EEQI: An ecological dietary quality index for developed countries

A dietary pattern (or index) is more likely to capture the effects of diet and food interactions on health than studying certain foods or food groups (Tapsell et al., 2016). While there are numerous a priori dietary quality indices, they all apply to the individual level.

This article introduces the Ecological Eating Quality Index (EEQI), a novel dietary quality index that measures the quality of nutrition at the country-level. The index allows the comparison of dietary quality between countries on a yearly frequency. It combines data from two sources, namely, the Food Balance Sheets (FBS) of the Food and Agriculture Organization (FAO) of the United Nations and the Global Dietary Database (GDD).

The EEQI is based on the weighted scores of its ten food components. The components represent the major food consumption groups with the addition of alcohol and added sugars (Micha et al., 2015). The component selection was influenced by the Mediterranean diet—for which several studies have shown a positive association with health outcomes and longevity (Eleftheriou et al., 2018; Martinez-Lacoba et al., 2018; Soltani et al., 2019)—as well as from the recommendations of the EAT-Lancet commission (Willett et al., 2019) and the World Health Organization (WHO, 2020).

The EEQI values are based on ten food items. Six beneficial to human health: fruits, vegetables, pulses, tree nuts, whole grains, and fish and seafood, and four detrimental to human health: processed meat, red meat, added sugars, and alcohol. All components from the FBS were waste adjusted following the FAO methodology (Gustavsson et al., 2011) as was adapted by the World Health Organization (WHO, 2023), so that values approximate actual food consumption and not mere availability.

Nine percentiles, namely p10, p20, p30, p40, p50, p60, p70, p80, and p90, were calculated from a pooled sample of countries and years for each component and a score from one to ten was assigned in the following manner. For consumption less than p10, a score of one was assigned. For consumption more or equal to p90, a score of 10 was assigned. Accordingly, scores were given for values between the other percentiles. These scores were then weighted since not all components are expected to affect human health equally. The assigned weights were chosen based on the strength of evidence regarding cancer and cardiovascular outcomes from the World Cancer Research Fund (WCRF, 2018) and Brandhorst and Longo (2019), respectively. Therefore, they give emphasis on the two most pertinent chronic diseases in the developed world.

An eating quality index must demonstrate predictive ability in health outcomes, even at the country level. To this end, associations with two health outcomes were examined for a panel of developed countries. These were life expectancy at birth

and premature mortality, measured by age-standardized potential years of life lost (PYLL) rates with 75 as the cut-off age. The data for the outcomes were extracted from the OECD health database (OECD, 2016).

Bayesian hierarchical models were used to examine the above associations. The standardized EEQI is positively associated with life expectancy at birth and negatively associated with premature mortality. A one standard deviation increase in EEQI was associated with 3.45 (Std. error = 0.15) years increase in life expectancy and 28% (Std. error = 0.01, in the original scale) rate reduction in potential years of life lost. Standardization of the index is strongly recommended.

The use of face values of food consumption (e.g., kg/per capita) from FBS or GDD to determine the EEQI score was deemed inappropriate. Therefore, percentiles allow a valid calculation of the index despite measurement errors, under the assumption that the errors are more or less the same for each country. Both the selection of components and weights contain a degree of objectivity. This may be more true for the weight selection. On the other hand, an unweighted score (i.e., equal food item contribution) would constitute an unrealistic assumption. In any case, the unweighted index (with one and minus one as weights) is very much collinear with the EEQI, therefore inference is not expected to differ.

The EEQI does not preclude alternate weights to be used or calculated, or even estimated. This index was developed mainly for developed countries. It is not clear if this methodology is adequate to capture diet quality in a developing country with food shortages and minimal processing of foods. Nor is it recommended to compare countries close to the extremes. The index is also sample dependent, that is, a different panel of countries and years will result in different scores. It is therefore important to specify if the values were drawn from this paper or calculated de novo.

This article presents the EEQI, a novel dietary index for cross-country comparison of nutritional quality. The index adjusts for wasted food before the calculation of its scores. Its validity is demonstrated by strong associations with increased life expectancy and decreased premature mortality. The index has many potential applications in the study of health geography.

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