ASSOCIATION OF HELMINTHOSPORIUM WITH CHRONIC RHINITIS IN A BULLOCK
M. Pal¹ B. Singh² B. Padhi³ and S. M., Dihya⁴
ASSOCIATION OF HELMINTHOSPORIUM WITH CHRONIC RHINITIS IN A BULLOCK

M. Pal¹ B. Singh² B. Padhi³ and S. M. Dhiya⁴

Though *Helmintosporium* spp. is a common dematiaceous fungus of the soil (Gilman 1959), it has also been isolated from sputum, eye, skin, nose and ear of men and animals (Davis and Shorten, 1936; Rippon, 1974; Sinha *et al*; 1976; Haris *et al*; 1978). The role of fungi with rhinitis has not been well studied. However, in one study covering 153 animals, *Aspergillus fumigatus* has been isolated and demonstrated in the nasal discharge of 12 animals suffering from various respiratory diseases (Pal, 1980). The present paper describes the occurrence and significance of *Helmintosporium* spp. in an eight-year-old bullock from Delhi.

Materials and Methods

An eight-year-old bullock with a history of chronic rhinitis was referred by a field veterinarian to the Disease Diagnostic Laboratory, New Delhi for diagnosis and treatment.

Details regarding the duration of illness, clinical signs and treatment given were available with the veterinarian. The nasal exudate was collected by inserting sterile swabs in both the nasal cavities. Blood was also collected by venipuncture into EDTA vials for haematology and culture. The specimens of nasal exudates and blood were cultured on blood agar, Sabouraud’s medium (Emmons *et al*, 1977), Sunflower agar (Pal and Mehrotra, 1982). The former medium was kept at 37°C and the latter were incubated at 28°C. A part of the specimen was treated with 10% KOH for 20 minutes and examined directly under the microscope. In addition sedimentation technique using saturated sugar solution was also employed for schistosomiasis. Nasal swabs were also obtained from 13 apparently healthy cattle and processed for mycological investigation. In order to establish the source of infection, five soil samples from cattle shed were processed for the fungus (Pal and Mehrotra, 1982).

Results

The diseased animal had constant unilateral mucopurulent nasal discharge from the right nostril for the last 40 days besides dyspnoea. The prolonged treatment with antibiotics (Kanacir Alembic; Terramycin-Pfizer), corticosteroids (Betnasol-Glaxo) and antihistaminics (Avil-Hoechst) proved futile. The haematological figures were as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin</td>
<td>10.6 mg.%</td>
</tr>
<tr>
<td>Packed Cell Volume (P.C.V.)</td>
<td>37.5%</td>
</tr>
<tr>
<td>Total Leucocyte Count (T.L.C.)</td>
<td>8,260/cumm</td>
</tr>
</tbody>
</table>

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Differential Leucocyte Count (D.L.C.) = N-38%, L-59%, E-02%, M-01%, B-00%.

The nasal exudate under 10% KOH revealed light brown, septate, branched filaments. Of nine nasal swabs cultured (3 right and 3 left nostril), only 3 specimens from right nose yielded growth of Helminthosporium spp. on Sabouraud's medium. The growth of the fungus was noted on 3rd day of inoculation at 28°C and appeared grayish-brown with matted centre and grayish periphery. The lactophenol cotton blue mount of the isolate revealed septate, ched hyphae with knotted appearance at the end bearing the conidia (Ellis, 1971).

Helminthosporium spp. could neither be isolated from the blood nor from the left nostril of the diseased cattle. Similarly, 13 nasal swabs cultured from 13 apparently healthy animals uniformly negative for the fungus. No bacterial growth was observed on blood agar at 35°C. In addition, the nasal exudates also failed to reveal the ova of Schistosoma nasalis. Of 4 soil samples examined, Helminthosporium spp. could be recovered from a solitary specimen.

Discussion

The clinical history, the failure to respond to various drugs, demonstration of light brown, septate, branched mycelia in the wet mounts and repeated isolation of the fungus on Sabouraud's medium suggest that the animal had rhinitis due to Helminthosporium spp. infection.

The role of Helminthosporium spp. as an allergen in provoking bronchial asthma and sic bronchopulmonary disease in human beings has been described (Rippon, 1974; Matthies-1981). However, the etiological significance of this dematiaceous fungus in the cases of animals has not been well-established though the earlier workers have reported the isolation of Helminthosporium spp. in the nasal granulome of cattle (Davies and Shorten, 1960; Bridges, 1960).

It is well-recognised that increased use of broad spectrum antibiotics and corticosteroids increase the individual susceptible to fungal infection (Rippon, loc. cit.; Pal 1983). The same is in the present case as the animal had received prolonged treatment with antibiotics and cortis. Therefore, one can visualise if this therapy was a predisposing factor in the Helminthosporium infection in the present case.

Authors are of the opinion that Helminthosporium spp. may be considered as one of the agents of chronic rhinitis in animals particularly those negative for nasal schistosomiasis and rhinosporidiosis.

Summary

During an investigation on the prevalence and incidence of pathogenic fungi and actinomycetes in the respiratory tracts of ruminants, a case of chronic rhinitis in a 8-year-old indigenous cow has been described. The diagnosis was established by the repeated isolation of Helmin-
Association of Helminthosporium with chronic rhinitis

.. *Helminthosporium* spp. on Sabouraud's medium from the nasal exudates and its direct microscopic examination by potassium hydroxide technique. The animal had constant unilateral, mucopurulent discharge from right nostril for the last 40 days besides difficulty in respiration. The fungus could not be demonstrated in the nasal swabs collected from 13 apparently healthy animals. Epidemiological investigation established the source of infection in the environment of animal. In addition, differential diagnosis has been discussed.

Acknowledgements

The authors wish to express their thanks to Dr. H.S. Jain, Veterinary Surgeon and other staff of the Veterinary Hospital Bijwasan, Delhi for their help in the collection of the clinical materials.

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STUDIES ON THE OCCURRENCE OF NASAL RHINOSPORIDIOSIS IN DOMESTIC RUMINANTS

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SUMMARY

In all 113 nasal swabs originated from 37 buffaloes, 32 cattle, 21 goats, 18 sheep and 5 camels were investigated for the prevalence of Rhinosporidium seeberi infection. Rhinosporidiosis could be diagnosed in a bullock and a goat. Both these animals had persistent mucopurulent nasal discharge for the last 38-45 days and had received prolonged treatment with antibiotics, hydrocortisone and antihistaminics. Cultural attempts to isolate the fungus on Brain Heart Infusion agar, Blood agar, as well as mice and Guinea-pig inoculation were futile. The diagnosis was based on the demonstration of thick walled sporangia and sporangiospores in the clinical material. In addition, the clinical picture and differential diagnosis has been discussed.

Introduction

Rhinosporidiosis is a chronic, benign, mycotic disease particularly of the nasal mucosa characterized by polypoid growths and is caused by Rhinosporidium seeberi (Jungerman and Schwartzman, 1972; Emmons et al., 1977; Pal, 1981). The disease has been reported from horse (Zschokke, 1913; Sahai, 1938), mule (Quinlan and de Kock, 1926; Bueno and Farin, 1941), cattle (Rao, 1938), dogs (Nino and Freire, 1964), geese and ducks (Fain and Herm, 1957), goat (Singh, 1941-42), water buffalo (Rao et al., 1975) and man (Waller and Riker, 1930; Karunaratue, 1961). Except for few early reports from Southern India, there seems to be paucity of information about the occurrence of rhinosporidiosis in India. (Ayyar, 1932; Rao, loc. cit.; Reddy and Lakshminarayana, 1962). The present paper describes the prevalence of nasal rhinosporidiosis in domesticated ruminants.

Materials and Methods

The nasal exudates collected from domesticated ruminants constitute the material for this study. A total of 113 nasal swabs were collected/obtained from 37 buffaloes, 32 cattle, 21 goats, 18 sheep and 5 camels. Each specimen was immediately brought to the laboratory under ice for mycological investigation. The details regarding the age, sex, species of the animals, clinical signs, duration of illness, history of trauma, provisional diagnosis and line of treatment was obtained from the Veterinarian. The KOH wet mount preparation, Haematoxylin and Eosin stained smears were examined microscopically. The specimen was cultured on blood agar, brain heart infusion agar and incubated at 25°C and 37°C. Incubation into Swiss albino mice and Guinea-pigs was also attempted by intranasal as well as

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intraperitoneal routes. In order to rule out the possibilities of *Helminthesporium* and *Aspergillus* infection, the specimens were also inoculated on Sabouraud's medium. In addition, the sedimentation technique using saturated sugar solution was employed for schistosomiasis.

**Results**

The occurrence of nasal rhinosporidiosis was studied in 113 animals of different breed, age and sex. (Table 1). Of the 113 nasal exudates examined, 2 (1.7%) animals showed *Rhinosporidium seeberi* infection. The positive specimens originated from a 6-year-old male bullock and a 5-years-old she goat. Rhinosporidiosis could not be detected in buffaloes, sheep and camels. Both the animals had persistent, unilateral, bilateral, mucopurulent nasal discharge for the last 38-45 days besides dyspnoea. Occasionally blood stained discharge was noticed from the left nostril of the bullock. The same animal had also polyps in left nostril which were later removed by the Veterinary Surgeon. History of trauma to the nasal mucosa was available only in the bullock. The prolonged treatment with antibiotics (Terramycin-Pfizer; Kanacin-Alembic), cortisone (Hostacortin-H-Hoechst; Betnosol-Glaxo) and antihistaminics (Avil-Hoechst; Phenergan-M&B) proved futile. The organism could neither be isolated on laboratory media nor in experimental animals. The specimens on Sabouraud's medium failed to show the growth of *Aspergillus fumigatus* and *Helminthesporium* spp. In addition, the specimens were negative for the ova of *Schistosoma nasalis*.

**Table 1:** Prevalence of nasal rhinosporidiosis in domestic animals.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Species of animal</th>
<th>Number investigated</th>
<th>Number positive for <em>R. seeberi</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Buffalo</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Cattle</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Goat</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Sheep</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Camel</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>113</td>
<td>2</td>
</tr>
</tbody>
</table>

The wet mount and KOH preparation showed round, thick-walled cysts (sporangia) of various sizes. In haematoxylin and eosin stained smears, sporangia were surrounded by mononuclear cells and a few epitheliod cells. Sporangia measured from 19 to 276µ in diameter indicating different stages of development. In case of few mature sporangia, the wall ruptured and the presence of 5-7 µ endospores (sporangio-spores) was observed.
Occurrence of Nasal Rhinosporidiosis in Domestic Ruminants

Discussion

Zschokke (loc. cit.) is credited for the first report of animal rhinosporidiosis by describing the disease in a horse. Since then infection has been recorded in many animal species with frequency in equines (Smith and Frankson, 1961; Myers et al., 1964; Ainsworth and Austwick, 1973; Londero et al., 1977). The disease is cosmopolitan in distribution, however, the prevalence rate in human is higher in India particularly in the States of Kerala and Tamil Nadu (Chitravel et al., 1980). Further, the infection rate was reported to be higher in males than females (Karunaratne, loc. cit.; Nino and Freire, loc. cit.).

The present study reveals 1.7% prevalence of nasal rhinosporidiosis in domestic animals. The diagnosis in both the cases was established by the demonstration of sporangia and sporangiospores in wet mount, KOH preparation and haematoxylin and eosin stained smears. It was interesting to note that the bullock was constantly passing copious muco-purulent discharge from both the nostrils. However, most of the earlier workers have reported unilateral involvement of the nasal mucosa in this disease (Blood and Henderson, 1968; Ainsworth and Austwick, loc. cit.).

Although the exact mode of infection and pathogenesis of rhinosporidiosis is not well understood, it has been postulated that traumatic injury to the mucosa may act as a predisposing factor in the initiation of the disease (Karunaratne, loc. cit.; Maddy, 1967). The same is true in the present case as the cattle received trauma on the left nostril while ploughing the agricultural land. It has been reported that man and animals become infected by splashing the contaminated water into the nostrils while drinking (Maddy, loc. cit.). In one study Mandlik (1973) recorded 20% infection rate in a group of workers engaged in removing sand from a river bottom. This view was further supported by Nino and Friere (loc. cit.) that organism may be present in water and thus invade the nasal mucosa of man and animals. Likewise Paul et al. (1981) also mentioned that 18 out of 19 patient who had bathed in a pond which was frequented by the animals acquired the infection.

The failure to isolate the pathogen on various microbiological enriched media as well as in laboratory animals is inconsistent with the earlier observations of de Mello (1949) who could neither grow the organism on cultural media nor produce experimental transmission of the disease in animals and man.

It is felt that Rhinosporidium seeberi infection should be considered as one of the important etiological agents of chronic rhinitis in animals particularly those negative for nasal schistosomiasis, aspergillosis and nasal granuloma due to Heminthosporium spp.

Acknowledgements

Thanks are due to the field staff of local Veterinary Hospitals, Private Dairy Farms, Sheep and Goat Farms, Delhi and adjoining areas for their help and cooperation in the collection of clinical specimens. The help of Mr. Shiv Parkash for typing the manuscript is also acknowledged.
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Occurrence of Aspergillus fumigatus and Cryptococcus neoformans in bat excreta

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Received on December 24, 1983

ABSTRACT

The occurrence of Aspergillus fumigatus and Cryptococcus neoformans has been investigated in 248 bat droppings collected from different places in Himachal Pradesh, Assam, Goa, Madhya Pradesh, Uttar Pradesh, Haryana, Maharashtra, Rajasthan and Delhi. Aspergillus fumigatus was recovered from 16 specimens originating from six states namely Goa, Uttar Pradesh, Haryana, Maharashtra, Rajasthan and Delhi. On the contrary, C. neoformans could be isolated from 3 samples of which 2 (2.0%) came from Delhi and 1 (1.2%) from Rajasthan. Both the fungi proved pathogenic to Swiss albino mice. The public health implications of environmental exposure to bat guano harbouring these fungi have been discussed.

INTRODUCTION

Bat excreta or soil admixed with droppings of bat or other avian species has been extensively investigated for the prevalence of Histoplasma capsulatum (1-5) which causes histoplasmosis in man and animals (6-7). The information on the natural occurrence of A. fumigatus and C. neoformans in the bat droppings is very meagre. The present investigation provides information on the prevalence of both these fungi in bat excreta of many regions of India.

MATERIALS AND METHODS

Collection of bat excreta: The material for this study was collected from different localities of nine States. In all, 248 samples of bat droppings collected in clean polythene bags were brought to the laboratory for mycological examination. The details regarding the date of collection, site, type and texture of the material were recorded for each specimen. In case of unavoidable delay, the samples were kept at 10°C.
Cultural Procedure: About 5 gm. of each sample was transferred into a sterile test tube containing 25 ml of sterile physiological saline (0.85%). The tube was shaken vigourously for 4-5 minutes and allowed to stand for half an hour. Five ml of the clear supernatant was transferred into a sterile test tube containing equal amount of chloramphenicol (0.5 mg per ml) solution and kept at 37°C for one to one and a half hour. From this suspension, serial dilution of 1:10 and 1:100 were made in sterile distilled water and aliquots of 0.1 ml and 0.2 ml were streaked on Sabouraud's dextrose agar supplemented with chloramphenicol (0.05 mg per ml) and sunflower agar medium (8). The former media was kept at 37°C and latter at 28°C.

Identification: Identification of isolates of *A. fumigatus* and *C. neoformans* was made by studying their gross morphology on Sabouraud's as well as sunflower medium. The microscopical examination of these fungi was done in lactophenol cotton blue or India ink preparation mounts. The isolates were subcultured on Sabouraud's medium and purified by serial dilution. The detailed identification of the isolates was made according to criteria laid down by Raper and Fennel (9) and Lodder (10).

Pathogenicity test: The pathogenicity of 3 isolates each of *A. fumigatus* and *C. neoformans* was tested in Swiss albino male mice weighing 20 - 22 gm. A pure culture of the test isolate was grown on Sabouraud's agar slants at 37°C for 3-5 days. The spores or cells were harvested with physiological saline solution and shaken to make a uniform suspension. The mice were inoculated with 0.2 ml of the suspension of *A. fumigatus* containing 3 x 10⁸ spores in the tail vein. Similarly, 3 x 10⁸ yeast cells of *C. neoformans* in 0.5 ml suspension was injected intraperitoneally. The inoculated animals were sacrificed after 3-21 days and their internal organs were examined for gross lesions. Portions of brain, lung, liver, spleen and kidney were cultured on the above media for the isolation of the organism. Material was examined for gross lesions on the visceral organs by preparing impression smears and stained with Gram's method. The swabs from peritoneal cavity was also examined microscopically in India ink or lactophenol for the presence of encapsulated yeast-like cells of *C. neoformans*.

RESULTS

The recovery of *Aspergillus fumigatus* and *Cryptococcus neoformans* from bat droppings collected from various States is shown in Table 1. Of 248 samples examined from seven States and two Union territories, *A. fumigatus* was represented by 16 (6.5%) and *C. neoformans* by 3 (0.8%). The state-wise distribution of samples yielding *A. fumigatus* was as follows: Delhi 7, Rajasthan 4, Maharashtra 2, Haryana 1, Uttar Pradesh 1 and Goa 1. On the other hand, *C. neoformans* could be isolated from the bat excreta of two States namely Delhi (2) and Rajasthan (1). The isolates of this pathogenic yeast came from a window sill in an old monument in West Delhi, a long tunnel in South Delhi and a dark humid staircase of an old historical building in Bharatpur, Rajasthan. All the 3 specimens of bat guano which yielded *C. neoformans* were old, dry and originated from dark places inhabited by bats.
Table 1. Isolation of Aspergillus fumigatus and Cryptococcus neoformans from bat excreta of various states of India.

<table>
<thead>
<tr>
<th>State/Territory</th>
<th>Number of samples tested</th>
<th>Number of samples positive for:</th>
<th>A. Fumigatus</th>
<th>C. neoformans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>2</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Assam</td>
<td>3</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Goa</td>
<td>5</td>
<td>1</td>
<td>20.0</td>
<td>0</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>9</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>11</td>
<td>1</td>
<td>9.0</td>
<td>0</td>
</tr>
<tr>
<td>Haryana</td>
<td>13</td>
<td>1</td>
<td>7.7</td>
<td>0</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>21</td>
<td>2</td>
<td>9.5</td>
<td>0</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>83</td>
<td>4</td>
<td>4.8</td>
<td>1</td>
</tr>
<tr>
<td>Delhi</td>
<td>101</td>
<td>7</td>
<td>6.9</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>241</strong></td>
<td><strong>16</strong></td>
<td><strong>6.5</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

The colonies of *A. fumigatus* on Sabouraud’s medium were fast growing, while when young they quickly turned to smoky green with sporulation. All the 16 isolates grew well both at 25 and 37°C on Sabouraud’s agar. Microscopic examination of the isolate in lactophenol cotton blue mount revealed typical conidiophore expanded into large flask-shaped vehicles, bearing sterigmata, which gave rise to chains of conidia.

All the isolates of *C. neoformans* grew well both at 25° and 37°C. On Sabouraud’s agar the colonies were slow growing, mucoid, creamy white in colour, turning tan with age. Light to dark brown coloured colonies were observed on sunflower medium within 3 - 7 days of incubation at 28°C. On microscopic examination, spherical, yeast-like cells, with and without budding and surrounded by a thin capsule were seen in wet mount preparation of lactophenol. The cells were 3.5 to 8.8 μ in diameter. Urea was hydrolyzed by all the 3 isolates. Fermentation was absent with galactose, glucose, lactose, maltose and sucrose. Carbon and nitrogen assimilation tests showed good growth in the presence of galactose, dextrose, maltose, raffinose and sucrose but none on lactose and potassium nitrate. None of the strains showed true mycelium or pseudo-mycelium on corn-meal agar.

The isolates of both the fungi proved pathogenic to white mice as the organism could be reisolated from the viscerai organs of the autopsied animals. The fungus was also demonstrated in the impression smears of various organs. A wet mount preparation of peritoneal exudate in lactophenol cotton blue revealed many encapsulated yeast-like cells with or without budding (Fig. 1).
FIG. 1. Lactophenol cotton blue mount of *Cryptococcus neoformans* recovered from a bat guano showing encapsulated yeast-like cells with or without budding in a wet mount of peritoneal exudate of a Swiss albino mice, killed after 3 days of intraperitoneal inoculation of the yeast-cells suspension of the isolate. Magnification (x 157.5).

**DISCUSSION**

It is evident from this study that *A. fumigatus* and *C. neoformans* occur naturally in bat excreta of various regions of the country. Further, *A. fumigatus* was more prevalent (6.5%) in this saprobic matter than *C. neoformans* (0.8%).

*Aspergillus fumigatus* has been recognized as one of the most important etiologic agents of aspergillosis in man, animals and birds (6, 7). The recovery of this pathogenic fungi from various States indicates its widespread distribution in India. The pathogen has so far been isolated from soil, rice husk, saw dust, litter, hay, bagasse, stable manure and large variety of vegetable substrates (11-16). The isolation of *C. neoformans* from bat dropping was reported by Kajihiro (17) and Ajello et al (18). The Indian report came in 1972 (14). In this survey 3 isolates of *C. neoformans* were recovered from bat excreta of which two were from Delhi and a solitary one from Rajasthan. All these isolates originated from dark, humid, damp and closed sites of old monuments. From India, the organism has been frequently reported from old and dried excreta of pigeons, other avian species and soil (19-24).

The public health significance of both these pathogen has been discussed in length by a number of investigators (25-28). In one study Khan and colleagues (29) reported allergic bronchopulmonary aspergillosis in 2 of 131 workers occupationally exposed to *A. fumigatus* at Sugar Mills in Shamli (U.P.). Similarly, bagasse, saw dust and litter containing *A. fumigatus* were implicated as source of aspergillosis in birds (16, 30). Primary cryptococcal meningitis in a physician following exposure to a
library air conditioner laden with pigeon droppings harbouring *C. neoformans* has been described by Littman (31). Likewise, cases of cryptococcal meningitis and pulmonary cryptococcosis with a history of exposure to contaminated pigeon excreta have also been reported (32, 33).

It has been suggested that the factors which favour the growth, survival and multiplication of *A. fumigatus* and *C. neoformans* in bat excreta should be investigated to establish the ecological relationship of these pathogens with this saprobic matter as has been studied in pigeon excreta for *C. neoformans* (34 - 37).

**ACKNOWLEDGEMENTS**

We wish to express our thanks to Drs. H. S. Jain, G. D. Dube, Mr. Vijay Singh, Miss. Pratibha, Miss Anubha, Mrs. Raj Rani and others for their help in the collection of bat excreta samples.

**REFERENCES**

Prevalence of Intestinal Helminths in Children in a Higher Secondary School in Delhi

M. PAL* AND B. SINGH**

ABSTRACT

An epidemiological survey for various enteric helminths was conducted in a Government Boys higher secondary school of Najafgarh, Delhi, in October, 1978. A total of 118 faecal samples originated from the same number of students ranging in age from 12 years to 17 years were examined microscopically both by direct as well as concentration methods. At least one or more intestinal parasites were found in 40 (33.8%) of the population sampled. *Ascaris lumbricoides* (11.8%), hookworm (9.3%), *Enterobius vermicularis* (7.6%) *Taenia* sp. (3.3%) were the helminths encountered in that order. However, two students had two helminths i.e. hookworm and roundworm. The epidemiology and preventive measures have been discussed.

INTRODUCTION

Intestinal parasitic infections among human beings pose a public health problem to tropical and sub-tropical countries (1-5). A number of reports on the prevalence and incidence of intestinal parasites are available in the literature (6-11). However, the information on the epidemiological aspects of the helminths are still not well documented. The present survey was carried out to study the prevalence of various helminths from epidemiological point of view and the results are presented in this paper.

MATERIALS AND METHODS

The male students of Government Higher Secondary School, Najafgarh, New Delhi, constitute the material for study. The informations regarding name of the student, age, address, monthly income of the parents, type of latrine source of water supply, habit of shoe wearing, etc, were recorded from each and every student. They were asked to bring morning stool sample in the clean wide mouth glass stoppered bottle or faeces tube. The faeces were first mixed with 10 per cent formalin just to make an uniform suspension.
Three smears were prepared from every specimen. These were further subjected to microscopic examination in normal saline, lugol's iodine and zinc sulphate solution.

RESULTS AND DISCUSSION

The results of this survey are presented in Tables 1-5. Of the 118 students investigated, 40 (33.8%) were positive for at least one or more intestinal parasites. The most common helminth was *Ascaris lumbricoides* (11.8%) followed by hookworm (9.3%) and *Enterobius vermicularis* (7.6%). The taenia spp could be detected in four (3.3%) students (Table 1).

Table 1. Prevalence of various helminths in the gastrointestinal tract of School Children

<table>
<thead>
<tr>
<th>Number examined</th>
<th>Number Positive</th>
<th><em>Ascaris lumbricoides</em></th>
<th>Hookworm</th>
<th><em>Enterobius vermicularis</em></th>
<th>Taenia spp</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>40</td>
<td>(33.8)</td>
<td>14</td>
<td>11</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(11.8)</td>
<td></td>
<td>(9.3)</td>
<td>(7.6)</td>
<td></td>
</tr>
</tbody>
</table>

Interestingly two children (1.6%) showed mixed helminths in their faeces, viz., hookworm and *Ascaris lumbricoides*. The maximum number of students belonged to the poor socio-economic group (Table 2) whose parents income was less than Rs. 300-00 per month.

Table 2. Classification of helminths positive cases according to the socio-economic condition

<table>
<thead>
<tr>
<th>Number Examined</th>
<th>Number positive</th>
<th>Socio-economic groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rs. 0-300</td>
</tr>
<tr>
<td>118</td>
<td>40</td>
<td>18</td>
</tr>
</tbody>
</table>

The helminths were more common in students who had not safe and wholesome water to drink. They had their water supply from dug wells which were usually contaminated.

Table 3. Distribution of helminths positive cases according to the source of water supply

<table>
<thead>
<tr>
<th>Number examined</th>
<th>Number positive</th>
<th>Types of water supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tape</td>
</tr>
<tr>
<td>118</td>
<td>40</td>
<td>2</td>
</tr>
</tbody>
</table>

(Table 3). The highest prevalence of helminths were observed in the children who had gone for open defecation in the fields without wearing shoes (Table 4-5).
Table 4. Distribution of helminths positive cases according to the type of latrines

<table>
<thead>
<tr>
<th>Number examined</th>
<th>Number Positive</th>
<th>Type of latrines used</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>40</td>
<td>Sanitary 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsanitary 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>open field 28</td>
</tr>
</tbody>
</table>

Table 5. Distribution of helminths positive cases according to the habits of shoe wearing

<table>
<thead>
<tr>
<th>Use of shoes</th>
<th>Number positive</th>
<th>Number used shoes</th>
<th>Number not used shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>40</td>
<td>15</td>
<td>25</td>
</tr>
</tbody>
</table>

The preliminary findings of this epidemiological survey revealed that helminths were more prevalent in children coming from poor socio-economic group. They were not living in the hygienic conditions as most of them were found going bare foot in the field for defecation. Besides, they were consuming water from the dug well which may be one of the important source of infection.

It has been well established that the eggs and larvae of various helminths are fairly resistant to desiccation and may, however, remain infective for a considerable period of time (2). It would also be pertinent to mention that in tropics, banana groves, sugar cane, sweet potato fields and wet clay soils are ideal sites for the growth and development of various helminths (2, 12).

Nevertheless the control and preventive measures which can minimise the prevalence and incidence of helminths include installation of sanitary latrines in the rural areas, provision of safe and protected water supply, regular examination of stool under school health programme and prompt chemotherapy. In addition the health education regarding the source of infection, mode of transmission and personal hygiene should be imparted to the school children and more particularly to the teachers and parents.

In order to assess the exact magnitude of the problem, it has been suggested that systematic studies on the prevalence, incidence and epidemiology of various helminths and protozoa should be undertaken both in rural and urban areas. This will further help to devise preventive measures.

ACKNOWLEDGEMENTS

The authors are grateful to the Principal of Higher Secondary School, Najafgarh, New Delhi, for his cooperation during this survey. The help of Mr. J. B. Sharma is thankfully acknowledged.
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