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INFORMATION

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Editorial

The horizons of public health, all over the world, have been expanding and becoming more realistic. From a concept of prevention of disease we have come to a point where our goal is promotion of not only physical but mental and social health. Public health, which began as a sanitary science, has now become complex and multi-disciplined and includes development of social machinery for making available various kinds of preventive, promotional and social services through organized community effort.

The public and the health workers are the two wheels of the public health wagon. While it requires an awakened and social minded community; capable of making sacrifices for the high public health goals ; much depends upon the dynamic and vital role which the public health workers play individually and collectively. The role which our nation expects from the public health workers of Pakistan is not an "Obedient sort" of passive role. The need of the *time* is that the workers should pool all their inherent intellectual powers and acquired technical knowledge, for determining our problems and priorities and for formulating and initiating attack against ill-health. We must be imaginative, and must visualize and show the way of progress and reforms to the community. Through collective and balanced thinking we must guide the administrators and planners, in Government as well as in private agencies, and thus pave the way for future better health of the nation.

If Public Health workers of Pakistan are to play their vital role in national progress and fulfill their obligations, they must organize themselves into a dynamic group. Public health work has become very broad and complex and requires the united and coordinated efforts of a large number of experts belonging to various disciplines. Physicians, Public Health Nurses, Health Educators, Social Workers, Sanitary Engineers, Nutritionists, Administrators, Social Scientists, Bio-statisticians, etc., all

must work together for attaining our cherished goals. They must evolve an institution through which their pooled thinking and joint efforts can produce maximum results. The nation looks to them for the protection of the health of workers and soldiers and we must rise to the occasion and come up to their expectations.

We must not be content with the finding out of feasible and practical solutions to our community health problems but must also lead the way for our national progress and glory. The attainment of our goals requires the evolution of a dynamic public health leadership, and the provision of opportunities to our health workers to frequently meet at one platform, exchange ideas and thus benefit from each others skills and experiences. We must do self analysis and evaluate our attainments. We must do all in our power to make our existence worth-while through planned progress.

A.H. AWAN, M.D.

VENEREAL DISEASES AS A PUBLIC HEALTH PROBLEM IN WEST PAKISTAN

BY

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The object of this paper is to assess "Venereal Diseases" as a public health problem in Pakistan and to suggest the "know-how" of eradicating the same.

Prevalence

Various dispensaries and hospitals send yearly returns of the cases of Venereal Diseases treated by them. These figures are available with the statistical wing attached to the Health Department, Government of West Pakistan. Fig. I gives the incidence of Venereal Diseases from West Pakistan region-wise. The figures indicate that the highest incidence of Venereal Diseases is in Peshawar & D. I. Khan region. Figure II gives the incidence of Venereal Diseases in West Pakistan from the year 1955—61. This indicates a gradual decline in the incidence of Venereal Diseases during this period. The factors responsible for this decline have not been worked out. It may have a correlation with improved medical facilities. Fig. III & IV give the prevalence of various communicable diseases in the year 1949 in West Pakistan. In order of prevalence Venereal Diseases occupy the fifth place. In comparison to tuberculosis the incidence of Venereal Diseases has a ratio of 3 to 2 and hence deserves consideration in the setting up of health programmes. The reliability of these figures, however, is questionable due to the following facts.

1. The personnel involved in compiling figures from dispensaries and even hospitals are genereally compounders, orderlies etc., who besides being semi-educated do not realise the importance of the assignment. On verification this data may not only give wrong estimates but may be grossly falacious.

2. Except for the clinics attached to Medical Colleges, where laboratory facilities are available no serological tests are performed so that the cases reported may either not be of venereal origin or a number of venereal cases may escape.

3. Due to the stigma attached to Venereal Diseases a large number of patients do not get to public clinics and either resort ro private doctors or indigenous practitioners. There is no method of assessing their numbers since they are not reported.

4. No attempt is made to trace contacts.

5. No proper follow up is done of licenced prostitutes.

6. Cases reporting to clinics do so voluntarily. Medical treatment given at the clinics varies from clinic to clinic since no treatment regime is laid down. No assessment of the ultimate result of the treatment is made and no follow up is carried out on these patients. No attempt is made to sort out the infectious cases from the non-infectious.

A venereal disease control programme in Pakistan may be carried out in three phases.

1. Organization Phase

In this phase which may be accomplished in a year the following should be planned :—

(*a*) An estimation of the gravity of the Venereal Disease Problem which includes collection of statistics on the incidence of Venereal Diseases, prevalence of different stages of syphilis infection, number of infectious cases and on the contact rate etc.

(*b*) A survey of the facilities available for treatment, follow up, diagnosis, preventive measures, health education etc.

(*c*) A study of the regulations governing prostitution and health measures adopted to ensure that prostitutes remain free from Venereal Diseases.

The above may be entrusted to a committee consisting of a V.D. expert, a Bacteriologist, Statistical Officer, Public Health Practitioner and a Health Educationist.

At the end of the year the Venereal Diseases Commission would submit its report alongwith recommendations for a country wide V.D. Control Programme.

In setting up a programme the W.H.O. gives considerable help. The ILO, IRO, UNICEF and International Union against Venereal Diseases are all

actively interested in Venereal Disease Programmes in any part of the world and should be approached for help. In 1949 the WHO organised an international body of experts to study and evaluate the Venereal Diseases Control Programme in USA and to submit a report on the same. The report submitted by this commission and published in the year 1950 is a very valuable document. A special Commission was similarly organised in Britain in 1937-38 to study the anti-venereal disease measures in Scandinavia and Holland. Later the British Government incorporated valuable points in their Venereal Disease Control Programme. Today Venereal Diseases are well under control in Britain so much so that a patient for demonstration to medical students may be difficult to find.

2. Attack Phase

During the next 10 years an all round eradication programme should be under operation.

3. Consolidation Phase

When Venereal Diseases are well under control the programme may be incorporated with other health programmes. Active control should however always be the objective since in the experience of US Venereal Disease Control it was seen that slackening in the programme led to an immediate increase in the incidence when a Commission called TASK Force was employed to boaster up eradication efforts.

A Venereal Disease Control Programme must be backed by legislature. This is well illustrated by a study of the history of V. D. Control in U. S. A. It was not till the signing of the Chamberlain Kahn Act in 1940 that V. D. Control Programme was initiated. This created a division in U. S. Public Health Service with the appropriation of $ 1,000,000 per mensem.

It is suggested that for V.D. Control a separate cell should be created. This should organize the following :

1. Morbidity Reporting

In order to get a complete picture of the extent of disease reporting should be done from :—

(*i*) Clinics, hospitals and dispensaries

(*ii*) Private physicians

(*iii*) All other sources which would include courts, jails etc.

"*Pak: Jour: Hlth., 15 (1)*"

Compulsory blood testing is a very valuable tool. Thus a large population is covered if the following procedures are adopted :

(*a*) Premarital blood tests.

(*b*) Blood tests carried out as a part of routine medical examination for medical fitness of army personnel and civil servants.

(*c*) Prenatal blood test.

(*d*) Blood test on jail inmates and mental hospital patients.

(*e*) The health authorities may further insist on employers of private institutes such as hotels to have blood tests of their employees.

5. The morbidity reporting form should include the following points:—

Syphilis	...	Primary or secondary
Syphilis	...	Early latent
Syphilis	...	Late latent and late.
Syphilis	...	Congenital
Gonorrhoea		
Granuloma inguinable		
Lymphogranuloma venereum.		

The data sent can be compiled by the statistics wing of the West Pakistan, Health Secretariat, which is already engaged in the compilation of statistics. Such records should be published in a booklet and not only sent to the reporting unit, but to all interested parties. These records are of immense value in organization of public health control programmes and calculating budgets.

Treatment Facilities

At present Venereal Diseases Clinics are only present in the hospitals attached to the medical colleges. In the district hospitals and dispensaries Venereal Disease patients attend the dispensaries alongwith other patients. They are not investigated for venereal infection and the treatment given may sometimes only be supportive. Special treatment facilities are not available so that very often the patient would prefer to treat himself, visit an indigenous practitioner or a private practitioner.

At the present moment no separate indoor facilities are available for Venereal Diseases. Cases which require indoor treatment are admitted in general medical or surgical wards.

The following suggestions are being made :—

(*a*) A large number of Venereal Disease Clinics should be made available. At each district headquarter hospital a separate Venereal Diseases Clinic should be established. This should be manned by a recognised medical practitioner who should have received an additional training of a year's duration in Venereal Diseases from a recognised institution.

(*b*) Indoor facilities in the form of a Venereal Diseases Ward should be available at the regional level.

(*c*) In the teaching institutions where a V. D. specialist and separate outdoor already exist indoor facilities should be provided. Such institutions should become training centres for personnel involved in Venereal Diseases Control.

(*d*) Every case of Venereal Disease must be provided with free treatment facilities. These should be located at convenient places within easy reach of the community. As the private practitioner is treating at least 50% of the venereal diseases patients free drugs should be provided to them to treat these patients. Such cases should be registered with the nearest V. D. Clinic. This will take off a major burden from the clinics and will also be a useful tool which will enable cases being treated by private practitioners to come under governmental control.

(*e*) Indoor treatment of venereal infections is generally not essential. However, for pregnant women, neurosyphilis cases, infantile syphilis cases and unorganised communities with poor medical facilities institutional treatment may become essential. It has a further advantage in that treatment is compulsorily completed.

Treatment Regime for Syphilis

Procaine Penicillin G in Oil with 2% aluminium monostearate (P. A. M.) is the drug of choice. In primary syphilis a dose of 1.2—2.4 million units should be given as the initial 1st dose. This should be followed by two injections of 0.6 million units or 4 injections of 0.3 million units which may be spread over a week.

In secondary syphilis the above dosage is doubled. It is further to be made clear that the aim is a large initial dose, and that a single dose is as effective as divided doses.

"Pak: Jour: Hlth., 15 (1)"

Treatment for Gonorrhoea

The drug of choice for the treatment of gonorrhœa is penicillin.

Uncomplicated gonorrhœa in man

Procaine Penicillin G in Oil with 2% aluminium monostearate (P. A. M.) or Benzathene Penicillin G 1,200,000 units in one injection.

Uncomplicated Gonorrhoea in Women

P.A.M. 1,000,000 units I/M in one or two injections. Gonorrhoea with severe complications should be treated with aqueous crystalline penicillin G 2,400,000 to 10,000,000 units per day I/M given at four hours interval, until signs and symptoms have subsided and cultures if obtainable are negative.

Proposed Laboratory Regime

The following tests are used for laboratory diagnosis of syphilis.

1. Dark ground examination of primary or secondary lesions for the presence of Treponema. Presence of spirochaetes would confirm an "Infectious case." Inability to detect spirochaetes however does not exclude their presence.

2. Tests for W.R. antibody or Reagin

(*a*) *Complement Fixation Test*: It is important that the reagents used for the test be of international standards. The cardiolipin antigen should be used. It has to be prepared according to Mary Pangborn*.

(*b*) *Flocculation Test*: The standard Kahn's test should be used. The V.D.R.L. slide flocculation test is a rapid procedure. It is a useful mass screening tool. Both W. R. and Kahn's test, must be simultaneously performed on sera.

3. Tests for Treponemal Antibodies

1. Treponema Immobilization Test (T.P.I.)
2. Treponema Agglutination Test (T.A.T.)
3. Treponema Complement Fixation Test (T.C.F.T.).

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*Pangborn, M.C., Maltaner, F., Tompkins, V. N., Becher, T., Thompson, W. R., & Flynn, M.R., (1951) Cardiolipin antigens, Geneva (WHO Monograph series, No. 6).

These tests need an elaborate laboratory set up. Diagnosis in routine cases can be made on W.R. and Kahn's test alone. The need for T. P. I. and T. A. T. or T.C.F.T. arises in cases which are weakly sero-reactive with usual serological tests, cases with suspicious clinical signs and positive sero-reactors with usual tests having a negative clinical history.

4. Flourescent Treponema antibody technique

Laboratory Diagnosis of Gonorrhoea.

1. Isolation and identification of Neisseria gonorrhoeae.
2. Gonococcal complement fixation test. (G.C.F.T.).

Laboratory Facilities for Venereal Diseases Investigation

Proper Venereal Disease Control essentially needs the presence of good laboratories offering the most up to date facilities. It is suggested that the following laboratory facilities should be available.

District Headquarter Hospital Level

(*a*) D.G. Illumination

(*b*) W.R. Test

(*c*) Kahn's test

(*d*) V.D.R.L. slide flocculation test.

(*e*) Isolation and identification of *Neisseria gonorrhoeae.*

(*f*) G. C. F. T.

Regional Laboratories

a, b, c, d, e, f, as stated above

(*g*) Treponema Complement Fixation Test.

Provincial Laboratories

There should be two provincial laboratories located in the East Wing and West Wing. The bacteriology laboratory of the Institute of Hygiene & Preventive Medicine, which is the reference laboratory for public health bacteriology for the West Wing could be deputed to take up the job for provincial reference work.

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Tests to be performed by it would include *a, b, c, d, e, f, g,* stated above and

(*h*) Treponema immobilization test.

(*i*) Treponema agglutination test.

(*j*) Flourescent Treponema antibody technique.

National Health Laboratory, Islamabad

Division engaged in Venereal Diseases reference and research.

The duties of the laboratory should be as under :—

1. Training of personnel to man subsidiary laboratories.

2. Preparation of standard reagents for distribution to the laboratories of the country.

3. Standardization of laboratory tests and laying down of technique to be followed by the laboratories of the country.

4. Maintainence of reference standards.

5. Collaboration with international organizations. The Statens Seruminstitut in Copenhagen has undertaken to serve as the international reference laboratory.

6. Establishment of a reference library.

7. *Research.* In the WHO technical report series No. 190 (Printed in 1960 pages 67-73) the Expert Committee on venereal infections has suggested lines on which Venereal Disease research may be conducted.

Case Finding Activities

For the success of a Venereal Diseases Control Programme the most important aspect is to detect the infected case and find out his contacts. A patient may attend a clinic on discovering symptoms, and on understanding the need for medical care. His access to the doctor will depend on the availability of medical care and his financial ability to reach it. It is for this reason that clinics should be placed at convenient places. Very often free transport facilities will have to be made available to the patients.

Patients often do not complete treatment. Case holding may present real difficulties. Moreover, 5-15% adequately treated cases have recurrence. A method for follow-up of patients has to be planned by each clinic.

In order to make the public alive to the problem various recognised health education procedures should be adopted. Consideration should be given to the inclusion of Venereal Diseases and their preventive measures in high school hygiene curricula.

Case finding is an important Public Health Problem. It rests entirely on adequate contact investigations. Contact investigation is an expensive method. It should be applied continuously. It may need specially trained public health nurses or health educators but funds may not be available for such staff. It is strongly suggested that all personnel engaged in a Venereal Disease Clinic should receive a short term special training in health education procedures. Lay personnel thus trained have proved equally efficient in contact investigation in U. S. A. Venereal Diseases Control Programme.

Contact investigation involves interviewing and reinterviewing of patients. Contacts may be induced to come to the clinic by home visiting telephonic message, telegram and letters. It may be extremely difficult to reach contacts and induce them to come to the clinics for treatment. A continuous health education of public helps considerably. Legislative powers may render it compulsory for a person to attend.

Mass blood testing may pick up a few cases of syphilis but it is a less successful procedure for finding an infectious case and in the main is a measure for determining the prevalence of the disease.

Private Physicians

A large number of cases are being treated by private physicians. There is no law requiring notification of the same. Private physicians should be legally bound to report cases. Their cooperation should be sought in matters of control. This could be achieved by providing them with the following facilities :—

1. Free consultation from V. D. Clinics in all professional matters.
2. Free laboratory facilities.
3. Free distribution of drugs to patients provided the case is registered.
4. Services of a public health worker for contact interviewing.
5. Professional literature and short instructional courses.
6. Opportunities for employment on part time basis in V. D. Clinics.

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Syphilis in Mother and Prevention of Prenatal Syphilis

During pregnancy there is an attenuation of symptoms. However, the risk of abortion, still births and premature delivery adds to the morbidity and mortality of both mother and foetus. It has been stated that without treatment the mother with early syphilis will give birth to a dead or infected infant in about 95% of cases.

Case Finding of Syphilitic Mother

1. Syphilis in the pregnant female is generally without symptoms. It is for this reason that antenatal regime should compulsorily include a serological blood test which should be performed on the very first visit of the patient. When a patient is found negative in the early weeks of pregnancy a second test should be performed in the 7th month of pregnancy to exclude the possibility of contracting infection during pregnancy.

2. Contact investigation reveals a large number of women who may be pregnant or become pregnant later on. They should all be kept under observation.

Pregnancy wastage in Pakistan is considerable. Its extent and causation have not been worked out. Figures of returns from Gynæcology and obstretrics units also do not state the serological state of the patients in whom abortions, still births, etc. occur. It is not possible to predict the number of cases which may be syphilitic though one may presume that a considerable number may be syphilitic since this is the commonest cause of abortions, still births, etc. Unless prenatal blood testing is made a legal requirement apathy on the part of the physicians is bound to persist.

Treatment and Control of Syphilis in the Mother

The treatment of choice is Penicillin in high dosage (600,000 units of procaine Penicillin daily with a total of 4,800,000 units). The advantage of penicillin is that it is nontoxic to the foetus, crosses the placental barrier and reaches therapeutic levels in the foetus which if infected is simultaneously treated. Since 5-15% relapses occur in treated cases the patient must be kept under observation during the remaining period of pregnancy and a course of treatment repeated after the 7th month of pregnancy.

Premarital blood testing leads to a diminution of the incidence of maternal syphilis and should be legalised.

Policy against Imported cases of Syphilis

In order to safeguard against import of syphilis all persons entering the country should be serologically tested. Any person found suffering from infectious syphilis should be quarantined and treatment given. Such a law has been in operation in U.S.A.* and has resulted in a significant check on import of syphilis.

Summary

Statistics available on the incidence of Venereal Diseases (syphilis and gonorrhoea) in West Pakistan are enumerated. Lines on which a Venereal Diseases Control Programme could be organised are suggested.

*WHO Technical Report Series No. 15, 1950

"Pak: Jour: Hlth., 15 (1)"

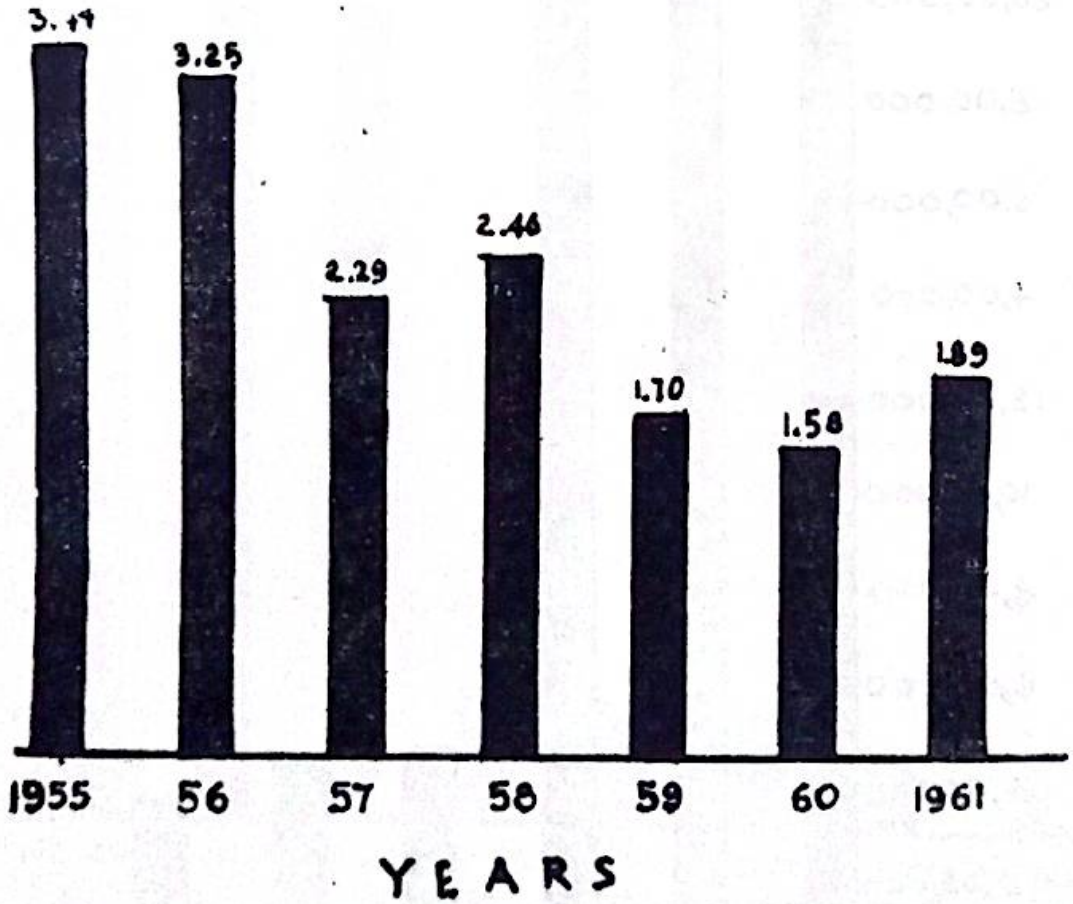
Figure 1.

INCIDENCE OF VENEREAL INFECTIONS IN WEST PAKISTAN PER 100,000, POPULATION.

Year	Peshawar & D. I. Khan	Rawalpindi & Lahore	Sargodha & Multan	Khairpur & Bahawalpur	Hyderabad & Karachi	Quetta and & Kalat
1955	5.79	.75	.97	3.90	5.77	
1956	5.53	.45	1.37	5.44	3.44	
1957	3.55	.91	.93	3.31	2.79	
1958	3.65	.61	.88	3.65	3.52	2.61
1959	2.83	.59	.67	2.74	1.65	2.65
1960	1.69	.57	.77	3.32	1.55	2.36
1961	1.74	1.55	.71	4.01	1.42	4.62

FIG. II

INCIDENCE OF VENEREAL DISEASE PER 100,000 IN WEST PAKISTAN (EXCLUDING QUETTA/KALAT DIVISION)



"*Pak: Jour: Hlth., 15 (1)*"

FIG. III

PREVALENCE OF COMMUNICABLE DISEASES IN WESTPAKISTAN IN 1949.

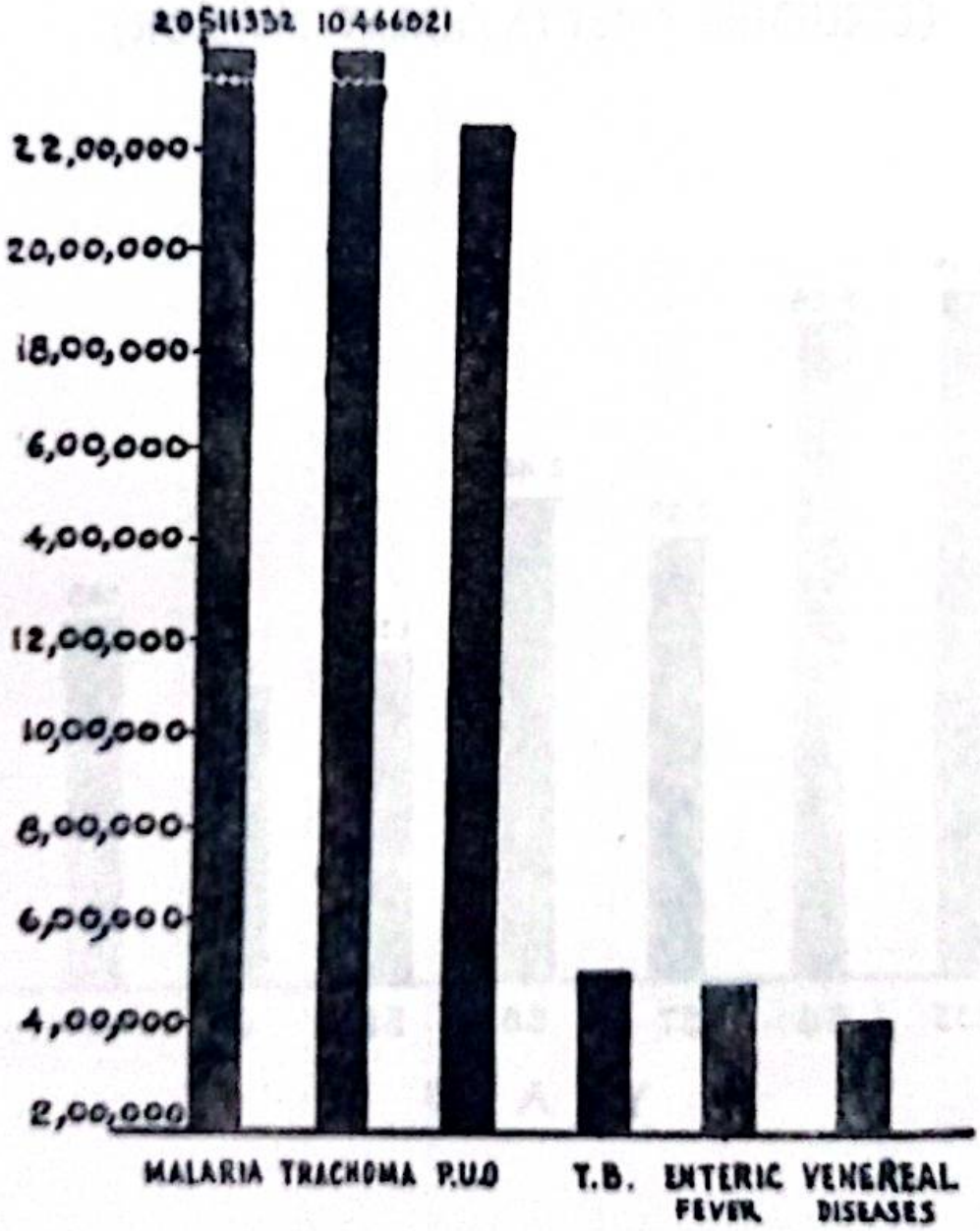
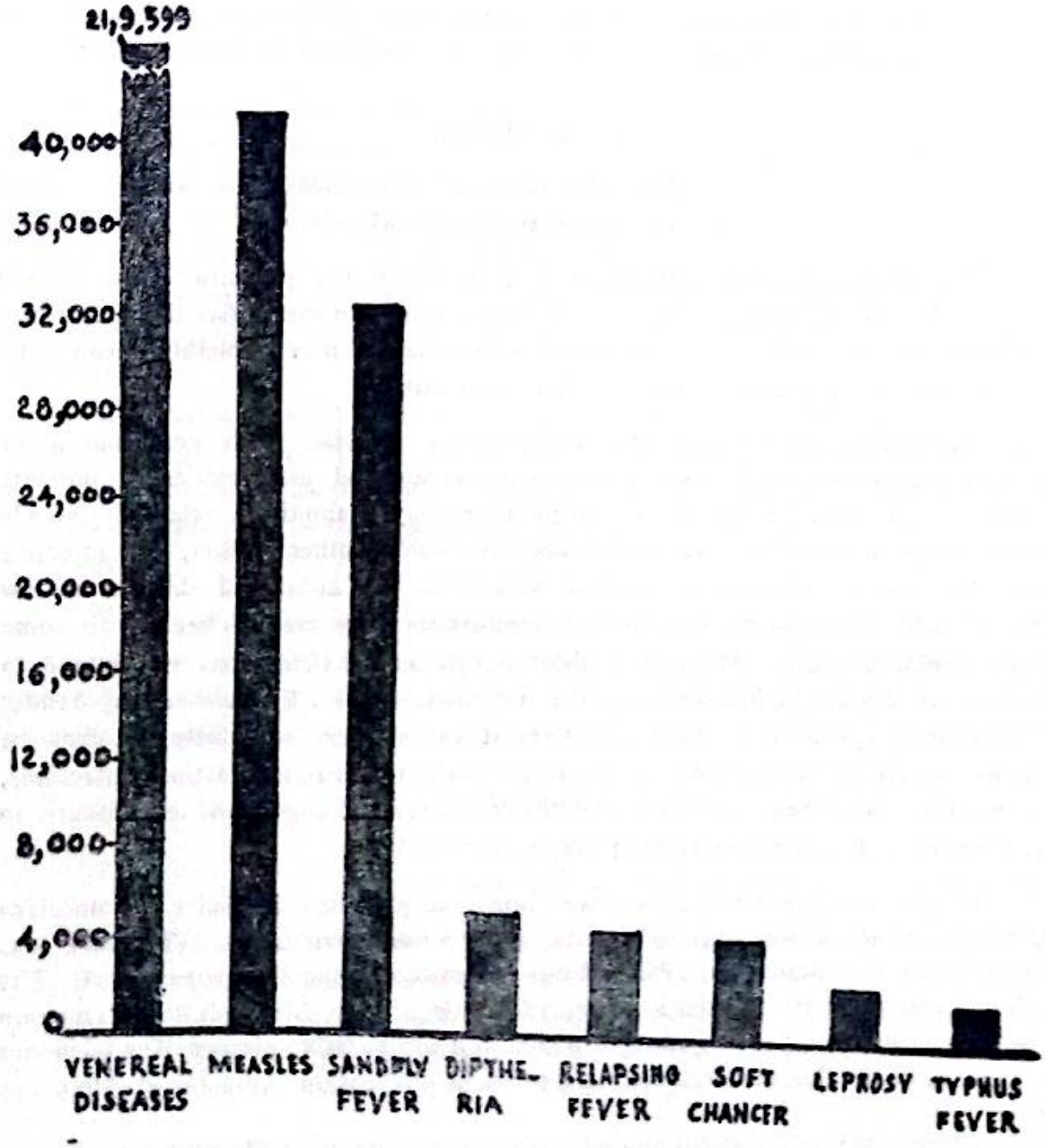


FIG. IV
PREVALENCE OF COMMUNICABLE DISEASES IN WEST PAKISTAN IN 1949



"*Pak: Jour: Hlth., 15 (I).*"

A SURVEY OF INTESTINAL PARASITES IN VILLAGE SAHOWARY—INCIDENCE IN MALES

BY

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1. Introduction

Know then thyself, presume not God to scan;
The proper study of mankind is man (Pope)

The infective stages of a parasite fail to establish the parasitic stages in the host, if chances of contact are not sure and certain. In most cases this factor may be a death warrant to the very existence of a parasite and may probably mean total elimination of some species, at least in that community.

Men differ from women in their occupational persuits. This condition alone may favour transmission of certain parasites in one sex and may hinder or mitigate chances of invasion in the other. A parasite may maintain a relatively steady level of infection in misters and masters because, besides other factors, the infective stages have better chances of contact with them. A continued absence and low grade of worm load in madams and mademoiselles may mainly be due to some environmental barriers. Although mothers, daughters and sisters may not intend to evade or invite parasitic invasions, yet the very mode of their lives either may render the parasite incapable to establish or incite it to establish vengefully. It may be true that the females are less resistant than the males to various intestinal infections, but we must also bear in mind that the exposures and chances of re-exposures to infections constitute the crux of the problem.

With a view to know fluctuations of intestinal parasites in males, of different age groups, a survey was carried out in a suburban community. The work was started on the 17th September 1963 and was completed on the 31st August 1964. The moderate load of facts collected is presented in this paper. Although the information is not comprehensive, yet it is enough to give us a comparative picture. The incidence of infection in females was presented in a previous publication (Ansari et el 1964).

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[1]Professor of Parasitology and Medical Entomology and Head of the Department.
[2]Assistant Professor of Parasitology and Medical Entomology.
[3]Demonstrator in Parasitology and Medical Entomology.

1. 1. *The Village*—Sahowary is an old unplanned *abadi* of City Corporation of Lahore. Formerly it was an excellent rural area, inhabited mainly by zamindars. This proud majority of our country is now being replaced by factory workers in this village. Very meagre proportion of its male population, probably not more than five per cent, till the land. Steady merging of the village into the city has converted it into an urbanised rural area, where 85 per cent earn their livelihood from occupations other than agriculture. Gardening, vegetable growing and fodder raising are the common modified agricultural occupations left for them, who still choose to work behind the plough.

The general sanitation of the village is deplorable. Litter of every type may be found scattered anywhere and everywhere and at any time of the year. Largest proportion of men defaecate into the fields. Promiscuous defaecation is an abnoxious practice with the children. House-fly menace is most disgusting. Swarms of the filth flies may be seen resting leisurely and basking restlessly on each wall of the village. Adulterated and unhygienically prepared foods are available in abundance. The common sight is of the mobs of neglected children running about violently in the streets.

The literacy level, due to socio-economic conditions, cannot afford to rise above 2 per cent. Availability of jobs in nearby workshops at an early age has given terrible set-back to education and vivid flip to technical training in the community. Early age employment, was once started as a matter of necessity, is now a rule and practice.

Protected water-supply is unknown in the village. Sewage and refuse disposal systems do not exist. It is a poorly organised community, living under low sanitary standards. Chances for the spread of communicable diseases are numerous and the intestinal parasites have easy chances of transmission.

2. Observations

Let observation with extensive view
Survey mankind from China to Peru (Dr. Johnson)

The incidence of infection with various intestinal parasites in the males of Sahowary was found to be 57.94 per cent as aganist 65.88 in the females. 40.07 per cent of the total stools examined, were carrying pathogenic parasites. When the positive cases are taken into consideration, this figure goes up to 69.16 per cent as against 69.12 per cent in the females.

190 individuals, 34.29 per cent of total examined and 59.19 per cent of the total found positive, had protozoan parasites. Over all incidence of protozoan parasites was

a little more than what (46,67 per cent) was found in the females. Out of 190, 63 individuals (11.19 per cent of the total stools examined and 19.63 per cent of the total found positive) had pathogenic forms of protozoa.

The helminthic parasites occurred in 194 males *i. e.* 35.04 per cent of the total stools examined and 60.43 per cent of the total found positive. The corresponding percentages in females were 30.81 and 46.76 respectively. Out of 194 males, 183 individuals *i.e.* 33.03 per cent of the total stools examined and 57.01 per cent of the total found positive, had pathogenic forms of the helminths.

2.1. Protozoan Parasites

2.1.1. *Entamoeba histolytica* does not seem to present a serious picture. 16 cases, 2.89 per cent of the total stools examined (554), 4.98 per cent of the total stools positive (321), 8.42 per cent of the total cases (190) harbouring protozoa and 25.39 per cent of the total (63) carrying pathogenic protozoa, had *E. histolytica* or *E. hartmanni.*

In 4 cases, it occurred alone. In 7, it was involved either with *E. coli* (3 cases), *I. butschlii* (one case), *A. lumbricoides* (2 cases) or *A. duodenale* (one case). In one case it occurred with *E. coli*+*E. vermicularis.* In three cases it occurred with three other parasites viz., *E. coli*+*I. butschlii*+*G. intestinalis, E. coli*+*I. butschlii*+*A. duodenale* and *I. butschlii*+*G. intestinalis*+*A. duodenale.* In one case its companions were *E. coli, G. intestinalis, A. doudenale* and *E. vermicularis.*

None of these cases complained of dysentery or diarrhoea. Vague abdominal distress was, however periodically experienced by some.

The incidence of *E. histolytica* was below all the pathogenic parasites, except *TH. trichiurus* and *T. saginata* (see Table IX).

Six cases of *E. histolytica* occurred in children between 6 and 12 years of age. Two cases were from 13 to 17 years of age, five cases from 18 to 35 years of age, one case from 36—40 years of age, two from 42—50 years of age and one from 51 to 70 years of age. The youngest child, carrying *E. histolytica* was of 3½ years of age.

Although in this discussion we did not differentiate between *E. histolytica* and *E. hartmanni* yet we are of the opinion that ratio between the two was of 3:1.

2.1.2. *Entamoeba coli* was found in about 19.31 per cent persons examined, 33.33 per cent of the total cases found positive and 50.63 per cent of the total cases harbouring protozoa. In 35 cases, it occurred alone, while in 71 it occurred along with

other parasites. In 47 two parasite infections, it occurred either with a protozoan (31 cases) or a helminth (16 cases). Its protozoan associates were *E.histolytica* (3 cases), *I.butschlii* (26 cases) and *G. intestinalis* (2 cases) while the helminthic associates in this series were *A. duodenale* (7 cases), *E. vermicularis* (one case), *A. lumbricoides* (3 cases) and *H. nana* (5 cases).

E. coli also occurred in 19 triple-infections. In 4 cases, it was found with two other protozoa *viz.*, *I. butschlii* and *G. intestinalis* ; in 10 cases the association was established with a protozoan and a helminth *viz.*, *I. butschlii* + *A. duodenale* (3 cases), *I. butschlii* + *E. vermicularis* (2 cases) and *I. butschlii* + *H. nana* (3 cases) ; and in 5 cases, however, it was found associated with two helminths *i.e. T. trichiurus* + *A. duodenale*, *A. duodenale* + *A. lumbricoides*, *A. duodenale* + *H. nana* (2 cases) and *A. lumbricoides* + *H. nana.*

There were 4 cases, in which four parasites were involved. In one case the other three partners of *E. coli* were protozoa (*E. histolytica* + *I. butschlii* + *G. intestinalis*), in another case two protozoa and a helminth were involved (*E. histolytica* + *I. butschlii* + *A. duodenale*) while in one case one protozoa and two helminths were associated (*I. butschlii* + *A. duodenale* + *A. lumbricoides*). In one case *E. coli* occurred with three helminths *viz.*, *A. duodenale* + *A. lumbricoides* + *H. nana.*

There was one solitary case, in which three protozoas and two helminths occurred together. The organisms involved were *E. coli*, *E. histolytica*, *G. intestinalis*, *A. duodenale* and *E. vermicularis.*

The youngest child having *E. coli* infection was of two years as against an old man of 70 years on the end of the beam.

The calculated numbers of other parasites for each case of *E. coli* are given in table IX. It was decidedly more common than other parasites in this series.

2.1.3. *Endolimax nana* was rarely detected in this series. It is probably an unreal absence. It is inconspicuous because it is a small commensal. It was found in one case of 45 years of age. In the females of the same series, however, this parasite was found in 4.62 per cent females examined as against 0.18 per cent in males.

2.1.4. *Iodamoeba butschlii* was found to be second commonest protozoan and third commonest parasite in this series. It occurred in 14.72 per cent cases examined, 24.61 per cent cases found positive and 42.63 per cent cases harbouring protozoa.

I. butschlii was found in 35 pure-infection cases. In 27 cases it was involved with another protozoan *viz. E. histolytica* (one case), *E. coli* (26 cases). In 7 cases its association was established with *A. duodenale* (3 cases), *E. vermicularis* (1 case), *A. lumbricoides* (2 cases) and *H. nana* (one case).

In 4 cases it occurred with two other protozoa *viz.*, *E. coli* and *G. intestinalis*. In 10 cases its companions were a protozoan and a helminth *viz.*, *E. histolytica* + *A. lumbricoides* (one case), *E. coli* + *A. duodenale* (3 cases), *E. coli* + *E. vermicularis* (two cases), *E. coli* + *H. nana* (3 cases) and *G. intestinalis* + *T. trichiurus*. In one case it was found with two helminths (*A. duodenale* + *A. lumbricoides*).

Two children of two years of age were the youngest victims of this parasite. It was almost common in all the other age groups.

The calculated numbers of other parasites for each one case of *I. butschlii* are given in table IX. It was found more common than other parasites except *E. coli* and *A. duodenale* in this series.

2.1.5. *Giardia intestinalis* was found in 8.84 per cent cases examined, in 15.26 per cent cases found positive and in 25.79 per cent cases harbouring protozoa.

The duodenal flagellates occurred in 23 pure infection cases.

In two cases, *G. intestinalis* was found with *E. coli*. In 12 cases it was associated either with *A. duodenale* (6 cases), *E. vermicularis* (one case), *A. lumbricoides* (2 cases) or *H. nana* (3 cases).

In 8 cases, *G. intestinalis* was involved in triple-infection cases. In four cases it was involved with two other protozoa *viz.*, *E. coli* + *I. butschlii*. In one case its companions were *I. butschlii* and *T. trichiurus*, while in three others, its associates were two helminths *viz.*, *A. duodenale* + *A. lumbricoides* (2 cases) and *A. duodenale* + *H. nana*.

It was found in infants of 6 and 9 months. Two cases each, occurred in children of one 1½, 2, 3½ and 4 years of age. One case occurred in a child of 3 years while 4 cases were of 5 years of age. 17 cases occurred in children of ½—5 years. 7 cases in age groups above 5½ years and below 12 years, 5 cases between 13—17 years of age, 14 cases were of 18—35 years of age and only 6 cases were detected in adults above 36 years.

2.2. Helminthic Parasites

2.2.1. *Trichocephalus trichiurus* was found in three cases. In one case it occurred alone. In another it was found together with *I. butschlii* and *G. intestinalis* and in the third case its companions were *E. coli* and *A. duodenale*. All these cases occurred in advance age groups *viz.*, 22, 35 and 42 years. The whip-worm has not so far been found common in any series we had a chance to survey.

2.2.2. *Ancylostoma duodenale* was found to be the commonest pathogenic parasite in this series. It was found in 16.66 per cent cases examined, 28.66 per cent cases found positive and in 47.42 per cent cases carrying helminthic parasites. Although

5 per cent inhabitants are engaged in agriculture yet 16.66 per cent had successful contacts with the infective stages of the worm.

In 41.77 per cent cases it was the only parasite involved. In 18.68 per cent it was with a protozoan *viz.*, *E. histolytica* (one case), *E. coli* (7 cases), *I. butschlii* (3 cases) and *G. intestinalis* (6 cases). In 18.68 per cent it was with a helminth *viz.*, *E. vermicularis* (4 cases), *A. lumbricoides* (6 cases), *H. nana* (6 cases) and *T. saginata* (one case).

In 14 cases (15.38 per cent) it was associated with two other parasites *i.e.*, *E. coli* + *I. butschlii* (3 cases), *E. coli* + *T. trichiurus* (one case), *E. coli* + *A. lumbricoides* (one case), *E. coli* + *H. nana* (2 cases), *I. butschlii* + *A. lumbricoides* (one case), *G. intestinalis* + *A. lumbricoides* (two cases), *G. intestinalis* + *H. nana* (one case) and *A. lumbricoides* + *H. nana* (3 cases).

In 5 cases (5.49 per cent) *A. duodenale* was involved with 3 or 4 other parasites *viz.*, *E. histolytica* + *E. coli* + *I. butschlii* (one case), *E. histolytica* + *I. butschlii* + *G. intestinalis* (one case), *E. coli* + *I. butschlii* + *A. lumbricoides* (one case), *E. coli* + *A. lumbricoides* + *H. nana* (one case) and *E. histolytica* + *E. coli* + *G. intestinalis* + *E. vermicularis* (one case).

The corresponding number of other pathogenic and non-pathogenic parasites for each hook-worm infection in this series is given in table IX. Its incidence was 1.37 times higher than *A. lumbricoides* and 1.95 times higher than *H. nana*.

Hook-worm infection was detected in children of one year and 3½ years of age. Three cases occurred in children of 5 years of age.

Five cases were recorded in children of 1—5 years, 15 in 6—12 years, 31 in adults of 18—35 years and 15 cases in adults above 35 years.

2.2.3. *Enterobius vermicularis* was found in 3.61 per cent persons examined and in 6.23 per cent cases positive for one or the other parasite and in 10.31 per cent cases carrying helminthic parasites.

In 5 cases, it was the only parasite detected. In three cases, it was involved with protozoas *viz.*, *E. coli* (one case), *I. butschlii* (one case) and *G. intestinalis* (one case). In seven cases, it occurred with helminths *viz.*, *A. duodenale* (4 cases), *A lumbricoides* (2 cases) and *H. nana* (one case).

In 3 cases, its companions were two protozoas *viz.*, *E. histolytica* + *E. coli* (one case), *E. coli* + *I. butschlii* (2 cases).

In one solitary case, the seat-worm was found together with three protozoas and a helminth *viz.*, *E. histolytica* + *E. coli* + *G. intestinalis* + *A. duodenale*.

Routine stool examinations usually do not give true picture of its infection rate in a community. The figures, therefore, need not be taken to represent the load and the true state of incidence.

2.2.4. *Ascaris lumbricoides* enjoys favourable conditions for its development and distribution in the village Sahowary. Its incidence however, remained behind *E. coli*, *A. duodenale* and *I. butschlii*. It was found in 12.09 persons examined in the series. 20.87 per cent positive cases had *A. lumbricoides*, while 34.48 per cent having helminths had round worms.

In 62.68 per cent cases it occurred alone. In others it occurred either with protozoan parasites or helminthic parasites or both. In 9 cases it occurred with a protozoan *viz.*, *E. histolytica* (2 cases) and *G. intestinalis* (2 cases). In 14 cases it associated with another helminth *viz.*, *A. duodenale* (6 cases), *E. vermicularis* (2 cases) and *H. nana* (6 cases).

In 10 cases it was involved with two other parasites *viz.*, *E. histolytica* + *E. coli* (one case), *E. histolytica* + *I. butschlii* (one case), *E. coli* + *A. duodenale* (one case), *E. coli* + *H. nana* (one case), *I. butschlii* + *A. duodenale* (one case), *G. intestinalis* + *A. duodenale* (two cases) and *A. duodenale* + *H. nana* (3 cases).

In two cases, the giant-round-worm was found with three other parasites *viz.*, *E. coli* + *I. butschlii* + *A. duodenale* (one case) and *E. coli* + *A. duodenale* + *H. nana* (one case).

The round-worm was found in an infant of 5 months. 23 cases occurred in children of 5 months to 5 years. 25 cases were of 5½ to 12 years of age. The age of 5 cases ranged between 13 and 17 years. 11 cases were between 18 to 35 years. Only three cases were recorded from men of 36—70 years age.

2.2.5. *Hymenolepis nana* was commonly encountered in cases ranging between 1—17 years of age. The incidence started dwindling after 18 years of age and became almost insignificant thereafter. Its incidence was more or less half of *A. duodenale* in this series. It lagged slightly behind *A. lumbricoides*.

The dwarf-tape-worm was found in 8.48 per cent cases examined and 14.64 per cent cases found positive for one or the other parasite. When the helminthic parasites are taken into account, the dwarf-tape-worm was found in 24.23 per cent cases.

H. nana was recorded alone in 31.91 per cent cases. In 19.15 per cent cases it occurred with a protozoan parasite *viz.*, *E. coli* (5 cases), *I. butschlii* (one case) and *G. intestinalis* (3 cases). In 27.66 per cent cases it compromised with one or the other helminth *viz.*, *A. duodenale* (6 cases), *E. vermicularis* (one case) and *A. lumbricoides* (6 cases).

In 21.27 per cent cases, *H. nana* was found associating with two other parasites *viz.*, *E. coli* + *I. butschlii* (3 cases), *E. coli* + *A. duodenale* (2 cases), *E. coli* + *A. lumbricoides* (one case), *G. intestinalis* + *A. duodenale* (one case) and *A. duodenale* + *A. lumbricoides* (3 cases).

In one case, it occurred together with *E. coli* + *A. duodenale* + *A. lumbricoides.*

An infant of 5 months was found harbouring *H. nana.* It was detected frequently from children between 5—12 years. Sporadic cases occurred in 13—17 years of age group. Definite decline occurred thereafter, amounting to absence after 32 years.

2.2.6. *Taenia saginata* was detected in one case of 9 years of age. It is a sporadic case in this series. As has been pointed out elsewhere, the community is not rich enough and seldom affords eating smoked meat. The infection of beef-tape worm will probably remain low till such time that the *tika kababs* and *seekh kababs* become common.

3. Incidence of different intestinal parasites in various age groups

3.1. *Incidence in infants under one year:*—Two infants of 5 months were found infected with *A. lumbricoides* and *H. nana.* The presence of these parasites in these two infants indicates that on the whole the sanitary conditions in this locality are deplorable. The indoor sanitation is really bad, seeing is believing, the court and door yards are actually contaminated.

The presence of *G. intestinalis* in an infant of 9 months suggests, that the mothers both kept and fed him under unhygienic conditions. The filthy hands may perform worst tricks than the unclean environments may claim.

3.2. *Incidence in toddlers of 1.—5 years of age :*—Four intestinal protozoa were detected in this age group. *E. histolytica* was found in a case of 3½ years. *E. coli* was present in 7 cases of 2, 3½, 4, 4½ and 5 years of age. *I. butschlii* was also present in 7 cases of 2, 3, 3½ and 5 years of age.

G. intestinalis was found to be most common protozoa. It was found in 15 per cent toddlers examined. It was present in children of 6 months (one case), 9 months (one case), one (2 cases), 1½ (2 cases), 2 (2 cases), 3 (one case), 3½ (2 cases), 4 (2 cases) and 5 (4 cases) years of age.

A. duodenale was found in a child of one year. The presence of hook-worm infection in such a young age may mean that he has been crawling, toddling and walking about in contaminated soils. The kacha yards, both inside and outside the houses, are probably carrying the infective stages of these parasites in this village.

We would not comment on the incidence of *E. vermicularis*. 4 per cent rate of infection is too low and not discovering of the infection in early age groups is another defect in the data available. The youngest child, having seat-worm, was of $1\frac{1}{2}$ years of age.

The giant round-worm was found in 22 per cent toddlers examined. This parasite was found frequently in this age group. The 22 cases detected were of $1\frac{1}{4}$ (one case), $1\frac{1}{2}$ (3 cases), 2 (2 cases), $2\frac{1}{2}$ (one case), 3 (2 cases), $3\frac{1}{2}$ (one case); 4 (6 cases), $4\frac{3}{4}$ (one case) and 5 (5 cases) years of age. Although the history of passing round-worms was given for almost all the toddlers examined, yet the presence was detected from a small fraction.

The dwarf tape-worm was found in 11 per cent cases. It was found from $1\frac{1}{2}$ (one case), 2 (one case), $2\frac{1}{2}$ (one case), $3\frac{1}{2}$ (2 cases), 4 (2 cases) and 5 (4 cases) years of age. The presence of this parasite in the young age group also throws light on the sanitary conditions of the village.

3.3. *Incidence of infection in children of 5½—12 years* :—The incidence of *E. histolytica* in this group was 3.84 per cent. The water and food available in the locality is always open to contamination. This level of infection is therefore not unexpected.

E. coli was found in 23 cases. It was of frequent occurrance in this age group.

I. butschlii occurred in 11.54 per cent cases, as against 5.77 per cent cases who had *G. intestinalis*.

The eggs of *A. duodenale* were detected in 20 per cent boys of 6 (one case), 7 (2 cases), 8 (3 cases), 9 (2 cases), 10 (8 cases), 11 (one case) and 12 (9 cases) years of age.

The eggs of *E. vermicularis* were present in 4.61 per cent boys.

The giant round-worm occurred in more or less 20 per cent cases examined. Its eggs were found in $5\frac{1}{2}$ (one case), 6 (3 cases), 7 (4 cases), 8 (2 cases), 9 (2 cases), 10 (9 cases), and 12 (4 cases) years of age.

The dwarf tape-worm was also found too common in this group. It was found in 15.38 per cent boys of 6 (one case), 7 (5 cases), 8 (5 cases), 9 (one case), 10 (6 cases), 11 (1 case) and 12 (1 case) years of age.

The *Taenia saginata* was detected in a boy of 11 years. This was the only solitary beef tape-worm infection recorded from this series.

3. 4. *Incidence of infection in boys of 13—17 years* :—61.13 per cent of boys, falling in this age group, were found infected with either protozoan or helminthic parasites or both. The majority (81.58 per cent) had helminthic parasites

as against protozoan parasites which were harboured by 68.42 per cent boys in this age group.

E. histolytica was detected from two boys of 15 and 17 years of age. *E. coli* occurred in 28.94 per cent cases. *I. butschlii* was present in 21.05 per cent cases as against 13.15 per cent who had *G. intestinalis.*

The incidence of *A. duodenale* was three times as high as of *A. lumbricoides.* It was found in 34.21 per cent cases of 13 (3 cases), 14 (2 cases), 15 (3 cases), 16 (5 cases) and 17 (2 cases) years of age. Five cases of giant round-worm occurred in boys of 14 (2 cases), 15 (one case) and 16 (2 cases) years of age.

The stool examination of this group exposed the presence of seat-worm in 10.53 per cent cases.

The dwarf tape-worm was present in 18.42 per cent boys of this age group. Its presence was more or less as observed for *I. butschlii.*

3.5. *Incidence of Infection in adults of 18—35 years* :—In this age group, unlike the above groups, the incidence of protozoan parasites was more or less high than helminthic parasites. *E. histolytica* was found in 5 cases of 19, 25, 30 and 32 years of age.

E. coli was found in 43.21 per cent adults. It was more or less uniformly distributed throughout this age group. *I. butschlii* occurred in 33.33 per cent cases examined as against 17.28 per cent cases who harboured *G. intestinalis.*

Two cases of *T. trichiurus* also occurred in this group.

The incidence of *A. duodenale* again remained three times as high as of *A. lumbricoides.* It was found in 38.27 per cent people as against 34.21 in the previous age group. It was frequently discovered in all the ages viz. 18 (3 cases), 19 (one case), 20 (5 cases), 22 (3 cases), 23 (2 cases), 24 (2 cases), 25 (2 cases), 26 (3 cases), 28 (2 cases), 30 (3 cases), 32 (2 cases), 34 (one case) and 35 (2 cases) years.

The incidence of *E. vermicularis* was very low. *A. lumbricoides* occurred in 13.58 per cent people. Only 6 people, out of 81 found carrying one or the other parasite, had *H. nana.*

3.6. *Incidence of infection in 36 to 70 years* :—53.63 per cent people were found carrying parasites. The *E. histolytica* was detected in 3.63 per cent cases. *E. coli* was of frequent occurrence. It was found in 28.18 per cent cases. *E. nana* was also found in one solitary case of 45 years. *I. butschlii* occurred in 21.82 per cent cases. *G. intestinalis* was comparatively rare in this group; as it was detected from 5.45 per cent people examined.

T. trichiurus was also found in one solitary case of 42 years. *A. duodenale* was detected from 13.63 per cent cases. *E. vermicularis* and *A. lumbricoides* were found of equal frequency, each was found in 2.73 per cent cases. *H. nana* was also found in 2 cases.

TABLE I—MALES WITH SINGLE PROTOZOAN INFECTION

Age	Eh.	Ei.	Ec.	Age	Ec.	Age	Ec.	Age	Ec.	En.	Ib.	Age	IB.	Age	Ib.	Age	Gi.	Age	Gi.
32	1	...	...	11	1	22	1	45	2	...	...	5	1	26	1	½	1	14	3
48	1	...	...	12	2	24	1	48	1	...	...	8	1	30	2	¾	1	16	1
15	...	1	...	13	2	25	1	50	2	...	...	9	1	35	1	1	2	18	1
30	...	1	...	14	1	26	1	55	1	...	...	10	3	38	1	1½	2	20	1
4	...	...	2	16	2	30	2	65	1	...	...	14	3	45	2	2	1	24	1
4½	...	...	1	18	2	37	1	45	...	1	...	15	1	50	2	3	1	25	1
6	...	...	1	19½	1	39	1	2	...	...	1	20	2	65	1	4	2	27	1
8	...	...	2	20	2	42	1	3	...	...	1	22	1	70	1	5	3	45	1

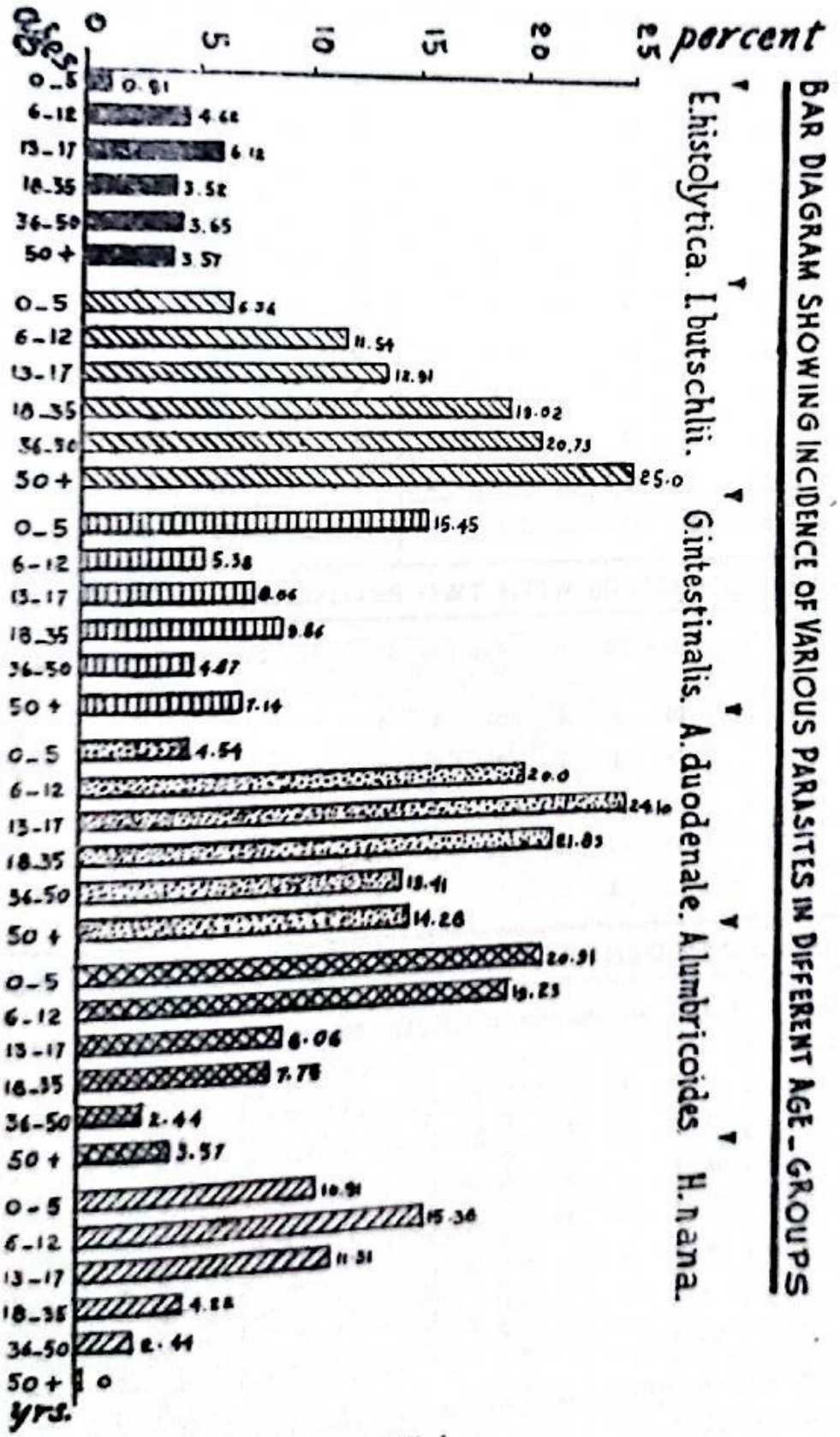
BAR DIAGRAM SHOWING INCIDENCE OF VARIOUS PARASITES IN DIFFERENT AGE-GROUPS
E.histolytica. I.butschlii. G.intestinalis. A.duodenale. A.lumbricoides H.nana.
Ages yrs.
0 5 10 15 20 25 percent
0-5 0.81
6-12 4.48
13-17 6.12
18-35 3.52
36-50 3.65
50+ 3.57
0-5 6.34
6-12 11.54
13-17 12.91
18-35 19.02
36-50 20.73
50+ 25.0
0-5 15.45
6-12 5.38
13-17 8.06
18-35 9.86
36-50 4.87
50+ 7.14
0-5 4.54
6-12 20.0
13-17 24.10
18-35 21.83
36-50 13.41
50+ 14.28
0-5 20.91
6-12 19.23
13-17 8.06
18-35 7.78
36-50 2.44
50+ 3.57
0-5 10.91
6-12 15.36
13-17 11.31
18-35 4.88
36-50 2.44
50+ 0

FIG. 1

TABLE II—MALES WITH SINGLE HELMINTH INFECTIONS

Age	Tt.	Hw.	Age	Hw.	Age	Hw.	Ev.	Al.	Age	Ai.	Age	Al.	Hn.	Age	Hn.
42	1	...	15	1	32	1	...	...	2	2	12	2	...	4	2
1	...	1	16	2	36	1	...	...	3	2	15	1	...	5	1
5	...	1	17	1	38	2	...	...	4	6	18	1	...	7	1
6	...	1	18	1	45	3	...	...	4½	1	24	1	...	8	2
7	...	1	19	1	5	...	1	...	5	2	28	1	...	9	1
8	...	1	20	3	9	...	1	...	5½	1	30	1	...	10	2
9	...	1	24	1	14	...	1	...	6	2	35	1	...	12	1
10	...	3	25	1	17	...	1	...	7	3	40	2	...	13	1
11	...	1	26	1	34	...	1	...	8	5	45	1	...	40	1
12	...	5	28	1	1½	...	...	1	9	2	2	...	1	50	1
13	...	1	30	2	1½	...	...	1	10	3	3½	...	1	...	...

TABLE III—MALES WITH TWO PROTOZOAN INFECTIONS

Age	Eh.	Ec.	Ib.	Age	Ec.	Ib.	Age	Ec.	Ih.	Age	Ec.	Ib.	Age	Ec.	Ib.	Gi.
6	1	1	...	10	1	1	24	1	1	35	1	1	50	3	3	...
8	1	1	...	16	1	1	26	1	1	36	2	2	60	2	2	...
36	1	1	...	17	1	1	27	1	1	39	2	2	70	1	1	...
19	1	...	1	19	1	1	28	2	2	45	1	1	23	1	...	1
2	...	1	1	23	2	2	33	1	1	48	1	1	35	1	...	1

TABLE IV—MALES WITH A PROTOZOA AND A HELMINTH INFECTION

Age	Eh.	Ec.	Hw.	Al.	Age	Ec.	Ev.	Al.	Hn.	Age	Ib.	Gi.	Hw.	Ev.	Al.	Hn.	Age	Gi.	Hw.	Ev.	Al.	Hn.
46	1	...	1	...	55	1	1	...	...	12	1	...	1	...	...	...	26	2	2	...	...	...
8	1	...	...	1	12	1	...	1	...	24	1	...	1	...	...	...	50	1	1	...	...	...
10	1	...	...	1	18	1	...	1	...	28	1	...	1	...	...	...	60	1	1	...	...	...
8	...	1	1	...	25	1	...	1	...	3½	1	...	...	1	...	...	3½	1	...	1	...	...
10	...	1	1	...	5	1	...	...	1	12	1	...	...	...	1	...	8	1	...	...	1	...
12	...	1	1	...	7	1	...	...	1	18	1	...	...	...	1	...	10	1	...	...	1	...
22	...	1	1	...	10	1	...	...	1	8	1	...	...	...	...	1	5	1	...	...	...	1
38	...	1	1	...	11	1	...	...	1	15	...	1	1	...	...	...	7	1	...	...	...	1
52	...	2	2	...	16	1	...	...	1	23	...	1	1	...	...	...	30	1	...	...	...	1

TABLE V—MALES WITH TWO HELMINTH INFECTIONS

Age	Hw	Ev.	Al.	Age	Hw.	Ev.	Al.	Hn.	Ts.	Age	Ev.	Al.	Hn.
12	1	1	...	60	1	...	1	...	...	6	1	1	...
16	1	1	...	7	1	...	...	1	...	6	1	...	1
20	1	1	...	15	1	...	...	1	...	5½	...	1	1
46	1	1	...	17	1	...	...	1	...	1¼	...	1	1
5	1	...	1	18	1	...	...	1	...	2½	...	1	1
10	1	...	1	30	1	...	...	1	...	5	...	1	1
16	2	...	2	50	1	...	...	1	...	7	...	1	1
35	1	...	1	9	1	...	...	...	1	8	...	1	1
...	...	...	...	1½	...	1	1	...	...	...	...	...	...

TABLE VI—MALES WITH THREE ZOOPARASITES

	PROTOZOAS					HELMINTHS				
	Age	Eh.	Ei.	Ec.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.
(*i*) With Three Protozoa (4 cases)											
	2	...	...	1	1	1	...	...	...	...	...
	34	...	...	1	1	1	...	...	...	...	...
	40	...	...	2	2	2	...	...	...	...	...
(*ii*) With Two Protozoa and a Helminth (12 cases)											
	17	1	...	1	...	...	...	...	1	...	...
	3½	...	1	1	...	...	...	...	...	1	...
	8	...	1	...	1	...	...	...	...	1	...
	13	...	...	2	2	...	...	2	...	...	...
	34	...	...	1	1	...	...	1	...	...	...
	8	...	...	1	1	...	...	...	1	...	...
	27	...	...	1	1	...	...	...	1	...	...
	10	...	...	2	2	...	...	...	...	...	2
	55	...	...	1	1	...	...	...	...	...	1
	22	...	...	...	1	1	1	...	...	...	...

TABLE VI—MALES WITH THREE ZOOPARASITES—*Contd.*

	PROTOZOAS					HELMINTHS				
	Age	Eh.	Ei.	Ec.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.
(*iii*) With One Protozoa and two Helminths (9 cases)											
	35	...	...	1	...	...	1	1	...	...	...
	20	...	...	1	...	...	...	1	...	1	...
	18	...	...	1	...	...	...	1	...	...	1
	23	...	...	1	...	...	...	1	...	...	1
	8	...	...	1	...	...	...	...	...	1	1
	5	...	...	...	1	...	...	1	...	1	...
	10	...	...	...	...	2	...	2	...	2	...
	3½	...	...	...	...	1	...	1	...	...	1
(*iv*) With Three Helminths (3 cases)											
	10	...	...	...	...	...	...	1	...	1	1
	14	...	...	...	...	...	...	2	...	2	2

TABLE VII—MALES WITH FOUR/FIVE ZOOPARASITES

	PROTOZOAS					HELMINTHS			
	Age	Eh.	Ec.	Ib.	Gi,	Hw.	Ev.	Al.	Hn.
(*i*) With Four Protozoa									
	60	1	1	1	1	...	...	...	...
(*ii*) With Three Protozoa and A Helminth									
	25	1	1	1	...	1	...	...	...
	32	1	..	1	1	1	...	...	...
(*iii*) With Two Protozoa and Two Helminths									
	8	...	1	1	...	1	...	1	...
(*iv*) With a Protozoa and Three Helminths									
	22	...	1	...	...	1	...	1	1
(*v*) With Three Protozoa and Two Helminths									
	12	1	1	...	1	1	1	...	...

TABLE VIII—INCIDENCE OF INTESTINAL PARASITES IN MALES OF VILLAGE SAHOWARY (LAHORE)

Age in years.	Number examined	Number Positive	PROTOZOAS						HELMINTHS					
			Eh.	Ei.	Ec.	En.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.	Ts.
1/6	2	...	...	...	...	...	...	...	...	...	...	...	...	...
1/4	2	...	...	...	...	...	...	...	...	...	...	...	...	...
1/3	1	...	...	...	...	...	...	...	...	...	...	...	...	...
5/12	1	1	...	...	...	...	...	...	...	...	...	1	1	...
1/2	1	1	...	...	...	...	...	1	...	...	...	...	...	...
7/12	2	...	...	...	...	...	...	...	...	...	...	...	...	...
2/3	1	...	...	...	...	...	...	...	...	...	...	...	...	...
3/4	1	1	...	...	...	...	...	1	...	...	...	...	...	...
1	9	3	...	...	...	...	...	2	...	1	...	...	...	...
1½	3	1	...	...	...	...	...	...	...	...	...	1	...	...
1½	9	5	...	...	...	...	...	2	...	...	1	3	1	...
1¾	1	...	...	...	...	...	...	...	...	...	...	...	...	...
2	12	7	...	...	2	...	3	2	...	...	...	2	1	...
2¼	2	...	...	...	...	...	...	...	...	...	...	...	...	...
2½	4	1	...	...	...	...	...	...	...	...	...	1	1	...
3	12	4	...	...	...	...	1	1	...	...	...	2	...	...
3¼	1	1	...	...	...	...	1	...	...	...	1	...	...	...
3½	4	4	...	1	1	...	...	2	...	1	1	1	2	...
4	18	12	...	...	2	...	...	2	...	...	...	6	2	...
4¼	1	...	...	...	...				...	...	...	...	...	...
4½	2	1	...	...	1	...	...	...	...	...	...	1	...	...
4¾	1	1	...	...	...	...	...	...	...	...	...	...	...	...
5	20	14	...	...	1	...	2	4	...	3	1	5	4	...
Total	110	57	0	1	7	0	7	17	0	5	4	23	12	0

TABLE VIII—INCIDENCE OF INTESTINAL PARASITES IN MALES OF VILLAGE SAHOWARI (LAHORE)—*Contd.*

Age in years.	Number examined	Number Positive	PROTOZOAS						HELMINTHS					
			Eh.	Ei.	Ec.	En.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.	Ts.
Percent of the total examined			0	0.91	6.36	0	6.36	15.45	0	4.54	3.63	20.91	10.91	0
Percent of the total positive.			0	1.75	12.28	0	12.28	29.82	0	8.77	7.02	40.35	21.05	0
5½	1	1	...	...	...	...	...	...	...	...	...	1	...	...
6	15	7	1	...	2	...	...	...	...	1	2	3	1	...
7	13	9	...	...	1	...	...	1	...	2	...	1	5	...
8	30	21	2	1	7	...	5	1	...	3	1	2	5	...
9	12	7	...	...	1	...	2	...	...	2	1	2	1	1
10	31	22	1	...	5	...	6	4	...	8	...	9	6	...
11	4	3	...	...	2	...	...	...	...	1	...	...	1	...
12	24	16	1	...	5	...	2	1	...	9	2	4	1	...
Total	130	86	5	1	23	0	15	7	0	26	6	25	20	1
Percent of the total examined.			3.85	0.77	17.69	0	11.54	5.38	0	20.00	4.62	19.23	15.38	0.77
Percent of the total positive.			5.82	1.16	26.74	0	17.44	8.14	0	30.23	6.98	29.07	23.25	1.16
13	9	6	...	...	4	...	2	...	...	3	...	...	1	...
14	20	11	...	...	1	...	3	3	...	2	1	2	3	...
15	6	6	...	1	...	...	1	1	...	3	...	1	1	...
16	17	10	...	...	4	...	1	1	...	5	1	2	1	...
17	10	5	1	...	2	...	1	...	...	2	2	...	1	...
Total	62	38	1	1	11	0	8	5	0	15	4	5	7	0
Percent of the total examined.			1.61	1.61	17.74	0	12.91	8.06	0	24.19	6.46	8.06	11.31	0
Percent of the total positive.			2.63	2.63	2.89	0	21.05	13.16	0	39.48	10.53	13.16	18.42	0
18	17	9	...	...	4	...	1	1	...	3	...	3	2	...
16	7	3	1	...	1	...	2	...	...	1	...	...	...	...

TABLE VIII—INCIDENCE OF INTESTINAL PARASITES IN MALES OF VILLAGE SAHOWARI (LAHORE)—*Contd.*

Age in years.	Number examined	Number Positive	PROTOZOAS						HELMINTHS					
			Eh	Ei.	Ec.	En.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.	Ts.
19½	1	1	...	...	1	...	...	...	...	...	...	...	...	...
20	15	10	...	...	3	...	2	1	...	5	1	1	...	...
22	9	5	...	...	3	...	2	1	1	3	...	1	1	...
23	7	5	...	...	4	...	2	2	...	2	...	...	1	...
24	8	6	...	...	2	...	2	1	...	2	...	1	...	...
25	8	5	...	1	3	...	1	1	...	2	...	1	...	...
26	9	6	...	...	2	...	2	2	...	3	...	...	...	...
27	5	3	...	...	2	...	2	1	...	...	1	...	...	...
28	13	5	...	...	2	...	3	...	...	2	...	1	...	...
29	2	...	...	...	...	...	...	...	...	...	...	...	...	...
30	18	10	...	1	2	...	2	1	...	3	...	1	2	...
32	5	3	2	...	...	...	1	1	...	2	...	...	...	...
33	3	1	...	...	1	...	1	...	...	...	...	...	...	...
34	3	3	...	...	2	...	2	1	...	1	1	...	...	...
35	12	6	...	...	3	...	2	1	1	2	...	2	...	...
Total	142	81	3	2	35	0	27	14	2	31	3	11	6	0
Percent of the total examined.			2.11	1.41	24.65	0	19.02	9.86	1.41	21.83	2.11	7.75	4.22	0
Percent of the total positive.			3.71	2.47	43.21	0	33.33	17.28	2.47	38.27	3.71	13.58	7.41	0
36	5	4	1	...	3	...	2	...	...	1	...	...	...	...
37	2	1	...	...	1	...	...	...	...	...	...	...	...	...
38	6	4	...	...	1	...	1	...	...	3	...	...	...	...
39	4	3	...	...	3	...	2	...	...	...	...	...	...	...
40	8	5	...	...	2	...	2	2	...	...	2	1	...	...
Total	25	17	1	0	10	0	7	2	0	4	2	1	0	0

TABLE VIII—INCIDENCE OF INTESTINAL PARASITES IN MALES OF VILLAGE SAHOWARI (LAHORE)—*Contd.*

Age in years.	Number examined	Number Positive	PROTOZOAS						HELMINTHS					
			Eh.	Ei.	Ec.	En.	Ib.	Gi.	Tt	Hw.	Ev.	Al.	Hn.	Ts.
Percent of the total examined.			4.00	0	40.00	0	28.00	8.00	0	16.00	8.00	4.00	0	0
Percent of the total Positive.			5.88	0	58.83	0	41.18	11.76	0	23.52	11.76	5.88	8	0
42	6	2	...	...	1	...	...	...	1	...	...	...	...	...
43	1	...	...	...	...	...	...	...	...	...	...	...	...	...
45	19	11	...	...	3	1	4	1	...	3	...	1	...	...
46	3	2	1	...	...	...	...	...	...	2	...	...	...	...
47	2	...	...	...	...	...	...	...	...	...	...	...	...	...
48	6	3	1	...	2	...	1	...	...	...	...	...	...	...
50	20	10	...	...	5	...	5	1	...	2	...	...	2	...
Total	57	28	2	0	11	1	10	2	1	7	0	1	2	0
Percent of the total examined.			3.51	0	19.29	1.75	17.54	3.51	1.75	12.28	0	1.75	3.75	0
Percent of the total positive.			7.14	0	39.28	3.57	35.71	7.14	3.57	25.00	...	3.57	7.14	0
51	1	...	...	...	...	...	...	...	...	...	...	...	...	...
52	5	2	...	...	2	...	...	...	...	2	...	...	...	...
53	1	...	...	...	...	...	...	...	...	...	...	...	...	...
55	3	3	...	...	3	...	1	...	...	...	1	...	...	...
56	1	...	...	...	...	...	...	...	...	...	...	...	...	...
57	1	...	...	...	...	...	...	...	...	...	...	...	...	...
59	1	...	...	...	...	...	...	...	...	...	...	...	...	...
60	7	5	1	...	3	...	3	2	...	2	...	1	...	...
65	3	2	...	...	1	...	1	...	...	...	...	...	...	...
67	1	...	...	...	...	...	...	...	...	...	...	...	...	...
70	4	2	...	...	1	...	2	...	...	...	...	...	...	...
Total	28	14	1	0	10	0	7	2	0	4	1	1	0	0

TABLE VIII—INCIDENCE OF INTESTINAL PARASITES IN MALES OF VILLAGE SAHOWARI (LAHORE)—*Contd.*

	PROTOZOA						HELMINTHS					
	Eh.	Ei.	Ec.	En.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.	Ts.
Percent of the total examined.	3.57	0	35.71	0	25.00	7.14	0	14.28	3.57	3.57	0	0
Percent of the total positive.	7.14	0	71.42	0	50.00	14.28	0	28.56	7.14	7.14	0	0

TABLE IX—SHOWING CORRESPONDING RATIOS OF DIFFERENT ZOOPARASITES IN THE MALES OF VILLAGE SAHOWARI (LAHORE)

	PROTOZOA						HELMINTHS					
	1	2	3	4	5	6	7	8	9	10	11	12
	Eh.	Ei.	Ec.	En.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.	Ts.
1 Eh.	1	0.38	8.23	0.07	6.23	3.77	0.23	7.07	1.54	5.15	3.62	0.07
2 Ei.	2.60	1	21.40	0.20	16.20	9.80	0.60	18.40	4.00	13.40	9.40	0 20
3 Ec.	0.12	0.05	1	0.01	0.76	0.46	0.03	0.86	0.19	0.62	0.44	0.01
4 En.	13	5	1.07	1	81	49	3	92	20	67	47	1
5 Ib.	0.16	0.06	1 32	0.01	1	0.61	0.04	1.13	0.25	0.82	0.58	0.01
6 Gi.	0.28	0.10	2.18	0.02	1.65	1	0.06	1.87	0.41	1.36	0.95	0 02
7 Tt.	4.33	1.66	35.66	0.33	27.00	16.33	1	30.66	0.66	22.33	15.66	0.33
8 Hw.	0.14	0.05	1.16	0.01	0.88	0.53	0.01	1	0.22	0.73	0.51	0.01
9 Ev.	0.65	0.25	5.35	0.05	4.05	2.45	0.15	4.60	1	3.35	2.35	0.05
10 Al.	0.19	0.74	1.59	0.02	1.21	0.73	0.05	1.37	0.29	1	0.71	0.02
11 Hn.	0.28	0.11	2.28	0.02	1.72	1.05	0.06	1.95	0.42	1.42	1	0.02
12 Ts.	13	5	107	1	81	49	3	92	20	67	47	1

4. Summary

All this is but a dream,
Too flattering—sweet to be substantial (Shakespeare)

This report is a continuation of the previous report published in Pakistan Journal of Health. This part deals with male population of village Sahowary.

4.1. The protozoan parasites were found in 35.04 per cent males as against 46.67 per cent in females. The pathogenic forms of protozoa were detected from 12.09 per cent men as against 26.55 per cent females examined from this village.

4.1.1. *E. histolytica* cysts were detected from 3.25 per cent males as against 2.32 per cent females. This number also includes 5 cases harbouring *E. hartmanni.*

4.1.2. The colon amoeba was the commonest protozoa in this series. It was present in 19.31 per cent cases examined as against 31.21 per cent in females of the series. The incidence was lowest in younger age groups (6.36 per cent in 0—5 years), and steadily increased in advance age groups. It was 17.69 per cent in 6—12 years of age, 17.74 per cent in 13—17 years of age and 24.65 per cent in 18—35 years of age and 28.27 per cent above 36 years of age. No infection was discovered in children below 2 years of age.

4.1.3. The cysts of *E. nana* were discovered in one case. This parasite may not be considered rare at this stage. Being very small, it is usually missed by the microscopists. It is one of the most innocent commensals. The workers, therefore, seldom attempt to detect it.

4.1.4. *I. butschlii* occurred in 14.62 per cent men as against 20.93 per cent females. Its incidence steadily increased with age. The rate of infection was 6.36, 11.54, 12.91, 19.01 and 21.82 per cent in 1/12 — 5, 5¼ — 12, 13 — 17, 18 — 35 and 36—70 years age groups respectively.

4.1.5. The cysts of *G. intestinalis* were found in 8.84 per cent men as against 9.69 per cent in females. Highest incidence of 15.45 per cent occurred in children of 1/12—5 years of age. In other age groups however, the incidence varied between 5.38 to 9.86 per cent.

4.2. The helminths were found in 34.29 per cent males examined as against 30.81 per cent females examined from village Sahowary.

4.2.1. The whip-worm infection occurred in a very small (0.54 per cent) proportion of male population. It occurred in 3 males of 22, 35 and 42 years of age as against one case in a female of 10 years.

4.2.2. *A. duodenale* was detected from 16.66 per cent males as against 9.31 per cent females, obviously frequent due to more chances of contact. The incidence was very low (4.57 per cent) in the younger age group of 1/12—5 years. In other age groups, however, the incidence varied between 20—25 per cent.

4.2.3. The seat worm infection was detected in 3.61 per cent stool examined. Since the data, based on coprological examination, does not indicate true rate of infection we would not discuss the rate of infection detected from various age groups in this series.

4.2.4. The giant round-worm was found from 12.09 per cent males examined as against 16.08 per cent females examined from this village. From this we infer that it is a door-yard infection and likely to occur more frequently in stay-at-home folks. Highest incidence was recorded in children of 1/12 — 12 years and suddenly dropped down in other age groups. The incidence was 2.72 per cent in adults of 36—70 years.

4.2.5. The dwarf tape-worm was detected in 10.91 per cent males examined as against 7.74 per cent in females. Highest incidence was found in children of 5—12 years. Sporadic cases occurred in males of 18—70 years.

4.2.6. *Taenia saginata* was found only in one male of 9 years of age.

TABLE X—SUMMARY OF PURE, DOUBLE, TRIPLE, QUADRUPLE AND QUINTUPLE INFECTIONS IN SAHOWARIAN MALES.

	PROTOZOA						HELMINTHS					
	Eh.	Ei.	Ec.	En.	Ib.	Gi	Tt.	Hw.	Ev.	Al.	Ha.	Tr.
1. Pure Infections	2	2	35	1	26	23	1	38	5	42	15	0
(i) Per cent of total (554) examined.	0.36	0.36	6.32	0.18	4.69	4.15	0.18	6.86	0.90	7.59	2.70	0
(ii) Per cent of total (321) positive.	0.62	0.62	10.91	0.31	8.10	7.17	0.31	11.84	1.55	13.08	4.68	0
(iii) Per cent of 89 with one Protozoa and 111 with one helminth.	2.25	2.25	39.32	1.12	29.22	25.84	0.99	37.63	4.95	41.58	14.85	0
2. Double Infections (Pure)	3	1	31	0	27	2	0	17	7	14	13	1
(i) Per cent of total (554) examined.	0.54	0.18	5.59	0	4.87	0.36	0	3.07	1.26	2.53	2.35	0.18
(ii) Per cent of total (321) positive	0.93	0.31	9.66	0	8.41	0.62	0	5.29	2.18	4.36	4.05	0.31
(iii) Per cent of 32 with 2 protozoa and 26 with 2 helminths.	9.37	3.13	96.87	0	84.37	6.26	0	65.38	26.93	53.85	50.00	3.84
3. Double Infections (Mixed)	3	0	16	0	7	12	0	17	3	9	9	0
(i) Per cent of total (554) examined.	0.54	0	2.89	0	1.26	2.16	0	3.07	0.54	1.65	1.62	0
(ii) Per cent of total (321) positive.	0.93	0	4.98	0	2.18	3.73	0	5.29	0.93	2.79	2.79	0
(iii) Per cent of 38 with one protozoa and one helminth.	7.89	0	42.11	0	18.42	31.57	0	44.74	7.89	23.67	23.67	0
4. Triple Infections	1	2	19	0	15	8	2	14	3	10	10	0
(i) Per cent of total (554) examined.	0.18	0.36	3.43	0	2.70	1.44	0.36	2.53	0.54	1.81	1.81	0
(ii) Per cent of total (321) positive.	0.31	0.62	5.92	0	4.68	2.48	0.62	4.36	0.93	3.12	3.12	0
(iii) Per cent of 28 with 3 parasites.	3.57	7.14	67.85	0	53.57	28.57	7.14	50.00	10.71	35.71	35.71	0
5. Quadruple Infections	3	0	4	0	4	2	0	4	0	2	1	0
(i) Per cent of total (554) examined.	0.54	0	0.72	0	0.72	0.36	0	0.72	0	0.36	0.18	0

TABLE X—SUMMARY OF PURE, DOUBLE, TRIPLE, QUADRUPLE AND QUINTUPLE INFECTIONS IN SAHOWARIAN MALES—*Contd.*

	PROTOZOA						HELMINTHS.					
	Fh.	Ei	Ec.	En.	Ib.	Gi.	Tt.	Hw.	Ev.	Al.	Hn.	Ts.
(*ii*) Per cent of total (321) positive.	0.93	0	1.24	0	1.24	0.62	0	1.24	0	0.62	0.31	0
(*iii*) Per cent of 5 with four parasites.	60.00	0	80.00	0	80 00	40.00	0	80.00	0	40.00	20.00	0
Quintuple Infections	1	0	1	0	0	1	0	1	1	0	0	0
6. Grand Total	13	5	107	1	81	49	3	92	20	67	4	1
(*i*) Per cent of total (554) examined.	2.34	0.90	19.31	0.18	14.62	8.84	0.54	16.66	3.61	12.09	8.48	8.18
(*ii*) Per cent of total (321) positive.	4.05	1.56	33.33	0.31	24.61	15.26	0.93	28.66	6.23	20 87	14.64	0 31
(*iii*) Per cent of 190 with protozoa and 194 with helminths.	6.84	2.63	56.32	0.53	42.63	25.79	1.55	47.42	10.31	24.53	24.23	0.52

5. Acknowledgments

Our thanks are due to the Sahowarians, who co-operated with our staff throughout the fact finding programme. Messrs. Din Mohammad Bhutta and Mohammad Allah Dad, deserve acknowledgment for carrying out the arduous job carefully, according to our instructions.

6. References

A little learning is a dangerous thing
Drink deep, or taste not the Pierian Spring. (Pope)

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THE SUMMER MONSOON IN INDO-PAKISTAN SUB-CONTINENT*

BY

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1. Introduction

The summer monsoon of Southeast Asia, better known in India and Pakistan as the Southwest monsoon, is the most important and well developed secondary circulation in the atmosphere exercising significant influence on the general circulation. The monsoonal circulation over India and Pakistan last from June to September but July and August are considered to be the typical monsoon months. During these two months the equatorial trough (monsoon trough) lies normally over the Gangetic plains stretching approximately from 30°N, 75°E to 23°N, 88°E but the monsoon trough is not so steady and persistent in its position. Monsoon activity during the four months is neither steady with reference to time nor evenly spaced over different regions from year to year or even during each year. The monsoon period of four months in this area is interrupted by normal monsoon and breaks in monsoon alternatingly. These breaks and pulses are not strictly periodical.

Many simultaneous activities are observed elsewhere when the first monsoon, popularly known as the burst of monsoon, sets on. Sutcliffe and Bannon (1954) showed for year 1948—1953 that a time-relation exists between the shift of 200 mb. winds from West to East over Aden and Bahrein, the disruption from Polar to Tropical trapopause over Habbaniyah with the on-set of monsoon at the Malabar coast. Flohn (1960) mentions that during the first half of June, the frequency of blocking anticyclones between Iceland, Scandinavia and the British Isles reaches its maximum during the year when burst of monsoon take place in India and Pakistan. Ramanathan (1960) mentions, Walker discovered that a great transpot air-mass from Pacific Ocean near Japan to Pacific Ocean near the West coast of South America takes place when the transport of air takes place to North Indian Ocean as Southwest Monsoon from the southern hemisphere anticyclones. Yin (1949) and Riehl (1954) showed that burst of Indian summer monsoon is connected with the disintegration of sub-tropical westerly jet streams over Northern India and with the formation of a new westerly jets at 40—45°N at the northern edge of the central Asiatic highland and the Tibetan Plateau.

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Flohn (1960) has shown that the development of the summer monsoon in South East Asia is intimately connected with the formation of a warm anticyclone above the Tibetan Plateau at an altitude of about 20,000 feet.

Halley, in 1686, opined that the cause of monsoon was the differential heating of the land and sea surface over South-East Asia. It is generally believed that monsoon originates in the Southeast Trades of the southern hemisphere which after crossing the equator and deflection by coriolis force approaches the heated continental area of India and Southeast Asia as Southwesterly winds. Malurkar (1950) contends that small lows (pulses) formed in the southern hemisphere cross the equator at preferred location carrying the equatorial maritime air to northern latitudes.

Whatever may the cause be or whatever may take place elsewhere either at the lower level or at higher troposphere when the summer monsoon sets in this area, it is a fact that the burst of monsoon takes place in Indo-Pakistan sub-continent, generally during the first part of June or later part of May every year.

2. Predominent motion system affecting the rainfall distribution

From what has been stated above in para 1, it is clear that the summer monsoon of Indo-Pak. sub-continent is not a purely local phenomena disconnected with synoptic situation elsewhere. It is, therefote, appropriare to survey the surface pressure distribution over northern hemisphere during the season. The pressure distribution over the northern hemisphere during the summer season decides to a great extent the nature and intensity of the summer monsoon in the sub-continent.

During the winter season the northern hemisphere is controlled by five major anticyclones and three cyclonic belts. The most prominent of these anticyclones rests over Russia and Siberia. The second one prevails over the Atlantic Ocean along 30°N stretching from North America to the Coast of Africa and Spain. The third is the anticyclone over the Pacific Ocean situated to the West of North America. The fourth anticyclones is over North America and the Arctic regions connecting Asiatic antieyclones with the North American Anticyclones. The fifth is the north African high stretching from the West Coast of North Africa and extending to the Eastern Coast of Arabia and Iran. The two cyclonic belts are the North Atlantic cyclonic belt along 30° to 60°N and North Pacific cyclonic belt slightly to the south of 60°N and approximately across 45—50°N. There is a third small cyclonic belt during winter over the Mediterranean Ocean.

During the summer the situation changes a lot. The Asiatic anticyclone totally collapses. The one over North Africa and Arabia is also disappearing from the mean chart. The whole of Africa and Asia is dominated by a "Heat Low" with the lowest

pressure area lying over North West India, West Pakistan and Iran. There is a 'secondary heat low' over North Africa. These 'heat lows' actually start from the West Coast of Africa and extend to the Pacific Ocean after crossing the Eastern Coast of Asia. The North American anticyclone is also replaced over the surface by a small 'heat low' over Maxico. The Atlantic anticyclone shifts much towards the North and occupies approximately up to 45°N. The Pacific anticyclone exists to the North of Lat. 30° in the area from about 25°N, between 150°E to 60°W. The Arctic region is occupied by an anticyclone. The cyclonic belt over the Mediterranean almost completely disappear whereas the cyclonic belt of North Atlantic moves to the North of 60°. The Pacific cyclonic belt also become less intensified and shifts to the 60°N and further North. With these changes in the surface condition the summer monsoon in this sub-continent begins. Though the anticyclone of Asia and Africa is replaced during the summer by the heat low; it is noticed that this heat low over Asia and Africa is very shallow and is replaced by a high level anticyclone above 10,000 feet or so over North Africa, Arabia and West Pakistan. The heat low over Maxico is also replaced by a high level anticyclone above the same height.

3. Major wind systems in the tropics and the monsoon

The upper wind circulation over the northern hemisphere is, primarily in winter, the high latitude Westerlies. The sub-tropical Westerly jet stream at a height of about 35 to 40 thousand feet passing almost parallel to 30°N controls the zonal flow of wind over the entire tropics. Only a very small belt of Easterlies over the equator and 5-7°N and South controls the entire troposphere of the equatorial region. During the summer season, however, the sub-tropical Westerly jet stream shifts much to the North in the northern hemisphere, and lies approximately at a height of about 35 to 40 thousand feet very roughly along Lat. 40—45°N. The Easterlies of equatorial region becomes much more strong during the summer and a core of Easterly jet stream forms approximately along Lat 10—15°N in the region from say 30°E to 120°E. This Easterly jet stream with a central speed nearing about 100 knots is found at an altitude of about 55,000 feet above. It is probably strongest above South India and weakens eastwards and westwards from 75—80°E across 10—15°N. This Easterly jet stream over South East Asia and Indian Ocean, as a matter of fact, controls the entire upper air circulation over the whole of South East Asia during the summer season. A very small lower region from the surface up to 15—20 thousand feet above 10°N and 5—7 thousand feet above 25°N is, however, controlled by Southwesterly and southerly streams which during the summer season we call as the Southwest Monsoon. But an inspection of the upper air circulation clearly indicates that the wind circulation over the entire Southeast Asia and Indian Ocean in the northern hemisphere is controlled by the Easterly jet stream only slightly interrupted, as has been mentioned, in the lower layers by the summer monsoon current.

4. Burst of the Southwest Monsoon and the jet

In 1964 the burst of summer monsoon took place on 5th June when Malabar Coast got its first monsoon rainfall. The position of the Northern limit of the monsoon at 1.5 Km. during June 1964 is shown in Fig. I.

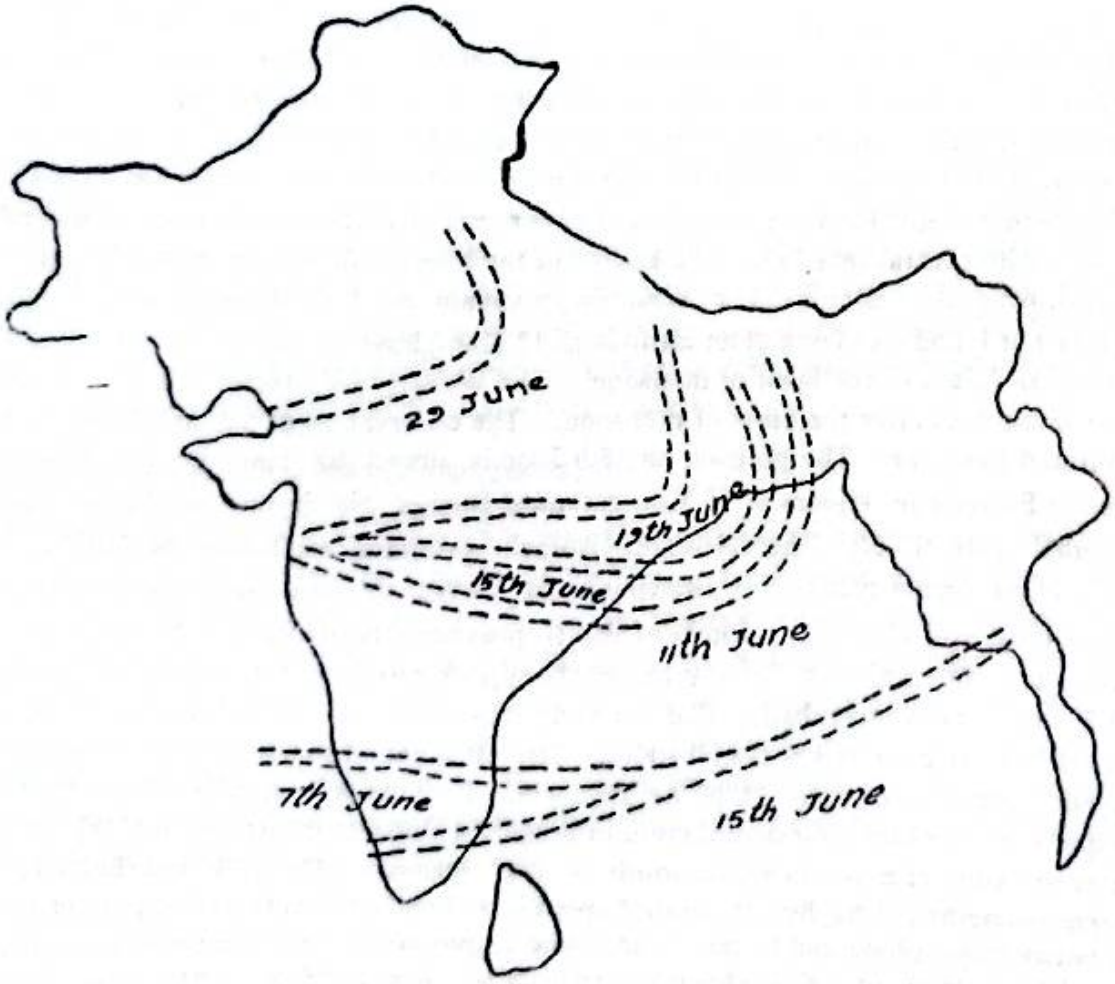

Fig. I. The Northern limits of the monsoon at 1.5 Km. on various dates in June, 1964.

It affected South India, South of Madras by 7th June ; the whole of the Deccan approximately South of Lat. 20° by 11th June. The whole of country excluding West Pakistan was under the grip of the summer monsoon on 29th June. The details are given in Fig. I. I have tried to investigate the observations of Yin and Riehl as mentioned in para 1 to find out how far correctly the burst of monsoon takes place simultaneously with the disintegration of the sub-tropical Westerly jets stream over Indo-Pakistan sub-continent.

"Pak : Jour: Hlth., 15 (1)"

Ten vertical cross sections for the zonal winds along 75°E for 3rd, 7th, 11th, 15th, 19th, 25th, 29th and 30th June as well as for 1st July 1964 have been prepared. Figures are not included in this paper to avoid too much of figures. It has been noticed that when on 3rd June there was no summer monsoon over India the Easterly jet stream was existing above Trivandrum (Lat. 9½°N) at a height of about 16 Km. with its central speed more than 73 knots. On that particular day the sub-tropical Westerly jet stream was lying at about 10 Km. with its core at about 26½°N. It was rather weak. This was the position two days before the burst of monsoon. The cross section for 7th June shows the existence of Easterly jet stream almost the same as on the 3rd but shifted towards North by about 1° Latitude. The Westerly jet stream with its core, shifted to about 28½°N while the same altitude was maintained. On 11th June it has been noticed that the Easterly jet stream approximately remain at an altitude of 16 Km. with central speed about 70 knots but the upper troposphere was Easterly at 18 Km. over New Dehli. The Westerly jet stream on 11th June suddenly shifted further north and was lying at an altitude of 12 Km. above 34°N. This is a remarkable shift after 7 days of the burst of monsoon. The Westerly jet stream did not disintegrate seven days after the burst of monsoon. The observation of Yin and Riehl is not confirmed this year. The position on 15th June is almost the same with the difference that the Easterly jet stream at 16 Km. extended further North and 60 knots isotach extended upto 15°N. The 40 knots isotach extended as North as 20½°N. The Westerly jet stream confined in the vicinity of 34°N ; on 19th June the Easterly jet stream took over almost the whole of the troposphere right from 5°N excepting the lower monsoon layer with the Southwesterly approximately at 9 Km. over Trivandrum and 2 Km. over Ahmadabad. The Westerly jet stream still existed above 34°N with its speed in the core 81 knots at 14 Km. The 60 knots isotach of the Westerly jet extended southward upto 31°N at 12½ Km. It is seen upto 25th June that the Westerly jet stream is not disintegrated though the Easterly jet stream has taken over the entire wind circulation to the south of 28½° latitude. On 29th the Easterly jet stream strengthened further, its central speed was about 100 knots and was controlling the entire troposphere and lowered stratosphere upto 30°N. The monsoon current was extending from about 8 Km. above Trivandrum to 2 Km. at 28°N. The Westerly jet stream still exists at 34°N at a height of about 12 Km. Its speed in the core also was about 60 knots. So, after the burst of monsoon over Malabar Coast on 5th June, the sub-tropical westerly jet stream continued over this sub-continent upto 29th and did not disintegrate. On 30th June, the cross section shows that the Westerly jet stream suddenly disappeared. Srinagar reported only 20 knots of Westerly component at 14 Km. It might have shifted to the North of Himalayas or might have disintegrated but the position remains that the sub-tropical Westerly jet stream remained continuously in existence for 24 days after the burst of monsoon in this sub-continent. This special phenomena indicates that sub-tropical Westerly jet stream probably is not antagonistic to the burst of monsoon in the sub-continent. On the other hand it

appears that the burst of monsoon is very clearly connected with the movement of the Easterly jet stream. It must be pointed out, as is clear from the 10 cross sections of zonal winds, nine for June 1964 and 1 for the first July 1964 that the basic current over the South East Asia during the summer season is the prevailing equatorical Easterlies centring the Easterly jet stream. The Westerly jet stream shifts to the North to 40 – 45°N which probably facilitate in the extension of Easterlies.

The cross sections further show that the Easterly jet stream sweeps down to surface over India and Pakistan in the region North of 20°N. This is very clear from the cross section of 19th, 25th, 29th, 30th and 1st July. We have a notion that the Southeasterly current over the Gangetic plain from East Pakistan upto Punjab and even upto Frontier region is the deflected monsoon current. It is ordinarily considered to be the Southwesterly monsoon current but deflected due to the position of mountain to the North and Northeast and also due to the low pressure area lying over Northwest India and West Pakistan. The Southwesterly current is certainly brought by this low pressure area but the Northeasterly over the Gangetic Valley approximately from 23°N 88°E to 30°N—75°E is a part of the equatorial Easterlies.

5. Normal and breaks in the monsoon and the Jet

After the burst of monsoon on 5th June the monsoon activity was not continuous over the sub-continent. In this connection Fig. 2 may be referred to in which there are three curves. Curve AA shows the monsoon rainfall over Lahore Region from 1st June to 30th September, 1964. Curve BB shows the monsoon rainfall over Bombay during the same period and curve CC represents the monsoon rainfall over Calcutta during the same period. Each curve has 24 points, each point represents five days mean daily rainfall over the place or the region, point 2 for example, represents average daily rainfall from 6th to 10th June over Calcutta, Bombay or Lahore region in their respective curves.

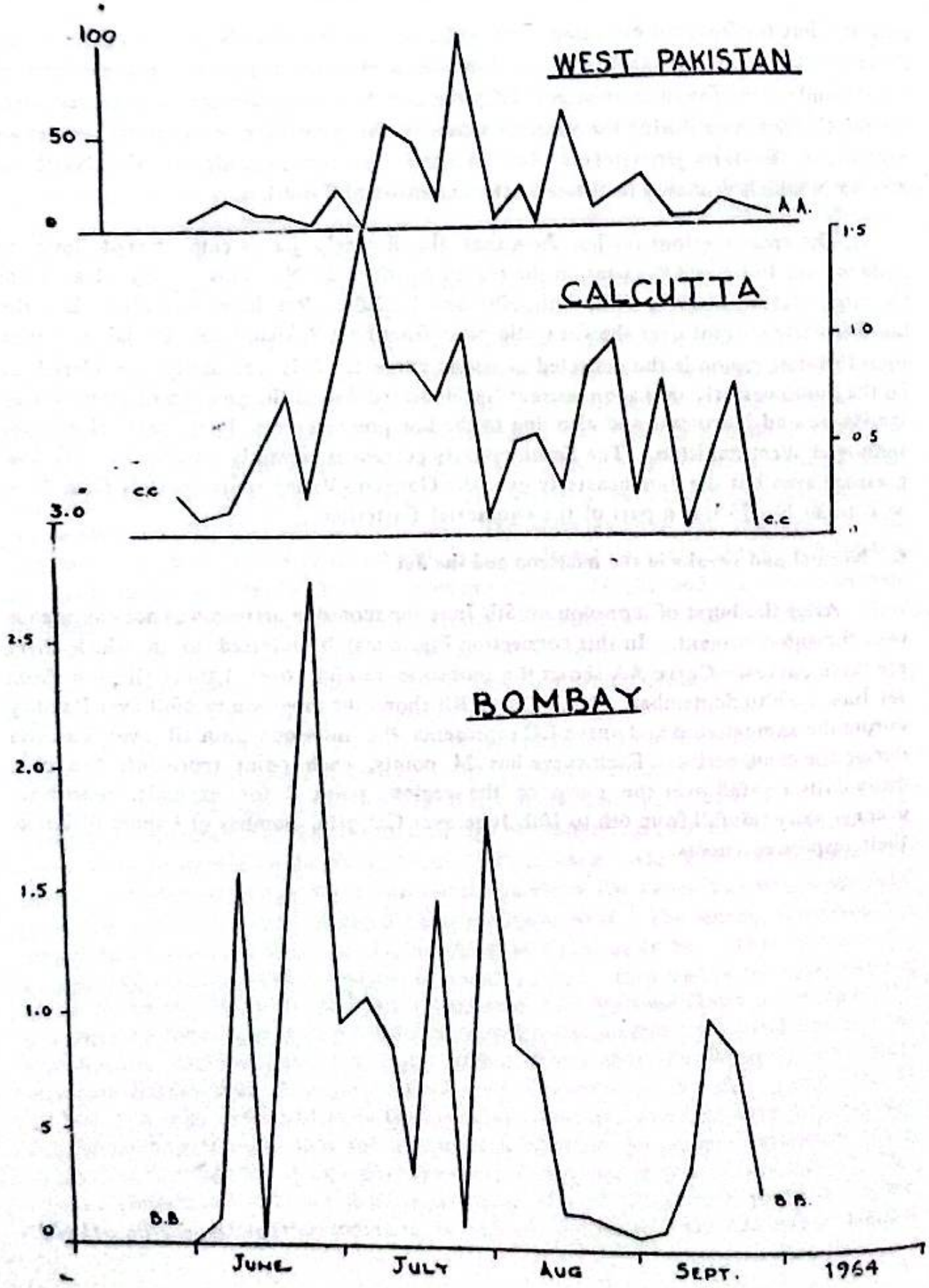

Fig. 2. The monsoon rainfalls with pulses and breaks in Monsoon in West Pakistan, at Bombay and at Calcutta during June to September, 1964.

The following special feature may be observed from the three rainfall curves.

The rainfall during the summer monsoon of 1964 has never been steady with respect to time. In West Pakistan there has been about 8 spells of rainfall interrupted by equal number of breaks during the season. In Bombay and Calcutta there has been about 7 spells during these four months. This shows that the monsoon of 1964 over East Pakistan, East India, South India and finally over West Pakistan, as indicated by Lahore region curve, had alternate normal monsoon accompanied by break in monsoon.

During these normal monsoon, the monsoon trough extends from 30°N, 75°E to 23°N, 88°E when rainfall is quite abundent over the whole of the sub-continent. The breaks condition, on the other hand, is connected with the fact that the monsoon

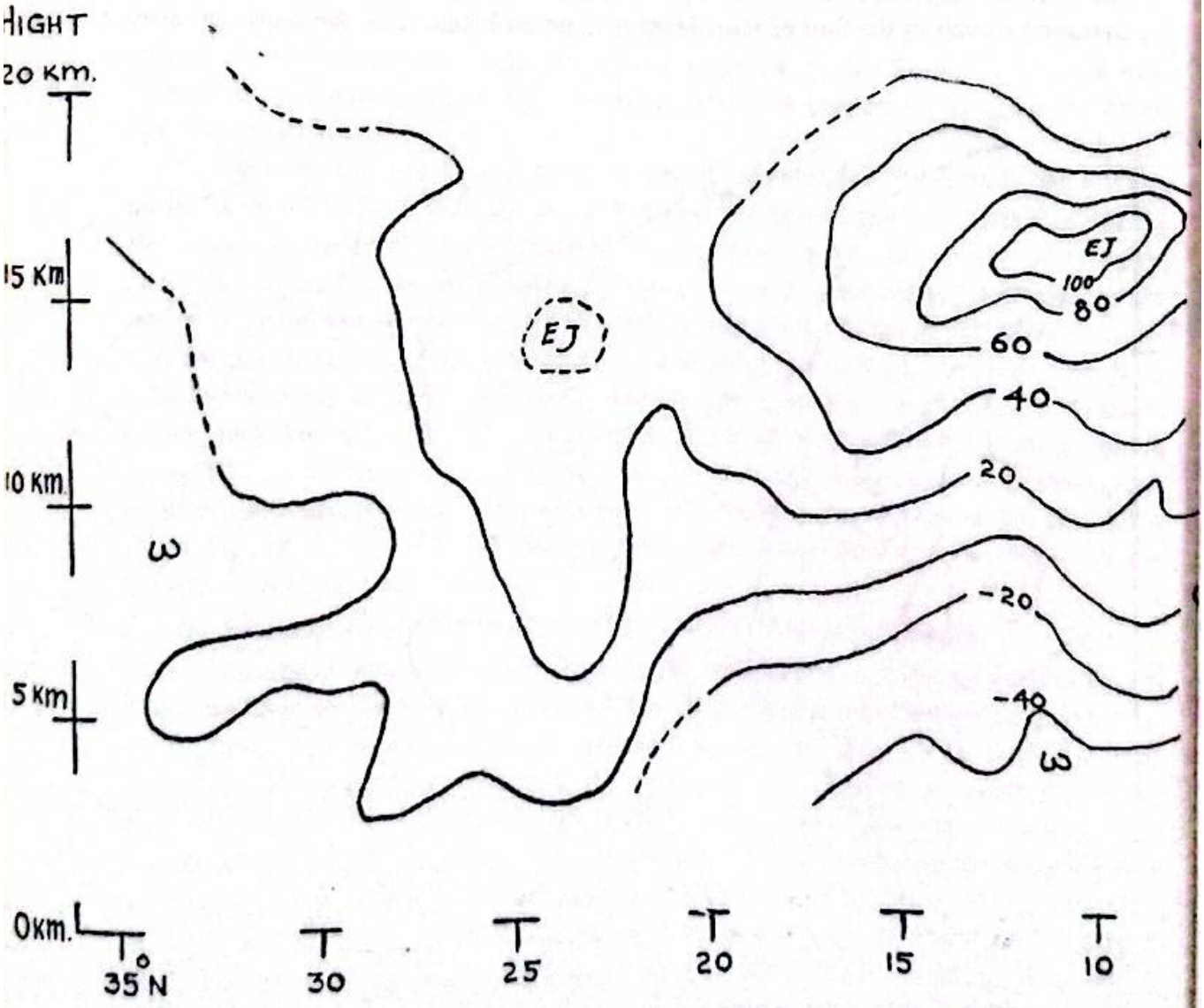

Fig. 3. Vertical cross sections of zonal winds along Long. 75°E for Lat. 8°N to 35°N on 1st July 1964 when the monsoon activity was normal and wind speed show in knot.

trough from its normal position indicated above shifts to the foot of Himalayas very roughly to 32°N, 75°E to 26°N, 90°E. During this breaks period the rainfall over the plains are very meagre whlie the rainfall over the foot of Himalayas are very heavy. The upper air structure connected with the normal monsoon activity is indicated by the vertical cross section of July 1st, 1964 in Fig. 3. The Westerly jet stream is not at all in existence; on the other hand, the Easterly jet stream is very prominent and controls the entire troposphere excluding the lower monsoon layer right from equator to the northern parts of the sub-continent.

The Easterly jet stream, with 110 knots in core, at 16 Km. over Trivandrum, had 93 knots at 14 Km. over Madras, 40 knots at 16 Km. at Bombay extended upto 33°N. Srinagar only reported 12 knots of Westerly component at 12 Km. During the breaks condition, the upper air structure entirely differs. With the shift of monsoon trough to the foot of Himalayas it is noticed that the Westerly jet stream

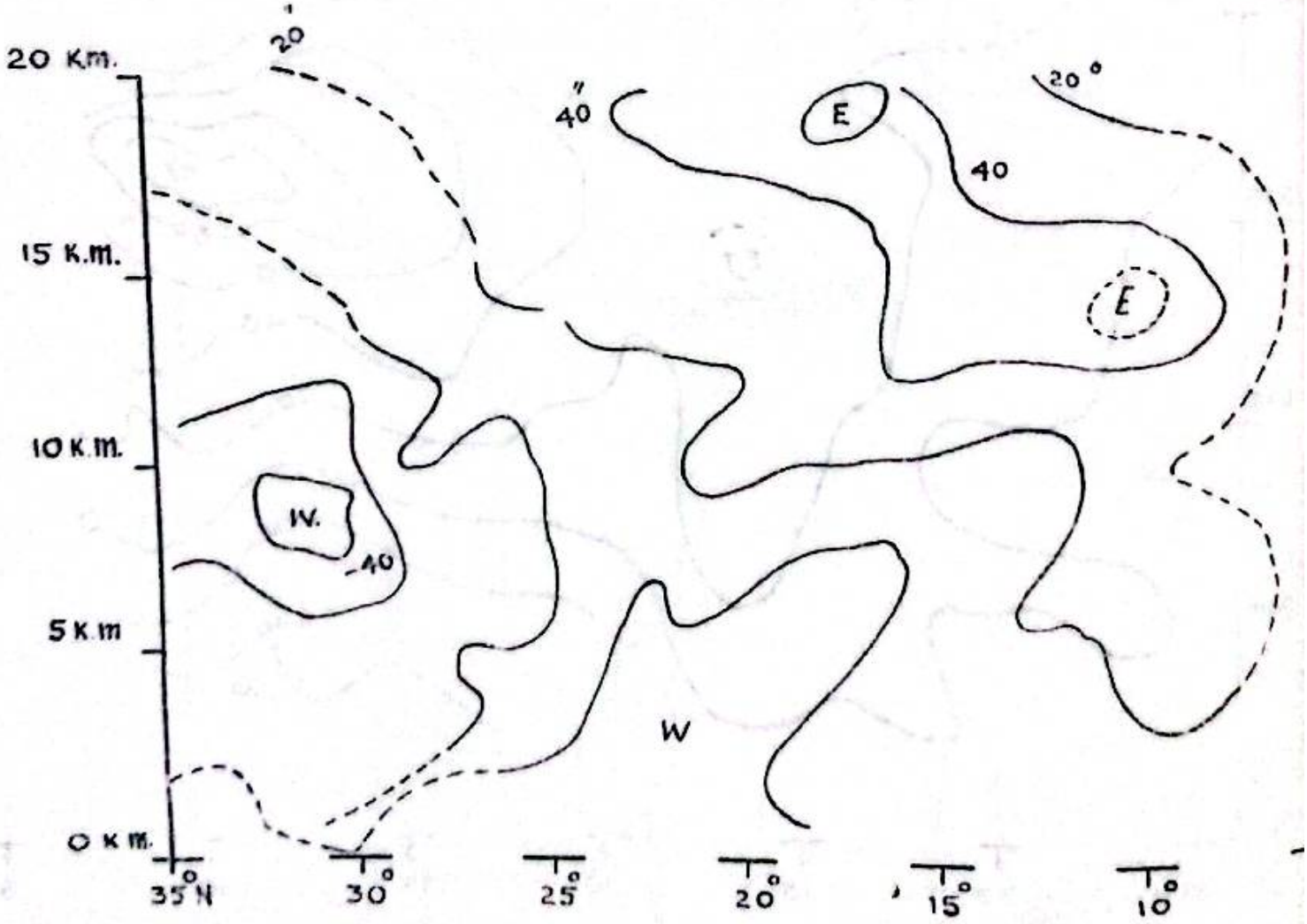

Fig. 4. Vertical cross section identical to Fig. 3, for 5th September, 1964 when there was break in the monsoon.

reappears over the sub-continent. While the Easterly jet stream remains almost in its normal position. Breaks in the Indian monsoon has been explained as a phenomenon of inter action between the Easterly and sub-tropical Westerly jet streams by Ramaswamy (1962). He produced vertical cross-section of zonal winds across 75°E for 5th August 1957 and showed that during the breaks in the Indian monsoon, "the Westerly jet intrudes into Indo-Pakistan the Easterly jet developes a secondary core to the north of the mean core, thus, resulting the two jets of entirely different types coming very near to each other". In Ramaswamy's cross section for 5th August 1957, he found the maximum speed in the Easterly jet above 100 knots and that of the Westerly jet was also above 60 knots but in this case the breaks in Indian monsoon on 5th September, 1964 as is shown in Fig. 4, neither the maximum Easterlies in the so-called Easterly jets nor the Westerly in the intruding sub-tropical Westerly jet reached the limit of 60 knots. The Easterly jet certainly weakened on this occasion with maximum wet wind at 10 km. about 50 knots. Almost the entire South Westerly current, from equator to about 20°N was replaced by the Easterlies. The South Westerlies prevailed only from 20°N to about 28°N with deepest layers (7 km) at 20°N and most shallow at 28°N.

The breaks in monsoon is therefore due to the extension of Westerly jet stream on the northern India and the heavy rainfall over the Himalayan regions is also due to the trough in the high latitude Westerlies and not due to the monsoon. The heavy rainfall is, of course, possible, because, during the normal monsoon, lot of moisture is carried to the Himalayan region which the Westerly trough helps in the precipitation. The normal monsoon, on the other hand, had nothing to do, it appears, with the high latitude Westerlies. It is exclusively the outcome of the low level South Westerly current and the Easterlies aloft. Fig. 4 is an upper air cross-section of zonal winds along 75°E for 5th September, 1964. It gives an ideal upper air structure of the breaks in monsoon condition in the sub-continent. The vertical cross section of the zonal winds for 1st July, 1964, on the other hand, gives the ideal upper air structure for the normal monsoon activity.

6. The Monsoon Rainfall of 1964 and How it departed from its Normal

The monsoon rainfall of 1964 over India and Pakistan has been shown in Fig. 5. It indicates the total rainfall from 1st June to 30th September, 1964 each station over the sub-continent received. It is noticed that the Malabar coast had more than 100 inches of rainfall during this monsoon. One station has reported 290 inches. The influence of West Ghat Mountain is very clear here. On the lee side of the mountain the rainfall has been so meagre that the rainfall during the monsoon over the Deccan, South of Lat. 17°N situated on the lee side of the West Ghat mountain varied from 13 inches to 30 inches. The stations on the foot of Himalayas received more than 80 inches of rainfall at many places. The West Pakistan, as a whole, received less than 10 inches of rainfall outside Lahore and Rawalpindi Divisions. As

a matter of fact, the rainfall of West Pakistan during this season varied generally from 1 to 10 inches. Fig. 5 is giving the actual rainfall of the season.

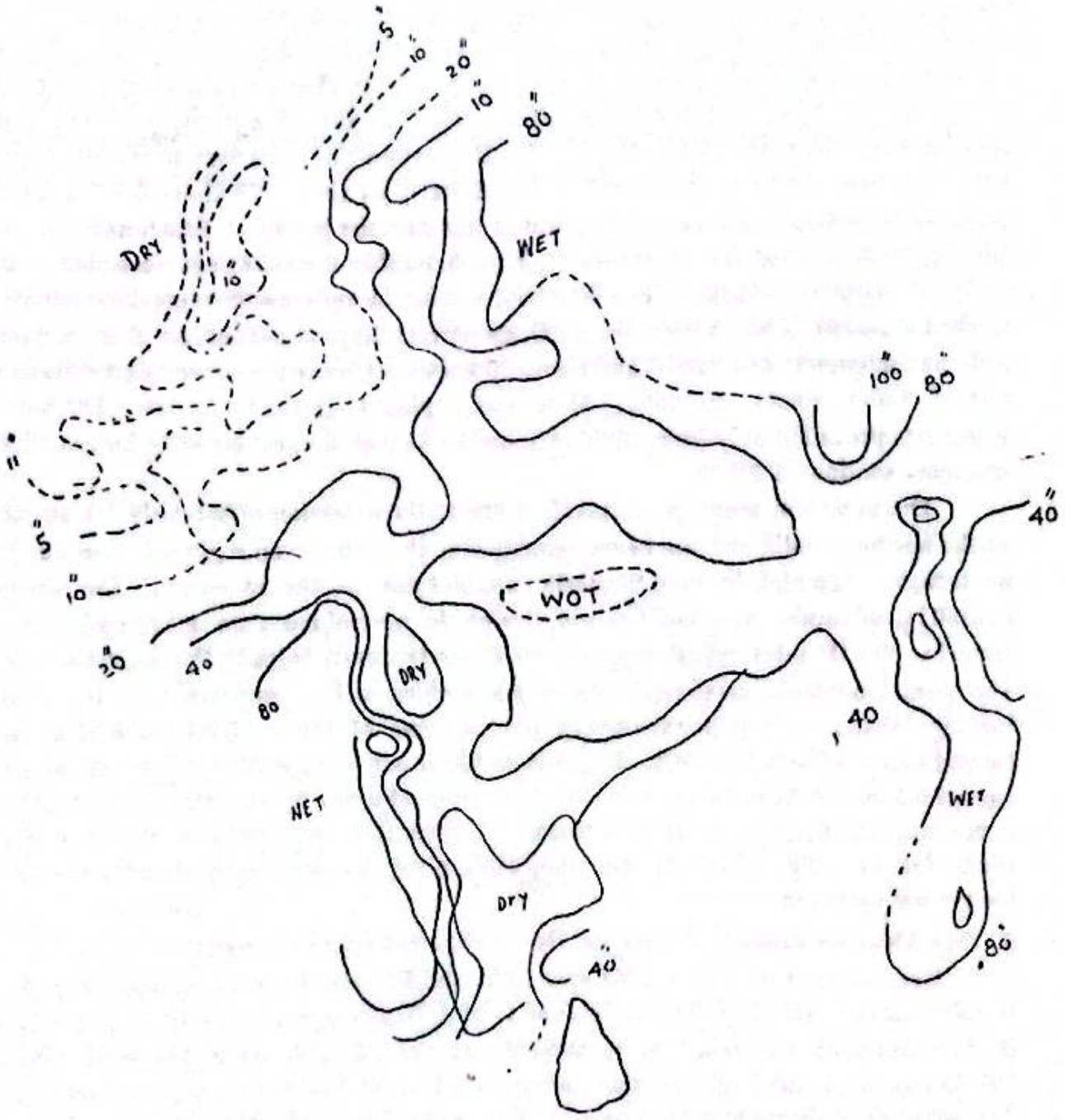

Fig. 5. The monsoon rainfall India and Pakistan from June to September, 1964.

Fig. 6 shows the departure from normal of the monsoon rainfall during 1964 over the sub-continent. It is noticed that the whole of India approximately to the north of 21°N excluding East Panjab and Rajputana had less than normal rainfall during the season. West Pakistan has on the whole monsoon rainfall above normal excluding a very small region of Peshawar and D.I. Khan Division where the rainfall was less than normal.

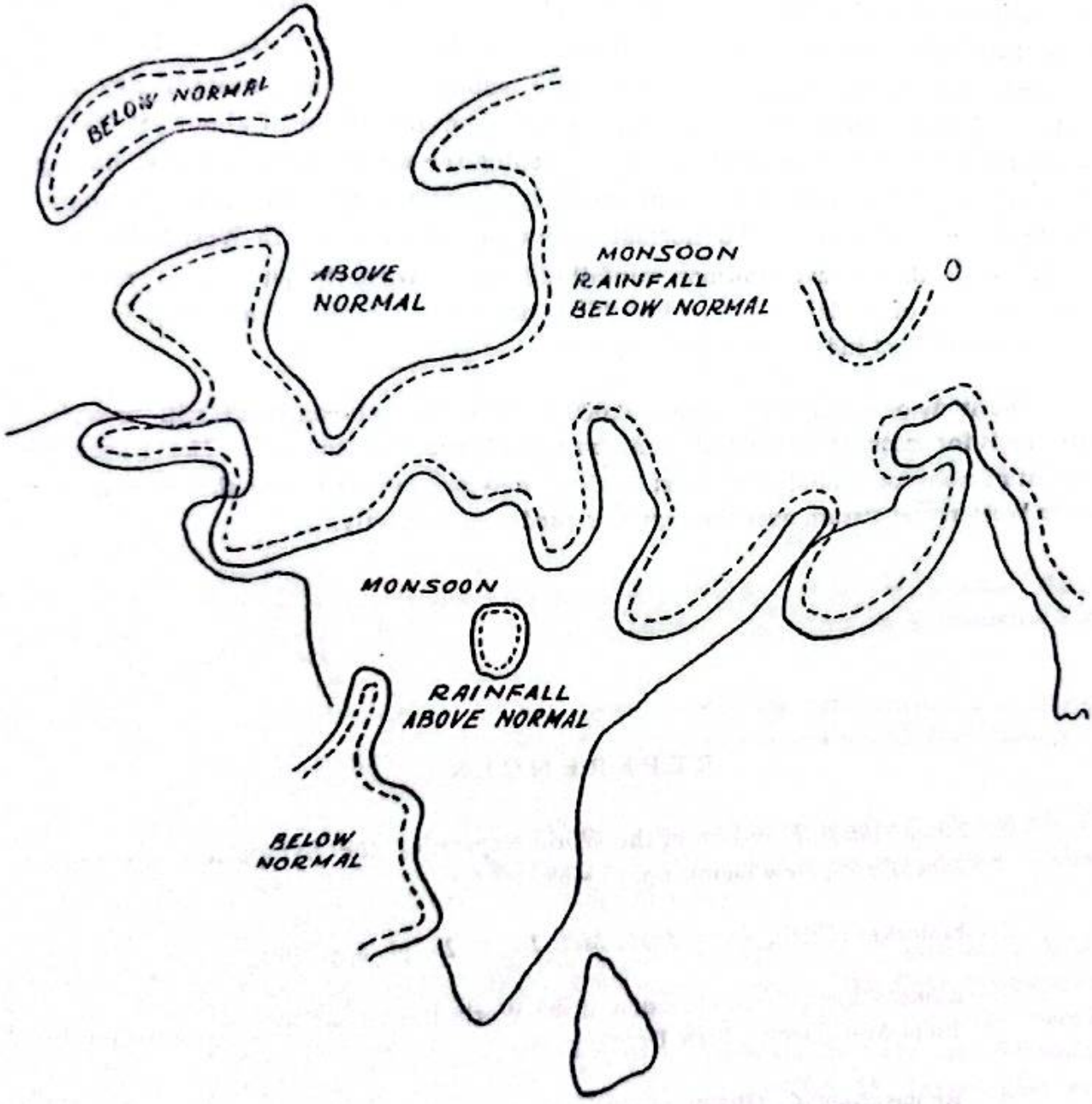

Fig. 6. The departure of monsoon rainfall from the Normal in June to September, 1964 in India and Pakistan.

7. A few conclusion

Daily rainfall reported over all the stations during each of the break period as well as each normal monsoon period has been investigated. The general feature is during the break period rainfall over the entire sub-continent is very very meagre and almost absent while it is very heavy over the foot of Himalaya mountains, with a Westerly jet stream in the upper troposphere as South as 30°N and the Easterly jet

stream rather weak but extends from South upto 30°N. During the normal monsoon activity the rainfall over the foot of Himalaya mountains are much less and, on the other hand, rainfall on plains over the entire sub-continent are quite heavy and abundant. Simultaneously the Easterly jet stream from the height of about 55,000 ft. with central speed more than 100 knots was sweeping the whole of the country, having no Westerly jet stream upto 34°N. The Westerly jet stream, probably remains somewhere near 40—45°N during the normal monsoon activity. North-West India and West Pakistan will not have monsoon rainfall unless the Westerly jet stream retreats to the other side of the Himalayas. But this is not a bar to monsoon activities in East Pakistan, North East India and South India.

The study of upper winds above 30,000 ft. over the sub-continent will provide better tools for seasonal forecast of monsoon rainfall over the country. The seasonal forecast of monsoon rainfall over West Pakistan may not mature unless the movement of the Westerly jet stream over the region is predicted correctly.

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Book Reviews

Bacteriology Illustrated : By R. R. Gillies, M.D., D.P.H., M. C. Path. and T.C. Dodds, F.I.M.L.T , F.I.B.P., F.R.P.S. (Pp 163, 166, illustrations, 45s). Edinburgh and London : E. & S. Livingston Ltd. 1965.

This well illustrated book is the successor to Low & Dodds: Atlas of Bacteriology. It is divided into three sections. The first section deals with morphology, physiology, cultivation and classification of bacteria. The others give the important features of the various genera and the diagnestic procedures. There are 110 full colour illustrations. The house of E. & S. Livingston are congratulated on the high standard of this presentation. I strongly recommend it to the students of bacteriology as it would be of immense value to them.

Whitby and Hynes' Medical Bacteriology : Edited by Martin Hynes, M. D. F.R.C.P., F. C. Path. (Pp viii + 495, 40s). London; J. & A. Churchill Ltd, 8th Ed., 1964.

This standard work for medical students has been revised and brought up-to-date. It provides a concise and practical presentation of microbiology. It will be a useful companion for the undergraduate.

The Pathogenesis of Leprosy : Ciba Foundation Study Group No. 15 : Edited by G. E. W. Wolstenholme, O.B.E., M.A., M.R.C.P. and Maeve O'Connor, B.A. (Pp ix+101, 15 s). London, J. & A. Churchill Ltd., 1963.

This booklet incorporates the proceedings of a conference held on 16th January, 1963. The symposium was sponsored by the Ciba Foundation and was presided over by late Dr. J. A. Doull. Various aspects of leprology were discussed. Dr. G. Weddel observed in vivo preference of the rat Schwann cell for M. lepraemurium and the human Schwann cell for M. leprae. He also stated that once the bacilli are in the body M. leprae are disseminated primarily via the blood stream to their target organs — the Schwann cells. Other interesting papers presented were on cytopathology of the Virchow cell of human leprosy, applicability of experimental leprosy to the study of human leprosy, experimantal studies on human leprosy and leprosy bacill in mouse foot pads.

This book is recommended as a stimulus to those interested in Laprology.

Biochemical Values in Clinical Medicine: By Robert Duncan Eastham, B.A.,M.D., D.C.P, Dipl. Path. Second Ed. 1963. (Pp 160,15 s). Bristol: John Writing & Sons Ltd.

"Pak: Jour: Hlth., 15 (1)"

This book has been revised and brought up-to-date. The Author has provided an accurate brief account of the different conditions affecting the biochemical tests. This would be of great help to the Clinicians and the Junior House Staff to interpret the findings of different biochemical tests carried our in the Laboratory.

Child Health in the Tropics: Edited by J.B. Jelliffe, M.D., F.R.C.P., F.A.P.H.A., D.C.H., D.T.M. & H. Second Ed. 1964. (Pp v+152,9 s). London: Edward Arnold (Publishers) Ltd.

This book contributions of seven experts dealing with the main aspects of child health including clinical, preventive and social. It would be a useful guide for the medical and para-medical personnel.

Environmental Health and Hygiene: Edited by Evelyn Pearce, S.R.N., 1964. (Pp 294, 25 s) London: Faber & Faber.

Miss Evelyn Pearce is an experienced tutor sister and author of many books on nursing. This is an interesting book and deals with improvements in our environment. It is divided into six parts which dealing with a different aspect. It includes chapters on Health Education and certain contemporary social problems for example unmarried mother, prevention of suicide etc. It is well written and adequately illustrated work. It is recommended to Nurses, Lady Health Visitors and medical-social workers.

ZAFFAR-UL-AZIZ
M.B.B.S. (Pb.), D. Bact. (London),
M.C. Path. (London), F.I.C.S.