EPIDEMIOLOGICAL AND SOCIO-ECONOMIC STUDIES OF ONCHOCERCIASIS IN BALI AND TAKUM LOCAL GOVERNMENT AREAS, TARABA STATE, NIGERIA.

BY

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DECLARATION

I hereby declare that the work reported in this thesis was carried out by me under the careful supervision of Dr. I.H. Nock, Department of Biological Sciences, Dr. M. Galadima, Department of Microbiology, and Dr. A. Kolowole Center for Social and Economic Research.

No part of this work has been submitted for any degree or qualification before. The works of other workers referred to during this work are duly acknowledged.

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CERTIFICATION

This thesis entitled "Epidemiological studies and Socioeconomic effects of onchocerciasis in Bali and Takum Local Government Area of Taraba State, Nigeria" by Miss Puna-riman Ripiye meets the regulations governing the award of the Degree of Masters of Science of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

To my late sister Arisim Ripiye Adegoroye

and

To my Parents Mr. and Mrs. Ezekiel Ripiye.

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ABSTRACT

A study was undertaken in ten communities of Bali and Takum Local Government Areas (LGA) of Taraba State to examine the prevalence of onchocerciasis together with its accompanying socioeconomic effects.

A total of 934 persons were examined for onchocerciasis by skin snip for the presence of Onchocerca volvulus microfilariae and by clinal signs such as nodules, leopard skin and blindness. Two hundred and sixty nine (269) household heads were administered questionnaires for the purpose of evaluating their responses with respect to knowledge and perception of both the disease (onchocerciasis) and the blackfly Simulium vector plus the associated social, and economic effects-

The overall prevalence of onchocerciasis in the study area was 46.92.$ frontline communities were generally hyper endemic in nature. Infection increased with age and was higher in men (34.67.) than women (13.87.) Nodules, leopard skin and blindness were found in .19.67., 5.47. and 4.5% of those examined respectively.

Majority (62.47.) of the respondents identified the blackfly sample shown to them;; 59.6% described it as a wet season breeding and bitting pest that is associated with rivers (73.9%), bites mainly in the morning hours (48.47.) and disturbs farming activities (53.7%) by way of reducing the time spent on the farm (80.97.) and forced people to migrate (15.4%). Suprisingly, only 6.4% of the respondents associated the fly with disease.

Blindness was associated with disease (27.9%) or spirits (13.6%) or enemies (10.8%) or largely to an unknown cause (38.7%). Majority (74.2%) of those who associated blindness with disease described the disease in such a manner that could be ascribed to onchocerciasis.

Onchocerciasis related effects such as body itching largely disturbed outdoor recreation (30.7%)$_p$ fishing and farming (23.6%) sleep (20.4%) and caused social/psychological discomfort (15%). Dermal changes such as leopard and lizard skins were seen as disfiguring the skin (48.2%) and causing social/psychological discomfort (23.5%) and equally discolouring of the skin (23.5%). Weakness of the body reduced farming strength (55%), and general ability to work (36.4%) and furthermore retarded mental ability (8.5%). Nodules caused disfiguration of the body (48.0%) and social and psychological discomfort (39.0%). Majority (37.1%) of the respondent agreed that scrotal enlargement affected sexual interaction, caused social/psychological discomfort (28.6%) and obstructed movement (22.8%) to the extent that farming activity was reduced (11.4%). The terminal stage of onchocerciasis i.e. blindness, reduced family income (24.3%), caused incapacitation (21.6%), and reduced crop output (17.1%) such that the blind felt a social and economic burden to their families (52.3%), disabled (31.5%) and dejected (9.9%). The burden of care rested on their household (64%) and to same extent the community (18.9%) and themselves (17.1%). Most blind persons preoccupied themselves with begging (34.2%) or weaving (26.1%). Regrettably., some remained idle (22.5%).

This study has thus revealed that both onchocerciasis and its transmitting vector constitute a major health, social and economic problem to the people of Takum and Bali.

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CHAPTER ONE

1.0 INTRODUCTION

Onchocerciasis (River blindness) is a disease associated with dermal abnormalities and ocular complications that eventually lead to blindness.

The disease has grown in importance as one of the major tropical disease that needed to be controlled (WHO., 1985).

The disease is widespread in Africa (Jamback, 1976) Yemen-Arab Republic (Garms, 1982), South America (Hamon, 1974) and Mexico (Davies, 1974). The flies breed in fast flowing streams or rivers and hence the disease is concentrated in areas along water courses hence the name "river-blindness" (WHO, 1985).

Ninety (90) million people world-wide are at risk of contracting the infection, but about 20 million are actually infected of these 300,000 are blind. In Nigeria 40 million are emposed and 7 million infected with about 100,000 blind (WHO, 1991).

The socioeconomic effects of onchocerciasis in Africa is particularly disturbing because blindness affects man at productive age leading to low crop output, hunger and malnutrition (Anonymous, 1978). The desertation of fertile agricultural lowland areas due to the disease leads to depopulation, disruption of social life and demographic imbalance (Hunter, 1972; Bradley, 1976; and Waddy, 1976). Migration to less fertile uplands areas as the result of the disease causes over-population and over ultilization of limited farmlands. This generally hampers economic development.

(Hunter, 1972; Philippon, 1977 and Philippon and Garms, 1978). Other effects include sterility and abortion (Budden, 1956).

In Nigeria, the disease was first reported by Parson (1909), thereafter a number of research work largely on the prevalence of the disease have been reported. Work on the socioeconomic aspect of the disease are relatively scanty and only a crude evidence exist on the disease effects on land, labour supply, emigration and social aspects (Bradley, 1976; Edungbola, 1982; Nwoke, 1990; Amazigo, 1993). Detail empirical studies on the magnitude of socio-economic effect due to onchocerciasis have not been reported. It was on basis of these reports that the on-going control programme, by ivermectin therapy, is being piloted.

There is the need to examine the impact of onchocerciasis socioeconomically by way of detailed studies in this regard. Results of such studies will not only provide with a vivid picture of the havoc caused by the disease, it will also serve as a score board on which the success of the on-going ivermectin control programme will be measured.

As a step towards achieving this goal, this study focuses on Taraba State, a state endemic for onchocerciasis (Uchay, 1982; Akogun, 1991, Akogun, 1992). The objectives of the study would be to:

(i) Evaluate the current prevalence and manifestation of the disease in some selected communities.

(ii) Examine the belief, perception and attitude of the people towards both the disease and the vector blackfly.

(iii) Study the effect of both the disease and the blackfly vector on the social and economic activities of the people.

It is hoped that the accomplishment of this study will lead to the understanding of the effects caused by onchocerciasis on the social and economic well being of the studied population and permit assessment of the desirability of the on-going control programme.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 ONCHOCERCIASIS

2.1.1 Causative and Transmitting Agents

Human onchocerciasis, a dermal and ocular disease, is caused by a phasmid filarial nematode worm, Onchocerca volvulus, which belongs to the family filaridae (Soulsby, 1968; Chitwood and Chitwood, 1974). The transmitting agents are insects of the genus Simulium (Blackfly: Simuliidae) which breed in fast flowing streams and rivers (Crosskey, 1981). The association of the insect fly with rivers gave rise to the name "riverblindness" by which the disease is popularly known (WHO, 1985). Simulium damnosum s.l, S. neavei and S. ochraceum are the major transmitting agents in tropical Africa, East African region and Southern America respectively (Jamback, 1976; Crosskey, 1981).

2.1.2. Transmission

The transmission of the parasite is associated with the feeding habit of the vector Simulium flies which feed on a wide variety of vertebrate animals (including man) and birds (Crosskey, 1973). Adult worms of Onchocerca volvulus produce millions of young worms, microfilariae, which migrate to the skin. During the process of blood feeding, the female Simulium fly tears the skin resulting in the creation of a pool of blood in which microfilariae (mff) migrate into. The fly encouge blood along with mff which subsequently move to and develop in the thoracic muscles of the fly as infective

larvae. The infective larvae migrate into the head region and may be transmitted to a susceptible host during a blood meal. Uptake and transmission of Onchocerca volvulus is facilitated by the long engagement time associated with fly feeding on a host.

2.1.3. Factors affecting transmission

The biting density of the blackfly in a particular area is affected by season (Nock, 1985). In tropical Africa and Southern Mexico, vectors of onchocerciasis bite mostly in the wet and dry seasons respectively (Crosskey, 1957, 1973). River water level, temperature, velocity, hydrogen ion content, amount of organic substances and the concentration of dissolves salt influence the development of the immature stages of Simulium (Garms, 1973; Grunewald, 1981). and invailably the biting density of the fly and the subsequent transmission of onchocerciasis.

The numbers of infective bites received by man in a unit time (infective biting rate) and the total number of infective flies per unit time (transmission potential) determine the degree of infection (Duke, 1968; Phillippon, 1977, Garms, 1978, Walsh, et al 1981). Many factors affects the infective biting density and the transmission potential such as the life span of the flies, their ability to support development of O. volvulus, their degree of zoophily, size of human population and human population reserviour for microfilariae (Duke, 1968). The development of microfilariae to infective stage is more ensure with the prolong longevity

of the infected fly while the preference to bite animal rather than man account for a low fly biting density on man (Garms, 1978).

2.1.4. Distribution

Latin America

The discovery of onchocerciasis in latin America was first made in Guatemala by Pacheco-Lun (1978) and Robles (1919). This was followed by a report of the situation in Mexico (Hoffman, 1930). Further discovery of the disease were also found in Venezuela (Lewis 1956, and in Columbia (Nelson 1970).

Arabian Peninsula

Onchocerciasis is endemic in the Taiz and AlBarh regions of Yemen (Merighi and Panienello, 1969; Garms and Kerner, 1982; Anderson and Fulsang, 1983).

Africa

Onchocerciasis has been reported in many African countries. In East and South Africa, comprising of Zaire, Uganda, Tanzania and Kenya, Browne (1976), Jamback, (1976), Brown, et al (1989) and Kipp, et al (1992), reported that Simulum damnosum s.l. was the major vector of onchocerciasis. It is also the vector in Ethiopia and Sudan in North Africa (Hasseea Satti and Sheriff, 1962; Kebede, et al 1993) and in West Africa, especially in the Savanna area of Volta Basin comprising parts of Benin, Ghana, Mali, Niger, Togo and the whole of Burkina Faso. At least one million are

suffering from onchocerciasis out of which 100,000 have serious eye manifestations including 35,000 already blinded (WHO, 1991).

Nigeria has the highest number of infected individuals, approximately seven million, with 113,000 blinded by onchocerca volvulus. Published figures by WHO, (1992) showed that 40% of all infected Africans and approximately one third of onchocerciasis blinded cases live in Nigeria. Gemade and Dipeolu (1981) recorded onchocerciasis prevalence of 61%, 72%, 71% among the Tivs of Kuke, Mano and Gube respectively in Benue State. Amazigo (1982), reported prevalence of 50% in Adeni, Oji River and Udi in Anambra State. In Kaduna State, prevalence rate of 37.2%, 28.6% and 0.53% was recorded in Kudaru, Piti and Kagoro respectively (Amuta, 1982). Uchay (1982) summarised the prevalence of onchocerciasis in 6 states in Northern Nigeria. Borno and Kwara States had 0.12% and 0.39% respectively while Plateau and Kaduna states had the highest rates of 8.13% and 6.14% respectively. Gongola and Benue state recorded 3.28% and 3.21%. In Kwara State, Edungbola (1982) reported 64.2% prevalence in 8 Local Government Areas. Edeghere et al (1992) reported 0.37% prevelence in 5 L.G.A. in Katsina State. Nwuliri and Payne (1992) found 28.2% infection in Lame district of Bauchi State and 7.5% of the infected people were totally blind. The prevalence in Taraba state was reported by Akogun and Nwuliri (1991). They recorded high mean microfilariae rate density reaching up to 169.2 per skinsnip in the Taraba valley. Also in the same area, out of the 14 communities

examined, blindness rate exceeded 20% in six communities, with one community recording 71.9% and visual impairement exceeded 16.1% in the whole community (Akogun, 1992). Also in Bali district, Akogun (1994) recorded 13.3% prevalence rate.

In the Southern part of the country, the disease is endemic around Lokoja where the history of the disease was traced to in 1909. Odetoyinbo (1980) in his investigation found that onchocerciasis occurred in Ife-Ijesha and Owena zone and extends to Oshogbo Abeokuta region. In their investigation, Braide (1982), Ezike (1982) and Iwuala (1982) reported that out of 3,039 patient examined in Rivers State, 19% were habouring the filaria worm. Amazigo (1982) reported that the prevalence of microfilaria in skinsnips increased progressively with age in Adeni, Oji river and Udi area of Anambra State. In Oyo state, Ogunba (1982) reported a 48.8% prevalence in Ibarapa division. Mafiani (1992) recorded a prevalence of 55.3% in Ugbo-Owa area of Bendel State. Also Davan and Ezigbo (1992) reported the prevalence rate of 50% and 98% from Egbe in Ogofa L.G.A., Cross rivers state and Etteh in Igboeze L.G.A. in Anambra State respectively.

2.1.5 Geographical variations

Onchocerca volvulus is not a uniform species. Biological variants of the parasite exist each having its own inherent biological properties which determine the severity and the clinical manifestations of the disease in man. Brumpt (1991) noted striking differences in the epidemiology of onchocer-

ciasis in Central America and Africa. The African form of onchocerciasis is more associated with blindness than the American type. Studies by Deleon and Duke (1966) suggested that the Central American and African parasites are distinct strains. There are also differences in the clinical and pathological process of the disease in Africa suggesting that variants of O. volvolus exist. By this, the savanna and forest forms of the parasite, vector and disease exist in West Africa (Nelson, 1972). Similarly, in West and Eastern Africa, there exist marked differences in the clinical manifestations of onchocerciasis.

The disease is characterised by mild skin lesions in the western hemisphere. Head nodules are common and there is high risk of ocular complication in Guetemala ocular infections are less risky in Venezuala and South America. (Duke, 1974). Blackened skin lesion of Sowda and enlarged femoral glands is associated with the disease in Yemen Arab Republic (Merighi and Parrinello, 1969, Duke, 1974). In the savannah zone of West Africa high endemicity is associated with ocular onchocerciasis. Blindness rate range from 10 - 20%. Nodules, skin and gland lesions are less common, but there is high microfilarial densities (Nelson, 1970; Anonymous, 1973, Anderson and Fulsang, 1974).

2.1.6 Pathogenesis and pathology of onchocerciasis

It is generally agreed that the presence of microfilariae in the skin causes ocular and dermal abnormalities (Nelson, 1970). This results from the toxic effect and host immunological reactions to dead microfilariae of O. volvolus.

Eye Lesions

The eye lesions are the most serious consequences of onchocerciasis. They result from the invasion of different parts of the eye by microfilariae (Nelson, 1970). The severity is related to the number of microfilariae reaching the cornea. Punctate keratitis constitute the earliest lesions and this is followed by fibrous tissue invasion which produces a pannus which obliterates the lower part of the cornea (Thylefors, 1978; Nelson, 1981). Choyce (1966) reported that the microfilariae are usually attached to the Descement's member and this may caused physical damage leading to limbitis. Usually with an associated iridocyclitis and the production of a characteristic "Pummic stone" appearing in the iris in the lower anterior chamber, an hypopyon may be formed. Posterior synechiae develops, the pupil becomes fixed and coupled with posterior inflammatory fibrosis and overlying of exudeate in the lens, which results in complete blindness. (Nelson, 1970; Thylefors, 1978).

Ocular onchocerciasis is an accumulative disease and complications appear only after a certain number of years. The higher the rate of transmission, the earlier they occur. In certain hyperendemic areas, blindness appears between the ages of 30 and 39 years but may be earlier in some people (WHO, 1985).

Skin lesions

There are basically 3 stages involved in the development of skin lesions (Nelson, 1971).

The first stage is pruritis which may be accompanied by popular rash, intense itching and scratching. (Nelson, 1971).

The second stage is characterized by thickening of the skin due to intradermal oedema and the enlargement of lymph glands (Nelson, 1971). In central America, the patient may develop a condition termed "Erisipela de la costate" which usually affects the face and upper trunk (Nelson, 1970).

The last stage of onchodermatitis is the atrophication of the skin with loss of elasticity which make the patient look prematurely older than the normal appearance. Depigmentation is chronic feature associated with this stage and it is usually more pronounced on the shins. It usually leads to leopard skin and is associated with long standing of infection at sites readily exposed to the bites of blackflies (Fugulsang, 1983). Lizard skin is also associated with the last stage of infection that is the atrophic stage (Hughes and Daly, 1951; Duke, 1974).

Nodules

When adult onchocercal worms accumulate in the tissue, they give rise to subcutaneous nodules. A nodule may measure between 0.5cm - 10cm in diameter and may contain over 100 adult worms (Chandler and Read, 1961). They are located

around the hips and rip cage but may also be found on the head, legs and sometimes unusual sites like anus and mammae (Akogun, 1992). The nodules are usually distributed around the pelvis in the African form of onchocerciasis. Sometimes they are found over the illiac crest, trochanter of femur, sacrum, knees, lateral chestwall and spine (Nelson, 1971, Nwoke, 1991). In central America the nodules are mostly in the upper part of the body and in Venezuela the distribution is similar as in Africa (Kershaw, 1992).

Hanging groin scrotal enlargement and elephantiasis

In Africa the loss of elasticity in the skin gives rise to hanging groin. This condition results from immune reactions to antigens released from the microfilariae of O. volvulus. Consequently, the deposition of the immune complex in tissues, cause inflammation and fibrosis which lead to obstructive lymphadenitis (Nwoke, 1990) and finally hanging groin (adenolymphocele) and elephantiasis of the genitalia (which is common in adult males, Nelson, 1970). In women, genital distortion have been observed (Cherry, 1959). Most of the female patients in Africa have fullness in the femoral and inguinal regional regions exposing bilaterial onchocercal lymphadenomatous skin (Connor, 1985).

2.2 Diagnosis

There are various methods used for the diagnosis of onchocerciasis. This include the (a) Parasitological (b) Immunological test (c) Clinical and (d) Mazzottic tests.

2.2.1. Parasitological test (Skin snip)

Skin snipping is the definitive method of diagnosis (Duke, 1962). The technique involves snipping the skin; a 2mm bite of skin is usually taken from the illiac crest and scapular with the aid of a cornea scleral punch (Kale, 1984). The skin is placed in two drops of 0.85% normal saline on a slide or microtitre and left for one hour or more. A microscope is used to view and count the microfilariae (Kale, 1978; 1981).

However there are variations in the timing of the emergence of microfilaria, the size of the snipped skin and the body region from which the skin is snipped. Because of these, other variation applied by individual workers has made the comparison of epidemiological data difficult (Kale, 1981).

2.2.2. Immunological Test

Immunodiagnostic techniques are divided into two groups, intra dermal and serological methods. Firstly, there is a limitation in the supply of antigen and the problem of cross-reactivity which gives rise to false positive results.

2.2.3. Mazzotti test

Diagnosis by the mazzotti test consist of dosing a patient with 50mg of diethyl carbamazine which provokes itching. This is due to massive death of parasite. Occasionally patients with quite high densities of microfilariae in the skin show no reaction and Oomen (1967) found that the test is particularly unreliable in Ethiopia. Also

infection with other filaria worms may mimic the early stage of onchocercal infection and microfilaria which also occur in the skin can cause some confusion, but Duke (1968) maintains that the mazzotti test is negative in cases of streptocesciasis except with doses of more than 200mg.

2.2.4. Clinical diagnosis

The method is presently replacing skin snipping and other method because it is simple, low cost and requires no instrument. It is known usually as the rapid assessment method (RAM) (Pond, 1990). Certain manifestations like nodules, leopard skin and blindness are use to measure the endemicity level of the disease in a community (Dadzie et al, 1991). Ngoumou and Wash (1993) reported that in each community a sample of 30-50 males aged 20 years and over should be examined for presence of nodules. They further suggested that persons sampled should be engaged in rural occupations and should have been resident in the community for at least 10 years. Males are normally prefered because they are more expose to infection than females.

2.3. Control

2.3.1. Control of parasite

Chemotheraphy

This method is aimed at destroying the parasite in man. Several experiments have been undertaken in order to find an effective microfilaricide. Drugs like diethyl carbamazine citrate (DEC), Suramin and Benzimidazoles have been used for treatments but their use for mass campaign has not been

possible because of their toxicity (Le Berre, 1978).

Presently ivermectin is used for mass treatment. The earliest clinical trials showed that ivermectin treatment of onchocerciasis patients resulted in lower numbers of microfilariae recoverable from the skin. The treatment of human population with the drug affect transmission in two ways. Firstly, it lowers the microfilaria density in the skin of treated individual and this reduces the number of microfilariae available for the vector to pick up.

Secondly, the microfilariae taken from treated people might be defective and incapable of reaching the infective stage and infecting other human beings (Campbell, 1991). Studies in Liberia in the cause of phase II trials showed that after treatment of patient with ivermectin (200mg/kg), the microfilariae uptake by after six months of treatment was reduced (Cupp, 1986). At the same time, the number of microfilariae reaching their developmental site in the thorax of the flies was also reduced. The effect was also more pronounced in patients whose microfilaria load had been reduced by DEC therapy. These observation lead to the conclusion that ivermectin could be effective in interupting transmission of Onchocerca volvulus for epidemiological important periods of time (Campbell, 1991).

2.3.2. Control of the vector

Chemical method

The earliest chemical used for blackfly control was DDT; it was highly effective in eradicating vector simuliid

species in East Africa (Garnham, 1981). In Nigeria, DDT was used as larvicide for most of the years of control; the methods and effects of the scheme have been exceedingly well documented (Crosskey, 1958; Davies, 1963; Rodger, 1973). In the West African onchocerciasis control programme (OCP) area, larviciding is by use of Temephos (Abate R). When used in 20% emulsifiable concentrate at a dosage rate of 0.05mg/litre/10 minutes at high water level and 0.1mg/litre/10 minutes in the dry season, it produces a 100% mortality of blackfly larvae. The effect is identical whether the entire dose of the product is release over 10 minutes from a boat or in a single very brief discharge by aircraft provided that the total quantity of the product remains the same. (WHO, 1985)

Biological method

Under natural conditions, S. damnosum is infested by numerous parasites (Lewis, 1953; Jenkins, 1964). Presently Bacillus thumingiensis 11-14 is used to control the vector (WHO, 1990).

Ecological control

The reduction of rapids which consequently reduces the water velocity would constitute the definitive solution of the onchocerciasis problem (Le Berre, 1980). Hydrological changes can also be used in the control of blackfly. During the construction of hydroelectric facilities such as dams, environmental changes are clearly inevitable (WHO, 1985). Any sharp reduction in river levels prejudices survival of blackfly immature stages. Also any alteration in water

temperature prejudices the immature stages of blackflies (WHO, 1987).

Mechanical control

This was initiated in U.S.A. in 1976. The measure consisted of physically scrapping the eggs, larvae and pupae from their attachment sites with wire bristle, brooms and modified pole brushes. Also habitat manipulation induced removal of heavily infested rocks, vegetation and other breeding subtrates from control sites (Haufe, 1980).

Genetic control

At present it is only being contemplated because it is a very difficult and almost impossible method for the fact that female S. damnosum mate only once at the begining of their adult life. Other problems include mass breeding, fertilization, blood feeding, oviposition and difficulty in laboratory rearing of the blackfly. All these are difficult to attain under conditions of captivity (Le Berre, and Wenk, 1969; Gassouma, 1972; Wenk and Raybould, 1972).

2.4 Socio-economic effects of onchocerciasis

Onchocerciasis is associated with blindness, visual impairment and other disabilities which lead to reduced or complete loss of productive activity, withdrawal of potential labour, desertion of fertile river valleys and demographic imbalance among others.

Blindness distrupts the social structure of a community, this is well represented by a common social trend whereby blind men and women are led around markets, towns or cities by children with good vision to beg for alms. As a result the dependency ratio increases leading to reduced farming strength, low crop output, malnutrition and hunger set in. Most at times, the future of the young ones are dashed as they are unable to go to school because they have to lead their blind parents and elders (Nwoke, 1990; Akogun, 1991). Blindness also withdraws the individual potential labour supply away from activities requiring vision. Various workers have reported that blindness is concentrated at the most productive period of the patients working life and it reaches very high levels in hyperendemic areas, thereby affecting the efficiency to work and hence reducing productivity (Nwoke, 1991). Indeed, in hyperendemic communities where blindness is above 20% in adult males, the farming capacity is lowered below survival level (Hamon and Kartman, 1973).

The effect of onchocerciasis on migration and effective supply of land in Africa have been reported in the Hawal river valley in present Borno State, and the Volta River Basin. Onchocerciasis was associated with low population densities and abandonment of the riverine fertile areas i.e the lowland zone leading to the disruption of community life and economic activity (Bradley, 1976; Waddy, 1976; Hunter, 1976; Phillippon and Garms, 1978).

In these areas, particularly towards the rivers, blind-

ness rate increases rapidly until a point where the disease situation becomes incompatible with human settlement. Hunter (1976) noted that the settlements had been retreating steadly over the years as a result of onchocerciasis in the fertile riverine areas. He projected a hypothesis of cyclical advance and retreat whereby a population residing in the fertile lowland area may be forced out by onchocerciasis to the less fertile upland area. Subsequently, famine and population pressure force families once again to move into the fertile riverine are where onchocerciasis and its disabling manifestations caused settlements to be wiped out.

Rolland and Ballay (1969) reported that many factors were responsible for village abandonment in the riverine area of Upper Volta. These include famine, non-availability of water supply, river, force labour recruitment and bush spirits. Of all these factors, they concluded that onchocerciasis was the major cause of depopulation and an obstacle to repopulation of deserted areas. When hyperendemic areas are evacuated, it leads to distorted distribution of population; such set backs could be damaging. In the case of West Africa where annual population increase is 2.5%, the danger ahead is that if imigration is not checked, free lands may become over used and ruined beyond recovery (Anonymous, 1978).

The bites of blackflies cause annoyance in susceptible persons because of unbearable pruritus and scratching (Nelson, 1970). Onchocerciasis cause skin changes which include papular eruption, hypo and hyper pigmentation,

scaling, oedema and atrophic epidemis which results in the loss of skin elasticity giving the patient a prematurely age appearance which in the old people look like lizard skin. Leopard skin is associated with long standing infection, it has distressing effects on the life style of infected individuals and is sometimes mistaken for leprosy (Nwoke, 1990). In Africa, development of obstructive lymphadenitis leads to hanging groin and elephantiasis of the genitalia commonly seen in adult males. Similarly distortion of females genital have been observed. These malformations serve as an obstacle to free social interaction within the locality. Sexual life is also greatly affected and in some cases hindered (Gibson, 1978, Connor, 1985). Other effects of onchocerciasis include habitual abortion in women (Budden, 1956; Ikejiani, 1954). It has also been incriminated as a cause of dwarfism in Ugandans. The finding suggested that microfilaria affects the pituitary gland and this feature made the victim, psycologically depressed (Nelson, 1970).

The effect of onchocerciasis on the economy are also numerous. Hamon and Kartman (1973) reported that labour forces engaged in the control of the vector and dam construction in Africa spend huge sum of money on protective measures. The responsibility of caring for the disable is shouldered on the society at considerable cost.

CHAPTER THREE

3.0 Materials and methods

3.1 Study area

The study was carried out in Bali and Takum Local Government Areas (LGA) of Taraba State. Bali LGA (10^{o}E-12^{o}E and 7.5^{o}N-8.5^{o}N) has a land mass of 14,386 Km^2 and a population of 312,817, while Takum LGA (9.6^{o}E 10.8^{o}E, 6.2^{o}N-8.1^{o}N) has a land mass of 6,999 Km^2 with 148,294 people (NPC, 1991). A major road connects the two Local Government Areas via Manya and to Benue State via Katsina-Ala.

Bali LGA is drained by the Taraba river and its tributries (Fig 1) The river descends from a high altitude at the Nigerian - Cameroonian border at the rate of 0.6km/min and flows over a precambian rock basement throughout the first two-thirds of its length creating rapids suitable for blackfly breeding (Akogun, 1991). The river and its tributaries are extensively used for irrigation and fishing, the latter serving as great source of protein and income for the people.

The Takum area is drained by two major rivers, the Katsina-Ala and Donga, both of which lie within the Benue valley drainage basin. These rivers have many tributries including River Gamana (Plate 1) which passes through Fikyu and Manya (Mgbe, 1982). The river flows mostly over hard precambian rock basement which creates rapids suitable for blackfly breeding. Also the river is hedged by thick

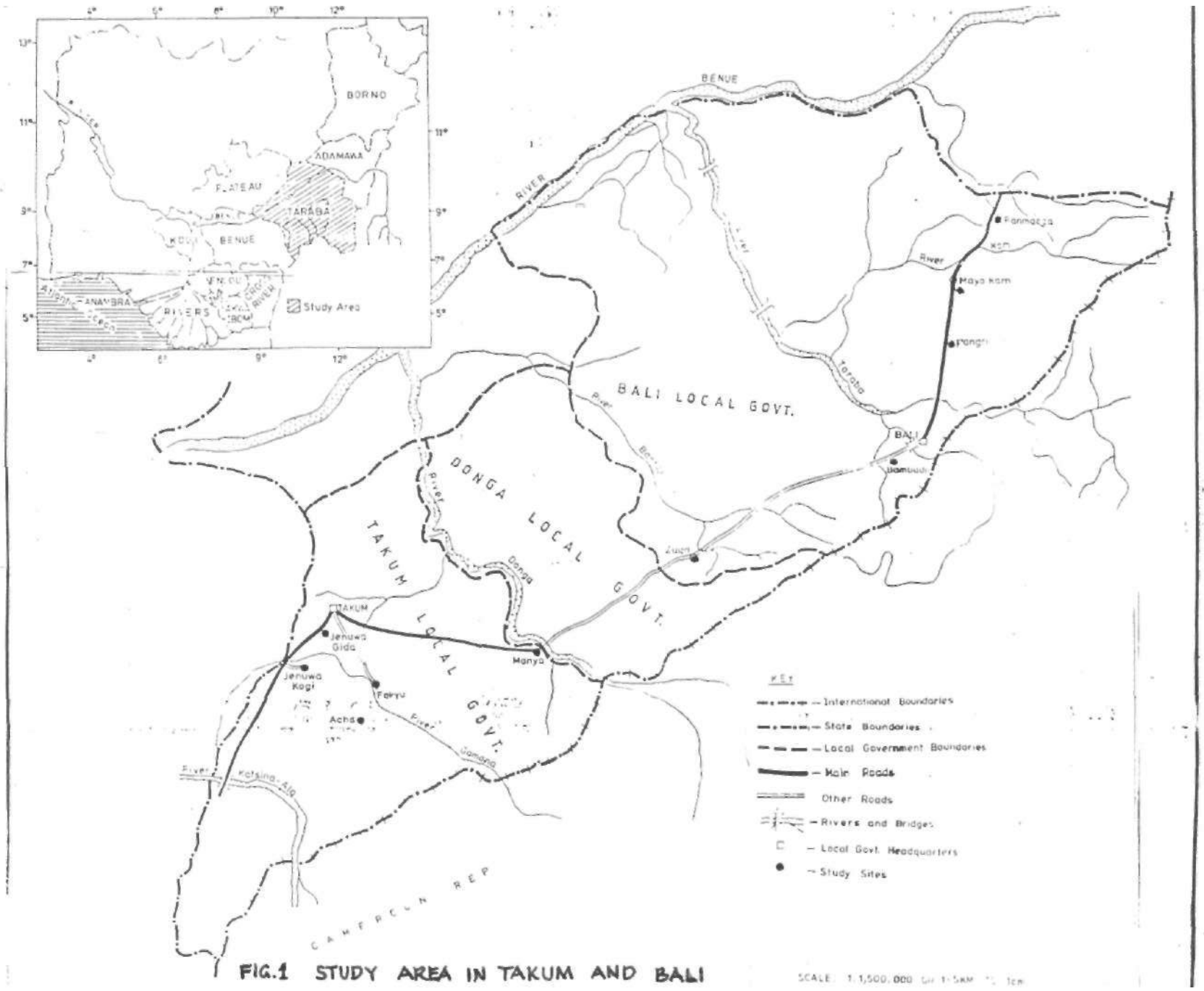


FIG.1 STUDY AREA IN TAKUM AND BALI

SCALE 1:1,500,000



Plate I: River Manya.

trailling vegetation that provides suitable sites for attachment of blackfly larvae.

In both Local Government Areas, the vegetation cover is of the derived savanna type (ADP, 1995). An annual rainfall of 1,150mm to 2250mm is experienced in Bali from April to October. In Takum, the annual rainfall is between 1,250mm to 2500mm and fulls from April to November.

For the purpose of this study, ten villages were chosen. These include Bambado, Pangri Fan-manga, Zaga, and Mayokam in Bali LGA and Fikyu, Acha, Jenuwa Gida, Jenuwa Kogi and Manya in Takum LGA. These villages are situated not more than 3 Km from a river except Mayokam and J. Gida which are located about 7 Km.

3.2 Parasitological, clinical and socioeconomic studies

3.2.1 Parasitological study

Of the resident population of approximately 23,500 in the ten villages selected, 1,988 persons (men and women) between the ages of 5 and 70 years were skin snipped. Snips were taken from the left and right sides of the iliac crest using a corneo scleral punch (HOLTH-TYPE, Germany) with 2mm diameter bite. Before snipping, the spot was first cleaned with cotton wool soaked in 70% ethanol. The snips were immersed seperately in flat bottom microtitre plate wells containing two drop of 0.9% saline solution as described by Barbiero and Trips (1984). The plates were covered with adhesive tape to prevent evaporation and spilling of the content during transportation. The snips were incubated

overnight at room temperature and thereafter examined for the presence of microfilariae under an inverted light microscope. The number of microfilariae were counted and recorded, and the density was expressed as the mean number per skin-snip.

3.2.2. Clinical study

Individuals were examined for the presence of rash, itching nodules, leopard skin and blindness.

3.2.3. Socio-economics studies

Prior to the start of the actual survey, letters of introduction were obtained from the Primary Health Care Director to village heads explaining the purpose of the survey and seeking their co-operation and that of the villagers. A preliminary survey was also carried out in two Local Government areas in order to determine suitable sites or villages for the survey. Villages were picked with special consideration to the distance from Simulium breeding sites, population size, knowledge about the blackfly, presence of onchocercal manifestations like nodules and leopard skin. Also the questionnaire to be used for the survey was pre-tested and various adjustments were made before the actual survey.

Methodology

Data was collected from 269 household heads from eight communities namely Bambado (38), Pangri (32), Zaga (35), and Mayokam (35) in Bali LGA. In Takum LGA, it included Fikyu (28), Jenuwa Gida (31), Jenuwa Kogi (36) and Manya (34). Two villages, Fan Manga and Acha, initially included in the parasitological studies were later omitted due to lack of co-operation from the people.

Before the interview was conducted, the names of each households head was obtained and names were selected randomly with special consideration to the blind household heads. The initial targeted sample size was 320 household heads i.e. 40 from each village. The selected household heads were interviewed on a house to house basis. The main research methodology was the rapid rural appraisal (RRA) techniques (Mccrake, Pretty and Conway, 1988). The interview consisted of 2 types. The scheduled and unscheduled interview. In the scheduled interview all the questions asked were from the questionnaire while in the unschedule interview certain number of observations raised by the household heads that were not in the questionnaire were taken note of.

The data so collected were processed and analysed using the statistical package for social sciences (SPSS). Regression analysis was done to test the strength of relationships between some key variables such as the correlation between perception and age, education, religion and occupation. Also education and perception, age and perception, and occupation

and perception were included. Further relationship between the effects of blackfly/onchocerciasis and migration/productivity was tested.

Questionnaire

The responses of 269 household heads were entered into a questionnaire designed for the survey (Appendix 1). The questionnaire had five sections as follows:

(a) Personal

Information required included name, age, sex, educational level, occupation, religion, marital status and farm size.

(b) Residence and Migration

History of residence, migration, reasons for migration, likelihood of further migration were recorded under this section.

(c) Perception, Knowledge and effect of the blackfly

The extent to which the people recognised the vector, what it causes, their perception about the behaviour of the fly, place where fly is encountered, protective measures taken against the fly bites, and whether the fly is responsible for disrupting occupational activities, social life and residence.

(d) Perception, Knowledge and effect of onchocerciasis

Responses on knowledge of dermatological and ocular effects caused by onchocerciasis and how it affected social life, productivity and economy of the people were inquired.

(e) Rapid assessment of prevalence of onchocerciasis

For every household head interviewed, the family was examined for the presence of nodules, blind cases, leopard skin, rash, itching and elephantiasis as a measure of the prevalence of the disease and its accompanying effects.

CHAPTER FOUR

4.0 RESULTS

4.1 Parasitological and clinical studies

The prevalence of human onchocerciasis in the ten villages examined showed varying levels of endemicity of the disease (Table 1 & Appendix 4). The level of endemicity by skin snip examination, was hyperendemic in Pangri (67%), Fan-Manga (72%), and Jenuwa Kogi (60%), mesoendemic in Zaga (55%), Bambado (53%), Fikyu (49%), Manya (42%), and Acha (58%), and hypoendemic in Jenuwa Gida (34%) and Mayokam (30%).

The prevalence of nodules was highest in Fan-Manga (40%) followed by Jenuwa Kogi (33%), Fikyu (31%) and then Pangri (30%). The overall result from each LGA shows that nodules were more prevalent in Bali (22%) than in Takum (17%).

The prevalence of leopard skin was highest in Fan-manga (14%), followed by Pangri (8%) and then Zaga (7%). Leopard skin prevalence was also higher in Bali LGA (7%) than to Takum LGA (4%).

Blindness was highest in Jenuwa Kogi (9%), then Pangri (8.%) and Fikyu (7%). The number of blind in Bali (4%) were slightly less than the ones in Takum (5%).

From the grand total, 48% had positive skin snips, 20% had nodules, 5% had leopard skin and 5% of the victims were blind. The above results show that both skin snip and dermal manifestations are higher in Bali LGA than in Takum

LGA.

Table 1: Prevalence of onchocerciasis

Village		No. examined (%)	No. SS positive (%)	No. With Nodule (%)	No. With LS (%)	No. Blind (%)
BALI LGA.						
Zaga	T	106	58 (54.7)	15 (14.2)	7 (6.6)	4 (3.8)
	M	94 (88.7)	53 (50.0)	14 (13.2)	7 (6.6)	4 (3.8)
	F	12 (11.3)	5 (4.7)	1 (1.0)	0 (0)	0 (0)
Pangri	T	143	117 (67)	43 (30.1)	11 (7.7)	3 (8.1)
	M	95 (66.4)	75 (52.4)	31 (21.7)	11 (7.7)	3 (8.1)
	F	48 (33.6)	42 (29.4)	12 (8.4)	0 (0)	0 (0)
Bambado	T	266	142 (53.4)	58 (21.8)	14 (5.3)	13 (5.6)
	M	202 (75.9)	109 (40.9)	44 (16.5)	11 (4.1)	10 (3.7)
	F	64 (24.1)	33 (12.4)	14 (5.3)	3 (1.1)	3 (1.1)
Mayokam	T	330	100 (30.3)	23 (6.9)	10 (3.0)	15 (4.5)
	M	160 (48.5)	52 (15.8)	13 (3.9)	6 (1.8)	9 (2.7)
	F	170 (51.5)	48 (14.5)	10 (3.0)	4 (1.2)	6 (1.8)
Fan-Manga	T	243	184 (72.4)	97 (39.9)	33 (13.6)	10 (4.1)
	M	188 (77.4)	153 (62.9)	81 (33.3)	30 (13.5)	7 (2.9)
	F	55 (22.6)	31 (12.8)	16 (6.6)	3 (2.1)	3 (1.2)
Sub-Total		1088	572(52.6)	236(21.7)	75(6.9)	46(4.2)
	M	739(67.9)	442(40.6)	183(16.8)	65(5.9)	33(3.0)
	F	349(32.1)	159(14.6)	53(4.9)	10(0.9)	12(1.1)
TAKUM LGA.						
J. Kogi	T	104	61 (58.6)	34 (32.7)	10 (9.6)	9 (8.7)
	M	66 (63.5)	33 (31.7)	21 (20.2)	7 (6.7)	6 (5.8)
	F	38 (36.5)	28 (26.9)	13 (12.5)	3 (2.9)	3 (2.9)
Manya	T	153	65 (42.3)	19 (11.9)	3 (1.9)	4 (2.6)
	M	107 (69.9)	46 (30.1)	14 (9.2)	3 (1.9)	4 (2.6)
	F	46 (30.1)	19 (12.4)	5 (3.3)	0 (0)	0 (0)
Fikyu	T	174	86 (49.4)	54 (31.0)	8 (4.6)	13 (6.8)
	M	132 (75.4)	61 (35.1)	34 (19.5)	6 (3.4)	7 (4.0)
	F	42 (23.6)	25 (14.4)	20 (11.5)	2 (1.1)	4 (2.3)
J. Gida	T	364	89 (24.5)	27 (7.4)	9 (2.4)	12 (3.3)
	M	206 (56.5)	50 (13.7)	15 (4.1)	8 (2.2)	8 (2.2)
	F	158 (43.4)	39 (11.8)	12 (3.3)	1 (0.2)	5 (1.4)
Acha	T	105	61 (58.1)	20 (19.0)	2 (1.9)	6 (5.7)
	M	71 (61.6)	46 (43.8)	17 (16.2)	2 (1.9)	6 (5.7)
	F	34 (38.4)	15 (14.3)	3 (2.9)	0 (0)	0 (0)
Sub-Total		900	362(40.2)	154(17.1)	32(3.6)	43(4.8)
	M	582(64.6)	246(27.3)	101(11.2)	26(2.9)	31(3.4)
	F	318(35.3)	116(12.9)	53(5.9)	6(0.6)	12(1.3)
Grand Total		1988	934(46.9)	390(19.6)	107(5.4)	89(4.5)
	M	1321(66.4)	688(34.6)	284(14.3)	91(4.6)	64(3.2)
	F	667(33.6)	275(13.8)	106(5.3)	16(0.8)	24(1.3)

T = Total (Male(M) + Female(F)); SS = Skin snip; LS = Leopard skin

The distribution of onchocerciasis by age and sex in the study area is shown in Table 1 and Fig. 2,3,4 & 5. The results show that men were more infected than women except in few cases such as Pangri at the age group 11-20, Jenuwa Kogi 41-50, Mayokam 31-40; 51-60 and ≥ 61, and Manya 21-30, where infection in females exceeded that in males. The differences observed between males and females was significant ($P < 0.05$). Prevalence also increases with age. In the age group ≤ 10, only Bambado, Pangri, Jenuwa Kogi and Fanmanga recorded positive cases. Also 100% prevalence was recorded in the age group ≥ 61 in Fam-manga, Bambado, Zaga, Manya and Pangri.

4:2 Socio-economic studies

Personal Data

Sex distribution

Out of 269 respondents, 261 (96%) were males. 8(4%) were females who have become household heads on account of the death of their husbands in accordance with tradition.

Age distribution

Table 2 shows that most household heads are within the age groups of 31-40 and 41-50 years in all villages except in J.Gida where a preponderance was observed in the ≥ 51 years age group.

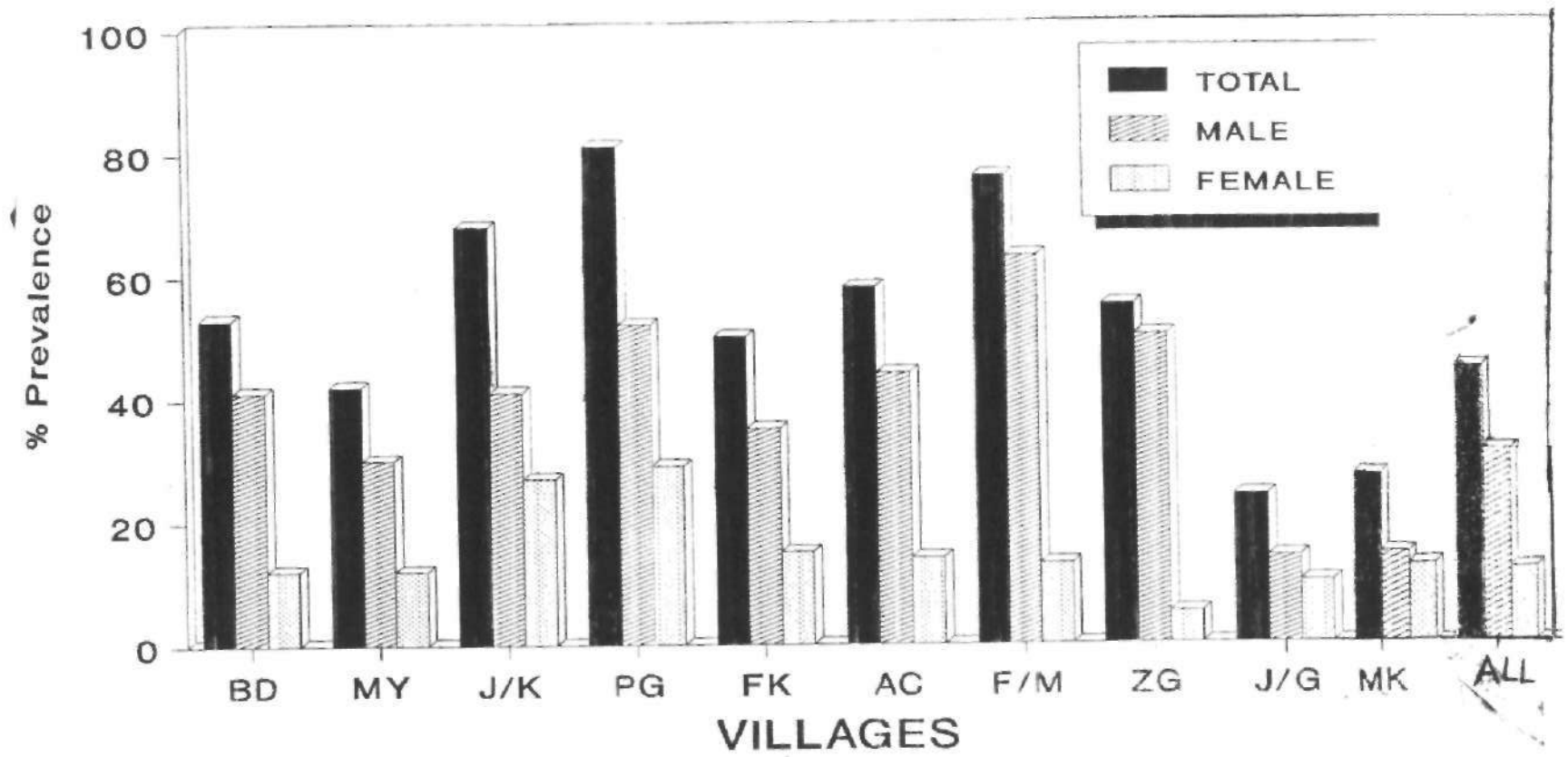


FIG. 2: SEX DISTRIBUTION OF ONCHOCERCIASIS IN STUDY AREA

BD=BAMBADO, MY=MANYA, JK=JENUWA-KOGI, PG=PANGRI
FK=FIKYU, AC=ACHA, FM=FAM-MANGA, ZG=ZAGA
JG=JENUWA GIDA, MK=MAYO-KAN

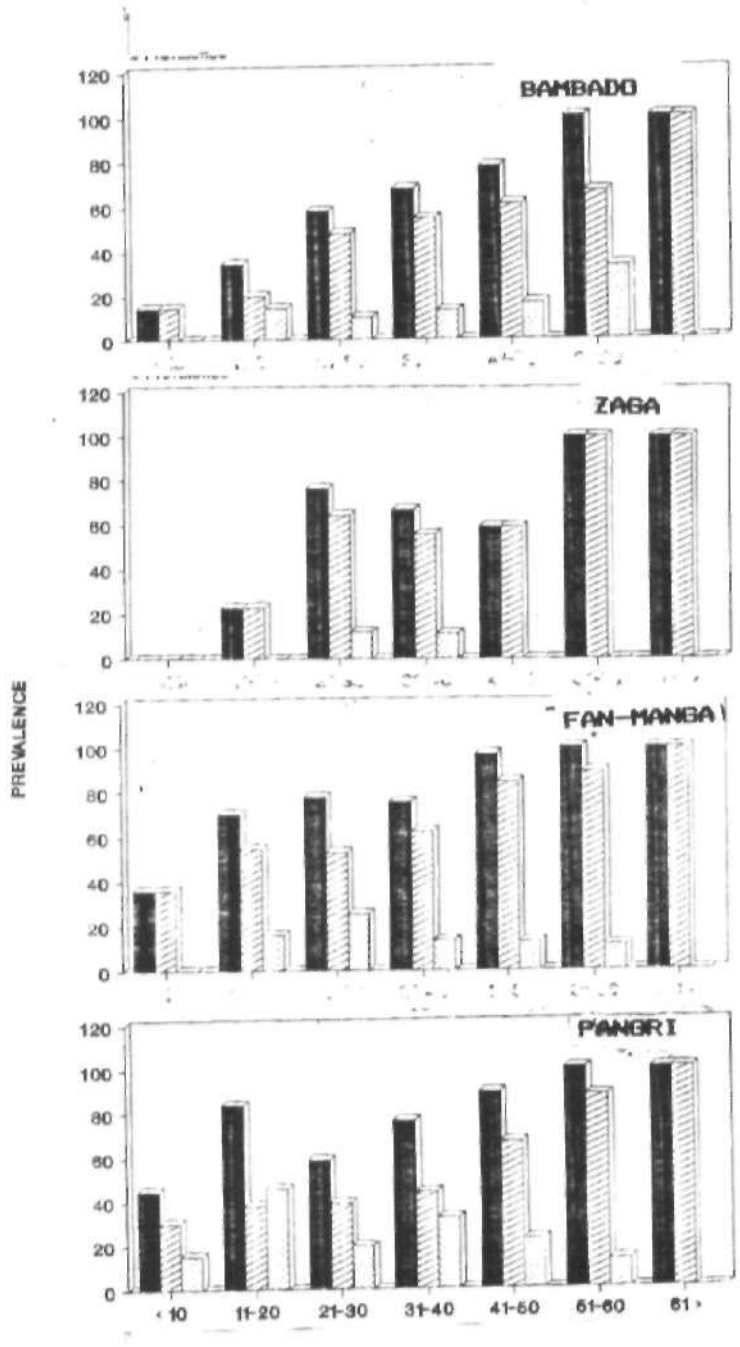
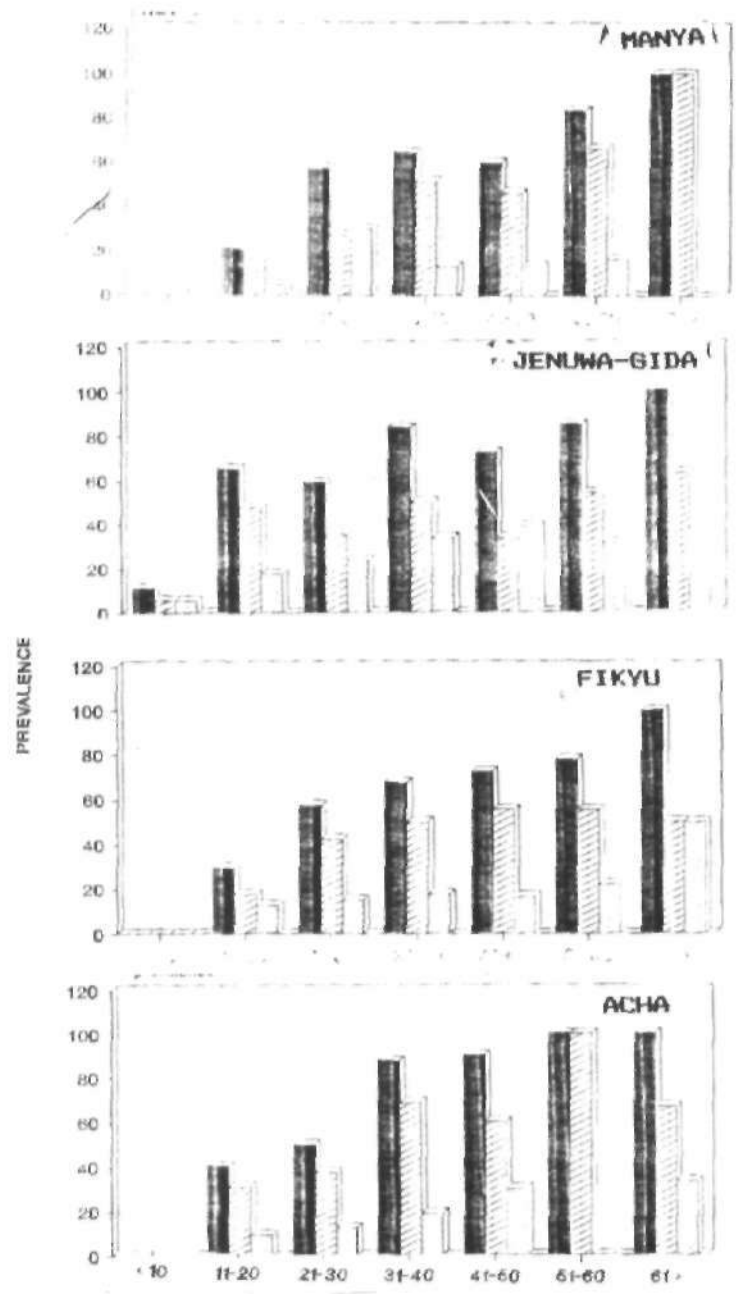
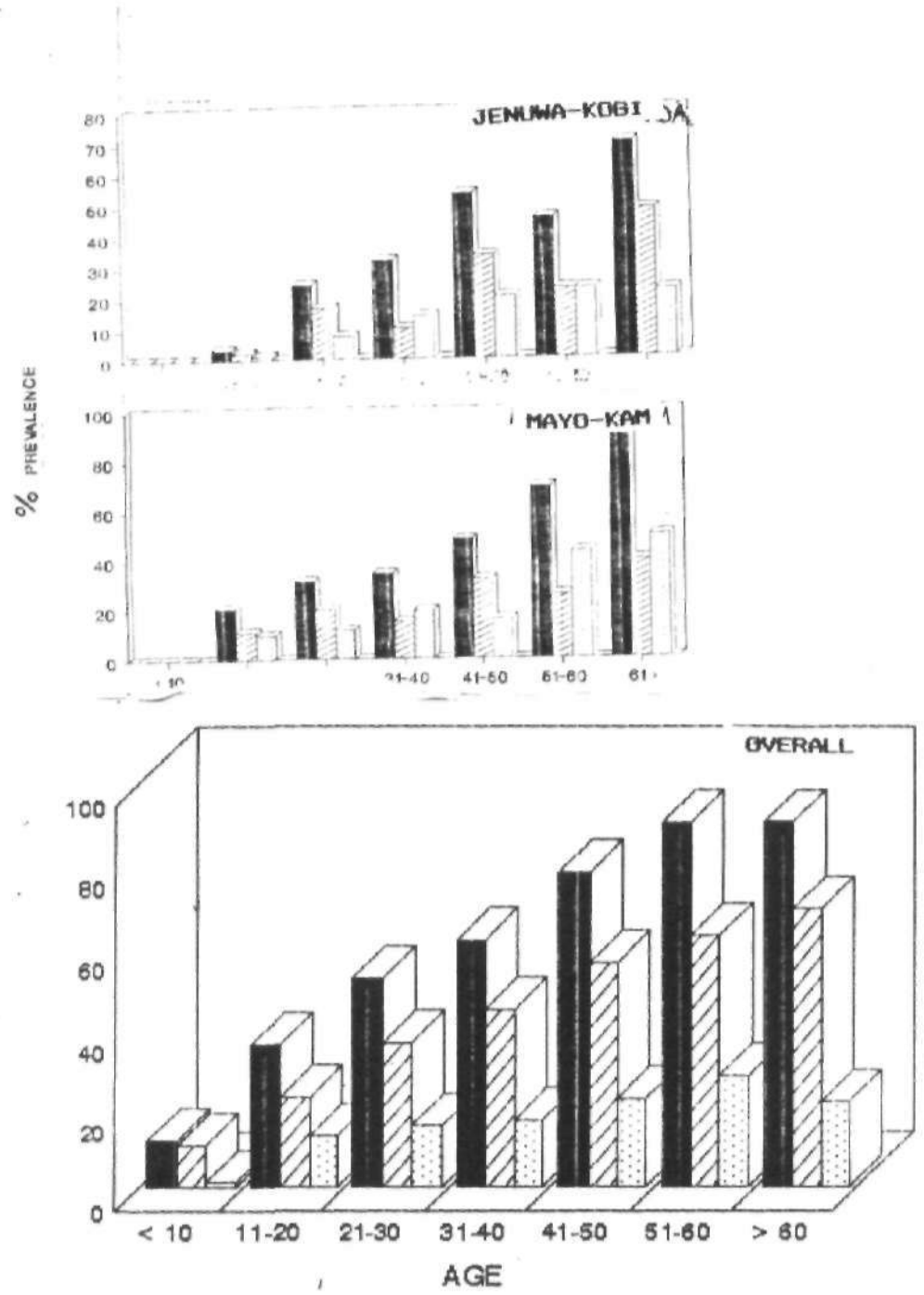


FIG.3 PREVALENCE OF ONCHOCERCIASIS BY SEX AND AGE



FIG·4 PREVALENCE OF ONCHOCERCIASIS BY SEX AND AGE



PREVALENCE OF ONCHOCERCIASIS BY SEX AND AGE
JENUWA-GIDA MAYO-KAN

Table 2: Age distribution of household heads

Village	No. of Respondent	Number in Age group ≥ 20 (%)	21-30 (%)	31-40 (%)	41-50 (%)	≥ 51 (%)
BALI LGA						
Zaga	35	1(2.9)	7(20)	8(22.9)	13(37.1)	6(17.1)
Pangri	32	0	10(31.3)	13(40.6)	6(18.8)	3(9.4)
Bambado	38	0	3(7.9)	10(26.3)	16(42.1)	9(23.7)
Mayokam	35	0	2(5.7)	15(42.9)	11(31.4)	7(20.0)
Sub-Total	140	1(0.7)	22(157)	46(32.9)	46(32.9)	25(17.9)
TAKUM LGA						
Jenuwa-Kogi	36	1(2.8)	6(16.7)	11(30.6)	8(22.2)	10(27.8)
Manya	34	0	2(5.9)	7(20.6)	14(41.2)	11(32.4)
Fikyu	28	1(3.6)	4(14.3)	15(53.6)	7(25.0)	1(3.6)
Jenuwa-Gida	31	0	8(25.8)	8(25.8)	1(3.2)	14(45.2)
Sub-Total	129	2(1.6)	20(15.5)	41(31.8)	30(23.3)	36(27.9)
Grand Total	269	3(1.1)	42(15.6)	87(32.3)	76(28.3)	61(22.7)

Level of Education

The educational attainment of the respondents in Table 3 shows that majority (63%) of them lacked formal education. In Bali LGA, religious education was the most common (13.6%) followed by primary (12.1%) and adult education (10%). In Takum LGA, primary education (15%) is the most common followed by religious (11.1%) and adult education (7.0%).

Table 3: Educational status of household heads

Village	No. of Respondent	Educational Attainment: Christian/ Koranic (%)	Primary (%)	Adult Educ. (%)	Sec. (%)	Post Sec. (%)	None (%)
BALI LGA							
Zaga	35	3(8.6)	6(17.2)	3(8.6)	0	0	23(55.7)
Pangri	32	7(21.9)	3(9.4)	1(3.1)	1(3.1)	0	20(62.5)
Bambado	38	8(21.1)	4(10.5)	6(15.8)	0	0	20(62.5)
Mayokam	35	1(2.9)	4(11.4)	4(11.4)	0	2(5.7)	24(68.6)
Sub Total	140	19(13.6)	17(12.1)	14(10)	1(0.7)	2(1.4)	87(62.1)
TAKUM LGA							
Jenuwa-K.	36	3(8.3)	1(2.8)	3(8.3)	2(5.6)	0	27(75)
Manya	34	6(17.6)	10(29.4)	0	0	0	18(52.9)
Fikyu	28	2(7.1)	5(17.9)	1(3.6)	1(3/6)	0	19(67.9)
Jenuwa-G.	31	0	7(22.6)	0	3(9.7)	1(3.2)	19(61.3)
Sub-Total	129	11(8.5)	23(17.8)	4(3.1)	6(4.6)	1(0.8)	83(64.3)
G.Total	269	30(11.1)	40(15)	19(7.0)	7(2.6)	3(1.1)	170(63.1)

School Aged Children

Table 4 shows the number of school aged children and those actually attending school. Generally, more than 50% of school aged children in the study area do not go to school. However, there was a slight preponderance of children attending school in Takum LGA (50%) than in Bali (43%) .

Table 4: Size of school aged children

Village	No. of Children	No. of children	
		In school (%)	Not in school (%)
BALI LGA.			
Zaga	106	39 (36.8)	67 (63.2)
Pangri	115	32 (27.8)	83 (72.2)
Bambado	117	73 (62.4)	44 (37.6)
Mayokam	121	52 (42.9)	69 (57.1)
Sub-Total	459	196(42.7)	263(57.3)
TAKUM LGA			
Jenuwa Kogi	98	68 (69.4)	30 (30.6)
Manya	95	61 (64.2)	34 (35.8)
Fikyu	123	47 (47.2)	41 (52.8)
Jenuwa Gida	90	36 (17.8)	50 (82.2)
Sub Total	406	212(50)	155(38.2)
Grand Total	826	408 (49.3)	418(50.6)

Occupation

The various occupational activities identified in the study area are summarised in Table 5. The results show that majority of the respondents (41%) were engaged in farming, followed by fishing (13.7%). In Bali LGA, farming was the most common occupation (42%) followed by fishing (21%); in Takum farming also tops the occupational activities (33%) followed by weaving (14.7%).

TABLE 5: Occupation of respondents

Village	No. of respon. (%)	Type of occupation																				
		Fr. (%)	Fh. (%)	Tr. (%)	Cs (%)	Th. (%)	Ht. (%)	Rl (%)	Cr. (%)	Bs. (%)	Ca. (%)	Dr. (%)	Pt. (%)	Bd. (%)	Bt. (%)	Br. (%)	Wv. (%)	Dm. (%)	Sn. (%)	Bg. (%)	Nn. (%)	
BALI LGA																						
Zaga	35	15 (42.9)	4 (11.4)	2 (5.7)	0	0	0	1 (2.9)	2 (5.7)	0	1 (2.9)	0	0	0	0	0	2 (5.7)	0	0	6 (17.1)	2 (5.7)	
Pangri	32	12 (37.5)	10 (31.3)	1 (3.1)	0	0	0	0	1 (3.1)	0	0	0	0	0	0	0	2 (6.2)	1 (3.1)	1 (3.1)	4 (12.4)	0	
Bambado	38	21 (55.3)	5 (13.2)	1 (2.6)	0	0	0	0	0	1 (2.8)	0	0	0	0	0	0	1 (2.8)	0	2 (5.2)	7 (18.4)	0	
Mayokam	35	12 (34.3)	9 (25.7)	3 (8.6)	1 (2.9)	1 (2.9)	1 (2.9)	0	0	0	1 (2.9)	0	1 (2.9)	0	1 (2.9)	0	1 (2.9)	0	0	4 (11.4)	0	
Sub Total	140	66 (47.1)	30 (21.4)	7 (5)	1 (0.7)	1 (0.7)	1 (0.7)	1 (0.7)	3 (2.1)	1 (0.7)	2 (1.4)	0	1 (0.7)	0	1 (0.7)	0	12 (8.6)	1 (0.7)	3 (2.1)	21 (15.0)	2 (1.4)	
TAKUM LGA																						
Jenuwa Kogi	36	14 (39.8)	2 (5.6)	1 (2.8)	0	2 (5.6)	1 (2.8)	0	0	0	0	1 (2.8)	1 (2.8)	0	0	0	8 (22.2)	1 (2.8)	3 (8.3)	0	2 (5.6)	
Manya	34	12 (35.3)	4 (11.8)	2 (5.9)	1 (2.()	0	4 (11.8)	0	1 (2.9)	1 (2.9)	0	1 (2.9)	0	0	1 (2.9)	0	5 (14.1)	0	1 (2.9)	0	1 (2.9)	
Fikyu	28	9 (32.1)	1 (3.6)	1 (3.6)	2 (7.2)	2 (7.2)	0	1 (3.6)	0	0	0	0	3 (11.8)	0	0	0	4 (14.3)	0	1 (3.6)	0	4 (14.3)	
Jenuwa Gida	31	15 (48.4)	0	0	3 (9.7)	2 (6.5)	0	2 (6.5)	0	1 (3.2)	0	0	2 (6.5)	1 (3.2)	0	1 (3.2)	2 (6.5)	1 (3.2)	1 (3.2)	0	0	
Sub Total	129	50 (32.6)	7 (5.4)	4 (3.3)	6 (4.7)	6 (1.6)	5 (0.8)	3 (2.3)	1 (0.8)	2 (1.6)	0	2 (1.6)	6 (4.7)	1 (1.6)	1 (1.6)	1 (1.6)	19 (5.6)	2 (1.6)	6 (4.7)	0	7 (5.4)	
Grand Total	269	110 (40.8)	34 (12.6)	11 (6.4)	7 (2.6)	7 (2.6)	6 (2.2)	4 (1.5)	4 (1.5)	3 (1.4)	2 (0.7)	2 (0.7)	7 (2.6)	1 (1.4)	2 (0.7)	1 (0.4)	25 (9.3)	3 (1.4)	9 (3.3)	21 (7.8)	9 (3.3)	

Table 5 Keys

1. Fa - Farmer
2. Fh - Fisherman
3. Tr - Trader
4. Cs - Civil servant
5. Th - Teacher
6. Ht - Hunter
7. Rl - Religious leader
8. Cr - Cattle rearer
9. Bs - Blacksmith
10. Ca - Calabash carver
11. Dr - Driver
12. Pt - Potter
13. Bd - Builder
14. Bt - Butcher
15. Br - Bicycle repairer
16. Wv - Weaver
17. Dm - Drummer
18. Sn - Singer
19. Bg - Beggar
20. Nn - None

Religion

The religious practices of the respondents (Table 6) shows that in Bali, 40% practice Islam as against 35% that practice Christianity and 25% traditional faith. In Takum, Christians constituted 70.5% followed by trandition faith 18.6% and Moslems 10.1%. In the overal study area, majority practice Christianity (52%) followed by Islam (25.5%) and then tradition (22.3%).

Table 6 Religious practices of respondents

Villages	No. of respondents	Religious Practice :Christianity (%)	:Islam (%)	:Traditional (%)
BALI LGA				
Zaga	35	16(45.7)	14(40)	5(14.3)
Pangri	32	8(25)	15(46.9)	9(28.1)
Bambado	38	14(36.8)	11(29.9)	13(34.2)
Mayokam	35	11(31.4)	16(45.7)	8(22.9)
Sub Total	140	49(35)	56(40)	35(25)
TAKUM LGA				
Jenuwa Kogi	36	30(83.3)	0(0)	6(16.7)
Manya	34	20(58.8)	10(29.4)	3(8.8)
Fikyu	28	18(64.3)	2(7.1)	8(28.6)
Jenuwa Gida	31	23(74.2)	1(3.2)	7(22.6)
Sub Total	129	91(70.5)	31(10.1)	24(18.6)
Grand Total	269	141(52.4)	69(25.5)	59(22.3)

Farm size

Farm size of the respondents (Table 7) show that just 40% had ≤ 1 hectare of farmland. The number with farm size of this nature in Takum was higher (44.2%) than in Bali LGA (36.4%).

Table 7: Farm size of respondents

Village	No. of respondents	No. with Farm size ≤ 1 Hectare (%)
BALI LGA		
Zaga	35	17
Pangri	32	10
Bambado	38	11
Mayokam	35	13
Sub Total	140	51(36.4)
TAKUM LGA		
Jenuwa Kogi	36	17
Manya	34	9
Fikyu	28	18
Jenuwa Gida	31	13
Sub Total	129	57(44.2)
Grand Total	269	108(40.1)

Residence/migration

In the study area, many people emmigrated out of or immigrated into it for several reasons as shown in Table 8 and 9. In Bali LGA, majority of the respondents attributed emmigration to fear of disease (55.2%), followed by fear of spirits (12%) leading to abandonment of settlement (Plate II), and the quest for a marriage patner (10.3%). In Takum, the search for school, particularly by children, was the main reason for emmigration (36.1%), followed by the quest for a marriage patner (22.9%) and a job (19.7%). Immigration from previous residence into Bali was mainly due to inavailability of fertile land leading to the abandonment of settlement (42.5%), followed by fear of disease (27.5%) and avoidance of fly bite (20%). Immigration into Takum was mainly due to fear of blinding disease (25%) followed by lack of river (19.2%) and inavailability of fertile land (13.5%).

Table 8: Emmigration out of study Area

Village	No. of respond. (Emmigrant)	Reasons for Emmigration out of study Area: Insearch of school (%)	:Fear of spirit (%)	:Marriage (%)	:Insearch of farmland (%)	:Fear of disease (%)	:Insearch of Job (%)	:Others (%)
BALI LGA								
Zaga	17	5(29.4)	1(5.9)	2(11.8)	-	8(47.1)	-	1(5.9)
Pangri	19	-	3(15.8)	2(10.5)	-	14(73.7)	-	1(5.3)
Bombado	18	1(5.6)	4(22.2)	1(5.6)	-	9(50)	2(11.1)	1(5.6)
Mayokam	4	1(25)	-	1(25)	1(25)	1(25)	-	-
Sub Total	58	7(12.1)	7(12.1)	6(10.3)	1(1.7)	32(55.2)	2(3.4)	3(5.2)
TAKUM LGA								
Jenuwa Kogi	16	8(50)	-	4(25)	-	2(12.5)	-	2(12.5)
Manya	9	1(11.1)	-	2(22.2)	2(22.2)	-	4(44.4)	-
Fikyu	16	7(43.6)	-	5(31.3)	1(11.1)	1(11.1)	1(11.1)	1(11.1)
Jenuwa Gida	20	6(30)	-	3(15)	2(10)	-	7(35)	2(10)
Sub Total	61	22(36.1)	-	14(22.7)	5(8.2)	1(1.6)	12(19.7)	5(8.2)
G. Total	119(100)	29(24.3)	7(5.8)	20(16.8)	6(5.7)	33(27.4)	14(11.7)	8(6.7)

Table: 9 Immigration to study Area

Villages	No. of respond. (Immigrant)	Reasons for immigration into study Area: Fear of disease (%)	No. fertile land (%)	No. jobs (%)	No. river (%)	Fear of spirit (%)	Fear of persec. (%)	To avoid fly bite (%)	Over pop. (%)	No reason (%)	Others (%)
BALI LGA											
Zaga	14	2(14.3)	7(50)	1(7.1)	1(7.1)	1(7.1)	-	2(14.3)	-	-	-
Pangri	9	1(11.1)	3(33.3)	-	1(11.1)	-	-	2(22.2)	1(11.1)	1(11.1)	-
Bambado	13	2(15.4)	7(53.8)	-	-	3(23.1)	-	1(15.4)	-	-	-
Mayokaa	16	6(37.5)	-	-	-	2(12.5)	-	5(31.3)	-	2(12.5)	1(6.25)
Sub Total	40	11(27.5)	17(42.5)	1(2.5)	2(5)	6(15)	-	10(20)	1(2.5)	3(7.5)	1(2.5)
TAKUM LGA											
Jenuwa K.	11	5(45.5)	-	-	3(27.3)	-	-	1(9.1)	2(18.2)	1(9.1)	-
Manya	14	2(14.3)	4(28.6)	1(7.1)	1(7.1)	-	-	1(7.1)	-	-	-
Fikyu	10	2(20)	2(20)	-	-	-	-	-	-	3(40)	2(20)
Jenuwa G.	17	2(11.8)	1(5.9)	-	6(35.3)	6(35.3)	2(11.8)	1(5.9)	-	-	-
Sub Total	52	11(21.2)	7(13.5)	1(1.9)	10(19.2)	6(11.5)	2(3.8)	3(5.8)	2(3.8)	4(7.7)	2(3.8)
G. Total	92(100)	22(23.9)	24(26.0)	2(2.17)	12(13.04)	12(13.04)	7(7.60)	13(14.13)	3(3.26)	7(7.6)	3(3.26)

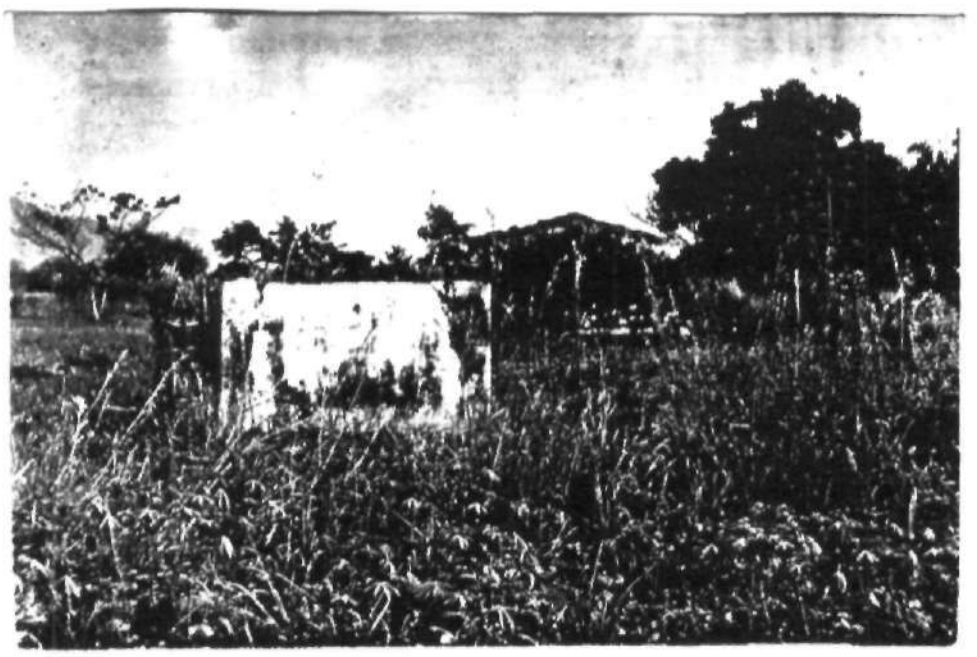


Plate II: Abandon Settlement due to onchocerciasis.

Perception, knowledge and effects of blackfly

Perception/knowledge of blackfly

In the study area, 62.4% of the respondents identified the blackfly sample shown to them. In Bali, the Jibawa ethnic group called the fly "Ayir" while the Tiv called it "Vyombu". In Takum, the Kutebs called it "Kumkwe" meaning humped neck fly. Table 10 shows that majority (60%) of the respondents recognised the fly as a wet season breeding and biting pest. 17.6% recognised it as all season breeding and biting insect, 14.9% had no knowledge while 9.9% recognised it as a dry season fly.

Table 10: Knowledge of fly breeding/biting period.

Breeding and biting Season of fly	No. of respondents (%)
Dry season	15 (9.9)
Wet season	112 (59.6)
All year	33 (17.6)
Don't know	28 (14.9)
Total	188 (100)

Table 11 shows that majority of the respondents (73.9%) were aware that the blackfly breed in rivers while 12.8% indicated that they breed on land and 7.4% in the forest.

Table 11: Blackfly breeding place

Breeding place	No. of respondents (%)
Land	24 (12.8)
Forest	14 (7.4)
River	139 (73.9)
Don't know	11 (5.9)
Total	188 (100)

Table 12 is a summary of the various periods of the day in which the fly is thought to bite. Majority (48%) of the respondents said that they experienced the fly bite mostly in the morning hours of the day, 14.9% had no knowledge and the least 1.1% experienced the bite in the night.

Table 12: Knowledge of fly biting time

Period of the day	No. of respondents (%)
Morning	91 (48.4)
Afternoon	24 (12.8)
Evening	19 (10.1)
Night	2 (1.1)
All day	24 (12.8)
Don't know	28 (14.9)
Total	188 (100)

Effect of fly Bite

The effects caused by fly bite are shown in Table 13. Majority of the respondents (53.7%) said that their farming acitvities was disturbed by the fly bite. The fly caused migration (15.4%) and disturbed fishing activities (14.4%) while in 4.8%, it disturbed outdoor recreation (Plate III) The extent to which farming was disturbed is shown in Table 14. An overwhelming majority of the respondents (80.2%) said farming was disturbed by fly bite through reducing their farming time and invariably crop output (13.8%).

Table 13: Effects caused by fly bite

Effect of fly bite	No. of respondents (%)
Causes disease	12 (6.4)
Disturbs farming activites	101 (53.7)
Disturbs outdoor recreation	9 (4.8)
Disturbs animal crazing	4 (2.1)
Causes migration	29 (15.4)
Disturbs fishing	27 (14.4)
Don't know	6 (3.2)
Total	168 (100)

Table 14: Effect of fly bite on farming

Extend to which farming is disturbed	No. of respondents (%)
Farming time reduced	152 (80.9)
Farming is avoided at fly peak	10 (5.3)
Crop output is reduced	26 (13.8)
Total	188 (100)



Plate III: Children playing and washing in the river (such activities exposes them to fly bite).

4.2.4. Perception, Knowledge and Effects of Onchocerciasis

Knowledge of cause of blindness

Table 15 summaries the perceived causes of blindness in the study area. Majority of respondents (38.7%) had no knowledge of the cause of blindness, 27.9% attributed blindness to disease while 13.6% and 10.8% ascribed blindness to spirits and family enemies respectively.

Table 15: Perceived causes of disease (blindness) in the study area

Perceived causes	No. of respondent (%)
Disease	31 (27.9)
Spirits	15 (13.6)
Family enemies	12 (10.8)
Natural cause	4 (3.6)
Unknown	43 (38.7)
River activities	6 (5.4)
Total	111 (100)

Knowledge of onchocerciasis

The result in Table 16 shows that 74.2% of the 27.9% of the respondents that indicated that blindness was as a result of disease (in Table 15), attributed it to onchocerciasis while 13% ascribed it to measles and 6.5% did not know the cause.

Table 16: Knowledge of the disease that caused blindness

Type of disease	No. of respondent (%)
Blinding disease (onchocerciasis)	23 (74.2)
Body itching	0
Sleeping sickness	1 (3.2)
Leprosy	0
Fever	1 (3.2)
Skin depigmentation	0
Headache	0
Abortion	0
Measles	4 (1.3)
Don't know	2 (6.5)
Total	31 (100)



Plate IV: Leopard skin on a 52year old onchocerciasis victim.

Onchocerciasis - induced effects

Body itching

Table 17 shows that onchocerciasis - induced body itching mostly affected outdoor recreation (30.7%), and further disturbed farming/fishing activities (23.6%) and even sleep (20.4%).

Table 17: Effect of body itching caused by onchocerciasis.

Effect of body itching	No. of respondents (%)
Causes social/Psycological discomfort	19 (15.0)
Disturbs outdoor recreation	39 (30.7)
Disturbs farming/fishing activities	13 (23.6)
Peels skin and cause pain	30 (10.3)
Disturbs sleep	26 (20.4)
Total	127 (100)

Dermal changes

The effect of dermal changes caused by the blinding disease (onchocerciasis) (Plate IV) on the respondents is shown in Table 18. It mostly disfigured the skin in 48% while in 23.5%, it caused social/psychological discomfort and discolored the skin in another 23.5%.

Table 18: Effect of dermal changes caused by onchocerciasis

Effect of dermal changes	No. of respondent (%)
Disfigures the skin	41 (48.2)
Causes social/psycological discomf.	20 (23.5)
Obstructs movement	4 (4.7)
Discolor the skin	20 (23.5)
Total	85 (100)

Body weakness

Majority of the respondents (55%) who experienced body weakness said that body weakness reduced farming strength followed by reduced ability to work (36.4%) and retardation of mental activites (8.5%).

Table 19: Effect of body weakness caused by onchocerciasis

Effect of body weakness	No. of respondents (%)
Reduces farming strength	71 (55)
Reduces ability to work	47 (36.4)
Retards mental activity	11 (8.5)
Total	129 (100)

Nodules

The effects of nodules is summarised in Table 20. Majority of the respondents (48.%) claimed that nodules disfigured their body, 39% associated nodules with social/psycological discomfort while 8% said that nodules obstructed movement. These notwithstanding, nodules had little effect on farming activities (2%).

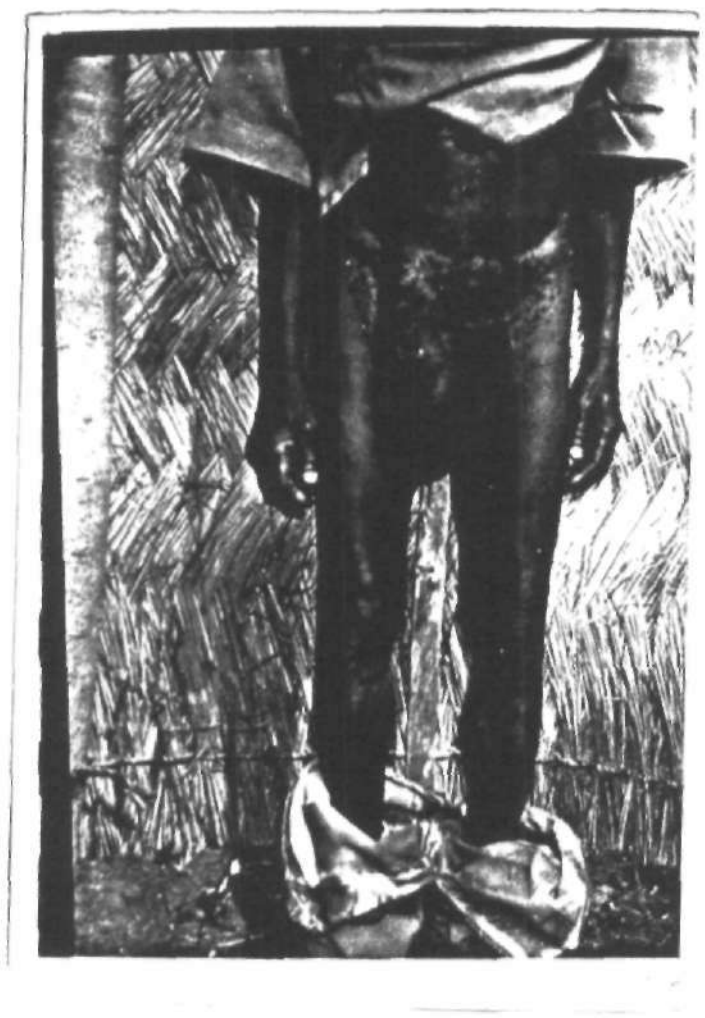


Plate V: Scrotal enlargement on a 45year old onchocerciasis victim.

Table 20: Effect of nodules

Effect of nodules	No. of respondent (%)
Cause pains	3 (3.0)
Disfigure the body	48 (48.0)
Cause social/psycological discomf.	39 (39.0)
Obstruct movement	8 (8.0)
Obstruct farming activities	2 (2.0)
Total	100 (100)

Scrotal enlargement and genital distortion

Table 21 shows that 37.1% of the respondent agreed that onchocerciasis - associated scrotal enlargement (Plate V) and genital distortion affected sexual interaction. In addition, it caused social/psychological depression in 28.6% and caused difficulty in movement (22.8%).

Table 21: Effect of scrotal enlargement and genital distortion

Effect of scrotal enlargement and genital distortion	No. of respondent (%)
Affect sexual interaction	13 (37.1)
Cause social/psycological depres.	10 (28.6)
Reduce farming activity	4 (11.4)
Obstruct movement/deformation	8 (22.8)
Total	35 (100)

Effect of blindness

Table 22 summaries the effect of onchocercal associated blindness (Plate VI). As shown, 24.3% of the respondents said that their family income was reduced while in 21.6% it incapacited them and in 17.7%, it reduced their crop output.

Table 22: Effect of blindness

Effect of blindness	No. of respondents (%)
Incapacitates those affected	24 (21.6)
Reduces family strength	11 (9.9)
Reduces family crop out put	19 (17.1)
Reduces family income	27 (24.3)
Increases economic and social burden of family	13 (11.7)
Causes less of Job/dismissal	8 (7.2)
Causes family to employ labor on farm	17 (15.3)
Total	111 (100)

Psychological feeling of the blind

The result from Table 23 shows that majority (52%) of the blind said they feel social and economic burden to their families while 31.5% felt disabled and 9.9% felt dejected.

Table 23: Psychological feeling of the blind

Psychological feeling of the blind	No. of respondents (%)
They feel dejected	11 (9.9)
They feel disabled	35 (31.5)
They feel social and economic burden to the family	58 (52.3)
They feel discriminated against	5 (4.5)
They isolate themselves	8 (7.2)
Total	111 (100)

Care for the blind

The responsibility of the physical and social needs of majority of the blind (64%) was shouldered on their household while 18.9% said the community was responsible while 17% took care of themselves.

Table 24: Care for the blind

Care for the blind	No. of respondents (%)
Self	19 (17.1)
Household	71 (64)
Community	21 (18.9)
Government	0
Organisation	0
Total	111 (100)

Occupation of the blind

Table 25 shows that in Bali LGA, majority (57.6%) of the blind turned to begging and to some extent weaving (16.7%). 18.2% remained idle. In Takum LGA, most blind people engaged themselves in weaving (26.1%) and to some extent singing (15.6%). Many (28.9%) remained idle.

Table 25: Occupation of the blind

Village	No. of respondents	Occupational activities of the blind					
		Begging (%)	Weaving (%)	Drumm. (%)	Singing (%)	Farming (%)	Nothing (%)
BALI LGA							
Zaga	17	10(58.8)	4(23.5)	0	0	1(5.9)	2(11.8)
Pangri	21	9(42.9)	5(29.4)	0	1(14.3)	0	6(35.3)
Bambado	15	12(80.0)	1(5.9)	1(5.9)	1(5.9)	0	0
Mayokam	13	7(53.8)	1(5.9)	0	0	1(5.9)	4(23.5)
Sub Total	66	38(57.6)	11(16.7)	1(1.5)	2(3)	2(3)	12(18.2)
TAKUM LGA							
Jenuwa Kogi	11	0	3(27.3)	1(9.1)	2(11.8)	3(27.3)	2(11.8)
Manya	13	0	9(69.2)	0	1(7.7)	0	3(23.1)
Fikyu	11	0	1(9.1)	2(18.2)	4(36.4)	1(9.1)	3(27.3)
Jenuwa Gida	10	0	5(50)	0	0	0	5(50)
Sub Total	45	0	18(40)	3(6.7)	7(15.6)	4(8.9)	13(28.9)
Grand Total	111(100)	38(34.2)	29(26.1)	4(3.5)	9(8.1)	6(5.4)	25(22.5)

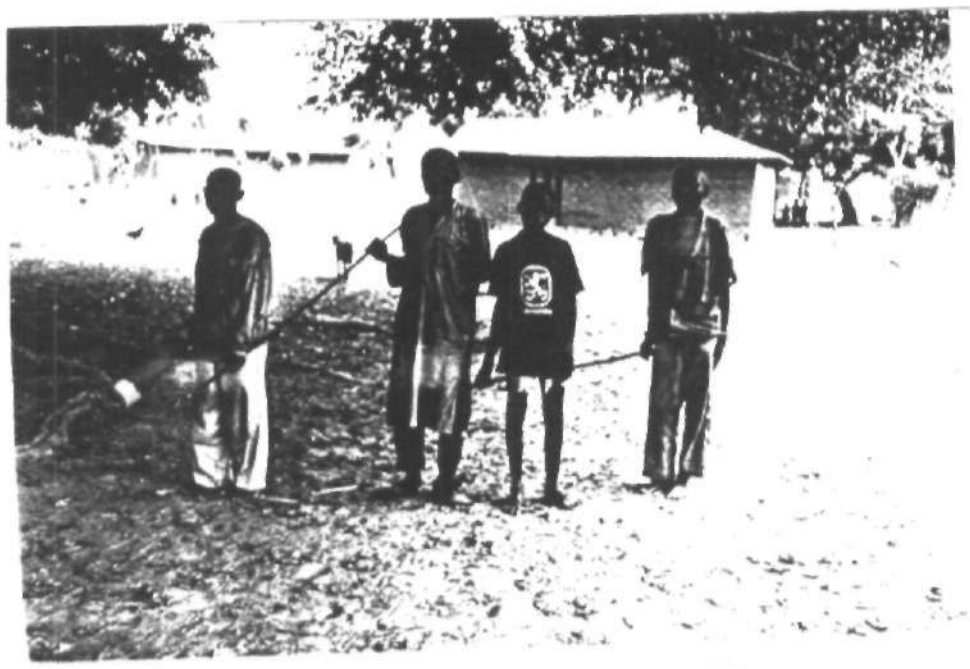


Plate VI: Blind men being led in Jenuwa kogi.

Acceptability of the blind

Table 26 shows that the blind are generally accepted (fully or partially) by their communities. The level was higher in Takum LGA than in Bali LGA.

Table 26: Acceptability of the blind

Village	No. of respondent	Acceptable (%)	Partially acceptable (%)	Not acceptable (%)
BALI LGA				
Zaga	17	6 (35.35)	9 (52.9)	2 (11.8)
Pangri	21	6 (28.6)	15 (71.4)	0
Bambado	15	5 (33.3)	10 (66.7)	0
Mayokam	13	4 (30.7)	9 (69.3)	0
Sub Total	66	21 (31.8)	43 (65.2)	2 (3.0)
TAKUM LGA				
Jenuwa Kogi	11	9 (81.8)	2 (18.2)	0
Manya	13	11 (84.6)	2 (15.4)	0
Fikyu	11	10 (90.9)	1 (9.1)	0
Jenuwa Gida	10	10 (10.0)	0	0
Sub Total	45	40 (88.9)	5 (11.1)	0 (0)
Grand Total	111	61 (54.9)	48 (43.2)	2 (1.8)

The blind and marriage

In terms of marriage and friendship, majority of the blind (72%) in the study area do not easily find marriage partners while 28% do. Also the chances of the blind getting married to one from a higher social status was 24% and from lower social status, 76%.

Rapid assessment survey

Table 27 summaries the rapid assessment survey result. The result shows that rash was the commonest manifestation and was highest in Pangri (63%), then Zaga (43%), Bambado (35%), Jenuwa Kogi (40%). Body itching was also very high in Pangri (24%), Zaga (23%) and Bambado (19%). There was high prevalence of nodules in Jenuwa Kogi (44%), followed by Pangri (43%) and Bambado (34%). The highest rate of blindness was recorded in Pangri (15%) followed by Bambado (11%) and Zaga (11%). The prevalence of leopard skin (2%) and elephantiasis (0.1%) was generally very low. Generally in Bali LGA, nodules (32%), rashes (39%) and blindness (11%) were more prevalent than in Takum LGA where the prevalence of nodules was (14%), rashes (22%) and blindness (8%). From the grand total, rashes (30%) was the most prevalent followed by nodules (22%), itching (17%) and blindness (8%).

Table 27: Rapid assessment method result

Village	No. of person	Nodules (%)	Elephant. (%)	Leopard (%)	Blind. (%)	Rashes (%)	Itching (%)
BALI LGA							
Zaga	401	131(32.7)	1(0.2)	14(3.5)	43(10.7)	171(42.6)	91(22.7)
Pangri	397	170(42.8)	0	28(7)	59(14.9)	249(62.7)	96(24.2)
Bambado	569	191(33)	0	9(1.6)	62(10.9)	201(35)	109(19.2)
Mayokam	421	82(19.5)	0	11(2.6)	28(6.6)	80(19)	61(14.5)
Sub-Total	1788	574(32)	1(0.05)	62(3.5)	192(11.3)	701(39)	357(20)
TAKUM LGA							
Jenuwa-Kogi	621	271(43.6)	0	14(2.3)	51(8.2)	211(339)	96(15.5)
Manya	492	98(19.9)	1(0.2)	6(1.2)	34(16.9)	82(16.7)	71(14)
Fikyu	659	199(30)	0	10(1.5)	31(3.2)	104(15.8)	94(14.3)
Jenuwa-Gida	399	54(13.5)	2(0.5)	4(1)	13(3.2)	74(18.5)	44(11)
Sub-Total	2171	295(13.6)	3(0.4)	34(1.6)	129(6.3)	471(21.6)	305(14)
Grand Total	3959	869(22)	4(0.1)	96(2.4)	321(8.3)	1172(29.6)	662(16.7)

CHAPTER FIVE

5.0 DISCUSSION

Varying degrees of endemicity have been observed in the villages examined for onchocerciasis. Hyperendemicity was associated with villages such as Pangri and Fan-manya which are frontline villages closed to rivers (largely not less than 3 Km) and whose population was stable and largely of arable farmers and fishermen. Such population were in close association with fly breeding sites and were invariably highly exposed to fly bites and transmission of onchocerciasis. This is in line with the report of Budden (1956) which showed that intensity of infection was directly related to the presence of Simulium breeding sites. Villages like Jenuwa Kogi, Zaga, Bambado, Fikyu and Manya turned out to be mesoendemic despite their proximity to rivers. In addition to being very populated, these villages, with the exception of Manya are not frontline village as there were settlements between them and the rivers. The observed level of endemicity thus conformed with the report by WHO (1985), in the Upper Volta River Basin, which showed that the higher the population density, the more transmission is diluted by "bite sharing" and also the severity of infection starts to decrease from a frontline settlement. Hypoendemic villages like Jenuwa Gida and Mayokam are associated with very large population size which are scattered about 7Km away from the rivers. In addition, most of their farmlands are equally not situated near rivers as compared to other villages. This reduces their exposure to the bite of the vector.

The results in Fig. 3,4 and 5 shows that infection was largely confined to the middle and elderly age group; these groups have had long term exposure to fly bites because of their involvement in farming, fishing, bathing and washing in the streams and rivers. This explains why prevalence increased with age. Also from the result, males were more affected than females. This is due to the fact that males are more exposed than the females because they are more involved in activities such as farming, fishing, cattle rearing, hunting etc. All these activities bring them in close contact with breeding sites and invariably blackfly bites. In addition, religious obligations especially by Moslem, restrict women to indoor activities such that they are less exposed to fly bite.

Clinical manifestations like nodules was the commonest in the study area. For instance, hyperendemic villages had correspondingly the highest percentage of nodules. This shows that nodules could be of considerable diagnostic value in the rapid estimation of endemicity in this area. Leopard skin was less common as compared to nodules and it occurs mostly on the skin of victims that were 40 years and above. Therefore it can not be effectively used for the rapid assessment of onchocerciasis. According to Pond (1990), different ecological zones, that is the forest and the savanna or different countries have different tendencies to manifest this marker.

In the socioeconomic studies, the sampled respondents

of household heads were largely males (96%) of between 20 years and above; females only become household heads on the death of their spouse. Generally, the level of formal education of these household heads was low. This low level of education appears to have a relationship with the people's perception and attitude towards the disease process and the Simulium vector. The level of education among children was equally low as over 51% of school aged children, mostly girls, do not attend school.

Majority of the respondents are farmers as shown in Table 5. Farming is usually diffused with other occupations due to lack of specialization. It is therefore common to see the respondents combining two or more occupations in the study area. However, despite the fact that majority of the respondents are farmers, many had small farm land whose size were equal or less than one hectre. This is contrary to the report of Fos (1984) which showed that the average farm size for the North-east region in which Taraba lies, is not less than 1.5 hectre. Small farm size in the study area was associated with immigration from other areas to study area; this is in addition to the nuisance effect of fly bite and fear of being blind. As a result, competition for little available farmland hightened. In addition, blindness and other manifestations like body weakness, elephantiasis and scrotal enlargement rendered the victims unable to fully utilise their farmlands thereby farm size became reduced.

Emmigration out of study area was high and associated with various reasons of which fear of blinding disease topped the list. This caused movement out of study area and desertion of settlements and fertile farmlands to less fertile upland areas. Movement out of Takum was largely by children seeking for school elsewhere. This may explain the relatively higher number of people with formal education in Takum.

Fear of disease and lack of farmland elsewhere also drove people to immigrate into the study area in search of fertile land, water for fishing, irrigation and domestic use. Gradually the nuisance effect of blackfly and onchocerciasis begin to take their toll, the community productivity weakens leading to reduced ability to work and to feed properly, eventually blindness sets in to put a halt to productive occupation leading to the abandonment of settlements. This retreat continues into the less fertile hinterland where the fly population is less. Then gradually the human population grows, land is over used leading to low food production, hunger finally sets in. The victims once again migrate to riverine areas where disease again takes the lead and the settlements are gradually abondoned. This observation was made in Ghana by Hunter (1970) where he derived the hypothesis of cyclical retreat and advance. One other interesting factor associated with migration in Pangri, Bambado and Zaga is the issue of witchcraft, "Kpinti", which some believed, especially among traditionalist, was the cause of blindness. It was therefore not surprising that

a positive correlation existed between migration and blindness. (Appendix 3) This brings us close to the role of the victim's perception and knowledge about the disease.

The role of perception in understanding the nature of the disease and its prevalence in control planning can not be overemphasized. This is due to the fact that perception highlights the degree of environmental hazard and influences the choice of adjustment mechanisms availability to individuals or group of individuals (Kolawole, 1987). Perception is a function of cultural background, the state of economic development, personality, personal idiosycracies and experience (Sonnerfied, 1965). In this study, perception is used to refer to the risk assessment of blackfly and river blindness, awareness of physical process contributing to hazard of blackfly and river blindness and identification of adjustment to the hazard of blackfly and river blindness by the victims. The most important factor influencing perception are age, occupation, religion and education (Appendix 2). A positive correlation exist between perception and age. This is not suprising because age affects the intensity and prevelence of infection in onchocerciasis as seen in Fig. 3,4 and 5 and Appendix 4 whereby the middle age groups and the elderly were the most affected. The middle age group are mostly involved in farming and fishing and as a result encounter more fly bites than the other age groups. The disease gradually develops in them and as they grow older, the signs and symptoms of the disease manifest increasingly

to the terminal stage of blindness. Occupational habits and perception showed positive correlation. Farmers and fishermen, for instance, had high perception, most likely because they were most unduerable as their activities took place near or by the breeding sites of Simulium. Education and perception also correlated because the educational level in the study area is very low and this influenced their level of understanding and knowledge about the disease.

The knowledge about the blackfly in the study area was high, as 62.4% identified the blackfly sample shown to them. Also the degree of knowledge about the blackfly habit was quite impressive, as 70.2% of the respondents said that fly breeds in the rivers because they mostly encounter it along water courses. Although fly biting was throughout the year, the wet season was favourable. Fly bite density was highest in the morning hours. This agrees with the report of Crosskey (1954) and Amuta (1981).

The nuisance value of the fly and invariably the socio-economic link began to emerge especially in Pangri and Jenuwa Kogi where endemicity was high, when a large majority (60%) of the sampled respondents said the fly disturbed their farming activity and caused migration (16%) and disease (7%).

During this study, only few people were aware that the blackfly transmits onchocerciasis and those that knew obtained their information from medical field workers and also in the hospitals in town. Their most concern is that much time is spent driving the flies and attending to itch-

ing due to flybite instead of concentrating on farm work. This was quite evident in Jenuwa Kogi, Fikyu, Bambado and Pangri.

In most villages, the blackfly and onchocerciasis are seen as seperate entities. Interestingly, most of the respondents associated high blindness rate with fishermen and Fadama farmers who had their farms along water courses. However most of them had no clue that the fishermen and Fadama farmers were being bitten by the fly vector which were in abundance along the water courses. This senerio is quite similar to that reported in the Senegal River Basin area by Impreator and Sow (1971).

In the study area, there was no any specific name for onchocerciasis. But it is generally being identified as the "blinding disease". Various manifestations of the disease like nodules, leopard skin, lizard skin and scrotal enlargement are not thought to be part of the same disease especially in Takum. Indeed many did not know the cause of blindness while others believed it was caused by evil spirits and some saw it as the work of God. Most people in Bambado believed it was a punishment from God brought about as a result of their wickedness while some believed that drinking water from the river could cause blindness. This explained the reason why a traditional healer used "Zane", a bark of a local tree, and some sacrifices to treat cases of blindness and other related diseases. Also most of the songs and folktales in Pangri and Bambado are interwooven with

blindness. Most of these songs show the extent of their believe and perception about blindness. For instance, one of the songs below was recorded from a blind beggar: "To be alive is good. Every one needs to live. I was born strong and healthy with full hope. The future was bright but the enemies got hold of me. I lost my vision. But we look up to you oh, God, what have we done? You make all living, souls, we look up to you".

From the above song, it is obvious that there is a perceptual dissonance in the way the disease is perceived. It is significant to highlight a number of observations on the perception made in this study. Firstly, there is predominant belief in witchcraft, spirits, enemies etc as cause of the blinding disease (onchocerciasis). This according to Dupree and Roder (1974) is typical of pre-industrial and preliferate farming societies with low educational level, strong religious beliefs and superstitions. Indeed, this was quite evident in this study in which a low literacy level of the respondent (Table 3) was recorded and also a strong positive correlation between perception and religious beliefs (Appendix 2) was observed. Secondly , there appears to be a perceptual dissonance, a conflict in perception as what was seen as an "act of God" was also caused by "Witchcraft" or by farming near the river. This perceptual dissonance is a function or two factors, notably, that when impacts are as not falling randomly, there is a tendency to blame some other sector of the society (WHO, 1985; Kolawole, 1986).

The various manifestations of onchocerciasis such as itching, dermal changes and blindness has drastic effect on their victims. Itching which is the earliest sign of the disease caused restlessness and sleeplessness especially in Pangri, Bambado, Jenuwa Kogi and Fikyu where the prevalence was high. Most people that have dermal changes in the study area look older than their ages and their skin roughened. Although in most cases (48%) it disfigures the skin, in some it was so pronounced that it had a distressing effect on the life style of the individual. For instance, in Jenuwa Kogi, leopard skin was mistaken for leprosy.

Dermal changes hardly affected marriage as most of the victims believed that it was not a criteria for choosing a life patner. This contradicts with the finding of Amazigo (1993) in Eteh community where dermal changes affected marriage.

Nodules constituted the most common clinical manifestation of onchocerciasis in the study area as shown in both parasitological and rapid assessment surveys in villages like Jenuwa Kogi, Acha, Pangri, Zaga and Bambado. It disfigures the body in majority of the victims (48%) and causes social/psycological discomfort (39%).

Scrotal enlargement has many effects on onchocerciasis patients. Majority of the respondents (37%) agreed that it affected them to the extend that they were unable to meet up with their sexual obligation. In addition, movement is obstructed as men are seen tieing wrappers round their waist

instead of putting on trousers. All these induce social and psycological depression on the victim. Interestingly however, even though 23% of the respondent agreed that scrotal enlargement obstructs movement, only 11% thought that it induces farming activity. By this, it is difficult to make out how such a victim can effectively cope with the rigor of farming even when he is unable to walk. Also, body weakness which is largely due to onchocerciasis reduced farming strength in majority of the victims followed by mobility to work. This invariably affected their productivity.

Blindness was noted to have the most distressing effect in the study area. Majority of the blind in the study area belong to the 20 - 40 year age group which are the most productive labour force. This conforms with the previous finding that blindness is usually concentrated at the working age group in Nigeria (Nwoke, 1991). The effects of blindness in the study area shows that it incapacitated them, reduced the family farming strength and caused economic burden to the family. The change of occupation by the blind and other deformities caused by the disease also affected the total annual income. For instance, blindmen who were initially farmers had to change to begging, weaving, singing, drumming or depend on their families. This explains the reason why some children have to drop out of school in Bali inorder to lead their parents to beg or take care of their immediate needs, money gotten from begging was used to sustain themselves and the family. In Takum, begging is forbidden. The family and community are responsible for

their upkeep and at most times free labour is provided on their farms. This comforms with the report of Bradley (1976) in Hawal River Valley where the blind were taken care of by the community.

Blindness also affects the social interaction of the blind in the society; this include the full participation of the blind in social activities of the society, marriage from higher social status and local responsibility like village head, ward head etc. It was observed that 61% of the blind were accepted in the society, 34% partially accepted while 1.8% not accepted. Although the blind were never totally rejected by their communities as outcast, the cases of the 2 blindmen that were not accepted in Zaga was a result of the believe that they were involved in witchcraft. Educational status also contributes to the acceptability of the blind. Thus in Takum where the educational status was higher, the blind were not allowed to beg and in most cases involved in craft work. Generally, majority of the blind feel disabled, incapacitated and were socially and economically dependent on their families because most of them could not contribute by way of full participation in the general activities of the society and for the fact that most of them have to be told what is happening around them.

In terms of marriage and friendship, majority of the blind do not easily find marriage patners (71%). According to the victims, the problem of marrying to the blind is that of added responsibility. For instance, five respondents

whose wives were blind had to do most of the household chores, although from time to time relations do assist. The chances of the blind getting married from a higher social status was low (23.7%). Although most of the blind victims got married before their predicaments, the effect was greatly felt in the family. In cases were both couples are blind, their children and the community became responsible for their upkeep. This is the most important reason why children of the blind had to drop out of school to lead and assist their blind parents on farm and to beg for alms.

Lastly the rapid assessment survey showed the detail clinical manifestation in each village as it was done from house to house basis. The high prevalence of rashes, nodules and blindness comformed with high endemicity of the disease obtained in the parasitological studies.

SUMMARY AND CONCLUSION

A study on the socioeconomic effects of onchocerciasis in Bali and Takum L.G.A., has revealed the endemicity of the disease in these areas. Hyperendemicity was associated with frontline villages.

Prevalence and intensity of the disease increased with age and generally males were more infected than females. Clinical manifestations like nodules were the most common as compared to leopard skin, and blindness.

In the socioeconomic studies, the general awareness of the disease is very low. Only 38.2% were aware of onchocerciasis. Generally there was a correlation between percep-

tion on one hand and age, occupation, education and religion on the other level. Correlation also existed between blindness and migration, blindness/dermatological involvement and social life.

The social life of the victims were affected by clinical manifestations such as itching which caused discomfort and sleeplessness especially in hyperendemic villages. Scrotal enlargement affected sexual interaction in 37% while lizard skin made the victims looked older than their ages. Blindness which had the most drastic effect on social problems and low farm productivity.

Economically, the disease affected occupational activities. Itching reduces the time spent on the farm and thus reduced the amount of time and effort put on the farm which eventually reduced the total crop output in hyper and mesoendemic villages.

Majority of the blind belong to age groups of between 20 - 40 years, and these are the most productive labour force. The effect of blindness shows that it incapacitated them, reduced family farming strength and reduced crop output. Also it caused economic burden and the family had to employ labour. Also the change of occupation by the blind and other deformities caused by the disease affected the total annual income.

In conclusion, the results of the survey have shown that onchocerciasis has accompanying socioeconomic consequences in the study area. Unfortunately, the people's level

of awareness of the real cause of the disease was low and marked with perceptual dissonance, which was dominated by cultural beliefs and practices.

For the National Onchocerciasis Control Programme to be effective and successful, it must emback on awareness programme in most of the rural villages to ensure understanding, co-operation and participation among the people towards an effective control programme. Also, there is the need to set up an entomological control unit to control the blackfly vector.

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APPENDIX 1

ONCHOCERCIASIS SOCIO-ECONOMIC RESEARCH SURVEY

Date..... Name of Investigator.....

Ward/Village..... Distric.....

L.G.A..... State.....

A PERSONNEL DATA

A1 Name of household head:.....

A2 Sex:

Male	(01)
Female	(02)

A3 Age:

< 20	(01)
20 - 30	(02)
31 - 40	(03)
41 - 50	(04)
above 60	(05)

A4 Level of Education:

Koranic	(01)
Christian	(02)
Primary	(03)
Adult Education	(04)
Secondary/Teacher's	(05)
College	
College of Education	(06)
Polytechnic	(07)
University	(08)
None	(09)
Others (specify)	(10)

A5 Occupation:

Farming	(01)
Fishing	(02)
Trading	(03)
Civil Servant	(04)
Cattle rearer	(05)
Blacksmith	(06)
Teaching	(07)
Hunting	(08)
Religious leader	(10)
Others (specify)	(11)

A6 If farming, farm type:

Fadama	(01)
Upland	(02)
Orchard	(03)
Plantation	(04)
Others (specify)	(05)

A7 Farm size:

1 acres	(01)
2-3 acres	(02)
4-5 acres	(03)
above 5 acres	(04)

A8 What types of crops do you grow?

Cereals	(01)
Groundnut	(02)
Vegetables	(03)
Legumes	(04)
Fruits	(05)
Tubers	(06)
Others (specify)	(07)

A9 Religion:

Christian	(01)
Islam	(02)
Traditional	(03)
Others (specify)	(04)

A10 Marital Status:

Single	(01)
Married	(02)
Divorced	(03)
Seperated	(04)
Widowed	(05)

A11 If married, number of wives:

One	(01)
Two	(02)
Three	(03)
Four	(04)
above four (specify)	(05)

A12 Number of children:

One	(01)
Two	(02)
Three	(03)
Four	(04)
above four (specify)	(05)

A13 Number of children in modern school.....

A14 Number of children not in school.....

A15 If some or all are not in school, reasons for not sending them to school.

Don't like the system	(01)
No money for school fees	(02)
No need for girls	(03)
Needed on the farm	(04)
Needed at home	(05)
Others (specify)	(06)

B RESIDENCE/INIGRATION

B16 Were you born in this village?

Yes	(01)
No	(20)

B17 If no, duration to residence in this village:

Less than 1 year	(01)
1-5 year	(02)
6-10 years	(03)
11-20 years	(04)
above 20 years	(05)

B18 Where did you migrate from?.....

B19 Main reason for emigrating from former villages.

Fear of diseases	(01)
No fertile farmlands	(02)
No jobs	(03)
No river	(04)
Fear of spirits	(05)
Fear of persecution	(06)
To avoid flybites and disturbance	(07)
Over population	(08)
No reason	(09)
Other (specify)	(10)

B20 If for fear of disease, which type?

Blinding disease	(01)
Body itching disease	(02)
Leprosy	(03)
Sleeping sickness	(04)
Abortion	(05)
Frequent death of children	(06)
Others (specify)	(07)

B21 If fear of flies, which type?

Blackflies	(01)
Mosquitoes	(02)
Brown flies	(03)
Others (specify)	(04)

B22 Any likehood of further migration?

Yes	(01)
No	(02)

B23 If yes, why?

Over population	(01)
Limited farmlands	(02)
Reoccurence of disease	(03)
Unsuitable farmlands	(04)
Others (specify)	(05)

B24 Has any member of your household left this village within the last 5 years?

Yes	(01)
No	(02)

B25 If yes, why?

In search of job	(01)
In search of school	(02)
Fear of disease	(03)
Fear of spirit	(04)
Marriage	(05)
In search of farmlands	(06)
Others (specify)	(07)

C PERCEPTION, KNOWLEDGE AND EFFECTS OF THE BLACKFLY

C26 Have you seen this insect (Blackfly) before? (show sample)

Yes	(01)
No	(02)

C27 If yes, what is the local name of the fly?

C28 Where does it breed?

Land	(01)
Forest	(02)
Don't know	(03)
Others (specify)	(04)

C29 Does the flybite?

Yes	(01)
No	(02)
Don't know	(03)

C30 If yes, which period of the day does it prefer to bite?

Morning	(01)
Afternoon	(02)
Evening	(03)
Night	(04)
Thoughout the day	(05)
Don't know	(06)
Others (specify)	(07)

C31 Which period of the year does it bread/bite most?

Dry season	(01)
Wet season	(02)
All year	(03)
Don't know	(04)
Others (specify)	(05)

C32 Which part of the body does the fly prefer to bite?

Head/face	(01)
Hand/shoulder	(02)
Waist	(03)
Legs	(04)
Don't know	(05)
Others (specify)	(06)

C33 What does the fly bite cause?

Causes disease	(01)
Disturbs farming activity	(02)
Disturbs outdoor recreation	(03)
Disturbs animal crazing	(04)
Causes migration	(05)
Don't know	(06)
Others (specify)	(07)

C34 If it causes disease which type?

Blinding	(01)
Body itching	(02)
Sleeping sickness	(03)
Leprosy	(04)
Fever	(05)
Skin depigmentation	(06)
Headache	(07)
Abortion	(08)
Don't know	(09)
Others (specify)	(10)

C35 If fly disturbs farming, to what extend?

Farming time reduced	(01)
Farming is avoid at flypeak	(02)
Crop output is reduced	(03)
Others (specify)	(04)

C36 What preventive measures do you take against blackfly bites?

Wear protective clothes	(01)
Burn herbs as repellants	(02)
Avoid going to farm	(03)
Others (specify)	(04)

C37 Where do you encounter the flies quite often?

By the riverside	(01)
In the house compound	(02)
Farm land	(03)
In the bush	(04)
Everywhere	(05)
Others (specify)	(06)

C38 Do you go to the river?

Yes	(01)
No	(02)

C39 If yes, reasons for going to the river.

To fetch water	(01)
To swim	(02)
To fish	(03)
To boat	(04)
To bathe	(05)
To wash	(06)
To irrigate farm	(07)
Others (specify)	(08)

D PERCEPTION KNOWLEDGE AND EFFECTS OF ONCHOCERCIASIS

D40 Have you heard about the eye disease onchocerciasis?

Yes	(01)
No	(02)

D41 If yes, what does the disease cause?

Blindness	(01)
Impaire vision	(02)
Nodules	(03)
Skin charges	(04)
Body weakness	(05)
Body itching	(06)
Others (specify)	(07)

D42 Do you or any member of your household experience body itching?

Yes	(01)
No	(02)
Don't know	(03)

D43 If yes how many?.....

D44 What is the effect body itching?

Causes restlessness	(01)
Causes social/psychol discomfort	(02)
Disturbs sleeping	(03)
Disturbs outdoor recreation	(04)
Disturbs farming/fishing activities	(05)
Others (specify)	(06)

D45 Are you or any member of your family with dermal changes such as leopard skin, lizard skin and elephantiasis?

Yes	(01)
No	(02)

D46 If yes, How many?

D47 What is the effect of dermal changes?

Desfigures the skin	(01)
Causes social/ psychological discomfort	(02)
Obstructs movement	(03)
Others (specify)	(04)

D48 Are you or any member of your family with body swellings (nodules)?

Yes	(01)
No	(02)
Don't know	(03)

D49 If yes, how many?

D50 Effect of nodules

Causes pains	(01)
Disfugure the body	(02)
Cause social/psylogical discomfort	(03)
Obstruct movement	(04)
Obstruct farming activity	(05)
Others (specify)	(06)

D51 Do you or any member of your family experience general body weakness?

Yes	(01)
No	(02)
Don't know	(03)

D52 Effect of body weakness.

Reduces farming strength	(01)
Reduces ability to work	(02)
Retards mental acitivity	(03)
Others (specify)	(04)

D53 Are you or any member of your family with scrotat enlargement/genital distortion?

Yes	(01)
No	(02)
Don't know	(03)

D54 Effects of scrotal enlargement/genital

Affects sexual in the action	(01)
Causes social and psycological depression	(02)
Reduces farming activity	(03)
Others (specify)	(04)

D55 Are you or any member of your family with impaired vision

Yes	(01)
No	(02)
Don't know	(03)

D56 If yes, how many?.....

D57 Effect of impaired vision

Reduces ability to form	(01)
Reduces ability to perform house hold chores	(02)
Retards learning at school	(03)
Others (specify)	(04)

D58 Are you or any member of your family blind?

Yes	(01)
No	(02)
Don't know	(03)

D59 If yes, how many?.....

D60 Effect of blindness:

Incapacitate those affected	(01)
Reduces family farming strength	(02)
Reduces family crop output	(03)
Reduces family income	(04)
Increases economic and social burden of family	(05)
Causes less of job/dismiesal	(06)
Causes family to employ laboranfarm	(07)
Others (specify)	(08)

D61 What was the cause of blindness?

Disease	(01)
Accident	(02)
Spirits	(03)
Family enemies	(04)
Natural cause (interited)	(05)
Unknow	(06)

D62 If by disease, which one?

Caused by blackflies	(01)
Fever	(02)
Malaria	(03)
Measeles	(04)
Leprosy	(05)
Don't know	(06)
Others (specify)	(07)

D63 When did blindness set in?

At birth	(01)
1 year ago	(02)
2 years ago	(03)
3 years	(04)
4 years	(05)
above 5	(06)

D64 Occupation of the blind

Begging	(01)
Singing	(02)
Weaving	(03)
Nothing	(04)
Others (specify)	(05)

D65 Who generally caters for the physical and social needs of the blind?

Self	(01)
Household	(02)
Community	(03)
Government	(04)
Organisation (name)	(05)
Others (specify)	(06)

D66 How acceptable is the blind in the society

Acceptable	(01)
Not acceptable	(02)
Partly acceptable	(03)
Others (specify)	(04)

D67 Do the blind easily find marriage partners?

Yes	(01)
No	(02)

D68 If yes, what are the chances of the blind getting a marriage partner from a higher social status?

High	(01)
Low	(02)
None	(03)

D69 How do the blind generally feel or behave in the family?

They feel dejected	(01)
They feel disabled	(02)
They feel social and economic burden to the family	(03)
They feel discriminated against	(04)
They isolate themselves	(05)

Others (specify) (06)

D70 Have any one in the past examined you?
Yes (01)
No (02)

D71 If yes, by what method?
Skinsnip (01)
Eye examination (02)
Physical examination (03)
Others (specify) (04)

D72 Have you heard of the "newdrug" for preventing "blindness"?
Yes (01)
No (02)

D73 Have you or any member of your family been given drugs in the past to prevent blindness?
Yes (01)
No (02)

D74 If yes, how often do you take the drug per year?
Once (01)
Twice (02)
Thrice (03)
Many times (04)
Others (specify) (05)

D75 Of what help was the drug and (or) member of your family?
Eliminated worms (01)
Increased appetire (02)
Stopped body itching (03)
Increased itching (04)
Increased vision (05)
Changes skin color (06)
Reduced body weakness (07)
Others (specify) (08)

D76 Where or from whom did you or any member of your family get receive the new drug?.
Community Based workers (01)
Mission dispensary or hospital (02)
Government dispensary (03)
Private doctor (04)
Organisation (name) (05)
Others (specify) (06)

D77 How much does it cost you to under take the above curative remedy?
#20 (01)
#50 (02)
#100 (03)
above #100 (04)
Free (05)

Nodule	Elephantiasis	Lizardskin	Blindness	Leopard skin	Rashes	Itching

Appendix 2:

CORRELATION ANALYSIS BETWEEN PERCEPTION AND SEX, AGE EDUCATION, OCCUPATION, RELIGION

	Socio-economic characteristics					
Villages	Sex	Age	Educ.	Occup.	Rel.	R(value)
TAKUM LGA						
Jenuwa Kogi	0.301	0.456 *	-0.101	0.524 *	0.175	0.329
Manya	0.004	0.095	0.131	0.378 *	0.153	0.344
Jenuwa Gida	0.051	0.191	0.398 *	0.128	0.365 *	0.361
BALI LGA						
Bambado	0.247	0.327 *	-0.175	0.621 *	0.331 *	0.325
Mayokam	0.009	-0.292	-0.037	-0.091	-0.078	0.334
Zaga	__	0.218	0.087	0.340 *	0.336 *	0.334
Pangri	__	0.365 *	0.112	0.359 *	0.451 *	0.349
OVERALL	0.074	0.215 *	0.320	0.317 *	0.638 *	0.107

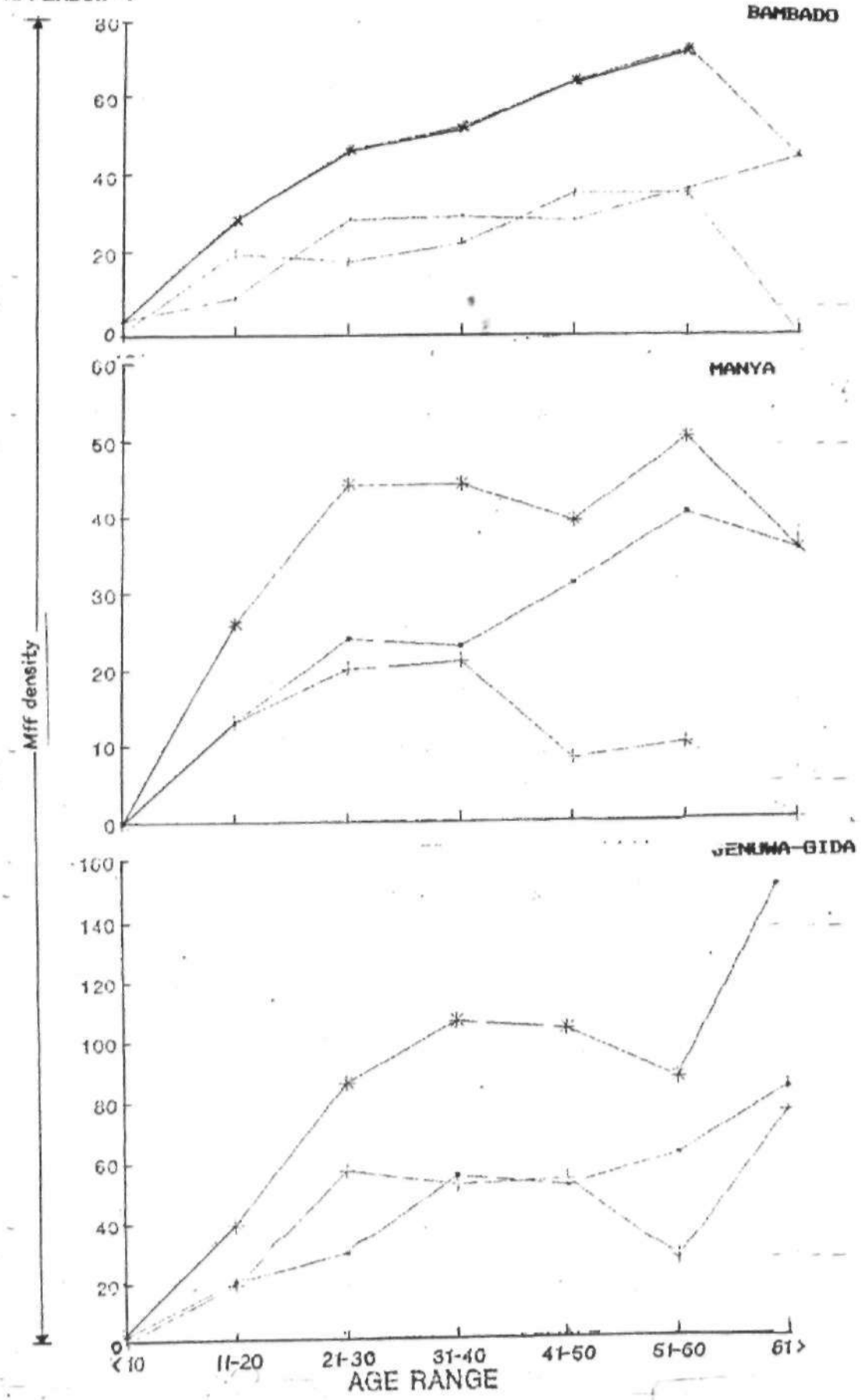
* - Significant

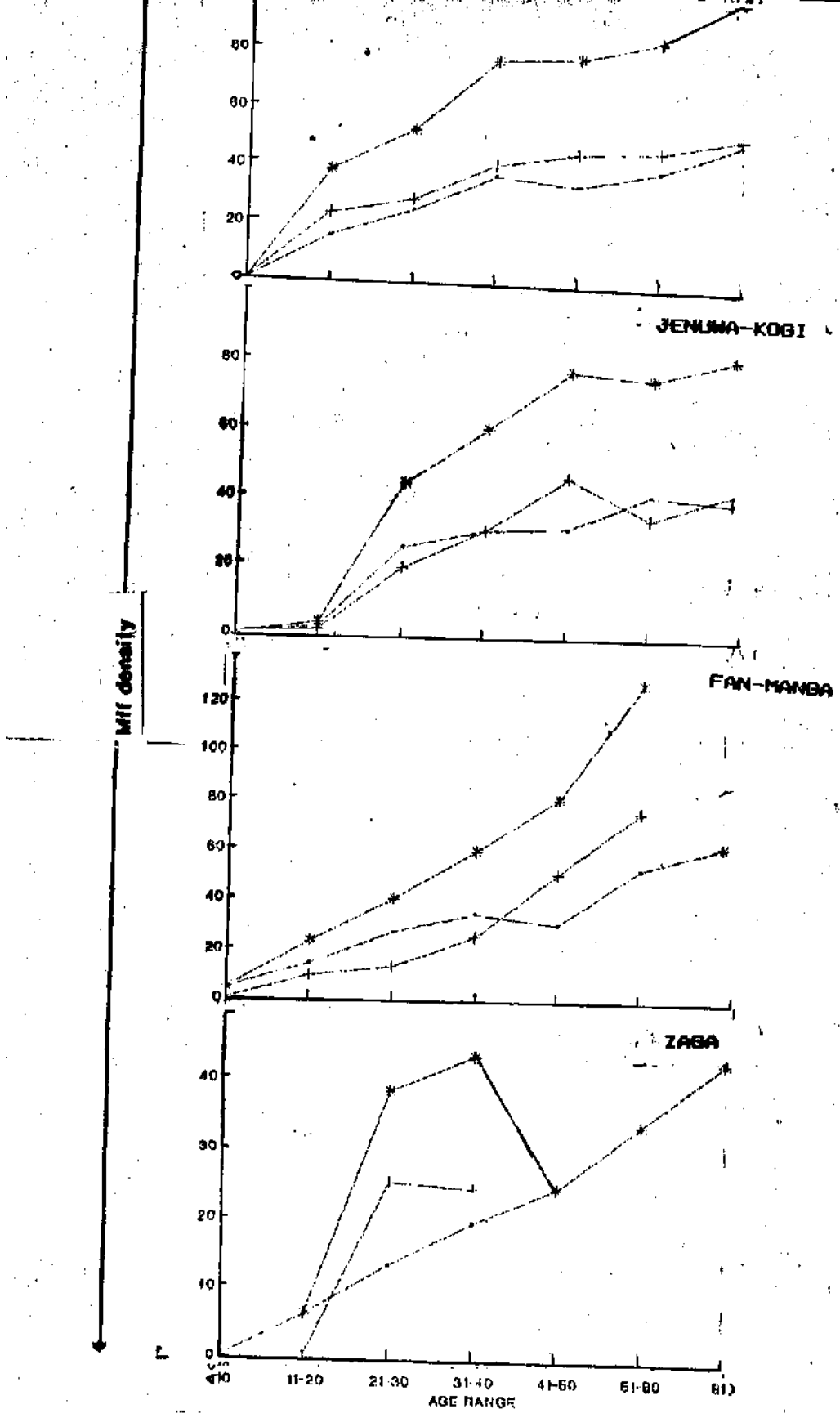
Appendix 3: Correlation analysis between socioeconomic variables.

Villages	Nuisance effect of Blackfly--> Prod.	Blindness/derm. Invol. -->Prod.	Blackfly effect --> migration	Blindness/derm. Invol. --> social	Blindness--> migration
BALI					
55% Zaga	cal- 16.534 x2- 12.592 *	cal- 15.048 x2- 14.447 *	cal- 19.211 x2- 16.919 *	cal- 5.880 x2- 3.87 *	cal- 16.447 x2- 12.599 *
66% Pangri	cal- 14.542 x2- 12.592 *	cal- 9.296 x2- 7.815 *	cal- 12.592 x2- 2.004 *	cal- 7.341 x2- 4.054 *	cal- 4.592 x2- 4.431 *
30% Mayokam	cal- 10.264 x2- 15.507	cal- 11.207 x2- 19.488	cal- 18.578 x2- 50.999	cal- 2.698 x2- 15.507	cal- 34.134 x2- 36.731
53% Bambado	cal- 9.836 x2- 7.815 *	cal- 13.783 x2- 2.004 *	cal- 22.497 x2- 21.066	cal- 12.807 x2- 11.341 *	cal- 7.815 x2- 4.054 *
63% Jenuwa Kogi	cal- 10.773 x2- 5.576 *	cal- 16.364 x2- 12.592 *	cal- 23.700 x2- 37.652	cal- 16.364 Tab- 5.992 *	cal- 21.026 x2- 26.717
42% Nanya	cal- 2.427 x2- 16.919	cal- 1.207 x2- 9.488	cal- 9.259 x2- 21.026	cal- 9.672 x2- 9.488 *	cal- 8.286 x2- 21.026
49% Fikyu	cal- 6.816 x2- 5.147 *	cal- 2.584 x2- 2.012 *	cal- 8.536 x2- 24.996	cal- 28.352 x2- 16/919 *	cal- 2.593 x2- 18.307
24% Jenuwa Gida	cal- 7.682 x2- 15.507	cal- 20.840 x2- 21.026	cal- 9.881 x2- 15.507	cal- 5.343 x2- 7.815	cal- 1.181 x2- 9.488
Overall	cal- 23.525 x2- 14.542 *	cal- 86.669 x2- 28.869 *	cal- 70.542 x2- 137.699	cal- 64.426 x2- 21.076 *	cal- 59.344 x2- 58.124 *

* Significant

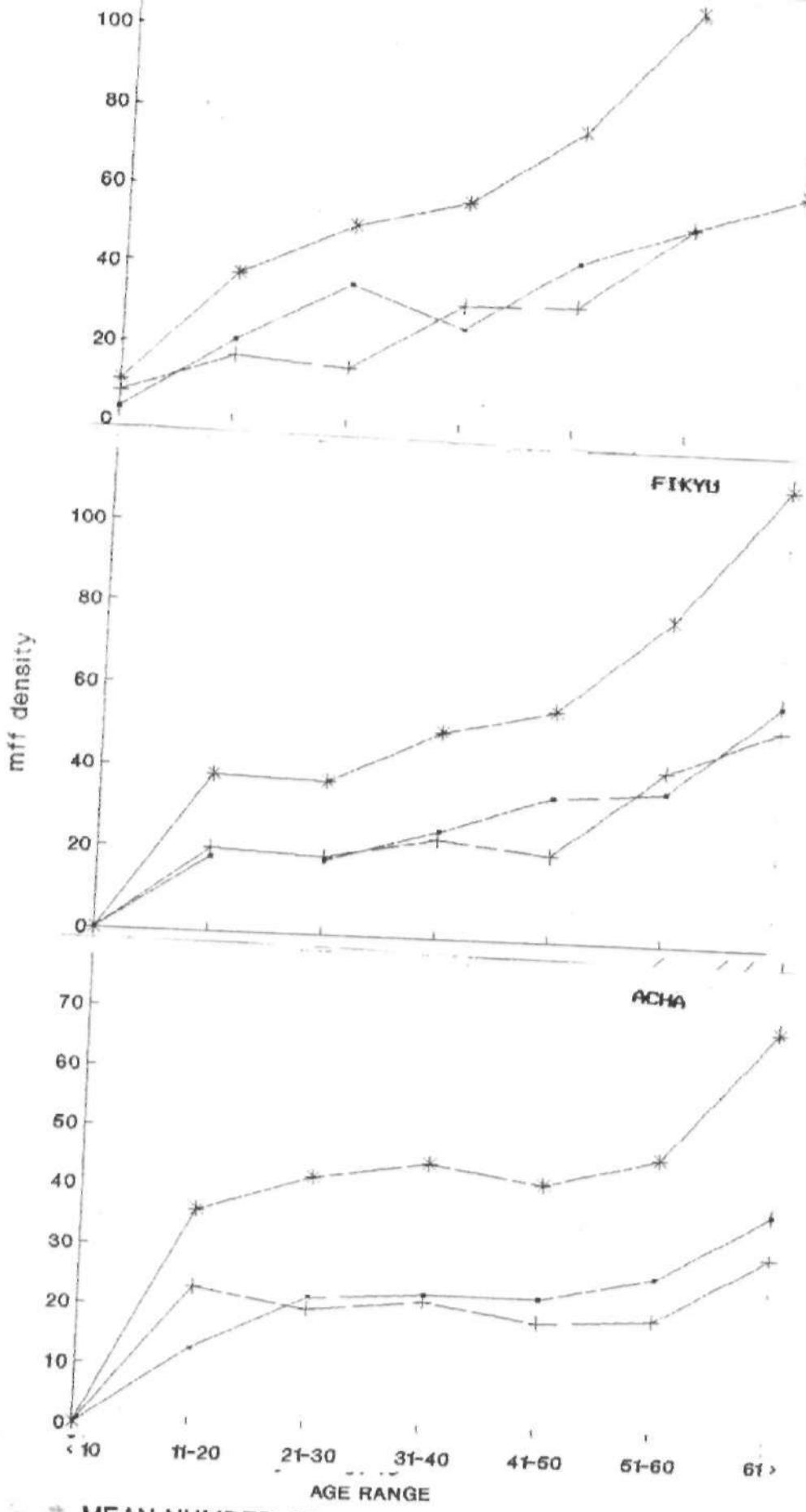
APPENDIX 4


BAMBADO
MANYA
JENUWA-GIDA
Mff density
AGE RANGE
< 10
11-20
21-30
31-40
41-50
51-60
61 >
MEAN MICROFILARIAE DENSITY BY SEX AND AGE
MALE
FEMALE
TOTAL



MEAN MICROFILARIAE DENSITY BY SEX AND AGE

MALE FEMALE TOTAL



MEAN NUMBER OF MICROFILARIAE DENSITY BY AGE AND SEX: PANGRI, FIKYU ACHA