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ERADICATION OF INTESTINAL PARASITOSIS IN JAPAN

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Introduction

Japan has been known for a long time as a country having a high incidence of parasitic infections. The result of the first systematic survey for parasitic infections, carried out during the period from 1918 to 1922 in seven prefectures by the government, showed that the general infection rate was as high as 86.7% on average with 96.5% as the highest. Among the various parasites the infection rate for Ascaris was the highest at 70.1%, on average. Based on the result of the survey, the government began parasite control activities on a nationwide scale, especially against Ascaris since 1922. As the result, the prevalence rate of Ascaris gradually decreased year by year and in 1941 was reduced to 34.7%.

During and just after World War II, food supply and environmental sanitation in Japan deteriorated seriously and remained so for several years. People, even in urban areas, utilized all available land for vegetable gardens and night-soil was used as fertilizer. Thus, parasitic diseases became once again a national problem. In particular, the infection rate of Ascaris increased to 62.9% throughout Japan in 1949 and there were some areas where it reached almost 100%. Eventually, there was a great popular demand for the control of ascariasis.

In order to cope with this serious problem, parasite control movements were initiated all over Japan to protect the health of the community, especially children. Since then, the prevalence rates have gradually decreased, year by year, and today it may safely be said that Ascaris and hookworms have almost been eradicated in Japan (Table 1).

Parasite control activities in Japan

Originally, public health activities such as parasite control operations were the duty of health centres. However, at that time, the diseases which caused the highest death rates were tuberculosis, pneumonia and bronchitis. The government, therefore, had to deal with these diseases as an emergency and had to develop and apply policies for their prevention and treatment. Thus, the government decided that responsibility for parasite control should be transferred to voluntary organizations.

Japan Association of Parasite Control (JAPC). Such voluntary organizations were first set up to start control activities in Tokyo and Osaka in 1949, and then private organizations and laboratories were established in other prefectures. These organizations developed rapidly. However, to ensure widespread and systematic coverage, a powerful central organization was needed and, so the Japan Association of Parasite Control (JAPC) was founded in 1955. By agreement, the voluntary organizations and laboratories became branch offices of the JAPC. Each branch office has, in general, two sections - health education and laboratory.

The JAPC carried out the main control measures, consisting of "mass-examination and mass-treatment", through these branch offices all over Japan. As the movement developed, the government formulated guidelines for parasite control, based on the accumulated experiences of the Association (1958). In the same year, the "School Health Law" was enacted and stool examinations for school children became obligatory. Consequently, the government came to allocate a budget for this purpose. This active support by the government resulted in further development of activities by the private sector.

It should be noted that, among these private organizations or laboratories, only those working on a non-profit basis and those which could get good support from the academic field survived and make significant contributions to the parasite control movement.

The experience in Japan clearly indicated that, for success in parasite control, close cooperation between the private sector, the government and the academic field was essential.

Theory and practice of parasite control in Japan

There was a dispute, in the initial phase of the activities, about the which measures should be adopted: the improvement of environmental sanitation or mass-treatment. Both were clearly recognized as of prime importance in parasite control but it was feared that the mass-treatment alone would fail in control without the prevention of reinfection by improvement of the environment.

It was also realized that the improvement of environmental sanitation would require a great amount of money and that it would be long before its effects became visible. Finally, it was decided to leave the improvement of the environment to the government and other organizations and to initiate a nationwide parasite control programme by means of mass-examination and mass-treatment under the JAPC.

This policy soon proved to be effective by the declining prevalence rates, although this decline was also to be attributed in part to public health education and improvements in general sanitation, nutrition and socioeconomic levels which occurred concurrently.

Control measures and their applications

Mass-treatment. The essential feature of Ascaris control in Japan was the practice of periodic mass-examinations and mass-treatment. Mass-treatment not only brings about individual cure but, even more important, improves the general situation of the community by reducing the infective pool. Therefore, periodic mass-treatment is, in itself, a preventive measure, having both primary and secondary effects.

(i) Primary preventive effect of mass-treatment. When mass-treatment is repeated, the number of infected persons is rapidly reduced and thereby the total worm burden in the community is diminished. In general, the infection rate which has been reduced by a single mass-treatment increases sooner or later to the pretreatment level, but the rate of increase of reinfection is relatively slow. If the mass-treatment is repeated before the infection rate reaches the initial pretreatment level, the incidence in the community is decreased and the rate of reinfection is slowed even more.

It has been reported that the life span of Ascaris eggs under natural environmental field conditions would be 10 months or more and that the monthly rate of new infections and reinfections would be about 10%, among the inhabitants of a closed community with a prevalence rate of as 70-80% (Kobayashi 1954; Komiya 1959).

However, the longevity of the infective eggs in soil varies widely, from 1-10 years, depending on geographical conditions (WHO, TRS 379, 1967; TRS 666, 1981). Meanwhile it was reported that the longevity of Ascaris eggs in soil may be shorter than 2-3 years in Korea (Seo and Chai 1980).

(ii) Secondary preventive effect of mass-treatment. As the infection rate is reduced, the percentage of persons discharging only infertile Ascaris eggs, among those positive for Ascaris, may increase. For example, such a rate would be around 20% if the total prevalence was at the 40-50% level, while it could rise to 80% or more, if the overall prevalence diminished to less than 5%. This means that the proportion of persons actually constituting the source of infection would be only 1% although the total infection rate was 5%. Under this condition, eradication of Ascaris is considered to be feasible (see Table 2 and Fig 1).

Frequency, timing and duration of mass-treatment. As to the frequency of mass-treatment in a year, there is no generally accepted standard. It has been known in Japan that there is an apparent tendency to seasonal fluctuations in the prevalence rate of Ascaris during the year, i.e. the prevalence rates are always higher in April-May and October-November (Kobayashi 1954, Yajima 1955), although a peak of the rate was shown only in autumn in the northern part of Japan (Fig 2). Accordingly, if mass-treatment were performed biannually in June-July and November-December, the results would be generally more effective.

For satisfactory control of Ascaris, mass-treatment should be continued until reinfection no longer occurs. In Japan, it took 7 years to reduce the nationwide prevalence from 27.8% to 10.4% and 16 years from 8.2% to 0.1%, by the annual mass-treatment scheme. Using mathematical analysis and a theoretical model for evaluation of control efficacy of soil-transmitted helminthiasis, the results achieved in Japan were not as good as might have been expected, perhaps because insufficient anthelmintics were used (Hayashi 1980).

Stool examination. A highly efficient, accurate and economical technique for stool examination was urgently needed for dealing with mass-examinations. The cellophane thick smear technique (Kato and Miura 1954) proved to meet this need (Komiya and Kobayashi 1954).

Anthelmintics. In selecting anthelmintics for mass-treatment, the ideal drugs would be non-toxic, effective in a single dose, cheap and easy to administer. For the mass-treatment of ascariasis a combination of santonin (50mg) and kainic acid (10mg) was used in Japan until the new broad spectrum anthelmintics were developed.

Environmental measures. Among problems belonging to this category, the use of night-soil for farming should be considered as the most important, as it plays a principal role of disseminating parasite eggs. In this connection, the following procedures were thought to be effective for preventing infections through night-soil.

(i) Killing eggs by fermentation of night-soil. It has long been proved that Ascaris eggs may be killed when night-soil is fermented through long storage in a tank. An improved privy and storage tank in the field were designed so that the night-soil would be stored for 5-6 months before use.

(ii) Killing eggs by heating. Based on the fact that the parasite eggs do not survive high temperatures, the following methods were considered: (a) utilizing the heat from incinerating city refuse to raise the temperature of night-soil in the storage tank; (b) passing steam into the transport tank car for night-soil; and (c) mixing night-soil into compost.

(iii) Killing eggs by chemicals. Among many chemicals examined, the following were found to be useful in killing eggs in night-soil; (a) carbon disulphate; (b) sodium nitrite; (c) oil of mustard; and (d) thiabendazole.

(iv) Separation of urine faeces. A special latrine for separating urine and faeces was designed and only urine was used as fertilizer.

Although much consideration and attention have been given to the night-soil disposal, it is true that the methods described have not been much used.

(v) Elimination of eggs from vegetables. It is well known that green vegetables grown with night-soil and eaten raw or pickled are the most important source of Ascaris infection. It was recommended that they should be treated with hot water or with synthetic detergent before eating and, in addition, the cultivation of clean vegetables by chemical fertilizer was promoted.

Health education of the public

Health education should occupy an important part of parasite control programmes as their success depends largely upon the cooperation of the community. The cooperation of the leaders of villages and towns is most important, whatever the type of control used and, to secure their help, meetings with the various community groups, such as the agricultural cooperative society and the women's association are also essential. Health education can be very effective, but its efficacy may depend on the understanding and intentions of school masters and teachers. The health education includes information about parasites, route of infection, damage caused by parasites, methods of prevention of infection, etc.

When the infection rate has declined considerably people's wish for the control programme may cool off and every effort should be made to keep up the interest, at least until the goal is reached of parasitic infections being no more a public health problem.

Evaluation of the programme

The success of a parasite control programme can be measured in terms of a reduction in prevalence rates, compared with the baseline statistics obtained in an earlier survey. However, an important aspect of evaluation, frequently overlooked, is the assessment of benefits, which cannot be measured in terms of progress towards the expressed goal of the project, namely, the improvement in the health, standards of living and social structure of the community.

According to the government report in 1951, 4 378 deaths due to parasites were recorded by physicians throughout Japan. This number decreased year by year, reaching 168 in 1964 and is supposedly very small at present. Concerning this problem, however, it should be considered whether or not parasitic infections might actually be the cause of more deaths, as in some cases it is often difficult to determine the true cause of death. At any rate, these data can serve as a rough indication of the efficacy of our control programmes.

Summary

In Japan, great efforts have been exerted for the control and eradication of soil-transmitted helminths. In the present paper, the theoretical base and an outline of Ascaris control programme have been described. The following are considered to be main factors which contributed to the success of parasite control activities.

1. Tripartite collaboration: there was a cooperation among the government officers, scientists and the private sector.

2. Selection of proper targets: selecting school children as the first target was proved to be a good starting point for developing an effective programme.

3. Maximum utilization of existing resources: public health nurses, midwives, community leaders, school nurses, etc., were mobilized to the maximum extent.

4. Credibility of health workers: public health nurses and other related personnel in city, town and village offices as well as health centres won the confidence of the community through their active participation.

5. People's participation: people became motivated to solve problems by themselves.

6. Legal support: the government supported parasite control activities by enacting related laws such as the "School Health Law".

7. Devotion of people involved: there were many dedicated people at various levels working for the improvement of the people's health.

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TABLE 1: INCIDENCE OF ASCARIS AND HOOKWORM INFECTIONS IN JAPAN 1918-1984

Year	No. exam.	Ascaris(%)	Hookworm(%)	Year	No. exam.	Ascaris(%)	Hookworm(%)
1918-1922	13,761	70.1	28.6	1961	7,444,796	12.8	2.8
1922-1926	1,157,373	61.3	23.2	1962	6,729,356	10.4	2.8
1927	670,914	55.1	12.6	1963	6,415,619	8.2	2.8
1929	554,258	56.4	13.7	1964	6,031,346	6.5	2.6
1931	593,443	45.9	12.1	1965	5,734,960	5.3	1.8
1933	501,658	47.1	11.2	1966	5,258,999	4.2	1.3
1935	609,331	42.0	11.6	1967	4,588,011	3.7	1.1
1937	608,496	38.6	10.0	1968	4,035,043	2.9	0.9
1939	767,779	36.4	10.6	1969	3,746,543	1.9	0.6
1941	520,254	34.7	8.9	1970	3,626,768	1.6	0.5
1943 *	165,068	36.7	3.7	1971	2,407,061	1.1	0.3
1945 *	413,241	51.8	9.6	1972	1,841,350	0.7	0.3
1946	821,765	57.1	5.8	1973	1,663,146	0.6	0.2
1947	2,055,274	60.5	3.3	1974	1,329,260	0.4	0.2
1948	3,334,597	62.5	3.1	1975	1,081,222	0.3	0.2
1949	5,559,078	62.9	3.5	1976	984,982	0.3	0.1
1950	7,026,499	59.6	4.5	1977	1,029,120	0.2	0.1
1951	6,552,143	55.1	4.8	1978	907,352	0.2	0.1
1952	6,191,612	48.3	4.9	1979	890,699	0.1	0.05
1953	7,107,763	43.2	4.8	1980	1,216,038	0.08	0.02
1954	7,234,396	40.4	5.3	1981	828,670	0.1	0.03
1955	7,324,726	33.3	4.2	1982	795,618	0.05	0.02
1956	7,292,895	27.8	3.9	1983	767,850	0.03	0.01
1957	8,310,858	24.8	3.8	1984	665,141	0.03	0.01
1960	8,194,662	15.5	3.3				

* during the World War II

TABLE 2: RELATION BETWEEN THE RATE OF POSITIVES FOR ASCARIS EGGS AND THE PERCENTAGE OF THOSE DISCHARGING ONLY UNFERTILIZED EGGS TO ALL (Komiya et al., 1962)

No. exam.	No. (%) positive for Ascaris eggs (A)	No. Positive for unfertilized eggs only (B)	B/A (%)
906	700 (77.2)	89	12.7
478	308 (64.4)	67	21.7
3,829	2,134 (55.7)	373	17.4
5,999	2,717 (45.3)	556	20.4
6,090	2,039 (33.5)	730	35.8
8,787	8,787 (24.5)	864	40.1
7,911	1,096 (13.9)	567	51.7
13,222	880 (6.7)	718	81.6
20,507	639 (3.1)	560	87.6

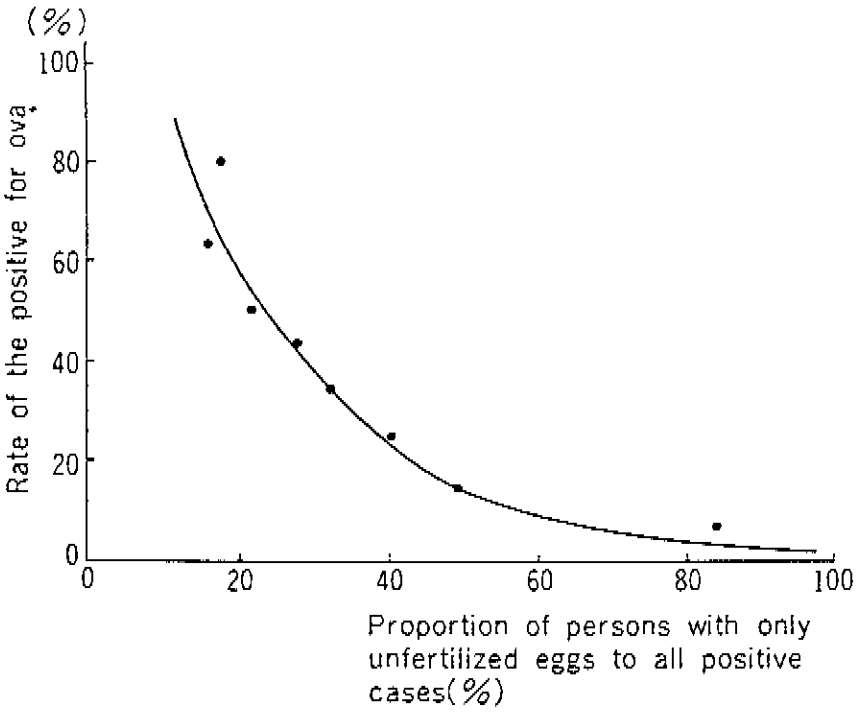

Fig. 1 Relation between the rate of the positives for Ascaris eggs and the proportion of those discharging only unfertilized eggs to all positives. (Komiya et al. 1962)

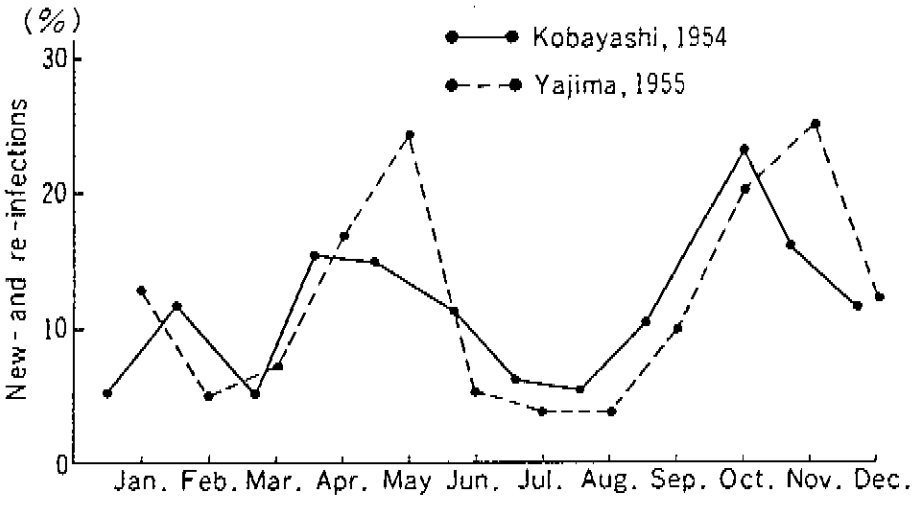

Fig. 2 Seasonal fluctuation of Ascaris infection.