

## HUMAN ONCHOCERCIASIS: CURRENT EPIDEMIOLOGICAL AND DERMATOLOGICAL ASSESSMENT OF THE DISEASE IN UFUMA, NIGERIA

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### ABSTRACT

**Epidemiological and dermatological assessment of Onchocerciasis was carried out in Ufuma, Anambra State, southeastern Nigeria, between October and December 2005. Total of 404 consenting individuals from the nine villages in Ufuma, were systematically examined by the nodular palpation method. Community nodular prevalence of 30.9 % was recorded, indicating that Ufuma was mesoendemic for Onchocerciasis. 208 (51.5 %) individuals had various degrees of Onchocerciasis-induced skin diseases (OSD). Concomitant infections (nodules with OSD) affected 105 (26.0 %) of all OSD+ve individuals, indicating that certain subjects presented with palpable nodules did not develop any OSD. Age, gender and inter-village specific prevalence of onchocercal nodules, OSD and concomitant infections (nodules with OSD) were also reported in this study. The practice of lay nodulectomy observed in the area is a strong indication of the people's attempt to control the disease. Awareness created by this study, in Ufuma, that Onchocerciasis is a controllable medical condition, may enhance compliance with Community Directed Treatment with Ivermectin (CDTI) in the study area.**

**Keywords:** Onchocerciasis, Onchocercoma, Onchodermatitis, Endemicity, Ufuma, Nigeria

### INTRODUCTION

Onchocerciasis (river blindness) is caused by the parasitic filarial worm, *Onchocerca volvulus*, and transmitted by *Simulium damnosum* complex in different parts of the world. The disease is acclaimed to be one of the major public health problems that afflict populations in endemic areas of the world where it may cause disfiguration of the skin and blindness. About 125 million people worldwide are at risk of Onchocerciasis, of which 96 % live in Africa (WHO, 1995). The disease thrives in fertile, arable lands around rapidly flowing rivers that provide breeding sites for the insect vector (Nwoke *et al.*, 1998). Onchocerciasis was also responsible for poor academic performance and a higher drop out rate among infested children while low productivity, low income, higher health related costs and gender differences in the stigma associated with OSD were found among infested adults (Nwoke, 1990; Vlassoff *et al.*, 2000; Okolo *et al.*, 2004).

*Onchocerca volvulus* infection areas in Africa have been defined in terms of the savannah and forest vegetation zones. However, there are areas of Africa, sometimes called 'forest savannah mosaic' (Okonkwo *et al.*, 1991), where the savannah and forest zones merge. Ufuma in Orumba-North Local Government Area of Anambra State, southeastern Nigeria, is a typical example of such an area. Much work had been done on the prevalence and importance of OSD in Anambra and adjoining states in Eastern Nigeria (Nwaorgu *et al.*, 1994; Ahmed *et al.*, 1995; Nwoke, *et al.*, 1998; Dozie and Onwuliri, 2004; Ivoke, 2004) but the epidemio-dermatological picture of the disease in Ufuma has not been fully

documented. We considered Ufuma, which was selected for this study, a potential Onchocerciasis infection focus because of the observable levels of OSD in the town. The study was therefore designed to investigate the prevalence of Onchocerciasis in Ufuma, where no published data exist. Results from this study will be useful in the surveillance of the disease in Anambra State. It may also stimulate further studies on the gender differences in the stigma associated with OSD as well as on some non-clinical signs, which have been reported in infected individuals in other areas of the country (Vlassoff *et al.*, 2000; Dozie and Onwuliri, 2004).

### MATERIALS AND METHODS

**Study Area:** This study was carried out in the nine villages in Ufuma, which is located between Latitude 6°28' – 6°32' N and Longitude 7°31' – 7°32' E in Orumba North Local Government Area of Anambra State, southeast Nigeria. The major bodies of water in the area are the perennial, well-aerated fast-flowing Mmam and Aghomiri rivers, confirmed by the natives to be the breeding sites of *Kpu-kpu* – a descriptive name for the hump backed *Simulium* fly – in the area. Luxuriant growth of bamboo (*Bambusa sp.*) along the Mmam and Aghomiri riverbanks and several geological formations on the riverbeds caused resistant rapids, providing suitable breeding sites for the *Simulium damnosum* complex, the vector of *Onchocerca volvulus*, in the area. The rivers provide water for drinking and other domestic purposes for the people. The area has two distinct climatic seasons in the year. The seven months (April-October) of wet season, with a break in July/August, is followed by

five months (November-March) of dry season when the harmattan occasionally occurred. Average annual rainfall (1620.4 mm), mean daily maximum air temperature ( $32.2 \pm 2.2^\circ\text{C}$ ), mean daily minimum air temperatures ( $23.3 \pm 1.1^\circ\text{C}$ ), mean soil temperature ( $29.7 \pm 2.4^\circ\text{C}$ ) and average relative humidity (84 %) have been recorded at the Mamu Forest Reserve in the area. The vegetation is typical rainforest but forest savannah mosaic had appeared around Umueji, Umuonyiba and Umuonyibauka villages, perhaps due to extensive human intervention. Farming, fishing and palm-wine tapping, are the main occupation of the people who are of Ibo ethnic origin. However, few petty traders and daily-paid job seekers shuttle to nearby commercial towns of Ekwulobia and Umunze for daily businesses. Ufuma has an important religious center where devotees travel to from different parts of the country. These devotees and non-resident indigenes of the town were not part of the study population.

**Community Mobilization:** The researchers, accompanied by two community-based facilitators (male and female) visited the area of study in mid-October 2005. Oral interviews with opinion leaders and some indigenes revealed the people's awareness of the existence of *Kpu-kpu* - the vernacular descriptive name for the hump-backed *Simulium* fly - in the area. The bites of *Kpu-kpu* sometimes resulted in the development of several *Kputu-kpu* or *Akpu* (nodules) under the skin of victims. Varying degrees of *Oko* (intense itching), *Agho-okoko* (scratches from Aghomiri) and *Mmuma-miri* (skin rashes from Mmam water) experienced by the people were associated with the bite of *Kpu-kpu* and contact with water from Aghomiri and Mmam rivers. Some indigenes also believed that these conditions were hereditary. Incision marks observed on the body of some Onchocerciasis victims evidenced the practice of lay nodulectomy in the area. Most of the villagers interviewed were willing to accept Ivermectin treatment for the disease since they had in the past patronized medicine vendors for Banocide®. The community was therefore adequately sensitized and mobilized for the eventual study.

**Dermatological Examination:** The study was carried out between October and December 2005 on four hundred and four (404) consenting individuals from the nine villages of the town. Each subject supplied information on his/her experiences with Onchocerciasis. They were then systematically examined for the presence of palpable nodules, and visually for Onchocercal Skin Diseases (OSD) characterized by itching, leopard skin, hanging groin and skin atrophy. Blindness was determined by the subject's inability to count fingers at a distance of less than three meters (WHO, 1996). The findings were recorded in a standard structured format.

**Data Collation and Analysis:** Data were collated and stratified by age, gender and village. Prevalence of Onchocerciasis was determined on the basis of the results of the nodule palpation and observed OSD.

Endemic levels were according to the classification adopted by Tada *et al.* (1973) as follows: hyperendemic (nodular prevalence, NP  $\geq 40$  %), mesoendemic (NP = 20-39 %), and hypoendemic (NP  $\leq 19$  %). Chi-square analysis and Student's *t*-test were respectively used to compare categorical variables (e.g., gender) and continuous variables (e.g., age between groups. *P*-values  $< 0.05$  were considered statistically significant.

## RESULTS AND DISCUSSION

The study population (n = 404) was stratified into 9 villages, gender and 6 age-groups (see Table 1). Each village provided about 45 (11.1 %) of the study population, which comprised 165 (40.2 %) males and 239 (59.2 %) females. 10-19 years age-group had the highest number of subjects 130 (32.2 %) examined, followed by 30-39 years age-group with 78 (19.3 %). Age groups  $\leq 9$  and  $\geq 40$  years however contributed 64 (15.8) and 82 (20.3 %) respectively. The short-fall in the number 50 (12.4 %) provided by 20-29 years age-group was thought to be due to the high rate of rural to urban drift observed in that group. Generally, there were more females than males in all age groups studied.

Table 2 shows the prevalence of onchocercal skin nodules in the study population. 125 (30.9 %) subjects were positive (+ve) for onchocercoma, indicating that at the community level Ufuma was mesoendemic for Onchocerciasis. Similar level of endemicity was reported from Oji-River areas in Enugu State (Nwaorgu *et al.*, 1994), which has common boundaries with the study area. Inter-village nodular prevalence, however, ranged from 8.7 % in Umuonyibauka to 53.3 % in Enugwu-Abo. Going by the classification of endemicity adopted by Tada *et al.*, (1973), only Umuonyibauka (Nodular Prevalence, NP = 8.7 %) was hypoendemic while Umuagu (NP = 42.5 %) and Enugwu-Abo (NP = 53.3 %) were hyperendemic for the disease. Umunebo (NP = 24.4 %), Umuogem (NP = 25.0 %), Umuonyiba (NP = 25.0 %), Umueji (NP = 27.2 %), Umuebu (NP = 35.3 %) and Umuinem (NP = 35.7 %) were mesoendemic for Onchocerciasis. The nearness of Enugwu-Abo and Umuagu to Oji River and their location within the rain forest vegetation which are breeding sites for *Simulium damnosum* complex, vectors of *Onchocerca volvulus*, was thought to be responsible for the hyperendemic levels recorded for the two villages. But Umuonyibauka village (in savannah forest mosaic), which was hypoendemic, is farthest from these rivers, and its inhabitants least came in contact with the blackfly. This is in line with the findings of Akogun *et al.* (1999) and Ivoke (2004).

Nodular prevalence of 30.3 % (females) and 31.4 % (males) suggested that both gender were equally exposed to the blackfly. It could be observed that 20-29 years age group had the highest nodular prevalence (50 %), followed by 30-39 years age group with 37.2 % then 40-49 years age group with 28.1 %. These age groups 20-49 were found to be the most active segment of the community.

**Table 1: Stratification of the study population**

Village	Study population			≤ 9 yrs.			10-19 yrs.			20-29 yrs.			30-39 yrs.			40-49 yrs.			≥ 50 yrs.		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
<i>Enugwu-Abo</i>	14	31	45	3	5	8	7	9	16	2	4	6	3	4	7	2	3	5	1	2	3
<i>Umuagu</i>	17	30	47	3	4	7	5	10	15	3	4	7	2	4	6	3	3	6	2	4	6
<i>Umunebu</i>	21	21	42	3	3	6	5	11	16	3	3	6	3	4	7	1	3	4	1	2	3
<i>Umuinem</i>	18	33	51	3	6	9	8	9	17	1	3	4	4	6	10	2	3	5	2	4	6
<i>Umueji</i>	20	24	44	2	4	6	5	7	12	2	3	5	3	7	10	4	2	6	2	3	5
<i>Umuogem</i>	19	29	48	4	4	8	7	11	13	3	2	5	4	5	9	1	3	4	3	1	4
<i>Umuonyiba</i>	21	19	40	3	2	5	7	3	10	3	4	7	4	7	11	2	2	4	1	2	3
<i>Umunebo</i>	15	26	41	3	5	8	5	7	12	2	3	5	4	4	8	2	2	4	1	3	4
<i>Umuonyibauka</i>	20	26	46	2	5	7	6	8	14	2	3	5	3	7	10	1	3	4	2	4	6
<b>Total</b>	<b>165</b>	<b>239</b>	<b>404</b>	<b>26</b>	<b>38</b>	<b>64</b>	<b>55</b>	<b>75</b>	<b>130</b>	<b>21</b>	<b>29</b>	<b>50</b>	<b>30</b>	<b>48</b>	<b>78</b>	<b>18</b>	<b>24</b>	<b>42</b>	<b>15</b>	<b>25</b>	<b>40</b>

M = Male, F = Female, T = Total (M + F).

**Table 2: Community specific prevalence of onchocercal nodules in the study population**

Village	Study population						Onchocerca nodules +ve					
	Total examined		Male examined		Female examined		Total +ve		Male +ve		Female +ve	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
<i>Enugwu-Abo</i>	45	11.1	14	31.1	31	68.9	24	53.3	9	64.3	15	48.4
<i>Umuagu</i>	47	11.6	17	36.2	30	63.6	20	42.5	7	41.2	13	43.0
<i>Umunebu</i>	51	10.9	18	35.3	33	64.7	18	35.3	8	44.4	10	30.3
<i>Umuinem</i>	42	12.7	21	50.0	21	50.0	15	35.7	6	28.6	9	42.9
<i>Umueji</i>	44	10.1	20	45.5	24	54.5	12	27.2	5	25.0	7	29.2
<i>Umuogem</i>	48	10.4	19	39.6	29	60.4	12	25.0	6	66.7	6	20.7
<i>Umuonyiba</i>	40	11.9	21	52.5	19	47.5	10	25.0	3	14.3	7	36.9
<i>Umunebo</i>	41	9.9	15	36.6	26	63.4	10	24.4	4	26.7	6	30.1
<i>Umuonyibauka</i>	46	11.4	20	43.5	26	56.5	4	8.7	2	10.0	2	7.7
<b>Total</b>	<b>404</b>	<b>100.0</b>	<b>165</b>	<b>40.8</b>	<b>239</b>	<b>59.2</b>	<b>125</b>	<b>30.9</b>	<b>50</b>	<b>30.3</b>	<b>75</b>	<b>31.4</b>
<b>Age (Years)</b>												
≤ 9	64	15.8	26	40.6	38	59.4	9	14.1	3	11.5	6	15.7
10-19	130	32.2	55	42.3	75	57.7	33	25.4	13	23.6	20	28.6
20-29	50	12.4	21	42.0	29	58.0	25	50.0	10	47.6	15	51.7
30-39	78	19.3	30	38.5	48	61.5	29	37.2	12	40.0	17	35.4
40-49	42	10.4	18	42.9	24	57.1	16	28.1	7	38.8	9	32.5
≥ 50	40	9.9	15	37.5	25	62.5	13	32.5	5	33.3	8	32.0
<b>Total</b>	<b>404</b>	<b>100.0</b>	<b>165</b>	<b>40.8</b>	<b>239</b>	<b>59.2</b>	<b>125</b>	<b>30.9</b>	<b>50</b>	<b>30.3</b>	<b>75</b>	<b>31.4</b>

Females engaged more with farming, fetching of water from the streams and wood gathering while the males were engaged in fishing, palm-wine tapping and extensive land preparation for cultivation. These activities ensure prolonged exposure and therefore the rate of vector-contact in the area. Nodular prevalence of 14.1 % recorded in infants less than 9 years old was not un-expected because, in the absence of house-helpers, they frequently accompanied their mothers to the streams and farms, making vector-contact in the process. Subjects over 50 years old also had 32.5 % nodular prevalence, an indication that Onchocerciasis is a cumulative disease.

Prevalence of onchocercal skin diseases (OSDs) in the study population, as well as in individuals with concomitant infections (onchocercal nodules with OSDs) is shown in Table 3. Total of 208 subjects were affected by OSDs, giving a prevalence of 51.5 % at the community level, but the endemicity of OSDs appeared to follow the same pattern as that obtained for onchocercal nodules by the nodular palpation technique. Inter-village OSD +ve prevalence ranged from 23.9 % in Umuonyibauka to 91.1 % Enugwu-Abo village, indicating that 6 villages in Ufuma were hyperendemic while 3 were mesoendemic for OSDs. There was no significant

difference between 52.7 % prevalence of OSDs in males and 50.6 % observed in females ( $P > 0.05$ ). However, the highest prevalence of OSDs was recorded in subjects between 20 to 40 years old, in line with the findings of Ahmed (1995). 105 (50.5 %) of all 208 OSD+ve subjects had concomitant infections of onchocercal nodules with OSDs, which was widespread in the community. Ranging from 36.4 % in Umuonyibauka to 64.7 % in Umuebu. Community nodule with OSD+ve prevalence was 26.0 %, indicating that certain individuals presenting with onchocercal nodules did not develop any OSD. Hence the community prevalence of OSDs (51.1 %) > Nodular prevalence (30.9 %) > Nodule with OSD (26.0 %).

The prevalence of OSDs among gender, age-groups in the villages are shown in Table 4. At the community level, the study population presented varying degrees of Onchocerciasis-induced dermatological changes and blindness. The prevalence of OSDs at the community level was 37.4 % for Itching with rashes, 10.9 % (Leopard skin), 1.7 % (Skin atrophy), 0.5 % (Hanging groin) and 1.0 % (Blindness).

Itching with rashes was observed in all age groups but appeared to increase with age, peaking at 20 to 29 years age-group.

**Table 3: Prevalence of concomitant infections (Nodules with OSD\*) in the study population**

Village	Study population		Nodule +ve		Community nodule prevalence (n=404)		OSD +ve		Community OSD +ve prevalence (n=404)		Nodule with OSD +ve		Community Nodule with OSD +ve prevalence (n=404)	
	no.	no.	%	%	no.	%	no.	%	no.	%	no.	%	no.	%
<i>Enugwu-Abo</i>	45	24	53.3	5.9	41	91.1	10.2	23	56.1	5.7				
<i>Umuagu</i>	47	20	42.5	4.9	34	72.3	8.4	16	47.1	4.0				
<i>Umunebu</i>	51	18	35.3	2.9	17	38.6	4.2	11	64.7	2.7				
<i>Umuinem</i>	42	15	35.7	4.5	26	51.0	6.4	13	50.0	3.2				
<i>Umueji</i>	44	12	27.2	3.7	25	59.5	6.2	12	48.0	3.0				
<i>Umuogem</i>	48	12	25.0	2.5	18	43.9	4.5	9	50.0	2.2				
<i>Umuonyiba</i>	40	10	25.0	2.9	21	43.6	5.2	10	47.6	2.5				
<i>Umunebu</i>	41	10	24.4	2.5	15	37.5	3.7	7	46.7	1.7				
<i>Umuonyibauka</i>	46	4	8.7	0.9	11	23.9	2.7	4	36.4	1.0				
<b>Total</b>	<b>404</b>	<b>125</b>	<b>30.9</b>	<b>30.9</b>	<b>208</b>	<b>51.5</b>	<b>51.5</b>	<b>105</b>	<b>50.5</b>	<b>26.0</b>				
<b>Gender</b>														
<i>Male</i>	165	50	30.3	12.4	87	52.7	21.5	42	48.3	10.4				
<i>Female</i>	239	75	31.4	18.5	121	50.6	30.0	63	52.1	15.6				
<b>Total</b>	<b>404</b>	<b>125</b>	<b>30.9</b>	<b>30.9</b>	<b>208</b>	<b>51.5</b>	<b>51.5</b>	<b>105</b>	<b>50.5</b>	<b>26.0</b>				
<b>Age (years)</b>														
<i>≤ 9</i>	64	9	14.1	2.2	17	26.6	4.2	11	64.7	2.7				
<i>10-19</i>	130	33	25.4	8.2	62	47.7	15.3	27	43.5	6.7				
<i>20-29</i>	50	25	50.0	6.2	41	82.0	10.2	22	53.6	5.4				
<i>30-39</i>	78	29	37.2	7.2	50	64.1	12.4	27	54.0	6.7				
<i>40-49</i>	42	16	28.1	3.9	22	52.4	5.4	10	43.5	2.5				
<i>≥ 50</i>	40	13	32.5	3.2	16	40.0	4.0	8	50.0	2.0				
<b>Total</b>	<b>404</b>	<b>125</b>	<b>30.9</b>	<b>30.9</b>	<b>208</b>	<b>51.5</b>	<b>51.5</b>	<b>105</b>	<b>50.5</b>	<b>26.0</b>				

\*Certain subjects presented with more than one OSD

**Table 4: Community prevalence of Onchocercal Skin Diseases (OSDs\*) in the study population**

Village	Study population		Itching with rashes		Leopard skin		Skin atrophy		Hanging groin		Blindness	
	no.	no.	%	no.	%	no.	%	no.	%	no.	%	
<i>Enugwu-Abo</i>	45	25	55.6	10	22.2	3	6.6	1	2.2	2	4.4	
<i>Umuagu</i>	47	22	46.8	7	14.9	2	4.2	1	2.1	2	4.2	
<i>Umunebu</i>	51	19	37.3	5	11.9	1	2.4	0	0.0	0	0.0	
<i>Umuinem</i>	42	20	47.6	6	11.7	0	0.0	0	0.0	0	0.0	
<i>Umueji</i>	44	14	31.8	3	6.8	0	0.0	0	0.0	0	0.0	
<i>Umuogem</i>	48	16	33.3	4	8.4	1	0.0	0	0.0	0	0.0	
<i>Umuonyiba</i>	40	11	27.5	4	10.0	0	0.0	0	0.0	0	0.0	
<i>Umunebu</i>	41	15	36.6	3	7.3	0	0.0	0	0.0	0	0.0	
<i>Umuonyibauka</i>	46	9	19.6	2	4.3	0	0.0	0	0.0	0	0.0	
<b>Total</b>	<b>404</b>	<b>151</b>	<b>37.4</b>	<b>44</b>	<b>10.9</b>	<b>7</b>	<b>1.7</b>	<b>2</b>	<b>0.5</b>	<b>4</b>	<b>1.0</b>	
<b>Gender</b>												
<i>Male</i>	165	63	38.2	18	10.9	3	1.8	1	0.6	2	1.2	
<i>Female</i>	239	88	36.8	26	10.9	4	1.7	1	0.4	2	0.8	
<b>Total</b>	<b>404</b>	<b>151</b>	<b>37.4</b>	<b>44</b>	<b>10.9</b>	<b>7</b>	<b>1.7</b>	<b>2</b>	<b>0.5</b>	<b>4</b>	<b>1.0</b>	
<b>Age (years)</b>												
<i>≤ 9</i>	64	17	26.6	0	0	0	0.0	0	0.0	0	0.0	
<i>10-19</i>	130	53	40.7	9	6.9	0	0.0	0	0.0	0	0.0	
<i>20-29</i>	50	27	54	10	20	4	8.0	0	0.0	0	0.0	
<i>30-39</i>	78	31	39.7	17	21.8	2	2.6	0	0.0	0	0.0	
<i>40-49</i>	42	13	30.9	5	11.9	1	2.4	1	2.4	2	4.8	
<i>≥ 50</i>	40	10	25.0	3	7.5	0	0	1	2.5	2	5.0	
<b>Total</b>	<b>404</b>	<b>151</b>	<b>37.4</b>	<b>44</b>	<b>10.9</b>	<b>7</b>	<b>1.7</b>	<b>2</b>	<b>0.5</b>	<b>4</b>	<b>1.0</b>	

\*Certain subjects presented with more than one OSD

This observation confirms the report (Ivoke, 2004) that onchocercal cutaneous changes were more prevalent in the younger age groups. There was no significant difference between the prevalence of itching with rashes, 36.8 % in females and 38.1 % in

males ( $P > 0.05$ ). The use of Banocide® (Di-ethyl-carbamazine, DEC) in the area contributed to the development of itches in affected individuals. The drug usually killed onchocercal microfilariae (mf), whose antigenic substances were suspected to trigger

off hypersensitive reactions that manifested in itching and development of skin rashes. Leopard skin was not reported in subjects under 9 years old. 30-39 years age-group, with 21.8 % prevalence, was mostly affected, followed by 20-29 years age-group with 20.0 %. This result was in line with the findings of Edungbola (1987) who reported the leopard skin only in patients over the age of 20 years. Generally, more females 26 (10.9 %) than males 18 (10.9 %) were affected by leopard skin lesion but this difference was not significant ( $P > 0.05$ ). Skin atrophy was not investigated in subjects over the age of 50 years in order not to confuse it with senile atrophy, which may occur in subjects that were advanced in age. Hanging groins and blindness showed no gender preference in the study population but occurred in  $\geq 50$  years old individuals. Low prevalence of blindness in the area may be as a result of the use of Banocide® by the people. The drug, which caused the death of onchocercal microfilariae, prevented them from migrating to the eye balls where their eventual death produced sclerosing keratitis – a hardening inflammation of the cornea – the cause of blindness (Pearlman, 1996). The prevalence of senile atrophy, hanging groins and blindness were too low to be considered of diagnostic value but they are important because if Onchocerciasis is not treated in time, it proves to be a long-term, disfiguring and blinding disease.

The practice of lay nodulectomy (also reported from an endemic area in Abia State by Abanobi *et al.*, 1999) and the use of Banocide® observed in the study area were evidences of the people's attempt at treating Onchocerciasis. The awareness created by this study in the community, that Onchocerciasis is a controllable medical condition, may enhance compliance with any Community Directed Treatment with Ivermectin (CDTI) in the study area. This study has established the endemicity of Onchocerciasis in Ufuma and confirms earlier reports that nodular palpation method was of great value in Community Assessment of human onchocercal endemicity (Nwoke, 1998; Nock *et al.*, 1998; Uzoegwu *et al.*, 2004).

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