# Papers and Originals

## Metabolic Maladies in New Zealand Maoris

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The problems of health and disease in the Maori and European people of New Zealand offer many opportunities for study of diseases by modern epidemiological methods. The emergence of the Maori people of New Zealand as a particularly high-risk group in terms of a variety of related metabolic disturbances has only recently been appreciated. Obesity, diabetes, hyperuricaemia, clinical gout, and coronary artery disease are common in both sexes, and the prevalence of certain of these conditions has been shown to far exceed that of the European section of the community (Prior, 1962).

The extent of the differences in mortality rates in the two racial groups has now been defined in the Report on Maori and European Health published by the Department of Health (1960). Notably higher death rates are shown from infectious diseases, pneumonia, tuberculosis, and diabetes in both sexes, while Maori women in the 40–59 age-group have a four times greater mortality from coronary disease and a five times greater mortality from hypertension than women of European stock. The rates in Maori men for these two conditions are similar to those for men of European stock. A higher incidence of atheroma has also been reported in American negro women with an increased susceptibility to coronary disease and hypertension as compared with white women (McVay and Keil, 1955; Rose, 1962). More recently, similar findings have been reported in Indian men and women living in urban conditions in South Africa (Walker and Seftel, 1962). Sir Douglas Robb (1960) has also recorded the occurrence of atheromatous aneurysm of the abdominal aorta in young Maori women.

The metabolic abnormalities described by the term "gouty diathesis" of the earlier European physicians included hypertension, diabetes, cardiovascular disease, and nephritis in addition to gout. Nevertheless, the existence of this clinical association between gout and diabetes could not be confirmed in the U.S.A. by such authorities on gout as Talbott (1953), and on diabetes as Joslin *et al.* (1952), who found only one gouty patient out of 1,500 diabetics. Snapper (1960) strongly disagreed with this belief and pointed out how the Europeans have taught about the diathesis for 400 years at least, while it is only now being rediscovered by the Americans. Kuzell *et al.* (1955) had gone so far as to stress the value of a family history of diabetes in the diagnosis of gout.

This sharp conflict of opinion between ancient and modern authorities was duly recorded by Bartels and Corn (1960), who reviewed the literature, adding 38 patients of their own with combined gout and diabetes. They also drew attention to Ishmael's (1945) family studies on the frequent association between gout and diabetes and their common connexion with obesity and atherosclerosis.

Clinical experience at the Queen Elizabeth Hospital, the National Rheumatic Unit for New Zealand, also supports an association between gout and diabetes (Isdale, 1961). Retrospective case studies showed five frankly diabetic subjects and three with an abnormal glucose-tolerance test among 40 gouty males.

The availability of high-risk Maori groups living in relatively isolated compact communities allows important information to be obtained about the relative importance of genetic and environmental, including dietary, factors and provides epidemiological evidence to support or refute the clinical concept of a gouty diathesis.

The present report deals with the findings among adults in an isolated rural Maori community and represents the first of a series of surveys planned to compare Maori and European communities in New Zealand living under different environmental conditions.

Details of the general findings of the survey, together with anthropometric data, blood-pressure distribution curves, and other clinical findings have been published (Prior, 1962). The emphasis in the present paper is on the metabolic abnormalities disclosed, particularly coronary artery disease, obesity, hyperuricaemia, clinical gout, and diabetes. The importance of genetic factors is discussed in the light of knowledge of family relationships of the group studied. Data on serum-cholesterol and uric-acid levels are also presented.

### Population Sample

The community studied consisted of one of the most isolated Maori rural groups in New Zealand who were also racially more pure Maori than any other group available; they belong to the Tuhoe tribe and live in the centre of the Urewera Country in the North Island. The area consists of a narrow valley about 10 miles (16 km.) in length surrounded by bush-clad hills, and is more than 35 miles (56 km.) from the nearest small township and 70 miles (113 km.) from the nearest major town. The men are employed on forestry or milling work, on farming, or on public works and road maintenance. The women marry young, have large families, and generally their physical activities are confined to housework, gardening, and occasional communal work such as potato-planting and harvesting and preparing food for feasts. The group speak Maori as their first language, but all except a few of the older residents speak English.

The infants and children were also examined, and the findings, particularly in relation to infection and anaemia, have been separately reported (Neave *et al.*, 1963).

The area of the survey was geographically defined and a census of the entire population was obtained. This represented a chunk population sample. The study was carried out in January, which is midsummer in New Zealand. The total

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population of the valley was 491, with 462 resident in the valley during the period of the survey. The majority of those who were away were below 20 years; four adults refused to participate. The participation rate reached 99% of those available in the valley at the time of the survey and 93% of the total in the census.

The data discussed were obtained from those examined aged 15 and over, this sample comprising 110 males and 102 females distributed as in Table I.

TABLE I.—*Ruatahuna Adult Population Studied. Sample Sizes on Which Data Are Based*

| Age-group | Male | Female |
|---|---|---|
| 15–19 | 18 | 19 |
| 20–29 | 33 | 24 |
| 30–39 | 15 | 23 |
| 40–49 | 23 | 16 |
| 50–59 | 7 | 8 |
| 60–69 | 11 | 8 |
| 70+ | 3 | 4 |
| Total | 110 | 102 |

## Methods

The W.H.O. Special Committee recommendations on methodology have been followed in most instances. Full details of these were published in the previous report (Prior, 1962).

*Anthropometry.*—Relative weights were calculated, using the 1912 Actuarial Society of America study as the standard (U.S. Department of Agriculture, 1960).

*Biochemistry.*—The cholesterol estimations were carried out by the modified Abell-Levy method (Abell, 1960). Uric acid was estimated by a modified Carraway colorimetric method at the National Rheumatism Unit at Queen Elizabeth Hospital, Rotorua.

*Diabetes Detection.*—Casual urines, one to four hours postprandial in most cases, were tested for sugar in all subjects. A modified glucose-tolerance test consisting of fasting and two-hour blood-sugar specimens after taking 50 to 100 g. of glucose according to weight was carried out in the majority of those with glycosuria. Fasting blood sugars above 120 mg. or a two-hour level of 130 mg. or over were regarded as abnormal.

*Dietary Data.*—A 24-hour recall of food taken in the previous 24 hours was obtained from each subject. Information regarding family diets and household food consumption was obtained from interviews with the housewife and from food order books at the local stores. The dietary survey included 73 households, consisting of 216 adults and 248 children. The size of the households ranged from 1 to 19 (8 adults and 11 children), with a mean number per household of 6.3. Dietary histories were obtained from 192 of the 212 adults medically examined.

## Results

*Anthropometric Findings.*—The heights and weights are set out in Table II. The distribution of relative weight changes in age-groups in both males and females is shown in Table III. Females two months or more pregnant have been excluded from Weight and Relative Weight Tables. A relative weight of 120% and over indicates moderate obesity, while one of 140% and over indicates gross obesity. The data are also shown in Fig. 1, where the percentages in the different age-groups below and above 120% relative weight are shown. Obesity reached its peak in the women aged 30–49, and this was confirmed by skin-fold data (Prior, 1962). The women of 50 and over had notably less obesity than the men in the same age-group.

*Cardiovascular Findings.*—The blood-pressure rose with age in both sexes and reached higher mean levels in the females for both systolic and diastolic pressures from the fourth decade onwards. The detailed blood-pressure data with frequency distribution curves and clinical data have been reported (Prior, 1962).

TABLE II

*Mean Heights*

| Age-group | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | No. in Sample | Mean Ht. in in. | S/D | No. in Sample | Mean Ht. in in. | S/D |
| 15–19 | 18 | 65·44 | 2·77 | 19 | 62·68 | 1·86 |
| 20–29 | 33 | 66·45 | 2·90 | 24 | 62·17 | 1·74 |
| 30–39 | 15 | 68·28 | 2·52 | 23 | 61·74 | 2·22 |
| 40–49 | 23 | 66·35 | 2·72 | 16 | 62·38 | 2·00 |
| 50–59 | 7 | 66·71 | 2·14 | 8 | 62·00 | 1·51 |
| 60–69 | 11 | 67·09 | 2·84 | 8 | 60·50 | 2·78 |
| 70+ | 3 | 64·0 | (2·0) | 4 | 60·25 | (2·06) |

*Mean Weights*

| Age-group | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | No. in Sample | Mean Wt. in lb. | S/D | No. in Sample | Mean Wt. in lb. | S/D |
| 15–19 | 18 | 146·5 | 43·7 | 17 | 136·9 | 21·6 |
| 20–29 | 33 | 173·8 | 31·7 | 21 | 146·5 | 32·2 |
| 30–39 | 15 | 194·0 | 36·5 | 18 | 171·4 | 33·4 |
| 40–49 | 23 | 185·7 | 41·6 | 16 | 168·9 | 40·2 |
| 50–59 | 7 | 174·3 | 24·7 | 8 | 152·6 | 33·5 |
| 60–69 | 11 | 188·9 | 46·0 | 8 | 148·6 | 33·7 |
| 70+ | 3 | 160·7 | (27·2) | 4 | 125·0 | (18·8) |

TABLE III.—*Relative Weight Distributions*

| Age-group | No. in Sample | Relative Weight | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | <100% | | 100–119% | | 120–139% | | 140%+ | |
| | | No. | % | No. | % | No. | % | No. | % |
| *Males* | | | | | | | | | |
| 15–29 | 51 | 9 | 18 | 26 | 51 | 12 | 23 | 4 | 8 |
| 30–49 | 38 | 7 | 18·5 | 22 | 58 | 4 | 10·5 | 5 | 13 |
| 50+ | 21 | 6 | 29 | 7 | 33 | 6 | 29 | 2 | 9 |
| *Females* | | | | | | | | | |
| 15–29 | 38 | 11 | 29 | 14 | 36 | 9 | 24 | 4 | 11 |
| 30–49 | 34 | 6 | 18 | 7 | 21 | 9 | 27 | 12 | 34 |
| 50+ | 20 | 8 | 40 | 9 | 45 | 1 | 5 | 2 | 10 |


FIG. 1.—Percentages below and above 120% relative weight in males and females in different age-groups.

## Ischaemic Heart Disease

Angina was diagnosed by the history in seven women and four men. Six of the women and two of the men had abnormal electrocardiograms (E.C.G.s), one of the men having a classical infarct pattern. The clinical details of the subjects with angina, including their cholesterol and uric-acid levels, are set out in Table IV. The criteria for clinical diagnosis of angina consisted of substernal chest pain or discomfort coming on with exertion, relieved by rest within less than 10 minutes.

Abnormality of the E.C.G. apart from those with an infarct pattern consisted of ST and/or T changes which could have been non-specific but were of the type commonly associated with ischaemic heart disease. One woman showed E.C.G. evidence of an old infarction but admitted to no chest pain.

In subjects of 30 years and over this gives a prevalence of ischaemic heart disease of 7% in the males and 16% in females.

Routine E.C.G. analysis showed a greater percentage of abnormal tracings in the women than in the men. The commonest abnormalities consisted of non-specific ST and T changes.

nosis was accepted. The diagnosis was confirmed by the modified glucose-tolerance test in 11, was accepted in two who had gross glycosuria and in one subject whose urine test was negative when seen at the survey and was diagnosed by an

TABLE IV

| Age | Height (in.) | Weight (lb.) | Relative Weight (%) | B.P. | Chest X-ray | E.C.G. | Uric Acid (mg./100 ml.) | Cholesterol (mg./100 ml.) | Other Findings |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Males with Angina* | | | | |
| 63 | 65 | 118 | 76 | 140/85 | N | Infarct pattern | 6 | 210 | |
| 62 | 71 | 287 | 157 | 150/110 | LV+ | T changes | 6·9 | 160 | Diabetes, cardiac failure |
| 60 | 64 | 164 | 109 | 170/85 | LV+ | N | 8·1 | 225 | Aortic incompetence |
| 60 | 69 | 184 | 106 | 120/100 | LV+ | N | 6·7 | 208 | |
| | | | | | *Females with Angina* | | | | |
| 37 | 62 | 196 | 152 | 120/90 | N | T changes | 7·2 | 275 | |
| 38 | 63 | 233 | 173 | 140/90 | LV+ | T ,, | 5 | 167 | |
| 56 | 63 | 218 | 147 | 230/135 | N | LV stress | 8 | 204 | Diabetes |
| 53 | 62 | 158 | 110 | 140/95 | LV+ | ST and T changes | 7·5 | 280 | ,, |
| 61 | 63 | 168 | 113 | 135/95 | N | N | 6·9 | 223 | |
| 66 | 62 | 176 | 121 | 156/110 | LV+ | T changes | 7·9 | 169 | |
| 85 | 59 | 145 | 108 | 230/115 | LV+ | LV stress | 6·4 | 193 | |

## Cholesterol Data

The mean cholesterol levels in different age-groups, with the standard deviations, are set out in Table V. The distribution curves of cholesterol in the two sexes are shown in Fig. 2 for those aged 20 years and over.

TABLE V.—*Cholesterol Data*

| Age-group | Females | | | Males | | |
|---|---|---|---|---|---|---|
| | No. | Mean (mg.) | S.D. | No. | Mean (mg.) | S.D. |
| 15–19 | 19 | 177·3 | 30·42 | 18 | 166·8 | 26·18 |
| 20–29 | 23 | 204·6 | 32·50 | 33 | 204·4 | 41·81 |
| 30–39 | 23 | 197·5 | 26·55 | 15 | 221·5 | 29·37 |
| 40–49 | 16 | 203·1 | 40·92 | 23 | 214·9 | 33·92 |
| 50–59 | 8 | 219·9 | 47·42 | 7 | 220·4 | 27·80 |
| 60–69 | 8 | 208·9 | 38·42 | 11 | 231·4 | 44·5 |
| 70–79 | 4 | 180·0 | 15·07 | 3 | 273·3 | 158·45 |

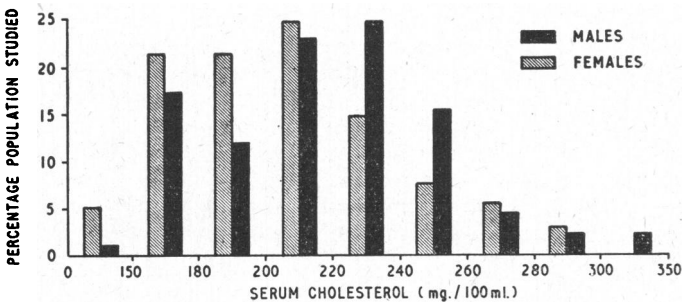


FIG. 2.—Percentage frequency distribution of cholesterol levels in 82 females and 92 males aged 20 years and over.

The levels can be seen to rise with age, reaching a peak of 231 mg. in the 60–69 age-group in the men and 219 mg. in the 50–59 age-group in the women. The sample size becomes too small in the over 70's to allow conclusions to be drawn. The relationship of cholesterol levels to relative weight was analysed in the 20–39 and 40–59 age-groups. The mean cholesterol levels were higher in those over 120% relative weight in both sexes but reached statistical significance only in the men in the 40–59 age-group ($P<1\%$) (Table VI).

A relationship of cholesterol level to dietary-fat intake was found in the men and women under 50 years, the groups on the lower fat intake having significantly lower cholesterol levels (Table VII).

## Metabolic Abnormalities

### Diabetic Abnormality

Seven men and 11 women were found to have diabetes. Four, previously diagnosed, showed gross glycosuria and the diagelevated blood sugar on admission to hospital some days later. Eighteen of the 212 subjects aged 15 and over were abnormal, 11% of the females and 6% of the males being affected.

The importance of obesity in contributing to diabetes is well recognized, and genetic factors could also be important. The mixed metabolic abnormalities found can be readily illustrated by this group. Six of the 11 female diabetics were overweight, six had significant hypertension, two had angina, and one had gout. Six of the seven male diabetics were overweight, three had clinical gout, and one had angina.

TABLE VI.—*Cholesterol Levels and Relative Weights, Comparing Those Less than* 120% *and Those* 120% *and Greater*

| | 20–39 Years | | 40–59 Years | |
|---|---|---|---|---|
| Relative Weight: | <120% | ⩾120% | <120% | ⩾120% |
| | *Males* | | | |
| No. | 32 | 16 | 16 | 7 |
| Mean cholesterol (mg.) | 207·7 | 213·9 | 202·1 | 244·0 |
| Standard error mean | 7·68 | 7·11 | 7·3 | 9·6 |
| Significance | N.S. | | 1% | |
| | *Females* | | | |
| No. | 20 | 24 | 14 | 10 |
| Mean cholesterol (mg.) | 193·3 | 209·3 | 202·4 | 217·5 |
| Standard error mean | 3·92 | 7·24 | 12·8 | 11·12 |
| Significance | N.S. | | N.S. | |

TABLE VII.—*Difference in Cholesterol Levels (mg./100 ml.) of Men and Women on Moderate and High Fat Diets*

| Men | 20–49 Years | | | 50 Years and Over | | |
|---|---|---|---|---|---|---|
| | Group I (n=27) | Group II (n=41) | Significance | Group I (n=12) | Group II (n=7) | Significance |
| Mean cholesterol | 196·30 ±7·20 | 224·76 ±5·16 | Significant at 1% level | 217·08 ±7·77 | 233·86 ±21·38 | Not significant |
| Women | Group I (n=15) | Group II (n=45) | | Group I (n=8) | Group II (n=10) | |
| Mean cholesterol | 180·33 ±3·81 | 210·29 ±5·38 | Significant at 1% level | 187·25 ±9·67 | 221·60 ±11·84 | Significant at 5% level |

Group I = Moderate fat intake, 35% or less of calories derived from fat.
Group II = High fat intake, more than 35% of calories derived from fat.

### Hyperuricaemia and Gout

Five men had a classical history of gout and one of probable gout; three of the six were diabetic. One woman aged 31 was observed in an attack of classical gout and was also found to be a diabetic; one other had arthritis of an ankle and a uric acid of 11.5 mg./100 ml.

Hyperuricaemia was common in both sexes, and the extent of this can be seen in Fig. 3. Taking the upper limit of normal for the method used as 7 mg. for men and 6 mg. for women, 59% of the men and 40% of the women had abnormal levels. The levels in men were higher than in the women in all age-groups and are detailed in Table VIII.

There was a rise in uric-acid levels with age, the peak being reached in the fourth decade in males and in the sixth decade in females. A relationship of uric acid to relative weight was shown in the women and in the men aged 40 and over, those 120% and over relative weight having significantly higher mean levels than those under 120% relative weight ($P<5\%$) (Table IV).

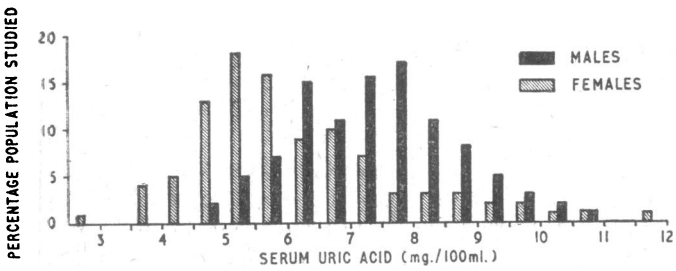


FIG. 3.—Percentage frequency distribution of uric-acid levels in 100 females and 109 males aged 15 and over.

TABLE VIII.—*Uric Acid Data*

| Age-group | Females | | | Males | | |
|---|---|---|---|---|---|---|
| | No. | Mean | S.D. | No. | Mean | S.D. |
| 15–19 | 18 | 5·71 | 1·14 | 18 | 7·01 | 1·44 |
| 20–29 | 23 | 6·03 | 1·80 | 32 | 7·17 | 1·03 |
| 30–39 | 23 | 6·32 | 1·64 | 15 | 7·44 | 0·99 |
| 40–49 | 16 | 6·43 | 1·46 | 23 | 7·94 | 1·52 |
| 50–59 | 8 | 5·79 | 1·44 | 7 | 7·91 | 1·11 |
| 60–69 | 8 | 7·64 | 2·21 | 11 | 7·52 | 1·27 |
| 70–79 | 4 | 5·80 | 0·85 | 3 | 6·60 | 1·21 |

TABLE IX.—*Uric Acid and Relative Weights, Comparing Those Less than 120% and Those 120% and Greater*

| Relative Weight: | 20–39 Years | | 40–59 Years | |
|---|---|---|---|---|
| | <120% | >120% | <120% | >120% |
| *Males* | | | | |
| No. | 31 | 15 | 17 | 6 |
| Mean uric acid | 7·07 | 7·59 | 7·53 | 9·12 |
| Standard error mean | 0·19 | 0·21 | 0·32 | 0·63 |
| Significance | N.S. | | 5% | |
| *Females* | | | | |
| No. | 19 | 27 | 14 | 10 |
| Mean uric acid | 5·47 | 6·67 | 5·71 | 6·92 |
| Standard error mean | 0·20 | 0·38 | 0·25 | 0·57 |
| Significance | 5% | | 5% | |

## Diet

The typical diet is high in carbohydrate from bread, potatoes, and sugar, and, depending on the amount of meat used, frequently high in fat.

Meals are very simple, consisting of large portions of a few foods. Staple foods are bread, potatoes, sugar, butter, meat, and green vegetables. Eggs, cheese, and fruit are used by almost all families, but at infrequent intervals by most. Milk is used by adults in tea only. The main meal of the day is taken in the late afternoon and most commonly consists of a meat stew, a green vegetable, which is cooked on top of the stew, potatoes, bread, and tea. The other one or two meals of the day are basically bread and tea supplemented by leftovers from the previous meal, or by cold meat or tinned fish.

Tea is the common beverage and is taken with large amounts of sugar by the majority. Beer drinking is confined to week-ends, and a bout of heavy drinking by men may be followed by an eating binge at which large quantities of meat or fried eggs will be eaten.

## Calories

The daily consumption per head of foods contributing calories to the diets of nine families was estimated over a four-months period. The families studied were representative of the different types of households in the valley and comprised 25 adults and 31 children, infants under 1 year being excluded. The average number per family was 6.3 and the age distribution was that of the total Ruatahuna population with 40% being under the age of 10 years. The mean daily consumption per head (children and adults) of calories from all foods excepting meat, and extras such as beer, ice-cream, soft drinks, and sweets, was 2,220 calories, made up as follows: bread, flour, breakfast cereals, and biscuits 880 ; potatoes 300 ; sugar 370 ; butter 390 ; milk 125 ; bacon 115 ; canned meat and fish 35 ; eggs <10 ; cheese <10. Supplies of fresh meat and consumption by individuals within the family were so variable that a daily consumption figure per head was not thought practicable. Most commonly used meats were fat mutton and corned brisket or beef ; methods of cooking—frying and stewing—tend to conserve fat. Butter is the only other important source of fat in the diet, and as butter consumption does not vary greatly the amount of meat eaten largely determines the amount of fat in the diet.

Men and women were readily grouped into two classes according to the amount of meat normally eaten. We were thus able to compare weights, serum-uric-acid levels, and serum-cholesterol levels of two groups whose diets were similar except in respect of meat intake. Group 1 includes those who normally ate one meat meal daily ; in group 2 are those who ate two or more meat meals daily. In group 1 35% or less of total calories was derived from fat, while in group 2 the contribution from fat exceeded 35%.

In the 20–49 age-group there was little difference in the mean weights or serum-uric-acid levels of the two groups, but the men and women on the higher fat diets in group 2 had significantly higher serum-cholesterol levels (see Table VII). In the over-50 age-group those in group 2, eating the larger amounts of meat, were heavier ; their serum-uric-acid levels were higher, but not significantly so, while the difference in serum cholesterols was significant in the women but not in the men.

## Discussion

The findings indicate a high prevalence of serious metabolic abnormalities in this group of isolated rural Maoris. Obesity, ischaemic heart disease, diabetes, hyperuricaemia, and gout have been found to be particularly common and are clearly linked in this group. Genetic factors are likely to be important as there has been and still is a considerable amount of intermarriage among this tribe. The role of genetic factors is being further studied in the group.

Although the numbers in the survey are small, the Maori women have emerged as a high-risk group with a prevalence of ischaemic heart disease that is notably higher than groups of American women of the same age studied at Framingham, U.S.A. (Dawber *et al.*, 1957). The Maori women had a higher prevalence than the men of both ischaemic heart disease and significant hypertension, and these findings are consistent with the high cardiac mortality from these conditions reported in Maori women (Department of Health, 1960). Obesity was common in both sexes and is considered to be an important factor contributing to the large number with both impaired carbohydrate metabolism and hyperuricaemia. The prevalence

rate of diabetes might well have been higher if the screening urine had always been collected after a large meal.

The high rate of clinical gout and the remarkable proportion with hyperuricaemia may be assumed to be due, at least in part, to genetic factors. The contribution from dietary factors, particularly an overall excess of calories with a large proportion coming from sources of fat, is being studied and could be important. Lennane *et al.* (1960) reported a high gout rate in Maori people, particularly in the males—namely, 8% of a male sample studied, as compared with 0.5% in a group of New Zealanders of European extraction. The findings of clinical gout in three of the seven men and in one of the eleven women with diabetes shows a remarkably high rate of association between the two conditions. This rate is notably higher than the eight cases in 1,000 diabetics reported from the Royal Free Hospital, London, by Beckett and Lewis (1960). Gertler *et al.* (1951) have drawn attention to higher uric-acid levels in subjects with cardiac ischaemia as compared with controls, particularly in those of endomorphic build. They showed a positive correlation with the ponderal index and weight.

The present study shows significantly higher mean uric-acid levels in those exceeding 120% relative weight compared with those under 120%, except in men under 40, and suggests that excess weight is at least one factor contributing to the hyperuricaemia. The mean cholesterol levels in the different age-groups follow the pattern of Western communities, with the men having higher levels than the women. The levels in the men are lower than those reported by Hunter and Wong (1961) in urban N.Z. European males. The only group to show a significantly higher cholesterol in those exceeding 120% of relative weight were men over 40. The diets were universally high in carbohydrates, and in fat where consumption of meat was high. Decreasing activity after marriage as well as an excess of calories are important factors contributing to obesity in the women. It was anticipated that multiple pregnancies may have been an important factor in contributing to excess weight, but no correlation was found between parity and weight.

There are many factors predisposing to atherosclerosis, and the demonstration of an unduly high prevalence of some of these in a group of people can give leads to their relative importance. Re-study of the same group after an interval will also be of considerable value in such a high-risk group, and is to be undertaken.

The group of people reported were chosen because of their relative isolation and their adherence to some of the older customs of Maori living and eating. Further studies of less isolated rural and urban Maori groups are at present being undertaken to obtain further information about the problems disclosed. Genetic influence may be less important in larger communities with less intermarriage, while adoption of a more Western way of life by the urban groups may reveal interesting trends.

## Summary

Mortality statistics have shown that the New Zealand Maori is becoming notably more prone to die from diseases such as diabetes, renal failure, hypertension, and coronary disease than New Zealanders of European stock.

The extent of these and related conditions has been studied by epidemiological methods among one of the most isolated and pure Maori tribes in New Zealand: 99% co-operation was achieved, and the samples comprised 110 males and 102 females aged 15 and over.

A remarkably high prevalence of ischaemic heart disease in the women, and hyperuricaemia and clinical gout, diabetic abnormality, and excess weight in both sexes was found. The diet pattern in the group was relatively simple in terms of foods used and methods of cooking, with a high carbohydrate and sugar intake and a moderate-to-high fat intake. The cholesterol and uric-acid levels and distribution curves are presented, the uric acids being notably higher than reported European levels.

The mixed metabolic picture shown by this group of Polynesians is thought to be in part genetic, with a concentration of abnormalities occurring due to intermarriage but also to such factors as diet and obesity.

The need for study of further groups of Polynesians living under different environmental conditions is stressed.

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