The Influence of Standard of Living on Blood Pressure in Fiji

By Ian Maddocks, M.B.

The HURRY and worry that accompany Western civilization are often invoked as etiologic factors in hypertension. In Fiji and the Gilbert Islands some populations do not show the higher blood pressures of later life characteristic of Western populations.1 It is tempting to associate the apparently indolent, secure, and unhurried life of the Pacific Islander with this relative freedom from hypertension.

To test the possible influence of the "Western" way of life among these Pacific populations, I set out to compare in the same race the blood pressures of a middle-aged group that had led such a life, with a group that had not. Few Fijians and hardly any Gilbertese lead "Western" lives, but there is such a group among the Indians of Fiji. The rural Indian population of Fiji has been studied and shown to have an incidence of high blood pressure almost as low as among Fijians.2 There are numbers of Indian men in business and the professions in Fiji, whose wealth and influence are increasing. Most of them have lived in relative physical comfort compared with the rural Indians. They have been concerned with clerical work rather than manual labor, and have accepted the strains of business competition. It is a common prejudice among members of this group that they suffer from high blood pressure, because, they say, high blood pressure is associated with worry and with drinking alcohol.

During March 1960, a survey of casual arterial pressure was conducted among the Indian business men of Suva, Fiji, to compare them with the blood pressures of the previously reported rural population.

Methods

Selection of Subjects

The sample sought comprised shopkeepers (general merchants, jewelers, tailors), transport and building contractors, and professional men (doctors, lawyers, insurance agents, teachers). To avoid a selection that might have been conditioned in any way by the health of the subjects, lists were obtained from the two Indian Clubs of all members thought to be over 40 years of age, and from the Civil List of all men over 40 years of age earning more than £500 annually, and all head teachers. A total of 146 names was collected, and of these 121 are included in the final sample. The remaining 25 either could not be located in Suva or were seen under circumstances that did not satisfy the criteria for the standard measurement of blood pressure. The Indians of Fiji originally came from many different parts of India. The genetic background of this urban sample was mixed, but is thought to be very similar to the genetic background of the rural sample with which comparison is made.

Measurement of Blood Pressure

The technic of measuring blood pressure and arm circumference has been described in detail elsewhere.2 Both this survey and that of the rural sample were conducted by the same observer. Subjects were visited in their offices or shops, and were kept seated for at least 10 minutes before the blood pressure was recorded.

Results

Mean systolic and diastolic pressures for this group of urban Indians are compared with those previously reported for rural Indians in table 1. Figure 1, which illustrates the comparison, shows that the means of both systolic and diastolic pressures of the urban population were consistently higher than those of the rural population. The significance of this difference was investigated by comparing the linear regressions of blood pressure
on age in the two populations by means of an analysis of covariance. The regressions for both systolic and diastolic pressures were significantly different in level but not in slope in the two samples.

Table 2 compares the mean arm circumferences in the two populations, and shows the effect of applying the correction for arm circumference recommended by Pickering, Roberts, and Sowry. The urban Indians had greater mean arm circumferences at all ages, but the differences between the corrected means remained significant, though reduced.

Discussion

For a systematic and significant difference to occur between the blood pressures of two populations, there need not be any way in which they can be contrasted. Bøe, Humerafelt, and Wedervang in their survey in the City of Bergen, found such a difference between the two halves of that apparently homogeneous city. Here, therefore, where two populations have been chosen to contrast in their way of life, the differences found in their blood pressures do not necessarily depend upon that contrast, but could occur from chance, or from the operation of other factors. The almost universal concern shown by the urban Indians about the level of their blood pressures, for example, may have been a sufficient emotional stimulus to raise their pressures above those of the rural population, who were generally less aware of the significance of blood pressure. This would have its effect more upon the systolic pressure, and the fact that the diastolic pressure is also significantly higher in the urban group probably means that the emotion is not the cause of the blood pressure difference.

A factor that might be responsible for the difference is body weight. The increase of blood pressure with body weight has been demonstrated in many races. Padmavati and Gupta found that the average systolic and diastolic pressures of a group of urban Indians were higher than a poorer rural group, and noted that the urban group had higher average body weights. Body weight was not measured in both the Indian population samples in Fiji, but its influence can be assessed from the measurements of arm circumference. From data available for part of the rural Indian population it has been calculated that an increase of 1 cm. in arm circumference is associated with an average increase of 3.7 Kg.

Table 1

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Systolic</th>
<th>Diastolic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
<td>Mean</td>
<td>Standard deviation</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30–39</td>
<td>394</td>
<td>121.3</td>
<td>14.0</td>
<td>77.4</td>
<td>11.6</td>
</tr>
<tr>
<td>40–49</td>
<td>448</td>
<td>126.1</td>
<td>18.8</td>
<td>79.4</td>
<td>13.4</td>
</tr>
<tr>
<td>50–59</td>
<td>187</td>
<td>134.1</td>
<td>26.2</td>
<td>81.3</td>
<td>15.4</td>
</tr>
<tr>
<td>60–69</td>
<td>179</td>
<td>135.9</td>
<td>24.1</td>
<td>77.9</td>
<td>11.2</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Age</th>
<th>RURAL</th>
<th>URBAN</th>
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<tbody>
<tr>
<td></td>
<td>Arm circumference</td>
<td>Corrected systolic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30–39</td>
<td>26.6</td>
<td>132.3</td>
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<td>40–49</td>
<td>26.3</td>
<td>128.7</td>
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<tr>
<td>50–59</td>
<td>25.7</td>
<td>137.4</td>
</tr>
<tr>
<td>60–69</td>
<td>24.2</td>
<td>141.2</td>
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</tbody>
</table>

Circulation, Volume XXIV, November 1961
in body weight. The average difference between the arm circumference of the two Indian samples (1.6 cm.) therefore represents a difference of approximately 6 Kg. in their average body weights. Bøe, Humerfelt, and Wedervang estimated that an increase of 10 Kg. in body weight was associated with an increase of 3 mm. Hg in systolic pressure and 2 mm. Hg in diastolic pressure. Weight differences between the two Indian populations, on those figures, are too small to explain the differences in their average blood pressures.

Table 3 compares the prevalence of systolic pressures greater than 180 mm. Hg and diastolic pressures greater than 100 mm. Hg in Fijians, Gilbertese, the two Indian populations, and a London population of men aged 40 to 69 years. The levels 180 and 100 mm. Hg were chosen because they are often taken in defining high blood pressure. The percentage of high pressures is least in Gilbertese, and gradually increases through Fijians, rural Indians, urban Indians, and Europeans. As the blood pressures of more racial groups are studied, it will probably become apparent that there is a continuous gradation from those populations in which essential hypertension is rare (e.g., Gilbertese) to those among whom it is a major disease and cause of death (e.g., Europeans). That two groups of Indians, apparently similar except for the Western way of life of one of them, form a step in this gradation, and that the influence of Western culture among these peoples parallels the incidence of high pressures among them, suggests that some environmental factors or factors associated with the Western culture pattern causes blood pressure to rise.

The sorting out of the possible operative influence in the Western culture pattern is a matter of great complexity. Diet, alcohol intake, exercise, and the frequency of psychologically stressful situations may all be relevant. Even if the inheritance of essential hypertension is eventually defined in terms of a single gene system, environmental factors could still have important triggering effects. The continuing study of population samples in poorer countries where hypertension is uncommon, as they adopt Western ways, may be the best available means for discovering and assessing these factors.

**Summary**

A group of Indian men in Suva, Fiji, selected for their relatively high standard of living had average systolic and diastolic blood pressures higher than those of the sample of the local rural Indian male population. There is gradation in the incidence of high blood pressure among several races of the Pacific Islands that parallels the degree to which they have been influenced by Western culture.
STANDARD OF LIVING AND BLOOD PRESSURE

Acknowledgment

My thanks are due to Dr. Dill Russell, Director of Medical Services Fiji, for permission to undertake these studies and to officers of the Administration of Fiji and the Colonial Sugar Refinery Company for their assistance in the field work. I am grateful to Professor R. R. H. Lovell for his valuable advice and criticism.

References


The first condition to be fulfilled by men of science, applying themselves to the investigation of natural phenomena, is to maintain absolute freedom of mind, based on philosophic doubt. Yet we must not be in the least sceptical; we must believe in science, i.e., in determinism; we must believe in a complete and necessary relation between things, among the phenomena proper to living beings as well as in all others; but at the same time we must be thoroughly convinced that we know this relation only in a more or less approximate way, and that the theories we hold are far from embodying changeless truths. When we propound a general theory in our sciences, we are sure only that, literally speaking, all such theories are false. They are only partial and provisional truths which are necessary to us, as steps on which we rest, so as to go on with investigation; they embody only the present state of our knowledge, and consequently they must change with the growth of science, and all the more often when sciences are less advanced in their evolution.—CLAUDE BERNARD. An Introduction to the Study of Experimental Medicine. New York, The MacMillan Company, 1927, p. 35.
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Circulation. 1961;24:1220-1223
doi: 10.1161/01.CIR.24.5.1220
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

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