Chapter Nine

CLINICAL SURVEYS

This chapter describes the results of the limited clinical surveys (nutritional anthropometry, spleens, temperatures) performed in the study population. The surveys are described in Chapter 2 (see p. 33).

Nutritional Anthropometry

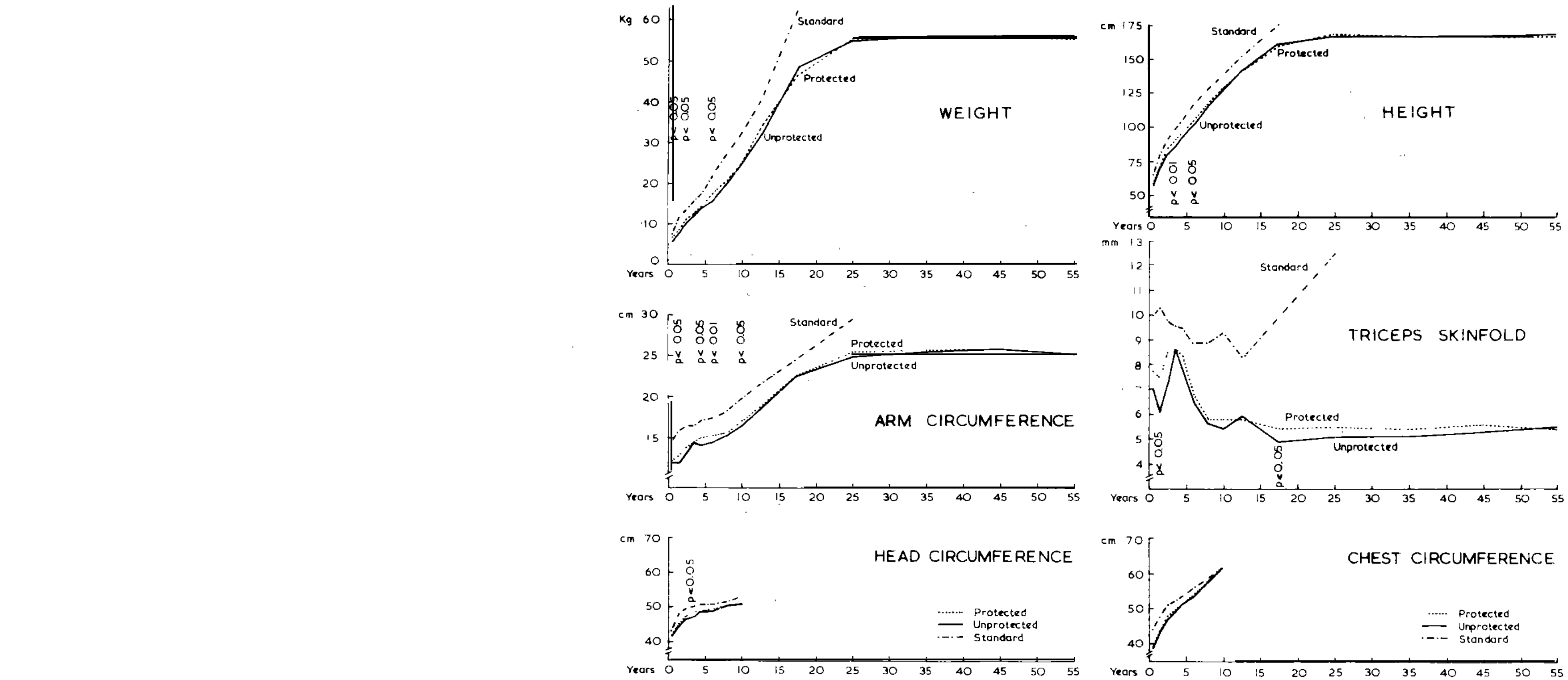
The anthropometric surveys were made in early 1974, 1975 and 1976, i.e., shortly after the second (and last) wet season of the intervention phase and after the first and second wet seasons of the post-intervention phase. The surveys were conducted in the 2 village clusters (No. 5 and No. 7, area A1) which were undergoing the most intensive control treatment (propoxur plus high-frequency MDA) and in 1 untreated comparison cluster (No. 2, area C). In the protected population, the prevalence of malaria *(P.falciparum)* had been reduced to 1-5% for about $1\frac{1}{2}$ years (see Chapter 5).

Figure 74 shows the results of the first nutritional anthropometric surveys, in the protected and unprotected populations, in comparison with certain international standards. The means of all anthropometric measurements were found to be clearly below the international standards. Protected infants and children had on the average slightly better anthropometric measurements. They were somewhat heavier and taller and had somewhat thicker arms and triceps skinfolds. The differences were small to moderate but rather consistent; in several cases, indicated on the graphs by the notations $p<0.05$ or $p<0.01$, the differences were significant. The largest difference was found in the triceps skinfold thickness.

The small differences between the protected and unprotected popu-

[a] The observations presented in this chapter were made by or under the supervision of Dr T. Matsushima and Mr J. Storey.

Fig. 74. Nutritional anthropometric survey, January–February 1974: comparison between unprotected villages, protected villages (prevalence of malaria reduced to 1–5% for 1½ years) and international standards[a]



[a] The Harvard standards were used for weight and height (*156*); various standards were used for arm circumference and triceps skinfold (*86*) and for head and chest circumferences (*162*). The *p* values refer to the comparison between protected and unprotected populations.

lations, detected in the first anthropometric survey, disappeared in the course of the post-intervention phase.

In addition to the surveys described here, the height of children had been studied in the preparatory phase of the project (13).

Spleen Surveys

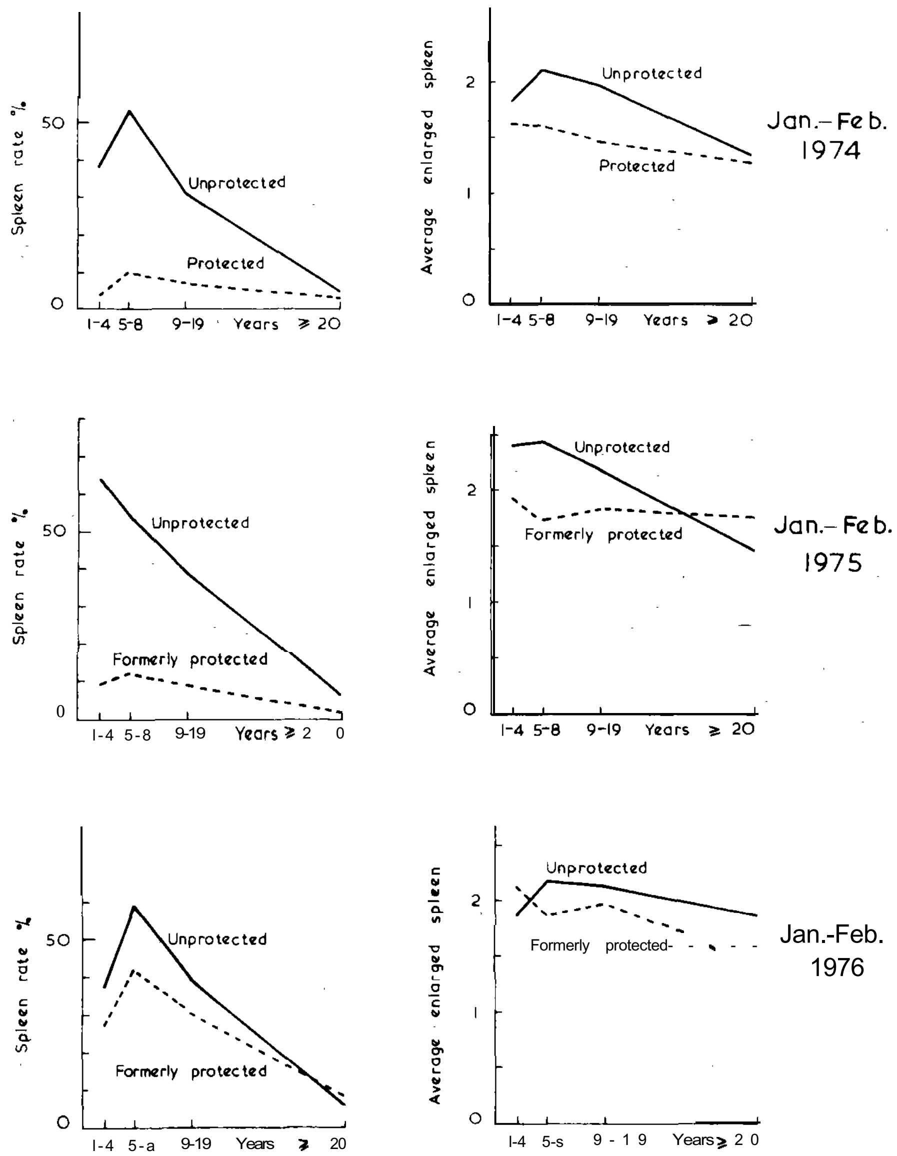
The spleen surveys were conducted simultaneously with the nutritional anthropometric surveys and are also shoivn graphically (Fig. 75). In the absence of control (village cluster No. 2), the spleen rate was high (around 50%) in young children, low (around 5%) in adults. The distribution of spleen sizes had 2 modes: 0 (not palpable) and class 2 (Hackett); this suggests that a significant number of spleens of class 1 were missed and that the spleen rates were underestimated. The average enlarged spleen (average size of enlarged spleens, where size is represented by Hackett's classification) reached **2–2½** in the age-group 5-8 years and decreased only slightly thereafter. The reduction of malaria to a very low level (1-5%, village clusters No. 5 and No. 7, see Chapter 5) for **1½** years also reduced the spleen rate to a low level, e.g., in the age-groups l-4 and 5-8 years the spleen rates fell to 4% and l0%, respectively, as compared to 38% and 53% in the untreated comparison group (see the graph for 1974). During the resurgence of malaria in the post-intervention phase, the spleen rate increased towards the same level as in the untreated villages, but while the parasite rate was nearly back to the baseline level in the wet season of 1974 (see Chapter 5), the spleen rate approached the baseline values only about a year later. The control of malaria, and later its resurgence, had apparently only a minor effect on the average enlarged spleen.

Temperature Surveys

Population, study design and methods

Three temperature surveys were conducted: namely, in the middle of the main transmission seasons of 1973, 1974 and 1975 as part of the 15th, 19th and 22nd parasitological surveys, respectively (see Fig. 43). They were conducted in the same population as the anthropometric and spleen surveys, i.e., in village cluster No. 2, untreated throughout, and in village clusters No. 5 and No. 7, treated. The treatment consisted of the

Fig. 75. Spleen rates and the average enlarged spleen in the protected and unprotected populations after $1\frac{1}{2}$ years of protection and 1 and 2 years later



following: (1) in 1972 and 1973: intradomiciliary propoxur plus mass distribution of sulfalene-pyrimethamine every 2 weeks in the wet season, every 10 weeks in the dry season, excluding negative infants; survey 15 was conducted 1 week after the previous round of sulfalene-pyrimethamine; (2) in 1974: 4 rounds of chloroquine, at intervals of 5 weeks, for those below IO years of age, during the main transmission season; survey 19 was conducted 5 weeks after the previous round of chloroquine; (3) in 1974 and 1975, chloroquine was given to clinical cases, presenting of their own volition, which represented 2.5% of the population in the 5-week period before survey 19 and 7% of the population in the 5-week period before survey 22. In 1972-1973 the following drug dosages were used for those above 10 years of age: 500 mg of sulfalene plus 25 mg of pyrimethamine, 450 mg of chloroquine-base; in younger age-groups, the dosage was appropriately reduced (see Chapters 2 and 3, in particular pp. 23 and 43-49).

Before the application of malaria control measures, the prevalence of ***P. falciparum*** varied between 41% and 66% in cluster No. 2, and between 42% and 65% in clusters No. 5 and No. 7. At surveys 15, 19, and 22, the crude prevalence of ***P. falciparum*** was, in the 2 populations respectively, 58% and 59%, 65% and 62%, and 62% and 61%; at survey 19, in clusters No. 5 and No. 7, the prevalence was lower than in the controls below 10 years of age, presumably because of chloroquine, but the prevalence was higher than in the controls above 10 years of age, presumably because of a loss of parasitological immunity (see Chapter 5).

Surveys were conducted in the afternoon by house-to-house visits, guided by the project's own updated census. Axillary thermometers were used, and temperature was recorded to the nearest 0.1 “C. For reasons of acceptability, it was planned not to include adult women in the temperature surveys, and very few were actually included.

Results

Temperature by survey, village cluster (treatment), age, sex and haemoglobin type

Most of the recorded temperatures were rather low: 81% (3759/4647) were below 37 “C, 16% (730) were below 36 °C, while only 6% (270) were above 37.4 “C, and 3% (132) above 37.9 °C.

In 1973, when malaria had been reduced to a very low level in village clusters No. 5 and No. 7, the prevalence of temperatures of 37.5 °C or above was lower in these treated villages than in the control village cluster No. 2 (Table 28); the difference was highly significant in the <9-year age-class. A similar difference, though less pronounced, was

Table 28

Prevalence of body temperatures of 37.5 °C or more, by age, survey and population

Survey	Village clusters	< 9 years			≥ 9 years		
15 (October 1973)	No. 2	11.1%	(25/226)	$p<0.001$	4.2%	(15/361)	n.s.
	No. 5 & 7 (protected)	3.8%	(17/448)		2.5%	(16/634)	
19 (October 1974,	No. 2	17.1%	(36/211)	n.s.	2.7%	(9/329)	n.s.
	No.587	12.8%	(55/429)		1.7%	(10/605)	
22 (October 1975)	No. 2	17.4%	(26/149)	$p<0.05$	3%	(9/300)	ns.
	No. 587	9.3%	(37/398)		2.7%	(15/557)	

shown in 1975 when the parasitological situation was almost back to the baseline situation. The differences between the two age-groups (< 9 and ≥9 years) were significant, except at survey 15 in village clusters No. 5 and No. 7.

Replacing 37.5 °C by 38.0 °C gives smaller numerators, but leads to the same conclusions. At survey 15, the prevalence of temperatures of 38 °C or above in the age-group<9 years was 0.7% (3/448) in the treated population vs. 6.6% (15/226) in the untreated ($p<0.001$). There was no significant difference in the prevalence of elevated temperatures between males and females, either in age-group <9 years or in the age-group 9-18 years (very few older females were examined). There was also no

Table 29

Distribution of persons having a given temperature into density classes for *P. falciparum* asexual stages

Age	Temperature °C	Proportion of fields positive for *P. falciparum* asexual stages: 0	0.1-4.0	4.1-16.0	16.1-64.0	64.1-100.0
<9 years	<37.5	789 (0.47)	98 (0.06)	84 (0.05,	199 (0.12)	495 (0.30)
	37.5-37.9	28 (0.30)	2 (0.02)	4 (0.04)	15 (0.16)	43 (0.47)
	≥38.0	18 (0.17)	4 (0.04)	3 (0.03)	10 (0.10)	69 (0.66)
≥9 years	<37.5	1 554 (0.57)	380 (0.14)	290 (0.11)	246 (0.09,	240 (0.09,
	37.5-37.9	23 (0.501	4 (0.09)	5 (0.111	1 (0.02)	13 (0.28)
	≥38.0	I0 (0.36)	4 (0.14)	1 (0.041	1 (0.04)	12 (0.43)

significant difference in the prevalence of fever between Hb AA and Hb AS persons.

Temperature and *P. falciparum*

There was a significant relationship between temperature and density of ***P. falciparum*** asexual stages. There was no consistent difference between surveys or between village clusters in this respect, and the figures were therefore combined (Table 29). It will be seen that, in both age-groups, the parasitological status of persons having a temperature of 38.0 °C or more was very different from the parasitological status of persons having less than 37.5 °C and that those having 37.5 °C to 37.9 °C had an intermediate parasitological status.

Discussion

Nutritional anthropometric surveys

The anthropometric indicators of the nutritional status used in this study were those recommended by Jelliffe (86). The nutritional status of the Garki population is not good, even though the international standards that were used may not be ideal as references. Appropriate local standards were unfortunately not available. The nutritional status of infants and young children was slightly better in villages under protection against malaria, than in unprotected villages. The improvement tended to disappear after the end of the intervention period, and it is likely that the difference was caused by the control of malaria. It is generally accepted that infections, including malaria, interfere with nutritional status (143). In Pare-Taveta, however, the successful control of malaria by residual spraying produced no significant change in the weight of infants (ages 1-18 months) (50). Malaria must be only one of the many factors that determine the poor nutritional status of the population of Garki and other comparable populations.

Spleen rates

The high spleen rate in young children, combined with the low spleen rate in adults, is generally believed to reflect high levels of transmission and of population immunity. Both were certainly present in Garki (see Chapters 4, 5 and 6). After 1½ years of control, the spleen rate was a relatively good indicator of the level of control, but the speed at which the spleen rate declined was not documented. During the resurgence of malaria, the spleen rate probably increased much more slowly than the parasite rate and was thus not a very good indicator of resurgence. It should be noted, however, that spleens were palpated after the end of the main transmission season.

Temperature surveys

This study of temperature has obvious limitations. There was no baseline survey. The sample (a single cross-sectional temperature survey per year in the middle of the main transmission season, excluding adult women) and the method of measuring temperature were certainly far from ideal. Survey 15 fell about halfway between rounds of drug administration, while survey 19 fell at the very end of the 5-week interval; this may have increased the contrast. While keeping these limitations in mind, the following observations are nevertheless of interest: (1) in the absence of malaria control, high temperatures are more common in children than in adults; (2) the effective control of malaria by propoxur, and especially by the addition of sulfalene-pyrimethamine every 2 weeks, is accompanied by a marked decrease in the prevalence of high temperatures in children, but not in adults (see Table 28, survey 15); (3) the administration of chloroquine every 5 weeks was accompanied by a small, non-significant, reduction in the prevalence of high temperatures (see survey 19, <9 years); it was also accompanied by a lower prevalence of parasitaemia (see p. 156); (4) in the older age-groups, the increase in prevalence of infection above the control levels after interruption of chemoprophylaxis (see Chapter 5) was not accompanied by an increase in the prevalence of high temperatures (see Table 28, survey 19, ≥9 years), suggesting that at ≥9 years there was a loss of parasitological immunity without loss of clinical immunity; (5) there was a positive correlation between temperature and density of ***P. falciparym*** asexual stages (see Table 29); (6) it can be seen from Table 29 that screening the population for temperatures of 37.5 °C or more would have detected only 14.6% (15011026) of the positives below 9 years and only 3.4% (41/l199) of the positives above 9 years of age. These findings are probably characteristic of a situation of intense transmission and relatively strong immunity of the survivors.

Summary

Nutritional status, as measured by simple anthropometric indicators, was poor. Infants and young children of the villages in which malaria was controlled for 1½ years by means of residual spraying and MDA had a slightly better nutritional status than their peers in the unprotected villages. The difference tended to disappear during the post-intervention phase.

In the absence of malaria control, the recorded spleen rates were typical of high levels of transmission and population immunity, namely, about 50% at ages 1-8 years and below 10% in adults. The spleen rate was much lower after 1½ years of malaria control; during the post-intervention phase it returned to the baseline levels more slowly than the prevalence of parasitaemia.

In the unprotected population the wet-season point prevalence of temperatures of 37.5 °C or above was 11% below 9 years of age and 4% above 9 years of age; in the protected population, the prevalence was significantly lower below 9 years of age (4%) but not above that age (2.5%). There was a positive correlation between temperature and ***P. falciparum*** parasitaemia but it was not very strong, and temperature was a relatively insensitive indicator of parasitaemia. The increase in prevalence of ***P. falciparum*** above the control levels, detected at ages ≥9 years after the last MDA round, was not accompanied by a corresponding increase in the prevalence of fever.