Health implications of obesity in American Indians and Alaska Natives[1-3]

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ABSTRACT American Indians and Alaska Natives (AI/ANs) are experiencing an epidemic of diabetes, increasing rates of coronary artery disease and hypertension, and poor survival rates for breast cancer that are likely partially attributable to the increasing prevalence of obesity over the past generation. Obesity may also contribute to the high rates of gallstones and to adverse outcomes of pregnancy in AI/ANs. Although overall mortality was not associated with obesity in Pima Indians (except in the most obese men), the relationship of obesity to longevity in other AI/AN groups is not known. Further study of the specific health effects of obesity in various groups of AI/ANs are needed. In the meantime, community-based programs to prevent obesity and its sequelae should be implemented in all AI/AN communities. *Am J Clin Nutr* 1991;53:1616S–20S.

KEY WORDS American Indians, Alaska Natives, diabetes, coronary artery disease, hypertension, cancer, obesity, gallstones, pregnancy, mortality

Introduction

Many of the health problems of American Indians and Alaska Natives (AI/ANs) are related to obesity. Health problems vary greatly in the Indian Health Service (IHS) areas because of differences in risk-factor prevalence in various tribal groups and differences in genetic predisposition for various diseases (1). Although AI/ANs are not a homogeneous group with regard to health problems, they have all suffered adverse effects from the high prevalence of obesity (2).

Obesity has become a major health problem in AI/ANs only in the past one or two generations (3). In 1967 a health survey conducted in a small Navajo community revealed that malnutrition was a serious health problem (TK Welty, unpublished observation, 1967). The malnourished children in this community became ill with diarrhea or respiratory diseases, and many died from those common health problems. Data from this survey indicated that 26% of the children were below the third percentile for height and 13% were below the third percentile for weight, with Bostonian and Iowan children used as a standard. This study raised questions about whether it was appropriate to use standard growth charts for Indian children.

Prompted by the 1968 television program "Hunger in America," massive feeding programs were made available to reach malnourished people, including AI/AN populations. Many of the commodity foods were high in fat as well as calories and low in fiber. Concurrently, physical activity also markedly decreased. Most Indian populations developed obesity in less than a generation. The term Comod Bod, linking commodity foods to body weight was coined to capture the essence of the changes that occurred. It might be surmised that at the community level, the etiology of obesity in AI/ANs is related to the relative abundance of high-fat, low-fiber foods accompanied by rapid changes from an active to a sedentary lifestyle. In addition, there may be multiple metabolic differences between Indians and non-Indians that may predispose Indians to become obese when food is abundant (4). In essence, the problem of malnutrition was solved and replaced by the problem of obesity and its sequelae.

Although obesity and high rates of diabetes were well-described in Pimas (5), there was a failure to recognize the potentially devastating effects of obesity in other Indians. IHS physicians were happy to see fat Indian children instead of the malnourished ones seen in the earlier times who occasionally died from diarrhea or respiratory diseases that would not have been fatal had these children been adequately nourished. Now there is no question that obesity is common and causes serious health problems.

Along with the increased prevalence of obesity that has occurred over the past 30 y in AI/ANs (6), there has been an epidemic of diabetes and other chronic diseases (7, 8). Although the health implications of obesity are staggering, their precise magnitude is poorly defined and varies considerably among tribal groups. Studies of the health implications of obesity in various groups of Indians are needed. A study of this kind was conducted to examine the risk of nonfatal myocardial infarction in a large cohort of nurses (9). The study showed that obese nurses who were smokers, hypertensive, diabetic, or hypercholesterolemic were more likely to sustain a myocardial infarct than those nurses who were obese but did not have other risk factors (9). Because the prevalence of smoking, hypertension, diabetes, and hypercholesterolemia varies greatly among tribal groups (10), the health implications of obesity also vary greatly and reflect the coexistence of other risk factors.

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Discussion

Diabetes

The epidemic of non-insulin-dependent diabetes (NIDDM) that is currently afflicting AI/ANs is largely attributable to the increasing prevalence of obesity (5, 7, 8). Only Alaska Natives have prevalence rates for diabetes lower than US all-races rates but their rates are increasing (11). In addition, the age of onset of diabetes has been occurring at younger ages as the prevalence of obesity and overweight increases. This is especially true in the offspring of women who have gestational diabetes during pregnancy (5).

Because the onset of diabetes predictably leads to significant weight loss, the incidence of diabetes is more strongly related to obesity and overweight, as measured by the body mass index (BMI, in kg/m^2), than is the prevalence of diabetes (5). Calculation of the incidence of diabetes requires longitudinal studies, and for that reason incidence rates are not available in most AI/AN populations. Studies of the incidence of diabetes in AI/ANs are needed to estimate the risk NIDDM that is attributable to obesity and overweight. Longitudinal studies of the Pimas have documented a highly significant association between BMI and incidence of diabetes (5). Less than 5% of Pima Indians aged 15–34 y developed NIDDM if their BMI was < 25 even if they had a family history of diabetes (5, 12). These data suggest that health professionals should strongly recommend that AI/ANs maintain a BMI < 25 to reduce their risk of developing diabetes to the lowest possible level.

Historical studies are also consistent with such a recommendation. Obesity and diabetes were uncommon several generations ago in AI/ANs, and the onset of the problems coincided with the following drastic changes in lifestyle: *1*) a continuous abundance of high-fat, low-fiber food provided by various feeding programs replaced the alternating periods of feast and famine that were common several generations ago and *2*) a subsistence economy changed to a wage economy that was associated with a more sedentary lifestyle and an increasing reliance on welfare programs.

A study of Tarahumara Indians, relatives of the Pimas, in northern Mexico documented the benefits of traditional lifestyles in terms of the virtual absence of obesity and overweight and very low concentrations of cholesterol (13). Not a single man among the 103 studied was overweight and the average BMI was 22.9 for men and 23.4 for women. Clinical diabetes has not been reported in this population and mean total cholesterol concentrations were 3.52 mmol/L for both men and women.

Historical data, ecological data, and data on the incidence of diabetes among the Pimas suggest that the epidemic of diabetes in AI/ANs can be controlled ideally by reducing the prevalence of obesity and overweight, with a goal of reducing the mean BMI in all communities to < 25, a level that would reduce the risk of diabetes to the lowest possible level and that could be achieved without increasing the risks of other health problems. Historical data and the Tarahumara study suggest that the ideal body weight for AI/ANs should be the same or perhaps even lower than US all-races rates because AI/ANs are genetically predisposed to developing diabetes if they become overweight or obese.

Cardiovascular disease

Although overall AI/ANs have lower cardiovascular mortality and morbidity rates than do US all races, there was a fourfold difference in cardiovascular mortality rates between the lowest (Navajo) and the highest (Bemidji) in 1981–1983 (10). Northern Plains Indians consistently have had rates of cardiovascular disease (CVD) that equal or exceed US all-races rates (14–16). In contrast, southwestern Indians have low rates of CVD despite having a high prevalence of obesity and diabetes (17). A study of Tarahumara Indians suggest that CVD in Indians who have maintained their traditional diet and lifestyle is rare or nonexistent (13). Thus, it is likely that the increasing prevalence of obesity and overweight in AI/ANs contributed to increasing rates of CVD that were documented over the past decade (18, 19).

Calculation of the attributable risk of obesity and overweight for CVD in AI/ANs has not been done and would require consideration of their interaction and synergism with other risk factors for CVD. For example, in the Nurse Health Study, coronary heart disease (CHD) was 3.3 times more common in obese nurses (BMI > 29) than in nonobese nurses after smoking was adjusted for (9). Thus, obesity is an independent risk factor for CHD in these nurses. As much as 70% of CHD in these obese women and 40% in women overall is because of obesity (9). The risk of CHD was much greater in obese nurses who had other risk factors such as smoking, high blood pressure, elevated cholesterol, and diabetes. Hypertension, elevated cholesterol, and diabetes are in part a consequence of obesity and represent mechanisms through which obesity mediates its effect on CHD risks (9).

Because smoking prevalence is 50% or higher in northern Plains Indians (20) and their rates of diabetes (7), hypercholesterolemia (21), obesity, and overweight (6, 22) are also high, a large epidemiologic study will be needed to accurately describe the contribution and interaction of obesity and other risk factors for CVD. Does the coexistence of smoking and obesity in a northern Plains Indian population with high rates of diabetes and higher concentrations of cholesterol than a southwestern Indian population explain the high CVD rates? Or, is there a difference in genetic susceptibility that is the primary reason for the high rates of CVD in northern Plains Indians? The relative risk and attributable risks of obesity for CVD in Indians are unknown, but such data should be available for the tribes participating in the Strong Heart Study (SHS) to calculate these risks and to answer these questions (23).

Hypertension

Obesity is a risk factor for hypertension, and hypertension in turn is a risk factor for CVD, especially coronary artery disease, stroke, and peripheral vascular diseases. Although several studies documented an association between hypertension and obesity in AI/AN populations, the prevalence of hypertension is not elevated in most populations studied (24–27; K Sharlin, unpublished observations, 1990).

Hypercholesterolemia

Mean total cholesterol concentrations in AI/AN populations are lower than in most other populations, and the low concentrations partly explain the low rates of CVD reported in southwestern Indians (10, 28). However, cholesterol concentrations are higher in northern Plains Indians (21) than in southwestern Indians. The relationship between obesity and lipid concentrations has not been studied in northern Plains Indians.

Preliminary data from the SHS indicate that obesity has little association with plasma lipoproteins in diabetic and nondiabetic women but is associated with higher concentrations of very-lowdensity lipoproteins and lower concentrations of high-density lipoproteins in nondiabetic men (BV Howard, unpublished observations, 1990). Similar findings were reported previously in Pimas (28) and urban Indians (26).

Renal disease

The annual incidence of end-stage renal disease (ESRD) is 2.8 times higher in AI/ANs than in whites (29). The majority of cases of ESRD are attributable to diabetes in AI/ANs, and their diabetes-attributable incidence was 5.8 times that of whites. More than 90% of ESRD in Pima Indians is attributable to NIDDM and its occurrence is related to the duration of diabetes (30).

Although obesity has not been independently related to nephropathy in diabetic patients (31), it is a well-defined risk factor for diabetes. Because the majority of ESRD in AI/ANs is attributable to diabetes, it is likely that if AI/ANs could maintain a BMI < 25, they would not develop diabetes and its complications, including ESRD. In addition, uncontrolled hypertension is a well-defined risk factor for ESRD that is also associated with obesity (31). Thus, prevention of obesity and overweight would likely prevent both diabetes and hypertension, and thereby most ESRD cases could be prevented if obesity and overweight were prevented.

Breast disease

Although mortality rates and incidence rates of breast cancer are lower in AI/AN women, the survival rates for breast cancer are lower for southwestern Indian women with breast cancer (32, 33; PA Nutting, SD Helgerson, SK Beaver, et al, unpublished observations, 1990). The rates of breast cancer vary by IHS area (32; PA Nutting et al, unpublished observations, 1990) and the role of obesity as a risk for breast cancer and its contribution to the low survival rates in AI/ANs are not known. Obesity was associated with shorter survival (34) and its role in the poor survival of AI/AN women with breast cancer should be evaluated.

Weight gain between the ages of 25 and 35 y was also reported as a possible risk factor for breast cancer (34) and could explain increases in breast-cancer mortality rates reported in North Dakota Indians over the past 30 y (35). Breast-cancer mortality rates in North Dakota Indian women exceeded rates in white women in the 1980s (35).

Gallbladder disease

High rates of cholecystitis and gallbladder cancer were reported in most AI/AN groups (32, 36–38). Obesity was reported as a risk factor for gallstones (39) and could be associated indirectly with the high rates of gallbladder cancer. Thus, prevention of obesity possibly could reduce rates of cholecystitis and gallbladder cancer in AI/ANs.

Uterine cancer

Uterine cancer rates in AI/ANs are lower than US rates except for Tucson-area Indians (PA Nutting et al, unpublished observations, 1990). The role of diabetes and obesity as risk factors for uterine cancer in Indians needs further evaluation. In obese non-Indians the risk of endometrial cancer is 5.4 times higher than the rate in nonobese non-Indians (40).

Infectious diseases

In the past, higher rates of morbidity and mortality in AI/ANs have been associated with malnutrition and poor environmental conditions (TK Welty, unpublished observation, 1967). Feeding programs have eliminated malnutrition as a problem (3) and rates of infectious disease have declined (2). Poor nutrition frequently related to alcohol abuse may still be associated with high rates of infectious diseases, especially tuberculosis, in AI/AN populations (41). Although tuberculosis tends to occur in debilitated persons with chronic diseases, especially diabetic patients with ESRD and patients with chronic alcohol abuse, obesity is protective (41). Thus, it is important to ensure that preventive efforts in reducing obesity and overweight do not lead to recurrence of malnutrition, which was associated historically with severe health problems in AI/ANs.

Musculoskeletal disease

Although rates of musculoskeletal diseases are not well-defined in AI/ANs, obesity may be a risk factor for lower-back strains, osteoarthritis, and disability (42). Reduction in the prevalence of obesity in AI/ANs would reduce musculoskeletal problems and disability days.

Pregnancy outcome

Perinatal mortality rates (fetal + neonatal deaths/1000 births) were 3.2 times higher for women who were obese before pregnancy (BMI > 30) than for thin women (BMI < 20) in the Collaborative Perinatal Study of 58 957 pregnancies followed prospectively from 1959 to 1966 (43). Part of the perinatal mortality increase associated with increasing maternal pregravid BMI is likely related to obesity or overweight and is partly due to higher rates of acute chorioamnionitis in obese women, leading to higher rates of preterm births. Diabetes mellitus, hypertensive disorders, congenital malformations, and dizygotic twinning all increased in frequency as maternal pregravid weight increased (43). Other studies have reported higher rates of Caesarean sections, fetal macrosomia, wound infection, and transient neonatal hypoglycemia in obese women (44, 45).

Although neonatal mortality rates are currently lower for most AI/ANs than for US all races (46), increasing maternal obesity may lead to increased fetal loss, higher neonatal death rates, higher Caesarean-section rates, and higher rates of preterm deliveries due to amnionitis and increasing rates of diabetes and hypertensive disorders during pregnancy. Further study of these serious sequelae of maternal obesity in AI/ANs is needed to define the risks and to implement preventive programs.

Overall mortality

Although obesity in Pimas was associated with significantly increased mortality only in the most obese men, the relationship of obesity to longevity in other AI/AN groups is not known (47). Obesity may be more strongly associated with mortality in groups with higher rates of smoking and hypercholesterolemia. Even in Pimas the mortality rates in nondiabetic males and females with BMIs < 25 are similar to the rates in heavier Pimas. Because Pima Indians who maintain a BMI of < 25 are less likely to get diabetes and because Pimas with BMIs < 25 also have low overall mortality rates, the implication is that the ideal BMI for Pimas is < 25. Further studies of the relationship of BMI with mortality, with alcohol use, smoking, and diabetes controlled for, are needed in other AI/AN groups to clarify these relationships and to establish ideal body weights for AI/AN more scientifically.

Other aspects of obesity with health implications

Regional distribution of obesity in northern Canadian Indians was primarily of the central type (22). There are no other reports of the regional distribution of obesity in AI/ANs. Truncal obesity is a significant and independent risk factor for CVD, diabetes, and hypertension (48–50). The SHS includes waist and hip measurements and will provide more information on the health implications of regional weight distribution in AI/ANs (23).

Weight gain after age 18 y was recently found to be a risk factor for diabetes in nurses (51). Duration of obesity is a stronger risk factor for diabetes than is rapid weight gain in Pima Indians (52). Prevention of weight gain in adolescence and early adulthood may decrease the incidence of diabetes in AI/ANs.

Conclusion

AI/ANs cannot afford to wait any longer to implement programs that prevent obesity and its sequelae. As public health professionals we need to focus our efforts to empower tribal people to address this serious health problem. It is unlikely that a magic bullet will fix the problem. The best approach is to rediscover and promote at all levels traditional values and ways that protected native peoples in previous generations against chronic diseases. Model programs, such as the Zuni Wellness Program, should be replicated in other AI/AN communities to stop the increase of obesity and its sequelae (53). The goals should be to have a more balanced low-fat, high-fiber diet that is similar to the traditional diet of AI/ANs and to increase activity levels in the community.

In the meantime, mortality and longitudinal studies must be continued in the Pimas and conducted in other tribal groups to better evaluate the health implications of obesity. The contribution of confounding variables, including diabetes and alcohol and tobacco use, should be evaluated and the impact of obesity on pregnancy outcomes should be studied.

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