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We congratulate Mahshid Dehghan and colleagues on the Prospective Urban Rural Epidemiological (PURE) study.<sup>1</sup> Their results are consistent with evidence suggesting that a diet high in fat might reduce mortality<sup>2</sup> and incidence of cardiovascular disease.<sup>3</sup>

However, the results suggesting that intake of unsaturated fatty acids (UFA) and saturated fatty acids (SFA) is associated with reduced mortality are divergent from recommendations to reduce dietary SFA.<sup>4</sup> This disparity could be attributed to the methods used to estimate UFA. Food Frequency Questionnaires mainly estimated UFA intake from food rather than from vegetable oils, which are a substantial source of UFA. Although foods rich in UFA are often also

rich in SFA (eg, dairy products and beef), vegetable oils (eg, olive oil) are extremely rich in UFA and low in SFA.

To address this problem, the authors could do multivariate analysis for the primary outcomes, including total UFA and SFA intake. In our previous study,<sup>5</sup> in multivariate analysis, only UFA was independently associated with our outcome of interest (peak oxygen consumption in patients with heart failure with preserved ejection fraction), although SFA was significantly associated with the outcome in univariate analysis. Additionally, the association between total UFA (monounsaturated and polyunsaturated fatty acids)<sup>2,5</sup> and the primary outcomes could be repeated.

In conclusion, the PURE study has provided important information for nutritional research, further supporting the beneficial effects of diets high in fat, and has established an evidence base to inform future targeted randomised controlled trials investigating whether a diet high in UFA improves clinical outcomes.

We declare no competing interests.

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The Prospective Urban Rural Epidemiological (PURE) study<sup>1</sup> has attracted considerable attention in both academia and the public domain. The conclusions of the study challenge the dietary advice and guidelines people have adhered to for decades. Scholars have questioned the accuracy of macronutrient distribution data reported in the PURE study for the Chinese population. The study reported that about 77% of the population in China consume at least 60% of energy from carbohydrate and 43% of individuals consume at least 70% of energy from carbohydrate, with a mean of 67.0% energy derived from carbohydrate and 17.7% from fat. However, these percentages differ from national data collected using the China Health and Nutrition Survey (CHNS).

The CHNS was the first reliable, large-scale survey dataset collected in China. Between 1991 and 2001<sup>2</sup> a rapid decline in energy intake from carbohydrate and an increase in energy intake from fat were observed. The basement survey<sup>3</sup> of the PURE study was done in September, 2005. In view of the CHNS dataset from 2000 to 2011,<sup>2</sup> it is reasonable to infer that Chinese participants in the PURE study during the basement survey period obtained 54.3–59.8% energy from carbohydrate and 27.8–32.0% energy from fat, which differs from the percentages reported in the PURE study.

Several factors could account for these discrepancies. The PURE study and the CHNS used different methods to collect dietary survey data. In the PURE study, food intake was recorded using Food Frequency Questionnaires at baseline with multiple 24 h dietary recalls as the reference method for validation, whereas the 2002 CHNS used 3 day, 24 h dietary recalls, combined with food weighing and Food Frequency Questionnaires. Furthermore, the measurement of edible oils (eg, cooking oils) is important. The five main sources of total fat for the Chinese population in the PURE study are highly controversial because edible oils were not listed, which are the main source of fat among



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the Chinese population,<sup>4</sup> accounting for more than 40% of fat intake.<sup>2</sup> Using Food Frequency Questionnaires to record the use of edible oils can also be inaccurate. Frying and broiling are the main cooking methods used in China, thus the measurement of cooking oil used in food preparation is important for the accuracy of data collected from the Chinese population. In 2010, the CHNS was updated to include the measurement of cooking oils and condiments before cooking.

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In *The Lancet*, Mahshid Dehghan and colleagues<sup>1</sup> reported a positive association between carbohydrate intake and non-cardiovascular mortality, and an unexpected inverse association between non-cardiovascular mortality and saturated fat intake. The authors recommended changes in dietary guidelines on the basis of assumed causality.

We were surprised that body-mass index (BMI) values were not reported, although this information was available for the cohort.<sup>2</sup> The authors only presented waist-to-hip ratio in the total cohort and in different subpopulations, defined by geographical region and income levels.

The differences in ratios were minor, in contrast to previously reported differences in BMI in the same cohort;<sup>3</sup> BMI values ranged from 23.3 kg/m<sup>2</sup> in low-income countries to 28.4 kg/m<sup>2</sup> in upper middle-income countries.

Previous studies<sup>4,5</sup> on the association between bodyweight and mortality, including studies done in low-income and middle-income countries, have shown an association between high BMI and mortality. Thus, BMI is a major confounder when studying the association between food intake and mortality. We are not aware of any studies suggesting that waist-to-hip ratio could be of better value than BMI for the prediction of mortality in large cohorts with variable demographic characteristics. Additionally, BMI is associated with saturated fat intake<sup>6</sup> but, to the best of our knowledge, no studies have investigated the association between saturated fat intake and waist-to-hip ratio.

Thus, we question why the authors used waist-to-hip ratio rather than BMI as a covariate in the multivariate analysis. Additional analysis with the inclusion of BMI in the model would be welcome.

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The Prospective Urban Rural Epidemiological (PURE) study,<sup>1</sup> which included 18 cohorts from low-income, middle-income, and high-income countries worldwide, reported that high carbohydrate intake was associated with an increased risk of total mortality, whereas high intake of total fat and individual types of fat were associated with reduced total mortality. These results contribute valuable evidence to the field of nutrition, but using questionnaires to infer the amount, quality, and composition of intake of fats is error prone because of the complexity of foods and the possibility of implausible questionnaire entries. Measuring fatty acids in tissues, such as erythrocyte membranes, provides more accurate information about the individual fatty acids consumed and absorbed.

Furthermore, using broad categories such as saturated, monounsaturated, and polyunsaturated to describe fatty acids does not take into account that individual fatty acids within these groups have variable