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Special Report Series No. 6

**INTESTINAL HELMINTHIC INFECTIONS  
IN BURMA**

**REPORT**

**OF THE**

**TECHNICAL COMMITTEE**

**OF THE**

**BURMA MEDICAL RESEARCH COUNCIL**

1968

Burma Medical Research Institute

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**Price—K 1.25}**



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## INTRODUCTION

It is common knowledge that intestinal infection with worms is prevalent in Burma, especially among children. The extent to which such infections cause disability and disease requires appraisal, in view of many health problems demanding attention in the country.

The Government has therefore appointed a technical committee for the study of intestinal helminthiasis in Burma which came into formal existence on 26 January, 1968. The terms of reference of this committee are :

1. Review current knowledge on the subject and consolidate available information on the subject as is pertinent to Burma.
2. Review the measures currently being employed to combat the problem in Burma.
3. Make definitive and practical recommendations on the actions required to solve the problem in Burma.
4. Chart the future course of research on the problem.
5. Specifically, to study the impact of intestinal helminthic infections on the health of the people of Burma, and to make suitable recommendations.
6. To report to the Burma Medical Research Council in 2 months.

In considering the scope of its study this committee included all intestinal helminthic infections of man, that is, infections with all those helminths which inhabit the lumen of the intestine of man during the fully developed or mature phase of their life cycle.



# **I. IMPACT OF INTESTINAL HELMINTHIASIS ON THE HEALTH OF THE PEOPLE OF BURMA**

## **I.1. Method of study of the impact on health**

In evaluating the impact on health of intestinal helminthic infections the Committee found it necessary to consider the concept of health as well as the practical measurement of levels of health.

WHO has broadly defined health as a condition of the human organism expressing the adequate functioning of the organism in given conditions. In a narrower sense and for working purposes health was also defined as conformity to accepted standards of given criteria in terms of basic conditions of age, sex, community and region (1). Health indicators are those related to persons and population, those related to physical environment, and those concerned with health services.

In the context of the present study it was deemed necessary to use only those health indicators related to persons or populations.

Also, such comprehensive indicators as crude death rate and expectation of life and even infant mortality rates were too general to be of use, and more specific indicators were sought.

The Committee arrived at the following conclusions regarding health indicators to be used in the assessment of the impact on health of intestinal helminthic infections.

1. Inasmuch as there is adequate *a priori* evidence that the helminthic infections under consideration do cause disease and disability at some time in some persons, the question of importance seems to be the extent of such disease and disability in the community.

The prevalence and intensity of intestinal helminthic infections in the community would generally indicate the extent of disease and disability attributable to the infection.

2. When measurable, the mortality and morbidity directly attributable to intestinal helminthic infection would be indicators as to the impact on the health of the community. Thus, cause-specific mortality and morbidity rates would have to be examined.

3. The relationship of nutrition to infection and more specifically to intestinal helminthic infection has been the subject of many authoritative studies. The Committee decided to include the nutritional

status of the community as among the possible indicators likely to reflect the impact of intestinal helminthic infection on health.

In addition to specific nutritional deficiencies, physical development and growth are of relevance to the present study.

## **1.2 The prevalence, distribution and intensity of intestinal helminthic infection in Burma**

There are two sources of such data. Firstly, there are the laboratory records of various institutions ; secondly, there are the results of various special surveys of different communities. Other sources such as autopsy records are not available.

In all the studies performed up to now in Burma, the presence of eggs or larvae in stools is taken as evidence of intestinal infection with the worm. Intracutaneous and serological tests have not been used. Stool examination for eggs or larvae is the most practical test and is sufficient to detect most types of intestinal helminthic infections. The exceptions are Enterobiasis, Taeniasis and Trichiniasis.

The routine laboratories have used only the direct smear method of stool examination whilst the various surveys have also used standard methods of concentration and preservation, such as the brine floatation and formol-ether method. Egg counts and specification as to the fertility of the ova were not recorded in any of the studies.

### *1.2.1 Prevalence rates from laboratory records*

The result of stool examination for helminth ova by the direct smear method in the laboratories of the various institutions in Burma are given in Table 1. Except for the National Health Laboratory other laboratories are attached to hospitals in the major towns of Burma. Most of the stool specimens are from inpatients and are either sent routinely or because of some gastrointestinal disorder. Except for the figures from the Children's Hospital where only children below ten years are treated, the data cannot be broken down according to age and sex. Since annual figures are given, seasonal variations, if any, have been averaged. It is difficult to be sure as to which population group the prevalence rates represent. They represent prevalence rates in hospital patients, and although of some absolute value, may be more useful for comparative purposes.



TABLE 1.—Results of stool examinations for intestinal helminths in different laboratories, Burma

Laboratory and year	Number of specimens	Per cent positive with intestinal helminths						
		<i>Ascaris lumbricoides</i>	<i>Enterobius vermicularis</i>	Hookworm	<i>Hymenolepis nana</i>	<i>Strongyloides stercoralis</i>	<i>Taenia</i> spp.	<i>Trichuris trichiura</i>
1. National Health Laboratory, 1963	713	25.7	...	0.6	...	...	0.3	5.0
1964	2,410	14.6	...	0.4	...	...	0.2	3.3
1965	4,179	10.1	...	0.4	...	...	0.1	2.7
1966	2,406	17.8	...	0.3	...	...	0.1	4.1
1967	4,502	17.1	...	0.4	...	...	0.4	3.6
2. Children's Hospital 1966	517	21.3	...	...	...	...	...	5.0
1967	2,440	21.0	...	...	...	...	...	3.9
3. Rangoon General Hospital 1967	6,302	19.4	0.1	0.7	0.1	1.4	0.1	4.3
4. Divisional Hospital, Magwe 1967	1,400	4.9	...	2.0	0.2	...	0.3	0.4
5. Divisional Hospital, Moulmein 1967	5,710	69.9	...	7.8	...	...	...	20.8
6. Sao San Htun Hospital, Taunggyi 1967	1,631	4.2	...	3.3	...	...	0.2	1.0

TABLE 2.—Results of special stool surveys for intestinal helminths, Burma

	Kachin State Arrom-dum village (Tarons) (1966)	Kachin State Arrom-dum village (Htalus) (1966)	Shan State Inle (1967)	Myin-gyan Tuywin-bo village (1968)	Chauk Perinatal Out-patient (1968)	Insein Shantegy village (1968)	Insein Sawbawgyigone village (1961)	Insein Kyaung-gone village (1963)	Insein Aung-sanmyo villages	Rangoon University Hostels Menial staff (1959)	Rangoon Medical students (1959)	Rangoon Food Handlers (1966)	Bassein Township (1968)
Number examined	55	24	107	55	135	125	238	426	3,882	114	99	671	393
Helminths	Percent Prevalence												
<i>Ascaris lumbricoides</i>	70.9	62.5	3.6	5.5	8.0	72.0	...	60.1	23.0	23.9	10.1	15.6	68.4
<i>Enterobius vermicularis</i>	7.3	...	...	5.5	...	9.6	...	1.2	1.3	2.6	...	...	0.5
Hookworm	32.7	25.0	2.7	...	...	7.2	37.8	12.9	27.0	0.9	...	...	11.7
<i>Hymenolepis nana</i>	...	...	...	3.6	...	0.8	...	...	...	...	...	...	...
<i>Strongyloides stercoralis</i>	...	...	...	3.6	...	...	...	...	...	6.1	1.0	0.1	2.3
<i>Taenia</i> spp.	...	...	2.7	...	...	...	...	...	...	0.9	...	...	...
<i>Trichuris trichiura</i>	5.4	4.2	...	...	...	28.0	...	6.8	2.7	10.5	6.1	1.6	51.4

It will be seen from Table 1 that *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, *Enterobius vermicularis*, *Hymenolepis nana*, and *Taenia* are the helminths recorded as present. The hookworm and *Taenia* species were not identified. Depending upon the location of the laboratory, the prevalence rate of *Ascaris* infection ranges from 4.2 per cent to 69.9 per cent ; of *Trichuris* from 1 per cent to 20.8 per cent ; of hookworm from 0.3—7.8 per cent. Other helminthic infections are found only sporadically.

### 1.2.2 *Prevalence rates from results of special stool surveys*

These are specially planned surveys in which unselected samples of well defined population groups are tested. With the exception of one study all of them were carried out on apparently healthy subjects. In some of them the brine floatation method and formol-ether concentration methods were used. In addition to being performed in different regions of Burma there are also differences in the seasons in which the surveys were conducted. They are, so far, the best indications of the prevalence rates in the communities surveyed. The results of various surveys are summarized in Tables (2, 3, 4, 5, 6, 7, 8, 9, 10, 11).

The special surveys show that the rate of infection with *Ascaris* ranges from 3.6 per cent to 70.9 per cent ; with hookworm from 0—37.8 per cent ; with *Trichuris* from 0—28 per cent and with *Enterobius* from 0—9.6 per cent. *Strongyloides*, *Taenia* and *Hymenolepis* are also found to a much smaller extent.

### 1.2.3 *The age distribution*

The comparative prevalence rates of intestinal helminthic infection in adults versus children have been compiled from the data of Kyaunggon Village (7) and Bassein Township (11) surveys (Table 3) and from the laboratory records of the Children's Hospital and the Rangoon General Hospital. In all the comparisons, children show a higher rate of *Ascaris* infection and with one exception a lower hookworm infection rate. The differences are statistically significant except the hookworm rates for Kozu Village and the laboratory data for the Rangoon General Hospital and the Children's Hospital.

The higher *Ascaris* and lower hookworm infection rates in the younger age groups are in accordance with the observation of others, and is due to differences between

TABLE 3.—*Rates of intestinal helminthic infections by age*

Location	Age (years)	Intestinal helminths	
		<i>Ascaris lumbricoides</i> %	Hookworm %
Bassein Town	5—15	78.0	1.9
	16—25	57.6	13.6
Kozu Village	5—15	71.0	21.5
	16—25	45.6	15.8
Kyaunggon Village.	0—12	66.7	7.3
	31 +	55.4	16.9

adults and children in factors such as behavioural and occupational activities, superimposed upon natural age resistance and acquired resistance. The relative importance of each may only be measured under controlled conditions.

Data from Burma is not sufficient to be broken down into smaller age groups but it is noted by others that the prevalence of infection with *Ascaris* is higher among the pre-school age and in the lower primary grades. In the case of hookworm infection, the maximum incidence occurs somewhere between the ages of 15—25 (12).

#### 1.2.4 *Urban versus rural distribution of intestinal worm infections*

The only comparable data on the relative rate of intestinal worm infection among urban and rural dwellers is that given by Bassein study. They found the *Ascaris* infection rate in Bassein Town to be 72 per cent versus 63 per cent in nearby Kozu Village. This is not significantly different; but the hookworm infection rate was 5 per cent in Bassein Town in contrast to 19 per cent in Kozu Village, the difference being highly significant (11).

Although this is but one example, these figures suggest that hookworm infection seems to be more susceptible to the influence of urbanization whilst *Ascaris* is not appreciably so.

The WHO Technical Report on Ascariasis also notes that because of overcrowding in towns of non-industrialized countries, the prevalence of *Ascaris* infection may be higher in urban than in rural areas (13).

Where faeces are used as agricultural fertilizer, it might be expected to influence the urban versus rural distribution of *Ascaris* infection. But according to the information available, the use of faeces as fertilizer is neither widespread nor common in Burma (Dr. Kaung Zan, Agricultural Research Institute, Rangoon, personal communication).

#### 1.2.5 *Distribution according to climate and region*

There is sufficient information available as to conditions of temperature, humidity and soil which are optimum for transmission of infection with the soil transmitted helminths and as to the limits within which transmission may occur. With the aid of climatographs it may be possible to predict the endemicity of infection with these worms in the various natural regions of Burma. But, then, the micro-environment to which the free living stages of the soil-transmitted helminths are exposed may be very different from the macro-environment. There are many examples of districts where certain helminths can survive whereas adjacent or surrounding areas are unsuitable for development. In Burma, although data are available for atmospheric temperature and rainfall there is yet little information on soil temperature and other soil conditions, which in addition to climate are influenced by factors such as vegetation. Thus only very broad generalizations may be made as to endemicity of the soil-transmitted helminths from the meteorological data available.

It may be expected that the prevalence of *Ascaris*, *Trichuris* and hookworm will be high in the warm, wet low lands such as the coastal strips and the delta, and to be low in the dry zone.

Actual measurements of the distribution of infection in the different regions of Burma have been carried out to a limited extent. In order to be able to compare the rate of infection in the different regions, a systematic collection of data would have to be done using comparable materials and methods and with due regard also to the seasonal variations.

The data available now, although imperfect, is capable of revealing large regional variations. The laboratory records of the various hospitals are comparable in the sense that they represent patient material, and that all use the direct smear technique. Seasonal variations have also been smoothed out because they are annual averages.



Admittedly, observer variations may be considerable. Yet the *Ascaris* infection rate of 4.9 per cent in Magwe Division Hospital, 4.2 per cent in the Sao San Htun Hospital contrasts markedly with the 69.9 per cent in the Moulmein Division Hospital and cannot be disregarded. In Rangoon there is a steady rate of about 20 per cent to 25 per cent. Similarly, the 7.8 per cent rate of hookworm infection in Moulmein may be compared to the 2-3 per cent and lesser rates in other hospitals.

Some of the materials and methods in the special surveys are not comparable. However, all the village surveys may be compared, and reveal that whereas all the Lower Burma and the Kachin State rates for *Ascaris*, *Trichuris* and hookworm infections are high, the dry zone village of Tuywinbo and Inle in the Shan States have remarkably low *Ascaris* and *Trichuris* infection rates. Such comparisons do not take seasonal variations into account but do confirm the previous laboratory variations. The inter-regional comparison of hospital proportional morbidity rates also provide additional corroborative evidence.

The conclusion seems justified that *Ascaris*, *Trichuris* and hookworm infection rates are low in the Dry Zone and in parts of the Shan States. They are high in the Delta, the coastal strips and parts of the Kachin State.

#### 1.2.6 *The intensity of infection*

The intensity of infection may be measured by doing egg counts during stool examination or by enumeration of the number of worms found at autopsy or after anthelmintics. Only one such study is known to have been done in Burma. The number of *Ascaris* passed after a dose of piperazine was counted in children under ten years having suggestive symptoms of intestinal ascariasis. The mean number passed was 22 with a range of 1—140 (Dr. Khin Myo Win, personal communication). Variation of the intensity of infection with age, locality and season has not been studied in Burma. Neither have studies been done on the intensity of infection with other intestinal helminths.

There appears to be general agreement that the intensity of infection with soil-transmitted helminths is reflected in the overall prevalence rates. The higher prevalence of *Ascaris* infection in the younger age groups

and in certain regions may probably be taken as indication of higher intensity of infection, but in the absence of definitive studies more cannot be said regarding the worm burden.

### II.2.7 Conclusions

It is obvious that more data are required to give a better picture of the prevalence and distribution of intestinal helminthic infection in Burma. But enough information is now available to show what helminths are present, and to reveal the most prevalent infections. A gross pattern of the distribution in terms of age and natural region may also be discerned. Unfortunately, almost no information is available on the intensity of infection with the various helminths.

The intestinal helminths prevalent in Burma are *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, *Enterobius vermicularis*, *Taenia*, *Strongyloides stercoralis*, and *Hymenolepis nana*. Others have not been recorded. Of these, the leading helminths from the view point of prevalence are the soil-transmitted helminths: *Ascaris*, *Trichuris* and hookworm.

Compared with the many published reports from other countries the prevalence rates of *Ascaris*, *Trichuris* and hookworm infection in certain regions of Burma may be regarded as high although not as extremely high as in some other countries.

Infection with *Ascaris* and *Trichuris* is widespread, with the highest prevalence in the wet delta and coastal strips and parts of the Kachin State. The prevalence is definitely lower in the Dry Zone and also appears to be low in the Shan States.

In children compared to adults, the *Ascaris* infection rate is higher and the hookworm rate lower. Urbanization seems to lessen the prevalence of hookworm infection but not that of *Ascaris*.

### 1.3 Morbidity and mortality due to intestinal helminthiasis in Burma

#### 1.3.1 *General evaluation*

The morbidity and mortality due to intestinal helminthiasis is difficult to assess. With regard to ascariasis, a WHO Expert Committee stated that objective measurement of morbidity is very difficult and that there is relatively little factual information concerning it (13). A UNICEF-WHO Joint Committee states that mortality statistics are generally undependable in countries with high prevalence rates of ascariasis. Nevertheless, an attempt is made hereunder to glean some factual information regarding morbidity and mortality due to intestinal helminths from the data available in Burma.

The morbidity and mortality data available in Burma with respect to intestinal helminthiasis have been compiled. The hospital proportional morbidity rate due to intestinal helminths, the inter-regional comparison of hospital proportional morbidity rates due to intestinal helminths, the inter-regional comparison of hospital proportional morbidity rates due to specified types of intestinal helminths, and the mortality rates due to specified types of intestinal helminths are given in Tables 4 to 8. The proportional morbidity rates have been calculated from the Health Statistics Reports of Township and District hospitals which state the number of patients treated in hospitals for various specified categories of diseases (14).

In assessing the significance of the aforementioned morbidity data certain considerations will have to be kept in mind. Firstly the criteria for the clinical diagnosis of the various helminthiasis are ill defined. Secondly, the data are based on hospital patients only. It cannot be expected that all minor illnesses due to helminthiasis will be seen in hospital, even if assessable. Only the more ill patients not amenable to household remedies will seek medical aid and even then all such patients may not elect to come to hospital but may seek help elsewhere. Also, the size of the population drained by a given hospital is not possible to estimate. The township hospitals drain not only the towns in which they are situated but also a varying portion of the surrounding countryside, depending upon communications and the seriousness of the illness. Because

TABLE 4.—Hospital Proportional Morbidity Rates due to intestinal helminths, Burma, 1958—1961

Diseases	1958		1959		1960		1961	
	In-patients	Out-patients	In-patients	Out-patients	In-patients	Out-patients	In-patients	Out-patients
1. Ankylostomiasis ...	140 (0.09)	1,260 (0.05)	71 (0.04)	794 (0.03)	504 (0.23)	616 (0.02)	67 (0.03)	322 (0.01)
2. Roundworm ...	1,044 (0.66)	76,095 (2.92)	828 (0.48)	74,579 (3.03)	1,082 (0.50)	95,187 (3.13)	1,100 (0.54)	95,027 (3.0)
3. Tapeworm ...	73 (0.05)	1,347 (0.05)	68 (0.04)	1,206 (0.05)	89 (0.04)	1,550 (0.05)	67 (0.03)	1,141 (0.04)
Total ...	1,257 (0.80)	78,702 (3.03)	967 (0.56)	76,579 (3.11)	1,675 (0.77)	97,353 (3.20)	1,234 (0.61)	96,490 (3.05)
Total of all hospital cases ...	157,201	2,601,648	173,329	2,459,339	218,341	3,039,565	202,631	3,159,920
Coverage (Towns) ...	214		210		245			303

\* Figure in parentheses denote the percentage of total cases. Source: Directorate of Health Services (Annual Health Statistics Reports).



TABLE 5.—*Inter-Regional comparison of Hospital Proportional Morbidity Rates due to intestinal helminths, 1958—1961*

Division/State	1958			1959			1960			1961		
	Helminths cases	All cases	Per cent	Helminths cases	All cases	Per cent	Helminths cases	All cases	Per cent	Helminths cases	All cases	Per cent
1. Arakan	1,910	95,982	2.0	2,610	113,522	2.3	4,800	154,846	3.1	2,728	115,889	2.4
2. Irrawaddy	10,309	288,510	3.6	12,375	327,139	3.8	17,751	357,918	5.0	16,273	379,307	4.3
3. Pegu	9,212	339,192	2.7	12,546	367,566	3.4	13,139	414,340	3.2	15,840	505,801	3.1
4. Tenasserim	12,657	129,956	9.7	16,032	225,088	7.1	15,518	222,089	7.0	17,328	217,187	8.0
5. Mandalay	4,090	303,045	1.3	3,602	199,794	1.8	6,248	378,290	1.7	3,986	295,269	1.3
6. Magwe	3,905	225,611	1.7	2,826	183,999	1.5	4,301	239,876	1.8	3,888	275,254	1.4
7. Sagaing	6,556	158,660	4.1	4,625	86,602	5.3	10,536	315,593	3.3	9,718	257,672	3.8
8. Chin Special	7,970	117,176	6.8	8,552	110,372	7.7	7,534	84,843	8.9	9,157	112,185	8.2
9. Shan	5,382	421,594	1.3	3,413	367,242	0.9	4,967	367,975	1.3	6,459	500,341	1.3
10. Kayah	1,714	28,743	6.0	283	20,155	1.4	680	16,341	4.2	727	18,676	3.9
11. Kachin	5,705	197,613	2.9	6,652	232,174	2.9	6,654	215,903	3.1	8,351	271,396	3.1
12. Kawthoolei	1,963	38,348	5.1	1,566	25,408	6.2	1,703	37,421	4.6	2,320	68,761	3.4
13. Rangoon	8,586	414,419	2.1	2,464	373,607	0.7	5,197	452,471	1.1	949	344,813	2.8
Total	79,959	2,758,849	2.9	77,546	2,632,668	2.9	99,028	3,257,906	3.0	97,724	3,362,551	2.9

Source : Directorate of Health Services (Annual Health Statistics Reports) Intestinal Helminths here is meant for ascariasis, Ankylostomiasis and tapeworm).



TABLE 6.—*Inter-Regional comparison of Hospital Proportional Morbidity Rates due to intestinal helminths specified, 1958—1961*

Division/State	1958						1959					
	Ankylostomiasis		Round Worm		Tape Worm		Ankylostomiasis		Round Worm		Tape Worm	
	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %
1. Arakan ...	...	...	1,910	2.0	...	...	...	...	2,435	2.1	175	0.1542
2. Irrawaddy ...	10	0.0035	9,900	3.4	399	0.1383	18	0.0062	12,270	3.8	87	0.0273
3. Pegu ...	11	0.0032	9,071	2.7	130	0.0383	5	0.0014	12,541	3.4	...	...
4. Tenasserim ...	759	0.5840	11,889	9.1	9	0.0069	750	0.3332	15,257	6.8	25	0.0111
5. Mandalay ...	31	0.0102	4,045	1.3	14	0.0046	2	0.0010	3,171	1.6	429	0.2147
6. Magwe ...	3	0.0013	3,796	1.7	106	0.0470	...	...	2,802	1.5	24	0.0130
7. Sagaing ...	...	...	6,556	4.1	...	...	...	...	4,625	5.3	...	...
8. Chin Special ...	120	0.1024	7,848	6.7	2	0.0017	...	...	8,552	7.7	...	...
9. Shan State ...	65	0.0154	4,744	1.1	573	0.1360	8	0.0022	2,997	0.8	408	0.1110
10. Kayah State ...	...	...	1,714	6.0	...	...	...	...	283	1.4	...	...
11. Kachin State ...	81	0.0410	5,596	2.8	28	0.0142	82	0.0353	6,556	2.8	14	0.0060
12. Kawthoolei State ...	...	...	1,958	5.1	5	0.0130	...	...	1,566	6.2	...	...
13. Rangoon ...	320	0.0772	8,112	2.0	154	0.0372	...	...	2,352	0.6	112	0.0300
Total ...	1,400	0.0507	77,139	2.8	1,420	0.0515	865	0.0320	75,407	2.9	1,274	0.0484

TABLE 7.—Inter-Regional comparison of Hospital Proportional Morbidity Rates due to intestinal helminths specified, 1958—1961—(concl'd.)

Division/State	1960						1961					
	Ankylostomiasis		Round Worm		Tape Worm		Ankylostomiasis		Round Worm		Tape Worm	
	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %
1. Arakan	7	0.0045	4,791	2.9	2	0.0013	...	...	2,728	2.4	...	...
2. Irrawaddy	16	0.0045	17,578	4.9	157	0.0439	10	0.0026	16,047	4.2	216	0.0569
3. Pegu	119	0.0287	13,003	3.1	17	0.0041	4	0.0008	15,810	3.1	26	0.0051
4. Tenasserim	437	0.1968	15,074	6.8	7	0.0032	362	0.1667	16,772	7.7	194	0.0893
5. Mandalay	19	0.0050	6,181	1.6	48	0.0127	2	0.0007	3,910	1.3	74	0.0251
6. Magwe	...	...	3,574	1.5	727	0.3031	...	...	3,697	1.3	191	0.0694
7. Sagaing	1	0.0003	10,498	3.3	37	0.0117	...	...	9,718	3.8	...	...
8. Chin Special	1	0.0012	7,533	8.9	...	...	...	...	9,157	8.2	...	...
9. Shan State	497	0.1351	4,116	1.1	354	0.0962	...	...	6,044	1.3	415	0.0829
10. Kayah State	...	...	678	4.1	2	0.0122	...	...	727	3.9	...	...
11. Kachin State	18	0.0083	6,583	3.0	53	0.0245	11	0.0041	8,305	3.1	35	0.0129
12. Kawthoolei	...	...	1,703	4.6	...	...	...	...	2,315	3.4	5	0.0073
13. Rangoon	5	0.0011	4,957	1.1	235	0.0519	...	...	897	0.2601	52	0.0151
Total	1,120	0.0344	96,260	3.0	1,639	0.0503	389	0.0116	96,127	2.9	1,208	0.0359

Source : Directorate of Health Services (Annual Health Statistics Reports).

TABLE 8.—Mortality Rates due to helminths specified during 1958—1962

Diseases	1958		1959		1960		1961		1962	
	No.	* Rate	No.	* Rate	No.	* Rate	No.	* Rate	No.	* Rate
1. Ankylostomiasis ...	6	0.3	8	0.3	13	0.6	85	3.6	...	...
2. Other diseases due to helminths.	337	14.7	237	10.3	344	16.9	236	10.0	172	14.9
3. All other diseases classified as infective and parasitic.	45	2.0	153	6.7	104	5.1	19	0.8	54	4.7
Total ...	388	16.9	398	17.3	461	22.6	340	14.5	226	19.6
Deaths due to all causes	44,625	1,940.7	45,181	1,966.8	40,626	1,998.5	43,536	1,842.4	21,856	1,892.3

\* Rate per 100,000 population.

Source: Directorate of Health Services (Annual Vital Statistics Reports).

of the foregoing considerations only hospital proportional morbidity rates have been considered. These rates will reflect, within the limits of the accuracy of the diagnosis, the proportion of hospital patients who are suffering from the more serious manifestations of intestinal helminthiasis. They will indicate the relative numerical importance of intestinal helminthiasis in hospital practice. It is impossible to be certain what relation such hospital proportional morbidity will have to conditions in the community. It is expected that the proportional morbidity due to intestinal helminthiasis will probably be much higher in the community than in hospitals.

The mortality rates are not only based on hospital deaths, but include all deaths due to helminthiasis within the municipal areas of towns. As such, the figures, though more representative in a sense have rendered diagnoses less dependable. Also, all helminthic diseases except ankylostomiasis have been grouped together, making them far less informative.

### 1.3.2 *Ascariasis*

As stated previously, objective measurement of morbidity due to ascariasis is very difficult and there is relatively little factual information concerning it. The prevalence of *Ascaris* infection might provide an index of the degree of morbidity due to this worm. In selected places it might also be possible to have some indication of the morbidity from the gross complication of ascariasis by detailed studies, frequently retrospective, of hospital admissions.

It is not known for certain what clinical manifestations are being diagnosed as ascariasis in Burma. It is generally accepted that gastro-intestinal symptoms such as intestinal colic or diarrhoea may lead to the diagnosis of ascariasis, especially if they occur in children. There may or may not be associated features of malnutrition. It is seldom that the pulmonary and skin manifestations of larva ascariasis are diagnosed as such, even when seen.

Mortality rates for ascariasis are not available. With regard to morbidity the Health Statistics Reports of the Directorate of Health Services, for the years 1958—61 show that out of a total of 2½ to 3 million out-patients annually



treated at Township and District Hospitals in Burma, ascariasis accounts for approximately 75,000 to 100,000, being 3% of the total number. Among in-patients 800 to 1,100 patients or only 0.5% approximately are diagnosed as having ascariasis. These figures would have been more meaningful if expressed separately for adults and children. At least double the value of 3%, that is about 6% to 10%, would be a crude estimate of the hospital proportional morbidity in children.

Compared with reports from Ceylon where ascariasis is said to be the third-ranking cause of death in children, the above proportional morbidity rates do not seem to be high (15).

Definitive studies of morbidity due to ascariasis are very few in Burma. According to one study at the Children's Hospital, Rangoon, over 95% of about 200 children who had gastro-intestinal symptoms suggestive of ascariasis expelled the worms on being given piperazine (Dr. Khin Myo Win, personal communication). This appears significantly higher than the infection rate of 20% in the general patient population of that hospital. In another study only 13% of children with diarrhoea had *Ascaris* ova in the stools on direct smear examination, in contrast to 88% in 25 controls (16). Even allowing for the dilution factor in diarrhoea stools, *Ascaris* infection does not seem to be a significant cause of these diarrhoeas.

As stated earlier, only gastro-intestinal symptoms tend to be taken as indicative of ascariasis. It is not known what the frequency is of pulmonary and skin manifestations due to larval ascariasis in Burma. Reports from other countries indicate that mortality due to pulmonary manifestation may be considerable in hyperendemic areas. Among aborigines in Queensland the mortality among children (3 months to 5 years), mostly attributed to "pneumonia" was high (29% to 54% of total deaths). After mass treatment of children for ascariasis, deaths fell to 8% (12).

With regard to the surgical complication of ascariasis in children 5, 6 and 11, children respectively underwent surgery at the Children's Hospital, Rangoon, during the years 1965-66-67 because of complications such as obstruction of the intestine or bile duct, appendicitis and intestinal



perforation (Dr. Pe Nyunt, personal communication). In comparison, 73 cases of intestinal obstruction due to ascariasis were seen in a single hospital in Ceylon in one year and 127 cases of biliary ascariasis alone were seen in a single Vietnamese clinic in a one year period (15).

In adults, surgical complications of *Ascaris* infection are a rarity in Burma, although not unknown. No studies of adult morbidity due to ascariasis have been made in Burma. The general impression is that the proportion of adults with gastro-intestinal symptoms due to ascariasis is much less than children.

It is probable that the quantity of anthelmintics in demand would bear a relation to the need and therefore to the morbidity due to ascariasis. The Burma Pharmaceutical Industry production of piperazine (BURAZINE) during the years 1962 through 1967 was 1,084,000, 598,000, 865,000, 1,645,000 and 1,529,000 oz. respectively; that is, about 1 to 1½ million adult doses or more annually. In addition, the UNICEF imported into Burma during 1961 through 1967, 5,610,000 tablets of piperazine for distribution to the Rural Health Centres which is about 100,000 average adult doses per annum. Thus about 2 million adult doses of piperazine were consumed annually, the bulk of it by the approximately 10 million children in Burma. This figure would be an estimate of the minimum demand for piperazine and indicates the morbidity due to ascariasis among children.

Definitive data on morbidity and mortality due to ascariasis is meagre but after consideration of all the aforementioned facts and with due regard to the experiences in other countries this Committee is of the opinion that in children in Burma, the morbidity directly attributable to ascariasis is noteworthy, but that in relation to other causes of morbidity in this country, it cannot be considered as large. Death directly due to *Ascaris* infection is probably very small. In adults, definitive factual information is even less available, but in view of the smaller prevalence of infection and again drawing from the experiences of others, it is concluded that adult morbidity and mortality due to ascariasis is also insignificant in relation to other factors.

### 1.3.3 *Hookworm disease*

It is not clear on what basis the diagnosis of hookworm disease has been made in the cases reported from hospitals. Commonly, it is made when anaemia and general debility is associated with the presence of hookworm eggs in stool.

During the years 1958—61 the maximum number of patients annually treated for hookworm infection were 1,280 out-patients and 140 in-patients throughout the country. The highest proportional morbidity rates during the same period are 0.23% for in-patients and 0.05% for out-patients. These figures would have been more informative if separately available for the sexes and different age groups. The inter-regional comparison of hospital proportional morbidity rates show a constant pattern of high rates in the Tenasserim Division and low rates in Magwe, Mandalay and Sagaing Divisions. The hospital proportional morbidity rates are obviously very low even in the Tenasserim Division, the highest recorded being 0.5%.

The predominant symptom and cause of disability due to hookworm infection, at least in adults, is iron deficient anaemia. This aspect of morbidity is fully discussed under nutritional deficiencies due to intestinal helminths.

### 1.3.4 *Enterobiasis, Trichuriasis and other intestinal helminthiases*

In the Health Statistics Reports about 70 to 90 cases of Taeniasis were stated to have been treated annually as in-patients during the years 1958—61, and about 1,000 to 1,500 as out-patients. It is not known what the diagnostic criteria were and is presumably the passage of segments by the patients. These patients comprise about 0.04% of the total patient number.

A heavy, *Trichuris* infection may cause symptoms such as chronic diarrhoea and abdominal pain. Persistent and massive infection may produce rectal prolapse and in endemic areas trichuriasis may be the leading cause of rectal prolapse in children. *Strongyloides* infection may cause enteritis with severe abdominal pain and diarrhoea.

Trichuriasis has not been separately reported in the Annual Returns from hospitals and the morbidity from it in Burma is not known. Similarly, other intestinal helminths found in Burma—*Strongyloides*, *Hymenolepis* and *Enterobius*—have not been separately reported in the morbidity

returns from hospitals in Burma, and the extent of the morbidity they cause is not known. With regard to enterobiasis it is the impression of some that it causes a considerable degree of morbidity in children.

#### 1.3.5 *Animal helminths*

Animal intestinal worms found in Burma and which are potential causes of human intestinal infections are: *Taenia taeniarformis*, *Dipylidium caninum*, *Fasciolopsis buski*, and *Gastrodiscoides hominis* (U Tha Khin, Veterinary College, personal communication).

### 1.4 **Effect of intestinal helminthiasis on the nutritional status of the people of Burma**

The complexities of host-parasite nutritional relationships have been studied by many investigators. It is stated in the Report of the WHO Expert Committee on Nutrition and infection that social and cultural factors determine the ways in which infection can influence nutritional status, and that the clinical consequences depend on the state of nutritional inadequacy at the time the infection is acquired. An infection may have no serious consequences in a well nourished individual, but in persons already in a precarious nutritional state it can set off a fatal chain of events (17). Again it was observed by Smith (18) that "except in the case of a few individual nutrients, the better the host's diet, the poorer the state of the parasites. Conversely, again with a few exceptions, it is the host with the poor diet and in a low state of nutritional health who harbours the most prosperous parasites." The above observations are also relevant to intestinal helminthiasis, and their effect on nutrition requires to be viewed against the background of the nutritional status of the country, as may be assessed from the results of nutritional surveys and the physical development of the people.

#### 1.4.1 *Results of Nutrition Surveys*

Maung Gale in 1939—41 (19), WHO/FAO/Govt. of Union of Burma in 1954—57 (20) and the Inter-departmental Committee on Nutrition for National Defence (ICNND) in 1961 (21) carried out countrywide clinical nutritional and



dietary surveys in Burma, most of which took place in the rural areas. The results show that the Burmese diet in general contains:

- (a) sufficient calories, vegetable proteins and niacin,
- (b) just sufficient amounts of fats, iron and ascorbic acid,
- (c) insufficient quantities of animal proteins, vitamin A and thiamine,
- (d) very low quantities of calcium and riboflavin.

The incidence of clinical signs of deficiency encountered are in agreement with the dietary data. The incidence of angular lesions is 18 to 28 per cent, of gingivitis 1-8 per cent, and Bitot's spots were found only in 0.5 per cent or less of the population surveyed. Protein malnutrition in any form was not recognized. Goitre is highly prevalent in the mountainous areas of the Chin Hills and the Kachin State and the Shan States, the prevalence rate being 50 to 90 per cent. In other parts of Burma the ICNND survey noted up to 100 per cent of grade 1 and 2 goitres among civilians.

Biochemical tests were done only by the ICNND team. Urinary excretion of thiamine, riboflavin, nicotamide and serum determinations of vitamin C, vitamin A, carotene and proteins were carried out. Except for urinary thiamine and riboflavin the other tests were found to be within normal limits. It should be noted that although urinary thiamine levels were suboptimal no frank cases of thiamine deficiency were found during the survey. Hemoglobin surveys by the Anaemia Research Project using the cyanmethemoglobin method gives mean values of 14.4 g/100 ml for men and 12.5 g/100 ml for non-pregnant, non-lactating women. The percentage incidence of men with Hb. less than 14 g was 30 per cent and of women with Hb. less than 12 g was 35 per cent (22).

Nutritional deficiencies due to intestinal helminthiasis, especially ascariasis, are expected to be more evident in children particularly of the pre-school age group. Of the civilian sample of 2,003 on whom the ICNND did clinical examinations, 587 or 29 per cent were below 15 years. In

TABLE 9.—*Nutritional data on children*

	Maung Gale (school children)	Postmus (school children)	ICNND (less than 15 years)
	%	%	%
Bitot's spot ... ..	.07	.55	.45
Phrynoderma ... ..	.77	15.2	3.4
Gingivitis ... ..	8.1	1.0	1.7
Angular lesions ... ..	18.2	18.4	21.2
Urinary thiamine excretion (deficient).	...	...	4.8
Urinary riboflavin excretion (deficient).	...	...	8.6
Serum Vit. A (deficient) ... ..	...	...	28.6
Serum Vit. C (deficient) ... ..	...	...	0

their biochemical survey, only 8—35 subjects below 15 years were included for the various tests. The results in children are summarized in Table 9.

As in adults, frank cases of beriberi were not encountered in children. But, infantile beriberi is frequently seen in hospital. In 5 months, over 500 cases of infantile beriberi comprising 14% of the total Medical admissions were seen at the Children's Hospital, Rangoon (23).

Kwashiorkor was also not seen in the surveys conducted, but clinical cases were observed in various hospitals in Burma (Dr. Tin U, personal communication). During 1966, 421 out of a total of 10,134 admissions (4%) into the Children's Hospital, Rangoon, were cases of Kwashiorkor, with a case fatality rate of 38 per cent (Dr. Khin Myo Win, personal communication).

Although the extent of nutritional deficiency among the school-going age group may be estimated from the above data there is no factual basis even for a crude estimate with respect to the situation in pre-school age groups. The nutritional deficiencies found in the school-going age group are similar to those found in the general population surveyed.



#### 1.4.2 *Measurement of physical development*

Anthropometric studies of the Burmese have been made by various investigators (19, 20, 21, 24). The mean adult height reported ranges from 63.1 inches to 66.1 inches in males and from 59.1 inches to 60.3 inches in females. The mean weights range from 108.5 lb. to 134.1 lb. in males and from 94.2 lb. to 105.2 lb. in females. These are manifestly lower than those from the developed countries.

In comparing the growth curves of Burmese school children from Aung San with those from Britain, Ko Ko observed that the Burmese children are already handicapped by the age of 5 years. At 5 years of age the British children are heavier than the Burmese by 2-3 years in terms of physical age and this difference even increases to the equivalent of 4-5 years of physical age in certain age groups. The difference in heights are not so marked but Burmese children were found to be shorter by 3-4 inches in corresponding age groups or by the equivalent of 1-2 years in terms of physical age. The gain in height of these Burmese children (5—15 years) runs parallel to that of the British but the curves for weight, by inspection alone, are slightly divergent suggesting a relative lag in growth of the Burmese (24).

During the ICNND survey, comparison was made between the growth curve of Burmese children (military dependents) and the State University of Iowa growth charts. In the pre-school age, growth appears to be adequate for the first year and then becomes retarded and remains so throughout the 18 years recorded. It was however noted that many of the babies, appear to be born small and remain below Western standards even in the first year of life. In the civilian sample which contained very few children below 5 years, the growth curves of the Burmese children were again outside those accepted as adequate for American children. However, the curves themselves follow the general pattern quite well and would seem only to indicate a "smaller stature" rather than growth retardation.

The anthropometric data indicate that the Burmese are smaller in stature when compared with the Western standards. There is uncertainty as to whether growth rates are retarded in the younger age groups. It is also questionable whether it is valid to use Western standards to assess Burmese growth rates.

### 1.4.3 *Ascariasis as a cause of nutritional deficiency in Burma*

A WHO Expert Committee on Soil-transmitted Helminths (12) states that malnutrition is more prone to occur in the *Ascaris* ridden child and that heavy infection with *Ascaris* has been related particularly to stunting and general sub-nutrition, avitaminosis A and Kwashiorkor. Again, a UNICEF-WHO Joint Committee on Health Policy (15) notes that malnutrition in children is inextricably bound up with helminthic infection and that *Ascaris* has been among the most widely incriminated in this respect.

Also it is commonly reported in the medical literature that heights, weights and mental performance of children with ascariasis are significantly less than those of unaffected children raised under "similar" conditions without ascariasis. While convincing controls for such studies have, almost of necessity, been lacking, well controlled experimental studies on dogs and swine infected with related worms do in fact show that weight gains of infected animals, even on adequate diets, are measurably reduced.

In Burma, no studies have been undertaken relating *Ascaris* infection to nutritional deficiencies or to physical development. But, in view of the fact that ascariasis has been incriminated as bound up with subnutrition and stunted growth in children, and because of its high prevalence in parts of Burma, this Committee is of the opinion that ascariasis is a significant factor contributing to malnutrition in children in endemic areas of Burma and that, at the least, it exists as a potential threat which, when complemented by other factors such as lowered dietary intake, may bring nutritional deficiencies out to the fore.

### 1.4.4 *Hookworm infection as a cause of nutritional deficiencies in Burma*

The predominant cause of morbidity due to hookworm infection is iron deficiency and iron deficient anaemia. The role of hookworm infection in the causation of anaemia in Burma is being studied by the Anaemia Research Project of the Burma Medical Research Institute.

Haemoglobin-surveys have been performed by various workers. Using the cyanmethaemoglobin method, mean values of 14.4 and 12.5 respectively for males and females were obtained by Aung-Than-Batu *et al.* (22).

TABLE 10.—*Iron deficiency anaemia in adult males*

	Shan-te-gyi village	Tuywinbo village	Insein Railway Workers
Number examined ... ..	259	262	860
Number anaemic (Hb. less than 11 g)	10	9	11
Iron deficient anaemia (serum iron less than 50/ug).	0.9%	1.1%	0.8%

TABLE 11.—*Hookworm infection rates in anaemic subjects*  
(2 Burmese villages)

	Males	Females
Number examined ... ..	521	645
Number anaemic (Hb. less than 11 g) ...	19	124
Anaemics whose stools were examined ...	13	89
Non-anaemic controls ... ..	23	60
Number in whom hookworm ova present ...	1 1	3 4
Per cent with hookworm ova ... ..	8 4	3 7

In females, anaemia and iron deficiency is to a large extent influenced by child-birth and pregnancy. The status of iron nutriture in males form a more reliable index of morbidity due to hookworm infection. In Table 10 is shown some of the results of investigation into the causes of anaemia in males. It was observed that only 5% of the males in the various surveys have deficient Hb. levels of less than 12.0 g/100 ml. Only 1% of the males in the various studies have iron deficient anaemia. In Table 11 is shown the hookworm infection rate among anaemic males, anaemic females and their controls. It may be seen that hookworm infection is definitely not associated with anaemia in the populations studied.

While these studies show that hookworm infection is not an important cause of anaemia and iron deficiency in the areas studied, the possibility exists that in the Tenasserim Division and other areas of high prevalence, hookworm may cause significant disease, at least in pockets, if not widespread.



Although the pathogenesis is not clear it is believed that hookworm infection may cause hypoproteinemia and oedema. Serum protein levels in Burmese measured by various investigators give mean values of 7.6 to 7.9 g/100 ml and are satisfactory. Serum protein measurement or other methods of assessing protein nutriture and metabolism in hookworm infected subjects have not been done in Burma. Children with Kwashiorkor are seen in hospitals but no reports are available as to the incidence and intensity of hookworm infection in such patients.

#### 1.4.5 *Enterobius, Trichuriasis and other intestinal helminthiascs*

*Trichuris* is the only other intestinal worm reported to be highly prevalent in Burma. There is little evidence that it produces nutritional deficiencies such as anaemia or oedama.

### 1.5 **Assessment of the impact on health**

The most prevalent intestinal helminths in Burma, according to results of stool examinations, are *Ascaris* (3.6 to 72.0%), *Trichuris* (1.6 to 28.0%), and hookworm (0.9 to 37.8%). *Enterobius* is expected to be more widespread than the stool survey results would indicate. The data available is sufficient only to give a gross picture of the prevalence and distribution according to age, urban versus rural residence and geography. The intensity of infection is not known.

Morbidity due to ascariasis is difficult to evaluate and only a few definitive studies have been done in Burma. The relationship between anaemia and hookworm infection has been the subject of special studies. Hospital proportional morbidity rates for the various helminths are the only factual basis for consideration of direct morbidity.

The nutritional status of the country has been assessed by several surveys. Limited data on physical development is also available. But information about the pre-school age group is meagre. Almost no studies have been done in Burma regarding the relationship between intestinal helminthic infections and nutrition.

The assessment of the Committee regarding the impact of intestinal helminthiasis on the health of the people will necessarily be circumscribed by the gaps in the available information, but the data at hand are deemed sufficient to reveal any significant effects that may be produced.



This Committee is of the opinion that direct morbidity due to ascariasis is noteworthy in children, although it does not rank high when compared with other causes of morbidity. The effect of ascariasis on nutrition in children has not been studied in Burma. From a consideration of the experience of other countries, and in view of the high prevalence in some areas and the extent of direct morbidity coming to the surface in hospitals, there is reasonable grounds to conclude that ascariasis is a significant contributing factor to the problem of malnutrition in children. Morbidity and nutritional deficiency due to ascariasis is negligible in adults. Mortality from it is insignificant in children and a rarity in adults.

Hookworm infection has not been shown to cause significant anaemia in adults in the areas studied. The epidemiological picture of iron deficiency anaemia does not suggest that hookworm infection contributes significantly or extensively to anaemia among adults in Burma, although there may be pockets of high intensity infection and morbidity. Mortality is very small. There is very little data on children.

Morbidity due to trichuriasis cannot be easily dissociated from that of *Ascaris* infection. Although not documented, enterobiasis is believed to cause a degree of morbidity in children.

## 2. CURRENT MEASURES AGAINST INTESTINAL HELMINTHIASIS IN BURMA

### 2.1 Introduction

There is now no deliberate large scale effort to control intestinal helminthiasis in Burma. Control occurs as a part of the overall programme aimed at providing better health services and improvement of sanitation and standards of personal hygiene. This again takes place against the background of measures to enhance the standard of living of the people of the country and more specially of the rural population. It is generally acknowledged that the gradual fall of intestinal worm infection rates in large parts of Western Europe and North America are unplanned by-products of generally improved standards of living and popular acceptance of relatively high standards of personal hygiene. The general social and public health improvement measures being carried out in Burma are also expected to bring about a gradual fall in infection and morbidity due to intestinal helminthiasis but these broad programmes are necessarily long-term and measurable in decades rather than in years.

With respect to infection with *Ascaris*, *Trichuris*, and hook-worms which are the three most prevalent soil-transmitted helminths in Burma the possible control measures are :

(a) Environmental sanitation—

This comprises—

- (i) the safe disposal of human excreta;
- (ii) the provision of safe water supply;
- (iii) prevention of food contamination by faecal matter.

(b) Clinical chemotherapy—

- (i) individual treatment;
- (ii) mass treatment

(c) Immunization;

(d) Health education, as a corollary to the others.

The measures at present being instituted in Burma are :—safe disposal of human excreta, provision of safe water supply, prevention of faecal contamination of food material, health education, and individual treatment with anthelmintics.

Immunization against intestinal helminths, which is still on an experimental basis, has not been tried in Burma.

## 2.2 Measures for the safe disposal of human excreta

2.2.1 In the villages the principal problem is that of building and encouraging the use of a sufficient number of sanitary latrines. In 2 sample villages from Upper Burma and Lower Burma with populations of approximately 1,500 each the number of latrines are 2, and 67 respectively (A). This is not exceptional for most of the villages. Latrine construction in the villages is the responsibility of the Rural Sanitation and Water Supply Board which is at present under the Agricultural and Rural Development Corporation of the Ministry of Agriculture. This Board operated in co-operation with the Mass Education Organization of the Dept. of Social Welfare, and the Rural Health Centres (R. H. C.) run by the Ministry of Health. Since about 1957, the Rural Sanitation and Water Supply Board has been concentrating its effort only on water supply and the latrine construction programme has been kept in abeyance. There are also no plans as to the future (Agricultural and Rural Development Corporation, personal communication). The Directorate of Health, through the staff of the RHC, also encourages the building of latrines by villagers on an individual self-help basis. But since it cannot provide material aid, and because RHC are spread thinly, the effect can only be seen in limited areas. Assessing the situation at a national level it may be concluded that excreta disposal in the rural areas is not satisfactory.

2.2.2 In towns, the number of latrines seem adequate and the main problem is one of seeing that the latrines conform to sanitary requirements. With the rapid increase of the urban population in recent times unauthorized shanty towns (*kwetthits*) have sprung up within most of the towns. The sanitary conditions and latrines in these *kwetthits* are appalling. Sanitary facilities and latrines in the better residential areas and in the few Government Housing Projects are satisfactory. Even so, there are instances of lack of co-ordination between the Public Works Corporation responsible for the construction of the Projects and the Local Health Authorities, resulting in situations where the sanitary system of the Housing Project may not fit in with that of the town. Although legal provisions exist under the by-laws of the Municipal Acts for the enforcement of proper sanitary facilities in houses, such



enforcement is not possible in most cases. One of the several reasons is the inadequate number of supervisory health personnel. All the towns and cities of Burma including the City of Rangoon are practically devoid of modern sanitary facilities.

### 2.2.3 *The use of latrines*

Apart from the construction of sanitary latrines the next problem is that of seeing that the latrines are regularly and habitually used. Although adults may use the latrines when present it is seldom that children, especially those under 5 years, will be made to use the latrines.

## 2.3 **Provision of safe water supply**

The Rural Sanitation and Water Supply Board of the ARDC is responsible for the development of domestic water supply in the villages. It is at present giving priority to the arid zones of Magwe and Mandalay Districts. In seeking means to supply sufficient water to these areas of great scarcity it sometimes has to ignore full sanitary requirements, which may be left to the local health personnel to satisfy.

The Directorate of Health, through health personnel at township and village levels, generally supervises the safety of domestic water supply. This is done by advice as to the construction of village wells and tanks and by chlorination, when necessary. Here again, the coverage is too thin to be fully satisfactory.

## 2.4 **Prevention of faecal contamination of food**

Generally speaking, the safe disposal of human excreta and good personal hygiene will prevent faecal contamination of food. One measure begun in Rangoon is the health examination stool survey, and supervision of food vendors and their wares. Whilst a beginning has thus been made, adequate and regular checks are not possible with the present number of personnel.

There is no legislation against the use of night-soil as fertilizer but according to available reports (Dr. Kaung Zan, Agricultural Research Institute, personal communication), such usage, although occasionally practised, is not widespread in Burma and is negligible.



## **2.5 Health education**

General health education is imparted by the Health Education Bureau under the Directorate of Health, and by all echelons of health workers in the course of their duties. In addition, the subject is taught at schools, Teachers Training Colleges, and to special groups such as Red Cross Societies and Maternal and Child Welfare Societies.

The health education at present being given and which is relevant to the control of intestinal helminthiasis, is that aimed at improving general sanitation and hygiene and the prevention of gastro-intestinal diseases in general. There are no programmes specifically aimed at intestinal helminthiasis.

## **2.6 Clinical chemotherapy**

The treatment, as a therapeutic measure, of persons exhibiting the clinical features of intestinal helminthiasis, also play a part in control, by reducing the prevalence and intensity of infection. According to available information, the Burma Pharmaceutical Industry annually produces approximately  $1\frac{1}{2}$  million ounces of piperazine (Burazine) of which about 100,000 ounces are distributed to Government hospitals. In addition the UNICEF annually distributes approximately 800,000 tablets of piperazine, for children.

## **2.7 Other measures**

The control of taeniasis is effected chiefly through meat inspection, and whilst legislation requiring such measures exist it can seldom be effectively carried out.

Enterobiasis may also be controlled by some of the measures already mentioned above.

### 3. RECOMMENDATIONS

This Committee is of the opinion that a more deliberate and active attitude should be adopted towards the control of soil-transmitted intestinal helminths. Whatever activity is undertaken should be done within the frame work of the control of gastro-intestinal infections in general. With regard to the control of soil-transmitted intestinal helminthiasis a three phase programme should be envisaged.

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- 3.1 The long-term goal would be that of so improving the general standard of living, environmental sanitation, and personal hygiene of the mass of the people that gastro-intestinal infections in general, including intestinal helminthiasis, would be diminished to negligible numbers.

This Committee is aware of the efforts, commensurate with the resources of the country, that are being made by the Health Department in this respect.

However, it has to point out certain areas in which action is still needed :

- (a) The village latrine construction programme which has been interrupted should be resumed as soon as feasible.
- (b) The unsanitary state of the latrines in many areas of the towns need to be remedied. For this and for the enforcement and supervision of other environmental sanitary measures the health personnel in towns should be suitably reinforced with a sufficient number of adequately trained persons.
- (c) A central body should be set up to co-ordinate the many agencies concerned with environmental sanitation, such as the Directorate of Health Services, the Public Works Corporation, the Rural Sanitation and Water Supply Board, etc.

- 3.2 The measures aimed at controlling transmission of infection may not yet be implementable in the near future.

Moreover, it may be stated, with particular reference to ascariasis, that environmental measures, especially the provision of latrines and safe water supply, have not, in themselves, eliminated ascaris infection from certain parts of Western Europe and North America. In addition, various studies have shown that

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the provision of latrines in villages as the sole preventive measure may have little or no effect upon prevalence. In Burma, it was observed in Bassein town that the ascaris infection rate was even higher than in an adjoining village. Yet, latrine construction in the villages cannot even hope to approach the numbers already in existence in towns.

Since the measures aimed at controlling transmission may not be successful in the near future, the best that may be done in the interim would be to direct control efforts towards the *disease* rather than the *infection* and its *transmission*.

A WHO-UNICEF Joint Committee on Health Policy (15) states that in countries where ascariasis is a recognized health problem it is now reasonable to incorporate into going health services a programme of periodic administration of piperazine on a wide community basis, not with the expectation of promptly eradicating the worms but of reducing the prevalence of infection in the general population and the worm burden in infected children. Greatest benefits can be expected from such a programme if directed particularly towards reducing the infection among school and, where possible, 4 pre-school aged children. Present information and experience indicate that ascariasis control with piperazine is safe and relatively inexpensive. It is feasible and definitely beneficial.

This Committee would endorse the views of the above UNICEF-WHO Joint Committee in principle. In the light of the *Ascaris* situation in Burma a programme of mass chemotherapy as a method of ascariasis control, especially in endemic areas, should be envisaged for the future. Depending upon resources the programme may be launched at district levels and gradually extended.

A pilot project to study the feasibility of such a programme should be instituted now. The pilot study may be based on 1 or 2 villages and should be jointly supervised by competent persons from the Directorate of Health Services and the Burma Medical Research Institute. The study area will need a reinforcement of health assistants and laboratory technicians. The duration of the pilot study may be up to 5 years.

- 3.3 Immediate efforts at control of intestinal helminthiasis should consist of the treatment of subjects with clinical manifestations. To a certain degree, such treatment will help lower the prevalence and the worm burden in infected persons.

With regard to ascariasis, the initial aim should be to supply to district, and township hospitals, rural health centres and maternal and child health centres in endemic areas enough piperazine to treat all children with symptoms.

Anthelmintics against hookworm should also be supplied to areas with high prevalence and morbidity, such as in the Tenasserim Division.

In brief this Committee recommends :

1. That the long-term general measures aimed at improving the standard of living and environmental sanitation and personal hygiene of the people be continued.

In particular, it recommends that the latrine construction programme be resumed when feasible, that a central body to coordinate the several agencies concerned with environmental sanitation be formed, that sanitary conditions of the towns be raised by appropriate measures, including the appointment of more health personnel.

2. That a pilot project be instituted now to study the feasibility of mass chemotherapy as an interim method of *Ascaris* control.
3. That immediate measures at control of intestinal helminthiasis should consist of the treatment of subjects with clinical manifestation and that adequate supplies of anthelmintics be available in endemic areas.



#### 4. RESEARCH NEEDS

Whilst a lot of fundamental research remains to be done, this Committee is of the opinion that initially research should be aimed at acquiring data necessary for the institution of effective control measures.

This Committee recommends that :

1. Further investigations be made into the prevalence, distribution, and intensity of infection of intestinal helminths, especially *Ascaris*. This should include the study of morbidity due to larval ascariasis, on which little information is now available.
2. The relationship between malnutrition, especially kwashiorkor, and intestinal worms, particularly ascariasis, be further investigated.
3. It would be profitable if the pilot study of mass chemotherapy as an ascariasis control measure is able to simultaneously include some of the above investigations.

## 5. SUMMARY

The impact of intestinal helminthiasis on the health of the people of Burma was studied by consideration of the prevalence, distribution and intensity of infection, mortality and morbidity data, and the indirect effect of the worms on the nutritional status of the people.

According to results of stool surveys, *Ascaris*, *Trichuris* and hookworms are the three most prevalent worms infection rates being up to 72.0, 51.4 and 37.8 per cent in some of the reports. There is a significantly higher *Ascaris* infection rate and a lower hookworm infection rate among children as compared to adults. Hookworm is less prevalent in towns whereas there is no such difference for *Ascaris*. The Delta, the Tenasserim and parts of the Kachin State have a high infection rate of these worms, whereas it is low in the dry zone and parts of the Shan States.

The hospital proportional morbidity due to ascariasis ranges from 0.48 to 3.13 per cent in different parts of Burma, and from 0.01 to 0.23 per cent for hookworms and from 0.03 to 0.05 per cent for tapeworms. Mortality is negligible.

In children, the direct morbidity due to ascariasis is noteworthy, although it does not rank high when compared to other causes. But, ascariasis is a significant contributing factor to the problem of malnutrition in children. Enterobiasis is believed to cause a certain degree of morbidity.

Hookworm does not appear to cause significant or extensive anaemia in adults, although pockets of high intensity infection and morbidity may exist.

Of the current measures against intestinal helminths the situation regarding the safe disposal of human excreta is unsatisfactory. There are no provisions in villages, and in towns it is generally inadequate, especially in the *Kwetthits*. The provision of safe water supply is being carried on according to resources available. Health education, in general, is directed towards improvement of environmental sanitation and standards of personal hygiene, but there is no special programme against intestinal helminths. The treatment of subjects presenting with clinical manifestations also serves as a control measure.

This Committee is of the opinion that a more deliberate attitude should be taken against intestinal worms, especially *Ascaris* and hookworms. It is recommended that whilst the all important long-term measures aimed at improving the standard of living, environmental

sanitation and personal hygiene be continued, an interim measure incorporating mass chemotherapy against ascariasis, especially directed towards children in endemic areas, be considered. A pilot project to study feasibility is advocated. Immediate measures should consist of providing adequate chemotherapy, at least for children with clinical manifestations in endemic areas. Anthelmintics for hookworm should also be provided where infection is high.

Research is needed to provide more definite information on the distribution of infection and morbidity according to age, geographical region, and season ; intensity of infection ; and the relationship between morbidity, nutritional deficiency and worm infection. Larval ascariasis as a cause of morbidity should also be investigated.

၅။ အကျဉ်းချုပ်

အူနေသံကောင်တို့သည်၊ မြန်မာပြည်ရှိပြည်သူလူထု၏ ကျန်းမာရေးကို မညီရွှေမည်မျှ မည်သို့မည်ပုံထိခိုက်စေသည်ကို လေ့လာရာတွင်၊ အောက်ပါ အချက်များကိုစိစစ်သုံးသပ်ခဲ့ပါ သည်။ (က) လူထုတွင် သံကောင်များစွဲကပ်နှုန်း **Prevalence**၊ (ခ) လူတိုင်းတွင် ပျမ်းမျှခြင်းစွဲကပ်သည့် သံကောင်အရေအတွက် **Intensity of infection**၊ (ဂ) အသက်၊ ရာသီ၊ ဒေသ၊ မြို့နေ၊ ရွာနေ အလိုက် စွဲကပ်နှုန်း ခြားနားပုံ **distribution**၊ (ဃ) အူနေ သံကောင်ကြောင့် လက်ဝင်းဖြစ်ပွားစေသည့် ရောဂါနှုန်း **Morbidity rate**၊ အသေနှုန်း **Mortality rate**၊ (င) အူနေ သံကောင်များကြောင့် သွယ်ဝိုက်၍ ဖြစ်စေသော အာဟာရချို့တဲ့မှုများ **Nutritional Status**။

**Ascaris** အက်(စ်)ကာရစ် သံကောင် **Trichuris** ထရိုင်ကုရစ် သံကောင်နှင့် **Hookworm** ဟွတ်(ခ်)ဝေါင်း (မ်) သံကောင်များသည် မြန်မာပြည်တွင် စွဲကပ်နှုန်းအများ အပြားဆုံးအူနေသံကောင် သုံးမျိုးဖြစ်သည်ကို တွေ့ရှိရသည်။

စွဲကပ်နှုန်းများမှာ၊ အက်(စ်)ကာရစ် **Ascaris** ၇၂ ရာခိုင်နှုန်း၊ ထရိုင်ကုရစ် **Trichuris** ၅၁ ရာခိုင်နှုန်းနှင့် ဟွတ်(ခ်) ဝေါင်း(မ်) **Hookworm** ၃၇ ရာခိုင်နှုန်းများအထိအသီးသီး လေ့လာချက်များတွင် တွေ့ရှိခဲ့ပါသည်။

အက်(စ်)ကာရစ် စွဲကပ်နှုန်းသည်၊ ခလေးများတွင် လူကြီးများထက် များပြားပြီး ဟွတ်(ခ်)ဝေါင်း (မ်) နှုန်းမှာ နည်းနေပါသည်။ မြို့နေလူထုတွင် ဟွတ်(ခ်) ဝေါင်း(မ်) စွဲကပ်နှုန်းသည် ရွာနေလူထုထက်နည်းနေသည်ကို တွေ့ရငြားသော်လည်း၊ အက်(စ်)ကာရစ် နှုန်းမှာမူ မခြားနားပါ။ မြစ်ဝကျွန်းပေါ်ဒေသ၊ တနင်္သာရီ ကမ်းရိုးတမ်းဒေသနှင့် ကချင် ပြည်နယ်အချို့တို့တွင်၎င်း အူနေသံစွဲကပ်နှုန်းသည် များ၍၊ မိုးခေါင်ရေရှား အလယ်ပိုင်း ဒေသနှင့် ရှမ်းပြည်အချို့နေရာတို့တွင် နည်းပါသည်။

ဆေးရုံများသို့ လာရောက်သော လူနာအများအနက် အက်(စ်)ကာရစ် သံစွဲကပ်ခြင်း ကြောင့် ဖြစ်သော ဝေဒနာခံစားရသည့် လူနာများမှာ ၀.၄၈ မှ ၃ ရာခိုင်နှုန်းအထိဖြစ်ပြီး၊ ဟွတ်(ခ်) ဝေါင်း(မ်) လူနာနှင့် တိတ်ဝေါင်း(မ်) **Tapeworm** လူနာတို့မှာ ၀.၁ မှ ၀.၂ ရာခိုင်နှုန်းနှင့် ၀.၀၃—၀.၀၅ ရာခိုင်နှုန်းအသီးသီး ဖြစ်ကြပါသည်။ အသေနှုန်းမှာမူ ပြောပ လောက်အောင်မရှိပါ။

ခလေးများတွင် အက်(စ်)ကာရစ်သံကောင် **Ascaris** ကြောင့် လတ်တလော ဖြစ်စေ သော ဝေဒနာခံစားရမှုများမှာ ဂရုပြုသင့်လောက်အောင် များပြားပါသည်။ သို့သော် ခလေးများတွင် ဖြစ်ပွားတတ်သော အာဟာရချို့တဲ့မှုများ၏ အကြောင်းရင်း များတွင် အက်(စ်)ကာရစ် သံကောင်ရောဂါသည်တခုအပါအဝင်ဖြစ်သည်။

ကျင်ကြီးစစ်ဆေးလေ့လာရာတွင်၊ ၎င်း၏ဥများ အတွေ့နည်းသော်လည်း၊ အင်ထရိုဗီး ယက်(စ်) **Enterobius** သံကောင်သည် ခလေးများတွင် ဝေဒနာ ဖြစ်စေတတ် ပါသည်။

ဟွတ်(ခ်) ဝေါင်း(မ်) သံကောင်သည် လူကြီးများ၌ သွေးအားနည်းရောဂါ **Anaemia** အပြန်အနံ့ အထိ အရောက်ဖြစ်စေသည်ဟူ၍ မတွေ့ရှိရသေးပါ။



အချို့နေရာများ၌ ကွက်၍စွဲကပ်နှုန်းများများနှင့် ရောဂါအဖြစ်များမှု မရှိဟူ၍ဆိုသောပါ။

အူနေသံကောင်များ တိုက်ဖျက်သည့် လုပ်ငန်းများကို သုံးသပ်ကြည့်ရာတွင် မစင်ကို သန့်ရှင်းစွာ သိမ်းဆည်းမှုလုပ်ငန်းသည်၊ ကျေနပ်လောက်ဖွယ်မရှိပါ။ ရွာများတွင် အိမ်သာ ဆောက်မှု အသုံးပြုမှုသည်၊ နည်းလွန်းလှပါသည်။ မြို့များအထူးသဖြင့် ကွက်သစ်များ၌လည်း ၎င်းလုပ်ငန်းများမှာ စံမမီသေးပါ။ သန့်ရှင်းသောရေ သောက်သုံးနိုင်မှု ဖြစ်မြောက်ရေး အစီအစဉ်မှာ တိုင်းပြည်၏ အင်အားအလိုက် ဆောင်ရွက်နေဆဲဖြစ်ပါသည်။

ကျန်းမာရေးပညာပေး အစီအစဉ်သည်လည်း၊ ယေဘုယျအားဖြင့် ပတ်ဝန်းကျင်သန့်ရှင်းရေး၊ တကိုယ်ရေ သန့်ရှင်းရေးများကို ရည်စူး၍၊ ပညာဖြန့်ဖြူးနေပါသည်။ အူနေသံကောင်များ တိုက်ဖျက်ရေးလုပ်ငန်းများကို အထူးရည်ရွယ်ထားသော အစီအစဉ်တော့မရှိပါ။

အူနေသံကောင်ကြောင့် ဝေဒနာခံစားရသည့် လူနာများအား ဆေးကုသမှုသည်လည်း ကာကွယ်မှုလုပ်ငန်းတရပ်ဖြစ်သည်။

ဤအဖွဲ့၏ယူဆချက်မှာ အူနေသံကောင်များ၊ အထူးသဖြင့် အက်(စ)ကာရစ်နှင့်ဟွတ်(ခ) ဝေါင်း(မ်) များအား တိုက်ဖျက်ရေး အစီအစဉ်များကို ယခုထက်ပိုမို၍ အလေးပြု စေလိုပါသည်။

ကာကွယ်ရေး လုပ်ငန်းများတွင် ရေရှည်အစီအစဉ်များ ဖြစ်သောလူနေမှုအဆင့်အတန်း တိုးမြှင့်ရေး၊ ပတ်ဝန်းကျင်သန့်ရှင်းရေးနှင့် တကိုယ်ရေ ကျန်းမာရေး ပိုမိုတိုးတက်လာရေး၊ လုပ်ငန်းများကို ဆက်လက်ဆောင်ရွက်နေစေလိုပါသည်။

၎င်းပြင်၊ ကြားအစီအစဉ်အနေဖြင့်၊ အက်(စ်) ကာရစ် **Ascaris** သံကောင်စွဲကပ်မှု များဒေသများရှိ ခလေးများကို အထူးရည်ရွယ်သော၊ အများစုလိုက် အက်(ဝ်)ကာရစ် သံချဆေးကျွေးခြင်း **Mass chemotherapy** အစီအစဉ်တရပ်ကို ပြုလုပ်ရန် တိုင်းပြည် အင်အားအလိုက် ချင့်ချိန်စဉ်းစားသင့်ပါသည်။ ဤကဲ့သို့သော အစီအစဉ်မျိုးသည် မည်မျှ အင်အားလိုမည်၊ မည်မျှအောင်မြင်မည်ကို ကြိုတင်သိရှိနိုင်ရန် ရွှေ့ပြေးလေ့လာရေး လုပ်ငန်း တရပ် **pilot study**၊ ယခုအစပြုရန် အကြံပေးလိုပါသည်။

လတ်တလောအစီအစဉ်အနေဖြင့်မူ၊ သံစွဲကပ်မှုများသော ဒေသများရှိ၊ အက်(စ်)ကာရစ် **Ascaris** သံစွဲကပ်မှုကြောင့် ခံစားရသော ဝေဒနာရှင် ခလေးတိုင်းအား သံချဆေး လိုလောက်စွာ ပေးနိုင်ရန် စီစဉ်သင့်ပါသည်။

ဟွတ်(ခ) ဝေါင်း(မ်) သံကောင် ပေါများသော ဒေသများတွင်လည်း ဟွတ်(ခ) ဝေါင်း(မ်) အတွက် သံချဆေးများ အလုံအလောက်ရှိသင့်ပါသည်။

သုတေသန လုပ်ငန်းအနေဖြင့် သံကောင်များသည်၊ အသက်၊ ရာသီ၊ ဒေသအလိုက် စွဲကပ်မှု၊ ရောဂါဖြစ်ပွားမှု ကွာခြားပုံ၊ လူတိုင်းတွင် သံကောင်စွဲကပ်ခြင်း ဦးရေနှင့် သံကောင် စွဲကပ်မှုနှင့် ဝေဒနာခံစားရမှု၊ အာဟာရချို့တဲ့မှုများ၊ မည်သို့မည်ပုံ ပတ်သက်သည် စသည် တို့ကို ဆက်လက်၍၊ မြန်မာပြည်တွင် လေ့လာသင့်ပါသေးသည်။

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