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The degree of misreporting of the energy-adjusted intake of protein, potassium, and sodium does not differ among under-, acceptable, and over-reporters of energy intake

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ABSTRACT

It is unclear whether misreporting of nutrient intakes differs according to energy reporting status. We examined misreporting of dietary protein, potassium, and sodium in under-, acceptable, and over-reporters of energy intake. Our hypothesis was that degree of misreporting of these three nutrients differs among under-, acceptable, and over-reporters. Participants were 1043 Japanese women aged 18 to 22 years. Self-reported dietary intake was obtained using a diet history questionnaire. Under-, acceptable, and over-reporters of energy intake were identified based on the ratio of self-reported energy intake to estimated energy requirement (<0.70 [17.2%], 0.70-1.30 [78.1%], and >1.30 [4.7%], respectively). Misreporting of dietary protein, potassium, and sodium was assessed against the corresponding biomarker-based estimate derived from 24-hour urinary excretion. On average, the degree of misreporting of intake of energy and the three nutrients varied considerably. Absolute intake (amount per day) of the three nutrients was under-reported in under-reporters of energy intake and over-reported in over-reporters compared with acceptable reporters. However, mainly because of high correlations between the ratio of self-reported energy intake to estimated energy requirement and the ratio of self-reported to biomarker-based estimates of absolute intake of three nutrients (Pearson correlation coefficient: 0.64 for protein, 0.51 for potassium, and 0.37 for sodium), the degree of misreporting of the energy-adjusted intake of these nutrients based on the density method did not differ across categories of energy reporting status. In conclusion, these findings may lend support to the usefulness of adjustment for energy misreporting and the futility of merely excluding energy misreporters from analysis.

1. Introduction

Although accurate assessment of habitual dietary intake is a prerequisite in studies of diet and health, the difficulty of obtaining dietary data that accurately represents what people usually eat is now generally recognized [1]. Misreporting, particularly under-reporting, of energy intake, a surrogate measure of total food intake, by a variety of

Abbreviations: DHQ, diet history questionnaire; PABA, para-aminobenzoic acid; PAL, physical activity level.

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dietary assessment methods relative to total energy expenditure measured by the doubly labeled water method, the gold standard for measuring free-living total energy expenditure, is common [2,3]. Additionally, misreporting of energy intake within a population might not be random, but might rather occur systematically within certain groups of the population [1-4]. It has not been well established whether misreporting is a consequence of selective misreporting of certain foods, proportional misreporting of all foods, or both.

Unfortunately, investigation of possible differential misreporting of dietary intake in free-living situations has been difficult, largely due to a lack of suitable methods for quantifying absolute true intake for all dietary variables except energy [1], protein [5,6], potassium [7,8], and sodium [7,9]. As a result, only a limited number of studies have examined this issue [10-16], none of which were conducted in Asian countries, including Japan, with one exception [17]. Because the way people interpret and respond to dietary assessment may differ between Western and Asian countries, mainly due to large differences in dietary habits and body size, the accuracy of reported dietary intake may also differ. This difference in turn hampers the extrapolation of findings in Western to Asian populations.

To our knowledge, misreporting of dietary intake against biomarkers in under-, acceptable, and over reporters of energy intake has not been reported. Numerous studies have compared self-reported food and nutrient intake between implausible and plausible reporters of energy intake [1,18-20]. In the absence of any true measure of dietary intake, however, such comparisons and observed differences (or similarities) between implausible and plausible reporters provide no information on whether the results represent a difference (or similarity) in reporting or a difference (or similarity) in food intake pattern [18].

This study examined misreporting of dietary protein, potassium, and sodium assessed against 24-hour urinary excretion in under-, acceptable, and over-reporters of energy intake in a group of young Japanese women. Particularly, we investigated the hypothesis that the degree of misreporting of dietary protein, potassium, and sodium intake differs among under-, acceptable, and over-reporters of energy intake.

2. Methods and materials

2.1. Study population

This observational study was based on data from the Japan Dietetic Students' Study for Nutrition and Biomarkers, a cross-sectional multi-center survey conducted from February to March 2006 and from January to March 2007 among female dietetic students from 15 institutions in Japan. All measurements at each institution were conducted according to the survey protocol. A total of 1176 Japanese women took part (response rate: 56%). A detailed description of the study design and survey procedure has been published elsewhere [17,21-23]. Written informed consent was obtained from each participant and also from a parent for participants below 20 years old. The study protocol was approved by the ethics committee of the National Institute of Health and Nutrition, Japan.

In total, 1105 women took part in the 24-hour urine collection procedure. For analysis, we selected women aged 18 to 22 years (n = 1083). We then excluded those with missing information on the variables used (n = 5). We further excluded those whose 24-hour urine collection was considered incomplete (n = 35), as assessed using information on urinary creatinine excretion and body weight based on a strategy proposed by Knuiman and colleagues [24]. This creatinine-based strategy has been validated against the para-aminobenzoic acid (PABA) check method in a subsample (n = 654) of the present participants (sensitivity: 0.47; specificity: 0.99; % of participants misclassified: 4%) [23]. The final analysis sample comprised 1043 women.

2.2. Self-reported dietary intake

Dietary habits during the preceding month were self-reported using a comprehensive self-administered diet history questionnaire (DHQ) [25-29]. Responses to the DHQ, as well as to a lifestyle questionnaire, were checked at least twice for completeness. When necessary, forms were reviewed with the subject to ensure the clarity of answers. Details of the DHQ's structure and calculation method of dietary intake have been published elsewhere [25-29]. Briefly, the DHQ is a structured 16-page questionnaire which asks about the consumption frequency and portion size of selected foods commonly consumed in Japan as well as general dietary behavior and usual cooking methods [25,26]. Estimates of daily intake for foods (150 items in total), energy, and selected nutrients were calculated using an ad hoc computer algorithm for the DHQ [25,26] based on the Standard Tables of Food Composition in Japan [30]. Information on dietary supplements was not used in the nutrient intake calculation, because none of the subjects consumed dietary supplements with predominantly containing protein, potassium, or sodium [17]. Energy-adjusted values of nutrient and food intake were calculated based on the density method (ie, percentage of energy for energy-providing nutrients and amount per 1000 kcal of energy for other nutrients and foods) [17]. Categorization of food groups has been published elsewhere [31].

Validity of the DHQ with respect to commonly studied nutritional factors has been investigated in several previous studies [25-29]. Briefly, Pearson correlation coefficients were 0.48 for energy, 0.37 to 0.75 for energy-providing nutrients, and 0.38 to 0.68 for other nutrients between the DHQ and 3-d estimated dietary records in 47 women [25]; 0.23 for sodium and 0.40 for potassium between the DHQ and 24-hour urinary excretion in 69 women [27]; 0.66 between the DHQ and serum phospholipid concentrations for marine-origin n-3 polyunsaturated fatty acids (sum of eicosapentenoic, docosapentaenoic, and docosahexaenoic acids) in 44 women [28]; and 0.56 between the DHQ and serum concentrations for carotene in 42 women [28]. Further, Pearson correlation coefficients between energy intake derived from the DHQ and total energy expenditure measured by the doubly labeled water were 0.34 in 67 men and 0.22 in 73 women [29].