ONCHOCERCA INFECTION, ONCHOCERCOMATA, VISUAL ACUITY AND NUTRITIONAL STATUS IN CHILDREN IN AN ENDEMIC AREA OF SOUTH EASTERN NIGERIA.

Abstract.

The association between onchocerca infection, vision and nutritional status in children aged 5-14 years in an onchocerciasis endemic area in Nigeria was evaluated using pre-ivermectin baseline data. A total of 6950 children in 3 local government areas (LGAs) was examined. The crude prevalence of microfilariae was 27.7% and of nodules 20.6%. The overall intensity was 5.3 ±. 7.6 SD microfilariae per skin snip. Only 1% of the children had visual impairment.

Weight - for -age, weight- for- height, height- for- age and body mass index (weight/height^2) were used as nutritional indices. Evidence of severe malnutrition was found in 56 % of children. Logistic regression showed that the presence of nodules and high microfilarial load were risk factors for weight-for-age, weight-for-height, height-for-age, and body mass index.

INTRODUCTION

Onchocerciasis is a public health and socio-economic problem of considerable magnitude in many sub-Saharan African countries. In endemic areas, children are exposed to infection from birth (Brinkmann et al., 1976). While it has been shown that other helminthic infections exert unfavorable effects on nutritional status, growth, mental development and survival in children, (Mata et al ,1972; Bundy et al. 1989; and Thein-Hlaing et al. 1991), there are no data concerning the effect of onchocerciasis infections.

The most important and best known complication of onchocerciasis is visual impairment, which has been well documented for adults. Blindness is not common in children, but there are few data on lesser degrees of visual impairment. It has been shown earlier (Nwaorgu, 1995) that visual impairment is a risk factor for malnutrition in adults, but there are no data for this in children in onchocerciasis endemic areas.

In this report, the association between infection, vision and nutrition in children aged 5-14 years in an onchocerciasis endemic area in Nigeria is evaluated.

MATERIAL AND METHODS

Study Area and Population

The study area consisted of three contiguous local government areas (LGAs) (Fig. 1) randomly selected by the Federal Ministry of Health, namely: Ezeagu (population 204,214.), Oji-River (population 114,160), and Uzo-Uwani (population 218,452). They lie in the rain-forest zone, and vegetation is Guinea- wooded savanna, with luxuriant vegetation during the rainy season (Oct-March).

The purpose of the survey was explained to the population, and a house-to-house census was conducted. In each village children who volunteered to participate in the study or whose parents consented underwent physical examination and parasitological studies.

Parasitological study

Skin snips were taken using a 2 mm corneo-scleral punch from the right and left iliac crests, the area believed to give the highest yield of microfilariae in West Africa (WHO, 1976). Snips were stored in coded 0.3 ml wells of a 96 well microtitre plate containing normal saline and kept at room temperature to allow the microfilariae to emerge. Examination of plates was done by using a stereo-dissecting microscope. The estimates of the microfilariae density in the skin sites were derived from the number of the larvae emerging from the skin specimens. Individuals were categorized in three groups depending on the average microfilarial count per skin snip: (I) uninfected, no microfilariae seen: (ii) average count of between 0.5 and 9.5 microfilariae per skin snip; and (iii) average count of 10.0 microfilariae per skin snip or above. Prevalence and intensity of infection are reported as percentage of persons found infected and as the arithmetic mean ± SD of the microfilarial load among the infected, respectively.

Physical Examination

After individuals were undressed, the location and number of palpable nodules characteristic of onchocercomata were determined. The skin was examined for the presence of hanging groins and other skin changes associated with onchocerciasis.

Visual acuity was measured with the Snellens illiterate E chart at 6 m, one eye at a time. Those with vision < 6/60 were then asked to count fingers at 3 m. The inability to count fingers at 3 m has been shown by Budden (1956) to be a reasonable measure for ‘economic’ blindness in Northern Nigeria. Visual acuity was thereafter classified as ‘normal’, corresponding to > 6/18; ‘impaired’ corresponding to > 3/60 or < = 6/18 or in-ability to count fingers at 3 m; or blind, corresponding to < = 3/60 or inability to count fingers at 1.0 m (WHO, 1973). The result from the best of the two eyes was used to determine visual acuity.

Height was measured on a vertical calibrated board with movable head-piece, while weight was taken with minimal clothing on Detecto bathroom scales.

The primary indicators recommended by FAO/UNICEF/WHO Expert Committee on Nutritional Surveillance (WHO, 1976) were used for the determination of nutritional status in children. These included height for age, weight for height, weight for age and body mass index (weight/height^2). The NCHS growth standards were used to express measurements as standard deviation scores for height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) (WHO, 1986). Children with scores < -2.0 SD, or 80 % of the reference median weight-for-height and 90 % of the reference median height-for-age were classified as undernourished and those with scores > = -2.0 SD normal. For body mass index (BMI) poor nutrition was defined as <18.5 and good >18.5. It should be noted that the weight-for-height growth standards are only available for the pre-puberty years and thus there are no weight-for-height for males above the age of 11 years and for females above the age of 9 years.

Data Analysis

Frequency distributions were calculated for all variables and for collapsed categories using the SAS statistical package. Mean body mass index, weight-for-age, weight-for-height, and height-for-age of infected and uninfected children were compared using analysis of variance and analysis of covariance. Simple logistic regression analysis was used to assess the relative influence of sex, age, LGA of residence, visual acuity, presence of nodules, and density of microfilariae on nutritional status.

RESULTS

A total of 6950 children 5-14 years old were examined, of whom. 3510 (50.5 %) were males and 3440 (49.5 %) females. Forty percent (2786) of the total population came from LGA1 (Ezeagu), 34.5 % (2,400) from LGA 2 (Oji-River), and 25.4 % (1764) from LGA 3 (Uzo- Uwani).

The overall prevalence of onchocerca infection was 27.7 % (table 1) and was similar for boys (28.4 %) and girls (26.9 %). Prevalence increased with age for both sexes from 24.6 % among 5-9 year olds and 27.7 % among 10-14 year olds (p = .001). Intensity ranged from 0.5 to 240 microfilariae per skin snip, increased with age (p = .001) and was greater for boys (mean 6.3) than girls (mean 4.0) (p = .001). The prevalence of nodules in the population was 20.6 %, was higher among boys (22.7 %) than girls (18.5 %) (p = .001), and increased with age. Both nodules and microfilariae were present in 28.4 % of the total population. Nodules were found most frequently on the iliac crest followed by the ribcage. Visual impairment (< = 6/18) was recorded in only 68 (1 %) of the children, roughly the same for both sexes, and was significantly higher in 5-9 year olds (60.3 %) than in 10-14 year olds (39.7 %) (p = .002).

Table 1 Characteristics of 6950 children infected with Onchocerca volvulus.

Number (%) infected		1923 (27 %)
Mean Intensity ± SD		5.5 ± 7.6
Number (%) with :	nodules	1432 (20.6.%)
	Nodules and microfilariae	547 (28.4 %)
	Impaired vision	68 (1%)
	Height for age < -2 Z score	3648 (52.4%)
	Weight for age < -2 Z score	2192 (31.5 %)
	Weight for Height < -2 Z score	3913 (56.3 %)
	Body Mass Index < 16.5	3630 (52.8 %)
	Body Mass Index < 18.5	2512 (36.5 %)
by	LGAI	778 (40.5 %)
	LGA2	833 (43.3 %)
	LGA3	312,(16.2 %)
	Sex Male	997 (28.4 %)
	Female	926 (26.9 %)
	Age 5-9	675 (24.6 %)
	10-14	1248 (29.7 %)

The Relationship between microfilarial load, visual acuity, presence of nodules and nutritional status was examined in several ways. First, analysis of variance and analysis of covariance were used to estimate the effect of each of several characteristics (microfilarial load, presence of nodules and visual acuity), on the mean BMI and mean Z scores (table 2). Logistic regression was used to estimate the risk of poor nutritional status associated with each of several variables (age, sex, LGA, microfilarial load, presence of nodules and visual acuity) while adjusting for all of the others (table 3).

Analysis of variance showed that all the nutritional parameters decreased significantly with increasing intensity of microfilariae by at least 0.2 kg/m^2 (p values : BMI 0.0001, WAZ 0.004, HAZ 0.001 WHZ 0.006). Although this trend was consistent across age-groups, it was more pronounced for boys than girls. Logistic regression showed that children who had high microfilarial load were at a higher risk (67%) of being wasted and stunted.

The presence of nodules was associated with a significant increase in weight varying from 0.4 kg/m^2 in boys to 1.4 kg/m^2 in girls. Logistic regression showed, however, that children who have nodules were at a higher risk (67 %) of being wasted (low weight-for-height) and stunted (low height-for age).

Analysis of variance and analysis of covariance showed that the weight-for-age of children who had impaired vision was 0.3 kg/m^2 greater than it was for children with normal vision ($p = .01$), and their weight/height^2 (BMI) was 0.9 kg/m^2 greater ($p = .0004$). This difference as shown by Duncan's multiple range test for variables was consistent for both the age-groups and sexes. There was however no significant difference in height-for-age and weight-for-age ($p = .9$ and .4 respectively) of children with impaired or normal vision.

Discussion:

Slightly more than 25 % of children in this study had microfilariae by skin snip and about one -fifth had onchocercomata. The prevalence of nodules increased with age and was greater for boys than girls (p = .001). These findings are similar to those of Anderson et al. (1976) who suggested that earlier exposure to infection in boys and a protective hormonal factor in girls may be responsible for these sex difference in severity of infection. The higher rate of nodules among boys may be responsible for higher rate of onchocercal blindness among the adult males (Kirkwood et al., 1983). While Renz et al. (1987) reported onchocercal blindness in boys aged 10-14 years in Sudan savanna region of Cameroon, we found no difference in the rate of visual impairment between the two sexes and no blind children were found.

There was generally poor nutritional status among the children, which may have been due in part to onchocercal infection. While an association between onchocerciasis, growth retardation and weight loss in children has not been reported previously, such an association has been seen for other helminthic infections (Thein-Hlaing, 1994; Nokes, et al., 1991; Stephenson et al., 1979; Crompton, 1986). Severe nutritional deficiencies can lead to a loss in cognitive performance and in severe cases death, and this may have been related to the death of 17 children infected with onchocerciasis in Liberia reported by Greene (1992). Of note, in our study, children with visual impairment were heavier than those with normal eyesight, perhaps due to reduced activity.

In view of the consequence of onchocerciasis among children, school screening for early detection and treatment is essential in endemic areas for early detection and treatment. Also, since ivermectin contraindicated in children weighing < 15 kg (Green, 1992), health education on use of protective clothing to avoid black-fly bites and recognition of early signs of onchocerciasis should be intensified in schools.

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