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Leptin concentrations in US adults[1,2]

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Since first reported less than a decade ago (1), leptin has been a topic of considerable study. The variation in serum or plasma leptin concentrations has been described according to sex, age, measures or indicators of body composition, and ethnicity. Because leptin is produced by fat cells, leptin concentrations are associated with all adipose tissue depots (2).

Because of notable increases in the prevalence of obesity in the United States and throughout the world during the past 2 decades, there is heightened interest in learning more about adiposity and the mechanisms that may regulate the accretion of adipose tissue, including the role of leptin. As our knowledge of leptin continues to grow, it is becoming clear that leptin's true promise may lie in information to be gained from its physiologic role as a satiety feedback mechanism, as a stimulator of thermogenesis, or in the regulation of energy expenditure—all fundamental to energy balance.

Numerous studies have verified that women have higher leptin concentrations than do men (3). This might be expected because women have a greater fat mass than do men. Although there are well-known biological explanations for this disparity, fat mass alone appears insufficient to explain why women have considerably higher leptin concentrations.

Fewer studies have investigated the role of ethnicity as a predictor of leptin concentrations. To what extent and why certain ethnic groups are more or less affected by obesity than are others and the potential role that leptin may play in the etiology of obesity in various ethnic groups continue to be topics of investigation. Racial differences in body composition and fat patterning that may contribute to differential findings in analyses of leptin concentrations are complex and require further study for a better understanding (4).

To better prevent conditions such as overweight and obesity from an epidemiologic perspective, it is useful to know which population groups in the United States are affected and how the trends change over time. Similarly, there is interest in the descriptive distribution of various anthropometric, biochemical, dietary, and demographic correlates of obesity in the US population.

For their report in this issue of the Journal on the distribution of leptin concentrations in the United States, Ruhl and Everhart (5) used demographic information combined with anthropometric and biochemical measures for samples of survey participants who were self-identified as non-Hispanic whites, non-Hispanic blacks, and Mexican Americans—the 3 largest ethnic groups in the United States. The availability of such data from the third National Health and Nutrition Examination Survey (NHANES III) is unique. NHANES is the only national survey that provides analysts with population-based body measurements and blood biochemistry data collected from major ethnic groups representative of the US population as part of a more comprehensive health examination.

Simple anthropometric measures may correlate well with serum leptin concentrations but they cannot distinguish between potential hypersecretion of leptin at the site of origin in various adipocyte tissues and the elevated serum leptin concentrations that result from decreased affinity at the receptor site or decreased clearance from the circulating blood. Nevertheless, to the extent that it is important to identify segments of the population who are at risk of having elevated serum leptin concentrations, Ruhl and Everhart confirmed, as did others (2), that a set of routine anthropometric measures (ie, skinfold-thickness measurements and arm, waist, hip, and thigh circumferences) may perform well in predicting leptin concentrations.

Because skinfold thicknesses are highly correlated with the percentage of body fat, estimates from skinfold-thickness measurements are still useful in the assessment of subcutaneous adipose tissue compartments in population-based studies. Because it represents the largest cumulative fat mass in the body, it is not surprising that subcutaneous fat is correlated with the concentration of leptin (6), which is generated by adipose cells. Another large mass of adipose tissue accumulation is in the abdominal (waist) and buttocks (hip) regions. Others found that the larger buttocks circumferences in women of African descent may help explain the established sex difference in serum leptin concentrations (7). Collectively, subcutaneous skinfold-thickness measurements and abdominal and buttocks circumferences would be expected to represent a significant portion of total body fatness, and hence would be an indicator of the relative leptin concentration, as Ruhl and Everhart showed.

Ruhl and Everhart, using the most reliable and routine anthropometric measures of height and weight, showed that body mass index (BMI; in kg/m^2) correlated as well with leptin concentrations as did any of the 4 skinfold-thickness measurements or 2 body circumference measurements alone. On a population level, because of its gen-

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erally high correlation with body fatness, BMI would be expected to be highly correlated with leptin concentrations. However, the ability of BMI to distinguish between the various body compartments is limited. As others showed, use of BMI as an indicator of body composition leads to incorrect conclusions in comparisons of relative leptin concentrations among subgroups in whom body composition varies (8). In this regard, skinfold-thickness measurements are a more direct measure of subcutaneous fat mass.

After adjustment for skinfold-thickness measurements and body circumferences as indicators of major fat depots in the NHANES III data, non-Hispanic black ethnicity was associated with leptin concentrations, suggesting that at least in blacks there may be other areas of fat not fully accounted for by the anthropometric measurements used. For example, there may be ethnic differences in body proportions, variation in the amount and distribution of deep adipose tissue, or ethnic-specific shifts in subcutaneous adipose tissue from the extremities to the trunk that occur with age (9).

Although not highlighted by the authors, perhaps the most important contribution of the analysis by Ruhl and Everhart is the straightforward descriptive distribution of population-based serum leptin concentrations for sex and ethnic groups by age or BMI. The descriptive tables in Ruhl and Everhart's article clearly show, as might be expected, that leptin concentrations increase as BMI increases, are higher in women than in men, and generally increase in adulthood in a direction similar to that of national distribution patterns for the prevalence of overweight and obesity based on BMI (10). Thus, Ruhl and Everhart provide for the first time national reference data for means and percentiles of serum leptin concentrations in US adults that may be used in evaluations of data from other studies in comparison with national distributions.

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