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The Economic Impact of Kala-zar:
the case of Umsalala and Mushr'a Koka villages,
El Gadarif State, Eastern Sudan

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Thesis Submitted in Partial Fulfillment of the Requirement of the
M.Sc. Degree (Economics)
DEDICATION

To my family

And friends

With love
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مستخلص الدراسة

لا يوجد نص يمكن قراءته بشكل طبيعي من الصورة المقدمة.
ABSTRACT

Kala-azar is considered as one of the most important parasitic disease affecting humans, and both wild and domestic animals. Nearly (٠٥٣) million people are at risk worldwide. From ١٩٩١, Kala-azar was considered to be the most important health problem in Sudan, particularly in the main endemic in eastern and central regions. The disease spread to other areas that were previously not known to be endemic for Kala-azar.

The study aimed at describing and measuring the economic burden of Kala-azar on household. Kala-azar was selected as a focus of this study because of its significant economic effect on patient and their families. In addition, the disease affects the population in the most productive zones in the Sudan. The study hypothesized that Kala-azar has a significant statistical effect on the household budgets, because of the cost of treatment which is very high. The study based on a field survey conducted in Umsalala and Mushra Koka villages, where a sample of (٣٨) household was selected at random. A structured questionnaire was used in data collection.

The main findings of this study were that the members infected by the disease in the household contribute less to the household income than members infected by other disease and the impact of Kala-azar has been found to be statistically significant compare to other diseases. Furthermore, the treatment of Kala-azar costs (٢٪٥٣) of household income which is very high considering the low income of the population.

The study recommended that increases efforts should be directed control the disease using both curative and preventive medicines to reduce the economic impact of the disease.
CHAPTER ONE

Č. Introduction:

ČČ. General Introduction:

Visceral leishmaniasis (VL, Kala-azar) is considered as one of the most important parasitic diseases affecting humans, wild and domestic animals. Twelve million people are already infected with the disease in the world (North and East Africa, India & China) and there are about 0.53 million people at risk. (Cahill, čēĚď). The disease is transmitted by a type of a fly known as sandfly (phlebotmus or lutzomya) that feeds on the blood of animals and humans Figs. (č,č) and (č,Ď) (Cahill, čēĚď). About čđ million new cases of visceral leishmaniasis are reported every year (WHO, čēčČ).

In the absence of treatment, the fatality rate is approximately close to čČČ percent. Treatment of cases in addition to vector control through insecticides are based the early stages of the diseases control (Nayar, P. K.B., čēĚď). Suspected cases can be identified by simple procedures at primary level of health care facilities. However, confirmation of the diagnosis requires well-equipped laboratory and treatment requires hospitalization (Zijlstra, et al., ĎČČČ).

Čč. Definition and Importance of the Problem:

Some diseases can enormously affect economic and social status of people such as schistosomiasis, onchocerciasis, leprosy, malaria and tuberculosis. The effects of these diseases are reflected in a number of
aspects e.g. income reduction, deterioration and stressed family budgets (Coulibaly, čěěě).
Fig (١,١) The amastigote phase of the visceral leishmaniasis parasite in
and out Macrophage cells of an infected patient
Fig (١,٢) The Sand fly, the vector of visceral leishmaniasis feeding with blood

Visceral leishmaniasis is one of these diseases which have drastic economic effects on patients and their families. The disease is endemic in several areas of the Sudan particularly El Gedarif State where the disease spreads over a wide belt that extends from the Sudanese - Ethiopian boarder to the west, up to the White Nile, with some scattered areas around the Atbara River, Kapoeta area, Nuba mountains and Darfur Region (Osman et al., ١٩٩١).

Treatment of VL, especially in Sudan, is costly for individuals, health authorities and non-governmental organization (NGOs). In addition to its costliness, VL spreads in areas, which are inhabited by low income earners, which, therefore, further aggravates its economic impact.

The Objectives of the Study were:
- To describe the economic burden of Kala-azar (VL) on households where some members are infected by this disease.
- To measure the economic impact of Kala-azar treatment on households, individuals and the community as a whole

Study Hypotheses:
- Kala-azar has a significant effect on household budgets.
- The treatment of Kala-azar (drug, hospital stay) as an economic cost is significantly high.

Study Area and Population: background:

This study is carried out in two villages, Umsalala and Mushra Koka. The two villages are located in a province that is covered by the programme of visceral leishmaniasis control. Umsalala and Mushra koka are located
on the eastern bank of Elrrahad river (approximately ۵۳° ۱۱'E and ۲۱° ۱۵'N; Galabat Province, Gadaref State, eastern Sudan Fig (۷,۸))

Umsalala village is mainly inhabited by Masaleet tribe, who are of western Sudan origin. The village witnessed increased and dramatical migration after the drought of Darfur in ۴۸۹۱ (Khalil, et al., ۲۰۰۲). A local census in ۳۳۸۱ estimated the total population of the village at ۰۳۴۱ members. (Khalil, et al., ۲۰۰۲). The inhabitants are mainly farm labourers and subsistence farmers and lived in huts made of grass. The standards of hygiene are poor. Their diet is mainly carbohydrates and fish once a week with some vegetables during winter.

The other village “Mushrakoka” is ۵۳ km north of Umsalala at the same line. The village is established by the Hausa tribe who migrated from northern Nigeria. (Khalil, et al., ۲۰۰۲). According to a local census in ۴۹۹۱ it has ۰۷۹ members. Houses in the village are huts constructed of wood and bamboo, clay, mud and bricks. All have latrines and bathrooms. The villages’ diet consists mainly of fishes, sorghum and millet porridge, vegetables and fruits. The area is characterized by large suitable and open areas to be cultivated, but the absence of financial resources for the population and because irrigation is mainly based on rain, production of the plots cultivated by the population comes to fluctuate from season to season. The people of the area depend on the shail system. “Shail” is a type of traditional financing system that widely practice in rural areas of Sudan. In this system small farmers may depend, concerning the financing phase of their agricultural activities, on another capable person within the area. However the system is based on pre-
agreement that enforces the farmer to pay the dept in goods after the harvesting season. The economic consequences of this system could be beneficial for the two, (creditors and indeptors) as the main financing method. Beside the cultivation of dura, and groundnuts, people breed goats, cows and sheep.

The ecology of the area was described by El-Hassan, et al., (٥٩٩١) Elnaiem et al., (٧٩٩١) Khalil et al., (٢٠٠٢). The land escape is generally flat and covered by cotton clay soil.
Fig (CD) Mshr’a Koka and Umsalala
The temperatures in the area have four seasons namely, dry summer (March-May), a warm, wet autumn (June-October) and a moderately warm winter (November-February). (Osman, et al, Khalil, et-al,)

From June to November the area is inaccessible because of the bad conditions of roads during the rainy season. (Khalil, et al.,) All the houses in the two villages are identified with special numbers, giving the registration of those previously infected with the disease.

The study area is characterized by limited forest, which is dominated by Balanites aegyptiaca (Higleeg) within the village and zizphus species - spina-christie (habeel) on the river bank. Scattered Acacia trees represent the previously dominant plant of the area, which have been cut down for fire wood and agricultural practices. The village is surrounded by large scale sorghum and sesame fields.

The two villages lie adjacent to the Dinder National Park which is characterized by rich forests of A cacia, Balanites and many other trees & grass species, which suit the vector of Kala-azar in the Sudan. The park is known as a high abundance of phlebotomus orientalis (Elnaiem, et al.,).

Methodology and Organization of the Study:

Ethical Considerations:

Preliminary visits have been organized to Umsulala and Mushra Koka villages to meet Sheikhs (local
community leaders) and to explain the purpose of the study. The practical was reviewed and passed by the Scientific Committee Institute of Endemic Diseases, University of Khartoum (IEND).

**Households Selection:**
Eighty-three households were selected randomly (simple random sample) from the two villages (Umsalala and Mushra koka), based on the records of the Institute of Endemic disease that provided all houses in the two villages with numbers and all individuals within a household were registered by name and given an identification number as well Fig (Č,Đ).

**Questionnaire Design:**
A questionnaire was designed to evaluate the following items:
- Demographic, Socio-economic status i.e. age, sex, occupation, education, source of income, number of individuals in household that are employed, household daily income, type of building and number of rooms, as well as having access to farm(s) animal(s) and other possessions.
- Health care: the household knowledge, attitude and Practice (KAP), mainly including the source of health care, the distance, the source of treatment, awareness of the disease. Number of malaria attacks before being infected by the disease. Number of the family members infected (sex, age). Cost of malaria treatment before being infected by the disease.
Fig (1, 4) Photograph shows some of the households selected in the Sample
Sample Size Determination:

Eighty-three households were selected from two villages sided the area. The selection of the sample is based on the following formula.

\[ n = Z^2 \frac{\partial^2}{E^2} \]

Where:
- \( n \) = represent randomly sample size
- \( Z^2 \) = critical value of significant (normal distribution)
- \( \partial^2 \) = variance
- \( E^2 \) = marginal error

\[ \partial^2 = \frac{NPq}{N - \bar{C}} \]

Applying the formula to the households in Umsalala village

Where:
- \( Z = (\bar{C}, \bar{E}) \), \( N = \bar{C}d\bar{C} \), \( P = \bar{C}d \), \( q = \bar{C}d \), \( E = (\bar{C}\bar{C}) \)
- \( n = (\bar{C}, \bar{E})^2 \cdot \frac{(\bar{C}d\bar{C}) (\bar{C}d) (\bar{C}d) (\bar{C}\bar{C})}{(\bar{C}\bar{C})^2} = \bar{C}\bar{C} \) households

Applying the formula to the households in Mushra koka

Where:
- \( Z = (\bar{C}, \bar{E}) \), \( N = dE \), \( P = \bar{C}d \), \( q = \bar{C}d \), \( E = (\bar{C}\bar{D}) \)
- \( n = (\bar{C}, \bar{E})^2 \cdot \frac{(dE) (\bar{C}d) (\bar{C}d) (\bar{C}\bar{D})}{(\bar{C}\bar{D})^2} = \bar{C}\bar{C} \) households

Z : dependes on \( \bar{d}\bar{E} \) confiedance level
\( \hat{\rho}^2 \): because no previous studies have been undertaken to determine \( \hat{\rho}^2 \) as well as the impossibility of doing an investigation sample, \( P \) value identified as equal to \( \hat{C}_0 \delta \) to obtain a big sample size as possible and, consequently calculated equal to \( \hat{C}_0 \delta \).
Data management and analysis

Data was entered into Epidemiological Information Epi-info computer program, then the data was entered to SPSS format, where the final analysis was done.

The analysis was based on the simple percentage tables and other simple statistical and economic equations.
CHAPTER TWO
Literature Review

Background:

Visceral leishmaniasis (Kala-azar) causes an estimated number \( \text{ \# deaths} \) annually, more than half of these deaths occurring in Sudan and India (Osman et al., 1991). In Asia the disease is also known as black fever for it is most severe, and difficulty of treatment and almost always fatal (WHO, 1991).

It was found that ninety percent of new cases occurred in five countries: Bangladesh, Brazil, India, Nepal, and Sudan (WHO, 1991).

Looking at these countries we can see that they share the characteristics of being poor and diversified in their climate. The disease is epidemic in India with an estimated \( \text{\# new cases} \) each year (WHO, 1991). Gadaref, is the area in Sudan that is being put under focus since 1991 (Zijlstra et al., 2002).

The above statements do not conceal the fact that the disease has been reported in Sudan since the beginning of the twentieth century, mainly in the eastern part of the country where it is considered as one of the transmissible diseases. The first case of VL was discovered in Africa in 1991, but the disease was first diagnosed in Sudan in 1991 in Bahar-el-Gazal district, Southern Sudan (Zijlstra et al., 2002). Historically the disease was known to the local people before it was officially reported.
Local people thought that it had been introduced from west Africa by the Baggara (the term Baggara according to Abdel Gaffar refers to people who mainly breed cows). Although, many groups of society could be included, strictly the term is used to denote Arab’s cow breeders of Darfur. (Abdel Gaffar & Harier, 1891) in the time of Mahadia. The Baggara called the disease as simeih, meaning beautiful, possibly referring to the full face that may develop in VL patients due to edema, also known as Dobaal, Marad-el-Sayid (Disease of the South) and Abu Safar. (Zijlstra et al., 1991).

In 1891 it became apparent that a major epidemic of VL occurred in Western Upper Nile in the Southern Sudan (Samani, et al., 1891, Elnaiem, 1891). Surveys in the area showed that the epidemic started in 1891 but, because of the remoteness of the area and the civil war, it was not fully realized until 19 years later. The first evidence of the epidemic was seen in Khartoum, where hundreds of people belonging to the Nuer tribe, from Western Upper Nile (WUN), presented with VL (De Beer, et al., 1991). A centre for treatments of kala-azar was established in El-Gadaref, and started operation in 1891 where, over 80 patients were treated (Zijlstra et al., 1991).

Recently an outbreak of VL was observed in Nuer tribe of Bentiu in Southern Sudan (Eltoum et al., 1991). Some cases were observed among the same group in their new settlement in Northern Sudan, namely Khartoum where Seven hundred and fifty three cases of VL were

\(\text{च,च. Population Susceptible to the Disease:}\)

Kala-azar affects both adults and children, but to some extent children are more susceptible to the disease. The VL is transmitted through bites of sandy fly of the genus *Phlebotomus orientalis*, Fig (च,च) and Fig (च,ड) where domestic dogs and rodents are considered as reservoir hosts. The symptoms and signs of VL resemble, that of Malaria, its incubation period ranges from 4 to 6 months. The poor health of the population generally enhances the spread of the disease, because poor health weakens the immune systems in human population so the spread and persistence of the disease can partially be attributed to the existing socio-economic structure which is closely associated with poverty. Another factor that leads to the spread of the disease is that most people living in the endemic areas of kala-azar are illiterate with very low level of income and poor quality of housing conditions (Kaendi, 1991). Malnutrition then seems to be an important factor in susceptibility to kala-azar, well-nourished individuals have a higher resistance to the disease (Wijers & Minter, 1991).

\(\text{च,ड Clinical Characteristics of the Disease:}\)

The clinical characteristics of kala-azar are, irregular fever, substantial weight loss, enlargement of the liver, spleen & anemia (WHO, 1991). Fig (ड,च) (Fever, weight loss with anorexia, epistaxes, diarrhoea and
vomiting, pallor hepatomegaly, splenomegaly and lymphadenopathy being constant feature (Zijlstra et al., čěěča).

The clinical feature of the disease are described by a number of researchers in the Sudan e.g. (Ahmed et al., čěĚĚ; El Hassan et al., čěěČ; El-Safi et al., čěěč; Saddig et al., čěěČ; Vanpeenen and Reid, čěěĎ). Splenomegaly may be absent in čě Ě of cases (Zijlstra et al., čěěč).
Fig (2) Photograph shows a patient with visceral leishmaniasis
Diagnosis:

Direct agglutination test was reintroduced by Harith et al., (Čěēřě) after being abandoned several years earlier because of the following: i) variability of the antigen can be read by eye, ii) large number of tests can be done simultaneously, iii) it is suitable for field conditions, and iv) it usually takes $\mathcal{E}$ hours, this period may be shortened to $\mathcal{D}$ hours under certain conditions (Zijlstra et al., Čěēřě).

Leishmanin skin test is used to test cellular immunity. The LST measures delayed-type hypersensitivity of individuals in terms of duration of the skin in reaction to an intradermal injection of leishmania antigen, the test should be read by a standard method such as the ball point pen method proposed by Sokal (Čěēřđ). The LST is typically negative during active primary VL (Zijlstra et al., Čěēče). In both a hospital study in Khartoum and a field study in Um Sulala, no case of VL had a positive LST (Zijlstra. et al., Čěēřď). The LST is of great value in epidemiological studies in endemic areas (Zijlstra. et al., ĎČČć).

Demonstration of the parasite is still the mainstay in the diagnosis of VL. Although in recent years serological tests have been developed with good sensitivity and specificity, they cannot yet replace parasitological methods and should be evaluated in each endemic situation. The leishmanin skin test (LST) is a useful tool, especially in epidemiological work.

Newer molecular biological methods such as Deoxyribonucleic Acid (DNA) Probes and Polymerase Chain Reaction (PCR) (Polymerize Chain
Reaction) have been developed; in particular, PCR has the potential of being the most sensitive means of diagnosis (Anderson et al., 1991). An increasing number of studies, including some from Sudan, have attempted to evaluate these new tools (El Hassan et al., 2002).

Lymph node aspiration is by far the easiest and most convenient method and is recommended for use in hospital and in the field. The technique was introduced in Sudan in 1991 by Kirk and Satti. Lymphadenopathy is a recognized feature in Sudan's VL (Zijlstra & El-Hassan, 2002). The sensitivity of these methods was found to be 35-85% in studies in Sudan (Saddig, et al., 1989; Zijlstra, et al., 1991). Bone marrow aspiration has a sensitivity of 35-0.7% in studies in Sudan (Saddig, et al., 1989; Zijlstra, et al., 1991); others have reported higher sensitivity of 58-98% (HO, et al., 1991).

Vector Environment:
The only proven vector of VL is Phlebotomus-oreintalis which has been found to be abundant mainly in woodlands dominated by Acacia Seyal and Balanites aegyptica trees (Ashford and Tomson, 1991; Elnaiem et al., 1991).

Treatment of VL:
First line treatment relies on the pentavalent antimonials sodium stibogluconate or meglumine which are expensive and need to be given
by injection, often for several weeks. The second line drugs-amphotericin B and pentamidine, is used in cases unresponsive to antimonials – need careful management to avoid serious side effects. For visceral leishmaniasis aminosidine alone or in combination with pentavalent antimonials, has shown good efficiency, but it is still under evaluation. Amphoterincin B included in liposomes seems very efficient but its use is still limited and expensive (Khalil et al., Češča).

The first specific drug used in treatment of VL in Sudan was trivalent antimony, which was first used in the Češčs (Zijlstra et al., Češč). This preparation was known for its toxicity and it was superseded by pentavalent antimonials in the Češčs, of which sodium stibogluconate (Pentostam, Welucome Laboratoris, UK) has become the main stay for treatment of VL in the country (Zijlstra et al., Češč).

Other drugs that have been used are the aromatic diamidine compounds such as ÐÐ diamidinodiphenoxypentane (pentamidine). Recently, other new and potentially powerful drugs such as lipsosomal have also been introduced .

Pentostam was introduce in Sudan in the Češčs by Kirk and Satti and is still the drug of choice, glucantime is not registered for use in Sudan. Several recent studies have shown stibogluconate as a very effective drug in the treatment of VL in Sudan (Veeken, Češč).

Sodium stibogluconate (pentostam) and meglumine (Glucanatime) are recommended for use while the dose is ČČ mg kg⁻¹ the duration of
treatment varies from 51-103 days in Sudan and up to 4 weeks in Kenya (Anabwani et al., 1991) and 4 days in India (Thakur, 1991). Currently, the World Health Organization (WHO) recommended a dose of 0.2 mg kg⁻¹ for at least 4 weeks (WHO, 1991).

Patients with confirmed or suspected kala-azar are treated with sodium stibogluconate (Welcome UK) 0.2 mg kg⁻¹ for 51 days. This regimen is chosen based on previous experience (Zijlstra et al., 1991) which provided evidence that 51 days of treatment was equally effective as 103 days and would make more efficient use of scarce resources (Khalil et al., 2002). Post Kala-azar dermal leishmaniasis in Sudan occurs within 0-6 months after treatment for VL. Fig (D,D)
Fig (٢) Photograph shows Post Kala-azar dermal leishmaniasis (PKDL) patient
Socio-economic correlation of the Spread of Kala-azar:

Like other parasitic diseases, spread of kala-azar is found to be influenced by interaction of multi factors that include social, economic and environmental variables. However infectious and parasitic diseases, disproportionately affect population that live in poverty (Sommerfield, J).

It is noted that social, political and economic inequalities are central to the persistence and spread of diseases in addition to the rate of the health system in protecting vulnerable populations from the impact of these diseases. (Sommerfield, poverty, for example, affects equity of treatment among those infected. Another observation is that, poverty inhibits the family to supply drugs to its members. Furthermore, kala-azar frustrates economic and social development in the regions where it is spread, the impact manifested in damaging individual economic performance leading to reduction of productivity and serious prolonged morbidity ends in death among the patients.

Perspectives of Economic Analysis of Diseases:

The effect of kala-azar as a disease could be traced at both macro and microeconomic levels.

The human capital approach in its discussion of the relation between health and economics, evaluates diseases effects using the production function. Some studies had been worked on the economic impact of Onchocercal skin diseases (OSD) in Sudan, Ethiopia and Nigeria to measure the effect of OSD upon labor input. Distributing the effect of th disease by school attendance of children, it is found that children were twice as likely to dropout of school compared to other children of the
same age from the same community. The relationship was especially strong among girls, who were $6$ times as likely to dropout of school if the head of household had OSD than if the had did not. It follows that Onchocerciasis impedes educational development. People with OSD spend extra US$ $2$ which represent $51\%$ of their annual expenditure. Another study was conducted in Uganda, Ghana and Nigeria to assess the effect of ivermectin treatment upon OSD. Treatment led to $4-5\%$ decline in severe itching compared to placebo, sustained for up to $21$ months after the first treatment, there was also a significant decline in the prevalence of reactive skin lesions following treatment compared to placebo (Anonymous, 1991).

In another study it is found that when women take care of ill family members, their workdays become longer, and their work load becomes heavier, and it happen that female looks after each other when it is difficult for one family to complete its own duties. (Vlassof. Bonilla, 1991).

The impact of tropical disease on agricultural economy could be seen in the complex interaction between the individual’s welfare and the family’s welfare-empirical quantification of these interactions and economic losses is obviously seen in areas where time extremely determines economic activities. Furthermore, the ill person’s struggle to minimize the economic effects of disease on family income will mask its true impact. The effects of diseases strikes low-income groups when measuring effects reflect in the earning side. However, income has affect the rate of consumption and items that are necessary for health such as food, housing, sanitation, medical care, education and so on.
To understand the economic consequences of diseases (Bonilla, & Rodriguez, 2011) found that the disease burden was greatest among males, but the economic impact of this burden was greatest among females who postponed or carried out their own activities in addition of caring for the sick by replacing them in farm production. Likewise, most diseases in Third World countries are described as diseases of poverty. However, individuals, communities and countries unable to afford the costs of treatment and prevention are at serious risk. Economic development projects aim at increasing income levels in these communities which may lead to negative results due to increased transmission of parasitic diseases.

Economists rely on cost-benefit analysis, cost-effectiveness analysis and financial analysis to analyze the economic consequences of such diseases and their control.

Despite the significance of such studies, there are some limitations in their conceptual methodological sides. However, most studies have not considered the epidemiology and natural history of the disease in estimating economic losses. (Rosenfield; Golladay; Davidgon, 2012.)

As we mentioned earlier that individuals lack the ability to maintain the treatment cost of diseases, humanitarian aid should be included to help those with income shortage. The cost effectiveness of humanitarian relief-intervention for visceral leishmaniasis treatment in Sudan is evaluated. Where more than USS 6 billion were invested. The data are available on the impact of VL treatment program for 10,000 patients between August and July. Calculations made with available data relevant
assumptions yielded a cost-effectiveness ratio of US$ €8,04 per disability adjusted life year. With an uncertainty range of US$ €3,35 – €7,36, a highly cost-effective health intervention. The applicability of the analysis to the internal management of the VL program, the procurement of funds to the program, and to priority setting in humanitarian relief interventions are discussed. When evaluating emergency interventions, efforts could be made more often to perform cost-effectiveness analysis, including the use of DALYs, provided that the outcomes of the analysis are seen in the broad context of the emergency situation and its consequence upon the affected population (Griekspoort; Sondorp; Vos, €666).

ć,Ę Control of the disease:

To control the disease, a ten years plan is introduce by the Lieshmaniasis Group of the Sudan (LRG/ Sudan). The first phase in ćĘ was design to collect epidemiological data about the disease; host, parasite and vector in addition to start active case detection and treatment with sodium Stibogluconate. New diagnostic techniques were introduced through a number of phases. The first phase was granted by EC (Zijistra et al ćĘ; Ibrahim et al ćĘ; Osman et al ćĘ; Osman et al ćĘ; Zijistra ŁŁŁŁ; El Hassan & Zijistra ŁŁŁŁ Khalil et al ŁŁŁŁ). The second phase was initiated in ćĘ with collaboration between MSF – Holland and Sudan. This was aimed at intensifying the program of active case detection and treatment as the only available method of disease control in the country. New treatment regimens and alternative drugs were also investigated during this period (Zijistra et al ćĘ; Khalil et al ćĘ; Khalil et al ćĘ). The
third phase was started in 1991 in collaboration with TDR/WHO. The plan aimed at introducing a vaccine to control the disease. (Khalil et al. 2002).

Although there are considerable number of scientific studies done in the area of epidemiology, in contrast economic and social studies about kala-zar are almost absent.
CHAPTER THREE

٣. Characteristics of the Sample:

Table (٣.١): Village surveyed

<table>
<thead>
<tr>
<th>Villages</th>
<th>Frequency of households</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umsalala</td>
<td>Ėđ</td>
<td>ĖĔ,đ'</td>
</tr>
<tr>
<td>Mushra koka</td>
<td>ĺĚ</td>
<td>ĺČ,ě</td>
</tr>
<tr>
<td>Total</td>
<td>Ėđ'</td>
<td>ĺČČČČ</td>
</tr>
</tbody>
</table>

Source: Field data 2002

Eighty-three questionnaires forms were distributed to the respondents. ĖĔ,đ% sixty five forms of them were distributed at Umsalala, and ĺČ,ě% eighteen at Mushra koka.

The distribution of the questionnaires was on the observation of a pilot visit to the area.

Table (٣.٢): Tribes of respondents

<table>
<thead>
<tr>
<th>Tribes</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masaleet</td>
<td>Ėđ</td>
<td>ĖĔ,đ'</td>
</tr>
<tr>
<td>Hausa</td>
<td>ĺĚ</td>
<td>ĺČ,ě</td>
</tr>
</tbody>
</table>
Umsalala is entirely inhabited by masalit and Mushraa koka is entirely inhabited by Housa.
Table (*,*): Heads of the households in the study villages

<table>
<thead>
<tr>
<th>Head</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father</td>
<td>١٧</td>
<td>٥٨٪،٥</td>
</tr>
<tr>
<td>Mother</td>
<td>٢</td>
<td>٢٪،٤</td>
</tr>
<tr>
<td>Son</td>
<td>٧</td>
<td>٨٪،٤</td>
</tr>
<tr>
<td>Others</td>
<td>٢</td>
<td>٣٪،٦</td>
</tr>
<tr>
<td>Total</td>
<td>٣٨</td>
<td>٠٠٪،٠</td>
</tr>
</tbody>
</table>

Source: Field Data

The above table (*,*) showed that, ٥٨٪،٥ of houses are headed by father, followed by ٨٪،٤ by sons, ٣٪،٦ by others (grand father and grand mother and uncle). The rest (٢٪،٤) of houses were headed by mothers.

Males related to these carry the responsibility their houses (sometimes) at very early ages, since they can financially contribute and be engaged in the labour market. Females also can contribute households income through a number of functions that they can do in the agricultural and traditional trade sectors Fig (*,*)
Fig (٣) Females participating in the traditional trade sector
Table (٤,٤): Descriptive statistics of the ages of head of household

<table>
<thead>
<tr>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under ٥١ years</td>
<td>١١</td>
<td>٢٪</td>
</tr>
<tr>
<td>٥١ - ٦٠</td>
<td>٢٦</td>
<td>٧٪</td>
</tr>
<tr>
<td>Over ٦٠</td>
<td>٤٢</td>
<td>١٪</td>
</tr>
<tr>
<td>Total</td>
<td>٣٨</td>
<td>٠٪</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢.

The importance of heads stems from the fact that the headship of the household reflects the person's ability to work and generate money which is reflected in increasing the household income to meet the expenditure of the household.

Table ٣,٤ showed that the ages of the household heads in the area range between ٥١ years as a lower end and ٦٠ years as maximum.

Concerning the females labour as we mentioned earlier, some variations exist between Hausa and Masalit, for example in Umsalala which is dominated by Masalit, women usually help in agricultural sector and sometimes we find women grow their own plots. This independence results in frequent divorce among the Masalit, where a mother can take her children and remarried to another man in a very short period of time. Although there is no questions on questionnaire regarding divorce, but according to the interveiw during the field information collected showed that divorces prevails among Masalit more than their counterparts the Hausa.
Table (٦٫٣): Educational level of heads of the household

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>Ṍč</td>
<td>Ṍ QDialog</td>
</tr>
<tr>
<td>Informal–school</td>
<td>ṢḌ</td>
<td>ṢḌḌ</td>
</tr>
<tr>
<td>Total</td>
<td>ṢḌ’</td>
<td>ṢḌḌḌ,Ḍ</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢.

In general, literacy rates among both Masaleet and Hausa of the area can be described as very low, people who continue their education after informal-school rarely exist. Most of the literate in the population, only complete the pre-school ṢḌḌ and illiteracy rate constitutes about ṢḌḌ of the household. The informal-school (khalwa) type of education in the area, which can be described as a traditional one is headed by “Khalwa” where formal education is marginalized.

Table (٦٫٤): Marital status of the heads of the households

among Masalit and Hausa

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>ṢḌ</td>
<td>ṢḌḌ,Ḍ</td>
</tr>
<tr>
<td>Single</td>
<td>ṢḌ’</td>
<td>ṢḌḌ</td>
</tr>
<tr>
<td>Divorced</td>
<td>ṢḌ</td>
<td>ṢḌḌ</td>
</tr>
<tr>
<td>Widow</td>
<td>ṢḌ’</td>
<td>ṢḌḌ</td>
</tr>
<tr>
<td>Total</td>
<td>ṢḌ’</td>
<td>ṢḌḌḌ,Ḍ</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢.
Most of household heads are married ٠Ｃ,٠Ｅ other, only ٠٠٠,٠٠٠ are single, ٠٠٠,٠٠٠ are divorced and ٠٠٠,٠٠٠ are widowed. This indicates that most families have house heads, but according to the observation and interviews with the population, a head of the household is not necessary the supporter or the financial agent of the family.
Table (ð, Ė): Household possessions

<table>
<thead>
<tr>
<th>Household possession</th>
<th>Frequently</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farms</td>
<td>ð</td>
<td>ð̃ Ė, Ė</td>
</tr>
<tr>
<td>Animals</td>
<td>Ė</td>
<td>Ė, Ė</td>
</tr>
<tr>
<td>Both</td>
<td>Ė</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>None</td>
<td>Ė̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>Total</td>
<td>Ė̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plot of land possession by the household</th>
<th>Frequently</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>ð̃ Ė</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>No</td>
<td>ð̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>not determined</td>
<td>ð̃ Ė</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>Total</td>
<td>ð̃ Ė</td>
<td>Ė̃ Ė, Ė</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultivation farm (S) than possessed</th>
<th>Frequently</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Ė̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>No</td>
<td>Ė̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>Not applicable</td>
<td>Ė̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
<tr>
<td>Total</td>
<td>Ė̃</td>
<td>Ė̃ Ė, Ė</td>
</tr>
</tbody>
</table>

Source: Field data 2002.

Statistically ð̃ Ė, Ė̃ of population own land, Ė̃ Ė own animals and Ė̃ Ė, Ė̃ owns both land and animals see table (ð, Ė), seventy percent of the population directly cultivate their land and ð̃ Ė̃ have no land and they hire land from land owners, see table (ð, Ė).

Table (ð, Ė): Common crops that are cultivated

<table>
<thead>
<tr>
<th>Common crop (S)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millet</td>
<td>ð̃ Ė</td>
<td>ð̃ Ė</td>
</tr>
<tr>
<td>Dura</td>
<td>ð̃ Ė</td>
<td>ð̃ Ė</td>
</tr>
<tr>
<td>Millet, drua, sesame</td>
<td>ð̃</td>
<td>ð̃ Ė</td>
</tr>
<tr>
<td>Millet, dura, groundnuts</td>
<td>ð̃</td>
<td>ð̃ Ė</td>
</tr>
</tbody>
</table>
The crops that are cultivated are millet (ذق،ذئب) which is the staple crop in the area. ٥٠% of the population cultivate “Dura”. There is main cultivation by the banks of Al Rahad River mainly vegetables as well as Mango, Guavas and Lemon trees.

<table>
<thead>
<tr>
<th>Not determined</th>
<th>٣</th>
<th>٦</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>٥</td>
<td>٦</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢.
Table (٣, ٩): Housing environment

<table>
<thead>
<tr>
<th>Type of latrine</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional W.C near the river</td>
<td>ĉĒ</td>
<td>ĉĐēĒ</td>
</tr>
<tr>
<td>near of around building Open area</td>
<td>ĉī</td>
<td>ĉê, ĉĒ</td>
</tr>
<tr>
<td></td>
<td>ē</td>
<td>ē, ē, ē</td>
</tr>
<tr>
<td>Total</td>
<td>Ėdī</td>
<td>ĖČČĒ</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢

**Housing Environment:**

Environmentally the housing and the surroundings can be described as poor for example Umsalala has a very poor environment compared to its counterpart (Mushra koka).

Generally the building materials of the area dominated by (goatia) Fig (٣, ٣) the problem of this type of building is that it needs continuous repairing and maintenance which is costly in a society where there is no sufficient or a regular source of income.
Fig (٣) Photograph shows housing structure in Umsalala and Mushra Koka villages
The impact of the mass media on health status could be positive. One of the most import mean of mass media for rural population is radio. The population lack communication with the outer universe, there health education of the people is said to be poor. Also the area is completely out of the electricity coverage.

The absence of means of mass communication and other objects used for the purpose makes it difficult for the authorities to run any program for health education.

The available human waste disposal system is very traditional, where most of the inhabitants (٨٧٪٣) use the open space, only ١٢٪٧ used the traditional W.C. This way of human waste disposal accelerates the spread of diseases especially that is linked to the digestive system. The Economic impact of these diseases on population activity is very clear, since they inhibit people from doing their work either directly or indirectly through the nursing of others.

The study also indicated the scarcity of drinking water where population depend on water brought from Alrrahad River Fig (٣٣) and Fig (٣٤). The strong link of the population to the river for water, fishing or other tasks links to their lives lead to the spread of a number of diseases, especially the kala-azar which is transmitted through a fly lives by the bank of the river.
Fig (٣) Arrahad river water resource in Umsalala village
Figure. (٣-١١) Alrrahad river water resource in Mushra Koka
Health Services in the Study Area:

The study area lacks health services. However people in both areas (Umsalala and Mushraa Koka) seek outside health services in the neighboring areas. The only two hospitals that receive patients from Umsalala and Mushraa Koka, are Umkuraa and Bazora hospitals. The former receives people from Umsalala, and the latter receives the population of Mushraa koka after being referred by a clinic in Eltoub Al Ahmar.

If a certain case is found to be positive for Kala-azar then authorities of Bazora further refer patients to Soba hospital at Khartoum, or Umkuraa's hospital, which is managed by the (MSF) Holland.

Beside these two hospitals and the clinic, sometimes people make their way to other remote hospitals such as Al Hawata, El Gadaref ...etc.

The clinic at Eltoub Al Ahmar is directed by one medical assistant and a laboratory technician, where people often pay only little money as fees.

The hospital at Bazora, has no medical officer. The interview with the people at the study area indicated that most people prefer to go to
Umkuraa, for certain purposes, among which are the free meals, and drugs.

Although the availability of medical services to those who suffer from kalazar, because of remote distance of hospital in the lack of clinics or other dressing stations. These factors inhibit people to reach the health services, especially at autumn, hence people normally reach hospitals by donkey or on foot. Difficulties of reaching hospitals and clinics, especially in autumn affect the desire of some people to see health providers, since seeing a doctor may cost the whole day walking, which means a loss of time that could be used for cultivation plot of lands.
Health Care seeking Behaviour

Table 3 shows that 87.7% of population seek care at hospitals when they get ill, and 91.3% seek care at clinics. At summer most people use trucks as a means of transportation (24.2%), but in the autumn (26.6) go on foot because using trucks and donkeys become more difficult.

Table (3): Source and the distance of health facilities

<table>
<thead>
<tr>
<th>Source of health care</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Ėē</td>
<td>ĖČ, Ė</td>
</tr>
<tr>
<td>Clinic</td>
<td>čĖ</td>
<td>čē, č'</td>
</tr>
<tr>
<td>Total</td>
<td>Ėđ'</td>
<td>čČČ, Ė</td>
</tr>
<tr>
<td>The distance of the unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Đ kilometers</td>
<td>čĖ</td>
<td>ĐČ, Ė</td>
</tr>
<tr>
<td>Đ kilometers</td>
<td>č</td>
<td>č, Đ</td>
</tr>
<tr>
<td>Ė kilometers</td>
<td>Ėđ'</td>
<td>Ėđ, Ė</td>
</tr>
<tr>
<td>No determined</td>
<td>č</td>
<td>č, Đ</td>
</tr>
<tr>
<td>Total</td>
<td>Ėđ'</td>
<td>čČČ, Ė</td>
</tr>
<tr>
<td>Transportation in summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On foot</td>
<td>čē</td>
<td>ĖČČ, Ė</td>
</tr>
<tr>
<td>By donkey</td>
<td>Đē</td>
<td>ĐČČ, Ė</td>
</tr>
<tr>
<td>By common trucks</td>
<td>Đđ</td>
<td>ĐČČ, Ė</td>
</tr>
<tr>
<td>Total</td>
<td>Ėđ'</td>
<td>čČČ, Ė</td>
</tr>
<tr>
<td>Transportation in autumn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On foot</td>
<td>ĖČ</td>
<td>ĖČČ, Ė</td>
</tr>
<tr>
<td>By donkey</td>
<td>Đ</td>
<td>ĐČČ, Ė</td>
</tr>
<tr>
<td>By common trucks</td>
<td>č</td>
<td>ĖČČ, Ė</td>
</tr>
<tr>
<td>Total</td>
<td>Ėđ'</td>
<td>čČČ, Ė</td>
</tr>
</tbody>
</table>

Source: Field data 2002.
The prevalence of diseases in the study area during the period of study

<table>
<thead>
<tr>
<th>Prevalence disease</th>
<th>Number of infection in Bazoura</th>
<th>Number infection Eltoubel el alaahar</th>
<th>Summation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>-</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
<tr>
<td>Meningitis</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
<tr>
<td>Inflammations</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
<tr>
<td>Syphilis</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
<tr>
<td>Total</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
<td>ء</td>
</tr>
</tbody>
</table>

Source: Data taken from Bazora and Eltoop AlAhmar.

The area of El Rahad province where Umsalala and Mushraa koka are located is generally well known for endemic and epidemic diseases. The health status with regard to spread of diseases during the survey is revealed in table ء ء ء ء. Which shows the prevalence of diseases in the study area at the time of the field survey. Inflammations represent about ء ء، malaria represent ء ء، diarrhea ء ء ء and meningitis ء ء ء.

Malaria is a prevalent disease in the area; almost every one in the population gets ill with malaria at least once during a year. We can not prove that the symptoms from which the people complain are malaria symptoms, because symptoms of malaria and kala-azar are quite similar.

It often happens that an ill person starts using malaria treatment only to discover, and after repeated doses that his case is a Kala-azar and not a malaria case.
Table (d,čō) Source and medication for malaria

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor prescribed</td>
<td>٣٤</td>
<td>٠٥,٨</td>
</tr>
<tr>
<td>Herbal Medicince</td>
<td>١</td>
<td>١,٢</td>
</tr>
<tr>
<td>Self prescribed</td>
<td>٩٣</td>
<td>٧٤,٠</td>
</tr>
<tr>
<td>Others</td>
<td>٠</td>
<td>٠,٠</td>
</tr>
<tr>
<td>Total</td>
<td>٨٣</td>
<td>٠٠,١</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>People's pharmacy</td>
<td>٦٤</td>
<td>٥٥,٤</td>
</tr>
<tr>
<td>Shop</td>
<td>٧٣</td>
<td>٤٤,٦</td>
</tr>
<tr>
<td>Others</td>
<td>٠</td>
<td>٠,٠</td>
</tr>
<tr>
<td>Total</td>
<td>٦٧</td>
<td>٦٩,٦</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢.

The sources where people get drugs is shown in table (d,čō) ٢٠٠٢, ٦٩,٦ of population received the drugs from the people's pharmacy, and ٦٩,٦ buy drugs from village shops and vendors.

**دائّ Knowledge and Awareness of Kala-azar**

To assess the level knowledge of Kala-azar two, sources have been solicited. Firstly interviews held with the leaders of the area. A number of questions have been raised to be answered by the origin settlers of Mushra kola and Umsalala. These questions were around the kala-azar, such as, what do people think kala-azar is? How do people know kala-azar? What are the traditional treatment applied to the disease before the modern medicine? …etc.

Here are some of their answers.
Sheikh Mustafa, a leaders of Masaleets reports that, before the coming of doctors, we are completely ignorant about the disease, and what is strange
for us is that our little children died in very early ages, it happened that three of my children died in a row within a very short period of time. The first time we knew about the disease was on the coming of doctor Salim who told us about the disease and its treatment. At that time the price to be paid for one injection is about ٠٠٠١ Sudanese Pounds, some of those who paid for the full dose were recovered but some of them died. After repeated visits of medical campaigns people became aware of the disease.

Table (٣,٣١) Knowledge and awareness about Kala-azar

<table>
<thead>
<tr>
<th>Degree of knowledge about kala-azar</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very much</td>
<td>Ėذ</td>
<td>٢٨٨٩،٨</td>
</tr>
<tr>
<td>Much</td>
<td>ء</td>
<td>١١،٢</td>
</tr>
<tr>
<td>Little</td>
<td>ء</td>
<td>٠٠،٠</td>
</tr>
<tr>
<td>Non knowdege</td>
<td>ء</td>
<td>٠٠،٠</td>
</tr>
<tr>
<td>Total</td>
<td>٣٨٠٠١،٠</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean's of awareness about the disease</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>By being infected</td>
<td>ء</td>
<td>ء٣،٠</td>
</tr>
<tr>
<td>After being infected</td>
<td>ء</td>
<td>ء٣،٠</td>
</tr>
<tr>
<td>Before being infected</td>
<td>ء</td>
<td>ء٣،٠</td>
</tr>
<tr>
<td>Total</td>
<td>ء</td>
<td>ء٣،٠</td>
</tr>
</tbody>
</table>

Source: Field data ١٢٠٢

Table ٣,٣١ above shows that ٢٨٨٩،٨ of the population now know about the disease, and about ٠٠،٣ of them recognize the disease by its symptoms.

**٣٤٤ Steps dealing with the Sickness**

Before a person confirms that the symptoms he is having is Kala-azar he may tend always to use the drugs of malaria. That is because the
secondary symptoms of kala-azar are similar to those of malaria. But if he doesn’t recover then he directly seeks the drug from the vendors before seeing the doctor. Our survey data indicated that 72% of kala-azar patients, used a drug of malaria before knowing that they had kala-azar and 21% used the drug of malaria for about two weeks before seeing the doctor, 41% used malaria drug for one month and 51% for more than month after all these periods if the ill person does not recover then he would come to see the doctor. This means that 24% of kala-azar patients at least use the wrong treatment for two weeks (the cost of malaria treatment in two weeks is equal to (388, 8 S.D) before being properly diagnosed. Apart from the side effects of the wrong use of malaria medications, this fact shows that both economic and medical costs of kala-azar are increased, when delaying diagnosis treatment become more difficult and more costly.

Table (d,čĐ): Time since last malaria treatment

<table>
<thead>
<tr>
<th>Time</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>ĩď</td>
<td>dČ,č</td>
</tr>
<tr>
<td>A week</td>
<td>đď</td>
<td>Đe,đ</td>
</tr>
<tr>
<td>Two weeks</td>
<td>ččČ</td>
<td>čĐČ</td>
</tr>
<tr>
<td>A month</td>
<td>čĐđ</td>
<td>čĐđ,đ</td>
</tr>
<tr>
<td>More than month</td>
<td>čďđ</td>
<td>čďđ,đ</td>
</tr>
<tr>
<td>Total</td>
<td>ĕďđ</td>
<td>ĕČČ,Č</td>
</tr>
</tbody>
</table>

Source: Field data 2002.
A person found to be kala-azar positive, will be admitted to a hospital for a period of ٨٢-٠٣ days.

The collected data showed that all patients receive their drugs from the doctor. Long ago a person could buy the drug from the shop's with a very high cost, that is why patients have no ability to complete the full dose. It is discovered that some drugs which exist in the shop vendors are expired and kept in bad storage conditions.

Now the cost of drug of kala-azar is completely free, since it is donated by non-governmental organizations. The cost to be covered by the patient or his relatives is only the transportation fees and the maintenance fees for food during the period of staying in the hospital.
Our survey showed that ٧٢,٪٧ of fathers play the role of co-patient instead of going to work, and ٢٤,٪٢ of patients are with their mothers, this means that nearly ٠٧,٪ of active labour force are out of being contributing to work as a result of the disease, see table (٣,٥١). The study also showed that people prefer the existence of patients in the hospital during treatment instead of the house, regardless of the cost of being there, which could be an indicator of awareness. Recently people turn to use mosquito net as a natural protection from the disease.

<table>
<thead>
<tr>
<th>The co-patient</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father</td>
<td>ظد'</td>
<td>ظد,ظ</td>
</tr>
<tr>
<td>Mother</td>
<td>ظد</td>
<td>ظد,ظ</td>
</tr>
<tr>
<td>Daughter</td>
<td>ظه</td>
<td>ظه,ظ</td>
</tr>
<tr>
<td>Son</td>
<td>ظأ</td>
<td>ظأ</td>
</tr>
<tr>
<td>Others</td>
<td>ظأ</td>
<td>ظأ</td>
</tr>
<tr>
<td>Non-</td>
<td>ظأ</td>
<td>ظأ</td>
</tr>
<tr>
<td>Total</td>
<td>ظد'</td>
<td>ظد,ظ</td>
</tr>
</tbody>
</table>

Source: Field data ٢٠٠٢.
CHAPTER FOUR
Economic Factors and Kala-zar

The Lorenz Curve:

The Lorenz curve is a graphical representation of proportionality of distribution (The cumulative percentage). It is used in economics and ecology to describe inequality in wealth or size. The Lorenz curves are measures the percentage of household on the X axis and the percentage of income on the Y axis. If the percentage of income is equal to the percentage of household we have the perfect equality line. If the percentage of households gets lower than the percentage of income then we have a measure of income inequality.

This shows the Lorenz curve as deviation from the perfect equality line. Perfect inequality occurs when all lower income percentiles get nothings and only a very small percentage which constitutes the upper income group gets all income and the graphically depicted by the think line on the X axis that That
suddenly moves up to the top of the Y-axis. We can illustrate inequality graphically by using the Lorenz curve. However we can calculate a numerical figure by calculating a Gini coefficient based on the Lorenz curve. The Gini coefficient is the ratio of the area between the Lorenz curve and the perfect equality line divided by the area between the perfect equality and perfect inequality lines. The Gini coefficient has a minimum value zero (perfect equality) and one (perfect inequality).
Income Inequality and Kala-zar:

Income inequality among infected households may partially reflects the severity of infection and its impact on the income generating power of households; also it may reflect the basic inequality in the distribution of income and as such will affect the
ability of household to spend on seeking and continuing treatment.
### Table (٤١) Family daily income where is the head of the household infected

<table>
<thead>
<tr>
<th>Income categories</th>
<th>Frequently the households</th>
<th>Percentage of the household</th>
<th>Percentage of income</th>
<th>% Of Households</th>
<th>% Of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>٠٥١ - ٠٥٢</td>
<td>e</td>
<td>dE,e</td>
<td>دE,E</td>
<td>دE,eC</td>
<td>دE,ECE</td>
</tr>
<tr>
<td>٠٥٢ - ٠٥٣</td>
<td>d</td>
<td>دE,E</td>
<td>دE,d</td>
<td>دE,EÇ</td>
<td>دE,CE</td>
</tr>
<tr>
<td>٠٥٣ - ٠٥٤</td>
<td>d'</td>
<td>چE,E</td>
<td>دE,چ</td>
<td>دE,dÇ</td>
<td>دE,CCE</td>
</tr>
<tr>
<td>٠٥٤ - ٠٥٥</td>
<td>D</td>
<td>چE,چ</td>
<td>چE,د</td>
<td>چE,DÇ</td>
<td>چE,EÇ</td>
</tr>
<tr>
<td>٠٥٥ - ٠٠٦</td>
<td>ĵ</td>
<td>dE</td>
<td>چE,د</td>
<td>چE,CÇ</td>
<td>چE,CC</td>
</tr>
<tr>
<td>Total</td>
<td>ĵ</td>
<td>چE,Č</td>
<td>چE,Č</td>
<td>چE,Č</td>
<td>چE,Č</td>
</tr>
</tbody>
</table>

Out of eighty-three, eighteen heads of the households were infected by kala-zar in the study area, this is being reflected in table ٤١. Given the data of that table, percentages have been calculated for all categories of family daily income. The table ٤١ shows that daily income of the households in Umsalala and Mushra Koka had total money incomes of less than ٠٠٦ Sudanese dinars. These households are received ٠٠٠ of the total income.
that households earned. ٦٢٥٢ ٪٨ of households earned between ٨٣٥٣ and ٨٤٥٣ Sudanese dinars, these households earned ٦٢٥٣ ٪٣ of the total income earned. ٦١٥٤ of households earned between ٨٤٥٤ and ٨٥٥٥ Sudanese dinars, and these households earned ٦١٥٥ ٪٤ of total income. ٦١٥٥ of households earned ٦١٥٥ and ٦٢٥٦ Sudanese dinars, and ٦٤٥٥ earned ٦٢٥٦ ٪٥ earned ٦٢٥٦ to ٦٣٥٦ Sudanese dinars.

The data in table ٦١٥٠ is taken from table ٦١٥٠ and represents the income distribution among households where the head is infected.
Table (ć,ć) Income distribution (the families where the household is infected)

<table>
<thead>
<tr>
<th>Percent distribution of aggregate household daily income in ĆĆĆĆ</th>
<th>Per households</th>
<th>Per income</th>
</tr>
</thead>
<tbody>
<tr>
<td>ćđ,ćĕ</td>
<td>Ćđ,ćĕ</td>
<td></td>
</tr>
<tr>
<td>Ćě,ćĆ</td>
<td>Ćě,ćĆ</td>
<td></td>
</tr>
<tr>
<td>Ćđ,ćć</td>
<td>Ćđ,ćć</td>
<td></td>
</tr>
<tr>
<td>Ćće,ćć</td>
<td>Ćće,ćć</td>
<td></td>
</tr>
<tr>
<td>Ććć,ćć</td>
<td>Ććć,ćć</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field data

The data in the table ĆĎ is fitted into Lorenz Curve such as that below, using Auto-cad program.
The Lorenz curve shows that there is inequality of income among infected household heads. Of the households have been taken of the average income of the households.

Table (Family daily expenditure where the households is infected)

<table>
<thead>
<tr>
<th>Expenditure categories</th>
<th>Frequently of the households</th>
<th>Percentage of the households</th>
<th>Percentage of the expenditure</th>
<th>% of households</th>
<th>% of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>٥٧١-٥٢١</td>
<td>٣٧٢,٣٠٨</td>
<td>٥٢١-٥٧١</td>
<td>٦١٤,٤٩</td>
<td>٠٠١,٠٠١</td>
<td>٠٠١,٠٠١</td>
</tr>
<tr>
<td>٥٨٢-٥٣٢</td>
<td>٢١١,٢٠٨</td>
<td>٥٣٢-٥٨٢</td>
<td>٤٩٤,٤٩</td>
<td>٠٠١,٠٠١</td>
<td>٠٠١,٠٠١</td>
</tr>
<tr>
<td>٥٩٢-٥٤٢</td>
<td>٣٨٢,٣٠٨</td>
<td>٥٤٢-٥٩٢</td>
<td>٣٩٤,٤٩</td>
<td>٠٠١,٠٠١</td>
<td>٠٠١,٠٠١</td>
</tr>
<tr>
<td>٦٠٢-٥٥٢</td>
<td>١١١,١٠٨</td>
<td>٥٥٢-٦٠٢</td>
<td>٢٠٠,٠٠١</td>
<td>٠٠١,٠٠١</td>
<td>٠٠١,٠٠١</td>
</tr>
<tr>
<td>٦١٢-٥٦٢</td>
<td>٠٧١,٠٠١</td>
<td>٥٦٢-٦١٢</td>
<td>٣٠٠,٠٠١</td>
<td>٠٠١,٠٠١</td>
<td>٠٠١,٠٠١</td>
</tr>
<tr>
<td>٦٢٢-٥٧٢</td>
<td>٢٢١,٢٠٨</td>
<td>٥٧٢-٦٢٢</td>
<td>٧٠٠,٠٠١</td>
<td>٠٠١,٠٠١</td>
<td>٠٠١,٠٠١</td>
</tr>
</tbody>
</table>

Out of eighty three, eighteen heads of the households is infected by kala-zar in the study area, this is being reflected in table . Given the data of that table, percentage has been calculated for all categories of family expenditure.

The table shows that daily expenditure of the households in Umsulala and Mushra koka had
money expenditure of less ٥٢١ Sudanese dinars. These households are receiving ٦١,١٪ of the total expenditure that households expended. ٦١,١٪ of households expended between ٥٢١ and ٦١ Sudanese dinars and these households expended ٦١,١٪ of the total expended. ٦١,١٪ of household expended between ٦١ and ٨٢ Sudanese dinars, and these households expended ٦١,١٪ of total expended. ٦١,١٪ of households expended between ٦١ and ٨٢ Sudanese dinars, and these households expended ٦١,١٪ of total expended. ٦١,١٪ of households expended between ٦١ and ٨٢ Sudanese dinars, and these households expended ٦١,١٪ of total expended. ٦١,١٪ of households expended between ٦١ and ٨٢ Sudanese dinars, and these households expended ٦١,١٪ of total expended. ٦١,١٪ of households expended between ٦١ and ٨٢ Sudanese dinars, and these households expended ٦١,١٪ of total expended.
The average daily expenditure for the family is ٥٧١,٢٢ Sudanese dinars, which implies a monthly average of about ٧٦١٥ Sudanese dinars. Based on the data in table ١٠, we can get the data in table ١٠, which represents the income distribution among households where the head is infected.

Table (١٠) Expenditure distribution (families where the household head is infected)

<table>
<thead>
<tr>
<th>Percent distribution of aggregate household daily expenditure</th>
<th>Per households</th>
<th>Per income</th>
</tr>
</thead>
<tbody>
<tr>
<td>٧٢,٠٨</td>
<td>٦١,٣١</td>
<td>١٦,٠١</td>
</tr>
<tr>
<td>٥٤,٦١</td>
<td>٧٩,٠٧</td>
<td>٢٣,٠٠</td>
</tr>
<tr>
<td>٠٠</td>
<td>٠٠,٠٠</td>
<td>٠٠,٠٠</td>
</tr>
</tbody>
</table>

Source: Data field

The data in the table ١٠ is fitted into Lorenz Curves below, using Auto-cad programme.

Expenditure distribution (families where the household head is infected)
The Lorenz curve shows that there is inequality expenditure among households head that infected by the disease. \( \text{of the households have been taken from the expenditure on goods and services.} \)

Table (Family daily income where the head of the households is not infected)

<table>
<thead>
<tr>
<th>Income</th>
<th>Frequently of</th>
<th>Percentage of</th>
<th>Percentage of</th>
<th>% of</th>
<th>% of</th>
</tr>
</thead>
</table>


<table>
<thead>
<tr>
<th>categories</th>
<th>the households</th>
<th>the households</th>
<th>the income</th>
<th>households</th>
<th>income</th>
</tr>
</thead>
<tbody>
<tr>
<td>٥١-٥٢</td>
<td>ĊÈ</td>
<td>ĊÈ, Ė</td>
<td>ĊÈ, Đ</td>
<td>ĊÈ, Ė</td>
<td>ĊÈ, Đ</td>
</tr>
<tr>
<td>٥٢-٥٣</td>
<td>ĐĐ, Ė</td>
<td>ĐĐ, Ė</td>
<td>ĐĐ, Ė</td>
<td>ĐĐ, Ė</td>
<td>ĐĐ, Ė</td>
</tr>
<tr>
<td>٥٣-٥٤</td>
<td>ĊČ, Č</td>
<td>ĊČ, Ċ</td>
<td>ĊČ, Č</td>
<td>ĊČ, Č</td>
<td>ĊČ, Č</td>
</tr>
<tr>
<td>٥٤-٥٥</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
</tr>
<tr>
<td>Total</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
<td>Ė Ė, Ė</td>
</tr>
</tbody>
</table>

Sixty-five heads of the households are not infected by kala-zar in the study area, this is being reflected by table ٥٤-٥٥ given the data of that table, percentage are calculated for all categories of family daily income.

Table ٥٤-٥٥ shows that daily income of households in Umsulala and Mushra koka had money income of less than ٥٤-٥٥ Sudanese dinars. These households are receiving ٥٤-٥٥% of the total income that households earned. ٥٤-٥٥ of households earned between ٥٤-٥٥ and ٥٤-٥٥ Sudanese dinars, these
households earned ٢٣,٩ of total income earned. ٥١,٤ of households earned between ٠٥٣ and ٠٥٤ Sudanese dinars, and these households earned ٨١,٣ of total income. ٠١,٨ of households earned ٠٥٤ to ٠٥٥ Sudanese dinars, and ٦١,٠ earned ٠٥٥ to ٠٥٦ Sudanese dinars. Based on the data in table ٤,٥ we can get the data in table ٤,٦ which represents the income distribution among households where the head is not infected.
Table (דד) Income distribution (the families where the household is not infected)

<table>
<thead>
<tr>
<th>Percent distribution of aggregate household daily income in דד</th>
<th>Per households</th>
<th>Per income</th>
</tr>
</thead>
<tbody>
<tr>
<td>דד,דך</td>
<td>דד,דך</td>
<td></td>
</tr>
<tr>
<td>дד,דך</td>
<td>дд,дך</td>
<td></td>
</tr>
<tr>
<td>Єך,ךך</td>
<td>Єך,ךך</td>
<td></td>
</tr>
<tr>
<td>єך,ךך</td>
<td>єך,ךך</td>
<td></td>
</tr>
<tr>
<td>Єך,ךך</td>
<td>Єך,ךך</td>
<td></td>
</tr>
<tr>
<td>єך,ךך</td>
<td>єך,ךך</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data field

The data in the table דד is fitted into Lorenz Curve such as that below, using Auto-cad programme.

Income distribution (the families where the household is not infected)
The Lorenz curve shows that of the households headed were not infected by the disease have been taken of the average income.

Table (Family daily expenditure where is the head of the households is not infected)

<table>
<thead>
<tr>
<th>Expenditure categories</th>
<th>Frequently of the households</th>
<th>Percentage of the households</th>
<th>Percentage of the expenditure</th>
<th>% Of Households</th>
<th>% Of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>ħd- čūd</td>
<td>čē</td>
<td>ĜE, Đ</td>
<td>ĝd, d</td>
<td>ĜE, Đ</td>
<td>ĝd, d</td>
</tr>
<tr>
<td>čūd- čéd</td>
<td>čē</td>
<td>ĜE, Đ</td>
<td>ĝd, ĝ</td>
<td>ğd, Đ</td>
<td>ĝd, Đ</td>
</tr>
<tr>
<td>čéd- ĕūd</td>
<td>čē</td>
<td>Ĝe, ĝ</td>
<td>ĝď ě</td>
<td>Ėd, ě</td>
<td>Ėd, ě</td>
</tr>
<tr>
<td>ĕūd- ĕéd</td>
<td>ĕ</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
</tr>
<tr>
<td>ĕéd- ĕūd</td>
<td>ĕ</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
</tr>
<tr>
<td>čūd- ĕūd</td>
<td>ĕ</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
</tr>
<tr>
<td>ĕď ě</td>
<td>ĕ</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
<td>ĕď ě</td>
</tr>
<tr>
<td>Total</td>
<td>Ėd</td>
<td>ĜČČ, Ė</td>
<td>ĜČČ, Ė</td>
<td>ĜČČ, Ė</td>
<td>ĜČČ, Ė</td>
</tr>
</tbody>
</table>

Out of eighty three heads of the households, sixty five heads of the households are not inflected by kala-zar in the study area, this is being reflected by table given the data of that table, percentage are calculated for all categories of family daily expenditure.
Table ٤ shows that daily expenditure of the households in Umsulala and Mushra koka had money expenditure of less than ٥٢١ Sudanese dinars, these ٥١ ٪٥ of the total expenditure that households expended. ٥١ ٪٦ of household expended between ٥٢١ and ٥٧١ Sudanese dinars and these household expended ٥١ ٪٧ of the total expended. ٧٣ ٪٨ of households expended between ٥٧١ and ٥٢٢ Sudanese dinars, and these households expended ٢٣ ٪١ of total expended. ٣١ ٪١ of households expended between ٥٧٢ and ٥٣ Sudanese dinars, and these households expended ٠٢ ٪٢ of total expended. ٣ ٪١ of households
and these households expended \( \delta, \delta \) of total expended.

Based on the data in table \( \delta_\varepsilon \) we can get the data in table \( \delta_\varepsilon \), which represents the income distribution among household where the head is not infected.

Table \((\delta_\varepsilon)\) Expenditure distribution (the families where the household head is not infected)

<table>
<thead>
<tr>
<th>Percent distribution of aggregate household daily expenditure in 2002</th>
<th>Per households</th>
<th>Per income</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \delta_\varepsilon, \varepsilon )</td>
<td>( \varepsilon \delta, \varepsilon \delta )</td>
<td></td>
</tr>
<tr>
<td>( \delta \varepsilon, \varepsilon )</td>
<td>( \varepsilon \delta, \varepsilon \delta )</td>
<td></td>
</tr>
<tr>
<td>( \varepsilon \delta, \varepsilon )</td>
<td>( \varepsilon \delta, \varepsilon \delta )</td>
<td></td>
</tr>
<tr>
<td>( \varepsilon \varepsilon, \varepsilon \delta )</td>
<td>( \varepsilon \varepsilon, \varepsilon \delta )</td>
<td></td>
</tr>
<tr>
<td>( \varepsilon \varepsilon, \varepsilon \delta )</td>
<td>( \varepsilon \varepsilon, \varepsilon \delta )</td>
<td></td>
</tr>
</tbody>
</table>

Source: field data

The data in the table \( \delta_\varepsilon \) is fitted into Lorenz
The Lorenz curve in the above figure shows that, inequality in expenditure distribution is existed among household.

Table (d₇,E) Family daily income where the head of the household is infected and not infected

<table>
<thead>
<tr>
<th>Income categories</th>
<th>Frequently of the households</th>
<th>Percentage of the households</th>
<th>Percentage of the income</th>
<th>% Of Households</th>
<th>% Of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>ĉaC- ĉaC</td>
<td>ʕa</td>
<td>ăC,Đ</td>
<td>ĉE,č</td>
<td>ĉC,Đ</td>
<td>ĉE,č</td>
</tr>
<tr>
<td>ĐaC- đaC</td>
<td>őe</td>
<td>őλέ</td>
<td>õe,đ</td>
<td>ēd,č</td>
<td>Đe,έ</td>
</tr>
<tr>
<td>đaC- đaC</td>
<td>ćđ</td>
<td>ćđ,ε</td>
<td>ĉE,Ě</td>
<td>ĖC,E</td>
<td>ĖE,Đ</td>
</tr>
<tr>
<td>ĐaC- đaC</td>
<td>ěe</td>
<td>ěČ,Ě</td>
<td>ěE, đ</td>
<td>ěč,Ě</td>
<td>ĐĻ,Ě</td>
</tr>
<tr>
<td>đaC- ĖaC</td>
<td>đ‘</td>
<td>Ė,Đ</td>
<td>đa,Đ</td>
<td>ĖČĆ,Č</td>
<td>ĖČĆ,Č</td>
</tr>
</tbody>
</table>
Eighty-three of the households are not infected by kala-zar in the study areas, this being reflects in table ٤-٩. Given the data of that table, percentage calculated for all categories of family daily income.

The table ٤-٩ shows that daily income of households in Umsulala and Mushra koka had money of less than ٠٥١ Sudanese dinars. These households are receiving ٨١,٪١ of the total income that households earned. ٤٣,٪٩ of households earned between ٠٥٢-٠٥٣ Sudanese dinars. These households earned ١٣,٥ of total income earned.

٥١,٪٧ of households earned between ٠٥٣-٠٥٤ Sudanese dinars, and these households earned ٨١,٨ of total income earned.
of total income earned. \( \frac{\text{of total income earned}}{\text{of total income earned}} \) of households earned between \( \text{between} \) and \( \text{between} \) Sudanese dinars, and these households earned \( \text{of total earned} \) of total earned. \( \text{of} \) of household earned between \( \text{between} \) and \( \text{between} \) Sudanese dinars, and these households earned \( \text{of total} \) of total income earned.

Based on the data in table \( \text{table} \) we can get the data in table \( \text{table} \), which represent the income distribution among household where the head is infected.
**Table (díččě)** Income distribution (the combined families where the household head is infected and not infected)

<table>
<thead>
<tr>
<th>Percent distribution of aggregate household daily income in ŽČČČ</th>
<th>Per households</th>
<th>Per income</th>
</tr>
</thead>
<tbody>
<tr>
<td>٤٠١</td>
<td>čč,čč</td>
<td>čč,čč</td>
</tr>
<tr>
<td>ěď,čč</td>
<td>čč,čč</td>
<td></td>
</tr>
<tr>
<td>ěč,čč</td>
<td>čč,čč</td>
<td></td>
</tr>
<tr>
<td>ěč,čč</td>
<td>čč,čč</td>
<td></td>
</tr>
<tr>
<td>čč,čč,čč</td>
<td>čč,čč</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data field

The data in the table Đččč is fitted into Lorenz Curve below, using Auto-cad program.

Income distribution (the combined families where the household head is infected and not infected)

Fig (4-8): A lorenz Curve Illustrates Inequality
The Lorenz curve $\mathcal{D}\mathcal{E}$ shows that there is inequality of income among households headed that infected. $\mathcal{O}
abla\mathbb{C} of the households have been taken $\mathcal{D}\mathbb{C},\mathcal{E}$ of the average income of the households.

Table $(\mathcal{D}\mathbb{C})$ Family daily expenditure where the head of the households is infected or not

<table>
<thead>
<tr>
<th>Expenditure categories</th>
<th>Frequently of the households</th>
<th>Percentage of the households</th>
<th>Percentage of the expenditure</th>
<th>% Of Households</th>
<th>% Of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mathcal{E}\mathcal{d}-\mathbb{C}\mathcal{d}$</td>
<td>$\mathcal{D}\mathcal{D}$</td>
<td>$\mathcal{D}\mathcal{E},\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{d},\mathcal{c}$</td>
<td>$\mathcal{D}\mathcal{E},\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{d},\mathcal{c}$</td>
</tr>
<tr>
<td>$\mathcal{c}\mathcal{D}-\mathcal{C}\mathcal{d}$</td>
<td>$\mathcal{D}\mathcal{d}$</td>
<td>$\mathcal{d}\mathcal{C},\mathcal{c}$</td>
<td>$\mathcal{D}\mathcal{E},\mathcal{e}$</td>
<td>$\mathcal{D}\mathcal{E},\mathcal{e}$</td>
<td>$\mathcal{D}\mathcal{D},\mathcal{c}$</td>
</tr>
<tr>
<td>$\mathcal{c}\mathcal{E}-\mathbb{D}\mathcal{d}$</td>
<td>$\mathcal{D}\mathcal{D}$</td>
<td>$\mathcal{D}\mathcal{E},\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{E},\mathcal{e}$</td>
<td>$\mathcal{E}\mathcal{d},\mathcal{c}$</td>
<td>$\mathcal{E}\mathcal{d},\mathcal{e}$</td>
</tr>
<tr>
<td>$\mathbb{D}\mathbb{D}-\mathcal{D}\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{C}$</td>
<td>$\mathcal{d}\mathcal{c},\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{E},\mathcal{e}$</td>
<td>$\mathcal{E}\mathcal{E},\mathcal{d}$</td>
<td>$\mathcal{E}\mathcal{d},\mathcal{d}$</td>
</tr>
<tr>
<td>$\mathcal{D}\mathcal{d}-\mathbb{D}\mathcal{d}$</td>
<td>$\mathcal{d}\mathcal{E}$</td>
<td>$\mathcal{d}\mathcal{E},\mathcal{e}$</td>
<td>$\mathcal{E},\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{C},\mathcal{C}$</td>
<td>$\mathcal{c}\mathcal{C},\mathcal{C}$</td>
</tr>
<tr>
<td>Total</td>
<td>$\mathcal{E}\mathcal{d}$</td>
<td>$\mathcal{c}\mathcal{C},\mathcal{C}$</td>
<td>$\mathcal{c}\mathcal{C},\mathcal{C}$</td>
<td>$\mathcal{c}\mathcal{C},\mathcal{C}$</td>
<td>$\mathcal{c}\mathcal{C},\mathcal{C}$</td>
</tr>
</tbody>
</table>

Eighty-three of the heads of the households, are infected and not infected by kala-zar in the study areas, this is reflected in table $\mathcal{D}\mathbb{C}$. Given the data of that table, percentage are calculated for all categories of family daily expenditure.
Table ٤ shows that daily expenditure of the households in Umsulala and Mushra koka had money expenditure of less than ٥٢١ Sudanese dinars, these households is ٥١,٪١ of total expenditure, that households expended. ٠٣,٪١ of households expended between ٥٢١ and ٥٧١ Sudanese dinars and these households expended ٦٢,٪٥ of the household expended between ٥٧١ and ٥٢٢ Sudanese dinars and these households expended ١٣,٪٧ of total expended. ٣١,٪٣ of the household expended between ٥٢٢ and ٥٧٢ Sudanese dinars, and these households expended ٩١,٪٨ of total expended. ٣,٪٦ of the households expended between ٥٧٢ and ٥٢٣.
Sudanese dinars, and these households expended $\bar{E},\bar{d}$ of total expended.

Based on the data in table $\mathcal{D},\mathcal{C},\mathcal{C}$ we can get the data in table $\mathcal{D},\mathcal{C},\mathcal{D}$ which represents the income distribution among household where the head is infected.

Table (d,\mathcal{C},\mathcal{C}) Expenditure distribution (the families where the household head is infected and not infected)

<table>
<thead>
<tr>
<th>Per households</th>
<th>Per income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{d},\bar{c}$</td>
<td>$\bar{c},\bar{d}$</td>
</tr>
<tr>
<td>$d,\bar{c}$</td>
<td>$\bar{c},\bar{d}$</td>
</tr>
<tr>
<td>$\bar{c},\bar{d}$</td>
<td>$\bar{d},\bar{c}$</td>
</tr>
<tr>
<td>$\bar{d},\bar{c}$</td>
<td>$\bar{c},\bar{d}$</td>
</tr>
<tr>
<td>$\bar{c},\bar{c}$</td>
<td>$\bar{c},\bar{c}$</td>
</tr>
</tbody>
</table>

Source: Data field

The data in the table $\mathcal{D},\mathcal{C},\mathcal{D}$ is fitted into Lorenz Curve below, using Auto-cad programme.
The Lorenz curve shows that there is inequality of income among households headed that infected.
\( \frac{94}{\%} \) of the households have been taken \( \frac{43}{\%} \) of the average income of the households.
Estimates of the Factors Affecting Income in the Study Area:

Description of the Model:

Any economic activity usually generates money income and any increases in income lead to increases in consumption which is expected lead to an improvement in the standard of living and this in turn has to an impact on health. Therefore studying the interrelation between health and income is important.

Income is affected by a number of variables (factors), this can be shown in the following functional relationship:

\[ Y = F (z_1, z_2, z_3, \ldots, z_n) \] \tag{1}

\( Y \) stands for income.

\( z_1, z_2, \ldots, z_n \) are the variables that affect income.

In this study factors that affect income are hypothesized to be the following:

\( z_1 = \) The number of household members.

\( z_2 = \) Number of the household members infected with kala-azar and number of household members infectd by other diseases, which can be taken together as ratio (both are diseases).

\( z_3 = \) Number of children in the household under 1 year of age.

\( z_4 = \) Stands for wealth which is approximated by the money value of assets owned by the household (animals and land plots).

\( z_5 = \) The Kala-azar health status of the household head.

These factors can be represented as \( z_1, z_2, z_3, z_4 \) and \( z_5 \) (independent variables) respectively.
\( z_d = \) (stands for a dummy variable).

Assuming linearity the model can be represented as:

\[
Y = b_0 + b_\zeta z_\zeta + b_D z_D + b_d z_d + e \quad \text{------------- (D)}
\]

\( b_0 = \) stands for constant.

\( (b_\zeta, b_D, b_d, b_d) = \) stands for coefficients.

\( e = \) stands for random error term.

Applying the field data in the model, if \( z_\zeta, z_D, z_d, z_D \) and \( z_d \) change by one percent, then income would be changed by \( b_\zeta \) in \( z_\zeta \), \( b_D \) in \( z_D \), \( b_d \) in \( z_d \) and \( b_d \) in \( z_D \).

| Table (D'→D) Regression Results (z_\zeta, z_D, z_d, z_D, z_D) |
|---|---|---|---|---|---|---|
| y | Coefficient (estimates) (\( \tilde{\zeta} \)) | Std. Err. (\( \tilde{D} \)) | T (\( \tilde{D} \)) | P > t (\( \tilde{D} \)) | R^2 (\( \tilde{D} \)) | Prob > F (\( \tilde{E} \)) |
| Constant | \( \tilde{E},\tilde{C},\tilde{E},\tilde{D} \) | \( \tilde{e},\tilde{C},\tilde{e},\tilde{D} \) | \( \tilde{E},\tilde{e},\tilde{E} \) | \( \tilde{C},\tilde{C},\tilde{C} \) | \( \tilde{C},\tilde{C} \) | \( \tilde{C},\tilde{C},\til{C},\til{C} \) |
| \( z_\zeta \) | \( \tilde{D},\til{D},\til{D},\til{D} \) | \( \tilde{c},\til{d},\til{d},\til{d} \) | \( \tilde{D},\til{D},\til{D} \) | \( \tilde{C},\til{C},\til{D} \) | \( \tilde{C},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) |
| \( z_D \) | \( \tilde{E},\til{C},\til{C},\til{C} \) | \( \til{d},\til{d},\til{d},\til{d} \) | \( \til{D},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) |
| \( z_d \) | \( \til{d},\til{d},\til{d},\til{d} \) | \( \til{C},\til{C},\til{C},\til{C} \) | \( \til{D},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) | \( \til{C},\til{C},\til{D} \) |
| \( z_D \) | \( \til{C},\til{C},\til{C},\til{C} \) | \( \til{C},\til{C},\til{C},\til{C} \) | \( \til{C},\til{C},\til{C},\til{C} \) | \( \til{C},\til{C},\til{C},\til{C} \) | \( \til{C},\til{C},\til{C},\til{C} \) | \( \til{C},\til{C},\til{C},\til{C} \) |
| \( z_d \) | \( \til{E},\til{E},\til{E},\til{E} \) | \( \til{e},\til{e},\til{e},\til{e} \) | \( \til{E},\til{E},\til{E} \) | \( \til{C},\til{E},\til{E} \) | \( \til{C},\til{E},\til{E} \) | \( \til{C},\til{E},\til{E} \) |

Coefficient = stands for parameters.

Std. Err = stands for standard Error.
\( T = \) stands for (t.statistic).

\( R^{\hat{b}} = \) stands for the coefficient of determination.

Prob > F = stands for probability value of (F. statistic).
Discussion of the Results:

Here below is the result of regression:

\[ y = 6028,129 + 504,862 z_1 - 0,106 z_2 - 563,865 z_3 - 664,408 z_4 - 3 z_5 \]

Statistically speaking, when the probability value of result is less than 0,05, the result will be significant and when it's greater than 0,5 it is not significant.

The probability values emerge from equation (3) for the (t. statistic) are respectively as follows

(0,400, 0,440, 0,412, 0,807, 0,036), see column (4) table (4,31). The first and second results are significant. This means that there is a significant effect of number of household members on income. Thus the relationship between (z_1 and y) could be described as positive as the number of people in the household increases, income also increases.

This result coincides with both observation and interviews of the field survey, that is the bigger the size of the household, the greater the income because in the study area production critically depends on the size of labour force.

Another result found by the study is that, the ratio of patients infected by kala-zar or other diseases (z_2) on income is found to be negative. Thirdly the relationship between income (y) and number of children under 0.1
years ($z_d$) is also negative the probability value of ($z_d$) is ($\hat{C},\hat{D}$) is greater than ($\hat{C},\hat{D}$).

Fourthly the relationship between income ($y$) and wealth of the household ($z_d$) is negative. This result contradicts economic theory, because the increasing of wealth leads to an increase of income and vice versa. The probability value of wealth is equal to ($\hat{C},\hat{D}$) this means that there is no significant effect between ($z_d$) and ($y$). The result is agrees with the observation that, people in the study area own wealth for goals away other turn investment, hence it can not contribute to improving their living standards. Finally the study shows that, the relationship between health status of the household (infected) and income is negative, this result is true and logical in the sense that, income will decrease when the head of the household is infected. Then if the head of the household is infected or not this has no significant effect on income.

Looking at the table $\hat{D},\hat{d}$ again, $R^2$ (the coefficient of determination) in equation ($d$) is equal to $\hat{C}$$\hat{D}$%. These percentage is very low, because other variables contributed $\hat{d}$, this means that the variables of the model do not determine income alone.

Over all model is significant since the probability value of (F-statistic) is equal to ($\hat{C},\hat{D}$)

Estimation of equation ($d$) shows shortcoming resulted in the high values of the coefficient, moreover the relationship between income ($y$) and
wealth (\(z_d\)) is not consistent with the economic theory, that might make the model suffers from a problem of heteroscedasticity.

To overcome the above problem, we regressed the value of the logarithms of the variables on the logarithm of income

\[
\log y = \hat{e} + \hat{c}_d + \hat{c}_{\delta} \hat{z}_\delta - \hat{c}_\delta \hat{z}_\delta + \hat{c}_D \hat{z}_D + \hat{c}_e \hat{z}_e - \hat{c}_e \hat{z}_e - \hat{c}_d \hat{z}_d
\]

To overcome the above problem, we regressed the value of the logarithms of the variables on the logarithm of income

\[
\log y = \hat{e} + \hat{c}_d + \hat{c}_{\delta} \hat{z}_\delta - \hat{c}_\delta \hat{z}_\delta + \hat{c}_D \hat{z}_D + \hat{c}_e \hat{z}_e - \hat{c}_e \hat{z}_e - \hat{c}_d \hat{z}_d
\]

The probability values for (t-statistic) emerge from equation (D) above are respectively represented as follows: \(\hat{c}_d\), \(\hat{c}_{\delta}\), \(\hat{c}_\delta\), \(\hat{c}_D\), \(\hat{c}_e\), \(\hat{c}_E\). The first value \(\hat{c}_d\) is significant where the coefficient is less than its counterpart in equation (D) and the relationship between income (y) and \((z_\delta, z_D, z_e, z_D)\) coincides with economic theory.

The above model equation (D) serves the objective of this study, though this model in not theoretical evident, it serves the purpose of this study. Further studies might study this model in more detail. Other variables-not explicit in the model-may operate to affect income and make \(R^2\) more conforms with the results obtained from equation (D) and (D).

Although the whole estimation of parameters in equation (D) and (D) are significant, this significance does not determine by neither health status, nor household size but by other non-mentioned varibles. There is a need
for further information to resolve this deficiency but due to the fact that
time allowed is limited and the research itself is partial and the distance
where this study is taken place is far remote in addition to the financial
problems, that additional information would be a matter for future task.
CHAPTER FIVE
Summary, Conclusions & Recommendations

Summary:
This research is conducted, as an attempt, to study the economic impact of kala-azar, and it is mainly an exploratory one hoping to pave the way for further studies.

The study revealed that 58%, 5% by mothers, 4% by sons and 6% by others (i.e. grand fathers, grand mothers, uncles). This indicates that males generally are the heads of the household in the area. It is known that when the household head is under infection of kala-azar or any others diseases such affects the income of the household and affect the consumption as well. However the study showed that infection or non infection of the head of the household does not affect the income. This can further mean that, the household is not the only
money provider, others members in the household are also contribute. This leads to increase the income of the household.

The study showed that there is positive relation between the number of the members in the households and income, the more the number of the members, the more income, the more consumption. Such positive relation leads to the improvement of living standard of the household.

The literacy rate in the area is very low, being caused by absence of formal schools. Recently, the population of the area became aware of the importance of schooling, they now-a-days come to know the linkage between schooling and living standards. This is reflected in their demand for new schools to be built, health units, in addition to pure drinking water. Analysis showed ٤٧،٧٪ of household heads were educated in normal education (Khalwa) and ٥٢،٣ were illiterate, with
these it is clear that education level is very low, mainly because informal education (traditional schools) usually does not help develop working skills. A commonly accepted view that, education has effect in life in general and environmental health of the household and the community as the whole, because its through education that a person becomes aware of the danger of the diseases.

Regarding the relation to marital status, the analysis showed that ٠٩،٤٪٤headed of the households are married, ٧،٤٪٤are divorce; ٣،٦٪٦are singles and ٣،٦٪٦widows, with fact reference to the married group we can fairly conclude that there is stability in the household.

As known, income affects the rate of consumption, food, housing, sanitation, medical care, education would come to lead these items in their link with health. kala-azar through attacking immune system causes disability and disability, this affects the
income level. The study revealed that there is an inverse relation between the number of children below ĉČ years of the age and the income of the household, the more the number of the children below ĉČ years in the household, the less the income, and the reverse is true. The study showed that ĕ Đđ Ė of the infected children died of the disease, due to their poor health.

In analyzing the results Đ Đđ Ė of the population infected by kala-azar, out of these Đ đ Ė were children aged ĉ - ĉ Č years, because of the fact that children are more likely to infect by the disease because of nutritional status, Đ Đ Ė of infected people were belonging to the age group ranging between ĉ ĉ - ĉ Ė, those ranged between ĉ Ė - đ Č years were found to be ĉ Đ Ė and only đ Ė of the population
from the age group between \(\text{d}^\text{c}\text{- E}\text{C}\) years. From these points we can say that the highest infection rate is corresponding to the lowest age \(\text{C}^\text{c}\text{- C}\text{C}\text{C}\) years flowed by the next age group \(\text{C}\text{C}^\text{c}\text{- C}\text{E}\) years and the lowest percentage response to highest age group.

Based on the fact that rural people are highly dependent on children as labour force specially in agricultural activities we can easy find links between infections and age on one hand and between age and income on the other hand.

Further analysis of the data showed that the infection rate among males is greater than among females (\(\text{d}\text{D}\text{E}^\text{d}\text{- D}\text{E}\text{E}\)) respectively, being known that in this study, most of households were headed by males. It’s more likely that males be highly affected. The study pointed to the fact that \(\text{d}\text{d}\text{E}\) of the dead are males, versus \(\text{D}\text{E}\text{E}\) who are females. In
comparing the same figures we can say that kala-azar causes very big economic, social, psychological problems

Hospitals and others health units are found to be located far away from villages, where the study is conducted, on average the nearest health units is about 2 kilometer far away from Umsalala which contribute 87,3% of the total households subject to study and for the other village Mushra Koka which contributes by 12,7% on average 4-7 kilometer to reach the nearest health units. Means of transportation in the area are few, irregular, 24,2% of the households from time to another they use local buses, 43,9% they use the traditional transportation donkeys and 22,9% go on foot, this is in summer. During the rainy season transportation becomes difficult, local buses
usually stop and most people become difficult to them to reach health units. The only way is on foot, ēē,ĒĒ of households depend on it.

To get relieved from kala-azar disease it takes ĎĒ to ďČ days. During this period both the infection and any of his relative accompanying or taking care of him both are losing their time this lost time can be economically calculated. The lost time is the opportunity cost that can be used in agricultural work. Results to question relating to the patient and co-patient showed that ĎĒ,ēĒ of the co-patient were fathers, ĎĎ,ĎĒ were mothers, others were ČĎ,ČĒ. this means that a round ĖČÊ of the co-patients were either fathers or mothers. Parents are usually the most active persons within the household and they are the real labour force thus wasting time as co-patient would keeps them out of the protection
process. The study showed that majority of the households are labours, average income is $2094$ S.D per person per month. In case of infection $52\%$ of these income is lost.

Kala-zar is characterized by an irregular fever which is quite similar to the symptoms of malaria. It is for this reason, added to it, the fact that hospitals and health units are located far away from the villages under study, the cost of transportation represents $3.5\%$ of the average of income. Moreover, in autumn there is always difficult in transportation. These facts together make households without referring to health units they take the drugs for malaria. Results of the study showed that $51.7\%$ use the malaria drugs for more than one month, $41.5\%$ use the drugs for one month, $21.2\%$ use it for three and two weeks and $72.7\%$ use it for one week, this
means that (٢٤٪) used the drugs of malaria, for two weeks and more. Results of questionnaire showed that on average weeks lost in treatment of malaria is equal ٢٤٪ cost per case (using the average number of weeks lost in malaria treatment ٢٤٪ = ٢٤٪ cost per case). Average cost of malaria treatment per case is equal to ٢٤٪ S.D (using the average cost of malaria treatment in one week is equal to ٢٤٪ S.D (٢٤٪ = ٢٤٪ S.D per person). This figure represents ٢٤٪ of the average income of the household per month.

On average three members per household in the study area were complaining of symptoms related to V.L. that means ٢٤٪ of income per month was used for malaria treatment. It is shown that a very
high percentage of the income is lost due to wrong usage of drugs of malaria instead of kala-azar. From the observation in the area of the study Umsalala & Musha Koka are considered to be among the poorest areas of the Eastern Sudan, Elrrahad province, this leads to the fact that food is poor and does not give the necessary protection from the disease. It is known that infection of kala-azar beside the fact that it has relation to the particular environment has close linkage to poverty as well.

**Conclusion:**

- The study found significant effect on income when taking the ratio of infected members of household to the other diseases infection, and this can be denoted by the positive relation between \( z_6 \) and \( (y) \).
- Reference to opportunity cost of time, the average income decreased by \( \%52 \) as the result of infection.
• Wrong diagnoses will lead to the decreasing of the average income by almost 0.01, of course wrong usage of drugs will be included here.

• And finally cost, of transportation had a decreasing effect on income by 0.05, and overall effect of the infection will be exaggerated by 0.07 of labour out of activity as the result of their status as being co-patients.
Recommendations:

In light of this study it is recommended that:

- The multi disciplinary studies including social, economic environmental and psychological studies to evaluate the overall situations in the area are needed.
- People should know that food is the cornerstone of health specially when fighting immune system diseases.
- More efforts are needed to control VL particularly by modern methods of control.
- More efforts are needed in the field of health education regarding kala-zar using simple and available methods.
- Construction of specialized hospitals in the towns and to be connected with health centres scattered throughout the endemic areas.
- Contribution of governmental and non-governmental organization (NGOs) is very
important to work together to control this disease and other outbreaks.

• For Kala-azar in order to avoid doubling the cost treatment, patients should have pre-diagnosis for any symptoms that are similar to Kala-azar.
This questionnaire is designed to collect data about Kala-azar for thesis submitted in partial fulfillment of the requirement of the M.Sc, Degree (Economics)

SECTION ONE:

1/ Village .................................................................

Tribe:

- Masalit
- Hausa
- Others

House number ........................................................................................................

Name of head of the household .............................................................................

- Age.................................................................................................................
- Marital Status
  - Married
  - Divorced
  - Widowed
- Educational level:
  - Illiterate
  - Informal-School ‘Khalwa’
  - Primary
  - Secondary
- Graduate
- Postgraduate

Occupation:

- Government or private employee
- Labourer
- Merchant
- Farmer
- Others

Name of Mother:....................................................................................................

- Age.................................................................................................................
- Marital Status
  - Married
  - Divorced
  - Widowed

Educational level:

- Illiterate
- Informal-School ‘Khalwa’
- Primary
- Secondary
Δ- Graduate  Ε- Postgraduate
- Occupation:
  ١- Government or private employee   ٢- Labourer
  ٣- Merchant   ٤- Farmer   ٥- Others

- Name of household head

- Sex : ١- Male   ٢- Female

- Age........................................................................................................................................

- Marital Status
  ١- Married   ٢- Divorced   ٣- Widowed

- Educational level:
  ١- Illiterate   ٢- Informal-School ‘Khalwa’   ٣- Primary   ٤- Secondary
  ٥- Graduate   ٦- Postgraduate

- Occupation:
  ١- Government or private employee   ٢- Labourer
  ٣- Merchant   ٤- Farmer   ٥- Others

- House members: ..............................................................................................................

- ١/ Name:.........................................................................................................................

- ٢/ Sex.........................................................................................................................

- ٢/ Age.........................................................................................................................

- ٢/ Educational level......................................................................................................

- ٢/ Occupation: ..............................................................................................................

- ٢/ Relationship with head of the household..............................................................

- ٣/ Name:.........................................................................................................................

- ٣/ Sex.........................................................................................................................

- ٣/ Age.........................................................................................................................

- ٣/ Educational level......................................................................................................

- ٣/ Occupation: ..............................................................................................................
- Relationship with head of the household ............................................

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- Sex: ........................................................................................................
- Age: ....................................................................................................... 
- Educational level: .................................................................................
- Occupation: ..........................................................................................
- Relationship with head of the household: .............................................

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- Sex: ........................................................................................................
- Age: ....................................................................................................... 
- Educational level: .................................................................................
- Occupation: ..........................................................................................
- Relationship with head of the household: .............................................

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- Name: ......................................................................................................
- Sex: ........................................................................................................
- Age: ....................................................................................................... 
- Educational level: .................................................................................
- Occupation: ..........................................................................................
- Relationship with head of the household: .............................................

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- Name: ......................................................................................................
- Sex: ........................................................................................................
- Age: ....................................................................................................... 
- Educational level: .................................................................................
- Occupation: ..........................................................................................
- Relationship with head of the household: .............................................

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- Name: ......................................................................................................
- Sex: ........................................................................................................
- Age: ....................................................................................................... 
- Educational level: .................................................................................
- Occupation: ...........................................................................................
- Relationship with head of the household

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- Educational level................................................................................
- Occupation: ........................................................................................
- Relationship with head of the household

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- Occupation: ........................................................................................
- Relationship with head of the household

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- Occupation: ........................................................................................
- Relationship with head of the household

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- Age......................................................................................................
- Educational level................................................................................
- Occupation: ........................................................................................
- Relationship with head of the household

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- Name:...................................................................................................
- Sex.............................................................................................................................
- Age............................................................................................................................
- Educational level.................................................................................................
- Occupation: ........................................................................................................
- Relationship with head of the household..............................................................

Family income per day ..............................................................................................

Other source of income

- Pension
- Rent
- Assistant
- Others

Material of house building

- Mud
- Break
- Others

Number of rooms:

- One
- Two
- Three
- More than four
Do you have:

<table>
<thead>
<tr>
<th>Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathroom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W.C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer fence</td>
<td></td>
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</tr>
</tbody>
</table>

How many household of domestic animals:
- Goats
- Cows
- Sheep
- Others

Do you own any of the following devices:
- Radio
- T.V
- Refrigerator
- Others

Estimate your own land: .................................................................

You are cultivating own the land?
- Yes
- No

For cultivation purposes, do you need additional areas:
- Yes
- No

What are the major crops usually cultivated:
- Sesame
- Millet
- Sorghum
- Vegetable
- Fruits
- Others

What method do you use in preparing land for cultivation:
- Mechine
- Animals
- Both (and)

Does the family on any of:
- Mechine
- Animals
- Both (and)

How many sacks you own in this season: ...........................................

How many at the last season...........................................................

Average harvest output during the last three years..........................

SECTION TWO:
Health care and surrounding environment
From where do you regularly received medical care
People’s pharmacy  Shop  Others

How far is the place from which you receive care: ..............................................

Means of transportation:

In summer:

- On foot  - Public trucks  - By donkey  - Others

In autumn:

- On foot  - Public trucks  - By donkey  - Others

Has any of your family’s members experienced illness during the last three weeks:

- Yes  - No

If yes, what kind of illness and how did long it last ...........................................

Source of treatment

- Prescribed by Doctor  - Herbal medicine  - Self prescribed  - Others

How much it costs ........................................................................................................

Who shoulder the cost of treatment ........................................................................

How do you get the cost of treatment ........................................................................

- Privetly financed  - Borrowing  - Selling assets  - Social fund  - Others

SECTION THREE:
Knowledge and awareness about KAla-azar:

Degree of knowledge about Kala-azar:

- Non  - Little  - Much  - Very much

Means of awareness about the disease

- Before being infected  - When being infected

- After being infected  - One of family members infected  - Others
How many doses of malaria treatment you received before checking diagnosis
Time since last treatment for malaria

- Non
- A week
- Two weeks
- Month
- More that month

How much treatment of malaria costs

Do you think that Kala-azar transmitted via touching

- Yes
- No

Do you think that Kala-azar transmitted via some types of foods

- Yes
- No

Which means do you use to protect your family from Kala-azar

- Mosquitonet
- Stop eating some types of food
- Others

Source of medicine

- People’s pharmacy
- Shop
- Others

The usual method of treatment usage

- Prescribed by Doctor
- Herbal medicine
- Self prescribed
- Others

Do you have had full doses of treatment

- All
- Partial

Do you prefer to have your patient being treated in hospital

- Yes
- No
Do you stay in the hospital for the required period

- Yes  
- No

How does a patient of Kala-azar get recovered

- Completely  
- Partially  
- Not recover

Do you have the treatment free of charge

- Yes  
- No

If you were to pay how much it costs

Who is going to shelter the cost

- Privately financed  
- Borrowing  
- Selling assets  
- Social fund  
- Others

Estimate the treatment cost of transportation

Information about the co-patient

- Sex
- Age
- Educational level
- Occupation

Kala-azar infected patients ‘current and on the past’

<table>
<thead>
<tr>
<th>Viable</th>
<th>Sex</th>
<th>Age</th>
<th>Education level</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current infectors</td>
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<tr>
<td>Infected and dead</td>
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<tr>
<td>Infected but recovered</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Not recovered</td>
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<td></td>
</tr>
</tbody>
</table>
Is there any infected person who lives with you and not member of the family
- Yes  - No

If yes what is his relation to the family ....................................................

Is the infected person from or outside the area ............................................
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