

Prevalence Rates and Risk Factors of Non-Insulin-Dependent Diabetes Mellitus in Minorities in the United States

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〈CONTENTS〉

ABSTRACT	III. Diabetes in Minority Populations
I. Introduction	IV. Management
II. Risk Factors Involved in the Development of NIDDM	V. Conclusion
	REFERENCES

ABSTRACT

Minority populations in the United States have a higher prevalence of non-insulin-dependent diabetes mellitus (NIDDM) and more persons die of the disease than white persons. This study was to review and compare risk factors and prevalence rates of NIDDM in African Americans, Hispanics, Korean Americans and Native Americans in the United States. The risk factors of NIDDM, including family history of diabetes, obesity, physical inactivity, diet and age, were reviewed in the minority populations. Risk factors such as obesity, physical inactivity and family history of diabetes occurred to a greater extent in some minority populations than in the white population.

Diabetes should be treated as a public health problem for minority populations. Due to the increase of older populations and the increased prevalence of obesity and sedentariness, NIDDM in minorities is nearing epidemic proportions. Good diet and regular exercise can reduce the incidence of NIDDM but an understanding of the cultural aspects of diabetes is imperative in order to provide adequate community health education programs because those programs involve

diet and behavior changes, characteristics that are often culturally determined.

In summary, it is important to plan a community health education program targeted on NIDDM in a culturally adapted manner that will be received with both comprehension and acceptability. In particular, the program for high-risk populations should be stressed so to prevent diabetes. Preventive approaches to diabetes should be considered because they can be both therapeutic and cost effective.

Key Words : NIDDM, Risk Factor, Management, Health Education, Minority

I. Introduction

There are approximately 15 million persons with diabetes in the United States. Of these 90 to 95% have non-insulin dependent diabetes mellitus (NIDDM) (Strano-Paul and Phanumas, 2000; Harris, 1998). Prevalence rates of NIDDM were 1.3% age 18-44 years, 6.2% at age 45-64 years, and 10.4% at age >65 years (National Diabetes Data Group, 1995). In addition, undiagnosed diabetes is a serious health threat in the United States. Undiagnosed NIDDM is highly prevalent in the U. S. population, reaching 10-20% in people > 50 years of age, with an even higher rate in minority population. Recent data show that onset of NIDDM occurs at least seven years before its diagnosis, and that significant morbidity and premature mortality occur in subjects with undiagnosed diabetes (Harris, 1993; 1995; 1998). Only half of the estimated

cases of diabetes have been diagnosed by a physician (Davidson, 1992). Thus, during the time that diabetes remains undiagnosed and, consequently, while it remains untreated, retinopathy and other complications of diabetes are developing (Harris, 1993). The cost of diabetes was approximately \$92 billion in 1992, including \$45.2 billion direct costs and \$46.4 billion indirect costs (National Diabetes Data Group, 1995).

Diabetes mellitus is common in all United States population, but it is more prevalent among African Americans, Asian Americans, Hispanic Americans, and Native Americans than among whites in the United States: Hispanic Americans have a 300% higher chance of developing diabetes than whites; African Americans and Asian Americans have two to three times the risk of Whites; while Native American have the highest rates of diabetes in the world (Davidson, 1991; 1992; Stern and Haffner, 1990).

Diabetes is twice as common among

African Americans aged 45 to 65 as among whites in the same age-group and three times more common after age 65. The diabetes is accompanied by a greater severity of diabetic complications. The mortality rate of African Americans is more than double that of whites. African American women are more severely affected than African American men (Burrus et al., 1998).

The rate of diabetes is also higher in the Hispanic population than in the Caucasian population. Hispanics are three times more likely to develop diabetes than non-Hispanics (Davidson, 1991). Within the Hispanic population Mexican Americans and Puerto Ricans have the highest rates of diagnosed diabetes (Davidson, 1991).

Native Americans, especially the Pima and Papago peoples, have the highest rate of diabetes in the world (Davidson, 1991; Carter et al., 1996; 1989). The problem is severe and constantly growing (Pi-Sunyer, 1992).

Asian Americans are a growing ethnic minority in the United States. In Asian migrants to Hawaii the diabetes prevalent in Japanese, Koreans, Chinese, and Filipinos is three to four times that in non-Asians. In west coast U. S. cities, the prevalence of diabetes in Asian Americans is two to three times the national rate. In middle-aged and older Japanese Americans in Los Angeles the prevalence of diabetes is over 20% (Hendricks

and Haas, 1991). The diabetes seen in Asian Americans is usually NIDDM. Studies show that the prevalence of NIDDM is generally higher in Asian groups in the United States than in their native countries (Hendricks and Haas, 1991). Among the Japanese, prevalence rates of NIDDM among migrants to Hawaii and King County, Washington, are two to four times higher than among native Japanese residing in Hiroshima. Similar increases have been observed among Chinese migrant populations. This data provide evidence for the impact of modern lifestyle factors on the risk of developing NIDDM in populations traditionally free from the disease (Manson and Spelsberg, 1994).

Although the proportion and the number of Korean Americans have increased in the United States (Min, 1995), few systematic studies of their health status have been conducted, especially in terms of prevalence and risk factors for diabetes. Those studies that have been conducted reveal higher mortality rates for diabetes mellitus, heart disease, hypertensive disease, and cerebrovascular disease among Koreans than among Japanese males and females (Yan, 1990). The literature also suggests that Korean NIDDM patients with a higher prevalence of hypertension and previous obesity had a higher prevalence of overt proteinuria than whites (Lee, 1995). One study (Lee and Gallagher-Tompson, 1993)

found that the prevalence of diabetes in Korean American elders was much higher than in white elders.

The aim of this study was to present summary data on the prevalence rates and to review the risk factors of NIDDM in African Americans, Hispanic persons, Korean Americans and Native Americans in the United States. Although summary and statistical data are available on diabetes, little is known about risk factors in minorities, especially Asian populations. Despite the important role of genetic factors, NIDDM should be considered as a largely preventable disease. The disease and its complications can be prevented by health education designed to change life-style and detect early diabetes. Therefore, the identification of potential risk factors for NIDDM will assist in the development of community-based health promoting interventions designed to reduce the incidence and prevalence of NIDDM in culturally diverse populations.

II. Risk Factors Involved in the Development of NIDDM

NIDDM is a group of metabolic diseases characterized by hyperglycemia due to decreased insulin secretion, decreased insulin action, or both. The condition develops in persons with risk factors for NIDDM.

1. Age

The rate of diabetes increases with age, and age is a well-established risk factor for NIDDM, although why diabetes is associated with age is not known. In all likelihood age reflects the accumulation of years of exposure to other risk factors for NIDDM (Strano-Paul and Phanumas, 2000; Harris, 1995). Nearly 18.4% of the United States population aged 65 and older has NIDDM (Strano-Paul and Phanumas, 2000)

2. Genetics

It is widely believed that specific genes determine whether a person develops diabetes, although the identity of these genes is unknown. Epidemiologic studies of the US population show that the incidence of NIDDM is about twice as high in persons with one diabetic family member, compared to persons with no diabetic family member. The rate doubles for those with two or more diabetic family members indicates that there may be genetic dose-response effect (Harris, 1995).

Also, the higher rate of NIDDM among certain ethnic groups is explained by differences in genetic susceptibility. Even when studies are controlled for the greater prevalence of

obesity in Mexican Americans, this group has a higher prevalence of NIDDM than non-Hispanic whites. Siblings of patients with NIDDM have a six times greater risk to develop the disease than are siblings of nondiabetics, and children of these patients have twice the risk (Davidson, 1991; Harris, 1990).

3. Gender

There appears to be some effect of gender in the differential development of NIDDM, but this effect does not appear to be large. For example, the age-adjusted rate of total NIDDM in the United States is only 20-30% higher in females compared to males. African American women have the highest age-adjusted prevalence of diabetes followed by African American men, white women, and white men (MMWR, 1997). The higher prevalence of NIDDM in females is associated with body fat. As women age, they experience a larger increase of body fat and a greater basal metabolic rate compared with men.

4. Obesity

This is a well-established risk factor for NIDDM within all ethnic groups in the United States (Pi-Sunyer, 1991; 1992; Kumanyika; 1994a) although it is less often associated

with Asian Americans (Hendricks and Haas, 1991). There is a high correlation between the mean weight of a country's residents and the prevalence of diabetes in that country (Davidson, 1991). The rate of diabetes increases with increasing levels of percent desirable weight in numerous populations. In the U. S., while there is some increase in the rate of NIDDM below a percent desirable weight of 139, the most striking increase occurs at a percent desirable weight of 140 and greater (Harris, 1989; 1995). Obesity is associated with insulin resistance, that is a decreased ability of the body to respond to the action of insulin, and a reduced number of insulin receptors (Harris, 1998; Manson and Spelsberg, 1994).

Data from the second National Health and Nutrition Examination Survey (NHANES II) showed that women (27.1%) are more overweight than men (24.2%), are more severely overweight (10.85% versus 8.0%) and between the ages of 25 to 74 years, had greater amounts of cumulative weight gain (7.3 Kg) than men (4.5 Kg) and more fluctuations (Walcott-McQuigg, 1997).

In most ethnic minorities (African Americans, Hispanic Americans, Asian and Pacific Islander Americans, American Indians and Alaska Natives, and Native Hawaiians), the prevalence of obesity is substantially higher than in whites, especially among women (Costello, et al., 1998; Kumanyika,

1993). For example, among women aged 35 to 55, 30% of European Americans and 60% of African Americans are overweight (Walcott-McQuigg, 1997).

Obesity is also related to socioeconomic status (Sobol and Stunkard, 1989; Kumanyika, 1993). Several studies have found that well-educated women were more concerned about their weight (Vickers, 1993) and women of higher socioeconomic status were less likely to be obese than women of lower socioeconomic status (Pi-Sunyer, 1990; 1993; Kumanyika, 1993; Vickers, 1993). Low-income women in some minority groups appear to have the greatest likelihood of being overweight (Sobol and Stunkard, 1989). For example, among Mexican-American women ages 20 to 74 years, the age-adjusted prevalence of overweight is 46% for women living below the poverty line compared with 40% for those living above the poverty line; comparable figures for non-Hispanic women are 39% and 25% for women below and above the poverty line, respectively. Thus, the NIDDM is more common in population with low incomes (American Diabetes Association, 1990).

5. Duration of obesity

The time that a person has been obese is directly proportional to his or her risk of developing NIDDM. Compared to subjects

who had a Body Mass Index >30 for $<$ five years, subjects who had experienced this degree of obesity for 10 years had a 2.5-fold higher incidence of NIDDM (Harris, 1995).

6. Body fat distribution

Body fat distribution is an additional dimension of obesity-related risk, somewhat independent of overall weight or total body fat. Upper-body fat, particularly intra-abdominal fat has been associated with an increased risk for NIDDM (Affenito and Kerstetter, 1999; Kumanyika, 1993). A greater waist-to-hip ratio (i. e., having more abdominal fat than extremity fat) has a positive association with diabetes in several studies (Affenito and Kerstetter, 1999; Davidson, 1991). A waist circumference of more than 35 inches signifies increased risk of diabetes (Taylor et al., 1998)

The distribution of body fat occurs to a greater extent in some minority populations than in whites (Kumanyika, 1993). A greater tendency toward upper-body obesity, indicated by a high waist-to-hip ratio or by a high centrality index (ratio of the subscapular to triceps skinfolds thickness), has been documented in African American compared with white women and in Mexican-Americans compared with whites regardless of sex (Kumanyika, 1993)

7. Socioeconomic status

Data from national surveys suggest that the prevalence of diabetes is related to socioeconomic status: it decreases as income increases from poverty level to middle income level, but no further decrease occurs as income rises higher; it is also inversely related to educational attainment (Harris, 1990). The prevalence of diabetes is highest among older people, the less educated, the formerly married, persons living alone, and persons in families with low incomes (American Diabetes Association, 1990). However, after controlling for age and obesity, these factors do not appear to be strong risk factors for NIDDM (Harris, 1990).

The majority of Hispanics have low incomes and educational levels. Traditionally, there is a lack of awareness of preventive health practices (Hedricks and Haas, 1991). As Hispanics immigrate to the United States, they adopt a "westernized diet" diet, i.e. high in fat and simple sugar. The change in diet and decrease in physical activity lead to obesity.

8. Physical inactivity

A sedentary lifestyle contributes to NIDDM by causing obesity. Also, diminished physical activity leads to a deterioration of glucose

tolerance and a reduction in insulin secretion. Exercise improves both of these functions (Davidson, 1991). In clinical trials obese individuals with impaired glucose tolerance (IGT) have been found to have lower insulin levels and improved glucose metabolism after moderate exercise regimens, even without weight loss. Studies among nondiabetic subjects suggest that the addition of exercise to caloric restriction will facilitate loss of adipose tissue and will assist in maintenance of reduced body weight (Manson and Spelsberg, 1994). Two thirds of American adults do not exercise on a regular basis, and many do not exercise at all. Minority diabetic persons are likely to exercise even less, since a majority are in urban settings, with poor facilities for exercise and fear of street violence (Pi-Sunyer, 1992)

A study of Native Americans found that sedentary individuals had a higher rate of diabetes (7.9%) than did physically active ones (2.8%). A study of Japanese Americans (Burchfiel et al., 1995) found that physical activity was associated inversely with incident diabetes after adjusting for risk factors such as age, body mass index, and blood pressure.

9. Hyperinsulinemia and insulin resistance

Several populations with high rates of

NIDDM have been studied for their insulin levels. Nondiabetic Hispanics, Nauruans, and Pima Indians all have higher basal plasma insulin levels compared to nondiabetic whites. The incidence of NIDDM rises with increasing insulin level at baseline study in Nauruans, Pima Indians, and Swedish women (Harris, 1995). Hyperinsulinemia is correlated with other risk factors for NIDDM. An increased waist to hip ratio is associated with hyperinsulinemia and insulin resistance in cross-sectional studies (Haffner et al. 1994, 1995). High physical activity is associated with lower levels of plasma insulin, and physical training can decrease the insulin resistance often found in older nondiabetic persons (Harris, 1995).

10. Impaired glucose tolerance

Impaired glucose tolerance (IGT) was defined by the US National Diabetes Data Group and World Health Organization at the time of the development of their consensus on classification and diagnostic criteria for diabetes. IGT is defined as glucose levels during the oral glucose tolerance test (OGTT) that are intermediate between normal and diabetes (2-h value, 7.8-11.0 mmol/L). In the U. S population approximately 11% of adults have IGT, and this rises to 23% at age 65-74 years. This condition is probably the

strongest known risk factor for diabetes. Subjects who already have postprandial glucose values that are in the IGT range have incidence rates of NIDDM that are substantially higher than subjects with normal glucose tolerance. IGT appears to represent a stage in the development of NIDDM, although many subjects with IGT, on repeat testing with the OGTT, revert to normal glucose tolerance (Harris, 1995).

11. Cardiovascular risk factors in prediabetic subjects

A number of studies indicate that traditional cardiovascular risk factors such as elevated blood pressure, increased cholesterol and triglycerides and decreased high-density lipoprotein cholesterol precede the onset of NIDDM (Affenito and Kerstetter 1999; Haffner, 1995).

In contrast to patients with insulin-dependent diabetes mellitus, who are usually normotensive until nephropathy develops, a considerable proportion of NIDDM patients are already hypertensive at the time of diagnosis. This suggests that hormonal or metabolic abnormalities might be present in essential hypertension before the onset of diabetes or, alternatively, that both disease conditions share a common pathophysiological basis (Rett et al. 1995).

12. Inadequate medical care

One risk factor that all low-income groups share is the lack of access to continuing, high-quality, affordable medical care. Decades of poor health-care result in a heavy burden of chronic disorders, including obesity, hypertension, diabetes, and associated complications (Davidson, 1991).

III. Diabetes in Minority Populations

Minority populations in the United States include four major subgroups: African Americans, Hispanic Americans, Asian-Pacific islander Americans and American Indians, and Alaskan Natives (Kumanyika, 1994). Black Americans are primarily native born and reside primarily in urban areas; slightly more than half live in the Southern United States. Hispanic Americans include Mexican Americans, Puerto Ricans, Cubans, Central American, and other persons with Spanish-surnames or from Spanish-speaking countries. Although the majority of Hispanic Americans are native born, a significant proportion are immigrants (Kumanyika, 1994).

Asians and Pacific Islander Americans are an extremely diverse group, the majority of whom are immigrants. This category includes Americans of Japanese, Chinese, Korean, and

Filipino origin, Samoans and other populations originating in the South Pacific, and populations from Southeast Asian and from the Indian subcontinent. Large proportions of the Asian/Pacific islander population live in California and Hawaii. Native Hawaiians are sometimes included in this category. Native Americans include members of more than 500 federally recognized Indian tribes as well as Eskimos and Alaskan Indians.

In the United States, minority or "non-white" status implies certain negative health outcomes. Most minority groups in the United States have higher rates of NIDDM than do white persons (see Table 1).

1. African Americans

Prior to 1940 diabetes was less common in the African American population than in the general population. Today, the incidence of diagnosed and undiagnosed cases of diabetes have been reported to be 60% higher in African American's compared with the white population (Harris, 1991). African American women have been reported to have a rate of diabetes that is two times higher than that of white women (Anderson et al., 1991). African American women thus are placed in a high-risk category for developing diabetes and related complications (Maillet et al., 1996). Diabetes is the third leading cause of death

〈Table 1〉 Prevalence of Diabetes in the United States

Population	Men %	Women %	Overall %
White persons ^a	2.9 - 8.4	2.5 - 7.8	
African-Americans ^a	8.5	12.1	
Hispanic populations ^a			
Southern Colorado	6.9	8.6	
Cuban	11.8	4.5	
Puerto Rican	17.8	12.8	
Mexican	7.2 - 16.7	4.5 - 19	
Asian Americans			
Japanese (Seattle) ^b	20	16	
Filipino (Hawaii) ^c			21.8
Korean (Hawaii) ^c			19.7
Chinese (Hawaii) ^c			14.6
Native Americans			
Indian Health Service ^d			8.9
Pima and Papago ^a	49.4	51.1	
Strong Heart Study ^e	33 - 65	40 - 72	

Note : a. Age, 30 to 60 years; direct age standardized prevalence of diabetes to the standard world population of Segi; b. Age, 45 to 74 years; not age adjusted; c. Age, 14 years and older; adjusted to 1950 U.S. Census, civilian labor force for Honolulu, Hawaii, standard metropolitan area; d. Age, older than 15 years; direct age adjusted to 1980 U.S. census; e. Age, 45 to 74 years; direct age adjusted to 1980 U.S. Census

from disease in the African American population, surpassed only by heart disease and cancer (Hendricks and Haas, 1991).

The risk of developing macrovascular disease, retinopathy, nephropathy, and neuropathy is higher in African Americans than whites with diabetes. The rate of lower-extremity amputation in African Americans is 1.5 to 2.5 times greater than in whites with diabetes. The

prevalence of blindness secondary to diabetic retinopathy in African Americans is twice that of whites, with African American women having a rate nearly four times higher than white men. The incidence of end-stage renal disease is more than three times higher in African Americans with diabetes than in whites with diabetes (Maillet et al., 1996).

The Department of Health and Human

Services statistics reports higher diabetes rates in African Americans across all sociodemographic parameters. The prevalence of diagnosed and undiagnosed diabetes in African Americans has increased to 9.9% of the population (Hendricks and Haas, 1991).

African Americans, particularly African American women, have a higher prevalence of obesity, which, as has been indicated, is a strong risk factor for NIDDM (Pi-Sunyer, 1992; Hendricks and Haas, 1991). Approximately 60% of African American women ages 45 to 74 years were reported to be overweight (Maillet et al., 1996). Of all Americans diagnosed with NIDDM, 82% of adult African American women are obese compared with 62% of white women (Hendricks and Haas, 1991).

2. Hispanics

The Hispanic population is the second largest ethnic minority in the United States, with a population of 19.5 million. Because of immigration trends and high birth rates, it is expected to continue growing. However, this population comprises heterogeneous ethnic groups. Mexican Americans are the majority, with the second largest group from Puerto Rico (Hendricks and Haas, 1991; Stern and Haffner, 1990).

It is now well established that the prevalence of NIDDM is two to three times

higher in Hispanics than in the non-Hispanic white population (Hendricks and Haas, 1991; Pi-Sunyer, 1992). Diabetes in Hispanics begins to appear at a younger age: in the 30s to 40s versus the 40s to 60s in non-Hispanic whites. Within Hispanic ethnic groups, clinical indicators of persons most at risk to develop diabetes are age; obesity, particularly central obesity; glucose intolerance; and decreased socioeconomic status, as measured by educational level; occupational classification; and income (Hendricks and Haas, 1991).

Persons from Hispanic ethnic groups are more likely to already have chronic complications of diabetes when diagnosed with diabetes, possibly due to late diagnoses. However, these complications may occur at a different rate than in other populations. Although severe proliferative retinopathy was reported to occur more frequently in Hispanics in San Antonio, this was not seen in Hispanics in Colorado or in Texas. End-stage renal disease was six times more common in Hispanics than non-Hispanic whites, even though Hispanics had less hypertension. The rate of Hispanics starting dialysis for end-stage renal disease increases fourfold from 1980 to 1986. There may be an increased incidence of gestational diabetes. Gestational diabetes has been diagnosed in 12% of low-income Hispanic women. Peripheral vascular disease may be more common in Hispanics, but there appears to be

a decreased incidence of nonfatal myocardial infarctions and decreased cardiovascular mortality (Hendricks and Haas, 1992).

3. Koreans

Asian Americans represent one of the smallest but faster-growing minority in the U. S. Koreans have been migrating to the United States at a rate faster than most other national groups with the exception of Mexicans and Filipinos (Kiefer et al., 1985).

The first Korean immigrants, approximately 7,000 people, arrived in Hawaii during the period of 1902-1905. However, after 1905, the Japanese government forced the Korean government to stop emigration to protect jobs for the Japanese working on Hawaiian plantations. Korean picture brides were the only immigrants until the National Origins Quota system in 1924 which almost completely stopped immigration of Koreans. It was not until the Immigration Act of 1965 when immigrants were allowed to enter the United States on the basis of their job skills and close family relations already living in the country. Then a later revision of the immigration act in 1976 put a limit on occupational immigrants (Lee and Gallaher-Tompson, 1993). By 1970 (United States Census, 1970) Koreans were finally recognized in the United States as a distinct ethnic group. The

1980 census estimated the Korean population in the United States to be 354,593. In 1990 the estimated number rose to 798,849. However, by 1990, the estimated number of Koreans was probably close to one million, taking into account recent immigrants, illegal residents, students and Korean children born in the United States (Min, 1995).

Although the proportion and the number of Korean Americans has increased in the United States, few systematic studies of their health status have been conducted, especially with respect to the prevalence and risk factors for diabetes.

In Asian migrants to Hawaii the diabetes prevalence in Japanese, Koreans, Chinese, and Filipinos is three to four times than in non-Asians. In the west coast in the United States, the prevalence of diabetes in Asian Americans is two to three times the national rate. In middle-aged and older Japanese-Americans in Los Angeles, the prevalence of diabetes is over 20%. One study found that Koreans in Japan have higher mortality rates for diabetes mellitus, heart disease, hypertensive disease and cerebrovascular disease than Japanese (Yan, 1990). This suggests that the prevalence of diabetes in Korean Americans may be higher than Japanese Americans. The literature also suggests that Korean NIDDM patients with higher prevalence of hypertension and previous obesity had a higher prevalence

of overt proteinuria than whites (Lee, 1995). One study (Lee et al., 1993) found that the prevalence of diabetes in Korean American elders was much higher than in white elders. This higher prevalence of diabetes for Korean American may reflect population differences in risk factors, such as obesity, physical activity, genetics, and other factors. One study (Sohn, 1997) found that Korean American women had the lowest physical activity compared to African, white, Hispanic, and Native American women. The study also found that Korean American women had higher levels of diastolic blood pressure than white and Hispanic American women. Studies of Korean immigrants have suggested that physical inactivity and high blood pressure may be important in the etiology of NIDDM.

4. Native Americans

Native American, ironically, comprise the smallest minority group in the United States, numbering 1.6 million or 0.7% of the entire population. It is projected that among some tribes, more than 50% of adults will develop diabetes. The rate of NIDDM is 40% higher in Native Americans than in white persons. The prevalence of diabetes is highest among the largest tribe, the Pima Indians. Indeed, Pimas have the highest rate of diabetes in the world. This rate is 10 to 15 times higher

than the overall US rate for diabetes, and is predominantly NIDDM (Hendricks and Haas, 1991).

Of major concern are the implications of diabetes among Native Americans, which are widespread, particularly those related to kidney disease, amputations, and blindness. According to Medicare and United States Renal Data System data, the age-adjusted incidence of diabetic end-stage renal disease is 6.3 times higher for Native Americans than for white persons in the United States (Carter et al., 1996).

IV. Management

Although it has been shown that diabetes prevalence is higher in minority populations than in white populations, the risk factors including diet, physical inactivity, obesity, and socioeconomic factors in minority population are not well defined. However, risk factors such as obesity, physical inactivity, and a family history of diabetes occurred to a greater extent in some minority populations than in whites. Further study is needed. However, some recommendations can now be made for prevention activities for NIDDM.

One of the most important efforts to be made is prevention of obesity because 75% to 80% of persons with NIDDM are overweight. In most minorities the prevalence of obesity is higher than in whites. Risk factors for

cardiovascular diseases such as high blood pressure, high lipid levels and smoking) should also be controlled. As minority women have a high incidence of diabetes, in part because of high rates of obesity (Costello et al., 1998; Walcott-McQuigg, 1997), management of the disease should be focused on women - especially because diabetes affects a women's reproductive health. For example, poor glycemic control during pregnancy is associated with higher maternal and infant morbidity. Lactation presents a challenge in terms of metabolic control. However, breast-feeding should be encouraged, especially in women with NIDDM who tend to be overweight because it is associated with reduction of maternal fat stores and the positive outcome for the child (Lunt, 1996). The control of risk factors for NIDDM can be carried out through diligent and effective health education. Health education can help to convince people that they will have diabetes for the rest of their life and that behavior change regarding diet, exercise, and smoking, and alcohol intake affect the quality and length of their of life.

In addition, differences in ethnic background and language barriers should be considered in planning health education programs designed to meet the special needs and customs of the people they serve. Use of culturally and socioeconomically appropriate diet and exercise programs would be most effective. Efforts to

educate minority people who do not understand English need to be expanded. Educational materials should be culturally sensitive, appropriate, and relevant.

The diabetes screening of high-risk populations is a necessary strategy to prevent and minimize the complications of diabetes. Individuals who exhibit one or more risk factors should be screened, and those over age 45 in general should undergo screening every 3 years. Researchers at the Centers for Disease Control and Prevention have developed a screening questionnaire that uses age, percentage of ideal weight, sedentary life style, first-degree relative with diabetes, and history of delivery of a baby weighing more than 4Kg as determinants of high risk. The questionnaire has sensitivity of 73% and is meant to be followed by blood screening (Carter et al., 1996).

V. Conclusion

NIDDM is one of the most prevalent chronic diseases in the United States. Especially, minority populations in the United States have a higher prevalence of non-insulin-dependent diabetes mellitus (NIDDM) and more persons die of the disease than white persons. Diabetes should be treated as a public health problem for minority populations. Epidemiologic evidence now supports the initiation of preventive measures for those

modifiable risk factors such as obesity, physical inactivity, and dietary factors. An understanding of the cultural aspects of NIDDM is imperative in order to provide adequate community health education programs because those programs involve diet and behavior changes, characteristics that are often culturally determined.

In summary, it is important to plan the community health education program in a culturally adapted manner that will be received with both comprehension and acceptability. In particular, the program for high-risk populations should be stressed to prevent diabetes. Preventive approaches to diabetes should be considered because they can be both therapeutic and cost effective.

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