

# Analysis finds mixed diets balance nutrition and reduce carbon footprints

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In Japan, this kind of specialty meal, known as shojin ryori, is often entirely plant based. Some common food in Japan can have a surprisingly low carbon footprint at times due to low meat content and relatively shorter cooking times. Credit: 2024 Rohan Mehra

What we eat can impact our health as well as the environment. Many studies have looked at the impacts of diets in very general terms focused at the level of food groups. A new study led by researchers at the University of Tokyo explores this issue following a more nuanced dish-level approach. The research is [published](#) in the journal *Science Advances*.

One of the benefits of this kind of study is that people's connections with their diets vary around the world and have strong cultural associations. Knowledge of the impacts of diets using dishes rather than broad food groups can help individuals make informed choices and those in the [food industry](#) improve their practices.

"Our main conclusion is this: Mixed diets can offer [good health](#) and environmental outcomes. This is because mixed diets can afford consumers a larger diversity of dishes that can meet both nutritional requirements and have low carbon footprints," said the lead author of the study, Associate Professor Yin Long from the University of Tokyo's Graduate School of Engineering.

"We identified trade-offs in terms of nutrition, carbon footprint and price for individual dishes with multiple ingredients, rather than using broad food categories such as red meat, fish or vegetables, as has been done in most similar studies so far.

"Although dishes from the same broad categories such as beef-based or fish-based dishes exhibit familiar trends as found in other studies in having comparatively higher carbon footprints, there are times when dishes do not follow the patterns of their respective food groups. It is also interesting to see a large concentration of dishes with low nutrient density and correspondingly low emissions and prices."

Such examples are diets based on dishes with a greater proportion of plant-based ingredients that indeed tend to have lower carbon footprints, but sometimes fail to meet daily requirements for some nutrients.

Conversely, mixed diets strike a balance between what is considered good nutritional outcome and [carbon footprint](#). This is because mixed diets tend to afford larger combinations of dishes that both meet daily nutrient requirements and have low carbon footprints than stricter diets, for example, diets relying only on a subset of dish categories.

The researchers found this out by analyzing data on 45 dishes popular in Japan that consist of multiple ingredients and have different cooking times, using algorithms that seek to optimize some parameters within sets of data.

"We should stress that we do not believe that impact analyses based on food groups and dishes are mutually exclusive, though. Instead, we believe they are highly complementary. For example, approaches relying on food groups can reveal broadly what sustainable diets can look like and how to achieve them at the production level, pointing to feasible directions for transforming food systems at the global and international levels," said Professor Alexandros Gasparatos, another author of the study from the University of Tokyo's Institute for Future Initiatives.

"At the same time, we believe dish-based approaches can inform better the day-to-day organization of food consumption at the national and local levels, by acting as a reality check to inform, design and convey feasible and acceptable ways to steer dietary habits toward more sustainable directions."

In a sense, dish-based approaches can better reflect how food is actually prepared and consumed in a given local context. This in turn better reflects cultural preferences for certain tastes or cooking methods, and cultural acceptability of certain food items. It can also better reflect the

relative availability of certain food items, which itself might be due to local environmental conditions, which continue to change.

"Varying cultural preferences and ingredient availability lead to radically different ways to build healthy and sustainable diets between different countries and local contexts," said Gasparatos.

"Dietary choices have important ramifications for human health and the environment. On the one hand, unhealthy [dietary habits](#) have been associated with the increased prevalence of obesity, diabetes and various types of cancers. On the other hand, food production can have severe environmental impacts through land use, carbon emissions, methane emissions, water pollution, and overconsumption and more.

"I myself have tried to make some diet-conscious changes in the last couple of years before working on this study. However, the engagement with this research reaffirmed my belief that mixed diets offer lots of benefits and helped me to identify some items and dishes to maybe be consumed in moderation."

**More information:** Yin Long et al, Mixed diets can meet nutrient requirements with lower carbon footprints, *Science Advances* (2024).

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