The following is the abstract of the article discussed in the subsequent letter:

Horowitz, Jeffrey F, and Samuel Klein. Oxidation of nonplasma fatty acids during exercise is increased in women with abdominal obesity. J Appl Physiol 89: 2276–2282, 2000.—We evaluated plasma fatty acid availability and plasma and whole body fatty acid oxidation during exercise in five lean and five abdominally obese women (body mass index = 21 ± 1 vs. 38 ± 1 kg/m²), who were matched on aerobic fitness, to test the hypothesis that obesity alters the relative contribution of plasma and nonplasma fatty acids to total energy production during exercise. Subjects exercised on a recumbent cycle ergometer for 90 min at 54% of their oxygen consumption. Stable isotope tracer methods ([13C]palmitate) were used to measure fatty acid rate of appearance in plasma and the rate of plasma fatty acid oxidation, and indirect calorimetry was used to measure whole body substrate oxidation. During exercise, palmitate rate of appearance increased progressively and was similar in obese and lean groups between 60 and 90 min of exercise [3.9 ± 0.4 vs. 4.0 ± 0.3 μmol·kg fat free mass (FFM)⁻¹·min⁻¹]. The rate of plasma fatty acid oxidation was also similar in obese and lean subjects (12.8 ± 1.7 vs. 14.5 ± 1.8 μmol·kg FFM⁻¹·min⁻¹; P = not significant). However, whole body fatty acid oxidation during exercise was 25% greater in obese than in lean subjects (21.9 ± 1.2 vs. 17.5 ± 1.6 μmol·kg FFM⁻¹·min⁻¹; P < 0.05). These results demonstrate that, although plasma fatty acid availability and oxidation are similar during exercise in lean and obese women, women with abdominal obesity use more fat as a fuel by oxidizing more nonplasma fatty acids.

Differences in Acetate Recovery Factor Between Groups May Interfere With Tracer Estimates of Fat Oxidation

To the Editor: Stable isotope tracer methodology can be used to make estimates of the oxidation rates of plasma fatty acids (FAs) and nonplasma FAs during exercise (2–4). Plasma FAs are liberated from adipose tissue, whereas nonplasma FAs are liberated in the muscle via hydrolysis of intramuscular triglycerides or in the muscle capillary bed after hydrolysis of very low-density lipoprotein-triglycerides. In their recent paper (1), Horowitz and Klein have used these methods and conclude that women with abdominal obesity have an increased oxidation rate of nonplasma FAs during exercise. To correct tracer estimates of FA oxidation for tracer loss in exchange reactions of the tricarboxylic acid cycle, it is imperative to use an acetate recovery factor (ARF) (4). Horowitz and Klein (1) used an assumed value of 0.80 for the ARF in both groups. This value was based on a relationship between ARF and oxygen consumption (in ml·kg⁻¹·min⁻¹) during exercise that was published by Sidossis et al. (4) for a group of young lean subjects. However, when we convert the oxygen consumption values for the groups studied by Horowitz and Klein (1) to milliliters per kilogram per minute and then apply the relationship reported by Sidossis et al. (4) to calculate the ARF, then we find a lower value for the obese subjects (0.71) than for the controls (0.80). This leads to an overestimation of nonplasma FA oxidation in the obese subjects in the study of Horowitz and Klein (1). Furthermore, we have shown that, although the ARF is reproducible within a subject, it has a high interindividual variability (3). Recently, we also showed that the ARF differs significantly between lean, obese, and Type 2 diabetic subjects (2). This variability was partly accounted for by percent body fat. Therefore, application of the same ARF in obese and lean subjects could result in a miscalculation of the oxidation of the various fat sources and their relative contribution. To illustrate this, we have used the relationship that we reported between percent body fat and ARF during exercise (2) to recalculate the values reported by Horowitz and Klein (1). The differences in relative contribution of plasma FAs and nonplasma FAs to total fat oxidation becomes minimal in that case (92 and 8% in lean and 88 and 12% in obese subjects, respectively). Horowitz and Klein reported respective values of 83 and 17% in lean and 58 and 42% in obese subjects.

It should be noted that we do not claim that Horowitz and Klein (1) should have used the ARF's that we published (2). This is primarily because we used [1,2-13C]acetate (2, 3), whereas [1-13C]acetate was used in the studies of Horowitz and Klein (1) and Sidossis et al. (4). The use of [1-13C]acetate in group comparisons would cause a slight difference in the absolute ARF values. However, the relative difference between the groups would most likely be similar to our results (2). Therefore, we believe the recalculations do illustrate that failure to account for differences in ARF between groups may have resulted in an artificial increase in the estimated ability of obese women to oxidize nonplasma FAs. More in general, it shows that the assumption of a single value for the ARF in different individuals and groups may have pronounced effects on the outcome of tracer studies and could potentially lead to erroneous conclusions. Because of the high interindividual variability in ARF, we recommend that the ARF is determined in each and every subject (2, 3).

REFERENCES

2. Schrauwen P, Blaak EE, Van Aggel-Leijssen DP, Borghouts LB, and Wagenmakers AJ. Determinants of the acetate recov-
imperfect because some of the [13C] (or [14C]) label in breath is typically used to evaluate the oxidation of a carbon-labeled fatty acid in conjunction with fatty acid oxidation during exercise. The intravenous infusion of a carbon-labeled fatty acid is to assess the recovery of label in expired air. Therefore, their data indicate that ARF was similar in lean and obese subjects but calculated an ARF for each subject by generating an ARF based primarily on hepatic, not muscle, acetate metabolism. Therefore, measuring the ARF may not completely eliminate possible errors in assessing plasma fatty acid oxidation rate.

REFERENCES

Jeffrey F. Horowitz
Division of Kinesiology
University of Michigan
Ann Arbor, Michigan 48109

Samuel Klein
Department of Internal Medicine
Washington University School of Medicine
St. Louis, Missouri 63110