Reduced Body Mass Index in Patients With Essential Tremor

A Population-Based Study in the Province of Mersin, Turkey

Okan Dogu, MD; Serhan Sevim, MD; Elan D. Louis, MD, MS; Hakan Kaleagasi, MD; Mihriban Aral, MD

Background: Body mass index (BMI) is an important health indicant. Individuals with a low BMI are more prone to various health problems and have an increased risk of mortality. A reduced BMI in essential tremor (ET) patients who were referred to a tertiary referral center was previously demonstrated. To our knowledge, this has not been confirmed in other groups of ET patients with different demographic characteristics or in a group of unselected ET patients living in the population.

Objective: To compare BMI in ET case and control subjects in a population-based study in the province of Mersin.

Interventions: The epidemiological survey used door-to-door examinations to evaluate 2253 residents in Mersin. There were 89 ET cases (mean age, 57.3 years) who were matched to 89 controls based on sex, ward (area of residence), and age. The BMI was calculated as weight in kilograms divided by the square of height in meters.

Results: The mean±SD BMI in ET cases was 26.0±4.3 vs 27.5±5.0 in controls (P=.04), representing, on average, a 5.5% reduction in cases. In a linear regression analysis that adjusted for age, sex, years of education, socioeconomic status, urban vs rural dwelling, cognitive screen score, and Cumulative Illness Rating Scale score, the BMI was lower in cases than in controls (P=.02).

Conclusions: A reduction in BMI is a common accompaniment of neurodegenerative diseases; a mild reduction also seems to be a feature of ET. It is important for physicians to be aware of the potential for a low BMI in their ET patients so that nutrition can be addressed as part of the treatment plan.

Arch Neurol. 2004;61:386-389
Inwood Genetic Study of ET tremor rating scale to rate the severity of the tremor during the examination.8 They had been trained to use the rating scale by viewing a training videotape.9 With the use of this training videotape, high agreement between raters with varying levels of experience previously has been demonstrated9; the 4 neurologists demonstrated substantial agreement with the training videotape ratings (weighted \(k=0.70\) for each neurologist). By using the Washington Heights–Inwood Genetic Study of ET tremor rating scale, each neurologist rated the tremor from 0 to 3 (0 indicates none; 1, mild; 2, moderate; and 3, severe) during each of the 12 tests, resulting in a total tremor score (range, 0-36 [maximum tremor]) for each case and control.9

Based on the interview and examination, each neurologist independently assigned a diagnosis of ET or healthy using published diagnostic criteria (moderate-amplitude kinetic tremor during a minimum of 3 tests or a head tremor without signs of dystonia or Parkinson disease).8 A final diagnosis of ET was assigned when both neurologists agreed on the diagnosis of ET. When the 2 neurologists disagreed, a consensus diagnosis was reached by a combined review of the medical information and a combined reexamination of the subject.

There were 89 ET cases.7 Eight (9.0%) of the cases had previously been diagnosed by a physician as having ET and 3 (3.4%) were taking a medication to treat their tremor. There were 2164 potential controls who were stratified by sex, age, and race. One control from the same race was matched to each case of the same sex based on the proximity of their birthdays. There were 89 controls.

As part of their assessment, each case and control had undergone a weight and height assessment using a standard protocol. With the subject standing, measurements were taken of body weight to the nearest 0.5 kg using a balance scale (model 6163; Soehnle, Murrhardt, Germany). Height was measured to the nearest 0.5 cm using a movable anthropometer (model 5001; Soehnle, Murrhardt, Germany).
Soehnle). The Cumulative Illness Rating Scale (CIRS) (range, 0-42 [maximum]) was used to document and rate the severity of coexisting illnesses. A brief cognitive screen (the 6-item Blessed Orientation-Memory-Concentration Test) was administered to assess memory and orientation; this was scored from 0 to 28 (maximally impaired).

By using published information on typical foods consumed in Turkey, we collected data on consumption during the previous year of foods in 14 food groups (eg, bread, red meat, cheese, and eggs). Subjects reported the frequency of consumption (<1 time per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, every day, or more) for each food group.

All analyses were performed using a commercially available software program (SPSS for Windows, version 11.0; SPSS Inc, Chicago, Ill). To test whether the BMI was normally distributed, a 1-sample Kolmogorov-Smirnov test was performed. χ² Tests were used to assess associations between categorical variables, and t tests were used to assess group differences in continuous variables. Pearson product moment correlation coefficients were used to assess correlations between continuous variables. Linear regression analyses were performed in which the dependent variable was BMI and independent variables, in different models, included subject type (case vs control), age (in years), sex, years of education, socioeconomic status (low, middle, or high), urban vs rural vs suburban dwelling, cognitive screen score, and CIRS score. An analysis of covariance was used to test whether there was interaction between sex and subject type in determining BMI. With 89 cases and 89 controls, and an α of .05, the study had 95.4% power to detect a 10% difference in BMI between cases and controls. Data are given as mean ± SD unless otherwise indicated.

**RESULTS**

The 178 participants (89 cases and 89 controls) had a mean age of 57.2 years and a mean of 3.7 years of education. Cases and controls were similar with regard to age and other demographic variables (Table). Cases had a higher mean CIRS score than controls. None had Parkinson disease or dystonia, based on the neurological examination. None had a history of hyperthyroidism.

The BMI was normally distributed (Kolmogorov-Smirnov test, z = 0.8, P = .59). The BMI was 28.7 ± 4.7 in women vs 25.1 ± 4.0 in men (t = 5.5, P < .001). The BMI was inversely associated with years of education (r = -0.16, P = .03). The BMI marginally increased with socioeconomic status, with the value in each level as follows: low, 25.9 ± 4.8; middle, 27.2 ± 4.7; and high, 27.9 ± 3.1 (linear regression analysis testing for trend, β = 1.2, P = .06). The BMI was also related to type of dwelling: rural, 25.6 ± 3.6; suburban, 26.2 ± 4.3; and urban, 27.9 ± 5.3 (linear regression analysis testing for trend, β = 1.2, P = .007). There was no correlation between BMI and age (r = -0.05, P = .54), even among individuals 65 years and older (r = -0.10, P = .48), or between BMI and cognitive screen score (r = 0.13, P = .11) or CIRS score (r = -0.02, P = .84). In a multivariate linear regression analysis, a higher BMI was independently associated with female sex (β = 3.6, P < .001) and higher socioeconomic status (β = 1.6, P = .01), but not with age, educational level, urban vs rural vs suburban dwelling, cognitive screen score, or CIRS score.

The BMI was 26.0 ± 4.3 in ET cases vs 27.5 ± 3.0 in controls (t = 2.1, P = .04), representing, on average, a 5.5% reduction in BMI in ET cases. In a linear regression analysis that adjusted for age, sex, years of education, socioeconomic status, urban vs rural dwelling, cognitive screen score, and CIRS score, there was an association between BMI and subject type (ET case vs control, P = .02). Five cases (5.6%) and 5 controls (5.6%) had a BMI that was less than 20, suggesting that malnutrition was not a concern in most subjects.

We also stratified by sex. The BMI was 24.4 ± 3.4 in male cases vs 25.7 ± 4.5 in male controls (t = 1.5, P = .13), which was, on average, a 5.3% reduction in male cases. The BMI was 27.8 ± 4.4 in female cases vs 29.6 ± 4.9 in female controls (t = 1.7, P = .09), which was, on average, a 6.1% reduction in female cases. Sex did not interact with subject type in determining BMI (analysis of covariance, F = 0.1, P = .72). Among cases, BMI was not associated with total tremor score (r = -0.04, P = .73) or disease duration (r = -0.09, P = .45). Cases and controls did not differ with regard to reported frequency of consumption of foods in any of the 14 food groups (data not shown).

**COMMENT**

A reduction in BMI is a common accompaniment of neurodegenerative diseases, with losses of 7.2% in patients with Parkinson disease when compared with controls and a loss of 3% to 9% in patients with Alzheimer disease. A 6.0% reduction in BMI in ET cases was previously reported at the Neurological Institute of New York, which is a tertiary referral center. The present participants were different from that cohort in multiple respects, allowing us to reexamine the previous finding by studying a group of ET cases with different characteristics. Differences between the present and former cohort included ethnicity (Turkish vs white, African American, and Hispanic), mean age (57.2 vs 67.4 years), educational level (3.7 vs 14.3 mean years), and socioeconomic status. More important, the Mersin study was population based, allowing us to examine BMI in ET case subjects who were not ascertained from treatment settings, were not taking medications for tremor, and were less prone to issues of selection bias. In the present study, there was, on average, a 5.5% reduction in BMI in ET cases compared with controls. This reduced BMI in cases was not a function of age, sex, cognitive screen score, medical comorbidities (CIRS score), educational level, or other socioeconomic variables that we studied, suggesting that it was not an association due to these confounding variables.

The explanation for the observed reduction in BMI in ET cases is not clear. Patients with ET have a mild olfactory deficit, and tremor can make eating and drinking difficult, potentially resulting in lessened food intake. However, in the previous study of BMI, the reported daily caloric (energy) intake was similar in cases and controls, and in the present study, food consumption patterns for 14 food groups were similar, suggesting that the lower BMI in ET cases was due to increased calorie expenditure rather than diminished food intake. Increased calorie expenditure could be due to either the underlying disease or excessive involu-
tary movements. Therefore, it remains uncertain whether a lower BMI is a premorbid condition, detectable before or at the onset of tremor, or whether this is an accompaniment of ET.

This study had limitations. While we excluded cases with comorbidities such as Parkinson disease that could have contributed to a lower BMI and also adjusted in the analyses for several potential confounding variables, other differences between cases and controls, which we did not measure, could have accounted for differences in BMI. Many of these differences (impaired olfaction, use of medications that result in loss of appetite, and intentional dieting), however, would have manifested themselves as a reduction in caloric intake, which was not found in a previous study.6 Second, individuals with dementia may have a lower BMI.4 While a brief cognitive screen was performed, we did not exclude the possibility that some of the cases or controls may have had dementia. The mean age of our subjects was 57 years, so it is unlikely that many had dementia. Also, the generalizability of these results to other populations remains to be demonstrated. A final limitation of the present study was that we assessed food consumption in 14 food groups but did not assess caloric intake in cases and controls, as we had done in a previous study.5

In summary, a reduction in BMI is a common accompaniment of neurodegenerative diseases, and in several studies, a mild reduction in BMI seems to be a feature of ET. It is important for physicians to be aware of the potential for a lower BMI in their ET patients so that nutrition can be addressed as part of the treatment plan.

Accepted for publication October 27, 2003.

Author contributions: Study concept and design (Drs Dogu, Sevim, and Louis); acquisition of data (Drs Dogu, Sevim, Kaleagasi, and Aral); analysis and interpretation of data (Drs Dogu and Louis); drafting of the manuscript (Drs Dogu, Sevim, Louis, Kaleagasi, and Aral); critical revision of the manuscript for important intellectual content (Drs Dogu and Louis); statistical expertise (Dr Louis); obtained funding (Dr Dogu); administrative, technical, and material support (Dr Dogu); study supervision (Drs Dogu and Louis).

Corresponding author: Elan D. Louis, MD, MS, Neurological Institute of New York, 710 W 168th St, Unit 198, New York, NY 10032 (e-mail: EDL2@columbia.edu).

REFERENCES