Sociocultural and Behavioral Influences on Health Status Among the Mississippi Choctaw

William W. Dressler, James R. Bindon and M. Janice Gilliland

Native American populations in North America are at increased risk of a variety of health problems, including (but not limited to) diabetes. This risk is presumed to be a result of the interaction of environmental influences with a population genetic susceptibility. Anthropologists have subsumed those environmental influences under the term "acculturation." Here, we break that broad concept into physical, behavioral, and sociocultural components in an examination of the correlates of arterial blood pressure and plasma glucose among the Mississippi Choctaw. In a sample of 93 adults, higher plasma glucose was associated with lower physical activity, higher body mass index, and higher lifestyle incongruity, after controlling for age, sex, and recency of food consumption. Higher arterial blood pressure was associated with higher body mass index and being single. These results suggest that the risk of disordered glucose metabolism within this Native American population is associated with acculturation broadly construed, but that refined models of health and disease must take into account the multiple dimensions of this concept. Physical, behavioral, and sociocultural factors combine to describe more precisely the concept of acculturation, and hence the factors contributing to the risk of disease in Native American communities.

Key words: Health status, Choctaw Indians, Sociocultural factors

Native Americans are at increased risk of a variety of acute and chronic health problems. With respect to chronic health problems, high rates of non-insulin dependent diabetes mellitus have been observed among some Native American Indian populations, ranging from an approximate 8% prevalence among the Dogrib of the Canadian Northwest Territories, to nearly 25% among the Pima of Arizona; corresponding prevalence rates for non-Hispanic whites range from 2–4% (Weiss, Ulbrecht, Cavanaugh, and Buchanan 1989). High rates of diabetes, representing an outcome of disordered glucose metabolism, pose questions about the adaptation of human populations that have stimulated considerable attention from biological anthropologists. Our aim is much more limited. This

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paper will focus on one dimension of the problem—psychosocial factors—that is considered of potential importance in the risk of diabetes within Native American populations, but which has remained under-theorized and largely inadequately analyzed.

DIABETES, HUMAN ECOLOGY, AND ADAPTATION

Ritenbaugh and Goodby (1989) have reviewed the literature on population adaptation and glucose metabolism. The risk of diabetes among Native Americans has been traced to the adaptive demands posed by the migration of the ancestral populations into the New World. Hunters and harvesters crossing the land bridge between the Old and New Worlds into what is now Alaska are hypothesized to have faced the problem of an irregular food supply. The most regular feature of that food supply would have been marine animals and herd ungulates, resulting in a diet low in carbohydrates and fiber, moderate in fat, and high in protein. The energy demands placed on this fuel supply included activity for hunting and the maintenance of body temperature.

Irregularity of the food supply led Neel (1962) to posit a “thrifty genotype” as the population basis for diabetes risk. That is, the regular liability to severe food shortages selected for a genetic adaptation to store energy. This adaptation, in the presence of regular food supplies, became problematic and led to increased obesity and risk of diabetes. As Ritenbaugh and Goodby (1989: 227) note, however, this is a very general concept that is not anchored by actual metabolic or genetic mechanisms. They go on to discuss two specific pathways that might be linked directly to glucose metabolism. These include the possibility that a genetically determined disorder of lipid metabolism results in diabetes (Weiss, Ferrell, and Hanis, 1984). A second possibility is that a more specific “glucose-sparing” genotype was selected for because of a very low glucose (i.e. low carbohydrate) diet (Szathmary 1986). Irrespective of the specific genetic or metabolic mechanism, the end result is the same: ancestral Native American populations adapted to an environment in which specific forces selected for a specific genotype, and to the extent that those forces are no longer present, that genotype results in enhanced risk of chronic disease.

Lending credence to the view that there is a population genetic susceptibility to diabetes among Native Americans is the relatively low rate of other chronic diseases, especially cardiovascular disease (Dressler 1984). The rate of essential hypertension (or chronically elevated blood pressure) is substantially lower among Native American groups than in the general U.S. population (Kunitz and Levy 1991: 79). It would seem that any glucose-sparing genotype selected for in migration to the New World has little effect on blood pressure.

Even assuming a genetic susceptibility to diabetes, it is likely that environmental influences are also important as “triggers” for the onset of the disease. Anthropologists have employed terms such as “acculturation” and “changing lifestyles” to describe the influences leading to increased risk of diabetes (Ritenbaugh and Goodby 1989). The use of these terms among some anthropologists mimics their use among biomedical scientists: “acculturation”
and "lifestyle" have come to be equated with changes in diet, activity patterns, the distribution of obesity, and the use of tobacco and alcohol, all of which are believed to combine to determine the risk of "diseases of civilization" such as cardiovascular disease and diabetes (Trowell and Burkitt, 1981; Corell, Levin, and Jaco 1985). Thus, it is argued that the "acculturation" of Native Americans to a high fat, high protein diet, along with an increase in "sedentary lifestyles," results in higher rates of obesity and the onset of diabetes.

There are, however, findings that are inexplicable under this model. For example, Szathmary and Ferrell (1990) presented an analysis of glucose level and acculturation among the Dogrib of the Northwest territories of Canada. The Dogrib have a very low rate of diabetes. In an analysis of dietary factors in the risk of diabetes, there was a persistent main effect (in analysis of variance terms) of village (versus more isolated) residence. In the face of the adjustment for a variety of factors, including dietary carbohydrate intake, triglyceride levels, and hand grip strength (a measure of physical fitness), residence in the main village in the region was associated with a higher risk of diabetes (as measured by glycosylated hemoglobin).

The authors describe the Dogrib as residentially divided between one main village and smaller dispersed, isolated settlements. Village residents, who make up seventy percent of this specific Dogrib band, live in a much more densely populated community, are more sedentary than others, interact with a greater proportion of non-Indians, have access to commercial restaurants and retail outlets, and are more likely to engage in wage-labor employment (Szathmary and Ferrell 1990: 319). The authors suggest, based on the differences between village residents and others, that "psychosocial stress" is higher among the village-dwelling Dogrib, which in turn is related to an increased risk of diabetes.

The notion that psychosocial stress might be related to the risk of diabetes is not new (Weiss and English 1949: 521; Scheder 1988). Frequently, however, the concept of stress is dealt with rather uncritically in the anthropological literature. Often stress is used synonymously with a variety of mental states, including anxiety, tension, worry, and fear, assuming some sort of isomorphism between broad descriptors of the social environment (such as acculturation) and these (equally general) mental states, which in turn are associated with psychophysiologic reactivity and risk of disease (Dressler 1996). An alternative to this general usage is to attempt to break down abstract concepts such as acculturation or socioeconomic status into more specific and precise social and psychological factors, and to examine how such factors combine to increase the risk of disease (Bindon and Dressler 1992).

One such model has been proposed as a "sociocultural model of disease risk" (Dressler 1993). This model decomposes the general processes described by acculturation into specific social and behavioral factors affecting individuals. One of the most potent of these factors is status incongruence (described below), which has been found to be associated with depressive symptoms (Dressler 1991), blood pressure (Dressler 1982, 1993; Bindon, Crews, and Dressler 1991), and serum cholesterol (Dressler, et al. 1991). In the remainder of this paper status incongruence will be examined, relative to competing explanatory factors, as a correlate of plasma glucose and arterial blood pressure among the Mississippi Choctaw.
Socioeconomic differentiation is a fundamental concomitant of acculturation. This concept refers to an increase in the socioeconomic distance between households. In communities experiencing rapid and profound social change, especially involving increasing penetration of the community by a capitalist market economy, some members of the community are able to take advantage of new opportunities for wage-labor, education, and the accumulation of new consumer goods, while others are not able to adopt such changes. It is almost invariable under these conditions of social change that higher prestige or social status comes to be associated with greater "success" in adopting new and visible styles of life. One important dimension of these higher prestige lifestyles is the accumulation of consumer goods and the adoption of related behaviors. The higher status associated with such consumer lifestyles are reinforced in the mass media (Dressler 1985).

A major problem in this process occurs when individuals attempt to attain and maintain a higher status lifestyle in lieu of real change in their economic status. For example, an individual may attempt to accumulate valued consumer goods without an associated increase in his or her level of education or occupational status. He or she may then be communicating in social interaction a claim to the prestige associated with lifestyle consumption, but it is a claim that is not buttressed by other indicators of economic success. The result is a discrepancy among different ways of ranking the individual within the community system of prestige. Such discrepancies can lead to confusion and uncertainty in social interaction, since individuals possess conflicting information as to one another’s social status (Goffman 1951). It is this discrepancy that, in general, has been referred to as status incongruence, and, more specifically, as “lifestyle incongruity;” it has been found to be associated with a variety of chronic health problems (Dressler 1993, 1996).

In interpreting this effect, primary emphasis has been placed on the physiologic effects of social interaction, because research has found repeatedly that association between lifestyle incongruity and health outcomes is independent of conventional measures of psychosocial stress, such as stressful life events or measures of chronic perceived stress (Dressler 1996). It would appear, then, that there are two pathways by which these factors influence health. One, involving psychosocial stress, is through the perceptions of threat associated with chronic or acute stressors. The second, involving status incongruence, is through the effect of social interaction on physiologic and metabolic adjustment (Dressler 1993).

Social and psychological factors are not the only ones of relevance to health outcomes in situations of acculturation or social change. Evidence exists that indeed diet, physical activity, and the prevalence of obesity also change in concert with social and behavioral changes (Bindon and Zansky, 1986; Greksa, et al. 1986). It is therefore incumbent upon investigators to incorporate theoretically useful and operationally valid measures of as many of these factors as possible. The focus here will be on the association of lifestyle incongruity, psychological stressors, physical activity, and body composition with plasma glucose and
Health Status among the Choctaw

Arterial blood pressure among the Mississippi Choctaw, a Native American group which has experienced profound social changes during the past two decades.

Ethnographic Setting: The Mississippi Choctaw

The Mississippi Choctaw have a population of approximately 6,000 persons (according to tribal rolls supplied to the authors) distributed across seven communities in eastern Mississippi. The tribal headquarters and the greatest concentration of the population are located in Neshoba County, Mississippi near the small town of Philadelphia.

To a large extent, the Choctaw are a cultural, linguistic, and economic isolate in the region. Prior to the removal of Native Americans in the early 19th century, the Choctaw controlled a large portion of present-day Mississippi and Alabama, and pursued a mixed horticulture and hunting subsistence economy. As Euroamericans extended their hegemony throughout the southeast, the Choctaw were forced increasingly to occupy marginal land. In 1830, the Treaty of Dancing Rabbit Creek was concluded which stipulated the removal of the Choctaw to an area west of the Mississippi River (in present-day Oklahoma) and the ceding of their land east of the river to the federal government. One provision, however, allowed for some Choctaw to remain east of the river and to receive allotments of land. Some 5,000 elected to do so and formed the basis for the contemporary Mississippi Choctaw community (McKee and Schlenker 1980: 64).

Throughout their history, the Choctaw have remained distinct from the two dominant ethnic groups in the region, Euroamericans and African Americans. Until the end of the Civil War, individual Choctaw families attempted to exercise their rights to land allotments, only to be frustrated by a government that favored removal (McKee and Schlenker, 1980). In lieu of receiving land allotments, families often struggled to maintain themselves on marginal agricultural land. Ironically, post-emancipation economic changes helped stabilize the Choctaw’s situation by enabling them to participate in the system of sharecropping (Peterson 1972). By sharecropping, Choctaw could remain in their own communities, working the land independently, and retain their ethnic distinctiveness. This relative economic stability, along with the establishment of Choctaw schools and churches, contributed to their cultural survival (Peterson 1972).

In 1903 the federal government attempted the so-called second removal, but again a substantial population of Choctaw (from 1,000 to 1,500 persons) chose to remain in Mississippi. In 1918, after visits to Mississippi by Bureau of Indian Affairs officials documenting severe living conditions and an influenza epidemic that caused several hundred deaths, the U.S. Senate established the Choctaw Agency in Philadelphia, Mississippi (McKee and Schlenker 1980). A federal land purchase followed that allowed for the greater concentration of the Choctaw around Philadelphia (Peterson 1972).

For fifty years after the establishment of the Choctaw Agency, social conditions were little changed for the Choctaw. A new hospital improved health
care somewhat for the population, and elementary schools were built to serve most Choctaw communities. But as Peterson has noted, by 1968:

Slightly over half of the population lived on trust land, and the median years of school completed by Choctaw heads of households was three. Over a third of the heads of households were unemployed and approximately a third worked only as temporary farm laborers... Choctaws faced the alternatives of unemployment, welfare, or migration to other areas (Peterson 1992: 142).

But the 1960s, and the social policy experiments initiated by the civil rights movements and the Johnson administration’s Great Society programs, saw the beginning of what the Choctaw tribal government later called “An Era of Change” (Peterson 1992).

Political innovations initiated by the Choctaw themselves resulted in true local control in decision-making. According to Peterson’s (1992) analysis of the situation, the Choctaw used their political control to pursue a distinct path of economic development. This development strategy included obtaining federal grants and contracts to establish programs such as Head Start and other social services, to initiate an extensive Choctaw housing program carried out by their own construction company and, ultimately, to develop an industrial park and establish six different factories offering employment opportunities for the Choctaw.

Today a Choctaw community looks much like any other small town or subdivision. Yet half of the sample for the current study exclusively speak Choctaw at home. In 1970 the median family income for the Choctaw was around $3,000 (McKee and Schlenker 1980), while in the current sample it was approximately $15,000. In the current sample, respondents report a mean of 9.4 years of education, compared to the median of 3 years in the late 1960s. In short, the Choctaw strategy of development has resulted in rapid change for the population, but to a certain extent change has enabled the Choctaw to retain their ethnic identity, as indicated by language use (Thompson and Peterson 1975).

This context of social change precisely parallels a process that has resulted in increased rates of chronic disease in other societies (Dressler 1985). While able to maintain their ethnic identity through the maintenance of their language, the Choctaw have not been immune from the values placed on a consumer lifestyle in the larger American society. As individuals are variably able to take advantage of new opportunities for upward economic mobility, it is likely that some attempt to maintain such a lifestyle inconsistent with their actual economic status as assessed by occupation, education, income, and employment status. This lifestyle incongruity is a chronic stressor that may be related to an increased risk of chronic disease. Such risk would be indicated by higher arterial blood pressure and plasma glucose levels. By the same token, the economic changes observed among the Choctaw can also be related to increasing rates of obesity and decreasing levels of physical activity. The relative effects of these factors will be assessed.

SAMPLING AND METHODS

Tribal rolls were used to sample adults (> 21) living in the vicinity of Philadelphia, Mississippi. The universe to be sampled was estimated to be 2,000
persons. A simple random sample of 139 individuals was selected, and complete data were obtained for 93 (67%) of this original sample, about an average completion rate for a field study. Those who refused to participate were only a small minority of the uncompleted interviews; most resulted from either an inability to contact sampled individuals, or difficulties in scheduling.

Interviews were conducted at a location convenient to the respondent, most often his or her home (68.8%). Other interviews were conducted either at the Choctaw Health Center, or in various workplaces around the reservation, mostly at the tribal headquarters. All interviews were conducted in private. A native Choctaw speaker served as translator when necessary. All interviews and measurements were completed by one researcher (M.J.G.).

Arterial blood pressure was measured using the auscultatory method with an aneroid sphygmomanometer that had been calibrated against a mercury instrument. A large-arm cuff was available. Three blood pressure readings were taken on the left arm of persons who were seated with their arm supported at heart level. First and fifth phase sounds were recorded. The three readings were then averaged.

Random capillary blood glucose was measured with a GLUCOSCAN Blood Glucose Meter and GLUCOSCAN Test Strips manufactured by Lifescan Inc. (Mountain View, CA 94043). This is a dry reagent test using glucose oxidase which is specific for D-glucose. A drop of capillary blood is applied to a test strip and the concentration of glucose is determined by a flurometric method and displayed as milligrams per deciliter of sample applied. The meter was monitored on a daily basis with the standard test strip supplied by the manufacturer, and no significant change in the test values was noted over the study period. Random glucose is the least desirable measurement of blood glucose in attempting to assess diabetic status or control; however, the logistics of the overall health risk survey precluded measurement of early morning fasting glucose or the administration of a glucose tolerance test. For plasma glucose, minutes since last meal is included as a covariate; since this influences casual glucose readings.

Self-reported treatment status is a dichotomy indicating both whether or not the respondent has been told he or she is hypertensive or diabetic, and whether or not he or she is currently engaging in any palliative behaviors (e.g. taking medication and/or following a special diet).

The Quetelet Index of body mass (kg/m²) is used to measure obesity. Four straightforward questions about physical activity at work and during leisure time were asked. Responses to the questions were summed, unweighted, to arrive at a total physical activity score.

Dressler's (1985) 25-item style of life scale was used (Table I). This scale assesses the accumulation of consumer goods and the adoption of behaviors that increase the individual's exposure to messages in the mass media regarding lifestyles. The scale shows acceptable internal consistency reliability (alpha = 0.85).

Occupations of all employed persons in the respondent's household were ranked on a six-point scale and household occupational scores were derived by summing these ranks. Occupational scores, total household income, respondent's
years of education, and respondent’s employment status were found to load a single principal component of economic status (Table II). Principal component scores were calculated with standard regression methods.

The style of life scale and the economic status score were used to calculate two new variables. The first, “lifestyle incongruity,” assesses the degree to which
style of life exceeds economic status. Each component variable is first converted to a distribution with a mean of 50 and a standard deviation of 10. Lifestyle incongruity thus becomes: (style of life—economic status). The second calculated variable, "socioeconomic status," then becomes: (style of life + economic status). Socioeconomic status thus measures overall standing in the status hierarchy, while lifestyle incongruity measures the discrepancy in two major components of overall standing.

Psychological stress is measured with a 10-item scale assessing the individual respondent's feelings of depression, anxiety, worry, tension, life satisfaction, perceived strength of social ties, and experience of recent life events. This scale was created specifically for this study from available items in the interview schedule and combines items regarding mood, chronic stress, and acute stress (see Cohen, Kessler, and Gordon 1995 for a general discussion of stress measurement). The scale exhibits adequate internal consistency reliability (alpha = 0.70).

Age, sex, and marital status are included in all analyses as covariates.

RESULTS

Descriptive statistics for the study population are shown in Table III.

Ordinary least squares multiple regression analysis is the data analytic tool of choice here, given that the dependent variables are continuously distributed. A hierarchical analysis is used in which all variables are forced into the analysis on the first step, save one: treatment status. On the second step, treatment status is added. Because an explicit model is being tested with the direction of the anticipated effects stipulated in advance, 1-tailed tests of statistical significance are reported.

The regression analysis of plasma glucose is shown in Table IV. Higher body
mass index and higher lifestyle incongruity are both associated with higher plasma glucose. Higher physical activity is also associated with lower plasma glucose. When treatment status is put into the analysis, the effect of the body mass index drops to nonsignificance, while the effects of physical activity and lifestyle incongruity remain significant.

The regression analysis of arterial blood pressure is shown in Table V. In the first step of the analysis, higher systolic blood pressure is associated with a higher body mass index, older age, male sex, not being married, and lower psychological stress. The correlates of diastolic blood pressure are slightly

**Table IV**
Hierarchical regression analysis of plasma glucose.
(standardized regression coefficients)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>0.168</td>
<td>-0.177**</td>
</tr>
<tr>
<td>2. Sex</td>
<td>-0.006</td>
<td>0.078</td>
</tr>
<tr>
<td>3. Time since last meal</td>
<td>-0.093</td>
<td>0.001</td>
</tr>
<tr>
<td>4. Socioeconomic status</td>
<td>-0.135</td>
<td>-0.019</td>
</tr>
<tr>
<td>5. Marital status</td>
<td>0.050</td>
<td>0.054</td>
</tr>
<tr>
<td>6. Body mass index</td>
<td>0.154*</td>
<td>0.074</td>
</tr>
<tr>
<td>7. Physical activity</td>
<td>-0.243*</td>
<td>-0.219*</td>
</tr>
<tr>
<td>8. Lifestyle incongruity</td>
<td>0.202*</td>
<td>0.230**</td>
</tr>
<tr>
<td>9. Psychological stress</td>
<td>0.044</td>
<td>-0.055</td>
</tr>
<tr>
<td>10. Treatment status</td>
<td></td>
<td>0.692**</td>
</tr>
<tr>
<td>R =</td>
<td>0.546**</td>
<td>0.762**</td>
</tr>
<tr>
<td>R² =</td>
<td>0.298</td>
<td>0.582</td>
</tr>
</tbody>
</table>

*p < 0.05

**Table V**
Hierarchical regression analysis of systolic blood pressure (SBP) and diastolic blood pressure (DBP).
(standardized regression coefficients)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SBP</td>
<td>DBP</td>
</tr>
<tr>
<td>1. Age</td>
<td>0.284**</td>
<td>0.048</td>
</tr>
<tr>
<td>2. Sex</td>
<td>-0.225**</td>
<td>-0.155</td>
</tr>
<tr>
<td>3. Socioeconomic status</td>
<td>0.011</td>
<td>0.103</td>
</tr>
<tr>
<td>4. Marital status</td>
<td>-0.202*</td>
<td>-0.295**</td>
</tr>
<tr>
<td>5. Body mass index</td>
<td>0.246**</td>
<td>0.211*</td>
</tr>
<tr>
<td>6. Physical activity</td>
<td>-0.082</td>
<td>-0.066</td>
</tr>
<tr>
<td>7. Lifestyle incongruity</td>
<td>-0.040</td>
<td>-0.51</td>
</tr>
<tr>
<td>8. Psychological stress</td>
<td>-0.170*</td>
<td>-0.96</td>
</tr>
<tr>
<td>9. Treatment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.531**</td>
<td>0.387**</td>
</tr>
<tr>
<td>R =</td>
<td>0.282</td>
<td>0.150</td>
</tr>
</tbody>
</table>

*p < 0.05

**p < 0.01
Health Status among the Choctaw different in that age and psychological stress are not significant. When treatment status enters the analysis for systolic blood pressure, age and psychological stress drop to nonsignificance. After entering treatment status in the analysis of diastolic blood pressure, only the effect of marital status remains significant.

DISCUSSION

These results are consistent with an orientation in which acculturation, broadly defined, is associated with an elevation of plasma glucose (which in turn can be interpreted as an indicator of an increased risk of diabetes). But “acculturation” is too blunt a theoretical tool to alone unravel the process involved. Rather, the concept of acculturation must be broken down into its component parts, each of which is independently associated with diabetes risk. In this study, these independent components include physical (body mass), behavioral (physical activity), and sociocultural (lifestyle incongruity) factors.

One striking outcome of this study was the failure of lifestyle incongruity (or physical activity) to be associated with blood pressure, a failure which, in light of previous studies (e.g. Dressler 1982, 1991; Dressler, Santos, et al. 1987; Dressler, Mata et al. 1987), is interesting. One interpretation for this finding is that there is a population genetic substrate upon which all environmental factors operate. Because of the selection for the “thrifty genotype” throughout the period of migration to the New World—whatever precisely that genotype is—Native Americans are vulnerable or susceptible to environmental variation through that specific physiologic/metabolic pathway. In turn, the observed effects of general risk factors such as obesity, physical activity, and lifestyle incongruity will be manifest primarily through that pathway. In this way, these factors may be associated with variability in disordered glucose metabolism among Native Americans, and then may be associated with, for example, disordered blood pressure regulation in another population, or perhaps disordered lipid metabolism in another. This theoretical orientation is consistent with Cassels’s (1976) concept of “generalized susceptibility.”

The results of this study challenge the notion that population genetic susceptibility is the sole basis for diabetes risk here. Rather, these results demonstrate that physical, behavioral, and sociocultural factors intersect to determine that risk. As a way of examining the risk strength of the association of these factors with casual plasma glucose, it is useful to calculate the contribution of each one of the variables to differences in glucose between individuals (based on the regression coefficients from Table IV). An individual who is at the sample mean on every variable in that analysis would have a casual plasma glucose of 123.5 mg/dl. If this hypothetical individual was one standard deviation below the mean on physical activity, this glucose would increase by 14.9 mg/dl to 138.4. If this person was also one standard deviation above the mean on lifestyle incongruity, plasma glucose would increase to 150.9 (or another 12.5 mg/dl). Finally, if that person also was one standard deviation above the mean on the body mass index, plasma glucose would increase to 160.5 (or another 9.6 mg/dl). Weiss and colleagues (1989) suggest that a casual plasma glucose, as measured
by glucometer, in excess of 120 mg/dl is grounds for more precise testing via standard clinical testing to rule out diabetes. It would appear, therefore, that the factors identified here are of biological significance.

Interpreting these results in this way requires that confidence be placed in the reliability of the measurement of casual glucose, which, as we have already pointed out, is the weakest (i.e. least reliable) measure of disordered glucose metabolism. Fortunately, there are additional data to suggest that the casual glucose measurements used here are reliable. Health center records were reviewed for the respondents. For 61 of the 93 members of the sample, a casual glucose measurement was recorded in the chart. For these respondents, the correlation between health center and our glucose readings is $r = 0.77$ ($p < 0.001$), indicating stability in the measurement. Also, clinical diabetes had been diagnosed on 28 of the 93 (or 30.1%) respondents. A one-way analysis of variance of casual glucose readings for diagnosed diabetics versus other respondents was highly significant ($F = 80.63; df = 1, 92; p < 0.001$). The mean casual glucose reading for diagnosed diabetics was 182.5 (95% confidence intervals=155.6, 209.5), and the mean casual glucose reading for nondiabetics was 91.3 (95% confidence intervals=84.0, 98.5). Thus, the casual glucose readings appear reliable.

The mechanisms by which body mass and physical activity influence glucose metabolism have been discussed already (Ritenbaugh and Goodby 1989). The mechanism through which lifestyle incongruity might operate requires further explication. A consistent finding in this regard is the independence of the effect of lifestyle incongruity on various outcomes from typical measures of psychological stress. The independence of lifestyle incongruity from psychological stress has been observed in a variety of studies, using a variety of outcome variables, and, especially, using different measures of psychological stress (Dressler 1991, 1993). The measures of psychological stress used range from simple ones such as that used in this study, to very specific measures of chronic social role stressors and stressful life events. Consistently, the effect of lifestyle incongruity is independent of psychological stress.

It seems likely that a process involving more than perceptions of stress is involved. Rather, the primary mechanism may be through social interaction and physiologic arousal associated with interaction (Dressler 1990). Adoption of a higher status style of life is a means by which individuals attempt to communicate an image of themselves—a social identity—to others. But as Goffman (1951) pointed out, if that higher status social identity is perceived by others to be inappropriately manipulated, it is unlikely to be confirmed in mundane interaction. The adoption of a high-status lifestyle in lieu of the social or educational "capital" (to borrow Bourdieu's (1984) phrase) to back it up, that is, in association with commensurate occupational, employment, and educational credentials, may be perceived by others as inappropriate, and lead to the rejection of that assumed social identity. This will leave the individual in a state of more-or-less continual struggle and vigilance in social interaction, attempting to attain a social identity forever denied him or her. The physiologic effects of such a continued vigilance have been described by others (Henry 1982), and these effects would influence glucose metabolism.
There are inherent weaknesses in this study. The problems with the measurement of casual glucose have been discussed in detail. Another problem involves the small sample size. The danger here is that, in some unknown way, the sample selection procedures have interacted with the measurement procedures to generate observed results; however, the small sample size and low power research design would actually have mitigated against the detection of effects rather than increased the likelihood of generating spurious effects. Also, the inspection of regression diagnostics indicated no influential cases.\textsuperscript{8}

A final point worth noting is that the associations of the various variables with plasma glucose are not confounded with treatment status. In fact, the strength of the association of lifestyle incongruity with plasma glucose is enhanced by adjusting for treatment status. The attenuation of the effect of the body mass index is probably not a function of that being a spurious effect; rather, it is probably a function of clinical decision making. Clinic personnel are probably more likely to test obese people for glucose tolerance, hence leading them to be selectively treated relative to normal weight persons. It is this selection factor that probably explains the dependence between treatment status and body mass.

Future research should consider additional factors in sorting out these relationships. Only one dimension of a sociocultural model of disease risk (Dressler 1993) has been examined here. Culturally appropriate measures of social supports and coping style should be incorporated into a model; the association of marital status with lower blood pressure may be indicative of the empirical value of including social supports. Similarly, measures of dietary intake would be useful, given the likelihood of diabetes risk being associated with a particular dietary pattern.

This study will hopefully serve as an impetus for more research in the biocultural epidemiology of disordered glucose metabolism. From an anthropological perspective the study of glucose metabolism represents an opportunity to examine processes of adaptation, both in terms of how contemporary populations represent the cumulative outcome of adaptations to past ecological circumstances, and in terms of how individuals adapt to the changing social and historical circumstances in which they find themselves.

ACKNOWLEDGEMENTS

Research was funded by the Research Committee of the College of Community Health Sciences, The University of Alabama. Our deepest gratitude goes to the Choctaw Tribal Council and the people of the Mississippi Band of the Choctaw for their encouragement in this study.

NOTES

1. To their credit, Szathmary and Ferrell (1990) are explicit concerning the lack of direct measurement, and hence evidence of, psychosocial stress among village residents; rather, they offer it as an hypothesis.
2. Plasma glucose readings had a range of 52-320, with a median value of 96; these values, along with the mean (see Table III) indicate a somewhat skewed distribution (skewness = 1.64). There was, however, no evidence of bimodality in the distribution. Log transformations improved somewhat, but did not normalize, the distribution. The results of the regression analysis presented in the results section were essentially unchanged using untransformed, transformed, or dichotomized (at glucose = 120, with logistic regression) values for plasma glucose. Since there were no differences in the results between ordinary least squares regression analysis and logistic regression, and, since regression diagnostics failed to indicate any influential cases (see note 8), it is unlikely that any departures from normality in the distribution of plasma glucose had substantial effects on the observed results of these analyses.

3. Basic psychometrics are inappropriate for this scale since there is no expectation that greater (or lesser) physical activity at work will be related to greater (or lesser) physical activity during leisure.

4. The formula for creating these scores is: \([(x_i-m)/s.d.] + 5\) x 10, where “\(x_i\)” are individual scores, “\(m\)” is the mean of the distribution, and “\(s.d.\)” is the standard deviation of the distribution.

5. For a more detailed exposition of the logic requiring the inclusion of both the sum of and the difference between these factors, the interested reader is referred to Whitt’s (1983) review.

6. The exact age and sex distribution for the sample is as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>25-34</td>
<td>19</td>
<td>15</td>
<td>34</td>
</tr>
<tr>
<td>35-44</td>
<td>9</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>45-54</td>
<td>7</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>55 and older</td>
<td>3</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>50</td>
<td>93</td>
</tr>
</tbody>
</table>

7. And of course, in these data, psychological stress is related to systolic blood pressure in the “wrong” direction. It would be beyond the scope of this paper to address this issue in any detail. Suffice it to say that there are numerous examples of various measure of psychological stress correlating with outcomes in the “wrong” direction. All this points to is the need for better theory and measurement in the area.

8. Regression diagnostics include conventional measures such as residuals, as well as what are called leverage values and measures of changes in the regression coefficients with the deletion of cases (Bollen and Jackman 1985). The deletion of even mildly suspect cases actually increased the strength of reported results.

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