

Is "Sugar" the Same as Diabetes?

A community-based study among rural African-Americans

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OBJECTIVE — To determine if differing beliefs about high blood glucose exist and are associated with blood glucose control among rural African-Americans.

RESEARCH DESIGN AND METHODS — A community-based sample of rural African-Americans completed a survey, and a subsample underwent a subsequent screening that included glucose and GHb measurement. Participants were asked if they thought they had diabetes or sugar-diabetes on the survey; "sugar" was added to the screening along with specific questions about this condition.

RESULTS — A total of 1,031 people completed the survey, and 403 the screening exam. The total prevalence of diabetes was 13.6% for men and 15.5% for women. Among those who reported having one of the three conditions, 64% said they had diabetes, 7% sugar-diabetes, and 29% sugar. There was a discrepancy between the survey and screening in that 31% of subjects who answered "yes" to whether they had sugar at the screening had answered "no" to the survey question about diabetes. Subjects who believed they had sugar felt their condition was less serious and had higher glucose levels than those who said they had diabetes.

CONCLUSIONS — Diabetes was very common in this population. Over one-fourth of those with diabetes believed they had the condition "sugar." Efforts are needed to improve control of diabetes in this population and should consider these disparate health beliefs.

Diabetes Care 23:330–334, 2000

The prevalence of diabetes is increasing in the U.S. and is especially high among certain racial and ethnic groups (1). According to the Third National Health and Nutrition Examination Survey (NHANES III), the combined prevalence of diagnosed and undiagnosed diabetes among African-Americans is 10% for men and 13.6% for women (2). The corresponding value for white men is 8.1% and for white women is 6.5%. In the same national sample, African-American women had the poorest glycemic control of their diabetes (3). African-Americans are also at high risk for complications of diabetes such as retinopathy and nephropathy that can be

decreased by lowering blood glucose and blood pressure levels (4–6).

Since diabetes is becoming more prevalent, and effective diabetes management can decrease complications, it is important to understand factors that may influence blood glucose control. Culturally specific health beliefs about elevated blood glucose levels have been described among African-Americans, especially those from the rural South (7,8). In particular, some people with elevated blood glucose levels refer to their conditions as "sugar" or "sugar-diabetes." Individual beliefs about high blood pressure have been linked to compliance and blood pressure control (9), but it has not been

established whether beliefs regarding elevated blood glucose have similar implications. The purpose of this study was to determine if differing beliefs about high blood glucose existed and were associated with blood glucose control among a population-based sample of rural African-Americans. Our hypothesis was that subjects who felt they had "sugar" would have different health beliefs than those who felt they "diabetes" and that their blood glucose control would be worse.

RESEARCH DESIGN AND METHODS — This study was undertaken as part of the Alliance of Black Churches Health Project, a community-based cardiovascular prevention project among African-Americans in two rural Virginia counties (10). The two counties had an adult black population of 7,147 according to the 1990 census. This was 30.6% of the total population. Data for the analyses were collected in two phases and the data collection procedures have been reported in detail elsewhere (11). The first phase was a population-based house-to-house survey of African-American adults ≥ 18 years of age conducted by the University of Virginia Center for Survey Research. Smokers were oversampled because the original project targeted smoking cessation. A total of 1,031 subjects completed the full questionnaire. The survey instrument was based on the Behavioral Risk Factor Surveillance Survey (12), and was administered in the respondent's home. A history of diabetes was assessed using the question, "Have you ever been told by a doctor that you have diabetes or sugar-diabetes?" The survey was administered orally by a trained interviewer, and the responses were directly entered into a laptop computer. The questionnaire took ~ 20 min to complete.

The second phase was a screening examination in which survey respondents were recontacted for measurement of BMI, glucose, and GHb. The original goal was to screen 500 of the original 1,031 respondents, and 403 were actually screened (39.1%). Those respondents who were contacted for the screening underwent a 30-min examination either at central locations or in their homes. The screenings

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Received for publication 5 August 1999 and accepted in revised form 29 November 1999.

Abbreviations: NHANES III, Third National Health and Nutrition Examination Survey; OGTT, oral glucose tolerance test.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—Self-report of diabetes using different questions

| Screening ("Do you have diabetes, sugar, or sugar-diabetes?") | House-to-house survey ("Have you ever been told by a doctor that you have diabetes or sugar-diabetes?") | | Total |
|---|---|----------|----------|
| | Yes | No | |
| Yes | | | |
| Diabetes | 35 (28) | 1 (1) | 36 (29) |
| Sugar-diabetes | 4 (2) | 0 | 4 (2) |
| Sugar | 11 (10) | 5 (4) | 16 (14) |
| No | 6 (2) | 341 (13) | 347 (15) |
| Total | 56 (42) | 347 (18) | 403 (60) |

Data are n (n with GHb >7%).

were conducted by a white nurse and medical student and two African-American laboratory technicians. The central screenings were conducted in conjunction with the local African-American health coalitions that participated in the Alliance of Black Churches Health Project. Height and weight measurements were made after respondents removed shoes and heavy clothing. Height was measured to the nearest inch. Weight was measured with a Health o meter model 150 scale (Health o meter, Ridgeview, IL) to the nearest pound. Blood was drawn and transported on ice to the University of Virginia clinical laboratories, where it was analyzed for glucose and GHb. GHb measurements were made by an affinity chromatographic method (GlycoTest II GlyHb Assay; Pierce Chemical, Rockford, IL).

Because of the high prevalence of diabetes reported on the initial survey (10%), we decided to inquire further about this condition at the screening examinations. Based on the literature and our own clinical experience in which many patients referred to their condition as "sugar," we decided to ask specifically about "sugar," in addition to diabetes and sugar-diabetes. Respondents were asked again about diabetes, beginning with the question "Do you have diabetes, sugar, or sugar-diabetes?" Those who answered "yes" were asked to specify which condition they had. They were then asked, "Is there a difference between sugar and diabetes?" and "What do you think causes (diabetes, sugar or sugar-diabetes)?"—using the condition they said they had. Finally, four questions were asked about the seriousness and treatment of the condition.

Statistical analyses were performed on a personal computer using the Statistical Package for the Social Sciences (SPSS,

Chicago). In order to maintain sample size, screening respondents with missing data for some measurements were not excluded from other analyses. Continuous variables were compared using t tests or analysis of covariance. Dichotomous variables were compared using χ^2 analysis or Fisher's exact test for comparisons with small cell sizes. To determine the overall prevalence of diagnosed and undiagnosed diabetes, the data were weighted to the age distribution of each county's African-American population using race- and sex-specific proportions from the 1990 U.S. Census. The data were also weighted by smoking status using sex-specific prevalences from the roster database for each county. The statistical analyses were also performed with and without weighting the data. The results were unchanged with weighting, and only the unweighted analyses are shown.

RESULTS — The subjects who participated in the screening were asked at two points in time if they had diabetes, using two different questions. The first question, asked during the house-to-house survey of all 1,031 respondents, inquired if the subject had ever been told by a doctor that he or she had diabetes or sugar-diabetes. A total of 103 respondents (10%) answered "yes." Of the 403 who participated in the screening, 56 (13.9%) had answered "yes" to this question. The second question about diabetes was asked only at the screening, and addressed whether the respondent currently had diabetes, sugar, or sugar-diabetes. A total of 56 subjects answered "yes" to this question. Overall, 36 said they had diabetes, 16 sugar, and 4 sugar-diabetes.

As shown in Table 1, the results of the two general questions were not completely concordant. Six subjects answered "yes" to the first question and "no" to the second. All six said they had been told in the past they had diabetes, but they believed they no longer had it. Two of the six had elevated GHb levels ($\geq 7.0\%$). Six subjects answered "yes" to the second question and "no" to the first question. Of these, five said they believed they had sugar on the second question, one said diabetes, and none said sugar-diabetes. Five of the six had elevated GHb levels. Thus, 6 of the 16 who believed they had sugar answered "no" to the first question about whether they had ever been told they had diabetes or sugar-diabetes, while only 1 of the 40 who said they had diabetes or sugar-diabetes had answered

Table 2—Responses to disease perception questions

| How serious is your condition? | Very | Somewhat | Not very | Not at all |
|--------------------------------|------|----------|------------|------------|
| Sugar* | 8 | 3 | 5 | 0 |
| Diabetes or sugar-diabetes* | 36 | 2 | 2 | 0 |
| Can it be treated? | Yes | No | Don't know | |
| Sugar | 16 | 0 | 0 | |
| Diabetes or sugar-diabetes | 40 | 0 | 0 | |
| How effectively? | Very | Somewhat | Not very | Not at all |
| Sugar | 10 | 5 | 0 | 0 |
| Diabetes or sugar-diabetes | 25 | 13 | 1 | 1 |
| Can it be cured? | Yes | No | Don't know | |
| Sugar† | 8 | 5 | 3 | |
| Diabetes or sugar-diabetes† | 5 | 33 | 2 | |

Data are n. *P = 0.004 for 4 × 2 contingency table; †P = 0.001 for 3 × 2 contingency table.

“no” earlier ($P = 0.008$ using Fisher’s exact test). Of the subjects who said they had sugar, 4 of 16 stated that it was different than diabetes, versus none of the 40 who said they had diabetes or sugar-diabetes ($P = 0.001$). Three of the four stated a specific reason it was different. These included: a person has sugar first, then it progresses to diabetes; sugar is caused by diet and diabetes by heredity; and sugar is treated by diet and exercise, and diabetes by pills and insulin. Overall, there were 13 subjects with elevated GHb levels who answered “no” to both questions and who had undiagnosed diabetes.

Additional beliefs about the conditions were compared between those who said they had sugar and those who said they had diabetes or sugar-diabetes, and are shown in Table 2. Those who said they had sugar rated their condition as being significantly less serious, with only 50% rating it as very serious, vs. 90% of those with diabetes or sugar-diabetes ($P = 0.004$). Those with sugar also considered the condition more curable than did the others, with 50 vs. 12.5% believing it could be cured ($P = 0.001$). There was no difference between groups in rating how treatable they felt their condition was.

Respondents were also asked to describe their condition and what caused it, in an open-ended fashion. Those who believed they had diabetes or sugar-diabetes listed a wide range of causative factors, including inheritance (40%), obesity (22%), a problem with the pancreas (22%), not enough insulin (20%), eating the wrong food in general (25%), eating sweets (6%) or starches (15%) in particular, and stress (6%). The mean number of causes was two per person. The range of responses was much less wide for those said they had sugar, with sweets (50%) and starch (40%) being the most common. Inheritance was mentioned by only 18%, and obesity and the pancreas only once each. No one mentioned insulin. The mean number of responses was 1.4. Overall, 80% of those with sugar mentioned a dietary cause, versus only 35% of those with diabetes or sugar-diabetes ($P = 0.002$).

The subjects who said they believed they had sugar were compared with those who said they had diabetes or sugar-diabetes in Table 3. The former group had significantly higher random glucose levels than the latter. There were also trends toward subjects with sugar being older and less likely to have finished high school ($P =$

Table 3—Comparison of subjects describing condition as “sugar” versus those with “diabetes” or “sugar-diabetes”

| | Sugar | Diabetes or sugar-diabetes | P |
|-----------------------------------|-------------|----------------------------|------|
| n | 16 (28.5) | 40 (61.5) | |
| Current age (years) | 64.6 ± 16.5 | 57.1 ± 13.1 | 0.08 |
| Age of onset (years) | 54.2 ± 16.6 | 47.1 ± 15.0 | 0.14 |
| Sex (% female) | 62.5 (10) | 57.5 (23) | 0.73 |
| Education (% high school or more) | 12.5 (2) | 35.0 (14) | 0.08 |
| Married (%) | 75.0 (12) | 57.5 (23) | 0.21 |
| Employed full- or part-time (%) | 25.0 (4) | 27.5 (11) | 0.85 |
| Current smoker (%) | 37.5 (6) | 50.0 (20) | 0.40 |
| Glucose (mmol/l) | 12.6 ± 4.8 | 9.8 ± 4.3 | 0.03 |
| GHb (%) | 10.1 ± 3.0 | 9.3 ± 2.7 | 0.30 |
| BMI(kg/m ²) | 30.0 ± 5.3 | 30.6 ± 6.8 | 0.76 |
| Waist-to-hip ratio | 0.90 ± 0.08 | 0.91 ± 0.06 | 0.61 |

Data are n (%), means ± SD, or % (n).

0.08 for each). The age of onset of in each group was 45–55 years of age, and only one person, in the diabetes group, listed the onset before age 20.

To determine if the screening participants were similar to the larger survey group, those who said they had diabetes on the initial survey were compared based on whether or not they participated in the screening. There were no significant differences ($P > 0.1$) between the screening participants and nonparticipants based on age or sex or smoking, marital, educational, or employment status.

The prevalence of previously diagnosed diabetes, based on a positive answer to either the survey or screening question, was 9.4% for men, and 13.1% for women. The rate of undiagnosed diabetes, defined as GHb >7% and a “no” answer to both questions, was 4.2% for men and 2.4% for women. The total prevalence of diabetes was 13.6% for men and 15.5% for women.

CONCLUSIONS — The results of this study raise several important issues concerning diabetes among rural African-Americans. First, whether or not a subject reported they had diabetes varied depending on the question asked. When the question was phrased “Have you ever been told by a doctor that you have diabetes or sugar-diabetes?” five subjects (31%) who were later found to believe that they had “sugar” answered “no.” This was 9% of the total number of subjects we classified as having diagnosed diabetes. On the other hand, when we asked “Do you have diabetes, sugar, or sugar-diabetes?” six subjects who had answered “yes” to the original survey

question answered “no,” believing they no longer had the condition. Thus, the phrasing of the question can have important implications for how people classify themselves with regard to diabetes. In particular, failing to ask rural African-Americans if they have “sugar” may underestimate the prevalence of diabetes by a clinically significant amount. Recent revisions of the Behavioral Risk Factor Surveillance System ask only about diabetes, and have even eliminated the term “sugar-diabetes” (13). This could lead to a further underestimation of the true prevalence of diabetes in this population.

The second point is that subjects who consider that they have the condition “sugar” differ in a variety of ways from those who believe they have diabetes or sugar-diabetes. Those with sugar were more likely to say that their condition was not serious and was curable, and were more likely to attribute it to a dietary cause. In addition, this group was older and less well educated than those who said they had diabetes or sugar-diabetes. As has been demonstrated for high blood pressure (9), the use of different lay terms for what is considered to be the same biomedical condition can be associated with systematically different beliefs. Even among well-educated patients with diabetes, discrepancies between patient and provider explanatory models have been described (14). Subjects who said they had sugar had significantly higher random glucose levels than those who believed they had diabetes or sugar-diabetes, and showed a trend toward higher GHb levels. Since those who believed they had sugar also believed their condition was less serious, they may have

been less concerned about control of their blood glucose levels.

Why people believe they have sugar rather than diabetes is not clear. Significantly more respondents who believed they had sugar said that there was a difference between the two conditions, but this was still a minority. Additional study will be needed to better understand what is meant by the use of this term, and to further delineate the importance of age and educational status as predictors. Whether addressing these beliefs would result in improved blood glucose control remains to be determined, but it would certainly be an important consideration in tailoring an approach to diabetes education and public awareness campaigns for this population.

Finally, the prevalence of diabetes as defined in this study is quite high. Overall, ~14% of the adult population either answered yes to one of two questions about current or past diabetes or had elevated GHb levels. This result compares with a prevalence of 11.8% among non-Hispanic African-American adults in NHANES III. The high prevalence of diabetes in this population is at least in part related to obesity (11). We found the prevalence of overweight (>120% of BMI) to be 38.7% among men and 64.7% among women in this population, higher than found in NHANES III (33.3% among men and 52.3% among women) (15).

Although the overall prevalence we found was high, the rate of undiagnosed diabetes was relatively low, only 2.4% among women and 4.2% among men. This is less than the overall undiagnosed prevalence of 5.6% among African-Americans in NHANES III. The rate of undiagnosed diabetes in the current study was 4.4% using only the original survey question; however, 4 of 18 (22%) were reclassified as knowing they had diabetes after answering the second question that included "sugar." Thus, a proportion of the difference in the prevalence of undiagnosed diabetes is accounted for by asking this question.

There are several potential limitations of this study. First, the sample we recontacted for the screening examination was not random. Although the initial survey procedure resulted in a representative population-based sample of African-Americans from the two study counties, recontacting selected survey respondents proved logistically difficult due to the remote area and the number of people without telephones. Those who were more easily recontacted were thus

more likely to receive the screening examination. Although those screened had a higher self-reported prevalence of diabetes than those who were not screened (13.9 vs. 10%), there were no significant differences between subjects with diabetes who were and were not screened. After weighting the samples, the self-reported diabetes prevalence of the screened group (9.9%) was very similar to that of the larger survey group (9.6%). Thus, we believe that the weighted screening data give a reasonable estimate of the prevalence of diabetes in these counties, and that the differences found between groups are also representative. In addition, although smokers were oversampled, the results were similar whether or not this factor was considered in the analyses.

The second potential limitation is the use of GHb as a screening tool for diabetes. This measure was chosen for practical reasons. It does not require a fasting state, and it demands less time and coordination between the respondent and interviewer than an oral glucose tolerance test (OGTT). The accuracy using the GHb level for diabetes screening, however, remains uncertain. A recent meta-analysis suggested that an HbA_{1c} level >7 is quite specific for diabetes diagnosed by an OGTT; although the sensitivity may be lower, few people classified as having diabetes by the GHb will not have the condition (16). Thus, the true prevalence of diabetes in this population is more likely to be higher rather than lower than we determined.

A third limitation is that we did not systematically collect information on medication usage. This would have been useful to determine if there were differences in how subjects with sugar and those with diabetes were treated, as was suggested by one respondent as a difference between the two conditions.

A fourth limitation is the small sample size. This would tend to limit our ability to determine differences between groups. Despite this, there were still statistically significant differences between those who felt they had sugar and those who considered their condition to be diabetes or sugar-diabetes. There may be additional important differences between these groups that we failed to identify, but the differences we did find were of sufficient magnitude that they could be determined even with the small sample we analyzed.

Diabetes is an increasingly important health problem in this country, especially among African-Americans. Rural African-

Americans represent a population that can be difficult to reach and that is frequently medically underserved; innovative programs may be required to address these issues. Of the sample, >25% felt they had the condition sugar, which they felt was less serious than those who thought they had diabetes perceived their condition to be. Culturally appropriate public awareness and diabetes education interventions for this population need to take these findings into consideration, and the effectiveness of specific interventions that address these different health beliefs should be determined.

Acknowledgments — We thank Dawn Hunt for her assistance in coordinating data collection and management, Margie Siegel and Julienne Roach for their roles as community coordinators, and the other staff of the Alliance of Black Churches Health Project for their support and assistance.

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