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JOINT OIHP/WHO STUDY-GROUP ON BILHARZIASIS IN AFRICA

Report on the First Session

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JOINT OIHP/WHO STUDY-GROUP ON BILHARZIASIS IN AFRICA

First Session

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The report on the first session of this study-group was originally issued in mimeographed form as document WHO/Bilharz/1, 10 November 1949.

JOINT OIHP/WHO STUDY-GROUP ON BILHARZIASIS IN AFRICA*

Report on the First Session[1]

The Study-Group on Bilharziasis in Africa, set up jointly by the Office International d'Hygiène Publique and the World Health Organization, met in Cairo, in the office of the Bilharzia Snail Destruction Section of the Ministry of Public Health, from 24 to 29 October 1949.

In addition to its closed meetings, the study-group held, on 25 and 26 October, four open meetings, in which the following took part:

Dr Abdel Kerim El Makrahi, Assistant Director, Bilharzia and Ankylostoma Section, Ministry of Public Health, Cairo, Egypt

Dr Abdel Khalek, Director, Bilharzia Snail Destruction Section, Ministry of Public Health, Cairo, Egypt

Dr N. Ayyad, Assistant Director, Bilharzia Snail Destruction Section, Ministry of Public Health, Cairo, Egypt

Dr C. H. Barlow, Expert, Bilharzia Snail Destruction Section, Ministry of Public Health, Cairo, Egypt

M. Fahmy, Assistant, Bilharzia Snail Destruction Section, Ministry of Public Health, Cairo, Egypt

Dr A. Halawani, Director, Fouad I Institute for Research and Tropical Diseases Hospital, Cairo, Egypt

Dr I. S. Hilmy, Professor of Parasitology, Fouad I University, Cairo, Egypt

Dr R. Kuntz, US Naval Medical Research Unit No. 3, Cairo, Egypt

Dr S. Madwar Bey, Director General, Endemic Diseases Department, Ministry of Public Health, Cairo, Egypt

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* Formerly entitled "Joint OIHP/WHO Study-Group on African Schistosomiasis"; see p. 14, footnote 5.

[1] The Executive Board, at its fifth session, adopted the following resolution:

The Executive Board

(1) NOTES the report of the Joint OIHP/WHO Study-Group on African Schistosomiasis on its first session, and

(2) AUTHORIZES its publication;

(*Off. Rec. World Hlth Org.* **25**, 6)

M. Marzouk, Assistant Director, Bilharzia Snail Destruction Section, Ministry of Public Health, Cairo, Egypt

Dr M. Nazif Bey, Under-Secretary of State, Ministry of Public Health, Cairo, Egypt

Dr J. Newsome, Bilharzia Research Unit of the British Medical Research Council, Cairo, Egypt

Dr A. Yehia Bey, Assistant Under-Secretary of State, Ministry of Public Health, Cairo, Egypt

Chairmanship

After the opening of the session by Sir Aly T. Shousha, Pasha, who gave the history of the bilharziasis problem in WHO, the study-group elected as Chairman for the session Dr M. Abdel Azim Bey.

Agenda

The study-group adopted its agenda, which covered the following points:

(1) Geographical distribution of *Schistosoma haematobium* and *S. mansoni* and of their vector snails. (The terms of reference of the study-group did not include *S. japonicum*.)
(2) Significance of bilharziasis as a cause of mortality, morbidity, and loss of productive power.
(3) Susceptibility and immunity to *Schistosoma* infection.
(4) Diagnostic methods.
(5) Control methods.
(6) Recommendations for WHO action.

Observations and Recommendations

The study-group agreed on the following observations and recommendations:

1. Geographical Distribution of Schistosoma haematobium and S. mansoni and their Vector Snails

1.1 In order to get a complete and more accurate picture of the geographical distribution of human bilharziasis throughout the world than that at present available, surveys should be made in the various countries of the incidence and of the intensity of the infection caused in humans by the various species of *Schistosoma*, using materially standard and therefore uniform techniques. In any case, every surveyor should specify in detail the methods used.

The knowledge to be obtained by such surveys is necessary to appreciate the social as well as medical importance of the disease and to enable national and international health-authorities to plan and carry out effective control measures.

Countries with adequate administrative and technical facilities, including trained staff, should be invited by WHO to make surveys of their territories, according to standard techniques, while countries without such facilities should receive the help of WHO in the form of individual experts or teams furnishing advice on survey methods or carrying out themselves sample surveys.

1.2 In order to determine the geographical distribution of the snail vectors, uniform classification and nomenclature are necessary. Such classification should be based on the internal morphology of the snails and on their ecological characters, rather than on the mere external characters of the shells, a system which has hitherto caused unnecessary complication and confusion in the classification. Identification can be carried out only by malacologists.

In order to facilitate and standardize such identification, WHO should make arrangements for competent specialists to undertake identification of snails sent to them by survey workers in the different countries. Specimens should preferably be sent alive, or at any rate in fluids [2] preserving the internal organs. Countries which are in a position to do so should entrust to malacologists the surveying of the snail distribution in their territory. Those who do not possess the necessary specialists should avail themselves of such specialists whose services may be provided by WHO, either in field surveys or in central identification laboratories.

1.3 Pending the surveys, WHO should endeavour to obtain from national health-administrations all the information they possess on bilharziasis incidence and intensity, including figures of patients treated in hospitals and outpatient clinics.

2. Significance of Bilharziasis as Cause of Mortality, Morbidity, and Loss of Productive Power

Bilharziasis, even when not associated with other infections, affects the physical and mental development of children and greatly diminishes the strength and productive power of adults. This is particularly true of *S. mansoni* infection.

In many countries in which bilharziasis is endemic, evidence already available indicates that it is a public-health problem second only to malaria.

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[2] In order to prevent retraction, the live snails may be placed in water containing a few menthol crystals before being immersed in the preservative.

Furthermore, the debilitating nature of the disease is a markedly deterrent factor in food production. In view of these facts the disease should receive more consideration than it has in the past.

In certain areas the impaired productivity of infected individuals is not obvious owing to the fact that they unconsciously adapt their working efforts and output to their lowered strength. But when such patients are subjected to heavier labour, as happened during the war, or in the execution of public works, irrigation projects, etc., their physiological balance breaks down, and subjective as well as objective symptoms of bilharziasis suddenly appear.

Quantitative knowledge is highly desirable concerning the relationship between the incidence and intensity of the infection and the loss of productive power of the individual and its economic consequences. WHO should encourage studies to obtain such knowledge.

3. Susceptibility and Immunity to Schistosoma Infection

Practically all individuals are receptive to *Schistosoma* infection, irrespective of race, age, and sex.

Too little is known about the development of an immunity following infection. This question, which has considerable epidemiological importance, should be the object of further investigation.

It has been observed in isolated instances that infections which are not renewed by further exposures tend to disappear spontaneously in a few years, as the worms in the body gradually die out. Their life span, which may extend to some 20 years, does not generally exceed 5. This may lead to a gradual disappearance of the manifestations of the disease in areas where the streams are no longer infested by vector snails.

4. Diagnostic Methods

4.1 In view of the number of diagnostic methods in use and of the lack of comparability of their results, the adoption of uniform techniques is necessary for the proper and comparative interpretation of the results of surveys in various areas and for assessing the value of both preventive and curative measures.

4.2 Diagnosis of intestinal bilharziasis

4.2.1 The smear method gives a low proportion of positive findings, but has the advantage of being easy to carry out. The smear is more likely to be positive when taken from mucus or blood in the stools.

4.2.2 Rectal swab gives a high proportion of positive findings but is objected to by certain classes of the population, particularly by women. A shallow notched glass probe, which may be used by the patient himself, is effective and may elicit less opposition than the swabbing made by the physician.

4.2.3 Precipitation, in a conical glass, of an emulsion of stools in normal or concentrated saline solution, gives a high percentage of positive results. Centrifugalization of the sediment may reveal ova which otherwise might be missed.

4.2.4 Hatching of ova : the use of Fülleborn's method, i.e., hatching the ova in water and observing the miracidia with the help of a hand lens or through projection on to a screen, yields a very high percentage of positive results.

4.2.5 Proctoscopy and rectal biopsies may give positive results where other methods fail but are not practical for field work.

4.2.6 In view of the fact that the discharge of eggs is not constant, and that the distribution of ova in the stools is not uniform, it is desirable in dealing with individual infections to repeat examination when the first findings prove negative.

4.2.7 The use of chemicals to improve the procedures, such as the acid-ether technique and the use of 0.5% glycerin, or sodium sulphate, as wetters in the diagnosis of intestinal infestations, should be the subject of further trials, particularly for the detection of ova in very light infections.

4.3 Diagnosis of urinary bilharziasis

4.3.1 Specimens of urine to be examined should be taken from the last part of a micturition, following physical exercise.

4.3.2 Specimens are to be left for half an hour in a conical glass and the sediment examined directly or, in the case of light infection, after centrifugalization. The examination may be made macroscopically by observing the hatching of the ova, or microscopically. The method gives a very high percentage of positive results but fails to detect very light infections.

4.3.3 Follow-up of the cases and repetition of the examinations are at present the best means of reducing the percentage of missed cases.

4.4 Diagnosis of bilharziasis by antigenic tests

4.4.1 The results obtained by various workers using intradermal tests and complement-fixation reactions show considerable discrepancies.

4.4.2 As with the antigens so far used—of which the cercarial antigen is the best—positive reactions may be obtained not only with bilharziasis

but with other helminthic infections as well, these tests are significant only when negative.

4.4.3 With the cercarial antigen now available, the complement-fixation reaction gives more reliable results than the intradermal tests, but its use is bound to be restricted to verifying doubtful diagnoses, such as those of single-sex and light infections, and as an eventual criterion of cure.

4.4.4 A skin test truly specific for bilharziasis would be of considerable practical value in the diagnosis of the infection in mass surveys of untreated populations, as the test can be read within 15 minutes, and further research is desirable to obtain a more specific antigen for such a test.

5. Bilharziasis Control

5.1 Considering the life-cycle of the parasite it would appear a priori that this cycle could be broken, and therefore bilharziasis could be broken, and the disease could be controlled by the prevention of the pollution of streams, the destruction of the intermediate hosts (snails), and the sterilization of the human reservoir.

Although a number of methods has yielded results that appear to make the above objects attainable, yet no one single method has proved entirely or permanently successful and brought about the eradication or even satisfactory control of the disease. It would appear that a combined attack on the disease by several methods is required to meet with success.

5.2 Prevention of pollution of streams

This requires not only the provision of pure water and of sanitary latrines, but even more a change in the customs and habits of the population, which education and propaganda cannot alone modify.

5.2.1 In irrigated agricultural areas, such as those of the Nile delta, the peasant, even if provided in his village with pure piped water and sanitary latrines, will be able to make use of them only to a limited extent, as he and his family spend the whole day in the fields, away from home, under permanent temptation to use the streams, such as irrigated ditches and canals, for all purposes.

5.2.2 The construction of villages away from streams or the removal of canals away from villages have proved unsuccessful when not accompanied by a change in the habits of the population.

5.2.3 Bored-hole latrines have been, in very large-scale experiments, installed inside houses of peasants in many villages of Egypt. They had no evident effect on the incidence of bilharziasis.

5.3 Measures against cercariae

5.3.1 The storage of water in containers free from snails makes it safe as regards cercariae. The time required for such safety depends upon the temperature (24 hours for example in Egypt, longer in colder countries).

5.3.2 Chlorine in a concentration of 1 part per million kills cercariae within 30 minutes. It is therefore essential for the purification of public waters as cercariae may pass through sand filters.

5.3.3 Bleaching powder may be used to protect labourers working in polluted waters.

5.3.4 Cercariae repellents in the form of ointments or solutions for impregnation of clothing have given promising results, but their use is bound to be limited to special circumstances and population groups (soldiers and labourers in infested waters).

5.4 Destruction of snails

5.4.1 *By biological methods*

5.4.1.1 Drying is of little value since snails resist long periods of drying, sometimes exceeding a year; therefore, alternation of filling and drying irrigation canals cannot control snail infestation.

5.4.1.2 Canal clearance and weed destruction are not in themselves effective methods of snail control, but may be used with effect to reduce the amount of copper sulphate required for snail destruction.

5.4.1.3 Covering the canals is a reliable method of snail control, as it prevents the growth of weeds on which snails feed, and also protects water against pollution, but it is very expensive.

5.4.1.4 Alternation of canals, i.e., changing the courses by digging new canals and filling old ones, is futile, as newer canals get infested with snails after a short period (two years).

5.4.1.5 Biological control of snails by means of natural enemies, such as ducks, fish, is useful but practicable only in a limited range of circumstances.

5.4.2 *By chemical methods*

5.4.2.1 Destruction of vector snails by chemicals is at present the best available method, as it has the advantage of not requiring the active co-operation of the population.

5.4.2.2 Copper sulphate is the chemical most commonly used as a snail destroyer in Egypt and in a number of other countries.

5.4.2.2.1 In Egypt, a country where irrigation bilharziasis prevails, the present situation is as follows:

5.4.2.2.1.1 An attempt is made to obtain a 20 parts per million concentration of copper sulphate in those parts of the canals and streams where the snails are abundant, i.e., the weed-grown marginal strips where the current is sluggish and the water shallow.

5.4.2.2.1.2 In large running canals or streams, only such marginal strips are treated. This is done by dipping into the water jute bags containing 4 kg. of copper sulphate crystals, hanging from the end of a long wooden pole. The dipping is done by men walking upstream along the banks. A bag of 4 kg. is sufficient to treat 50 metres of one side of the canal.

5.4.2.2.1.3 In small and shallow canals, the whole volume of water is weedy and therefore treated. This is done by dipping bags hanging from two strings held by men walking upstream on both banks.

5.4.2.2.1.4 Snails are destroyed within 4 to 15 minutes, i.e., before they have time to escape the action of the chemical by burying themselves into the muddy bottom of the canals.

5.4.2.2.1.5 Dosage of copper sulphate has to be adjusted to the amount of silt and organic matter in the water, including weeds — hence the desirability of previous removal of weeds.

5.4.2.2.1.6 Copper sulphate has unfortunately no action on the eggs of the snails. The eggs develop within 12 days into snails, which mature in 6 to 8 weeks, according to temperature, and produce a fresh generation of snails requiring repetition of the " sulphation ".

5.4.2.2.1.7 " Sulphation ", as described above, should be repeated every three months.

5.4.2.2.1.8 Copper sulphate used at the concentrations required for snail destruction has no deleterious effect on human beings and other mammals.

5.4.2.2.2 In Southern Rhodesia — a country where the natural water courses are infested with snails, and where streams dry up for eight months each year — sulphation is applied at the end of the rainy season, shortly before the streams become dry. It is proposed to sulphate also after the first rain.

5.4.2.3 Destruction of snails by chemicals other than copper sulphate: Certain chemicals such as the gamma isomer of benzene hexachloride (gammexane) and others have been tried recently in Egypt, with encouraging results.

In the USA, 541 chemical compounds have been tested systematically for their possible lethal action on snails. Of those which proved active and

were not unduly expensive, penta-bromophenol and penta-chlorophenol have been tried in the field and found effective at concentrations of 10 parts per million. Confirmation and further research is highly desirable.

Research on the physiology of the snail intermediate host is also desirable for the development of more effective molluscicides.

5.4.3 *By physical methods*

5.4.3.1 The lethal effect on snails of dynamite explosions in water courses, which has already been observed by certain workers, should be verified and further investigated.

5.4.3.2 The effect on snails of supersonic waves and of electrical currents has been tried, but the results so far obtained do not make it possible to consider these methods as practical.

5.5 Treatment of bilharziasis

5.5.1 Apart from its beneficial effect on the individual, treatment plays an important and necessary part in the prevention of the disease.

5.5.2 The time-tried antimonial compounds, whether given intravenously (sodium or potassium antimonyl tartrate) or intra-muscularly (Fouadin), have proved to be beneficial to the patients when given in adequate doses, i.e., taking into consideration their age and weight and the intensity of their infection.

5.5.3 Treatment by these compounds has in Egypt resulted in a considerable reduction of the frequency of complications of the disease.

5.5.4 Although a large proportion of infections is cleared by treatment, under Egyptian conditions the incidence of the infection eventually returns to what it was before treatment. This may be explained by:

(*a*) The possible development of worms which were immature but present during the time of treatment.

(*b*) True relapses, the frequency of which is not yet determined owing to the difficulty of the follow-up of cases, but which are common particularly in patients who have not completed the full course of treatment. (Relapses are particularly common in children on account of their rapid excretion of the drug.)

(*c*) The growth of a generation of children who were too young to receive treatment and became infected.

(*d*) Finally, the reinfection of many patients, cured, but continuously exposed to invasion.

5.5.5 The common methods of administering the antimonial compounds, particularly through the intravenous route, are long (3 to 6 weeks) as well

as painful, and entail considerable loss of time to the patients, especially those coming from a distance.

5.5.6 Recently an " intensive " form of treatment has been developed in Southern Rhodesia, reducing the course to a two days' period.

5.5.7 In Egypt, this method has been modified, extended over four or five days, as many Egyptian patients did not stand the intense short treatment without toxic symptoms, owing to the fact that they were weakened by several other parasitic diseases.

The immediate effects of the intensive treatment are excellent (100% of apparent cures) even though the possibility of a high relapse-rate is admitted. The latter should be the subject of investigation.

5.5.8 Recently, a new drug, Miracil D or Nilodin,[3] administered orally, has been tried with varying degrees of success. Among the drawbacks of the drug are its exceedingly bad taste (coating of the tablets may render absorption irregular) and the irritation which the drug produces in the gastro-intestinal tract.

More research is needed on the curative potency of this drug with a view to obtaining analogues with lesser toxicity and greater effectiveness.

5.6 Education of the public

No measure of bilharziasis control can be effective without the support of the population. This in turn requires understanding which only education and propaganda may provide.

Educational propaganda on the cycle of the infection and means to avoid that infection should be directed particularly to schoolchildren and therefore to schoolteachers.

Irrigation engineers and agricultural authorities should be made aware of the relationship between irrigation and the spread of disease.

5.7 Organization of bilharziasis control in Egypt

The study-group was informed by competent authorities and a number of specialists of the history, present development, and policy of the bilharziasis-control services in Egypt and saw instances of treatment of patients and snail destruction operations in both the Fayum and Kalyub provinces.

The study-group was impressed by the extent and difficulty of the problem which, under conditions of perennial irrigation, bilharziasis constituted for the authorities concerned.

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[3] 1-methyl-4-β-diethylaminoethylamino-thioxanthone hydrochloride

The study-group wished to record its appreciation of the work done. The work, in its opinion, was directed and carried out along the lines indicated by the most recent available scientific knowledge, much of which has been developed in Egypt itself.

The study-group believed that renewal of sulphation every three months would materially improve the efficiency of the snail control and that the cost of the additional amount of copper sulphate required would be amply repaid by the results obtained, i.e., more complete snail destruction, lessened chance of reinfection, and consequently improved productivity of the agricultural population.

As regards treatment, the study-group felt that, while extension of treatment facilities to the whole of the Egyptian territory had resulted in a lesser frequency of the complications of the disease, intensification of curative work, preferably by shortened treatment courses, was necessary to diminish the incidence of the infection.

The study-group was of the opinion that, with the present admittedly imperfect methods available for both curative and preventive work, both intensive snail destruction and treatment were necessary to bring about the control of bilharziasis.

6. Recommendations for WHO Action

6.1 Apart from the researches and studies which WHO should undertake, or stimulate and co-ordinate, on the problems mentioned in this report on which the need for further investigation has been stated, the study-group recommends :

6.2 Bilharziasis surveys [4]

6.2.1 The surveys on the geographical distribution of human bilharziasis and its vector snails mentioned under paragraph 1.2 should be carried out by individual experts to be selected and sent by WHO to the countries and territories in which the presence of bilharziasis is known or suspected, but for which adequate information is not available.

Wherever necessary, the experts should be provided with technical assistants.

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[4] The Executive Board, at its fifth session, adopted the following resolution :

The Executive Board ...

(3) REQUESTS the Director-General

(*a*) to make the necessary arrangements for the carrying out of the bilharziasis surveys recommended by the study-group, ...

(*Off. Rec. World Hlth Org.* **25**, 6)

6.2.2 While in an undeveloped territory the expert and his technical assistant will have to collect information by themselves through sample surveys, the main task of the expert will be to stimulate interest in the disease, collect available data, and demonstrate methods of survey.

6.3 Training in bilharziasis survey and control

The need of trained personnel for bilharziasis survey and control work will be increasingly realized as knowledge as to the incidence is brought to light through the activities of WHO.

It is therefore recommended that WHO grant fellowships to persons entrusted by health administrations with the initiation of bilharziasis survey or control work to enable them to attend appropriate training courses and/or visit endemic areas where field demonstrations could be arranged.

WHO might also, if necessary, assist, financially and otherwise, in the organization of specialized bilharziasis training in a centre dealing with the disease, should the number of persons requiring such training justify it.

6.4 Name of the disease and of its agent [5]

The study-group desired that the priority of Bilharz, as describer of the causative parasite of bilharziasis, should be recognized and that accordingly the name of *Bilharzia* be retained for its genus, and the name bilharziasis for the disease.

The study-group in consequence requested WHO to take the appropriate steps with the Nomenclature Committee of the International Zoological Congress, and with the WHO Expert Committee on Health Statistics as regards, respectively, the name of the parasite and of the disease.

6.5 Relation between irrigation schemes and spread of bilharziasis [6]

6.5.1 The introduction or development of irrigation schemes, as well as the change from basin to perennial irrigation, has always resulted in a considerable increase in the incidence and intensity of bilharziasis wherever

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[5] The Executive Board, at its fifth session, adopted the following resolution:

The Executive Board ...

(3) REQUESTS the Director-General ...

(*b*) to take appropriate steps for the revision of the international designation of bilharziasis and its causative agents.

(*Off. Rec. World Hlth Org.* **25**, 6)

[6] The Executive Board, at its fifth session, adopted the following resolution:

The Executive Board,

Considering the danger to health entailed by the establishment of irrigation schemes in areas where bilharziasis is present, if the necessary sanitary precautions are not taken at all stages of the development of the schemes,

that infection existed or was introduced by outside labourers. The severity of the infection may be such as to cause the abandonment of an irrigation scheme created at considerable expense.

6.5.2 The study-group recommended that WHO bring the danger of irrigation without proper sanitary and snail control to the notice of the United Nations and the Food and Agriculture Organization, as well as of all countries contemplating the introduction or extension of irrigation schemes with a view to economic development or the increase of food production.

6.5.3 The following precautionary measures, which might mitigate the sanitary risk involved, should be brought to the notice of the international and national organizations concerned.

6.5.3.1 *Administrative safeguards*

6.5.3.1.1 Every irrigation scheme should be submitted at the earliest planning stage to the public-health authority for consideration.

6.5.3.1.2 Approval by the public-health authorities should be a condition of its authorization and financing from public funds.

6.5.3.1.3 Public-health authorities should be represented on the governing body of any irrigation scheme established or sponsored by governments or international organizations.

6.5.3.2 *Technical safeguards*

6.5.3.2.1 Each irrigation scheme should possess a medical and sanitary organization capable of:

6.5.3.2.1.1 examining and if necessary treating for bilharziasis the whole population of the area to be irrigated, prior to and during the irrigation, also all the labourers who may enter the area, together with their families; and

6.5.3.2.1.2 controlling the vector snails in the streams and canals.

6.5.3.2.2 Villages should be established—or removed—away from streams and canals to reduce gross pollution of their waters and the use of the said waters for drinking, washing, and bathing purposes.

REQUESTS the Director-General

(*a*) to call the attention of governments and of the appropriate bodies and specialized agencies of the United Nations interested in irrigation to such danger and to the safeguards recommended by the Joint OIHP/WHO Study-Group on African Schistosomiasis; and

(*b*) to make appropriate arrangements to provide the said governments and organizations with the technical advice which they may require.

(*Off. Rec. World Hlth Org.* **25**, 6)

6.5.3.2.3 For the same reason, villages should be provided with piped potable water, together with installations for washing, bathing, and laundering. Houses and working camps should be provided with sanitary privies.

6.5.4 The study-group stressed the fact that, whatever the cost of the measures outlined above might be, it would be amply compensated by the maintenance of the health and of the productive power of the labourers and of their families in the irrigated areas.