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Obesity and exercise habits of asthmatic patients

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Abstract

Background—National guidelines recommend 20 to 30 minutes of exercise 3 to 5 days a week. However, achieving these goals may be challenging for asthmatic patients whose symptoms are exacerbated by exercise.

Objective—To describe relationships among exercise habits, weight, and asthma severity and control in adults with asthma.

Methods—Self-reported exercise habits were obtained from 258 stable patients by using the Paffenbarger Physical Activity and Exercise Index. Disease status was measured by using the Asthma Control Questionnaire and the Severity of Asthma Scale. Exercise habits were evaluated in multivariate analyses with age, sex, education, body mass index, and asthma control and severity as independent variables.

Results—The mean patient age was 42 years; 75% were women, 62% were college graduates, and 40% were obese. Only 44% of patients did any exercise. In bivariate analysis, patients with well-controlled asthma were more likely to exercise; however, in multivariate analysis, asthma control and severity were not associated but male sex ($P = .01$), having more education ($P = .04$), and not being obese ($P \leq .001$) were associated. Asthma control and severity also were not associated with type, duration, or frequency of exercise, but not being obese was associated in multivariate analyses. Only 22% of all patients (49% of those who exercised) met national guidelines for weekly exercise. Not being obese was the only variable associated with meeting guidelines in multivariate analysis ($P = .02$).

Conclusions—Compared with the general population, a lower proportion of asthmatic patients did any routine exercise and met national exercise guidelines. Physicians need to manage asthma and obesity to help asthmatic patients meet exercise goals.

INTRODUCTION

Since the early 1990s, national guidelines have recommended that adults get 30 minutes or more of moderate-intensity physical activity on most, and preferably all, days of the week.¹ An alternative is 20 minutes or more of vigorous-intensity exercise at least 3 days a week.¹ In 2005, approximately 52% of American adults did not meet these guidelines.² The general population acknowledges various obstacles to achieving these goals, such as being overweight, inclement weather, and lack of time, social support, motivation, and access to adequate facilities.^{3–6} Demographic factors, including older age, being female, and less education, also

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are associated with less exercise.^{2,4} In addition, it is likely that other obstacles exist because of chronic diseases. For example, in patients with arthritis, pain, fatigue, and restricted mobility are barriers.⁷ The few studies that considered exercise in asthmatic patients found that exacerbation of respiratory symptoms is a barrier.^{6,8}

Asthma is a chronic inflammatory respiratory disease that affects 15.7 million American adults (7.2%)⁹ and that can be precipitated by allergens, irritants, and physical activity.¹⁰ *Exercise-induced bronchospasm* is a term typically assigned to symptoms precipitated by physical activity and is estimated to affect, to varying degrees, 80% to 90% of those with asthma.^{10–12} Thus, many asthmatic patients avoid physical activity, especially exercise, because they are afraid that it will exacerbate their asthma.^{6,8,13} For those with well-controlled asthma, exercise is recommended at the same level as for the general population¹⁰ because in addition to cardiovascular benefits, prudent exercise aids long-term respiratory function.^{11,12,14–16} On the other hand, the absence of exercise and the adoption of a sedentary lifestyle can lead to respiratory deconditioning and to lower thresholds for exercise-induced symptoms.^{11,16} Such deconditioning can further discourage patients from exercising, thus perpetuating a vicious cycle of inactivity and worsening asthma symptoms.^{11,15} Compounding the problem, lack of physical activity can contribute to obesity, which is a well-known correlate of poor asthma outcomes.^{17,18}

In American adults, the prevalence of being overweight (body mass index [BMI] [calculated as weight in kilograms divided by height in meters squared] ≥ 25 to <30) or obese (BMI ≥ 30) has increased during the past decade, with 2004 prevalence estimates of approximately 34% and 32%, respectively.¹⁹ In asthmatic patients, these rates are higher (59% overweight and 33% obese).¹⁸ Although there is an association between asthma and obesity, the exact cause-and-effect relationship is complex and not fully understood.^{20,21} Several hypotheses propose that obesity increases gastroesophageal reflux, increases inflammation, and decreases pulmonary functional residual capacity, all of which contribute to worse asthma symptoms.^{20–22}

In addition to these mechanisms, obesity itself is a well-known obstacle to physical activity and exercise.^{3,5} Overweight patients consistently report less physical activity and more barriers to exercise than their normal-weight peers.²³ Reasons for these lower rates may include difficulty performing exercises and fear of musculoskeletal injuries, which occur more frequently and can be more serious in obese individuals.^{5,24} These factors also make exercise less pleasurable and, thus, further deter patients from participating.^{3,5} On the other hand, losing or maintaining weight can motivate patients to exercise. For example, one study²⁵ found that patients trying to lose weight were 3 times more likely to be regularly active than were those not trying to lose weight. However, if patients have unrealistically high expectations of how much and how quickly they will lose weight and these expectations are not met, they may become discouraged to continue further activity.^{5,26} Thus, patients who are overweight may have positive and negative attitudes toward exercise.

To help asthmatic patients derive cardiovascular and long-term respiratory benefits from exercise, it is important to know about their exercise habits, such as types and frequencies of exercise,⁴ and to understand what motivates and limits their exercise participation. We sought to describe relationships among exercise habits, weight, asthma severity, and asthma control in adults with mild to moderate asthma.

METHODS

Patients were followed up at the Cornell Internal Medicine Associates primary care practice in New York City and were recruited as part of a longitudinal trial to foster healthy physical

activity in patients with cardiopulmonary diseases. Aspects of the enrollment process have been previously described.^{27,28} Patients were included if they had mild to moderate asthma that was currently stable and if they were willing to become more physically active. Patients were excluded if they had limited mobility or other major comorbidity. This study was approved by the Committee on Human Rights in Research at the Weill Cornell Medical College/New York Presbyterian Hospital, and written informed consent was obtained from all the patients.

At enrollment (during routine office visits), patients were asked open-ended questions regarding what they thought were the benefits of physical activity and exercise. Responses were recorded verbatim in field notes. Categories then were determined from direct quotes using qualitative techniques and were corroborated by the investigators. Self-reported physical activity and exercise were evaluated using the Paffenbarger Physical Activity and Exercise Index.²⁹ Patients were asked how many blocks they walked and flights of stairs they climbed each day. In addition, they were asked whether they did any exercise, including sports, on a consistent basis and, if so, how many times per week and for how long. From this, patients were grouped according to whether they did any or no exercise. Exercise type was defined according to a standard compendium of physical activities that lists exercises and sports according to metabolic intensity, ie, the ratio of work metabolic rate to a standard resting metabolic rate (MET).³⁰ Consistent with standard definitions, we classified moderate-intensity exercise as requiring 3.0 to 6.0 METs and vigorous-intensity exercise as requiring 6.0 METs or more.¹ We previously reported total kilocalorie energy expenditure from blocks walked, stairs climbed, and exercise.²⁸ In this analysis, we focus on the exercise domain and provide details regarding exercise habits.

Asthma severity was measured using the Severity of Asthma Scale, a 16-item scale measuring long-term asthma status based on previous oral corticosteroid use, maintenance medications, and asthma-related hospitalizations and intubations.³¹ Responses are weighted and summed to generate an overall score ranging from 0 to 28, with 5-point increases corresponding to incrementally more severe disease. Asthma control was measured using the Asthma Control Questionnaire, a 7-item scale measuring short-term asthma status reflected by recent symptoms, rescue medications, and forced expiratory volume, which we measured using a portable spirometer.³² Scores for each item range from 0 to 6, and a higher overall mean score indicates worse control. Based on comparisons with clinical indicators, a mean score of 0.75 or less corresponds to well-controlled asthma and of 1.5 or greater to asthma that is not well controlled.³³ Scores between 0.75 and 1.5 represent partial control. In addition to these measures, self-reported weight and height were obtained and BMI was calculated. The BMI categories were defined according to standard guidelines as normal weight (<25), overweight (≥25 to <30), and obese (≥30).¹⁹

Exercise habits were defined as doing any exercise, doing any vigorous-intensity exercise, doing any moderate-intensity exercise, exercising 3 or more days per week, and meeting national guidelines for weekly exercise. Relationships between exercise habits and demographic and asthma characteristics were evaluated in bivariate analyses using χ^2 tests, *t* tests, and analysis of variance. Multivariate logistic regression models were set up with exercise habits as dependent variables and demographic and asthma characteristics as independent variables. A linear regression model was set up with minutes spent exercising as the dependent variable. Independent variables were grouped according to quartiles for age (≤30, >30 to ≤42, >42 to ≤50, and >50 years) and according to asthma severity, asthma control, and BMI categories as described previously herein. In subanalyses with only patients who did any exercise, exercise habits were evaluated according to whether patients met guidelines. Analyses were performed in SAS and R.^{34,35}

RESULTS

Of 450 patients eligible for this longitudinal trial, 258 were enrolled; 192 were not enrolled because of scheduling issues, patients' lack of time, or refusal.²⁶ The mean (SD) patient age was 42 (12) years; 75% were women; 62% were college graduates; 54% were white, 22% were African American, 9% were Asian, and 15% were multiracial; and 31% of the total were Hispanic. Patients had asthma for a mean of 21 years, and 52% were taking daily asthma maintenance medications. According to the Asthma Control Questionnaire data, 37% had well-controlled asthma (score ≤ 0.75) and 39% did not have well-controlled asthma (score ≥ 1.5). Severity of Asthma Scale scores ranged from 0 to 19, indicating that most patients had mild to moderate disease. The mean BMI was 29; 31% of patients were normal weight, 29% were overweight, and 40% were obese.

Overall, 233 of the 258 patients responded to the open-ended questions and cited a total of 394 benefits of physical activity and exercise, with a mean of 2 benefits per patient. Benefits were grouped into 7 categories encompassing physical and mental health (Table 1). The most common benefit was to improve overall health, cited by 37%, followed by to maintain or lose weight, cited by 26%.

From the exercise domain of the Paffenbarger Index, we found that 114 patients (44%) reported doing any exercise. Compared with those who did not exercise, those who did were more likely to consider exercise to be beneficial for respiratory function (18% vs 31%, $P = .02$) and for mental health/stress reduction (16% vs 30, $P = .008$) (Table 1). Similar proportions, 28% and 24%, respectively, considered exercise beneficial for weight maintenance and reduction ($P = .39$).

Exercise habits were evaluated according to demographic and asthma characteristics. In bivariate analysis, patients who did any exercise were more likely to be younger, to be male, to have more education, to have a lower BMI, and to have better asthma control (Table 2). In multivariate analysis, male sex ($P = .01$), being a college graduate ($P = .04$), and not being obese ($P < .001$) remained significant (Table 3). Asthma severity and control were not significant in the model.

Patients did a total of 31 different exercises: 17 were vigorous and 14 were moderate in intensity. Overall, 35% of patients reported doing vigorous-intensity exercises, the most common being using a treadmill, running or jogging, aerobics, using an elliptical machine, and Pilates (Table 4). Overall, 33% of patients reported doing moderate-intensity exercises, the most common being weight lifting, stretching, yoga, and toning (Table 4). In bivariate analysis, younger age, male sex, more education, lower BMI, and well-controlled asthma were associated with doing vigorous-intensity exercises (Table 2), and in multivariate analysis, younger age ($P = .01$), male sex ($P = .007$), being a college graduate ($P = .04$), and not being obese ($P = .002$) remained associated (Table 3). For moderate-intensity exercise, male sex, more education, and not being obese were associated in bivariate analysis, and only not being obese ($P = .01$) remained associated in multivariate analysis. Similar associations were found for exercising 3 or more days per week, with younger age ($P = .03$) and not being obese ($P = .008$) remaining significant in multivariate analysis. Male sex ($P = .01$) and not being obese ($P = .01$) also remained significant in multivariate analyses for exercising more minutes per week. Thus, obesity was the strongest and most consistent variable associated with exercise habits, whereas asthma control and severity did not remain associated in multivariate models.

The number of different exercises also was compared according to asthma and BMI characteristics. Except for more patients with better-controlled asthma participating in running or jogging, there were no differences in the number and types of exercises performed according

to asthma control (Table 4). Nonobese patients, however, were more likely than obese patients to participate in both moderate- and vigorous-intensity exercises and in more than 1 exercise.

Finally, only 22% of the total sample met overall national guidelines for total weekly exercise. Twenty percent met guidelines for vigorous-intensity exercise (ie, ≥ 20 minutes 3 days per week), and an additional 2% met guidelines for moderate-intensity exercise (ie, ≥ 30 minutes 5 days per week). In multivariate analysis, only not being obese ($P = .02$) was associated with meeting overall weekly exercise guidelines. Of the 114 patients who did any exercise, 49% met guidelines, 16% did not meet guidelines but participated in a combination of vigorous- and moderate-intensity exercises 2 or more days per week, and 35% did not approach guidelines. Of the 114 patients, those who met guidelines were more likely to do vigorous-intensity exercise ($P < .001$), to do 2 or more types of exercise ($P < .001$), to do vigorous- and moderate-intensity exercises ($P = .003$), and to exercise 3 or more days per week ($P < .001$). In multivariate analysis, all these variables remained associated ($P \leq .05$).

DISCUSSION

Of patients with mild to moderate asthma in this study, only 44% did any exercise and only 22% met national guidelines for recommended frequency and duration of weekly exercise. This is in contrast to the general population, in which 60% do any exercise³⁴ and approximately 48% meet national guidelines.² Similar to other studies in the general population, we found that younger age, male sex, and more education were associated with exercise.^{4,36} Short-term asthma control and long-term asthma severity, however, were not associated with exercise habits after adjusting for demographic and BMI covariates. In contrast, being obese was most consistently and strongly associated with exercise habits after adjusting for demographic variables and asthma status. This is the first study, to our knowledge, to demonstrate the relationship between BMI and self-reported exercise habits in asthmatic patients, adjusting for short-term asthma control and long-term asthma severity.

Exercise-induced bronchospasm (EIB) can be a deterrent to exercise in asthmatic patients.^{6, 12} Although an element of EIB can occur in almost all patients and depends on the intensity of the activity, an indicator of adequately managed asthma is the absence of EIB during prudent exercise.^{10,12} In the present study, we enrolled patients with stable symptoms, but 39% had asthma that was not well-controlled according the Asthma Control Questionnaire. In bivariate analysis, these patients were less likely to exercise; however, this relationship did not remain significant after adjusting for covariates. These results are surprising because they indicate that current asthma status was not as important as other variables in determining whether patients did or did not exercise. Regarding long-term asthma severity, there was no systematic relationship between severity and exercise in bivariate analysis. This may be because definitions of asthma severity are based on previous asthma exacerbations and do not necessarily reflect current limitations. Nevertheless, this finding also was surprising because exercise habits are usually formed over long periods and, therefore, should be subject to long-standing and recurrent respiratory limitations.

Of the variables we studied, higher BMI was most consistently and strongly associated with less exercise. These findings are consistent with studies in the general population. For example, in one study,²³ obese patients spent less time in light-, moderate-, and vigorous-intensity activities and did fewer activities than normal-weight controls, as measured using accelerometers worn for 1 week. Other studies found that obese patients considered their weight to be a barrier to starting an exercise program³ and were less likely to continue a program once initiated.⁴

The relationship between BMI and exercise is particularly important in asthma because of the high prevalence of obesity in this population. In this sample, 29% were overweight and 40% were obese compared with 34% and 32%, respectively, in the general population.¹⁹ In addition to being an independent deterrent to exercise, obesity leads to worse asthma, which itself can be associated with less exercise (as seen in the bivariate analysis). Less exercise, in turn, predisposes patients to obesity and long-term respiratory deconditioning, thereby sustaining the vicious cycle of inactivity, obesity, and worse asthma.^{11,15} Therefore, to help asthmatic patients engage in healthy exercise, physicians and patients must work together to manage obesity, select prudent exercise regimens,⁷ and use medications correctly to prevent symptoms induced by exercise. Addressing patient-identified benefits of exercise, as highlighted in this qualitative analysis, could help motivate and facilitate exercise.

Meeting weekly exercise guidelines depends not only on engaging in exercise but also on exercise habits, such as duration and frequency of exercise.⁴ In the present study, patients who met guidelines were more likely to engage in 2 or more exercises and to exercise more days per week. However, the type of exercise and the number of days per week exercising were not individually sufficient to meet guidelines. Therefore, encouraging patients to engage in multiple exercises more often and for shorter periods of time may be better tolerated and more effective for meeting guidelines.

This study has several limitations. First, we compared national population norms for several indices with values in the present sample of asthmatic patients. Second, this study was performed in an urban setting and may not be generalizable to nonurban settings, where access to different types of exercise varies. Third, some researchers found that obese patients are more likely than normal-weight patients to overestimate their exercise³⁷; however, this bias would strengthen the conclusions. Also, although we relied on self-reported weight, patients were weighed during the clinic visit that immediately preceded enrollment and, thus, were aware of their current weight. Fourth, we did not directly ask patients why they did or did not exercise, and, therefore, we cannot comment on their perceptions of how asthma and weight affected exercise. Finally, it would have been interesting to know how patients who met guidelines managed asthma while exercising.

In this study, we found that the proportion of asthmatic patients who met national exercise guidelines was lower than that of the general population. In addition, obesity was independently and more closely associated with exercise habits than were asthma control and severity. Given the high prevalence of obesity among asthmatic patients, physicians must address asthma and weight to help these patients achieve recommended guidelines for healthy exercise.

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Table 1

Responses to Open-Ended Questions About the Benefits of Physical Activity and Exercise by Category and Exercise Status

Category	Patients, % ^a	
	Does any exercise (n = 114)	Does not do any exercise (n = 144)
Improves overall health	36	38
Helps maintain or lose weight	24	28
Improves respiratory function	31	18
Improves mental status/reduces stress	30	16
Improves other medical conditions	21	18
Improves fitness/appearance	18	12
Improves longevity	3	1

^a Note that not all of the patients volunteered an answer that could be grouped into one of the categories.

Table 2
Exercise Habits of 258 Patients According to Demographic and Asthma Characteristics^a

Characteristic	Patients, %	Does any exercise, %	Does any vigorous exercise, %	Does any moderate exercise, %	Minutes per week exercises, mean	Days per week exercises, %		Meets guidelines, %
						1-2	≥3	
Overall	100	44	35	33	46	17	27	22
Age, y								
≤30	19	60 ^b	50 ^c	44	68	19	41 ^b	33
>30 to ≤42	33	43	35	29	42	21	22	17
>42 to ≤50	23	39	32	32	45	9	31	25
>50	25	39	25	29	36	17	22	15
Sex								
Female	75	38 ^d	29 ^d	29 ^b	38 ^c	14	24 ^e	20
Male	25	62	52	45	69	25	37	26
Education								
<High school	7	16% ^f	16% ^d	16% ^d	22 ^b	0	16 ^d	16
High school	31	33	27	22	32	11	22	17
College	32	45	32	34	51	15	31	23
Postgraduate	30	62	50	46	61	29	33	26
Body mass index ^g								
<25	31	67 ^f	53 ^f	48 ^f	70 ^d	24	43 ^f	33 ^e
≥25 to <30	29	46	37	35	46	20	26	20
≥30	40	25	19	19	27	9	17	14
Asthma Control Questionnaire score ^h								
≤0.75	37	50 ^b	42 ^b	34	52	15	35 ^b	26
>0.75 to <1.5	24	51	38	39	47	26	25	16
≥1.5	39	35	26	27	40	13	22	21
Severity of Asthma Scale score ⁱ								
<5	45	50	41	36	49	16	34	24
≥5 to <10	38	39	28	31	43	16	23	20
≥10 to <14	11	32	29	18	33	11	21	21
≥14	6	53	41	41	62	35	18	18

^aFrequencies were compared using χ^2 tests and means were compared using *t* tests and analysis of variance.

^b*P* ≤ .05.

^c*P* ≤ .01.

^d*P* ≤ .001.

^e*P* ≤ .005.

^f*P* < .0001.

^gCalculated as weight in kilograms divided by height in meters squared.

^hAsthma Control Questionnaire scores range from 0 to 6; 0.75 or less is well controlled and 1.5 or greater is not well controlled.

ⁱSeverity of Asthma Scale scores range from 0 to 28, with 5-point increments corresponding to greater severity.

Table 3
Multivariate Analyses for Exercise Habits^a

Variable	Odds ratio (95% CI)			
	Does any exercise	Does any vigorous exercise	Exercises ≥3 days per week	Meets guidelines
Age, y				
≤30	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
>30 to ≤42	0.44 (0.19–1.0)	0.45 (0.19–1.1)	0.37 (0.16–0.89) ^b	0.49 (0.20–1.2)
>42 to ≤50	0.48 (0.21–1.1)	0.53 (0.22–1.3)	0.79 (0.33–1.9)	1.0 (0.41–2.5)
>50	0.50 (0.22–1.1)	0.35 (0.15–0.82) ^b	0.51 (0.22–1.2)	0.55 (0.23–1.4)
Sex				
Female	0.44 (0.23–0.85) ^b	0.41 (0.21–0.78) ^c	0.58 (0.29–1.1)	0.74 (0.36–1.5)
Male	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Education				
<High school	0.23 (0.05–0.96) ^b	0.48 (0.11–2.0)	0.88 (0.21–3.7)	0.95 (0.22–4.1)
High school	0.49 (0.23–1.0)	0.64 (0.30–1.4)	0.96 (0.42–2.2)	0.84 (0.36–2.0)
College	0.52 (0.26–1.1)	0.47 (0.23–0.97) ^b	1.0 (0.49–2.1)	0.90 (0.41–2.0)
Postgraduate	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Body mass index ^d				
<25	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
≥25 to <30	0.55 (0.26–1.2)	0.65 (0.31–1.4)	0.55 (0.26–1.2)	0.57 (0.25–1.3)
≥30	0.28 (0.13–0.59) ^e	0.29 (0.13–0.64) ^e	0.34 (0.15–0.76) ^c	0.35 (0.15–0.82) ^b
Asthma Control Questionnaire score				
≤0.75	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
>0.75 to <1.5	1.4 (0.66–2.9)	1.1 (0.53–2.3)	0.64 (0.29–1.4)	0.59 (0.25–1.4)
≥1.5	0.77 (0.37–1.6)	0.67 (0.31–1.5)	0.76 (0.35–1.7)	1.0 (0.44–2.3)
Severity of Asthma Scale score				
<5	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
≥5 to <10	0.71 (0.37–1.4)	0.61 (0.30–1.2)	0.60 (0.29–1.2)	0.80 (0.37–1.7)
≥10 to <14	1.1 (0.37–3.0)	1.5 (0.49–4.3)	0.85 (0.27–2.6)	1.3 (0.39–4.0)
≥14	1.9 (0.56–6.2)	1.8 (0.53–6.0)	0.44 (0.10–1.9)	0.64 (0.15–2.8)

Abbreviation: CI, confidence interval.

^a Analyses were adjusted for age, sex, education, body mass index, asthma control, and asthma severity.

^b $P \leq .05$.

^c $P \leq .01$.

^d Calculated as weight in kilograms divided by height in meters squared.

^e $P \leq .005$.

Table 4
Most Common Types of Exercises According to Asthma Control and Body Mass Index

	Patients, %				Body mass index ^b
	Total	Asthma control ^a		Obese	
		Better controlled	Not well controlled		
Vigorous-intensity exercises					
Treadmill	9	9	10	10	9
Running/jogging	9	12 ^c	3	12 ^c	3
Aerobics	8	10	6	11 ^d	4
Elliptical machine	7	8	5	10 ^d	2
Pilates	3	3	3	5 ^d	0
Others	8	10	5	10	5
Moderate-intensity exercises					
Weight lifting	14	16	11	19 ^c	7
Stretching	5	6	5	6	5
Yoga	5	6	4	8 ^e	0
Toning	4	4	3	3	4
Others	19	20	18	22	15
No. of different exercises					
0	56	50	65	43 ^f	75
1	15	18	11	19	10
2	15	17	12	21	7
≥3	14	15	12	17	8

^a Better-controlled asthma was defined as an Asthma Control Questionnaire score less than 1.5; not well-controlled asthma, Asthma Control Questionnaire score of 1.5 or greater.

^b Calculated as weight in kilograms divided by height in meters squared. Not obese was defined as a body mass index less than 30; obese, body mass index of 30 or greater.

^c $P \leq .01$.

^d $P \leq .05$.

^e $P \leq .005$.

^f $P < .0001$.