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NOMADISM AND THE PROBLEM OF MALARIA ERADICATION IN SOUTHERN IRAN

by

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1. Introduction

It is estimated that there are more than 4 million nomads and semi-nomads in Iran, dispersed throughout almost all parts of the country. In spite of increasing urbanization, the nomadic way of life is far from coming to an end. The great annual migrations from summer quarters to winter quarters and vice-versa, covering long distances and passing through many villages and towns, are leaving marks on social and health conditions of the areas involved. For example, they play an important role in maintaining the transmission of malaria (Ghashghai and Bakhtiari tribes).

2. Population movements - background information

Mass population movements have occurred in many parts of Iran, especially in the southern region, where they can be considered under the following categories:

(i) Labour movements for the development of various agricultural and industrial projects and road construction bringing manpower from other areas which are now mostly in the consolidation phase. This type of migration has resulted in the resumption of malaria transmission and focal outbreaks in the labourers' area of origin. The problem of resurgence of malaria is becoming increasingly apparent.

(ii) Semi-nomadism concerning villagers moving from their permanent dwellings to surrounding mountainous areas during the hot season and erecting temporary dwellings such as summer huts and tents.

(iii) True nomadic migration, the pattern of which is regular and stable. The duration of migration and the concentration of population may change from year to year, depending on meteorological features, condition of pastures and other factors.

In the southern part of Iran, nomadic migration is the most important form of population movement, creating problems in most aspects of the social and economic life of this region.

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The special characteristics of nomadic life, annual migration within the malarious area during the malaria season, and the prevailing environmental and social factors have an effect on the epidemiology of the disease and its control. These factors are summarized below (Faghih et al., 1962):

(i) There is a considerable ecological difference between the winter quarters and summer quarters, i.e. low-lying salty plains in the south and high mountains in the north. Thus the topography of the living areas shows vast plains on one side and hilly, hardly accessible mountainous areas on the other, particularly in the summer quarters and on the migratory route.

(ii) Each family lives in a black tent made of goats' hair. The families stay in groups scattered among the mountains and flat lands, 1 to 6 km apart from each other. If necessary they also use other types of shelters such as farm or summer huts, mud houses, caves, etc., according to seasonal and climatic conditions.

(iii) The tents are frequently dismantled and packed for transport and re-erected again during migration at summer and winter camping sites.

(iv) Itineraries and settling quarters are constant in favourable years with abundant grass. There may be changes during unfavourable years or due to the renting of new pasture lands, causing the nomads to move more than 100 km away from the usual quarters.

(v) The occurrence of zoonoses causing high mortality among sheep may also affect the movement of the tribe, causing a major part of the tribal people to stop migration during the current year and only a few families will move to conduct the remaining herds to the summer pasture.

(vi) The death of the head of a tribal unit may make his unit lose its identity and join another tribal group, adopting their habits and migration pattern.

The above mentioned factors create many difficulties in the implementation of anti-malaria measures, and reduce operational efficiency and the degree of perfection which is needed in the malaria eradication programme.

The population of the country is divided into three types of communities, namely urban, rural and tribal. Fars Province in southern Iran is one of the country's main centres of nomadic life. Among the tribes existing in this province, Ghashghai, Khamsi-Basseri and Lor, the former is the largest, having the following structure:

The tribe is divided into seven clans and each clan is subdivided into a number of sects. Each sect has definite summer and winter camping sites and migratory routes. The sect is further divided into the "Bonkouh" and the "Bors". Each Bors consists of two to five families. Camping sites of these subdivisions of sects are not constant and vary within the sect's camping area.

3. Nomadism and malaria

Epidemiological investigations carried out all over the country during previous years have shown that in most parts of the country tribal movements usually do not affect the intensity of malaria transmission, especially in areas with a short transmission season (three to four months). In these areas migration starts before the commencement of the transmission season and camping sites in summer quarters are selected mainly in hilly and mountainous areas which are not favourable for the transmission of the disease. If it does occur, it will be limited to only a few sporadic cases. This observation was confirmed in course of the malaria eradication programme which commenced in 1957 in Iran and covers all malarious zones of the country. However, in the south, i.e. the southern slopes of the Zagros chain and along the Persian Gulf and the Oman Sea littoral, several setbacks were

observed as a result of operational and technical problems which have developed during the operation. The main operational failures in the south were due to the movement of tribes and extensive utilization of temporary dwellings such as tents, summer huts.

In the winter quarters of the south the duration of the transmission season is long, extending over about nine months. The development of resistance to chlorinated hydrocarbon insecticides in the main vector Anopheles stephensi and exophilic and exophagic tendencies in A. superpictus, A. fluviatilis and A. d'thali, the vectors in the hilly areas of the Zagros slopes, have made the south a problem area for malaria eradication.

In the summer quarters, however, the period of the transmission season lasts only three to four months and vector activity of A. superpictus, A. sacharovi starts from July. Both vector species are susceptible to DDT in these areas and malaria is under control.

Usually the tribes leave the winter quarters before transmission season has started (March-April) and most of the migratory route is not yet in the transmission season; thus they escape infection. In July the conditions for transmission are quite suitable in the summer quarters and they remain so along the way to winter quarters. Even in the winter quarters transmission is very active for quite some time. As a result, the tribes are liable to contract the disease in the summer quarters or on their way back to winter quarters. Owing to the malaria campaign in these areas during recent years, the risk of transmission in the winter quarters has become very low, but active foci still exist.

The disease is usually transmitted from the inhabitants of stable villages to tribal people who have camped close by, or from infected tribal people to other villagers. Rarely, a sort of inter-tribal malaria transmission is established when the camping site is favourable for the building up of a criterial density of vectors.

4. Malaria eradication and nomadism

Difficulties and obstacles created by nomadism in the implementation of various malaria eradication activities such as geographical reconnaisance, spraying operations, surveillance, and drug administration were extensively studied by the School of Public Health and the Institute of Public Health Research in cooperation with the Malaria Eradication Organization, Iran, since the beginning of malaria eradication in this country.

Several field trials were conducted among various sects of the Ghashghai tribe in the Kazerun area, southern Iran, and the results of these studies are summarized in the following paragraphs:

4.1 Residual insecticide spraying and impregnation

For these trials various formulations of DDT, dieldrin and HCH were used at different concentrations or dosages for impregnation or spraying of tents. The effects, also measured on different tent materials were evaluated by chemical estimate of insecticide residues, bio-assay tests and entomological observations. The most important results are given below:

(i) DDT solution in kerosene sprayed at a dose of 2 g DDT/m^2 has shown a biological residual effect of six weeks in the case of non-movable tents, with more than 50% kill in bio-assay tests, and a much shorter period in the case of movable tents.

(ii) DDT water dispersable powder (w.d.p.) sprayed at a dose of 4 g technical DDT/m^2 remained effective for four weeks in non-movable tents and for two to three weeks in movable tents. The effect in the latter was prolonged to four to five weeks if gum arabic or asphodalus were added to the formulation.

(iii) Dieldrin solution in kerosene sprayed at a dose of 1 g dieldrin/m^2 has shown a residual effect of two to three weeks in the case of both movable and non-movable tents.

(iv) Dieldrin w.d.p. sprayed at a dose of 1 g technical dieldrin/m^2 or dieldrin Nova Sol sprayed at a dose of 0.5 g technical dieldrin/m^2 remained biologically effective for six to seven weeks in the case of non-movable tents (60% kill in bio-assay tests, 90% kill in test huts after 24 hours).

(v) Dieldrin w.d.p. used at a dose of 0.5 technical dieldrin/m^2 for the impregnation of movable tents has shown an effect of about two months (70% kill in bio-assay tests).

(vi) HCH 50% w.d.p. sprayed at a dose of 1.0 g gamma-isomer/m^2 or HCH resin 25% at a dose of 1.0 gamma-isomer/m^2 have shown biological effect for about two to three weeks in the case of non-movable tents (25-35% kill in bio-assay tests).

These results indicate that the spraying of tribal tents with suitable insecticide formulations may be an effective measure against the local vector, but the rather short residual effect, especially in the case of movable tents seriously reduces its value.

The movements and the scattering of the nomadic populations and difficult operational conditions due to the local topography have not permitted to achieve the required operational efficiency and precision and to apply the insecticides frequently enough. Therefore, only spraying or impregnation of tents with residual insecticides cannot be considered adequate for achieving interruption of malaria transmission in this particular population group.

4.2 Use of medicated salt

In view of the inadequate efficacy and feasibility of the use of insecticides alone, a pilot study for the application of medicated salt was developed. Several groups of nomads, in total 1500 people, were selected and covered by this programme from 1959 to 1961. Some 600 persons received chloroquinized salt, 300 salt mixed with pyrimethamine, 300 salt mixed with chloroquine and pyrimethamine, and 300 remained as a control group.

The baseline parasite rate (PR) before doing application was 25%, with Plasmodium vivax and P. falciparum present. After administration of chloroquinized salt, the PR reduced during the second half of 1959 to 14%, whereas it remained in the control group between 20 and 30%.

On the basis of the experience gained in this pilot study, application at a larger scale was prepared for, covering about 11 000 nomadic population of the same tribe and 6250 settled inhabitants of villages (Motabar et al., 1971). The preliminary stage in 1962 served to perform geographical reconnaissance, to determine the sources of salt in the area, to study the preparation and distribution of table salt, to decide on the drug of choice (chloroquine/amodiaquine), to train agents, and to provide mixing machines and other equipment.

The actual operations started in April 1963, and continued up to 1966. They consisted of the following major activities:

(i) Preparation of medicated salt.

(ii) Monthly distribution of salt, tent to tent, among one group. In another group the distribution was six-monthly until the beginning of 1964, when it was changed to monthly distribution.

(iii) Checking of salt consumption, parasitological and entomological evaluation. In the course of the project chloroquine was distributed during two-and-a half years and amodiaquine during 18 months. This produced a significant reduction of malaria cases and the parasite rate dropped from 7.89% in 1962 to 0.01% in 1966 among the nomadic population and from 17.3% in 1962 to 0.05% in 1966 among the stable population.

The estimated cost of this programme was US$ 0.20-0.25 per capita per month. This amount excludes the cost of entomological activities.

Prior to starting these studies, it seemed that the indirect method of mass drug administration would be easier to apply, less expensive and quite effective. In practice it was observed that a parasite reservoir was maintained for some time as this method does not produce protection for infants breast feeding. It was also seen that the programme is costly and not suitable for use in Iran. The malaria incidence began to rise very soon after stopping the administration of medicated salt.

4.3 Malaria eradication operations

Malaria eradication operations in the south were resumed in 1968 when spraying with malathion was introduced in the areas of A. stephensi. Spraying with malathion and DDT was conducted extensively, in some regions as often as five times a year. Full surveillance was applied in the south, with timely, radical treatment of positive cases, mass drug administratio in regions where spraying was less effective, chemical larviciding around the cities and towns, and the abundant distribution of Gambusia fish.

In this programme special attention was given to the coverage among nomads; in November-December 1968, at the end of the transmission season in winter quarters, the entire tribal population received mass radical treatment using a seven day schedule. The coverage was 94% and the results were satisfactory. Blood smears were collected randomly during the following month and a considerable drop of the parasite rate was observed. In the following years, attempts were made to find the remaining infected foci and to apply there mass drug distributio using seven day or eight week schedules. Sects of tribes which were at the risk of infection in the winter quarters also received preventive drugs. Moreover, during migration to summer quarters, they were given 300 mg chloroquine and 30 mg primaquine (presumptive dose for adults) In summer quarters belonging to the infected areas, the nomads were protected by spraying operations, surveillance and drug administration. The data in Tables 1 and 2 indicate a general reduction of malaria incidence until 1971, whereas the coverage of treatment was gradually deteriorating from 1968 to 1971. This may explain the slight rise of the positivity rate in 1972. P. falciparum infections did not occur since 1969.

RESUME

L'une des principales difficultés auxquelles se heurte le programme d'éradication du paludisme en Iran du sud est due au nomadisme qui favorise la transmission au cours des déplacements entre les lieux de séjour d'hiver et d'été ou dans ces lieux eux-mêmes, les populations sédentaires rencontrées étant également affectées.

Différentes formulations d'insecticides pour pulvérisations dans les tentes ou pour imprégnation des toiles ont fait l'objet d'essais sur le terrain. Il est apparu que les mesures en question ne permettaient pas, à elles seules, d'interrompre la transmission. La distribution de sel médicamenté s'est révélée trop onéreuse et ne se prête pas à un emploi généralisé. En 1968, le malathion a été introduit en Iran du sud, où Anopheles stephensi est résistant aux hydrocarbures chlorés. Pour protéger les nomades, on a : traité les tentes au malathion, exercé la surveillance et utilisé toutes les méthodes complémentaires possibles, notamment l'application de larvicides dans les zones de passage et la chimiothérapie de masse. Les résultats ont été satisfaisants, dépassant même en général les prévisions.

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TABLE 1. RESULTS OF SURVEILLANCE AMONG TRIBES IN FARS PROVINCE DURING 1968 - 1972

Year	No. of households	Population	No. of slides		Positivity rate %	Parasite species		
			Examined	Positive		vivax	falciparum	Mixed P.f. P.v.
1968	7 551	40 334	4 447	127	2.85	105	21	1
1969	22 252	131 736	23 562	155	0.7	133	19	3
1970	13 396	70 142	7 541	32	0.42	32	0	0
1971	2 686	14 345	7 555	9	0.12	9	0	0
1972	3 825	19 126	3 087	6	0.19	6	0	0

TABLE 2. RADICAL TREATMENT AND DRUG DISTRIBUTION
AMONG NOMADIC TRIBES IN SOUTHERN IRAN DURING 1968 - 1971

Year	No. of sects	No. of households	Population	Treatment			Per cent. of coverage of treatment		
				completed	uncompleted	untreated	% completed	% uncompleted	% untreated
1968	566	39 701	199 578	178 115	10 298	11 165	89.26	5.15	5.59
1969	204	23 409	113 484	92 918	14 231	6 335	81.88	12.54	5.58
1970	150	14 868	73 256	54 104	14 149	5 003	73.86	19.31	6.83
1971	801	14 038	72 020	35 091	27 567	9 362	48.74	38.27	12.99

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