaria infections in two communities in Lagos. This is with the view that malaria has become one of the greatest menaces that causes high morbidity and mortality in most cities in Nigeria. The paper focused on strategy for irrigation management for vegetable cultivation, irrigation water quality, and socio-cultural perception of community members and reported cases of malaria among farmers and non farmers. The concept of Ecosystem Approach to Human Health (ecohealth) which argues that human activities influence the state of human health and well being was adopted. 150 questionnaires were use to obtain information from farm community household. Information on irrigation management and incidences of malaria were further obtained from farmers and neighborhood clinics. In addition wells were observed and water samples were collected to determine presence of mosquito larva. Household survey was also carried out to determine malaria intervention and control strategies, and experts' knowledge was sought on the link between irrigation and mosquitoes' activities and malaria infections. Water observations and analysis shows non- presence of mosquito larva in the well water used for vegetable cultivation. The study shows that socio-cultural and behavioral factors play a key role in determing the extent of malaria infection among residents of the same community. Estimations of the proportion of variance accounted for by all variables is 3.2% in Tejuoso and -5.6% in Alapere and size of land holding was found to have the greatest influence on irrigation activities in Alapere (r = .155) and in Tejuoso (r = .231).

Key word: Irrigation Management Strategy, Vegetable Production, Malaria Infections

Background to the Study

According to Redwood (2004), poverty and food insecurity are becoming grave problems in most developing cities. Food and Agricultural Organization cited in UN press briefing (1997) also estimated that unless progress is accelerated in food supply, there could be more than 680 million hungry people in the world by 2010, with more than 250 million of them in sub-Saharan Africa. This, in addition to urbanization process and lapses in rural agricultural activities together with rural-urban migration would leave many mouths to be fed and many persons to be employed in the cities. This concern has made urban agriculture especially vegetable production to become an important economic activity that has brought less stresses on the urban food systems in most cities in Africa.

In Lusaka, Zambia, in Cairo, Egypt, in Kampala, Bamako and other African cities vegetable cultivation has been recognized as an adaptive strategy to urban livelihood in recent times because it contributes appreciably to poverty alleviation and urban food security(UNDP, 1996; Redwood, 2004). However, one notable factor that has been attributed to its success has been the adoption of small scale water irrigation system. While the adoption of the irrigation technique has been beneficial in terms of cheap and easy access to water, low cost and increased agricultural output, concern for their spatial variation in the quality and suitability for vegetable production, as well as its health and environmental implications have remained a topical research issue in recent times. Birley and Lock (1999) have asserted that the health and environmental risk associated with urban agriculture include contamination of crops; heavy metals from soils; breeding pathogenic organism due to irrigation by water from polluted streams or inadequately treated waste (water and organic solid product); human diseases transfer from disease vector attracted by agricultural activity; occupational health risk for workers in food producing and food processing industries, apart from the destruction of the urban biodiversity due to agrochemical input. Empirical studies in Kenya, Ghana and Uganda have reported among other factors, cases of small-scale irrigation techniques such as shadoof, wash bore, deep wells and shallow wells in urban agricultural practices in these cities.

In Lagos, vegetable cultivation is an informal economic activity with vast use of irrigation technologies and malaria is one of the most common cases of morbidity found in the farming communities. There is limited information as well as uncertainty about issues related to the pattern of water management for vegetable crops and its impacts on human health. This concern has raised challenges for sustainable social, economic, health and environmental development for men and women whose livelihood depend on

vegetable. The challenges have also created blurred perspective about how water is integrated into food production especially for vegetable production in Lagos. This paper therefore examines the pattern of irrigation management and its determinants for vegetable crops. It further correlates irrigational water constituents with reported malaria infections among farmers in the study area.

Ecosystem Approach to Human Health

Existing conceptual framework to synthesize the relationship between human activity and its environmental and health impacts have been normative and those focusing on empirical solutions to problems are static and not all encompassing. A shift towards a holistic methodological approach had therefore brought Ecosystem Approach to Human Health (Ecohealth) to test. According to Forget and Lebel (2001), Ecohealth is a process oriented and dynamic concept that seeks to provide better understanding between the complex ecosystem (biophysical, socio-economic and cultural) and how these interactions influence the prevalence of health problems and well-being among human populations.

Ecohealth suggests that improved human health, living condition and sustainability of the ecosystems could be achieved by identifying ecosystem management strategies and understanding the socio-economic and cultural conditions (Lebel, 2003). It emphasizes health as a resource for everyday life that goes beyond personal lifestyle approach but include a more political and social one (DePlane *et al.,* 2004). Ecohealth believes human activities alter social and ecological context, and have positive and negative effects on individuals and communities involved. The concept suggests three core elements (Social Relations and Gender, Trans-disciplinary and Community Participation), as what is required to understand the interactions between society and environment. The synergistic interactions between the underlying factors defines the pathways for this paper as it uses the basic elements of Ecohealth as a framework for irrigation management in vegetable production in Lagos focusing on reported cases of malaria in two farm communities. It is hoped that the adaptation of this concept brings to fore the understanding that if appropriately tackled, could improve the livelihood of some of the urban farmers.

Study Area-Lagos Metropolis

Geographically, Lagos Metropolis lies within latitude $6^{o}23`N$ and $6^{o}41`N$, and longitude $3^{o}9`E$ and $3^{o}28`E$, and extends over an area of about

1,140km^2 out of the Lagos State total area of about 3577km^2. The population rose from 230,256 in 1956 to 650,000 in 1963 (Oyeleye, 2001). As at 2007, the metropolitan area of Lagos has a population of about 8,001,951 out of about 9,013,534 that make up the entire state (National Population Census2007). This gives over 90% of the state population. According to Akintola-Arikawe (1993), the density value for built up areas in Lagos is estimated at 20,000 persons per sq km, while minimum density is about 1,590 persons per sq km.

Lagos economy is highly dependent on service revenue but urban agriculture especially vegetable production is relatively minimal. Farming system is mainly of the small scale to medium scale as well as subsistence and commercial in nature. Agricultural practices such as market gardening, poultry, snail, bee keeping and livestock farming are common. Uneasy access to agricultural resources and unfavourable government policy has been the major hindrances to efficient farm practices. Nevertheless, availability of farm location has brought relief on some food items such as local and exotic vegetables, medicinal herbs and maize to urban household, hotels, food hawkers, foreign owned restaurants scattered all over the metropolis (Anosike,2003). For the purpose of this paper, the study concentrates on two main farm communities namely Alapere and Tejuoso (see Figure 1) with an estimated land area of 1296.07 hectares and 50.05 hectares respectively.

Methodology

Being an ecohealth based research, trans-disciplinary techniques were employed to synthesize the interactions between socio-economic, environmental and malaria infection issues related to irrigation management (see Figure 2). Apart from the consultation of existing literatures, information targeted to priority issues such as the socio-economic characteristics of farmers, were collected through questionnaires in order to allow much wider information. The questions cover perceived health problems associated with irrigation management and its perceived impact on the environment and cases of malaria, water transportation, conservation, drudging, treatment and application problems and methods. Seventy-five (75) questionnaires were administered at each farm community with three field assistants including trained farmers. A total of 150 questionnaires with 81 males and 69 females were administered using purposive and random sampling methods. Water samples were collected from the wells and taken to the laboratory to determine the physio-chemical and biological properties using standard methods. Parametres analyzed include total coliform count, faecal coliforms, nitrate, phosphate, potassium. Twenty (20) wells, ten in

each of the study-sites were examined in the farms and in the laboratory for presence of mosquito larvae.

Experts as Microbiologist and parasitologist among others were consulted for their expertise knowledge on the relationships between irrigation management, mosquito activities and cases of malaria. Hospital records were collated and interviews were also held with institutional heads like Lagos State Agricultural Development Authority and Lagos State environmental protection Agency officials to ascertain the extent to which irrigation management activities for vegetable production are monitored to minimize health and environment risk. Other methods employed to gather information include direct observations, informal discussions, meeting attendance and interviews. The data collected were analyzed using qualitative and quantitative analytical frameworks.

Discussion of Result

Determinants of Irrigation Management

To determine the factors that describe the pattern and extent of water utilization and irrigation activities, Pearson regression model was employed. This model is a test of the strength of the net as well as partial contributions of the various factors that could be responsible for the pattern of irrigation and water utilization for vegetable production in the study area. The empirical regression test was therefore conducted using six variables namely, level of education, farmers' experience, number of farms, monthly income, size of land holding and vegetable types being produced as independent variables (Xs) and the quantity of water utilize as the dependent factor (Y). The results are presented in Tables 1 and 2. The Tables depict that the estimations of the proportion of variance accounted for by combination of all the independent variables (regression) using percentages, are 3.2% in Tejuoso and -5.6% in Alapere. This result implies that the combined factors provide only 3.2% explanation to the extent which well water is utilized for vegetable cultivation in Tejuoso. The negative sign of the model in Alapere also implies that the combined factors are disincentive to the well water utilization in Alapere.

However, a consideration for partial contribution of each independent variable using standard Beta coefficient reveals that size of land holding has the greatest influence in Alapere (r = .155) and in Tejuoso (r = .231). This means that there is no difference in the factor determining the extent irrigation for vegetable production in the study area. This is because size of

the land own by farmer determines the extent of irrigation practices in both Alapere and Tejuoso.

Water Quality

Assessment of water use for irrigation shows has high concentration of Magnesium and chloride in Alapere(Table 3). Result from microbiological analyses as presented in Figure 3 shows that the average faecal coliform concentration in all sampled water in the two locations is high, exceeding World Health Organization's $1.0x10^3$ acceptable limit for irrigated crops. The high level of coliforms found in the water samples signifies that the water being used for irrigation is of poor quality, polluted and therefore could pose health risk to farmers and consumers, especially those who have direct contact with water. The presence of high coliforms in water could be attributed to absence of sanitary facilities and improper disposal of excreta in the farm environs, as well as the movement in and out of the wells during irrigation process.

Malaria infections level in the farm communities

Questionnaire analysis as depicted in Figure 4 revealed that farmers are infected with malaria more than non farmers in both Alapere and Tejuoso farm communities, whereas clinical information shows that non farmers are more infected with malaria in both communities. The different outcomes form the two analyses, could be as a result of the general misconception about mosquitoes activities and a combination of natural and human factors surrounding malaria infections (Interview with consultant parasitologist,18th October 2007). In his expert opinion, the ability of mosquito to infect an individual depends on a combination of natural and human factors part of which are: species of mosquito (either Anopheles Culex or Aedes); susceptibility of the persons to local parasite or infection, their predilection to enter the house to feed on the human host; the effect of climatic conditions and the speed of development of the parasite and the vector. However, field observations and laboratory analyses show absence of mosquito larva in well water in the two study locations.

This finding was also affirmed by consultant parasitologist who also asserted that the type of mosquitoes present in Lagos areas do not breed in relatively dirty, polluted and regularly disturbed water. Besides, farmers have the habit of taking local herb as preventive measures before they are attacked by malaria. However, the difference between laboratory and reported cases of malaria infection among community members is as presented in Figure 4. This depicts a variation of 30% and 4% in Alapere, and Tejuoso respectively

on one hand. On another hand the average differences using Wilcoxon test gives Z-value derived from the two sums as depicted in Table4. The result shows that there are no significant differences in malaria infections between farmers and non-farmers in the farm communities be attributed to the unstable nature of the wells as a result of irrigation activities.

Gender Roles in Irrigation Management and Malaria Control and interventions

Gender focused analysis is an important factor for determining the different roles played by men and women as well as their impacts in irrigation activities and malaria control and interventions. This analysis revealed that higher percentage of men (80%) than women (45%) play significant roles in irrigation activities. This has to do with the fact that the digging of wells and drudging activities are seen and accepted as men's activities because of the physical strength it requires. More women (55%) than men (20%) employed the services of labourers for their irrigation and drudging activities. The distribution of the roles of malaria control and intervention by men and women, and by households is as depicted in Table 5 & 6.

Conclusion

Irrigation management in vegetable production is a significant activity that contributes immensely to the livelihood of both men and women and consequently to the development of the urban economy. Irrigation activity is advantageous to farmers because it allows farmers to increase production output and income but do not play direct role in case of malaria infections in both Alapere and Tejuoso. Community perception of the relationship between irrigation activities malaria infection could be as a result of some limitations in information and knowledge about mosquito's activities. The water for irrigation is polluted with both biological and physio-chemical properties due to lack of toilet facilities and control of farm activities by local authorities and other enforcement agents in the communities. Although incidences of malaria infection is a major challenge in most coastal cities in Africa, irrigation activities in urban farms and in a place like Lagos could be said to contribute insignificantly to mosquito breeding and life cycle as there are several factors that stimulate the life cycle and the infection rate of mosquitoes. Be as it may, the contribution of irrigation activities to other health problems can not be over emphasized as the quality of the water use for irrigation is higher than the WHO standard. It is therefore suggested that a rigorous health education campaign should be embarked to increase farmer's knowledge on mosquitoes' activities, control and prevention of malaria infections. Proper monitoring and control of

sanitary condition should be improved upon in both non-farm and farm communities in Lagos.

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Table1: Regression Value for Well Water Utilization in the Study Area

Sites	Regression coefficient	R Square	Adjusted R squares	Percentage	Standard Error of Estimate	(ANOVA)	
						Significance level	F Value
Alapere	.180	.032	-.056	-5.6%	.485	.897	.368
Tejuoso	.332	.110	.032	3.2%	.689	.226	1.404

Source: Field Survey, 2007.

Table 2: Value of Standardized Beta Coefficient by Site

Independent variables	Alapere		Tejuoso	
	Beta value	Significant level	Beta value	Significant level
Constant	1.223	.000	1.726	.008
Level of Education	-.040	.753	-.118	.322
Farming Experience	.079	.630	-.170	.153
Number of farms	-.122	.350	.103	.383
Monthly income	-.002	.989	-.050	.679
Size of holding	.155	.332	.231	.049
Types of vegetable	-.029	.849	.089	.452

Source: Field Survey, 2007.

Table 3: Mean Concentration of Nutrients Properties in Well Water mg/l (ppm)

Parametre	**Alapere**	**Tejuoso**
Nitrate	1.88	0.43
Phosphorous	0.87	0.82
Sulphate	37.15	0.06
Magnesium	53.75	0.43
Potash	6.95	0.86
Calcium	1.8	5.05
Chloride	97.5	38.0

Source: Laboratory Analysis, 2007

Table 4: Wilcoxon Test on Malaria Infection Level on Farmers and Non-farmers

Study Site	Rank for the two sums(Z-value)	P-value	Remark
Alapere	-1.000	.317	Not significant
Tejuoso	-1.732	.083	Not significant

If PV ≥ P =significant; if PV ≤ P = Not significant

Table 5: Gender Roles in Irrigation management and Malaria Control

	Activities	Tejuoso (N=75)		Alapere (N=75)	
		Women	Men	Women	Men
1	Buy Mosquito Nets, spray, herbs	65%	35%	30%	70%
2	Care of the sick at home	90%	10	90%	10%
3	Take house members to health centre	95%	5%	90%	10%
4	Buy drugs	68%	32%	80%	20%
5	Clean the drains	25%	75%		

Source: Field Survey, 2007.

Table 6: Household Control of Malaria

Control	Tejuoso	Alapere
Malaria prevention methods	Can insecticide (8%), Coil (50%), use of Local herb (45%) House net (60%)	Can insecticide 10%, Local herb (52%) , coil (25%) House net (70%)
Access to LLIN/ITN & Use	15% & 11%	40% &15%
Treatment methods	Clinic/Hosp. 10%, chemist 45%, Herbs 51%	Clinic/Hosp. 15%, chemist 45%, Herbs 50%

Source: Field Survey, 2007

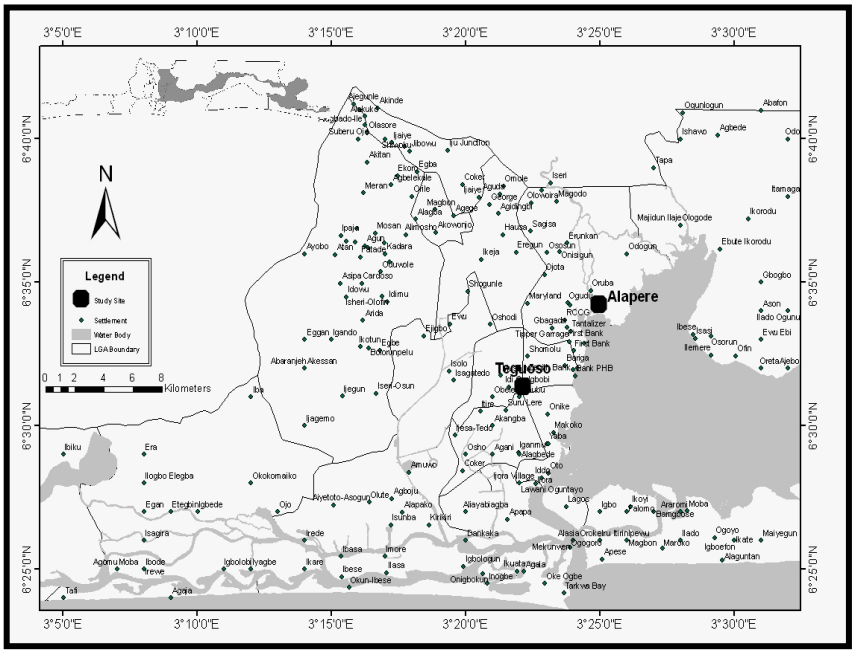

Figure 1: Map of Lagos Metropolis showing the study locations

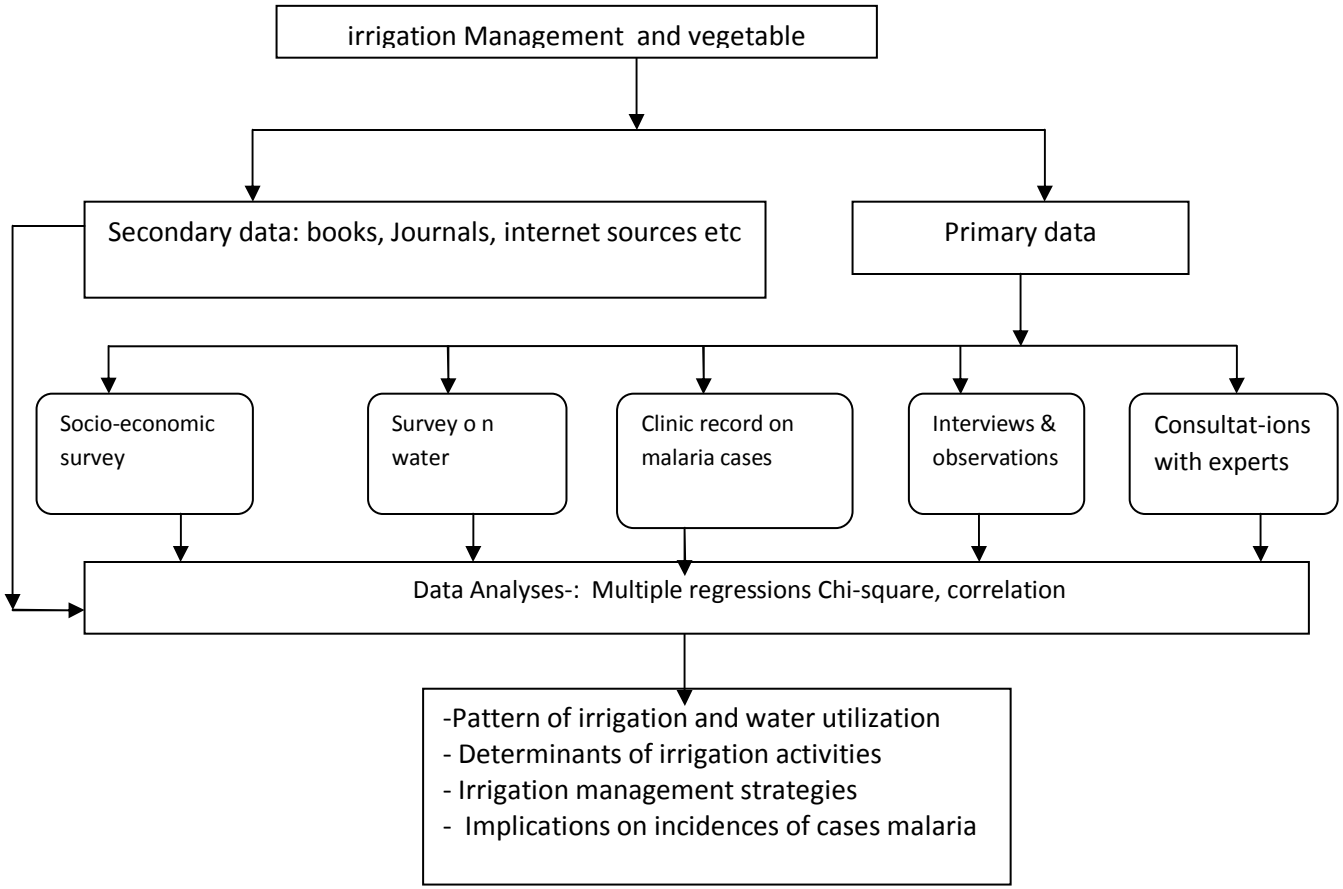

Figure 2: Methodology Flowchart

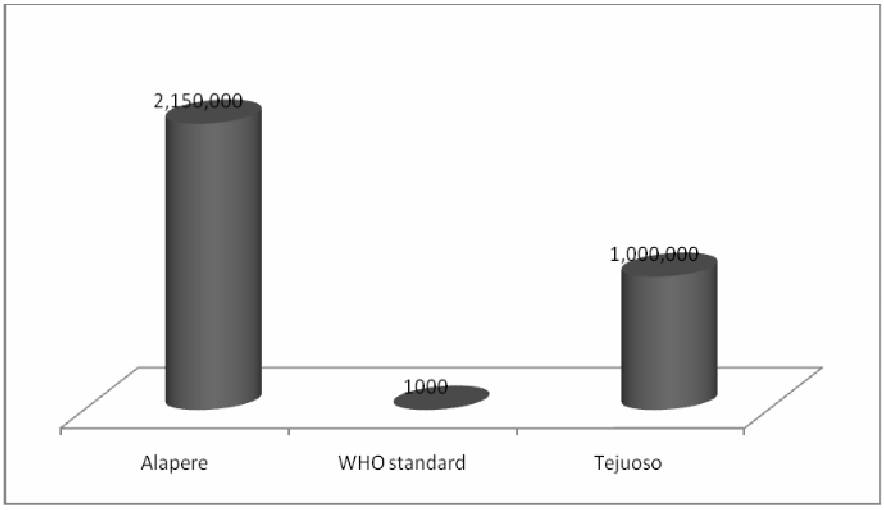

Figure 3: Average Concentration of Faecal Coliform per cfu/ml in well water

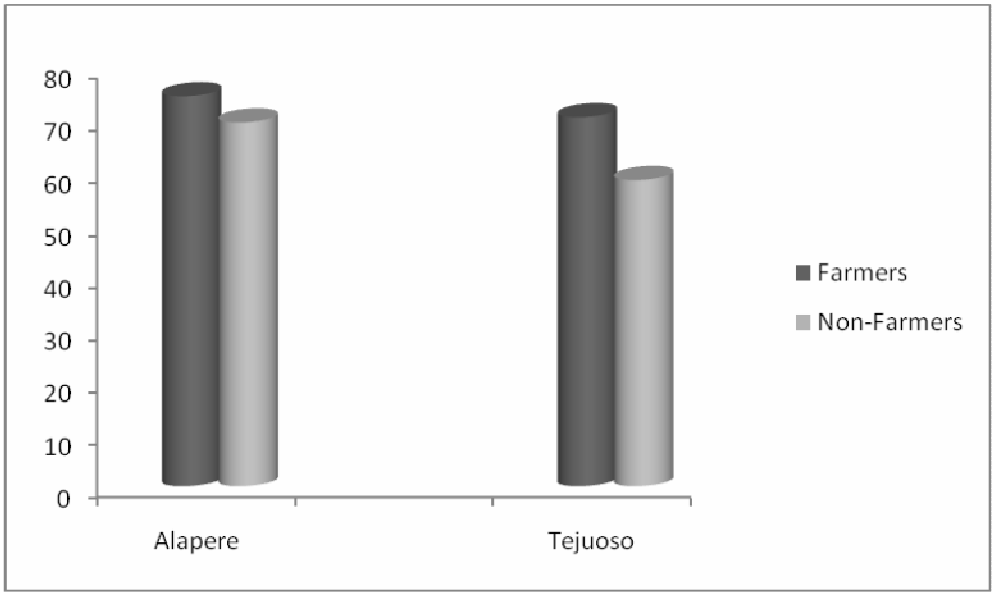

Figure 4: Reported Cases of Malaria among Community Members