
Introduction, Background and Methods

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I. Introduction, background and methods

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Two communities of Jews living in Israel were selected for study. They consisted of Jews from Kurdistan and from the Yemen. They lived in five villages in the Negev area of Israel where the climate is hot in the summer months and cool to warm in the winter months. Studies were carried out in the summer (June, July) and in the winter (January, February).

The studies were confined to the age group 20 to 30, and 75% of the population in this age group were examined.

The investigations comprised: (a) clinical examination, (b) anthropometric measurements, (c) genetic study of blood markers, (d) habitual activity, (e) energy expenditure, (f) food intake, (g) climatic exposure, (h) measurement of physical work capacity, and (i) reaction to a standardized heat test.

The environmental conditions of the subjects were similar for the two groups and the majority were engaged in farming.

INTRODUCTION

The effects of the physical environment on man have been widely studied, and much is known about the degree of physiological adaptation or acclimatization which can be achieved under various conditions. The unresolved question is whether there are significant innate physiological differences between different ethnic groups. There have been notable observations made of peoples living in unusually severe climates with apparently inadequate protection, such as the Australian Aborigines, the Bushmen of the Kalahari, or the Alacalufe Indians of Tierra del Fuego (Hammel 1964). It has been shown that there are considerable differences between these particular populations in their physiological responses to a standardized cold exposure. However, the interpretation of these and other results is complicated, as so far it has not been possible to distinguish the separate effects of the factors which may affect physiological responses. These include genetic constitution, nutrition, patterns of activity, state of health, and environmental exposure. There are obvious difficulties preventing a direct control or manipulation of such factors, and an alternative approach is to seek situations where these may be common to contrasting peoples. Such a situation exists in Israel (Edholm 1966), where there has been a large-scale immigration of many different Jewish communities since the state was established in 1948. It has been shown as a result of the extensive genetic studies carried out in Israel (Goldschmidt 1963) that there are considerable differences between these various Jewish communities in their gene frequencies for blood groups and a number of polymorphic systems of blood enzymes. Such a situation offers an unusual opportunity to examine the effects of the different genetic constitutions on the physiological characteristics of particular communities, especially those characteristics likely to be principally affected by the environment. The choice of communities to study was made on the basis of the following criteria. The communities should each consist exclusively of one ethnic group, should be engaged

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in the same occupation, live in the same locality and be accessible. A choice was made of rural communities, such comprising a single ethnic group, whose principle occupation was farming, and the locality chosen was the Negev, the southern area of Israel, where climatic conditions and terrain are uniform over wide regions.

The two ethnic groups selected for comparison were Kurdish and Yemenite Jews because (*a*) there was evidence from previous work (Goldschmidt 1963) that these two communities were genetically dissimilar; (*b*) the areas from which these people came, although geographically far apart, were in some respects similar; (*c*) the conditions under which they had lived in the Yemen and Kurdistan appeared to be comparable, and (*d*) they had lived in their loci of origin for a very long time in virtual isolation from other Jewish communities, and there were grounds for thinking that they could be regarded as genetic isolates. Although similar arguments could be put forward for examining other Jewish communities, none could be found which fulfilled all the criteria. The history of these two peoples is complex and, to some extent, obscure (Roth 1953, Ben-Zvi 1958).

We have used the terms 'Kurdish Jews' and 'Yemenite Jews' throughout this series of papers to describe these communities (rather than such terms as 'Jews from Kurdistan' or 'Jewish Kurds') mainly because they seem accurately to describe the communities, but also because there is already a very extensive scientific literature in English in which these and other terms of the same form have been used to describe Jewish communities now living in Israel and elsewhere.

THE YEMENITE JEWS

The Yemenite Jewish community migrated to Israel in an operation known as 'Flying Carpet' in 1949–50, when virtually all the Jews living in the Yemen left (Barer 1952) (see figure 1). This immigration consisted of approximately 40 000 persons, and associated with them were a small number from what was then the colony of Aden and from the Hadramaut. There had been a previous migration in 1923, from the Yemen, when some 5000 Yemenite Jews settled mainly in Jerusalem.

It is probable that the outward movement from Palestine was also in two stages. There is evidence that there was a sizeable Jewish community in the Yemen by 300 B.C. At any rate, they evidently ignored a summons to help in the building of the second temple and incurred a denunciation by the prophet Ezra. But the largest group reached the Yemen in the great Diaspora following the destruction of the second temple in A.D. 70. Since then contact with other Jewish communities has been minimal. During the centuries before Mohammed the Yemenite Jews achieved, on occasion, a position of dominance, but their fortunes varied with the fortunes of the Yemen. There were frequent wars with Ethiopia and for two periods, each lasting some 50 years, the Yemen was conquered and ruled by Ethiopia. During these periods of conquest there was a forced conversion to Christianity of the whole population. Conversely, there were periods when Judaism was established in Ethiopia. It seems probable that in the period before the rise of Islam, many Arabs were converted to Judaism.

When Mohammed rose to power, he attempted to enlist the Jews as supporters but on their refusal to accept the new doctrine many were massacred, and for a while the position of the surviving Jews in the region of the Yemen was precarious. However, the Mohammedans eventually accepted and tolerated the Jews for whom they felt a kinship as 'People of the Book'. Nevertheless, the degree of toleration varied considerably and, in general, the Jewish

communities remained poor and subject to various restrictions. Information for the period of the last 1000 years is very scanty, and depends mainly on accounts by occasional travellers. Jewish communities appear to have existed in all the main towns of the Yemen, but, in addition, there were a number living in villages. Their occupations included those of silversmiths, jewellers and makers of fine embroidery. A number were pedlars and most appeared to keep animals and to grow vegetables (Scott 1942).

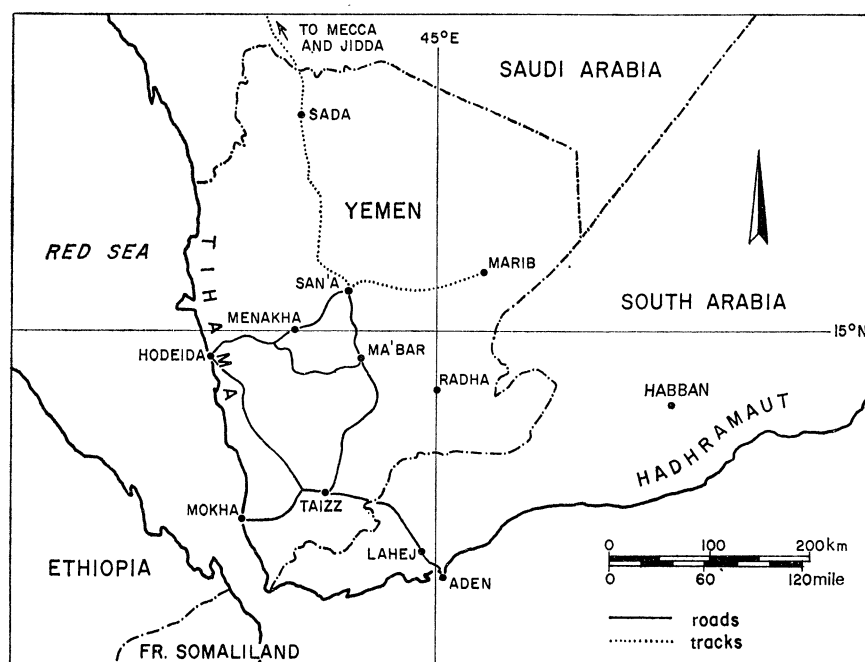


FIGURE 1. Map of Southern Arabia. The majority of the Jewish Yemenite subjects came from districts around Ta'izz and Radha.

The Yemen consists of a coastal plain with a hot climate and low rainfall, and a mountainous region with deep fertile valleys at altitudes ranging from 1000 to 2500 m. The Yemenite Jews we have studied all came from the city of Ta'izz (altitude *ca.* 1500 m) or neighbouring villages. Ta'izz had a population of about 30000 according to Scott (1942), who described it as a beautiful city with many streams. Banana and paw-paw grow there, as well as many flowering trees. There are two rainy seasons, spring and autumn, and the total annual rainfall is about 40 cm. The climate is warm to hot in the summer and cool but seldom cold in the winter. There are few meteorological records available from the Yemen; the mean temperature in Ta'izz in June to July is probably about 27 °C and in November about 20 °C. At higher altitudes than Ta'izz frost and occasional snow may be experienced during December to January. In the mountain valleys cereals, mainly wheat, are grown, as well as a wide variety of fruit.

When the State of Israel was established, there were negotiations for the return of the Yemenite Jews. The ruler of the Yemen at that time was favourably disposed and made it possible for all to leave. The Jews made their way on foot to Aden where they lived in camps until they could be flown to Israel, where they arrived in 1950–51. In Israel they were housed in large camps until they were settled in various regions of the country. To a considerable extent, community groups remained together and villages established by them consisted of

people from a particular region of the Yemen. When the Yemenite Jews arrived in Israel they were medically examined and their state of health was summarized by saying that everyone suffered from at least one of four conditions: malnutrition, malaria, schistosomiasis, tuberculosis (Davies & Eliakim 1955). Many had more than one condition and some suffered from all four. There was a considerable mortality, mainly amongst the very young and the old, during the first 3 months in Israel. Unfortunately, because of the great pressure of urgent medical work, record keeping was virtually impossible during this period and no reliable statistical information is available.

THE KURDISH JEWS

It is uncertain when Jewish communities were first established in the mountainous region known as Kurdistan. The tomb of the prophet Daniel (sixth century B.C.) is stated to be near Kirkuk (see figure 2), indicating that Jews might already have settled there. In recent years Jewish communities were to be found widely scattered in towns and villages throughout Kurdistan. The Kurdish Jews were illiterate and had few teachers or rabbis, so they were isolated from the rest of Jewry. They spoke Aramaic amongst themselves, and Arabic with their neighbours. They were occupied as pedlars, dyers of wool, dealers in clothing and cloth, and some were also engaged in smallscale farming (Edmonds 1957).

The region known as Kurdistan is not recognized as a political entity, although attempts were made at the 1919 Peace Conference to gain support for the establishment of an independent republic. The borders of the region are not defined, but it may be described as the mountainous country between Iran, Iraq and Turkey, the greater part being in Iran and Iraq. The map shown in figure 2 has marked on it the approximate area of Kurdistan. Kurdistan is described by many writers as a beautiful country, with fertile valleys. The climate is severe compared with that of the Yemen; bitter winters with strong winds, and heavy snowfall lasting for some 4 months. Summer is hot and dry and continues for some 5 to 6 months. There is a brief spring and a short autumn. Precipitation (mainly as snow) totals about 40 cm in the year, and is confined to the period November to April, when the mean temperature is about 0 °C; from May to October maximum temperatures are between 35 and 40 °C, and the mean daytime temperature in June to September may be close to 30 °C. Within this country there are many different communities; Kurds, Armenians, Nestorian Christians and Jews. The region has long been noted for its lawlessness, and although under nominal Iranian or Turkish rule there was no effective administration in the past; a situation which to some extent still persists. In the period since the beginning of World War I, Kurdistan has been fought over by Russians, Turks, Iranians and British. There have been massacres, particularly of the Nestorians and Armenians, towns looted and burnt, starvation and famine, but because of the very rugged country and absence of roads, many valleys remained untouched. The Jewish community, like others, suffered from many of these violent disturbances, but there was no marked anti-semitism among the Kurds. The migration from Kurdistan to Israel involved the great majority of the Jews in this region, but there are certainly small Jewish communities still remaining in some Kurdish towns.

The state of health of the Kurdish Jews when they arrived in Israel contrasted markedly with that of the Yemenites. The latter, as already mentioned, suffered from malnutrition, malaria, tuberculosis and schistosomiasis. Few or none of the Kurds had any of these conditions, although intestinal parasites were extremely common. No accurate statistics are available,

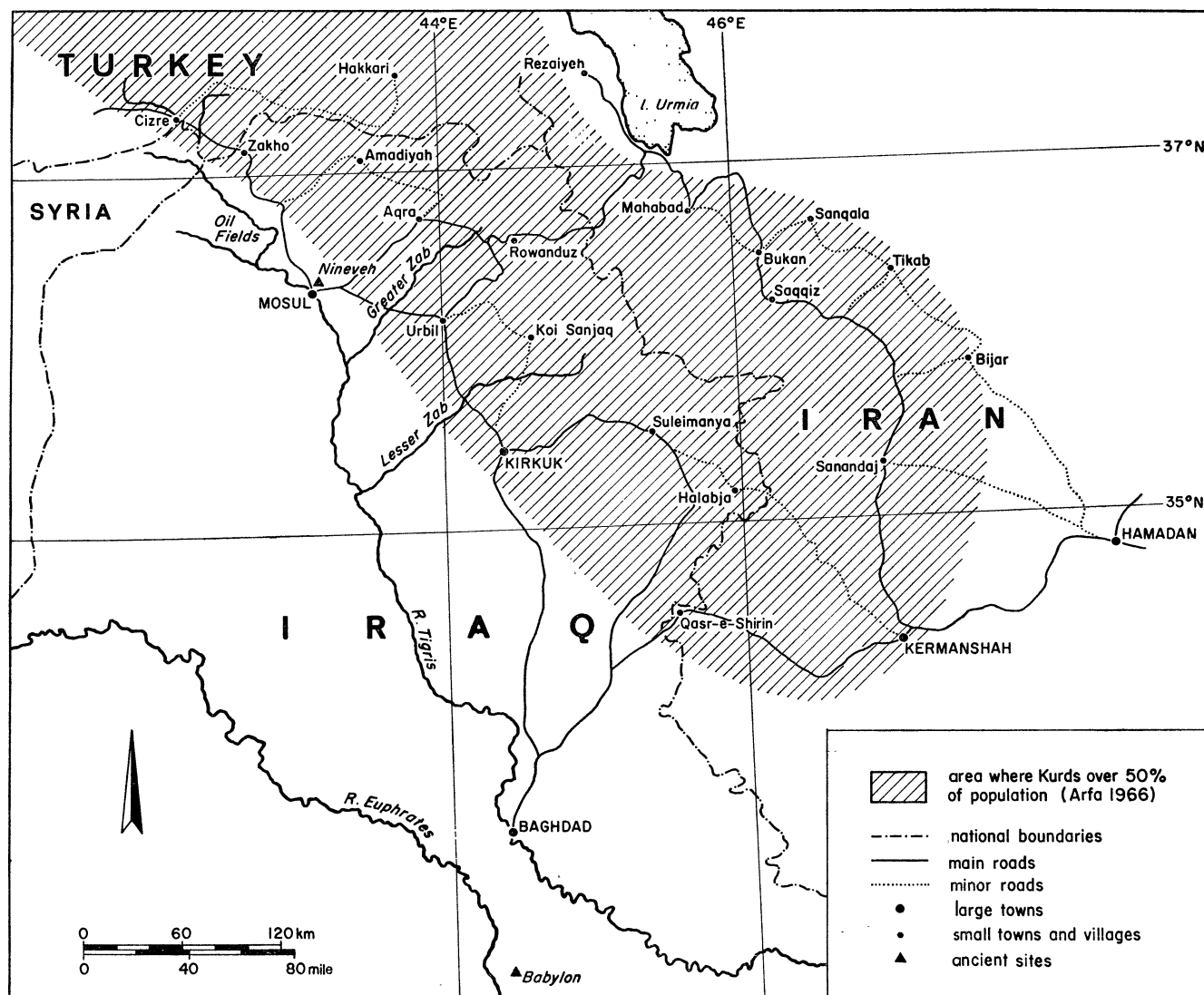


FIGURE 2. Map showing approximate area of Kurdistan. A majority of the subjects came from the Iranian (Persian) part, particularly in or near Bijar and Bukan. In the Iraq region, the subjects originated from the southeastern region marked by Kirkuk, Urbil and Suleimanya.

partly because of the difficulties experienced during the period of mass immigration, but partly also because the Kurdish Jews were not officially distinguished from the 'Babylonian' Jews from Baghdad. However, one of us (S. S.) acted as a medical officer in the receiving camps and had the opportunity of examining a large number of the immigrants from both Kurdistan and the Yemen. The difference in the state of nutrition of the two groups was particularly noticeable.

POPULATION SIZE AND POPULATION SAMPLE

The study forms part of the work of the Human Adaptability Section of the International Biological Programme, so the research plan was devised to be in conformity with the principles and methods set out in the *I.B.P. Handbook* (Weiner & Lourie 1969). The physiological characteristics chosen for special study were (a) physical work capacity, and (b) temperature

regulation, including the response to a raised body temperature. The recommendation by an international working party that in the first instance measurements should be made of the age group 20 to 30 was followed. It was decided to investigate approximately 200 subjects, as this was considered to be the largest number who could be studied in the field. The intention was to find villages with a sufficient population to provide 100 Kurdish and 100 Yemenite Jews. In order to avoid any sampling bias, it was agreed to attempt to recruit all the population in the selected villages between the ages of 20 and 30.

THE SELECTED VILLAGES

There were five villages, two exclusively occupied by Yemenite Jews (Bitha and Peduim) and three predominantly by Kurdish Jews (Pattish, Paame Tashaz and Eshbol) (figure 3). These villages were 25 to 40 km west and northwest of Beer Sheva. Apart from size differences the villages were similar. The houses were built of concrete blocks with corrugated roofs and

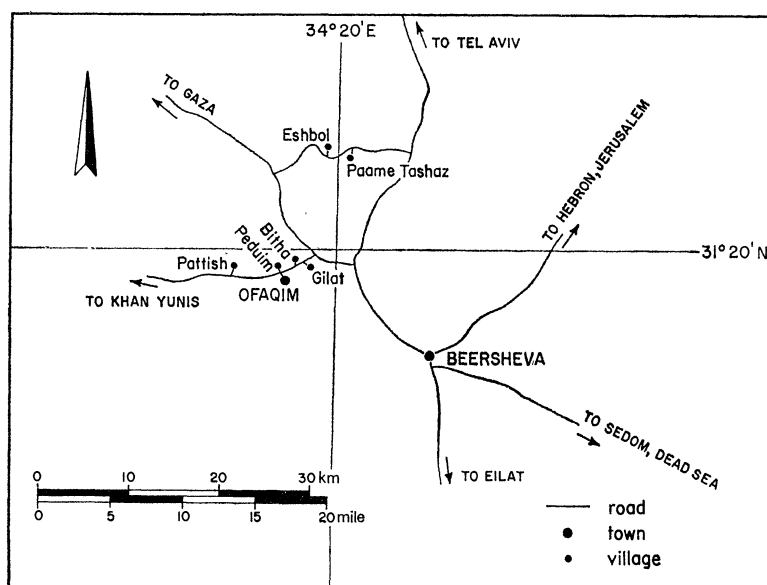


FIGURE 3. Map showing position in Israel of the two Yemenite villages, Bitha and Peduim, and the three Kurdish villages, Pattish, Eshbol and Paame Tashaz.

supplied with water and electricity. In each village there were variations in the size of houses and the number of rooms; some had shaded verandahs. Cooking was done on electric or gas stoves, and all had refrigerators; on the rare occasions in winter when indoor heating was needed paraffin stoves were used. About half the houses had solar heating plants which provided hot water on most days of the year. The layout of roads and the spacing of houses was similar in the five villages and so were the amenities of the village shop. The pattern of farming was based on irrigation, and a grid system of water pipes covered the fields, connected to a central national supply which was strictly rationed. Attending the irrigation pipes, moving them, controlling the supply, was work in which nearly all the subjects were involved at some time. Since the soil was the same in all five villages, so were the main crops: potatoes, sugar beet and groundnuts. Other crops included carrots, tomatoes, water melon, radishes and cucumbers. In Bitha, Peduim and Pattish there were considerable vineyards, whereas at Eshbol and Paame

Tashaz there were orange groves. There was no one season of harvest, as ground was prepared, crops sown and gathered throughout the year. The Yemenite Jews kept more cows than the Kurdish Jews who had rather more sheep. Battery hens were kept in all five villages.

The majority of the men were engaged in farming or in ancillary occupations, and nearly all of those who had other work also assisted in the fields. The women were primarily housewives, but many were responsible for hens and cows and most worked in the fields when required. Details of occupations are set out in table 1.

TABLE 1. PRINCIPAL OCCUPATIONS

	Kurdish Jews				Yemenite Jews			
	men		women		men		women	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
agriculture	58	85	2	4	37	46	6	15
driver or mechanic	4	6	—	—	9	24	—	—
housewife	—	—	40	78	—	—	28	72
clerk or storekeeper	1	1.5	2	4	5	13.5	—	—
unskilled	—	—	4	8	—	1	4	10
other	5	7.5	3	6	6	16	1	2.5

The villages could be fairly described as prosperous with, in general, a high standard of living. Farming was partly mechanized and there were many tractors, but manual work predominated.

CLIMATE

The five Negev villages all lie within 13 km west and northwest of the meteorological station at Gilat. Data obtained from the station were therefore used to describe the climate of the area throughout the year April 1968 to March 1969. Gilat is 150 m above sea level, 30 km from the Mediterranean coast and at a latitude of 31° 20' N. The climate, which changes very little from year to year, is essentially a desert one with hot, dry summers and mild winters. The annual rainfall is about 20 cm. Rain is confined to a few days in the winter months of November to March, and on these days it falls heavily. Winds are from a westerly or northwesterly direction and, except on days of rain, are normally light throughout the year. An early morning breeze of 0.5 to 1.5 m/s increases to 2 or 3 m/s by noon, then dies away to give a calm evening.

The summer months (May to September inclusive) were typified by cloudless skies, 9 to 13 h of sunshine, maximum air temperatures ranging from 25 to 36 °C and minimum relative humidities ranging from 26 to 54 % (table 2). The coolest month of the year was January, with maximum air temperatures ranging from 13 to 23 °C. During the winter months, cloud was more prevalent, but more than 50 % of days had at least 5 h of sunshine, and relative humidities within the summer range. The very high relative humidities at night (maximum r.h. 90 %) throughout the year resulted from the marked fall in air temperature, maximum to minimum air temperature differences being about 13 °C in the summer months and 9 °C in December and January.

TABLE 2. CLIMATIC CONDITIONS RECORDED AT GILAT

	1968									1969	
	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
maximum air temperature (°C)											
median	26.5	31.2	31.8	32.0	31.0	29.5	26.8	24.5	18.3	16.0	19.8
percentiles											
90	40.5	36.0	35.5	35.7	35.0	35.0	28.0	27.5	23.2	22.5	29.0
10	18.5	25.0	28.5	30.0	29.0	28.0	23.5	19.5	15.0	13.5	16.0
minimum air temperature (°C)											
median	9.5	17.0	17.5	19.2	18.5	18.0	14.5	11.5	9.2	7.0	7.8
percentiles											
90	23.0	21.5	19.0	20.8	19.5	19.5	17.0	15.0	13.7	11.0	17.0
10	8.0	12.0	16.0	17.0	16.5	16.0	12.5	9.5	6.3	4.5	4.5
maximum relative humidity (%)											
median	97	97	96	97	97	95	95	96	96	95	96
percentiles											
90	98	97	98	97	97	97	97	99	98	98	98
10	70	90	88	94	92	90	88	91	74	79	89
minimum relative humidity (%)											
median	36	39	39	39	43	46	50	55	48	49	45
percentiles											
90	62	53	48	48	54	51	63	71	65	66	60
10	23	26	28	28	30	30	38	34	35	31	24
daylight hours	12.9	13.7	14.1	13.9	13.1	12.4	11.5	10.6	10.2	10.5	11.2
sunlight hours											
median	9.5	11.6	12.5	11.6	10.7	10.4	9.2	8.3	6.9	5.2	8.7
percentiles											
90	11.4	12.4	13.1	12.7	12.0	11.4	10.2	9.3	9.1	8.3	10.0
10	4.2	7.1	10.3	8.9	8.9	9.2	6.4	4.2	1.3	0.8	2.2
cloud (oktas*) at 14h00	2.7	1.8	0.3	0.4	0.2	1.5	1.7	2.7	3.5	4.0	4.4

* One okta = one-eighth of the sky area.

DEMOGRAPHY AND POPULATION SAMPLE

Details of the population in the five villages are given in table 3. The population pyramids for the Kurdish and Yemenite Jews in these villages, obtained from the 1961 census, are shown in figure 4. The age distribution was similar in all the five villages, with 57% of the population under the age of 15, and it was estimated that this proportion could have risen to 65% at the time of the study in 1968. The population pyramids appear to show that men had a greater longevity in these villages than women. The numbers over the age of 70 are small, and these had spent the first 50 years in Kurdistan or the Yemen, where maternal mortality was high, hence it might be expected that men had a better life expectancy than women.

As mentioned above, the intention was to examine everyone in the villages between the ages of 20 and 30. This meant that the subjects would have all been born outside Israel, as they immigrated in 1949 to 1951, and the study was carried out in 1968. The village secretaries and the local administrative officers supplied a list of names and addresses of all those in this age group, and they were invited to attend a meeting at which the aims and objects of the study were explained. Subsequently, the subjects were asked to attend at the village clinic for a medical examination during which a blood sample was collected. The proportion of the population aged 20 to 30 who were eventually included in the study, was ascertained by obtaining as much information as possible about those who were absent. The village lists were not always up to date, but with increasing familiarity between members of the research team and the villagers, and repeated checks, it seems probable that most, if not all of the missing subjects

TABLE 3. DETAILS OF TOTAL POPULATION IN EACH OF THE FIVE VILLAGES AND NUMBERS OF SUBJECTS STUDIED

	Bitha Yemenite Jews	Peduum Yemenite Jews	Pattish Kurdish Jews	Eshbol Kurdish Jews	Paame Tashaz Kurdish Jews
population 1961 census	519	361	506	360	396
1968-9 (estimate)	650	280	530	390	350
number of subjects	51	25	47	37	35
population aged 20 to 30	68	34	61	53	41

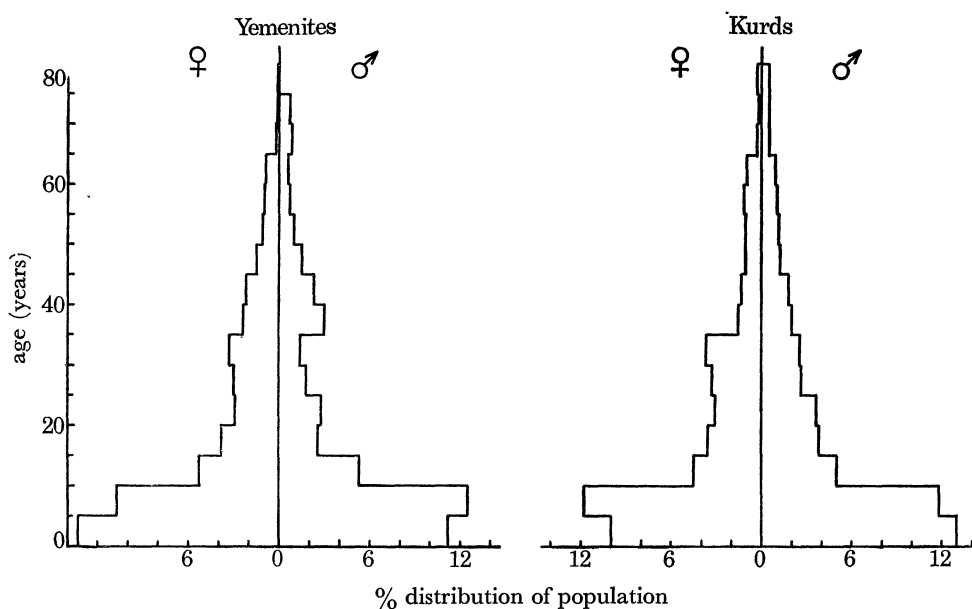


FIGURE 4. Population structure, Kurds and Yemenites, 1961 Census.

were traced. The majority of these were away in the army, as there is universal conscription for all those over the age of 18. A number were severely handicapped, physically or mentally, or were in hospital at the time of the clinical examination. A number refused to take part, frequently because of apprehension about venepuncture. There were also difficulties about the correct ages of the subjects; these were ascertained at the time of the clinical examination and again some 2 to 4 months later during the anthropometric survey, and there were many discrepancies. Most of these were resolved by questioning relatives and consulting available records, but a number of subjects were included in the study group who were probably above or below the required age of 20 to 30. Details of the number of subjects in each village are set out in table 3; it is estimated that 76% of all the inhabitants in the age group 20 to 30 were examined.

The marital status of these subjects and the number of their children are set out in table 4, which shows there was little difference between the Yemenite and Kurdish Jews in size of family or age at marriage. Intermarriage between the two communities was still rare, although a female Yemenite Jew from Peduum married a Kurdish Jew from Eshbol during the time of the study. Within each community, there was a high degree of inter-relationship, and 55 to 60% of the subjects were related to each other, as brothers, sisters or first cousins.

TABLE 4. MARITAL STATUS AND FERTILITY

	male		female	
	Kurdish Jews	Yemenite Jews	Kurdish Jews	Yemenite Jews
married	48	25	40	28
single	20	12	11	11
years married	6.8 ± 4.2	6.2 ± 3.1	9.0 ± 4.0	6.9 ± 3.4
age at marriage	20.5 ± 2.7	21.1 ± 2.6	18.3 ± 2.2	18.3 ± 1.8
no. of children per married subject	3.0 ± 2.1	3.3 ± 2.3	3.8 ± 2.1	3.7 ± 2.0
no. of children per year of marriage	0.43 ± 0.03	0.48 ± 0.05	0.42 ± 0.03	0.57 ± 0.05
no. of children and miscarriages per year of marriage	—	—	0.47 ± 0.03	0.72 ± 0.06

RESEARCH PLAN AND ORGANIZATION

The plan, following the clinical examination, was to observe and measure the environmental conditions of each individual subject, and to make an anthropometric survey. In addition, a proportion of subjects were invited to attend at a laboratory in Beersheva for measurements to be made of maximum oxygen consumption and physiological responses to a standard period of hyperthermia. Since the number who could be tested in the laboratory was estimated to be about 70, a choice of subjects had to be made. Pregnant subjects, and all those with haemoglobin levels below 12 g % were excluded. The physician in charge of the clinical examination (E. E. Lehmann) also rejected a number of subjects on medical grounds. A random choice of the remaining 150 subjects was planned, but was not feasible, since many refused, usually owing to difficulties in arranging a day away from farm or house. Nearly all the women who were available were tested, but a number of men had to be excluded. The physical characteristics of those who were examined were very similar to those not tested.

Each village had a clinic which was made available to the team who carried out the field investigations, including the anthropometric survey. A nurse was in charge in each village (3 men, 2 women); they provided valuable assistance and because of their familiarity with all the inhabitants, were most effective liaison officers. One of them (Salach Salman) worked full time with the team and he was largely responsible for the success achieved in the field work.

The whole investigation was carried out in two periods; summer studies during June and July and winter studies during January and February. Depending on the size of the village, 1 or 2 weeks were spent in each village in each season. Measurements of physical work capacity and response to hyperthermia were also carried out in both seasons.

CONCLUSIONS

The object of the investigations, to which this paper is an introduction, was to distinguish between inherited and acquired components in the physiological adaptation of individuals and populations to their environment. Reasons are given for choosing the Kurdish and Yemenite Jews living in Israel to be studied for this purpose. Such answers as have been obtained will be described in detail in the following papers.

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