Letter to the Editors

Global energy requirements, ethnicity, representative samples and basal metabolism: what can we really tell the world?

Continuing discussion of the validity of predictive equations for basal metabolic rate (BMR) as in the paper by Soares *et al*. (1998) on ethnicity in the *British Journal of Nutrition* is vital because of the equations' global public health importance in determining energy needs worldwide as well as their inherent physiological relevance.

Soares *et al*.'s Introduction elegantly reviewed the historical literature including older studies before closed-circuit on-line indirect calorimetry became available. The first paragraph of the Discussion summarized the principal objective: to examine whether differences in body composition could account for previously-reported putative ethnic differences in BMR.

Examination of the Methods section may be useful. Omitted entirely from this paper, apart from a passing mention in the Introduction (para. 2, page 334) on the error in the Schofield *et al*. (1985) equations from old Italian data, was any comment on the necessity or otherwise for studying formally representative population samples. The source of neither the Indian nor Australian subjects studied here was given but they were not randomly sampled from a community or population base. Thus these subjects were 'haphazard' (volunteer) samples representative of no one.

Sampling bias. In common with much of the world's literature on the topic, the issue of whether a group of volunteers in one location is comparable with presumably self-selected volunteers at another needs attention. In this or any circumstance in interpreting clinical science, key issues are external validity (can the observations be generalized to the subjects' community/location/country/geographic setting or worldwide?), as well as internal validity (are older volunteers perhaps healthier, wealthier and wiser than younger? Are older women with children systematically different to younger women without? etc.). They form the principles of robust research design for which only formal random samples from an identified sampling frame provide approximate answers (Editorial, 1994; Rothman & Greenland, 1998). Thus in the original paper by Henry & Rees (1991), which gave rise to Hayter & Henry's (1994) equations tested by Soares *et al*. (1998), this same problem afflicted all twelve 'ethnic' samples. 'Ethnic' was synonymous with geographic location, of Filipinos, Indians, South Americans, Africans and eight other South-East Asian and South Pacific groups (not populations). Happenstance volunteers were studied (CJK Henry, personal communication); thus much of the variation in Results, as so often, may be related to sampling bias from one site or publication to another. Another source of bias would be methodological differences between and within sites to which the authors refer and are less relevant here.

Analysis. Sample sizes are also an issue because of the potential dangers from 'type-2' errors; could the Soares *et al*. (1998) study be underpowered to detect genuine differences when none were found? For instance, in the 2-way ANOVA, including sex and ethnic group, the ethnic effect was 'not significant', but the F ratio of 2·94 had a P value of 0·09 with 173 of their 178 subjects included. Confidence intervals (CI) of 95 % help to estimate the size and range of potential differences, which here would include quite a large 'ethnic' effect if CI were calculated. Incidentally, there is no 'significant' difference between an F value of 2·94 and the one for sex of 3·75 which produced a P value of 0·054, apparently of borderline significance. Until journals require presentation of CI instead of P values (see Gardner & Altman, 1992) and *a priori* estimates of power for studies, such confusion will persist. Studies without relevant estimates of variance and power calculations cannot tell the reader the likely size of type-2 errors.

The term 'ethnic', very appropriately used by the authors in preference to 'race', also has no biological nor genetic definition and subsumes cultural and other behavioural issues (Cooper & David, 1986; Cruickshank & Beevers, 1989). There have been rapid changes in height within many ethnic groups in 1–2 generations, for instance among Japanese and Japanese migrants ('issei and nissei') to Hawaii and California and among Indian and Pakistani-origin children and young adults born in Britain compared with their parents. Apparently ethnic-specific equations are likely to become out-of-date very quickly. In this author's view, such rapid change indicates that very little of the geographic/ethnic variance in BMR worldwide is likely to be genuinely genetically determined.

There can be few more globally important public health issues than estimating worldwide food energy requirements properly. Surely the time has come for concerted efforts to determine the validity of current, and if possible to generate more precise equations for estimating BMR in many locations and ethnic groups carefully sampled across the world? Until we do so, all we can really tell the world on the subject is guesswork and, hence, a muddle.

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