Body Composition in Ambulatory Women With Multiple Sclerosis

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Objective: To compare whole-body fat mass and fat-free mass (FFM) in ambulatory patients with multiple sclerosis (MS) and control subjects without MS.

Design: Nonrandomized controlled trial or cross-sectional study.

Setting: An exercise physiology laboratory at a medical school.

Participants: Seventeen ambulatory patients with MS and 12 control subjects (all subjects were women). The median Expanded Disability Status Scale (EDSS) score was 4.0 for the individuals with MS.

Interventions: Not applicable.

Main Outcome Measures: Whole-body percentage of fat-free mass (%FFM), percentage of body fat (%BF), FFM, and fat mass.

Results: A significant difference in age was observed between the groups; thus, age was used as a covariate in the body composition analyses. No significant differences were observed between the groups in %BF: 32.5±13.9 and 27.8±5.6 (P=.54) for MS and controls, respectively, or %FFM, 67.1±14.9 and 71.3±12.4 (P=.42) for MS and controls, respectively. For individuals with MS, no significant relation was observed between EDSS score and %BF (P=.24) or between EDSS score and %FFM (P=.24).

Conclusion: No significant differences were observed in body composition between ambulatory MS patients and controls. Furthermore, the EDSS score was not a significant predictor of %BF or %FFM for people with MS.

Key Words: Body mass index; Multiple sclerosis; Rehabilitation.

MANY INDIVIDUALS WITH multiple sclerosis (MS) have muscle weakness[1-3] and fatigue[3] that result in an impaired ability to ambulate.[2] A potential manifestation of this impairment is reduced physical activity. Ng and Kent-Braun[4] reported that physical activity, as measured by triaxial accelerometer, was reduced by 35% in individuals with MS. Their subjects had a median score of 3.0 on the Expanded Disability Status Scale (EDSS). (In the present report, we found a median EDSS score of 4.5, which has been shown to have high inter- and intrarater reliability as well as high convergent validity.[5]) However, the relative difference in energy expenditure between individuals with MS and control subjects is probably lower than the relative difference in physical activity, because individuals with MS have a higher energy expenditure of physical activity (walking).[6] If reduced physical activity (and probably reduced energy expenditure) in MS is not accompanied by a reduction in energy intake, body fat will increase. A high body fat percentage is associated with an increased risk of heart disease and type II diabetes.[7,8] Thus, MS individuals with greater body fat than controls are at a greater risk for cardiovascular disease and type II diabetes.

To our knowledge only 1 published study[9] has compared body composition in individuals with and without MS. However, the focus of that study was on bone mass and the role of fat-free mass (FFM) on bone mass. Although percentages of body fat data were reported in the results section (there was no significant difference between ambulatory individuals with MS and non-MS controls), the researchers did not compare body fat data or the potential implications of excessive body fat. Thus, the purpose of our study was to compare fat mass and FFM of ambulatory individuals with MS (EDSS score, 0–6.0) with non-MS control subjects and to discuss the potential implications of the results. Additionally, we examined the relation between level of MS disability (EDSS score) and body composition.

METHODS

Participants

Seventeen individuals with MS and 12 non-MS controls participated in the study after they were informed of the risks involved and had given their written consent. The descriptive statistics for the 2 groups are provided in table 1. Subjects were recruited from the local area through a newspaper advertisement and from a university-based MS clinic. The study was approved by the University of Arkansas for Medical Sciences Institutional Review Board. The median EDSS score was 4.0, with a range from 1.5 to 6.0. The EDSS is a subjective scale that measures function from 1 (normal) to 10 (death).[10] The EDSS places the greatest amount of emphasis on ambulation. A score of 6.5 or less is considered ambulatory. Two women with MS exercised aerobically 3 times a week and 1 exercised 2 or fewer times a week, whereas 1 control subject exercised 3 times a week and 2 exercised 2 or fewer times a week.

Whole-Body Plethysmography

Each subject fasted overnight and then underwent whole-body air displacement plethysmography by using the Bod Pod device[a] while wearing a 1-piece bathing suit and swim cap.[11] Percentage of body fat (%BF), percentage of FFM (%FFM), fat mass, and FFM were calculated from the density data by using the equation of Siri[12]: %BF = (4.950/body density) − 4.50.

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Table 1: Descriptive Characteristics of Study Participants

	MS	Control	*P* (between group)
Age (y)	40.3±10.2	32.6±8.0	.04
Height (m)	1.6±8.7	1.7±7.7	.27
Mass (kg)	68.9±14.2	62.0±8.7	.15
EDSS (median)	4.0	1.5–6.0 (range)	

NOTE: Values are mean ± standard deviation (SD).

Statistics

Because there was a significant difference in age, 1-way analyses of covariance were used to compare %BF, %FFM, fat mass, and FFM between the 2 groups; age was used as the covariate. The Spearman rank correlations (ρ) were used to examine the relation between EDSS score and body composition. All analyses were considered significant at an α level of .05.

RESULTS

There were no statistical differences between MS individuals and controls with regard to %BF (P=.54), %FFM (P=.42), fat mass (P=.21), or FFM (P=.15) (table 2). For the comparison of %BF between the groups at a probability level of .05, it was calculated that 138 total subjects (the 2 groups combined) would be required at a power of .80, a difference between means of 4.70U (as found for the difference in %BF between the treatments), and a standard deviation (SD) of the response variable of 9.75 (the mean of the SDs for both groups in this study). There was no statistically significant relation between EDSS score and %BF (P=.24, ρ=−.304; fig 1) or EDSS score and %FFM (P=.24, ρ=.304; fig 2). For our observed Spearman rank correlation of .304 between EDSS score and %FFM (fig 1) at a power of .80 and at an α of .05, 62 subjects would be needed for significance for a double-sided test and 50 subjects would be required for significance for a single-sided test.

DISCUSSION

Our major finding was that there was no significant difference between ambulatory MS patients and non-MS controls in body composition. In the MS individuals there was no significant relation between any of the body composition measures and the level of disability as measured by the EDSS scale. Formica et al[9] found no difference in %BF between ambulatory MS patients and the control subjects. However, Ng and Kent-Braun[4] found lower physical activity in ambulatory MS patients than in controls. There are many possible explanations for the similar body composition despite lower physical activity in ambulatory MS patients. First, energy intake may be lower in MS individuals who are ambulatory. To our knowledge there are no data about energy intake in MS. Second, it has been reported that the energy cost of physical activity (walking) is greater in MS than it is with non-MS controls. Thus, although they have lower physical activity, as measured with a triaxial accelerometer, the amount of energy expended by ambulatory MS individuals compared with controls may not differ. It does not appear that the women with MS were involved in regular physical exercise to a significantly greater extent than the controls. Two of the women with MS exercised aerobically 3 times a week and 1 exercised 2 or fewer times a week, whereas 1 control exercised 3 times a week and 2 exercised 2 or fewer times a week.

When there is no statistical difference in between-group comparisons, or in correlations on variables between groups, an obvious question is: Was the sample size adequate? We found that for %BF, it would have required 138 subjects for a statistical difference to be observed, given our difference between means, the mean SD, a power of .80, and an α level of .05. Clearly, this indicates that the difference between means for %BF in our study was not a statistical difference, nor was it a trend toward a difference. Accruing 138 subjects, of which about 50% would have to have MS was impractical, given the number of individuals with MS in the local area. In addition, for a significant the Spearman rank correlation, the number of MS patients needed for a statistical difference (62 for a double-

Table 2: %BF, Fat Mass (FM), and FFM for MS and Control

	%BF	FM (kg)	%FFM	FFM (kg)
MS	32.5±13.9	23.6±13.9	67.1±14.9	45.1±6.6
Control	27.8±5.6	17.2±4.8	71.3±12.4	42.1±3.8
F	0.39	1.62	0.50	2.2
P	.54	.21	.42	.15

NOTE. Values are mean ± SD. F statistic and P values are for between-group comparisons.

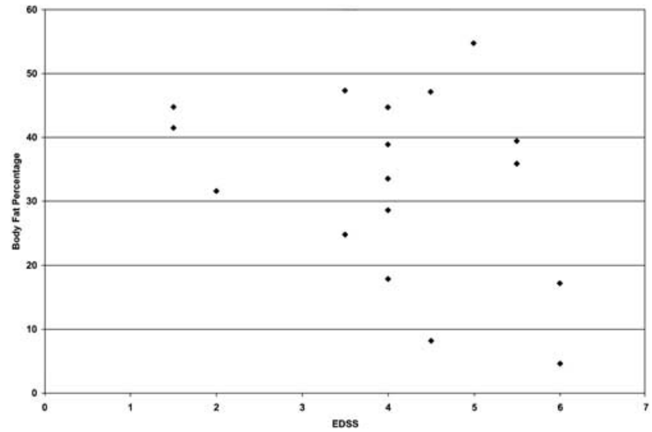

Fig 1. The Spearman rank correlations between EDSS score and %BF (P=.24, Spearman ρ=−.304).

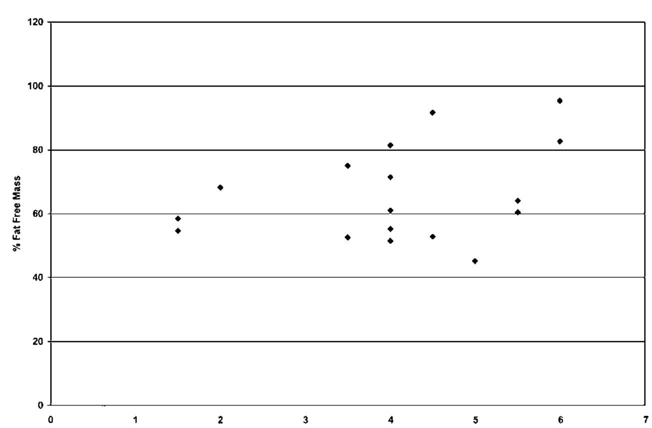

Fig 2. The Spearman rank correlations between EDSS score and %FFM (P=.24, Spearman ρ=.304).

sided test, 50 for a single-sided test) is large and suggests a relatively weak relation between %BF and EDSS score.

Formica et al[9] found a significant inverse relation between FFM and EDSS score when ambulatory and nonambulatory MS subjects were combined. We did not find a significant inverse relation between %FFM and EDSS score. It would seem apparent that including nonambulatory subjects, as Formica[9] did, who had significantly lower FFM than ambulatory patients with MS and controls, would strengthen the inverse relation between FFM and EDSS score. It would be interesting to know if the significant inverse relation between EDSS score and FFM would hold if only the ambulatory MS patients had been studied by Formica.[9]

Ng and Kent-Braun[4] found no significant relation between the level of physical activity, as measured by triaxial accelerometer, and the level of disability in individuals with MS. Thus, because MS would likely have a much greater effect on physical activity than on energy intake, our finding of no relation between EDSS score and %BF fits well with the data of Ng and Kent-Braun.[4]

The implications of the lack of a significant linear relation between any of the body composition measures or physical activity and the level of disability are extremely important. Based on our findings, it appears that the level of disability of ambulatory individuals with MS does not predict body composition. This suggests that a significant level of disability does not force these individuals to be physically inactive and does not result in a greater body fat content. There are many detrimental manifestations of excess body fat, such as hyperlipidemia, insulin resistance, and type II diabetes. Based on our relatively small sample size, it would appear that ambulatory MS patients are not more predisposed to these maladies than individuals who do not have MS.

The largest component of FFM is muscle mass.[13] If muscle mass is lower in individuals with MS than in controls, it may also contribute to the impaired ability to ambulate and perform other activities of daily living. Kent-Braun et al[14] reported that muscle fiber size from biopsy specimens of the tibialis anterior were 26% smaller than specimens from control subjects. Thus, at least for this 1 small muscle, muscle mass was lower in MS. This relationship may not hold for other muscle groups or for whole-body muscle mass. Our data suggesting that FFM does not differ between ambulatory MS patients and controls support this contention.

CONCLUSION

In this study, individuals with MS had similar percentages of body fat and FFM as did non-MS controls. Furthermore, for the individuals with MS, there was no statistically significant relation between the body composition measures and EDSS score. Thus, the level of disability does not predict body composition in individuals with MS.

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