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Association Between Exercise and Other Preventive Health Behaviors Among Diabetics

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Synopsis

Two hundred and seventy patients were studied to investigate the cross sectional association between exercise and other preventive health behaviors in a diabetic population. Patients included both insulin and noninsulin dependent diabetics and were recruited from the Family Practice and Pediatrics Clinics at Bowman Gray School of Medicine. During screening, patients underwent a physical examination as well as completing a survey to assess exercise and health behavior habits. Three exercise groups were compared: (a) patients who expended more than 600 kilocalories per week during exercise, (b) patients who expended 600 kilocalories or less, and (c) patients who did not exercise.

The mean body weights of both exercise groups were found to be less than the nonexercise group, and the heavy exercise group also had a lower mean body mass index. Heavy exercisers reported greater caloric intakes than both moderate and nonexercisers. There were no differences found concerning the composition of their diets among groups.

The heavy exercise group reported wearing their seatbelts a greater percentage of the time and visited the dentist more often compared with the sedentary group. There were no significant differences found among exercise groups concerning blood sugar monitoring, alcohol consumption, smoking, or in obtaining periodic health examinations. It was concluded that exercise was associated with several, but not a majority, of other healthful behaviors in a population of diabetics.

PATIENTS WITH DIABETES MELLITUS are often advised to engage in various forms of physical exercise as part of the management of their disease. Beneficial effects of exercise include improved lipid profiles, lowered blood pressure, and reduced perception of stress and anxiety (*1*). Previous studies have demonstrated that nondiabetic subjects who participate in exercise are also more likely than nonexercising subjects to display other healthful behaviors such as proper weight control, increased seatbelt use, and obtaining periodic health examinations (*2,3*).

Although the physiological benefits of exercise for diabetics are generally accepted, associations between exercise and other healthful behaviors in this population have not been reported. If these relationships can be documented, it would suggest that recommending exercise to patients with diabetes could be a primary target behavior on which to focus when trying to encourage positive lifestyle

Table 1. Characteristics of diabetic subjects

Category	Sedentary (N = 126)		Moderate exercise (N = 81)		Heavy exercise (N = 63)	
	Mean	SD[1]	Mean	SD[1]	Mean	SD[1]
Age (year)	53.6	15	52.3	14	51.1	18
Percentage males	52	...	35	...	52	...
Percentage NIDDM[2]	84	...	80	...	75	...
Diabetes duration (year)	9.4	8	9.2	8	9.6	9
Glucose (milligram per deciliter)	200.0	92	198.0	85	199.0	78
Percentage glycosylated hemoglobin	7.4	2.0	7.1	2.3	7.4	2.0

[1] SD = standard deviation.
[2] NIDDM = noninsulin dependent diabetes.

changes. This study was designed to explore this issue by collecting data on the relationships among exercise habits and selected preventive health behaviors in a population of diabetics.

Materials and Methods

Two hundred and seventy patients with type I (insulin dependent diabetes) or type II (noninsulin dependent diabetes) were recruited from the Family Practice Center and the Pediatrics Clinic at Bowman Gray School of Medicine. Patients were randomly selected and were representative of our total diabetic population. Those with severe complications and deemed unable to exercise were excluded from the study. During screening, patients underwent a physical examination and were asked to complete a survey instrument (Health Risk Appraisal) to assess health behaviors (*4*).

Data were collected on items related to smoking, alcohol consumption, seatbelt use, and periodic health examinations. Based on height and weight data collected during screening, a body mass index (kilogram per meter^2) was derived. Dietary information was collected using a 3-day food record and computer analyzed by Nutritionist III (*A*). In addition, the type, frequency, and duration of exercise were recorded from each patient's self-report of his or her usual physical activity.

We used the definitions of physical activity and exercise developed by Casperson (*5*) and restricted our data collection to voluntarily undertaken activity. An intensity code (*6*) for each activity was used to calculate the approximate number of kilocalories expended per week during exercise. Patients were then divided into three groups based upon their weekly caloric energy expenditure for voluntary exercise. The heavy exercise group was defined as those subjects who expended greater than 600 kilocalories per week. The moderate exercise group expended up to 600 kilocalories per week. A third group of subjects reported no exercise. The terms "heavy" and "moderate" are used to differentiate activity levels and do not necessarily indicate an absolute amount of exercise. Approximately 600 kilocalories are utilized jogging or walking 2 miles, three times per week. This level of exercise was selected because it is the minimum level for improving cardiovascular fitness.

Patients were also divided into age groups for analysis: (*a*) less than 40 years of age, (*b*) 40 to 59 years, and (*c*) 60 years or more. Duration of diabetes was stratified as (*a*) 10 years or less and (*b*) longer than 10 years.

Means and standard deviations were determined for each variable. Continuous data were analyzed using three-way analysis of variance to test for differences among groups. Two separate ANOVAs were performed: (*a*) exercise group, age, and sex as independent variables and (*b*) exercise group, diabetic type, and duration of diabetes as independent variables. A single analysis was not performed because of highly significant correlations among independent variables. Where differences were found, the Tukey simple effects test was applied to determine their location. Dichotomous data were analyzed using logistic regression and chi-square.

Results

The characteristics of subjects are presented in table 1. The 270 patients included 218 (81 percent) type II and 52 (19 percent) type I diabetics. Their ages ranged from 13 to 86, with a mean of 52.6 years (standard deviation [SD] = 15.4). Of the subjects, 54 percent reported exercising a minimum of once per week with walking, cycling, and jogging being the most popular activities. There were no significant differences found among exercise groups for age, sex, type and duration of diabetes, or metabolic control measured as fasting glucose and glycosylated hemoglobin.

A summary of the associations found between exercise and various preventive health behaviors is found in table 2. A significant main effect for the exercise group was found for a number of dependent variables. Among the three groups, the mean body weights of both exercise groups were found to be less than the mean body weight of the sedentary group ($P < 0.05$). In addition, the heavy exercise group was found to have a smaller mean body mass index ($P < 0.05$) than the sedentary group.

Table 2. Health behaviors of diabetic subjects by exercise group

Behavior	Sedentary		Moderate exercise		Heavy exercise	
	Mean	SD	Mean	SD	Mean	SD
Weight (lbs)	[1,2]195	51	[2]179.6	37	176.5	42
Body mass index	[2]30.9	7	30.0	6	27.7	6
Caloric intake, kilocalories per day	[2]1486	526	[2]1405	509	1657	507
Alcohol consumption, drinks per week	1.9	6	0.9	3	2.4	7
Percentage seatbelt use	[2]65	42	77	36	82	33
Dentist, visits per year	[2]1.0	1.1	[2]1.1	1.0	1.6	0.9
Check blood sugar, checks per week	2.2	1.3	2.7	1.5	2.7	1.6
Percentage who smoked	23	...	19	...	18	...
Percentage who had blood pressure check within 2 years.	86	...	92	...	84	...
Percentage who had cholesterol check within 2 years	66	...	67	...	60	...
Percentage who had Pap smear within 2 years[3]	82	...	93	...	85	...
Percentage who had a mammogram[4] within 2 years	70	...	80	...	63	...

[1] $P<0.05$ versus moderate exercise group.
[2] $P<0.05$ versus heavy exercise group.
[3] Women >18 years.
[4] Women >35 years.

The heavy exercisers also reported greater caloric intakes than both moderate and nonexercisers ($P<0.05$). There were no significant differences among groups in regard to the percentage of total kilocalories supplied by fats, proteins, and carbohydrates.

The heavy exercise group reported wearing their seatbelts a greater percentage of the time, and visiting the dentist more often, compared with the nonexercisers. There were no differences found among groups regarding blood sugar monitoring, alcohol consumption, smoking status, or having had blood pressure and cholesterol checks within the past 2 years. Female diabetics who exercised were no more likely to have obtained a Papanicolaou's (Pap) smear or mammogram within the past 2 years compared with the sedentary group.

A significant two-way interaction for exercise group and diabetic type was found for the dependent variable blood glucose monitoring (table 3). Among insulin dependent diabetics (IDDM), there was an increase in weekly blood sugar monitoring with increasing levels of exercise. This pattern was not evident for diabetics who were noninsulin dependent (NIDDM). All other two-way interactions (exercise group and age, exercise group and sex, exercise group and diabetic type, exercise group and diabetes duration) and three-way interactions (exercise group, age, sex) (exercise group, diabetic type, diabetes duration) for dependent variables were not significant.

Table 3. Interaction of exercise group and diabetic type, shown by two-way ANOVA of the variable blood glucose monitoring[1]

Exercise group	Diabetic type: IDDM		Diabetic type: NIDDM		Total	
	Mean	Number	Mean	Number.	Mean	Number
Sedentary	2.75	20	2.08	106	2.18	126
Moderate	3.69	16	2.40	65	2.65	81
Heavy	4.25	16	2.13	47	2.67	63
Total	3.50	52	2.19	218	2.44	270

[1] Weekly blood glucose tests.
NOTE: IDDM = insulin dependent diabetic; NIDDM = noninsulin dependent diabetic.

Discussion

Our results using diabetic subjects generally agree with published reports on nondiabetic populations that found exercise to be associated with several positive health behaviors. It is clear from previous research that sedentary persons weigh more than active ones and that exercise is associated with a lower body mass index (*2,6,7*). Our diabetic subjects who exercised were found to weigh less than those who were inactive, and those participants who expended more than 600 kilocalories per week during exercise were found to have a lower body mass index than nonexercisers. Body mass index is a more revealing expression of weight control than body weight because the effect of height is minimized. Obesity is extremely prevalent among diabetic patients, especially those with NIDDM, and these results lend strength to the recommendation that this group would benefit from increasing their activity levels.

Persons who exercise regularly have been found to have a higher caloric intake than those who do not exercise (*8–10*). This is not unexpected as greater activity levels would require more calories to maintain an energy balance. In our study, heavy exercisers consumed approximately 200 more kilocalories per day than nonexercisers, suggesting that

'In this study, preventive health behaviors such as smoking status, alcohol consumption, and obtaining certain periodic health examinations were not found to be related to exercise habits among diabetic persons.'

many obese people may be under-exercised rather than overfed. However, these results should be interpreted with caution due to the underreporting of kilocalorie estimates that can occur with dietary recall methods.

Surprisingly, differences in composition of the diet between active and inactive groups have been found to be small or nonexistent. Several studies found that exercisers consumed less sugar and red meat compared with nonexercisers (*2-3*). However, these differences disappeared when socioeconomic status, sex, and age were controlled (*2*). Fats, proteins, and carbohydrates expressed as a percent of total calories have not been found to differ between exercisers and nonexercisers, which is in agreement with our results.

Data from other studies indicate weak negative associations (*2,5,11,12*) and no associations (*13-14*) between exercise and smoking status. These contradictory results may be due to the difficulty in distinguishing between active and nonactive populations (*3*). There was no association found between exercise and smoking in our study. The overall rate of smoking in our study population was low (20 percent), which may account for the lack of association. Published data comparing exercise and alcohol consumption are also inconclusive as negative, positive, and no associations have been found (*2,3,6*). We found that heavy exercisers reported consuming more alcoholic drinks per week than both the moderate and nonexercise groups. However, these differences were not significant. Again, the lack of association could be because of the low alcohol consumption reported by our subjects.

Other favorable health behaviors were associated with exercise. The heavy exercise group reported wearing their seatbelts a greater percentage of the time and visiting the dentist more often than the sedentary group. This observation agrees with previous research using nondiabetic subjects (*2,12,13,15*). Several studies have also indicated that exercisers are more likely to obtain regular medical checkups, such as a physical examination or blood pressure check within the last 2 years (*2*). Active females have been found to be more likely to have had a clinical breast examination within 2 years but not more likely to have obtained a Pap smear (*2*).

A health behavior unique to diabetics, blood glucose monitoring, differed between subjects who were insulin and noninsulin dependent. Among IDDM patients, there was an increase in blood glucose monitoring with increasing levels of exercise, a pattern not seen with NIDDM patients. IDDM patients are more likely to check their sugar levels due to the severity of their disease which may account for the differences found.

There are several reasons why exercise may be associated with these behaviors. Using seatbelts, monitoring blood sugar, and obtaining medical and dental checkups are expressions of personal interest in safety and health. Involvement in exercise may lead people to increase their knowledge of other factors that influence health. An enhanced self-image may also play a role, which could increase motivation to comply with preventive and safety measures (*3*). Socioeconomic differences may account for part of the several associations found between active and inactive persons. The use of medical and dental services, and increased safety awareness, may reflect economic status rather than health-conscious behavior (*3*). We did not measure income in our study, but exercise groups were found to have similar levels of education.

In this study, preventive health behaviors such as smoking status, alcohol consumption, and obtaining certain periodic health examinations were not found to be related to exercise habits among diabetic persons. Several factors may be responsible for this lack of association. One reason is that exercise may actually be unrelated to these behaviors. Misclassification could be a problem because of the difficulties of measuring both behaviors and exercise habits, which could weaken possible associations. Another reason that we did not find certain favorable health behaviors to be related to exercise in our subjects may be because of their diabetic status. Those with diabetes, especially type II diabetes, are poor compliers with health maintenance (*16*). It may be that exercisers within this population are not concerned with, or are poorly motivated to acquire, additional healthful behaviors.

Even though relatively few associations with healthful behaviors were found, health professionals should continue to prescribe exercise to improve the health of both normal and diabetic persons. Exercise can ameliorate coronary risk factors, improve sense of well-being and self-esteem, and may contribute to an increased awareness of personal health and safety (*1,3*). Until the relationship between exercise and other preventive health behaviors is better understood, perhaps health promotion programs, which include exercise, should target other known health risks as well.

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Equipment

A. N Squared Computing, 3040 Commercial SE, Salem, OR 93702.

WIC Program Participation—a Marketing Approach

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Synopsis

Recent evaluation studies have described the benefits accruing to low-income women and children who participate in the Special Supplemental Food Program for Women, Infants, and Children (WIC). However, participation is not uniform among all groups of eligible persons. This study examines the geographic variation in WIC participation rates of eligible pregnant women in Rhode Island to determine whether the program is effective in reaching the neediest segments of the population.

Eight groups of small geographic areas in Rhode Island (census tracts) were formed on the basis of need for maternal and child health services, as determined from a statistical method employing factor and cluster analysis of existing health and