

How do our food choices affect the environment?



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Associate Editor:

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Abstract

Which diets are most healthy and environmentally sustainable? Many scientists have tried to answer this question by researching the impacts of peoples' food choices on health and the environment. We compiled all this previous research to summarize how changes to what we eat would affect water use, land use, greenhouse gas

emissions, and human health. Overall, we found that if people shifted their diets to eat less animal-sourced food and more fruits and vegetables, it would generally reduce environmental impacts. Furthermore, there would also likely be benefits to health.

Introduction

Producing the foods we eat has massive environmental impacts: it requires vast tracts of land and huge quantities of water. In addition to using land and water, food production results in greenhouse gas emissions – from the fossil fuels burned to run tractors and harvesters, for example, and from the gases released when cow manure decomposes and from when cows burp and fart (Fig. 1). These emissions add up: scientists estimate that food production around the world causes up to 30% of all the greenhouse gases people release to the atmosphere each year.

Raising cows and sheep for meat has an especially large environmental footprint with regards to land use, water use, and greenhouse gas emissions. Because of this, we wanted to find out: Would changing peoples' diets have a significant environmental effect? And if so, which diets are likely to be healthiest for ourselves and for the planet?

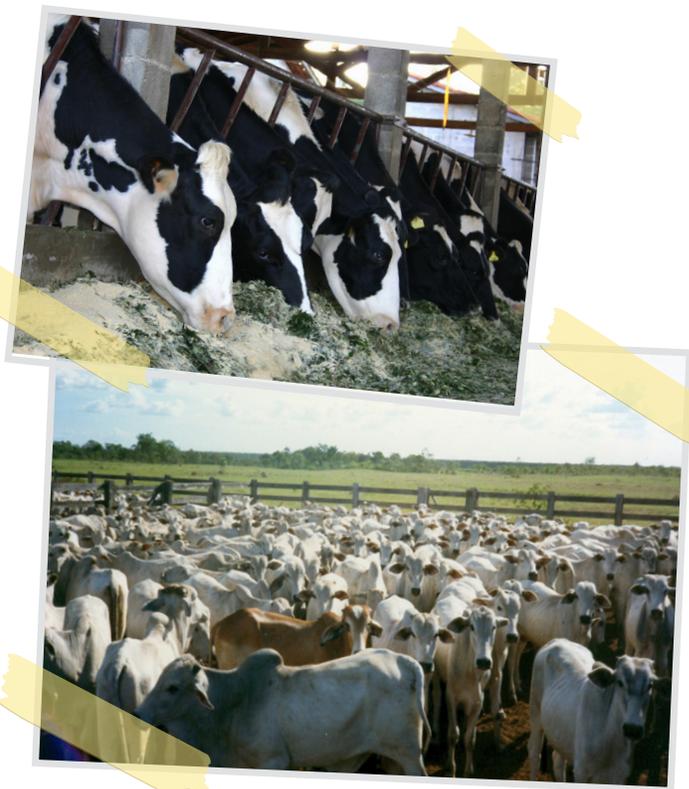


Figure 1:

Cows in a crowded feedlot.
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Methods

We compiled 63 past studies about the environmental impacts of changing dietary habits to assess the current state of knowledge about the impact that our food choices have on water use, land use, greenhouse gas emissions, and human health. Most of these studies came from high-income countries. We then analyzed and summarized the studies' results in our scientific review article.

Each of the studies compared a country or region's average "baseline" diet to an alternate diet meant to be

more environmentally sustainable. For each comparison, we calculated changes in the amount of greenhouse gas emissions, water use (in liters per person per day) and land use (in meters squared per person per year) required to produce the food. We made sure that even though the compared diets were made up of different foods, they roughly contained the same number of calories, so that we could be sure that any reductions in environmental impact were not due to people simply eating less food.

Results

We identified 14 diets that scientists have proposed as being more environmentally sustainable: these included vegan, vegetarian, pescatarian, and replacing red meat with pork and chicken, to name a few (Fig. 2).

Overall, our review found that reducing meat intake generally resulted in less greenhouse gas emissions, less land use, and less water use. The environmental

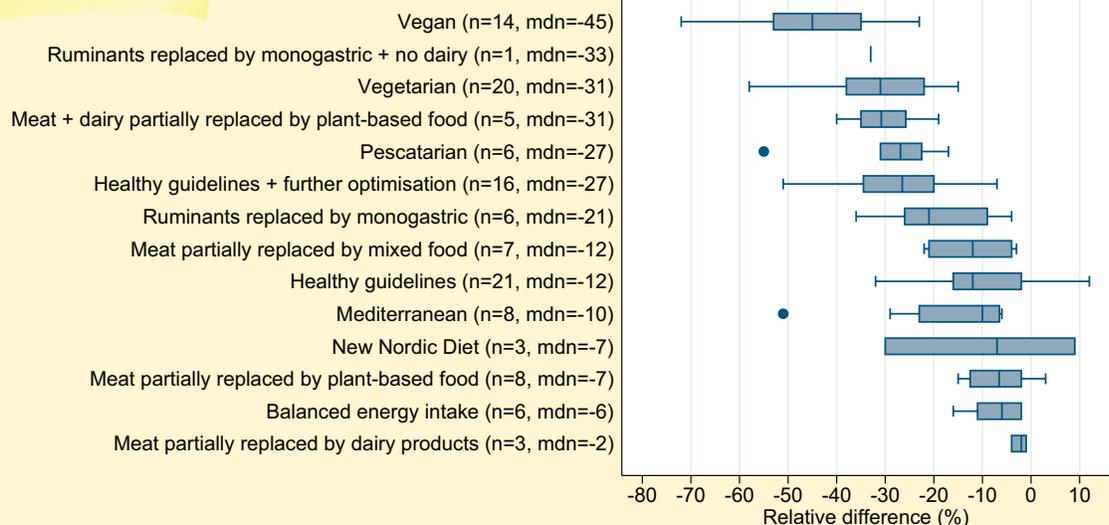
impact from switching to alternative diets varied greatly across the studies – some found changes of 70% less greenhouse gas emissions and land use, while others found only slight reductions or even increases.

The more sustainable diets were generally considered slightly healthier due to increased vegetable and fruit and reduced red and processed meat consumption.

Figure 2:
Differences in greenhouse gas emissions (kg CO₂ equivalents/person/year) between average baseline diet and alternative diets.

n = number of studies that considered this diet
mdn = median percent change between baseline diet and alternative diet

"Box and whisker plots" are a good way to summarise findings across studies. Here, they show the difference in greenhouse gas emissions of "sustainable" diets compared to current diets. The boxed areas represent the middle half of the estimates and the vertical line in the middle of each box is the median estimate. The whiskers represent the range of estimates, and dots represent outliers, which in this case are unusually low values.



Discussion

While our review showed that reducing meat and dairy consumption is likely to reduce a diet's environmental impacts, the reality of the situation is more complex. The specifics of how food is grown in different places determines its greenhouse gas emissions, water use, and land use.

Consider, for example, that growing tomatoes in a warm climate far away and shipping them to your door may produce fewer emissions than growing them locally in greenhouses that require electricity for heating.

Similarly for livestock, using rocky land for grazing cows may take a lot of space, but it makes use of an area where crops would not be able to be grown anyway. Producing meat in a "factory farm" may take much less land, but still may not be the most humane or environmentally sustainable way to grow food.

It's also important to note that the importance of "water

use" is not the same everywhere; the water use we measured included rainfall, groundwater extractions, and surface water diversions for agriculture. But in terms of sustainability, using rainwater to grow crops has much less environmental impact than depleting underground aquifers or diverting water from rivers.

There are other trade-offs between environment and health as well. For example, sugar and oil have lower greenhouse gas emissions than many meats, but eating these in large amounts is unhealthy.

Researchers are still investigating these many complexities. What sustainable diets might look like specifically may change across different cities and countries. However, for most developed countries like the US or UK, it is safe to say a more sustainable diet is one in which meat and dairy are eaten in moderation, and which contains lots of fruits and vegetables.

Conclusion

Being conscious about both the environmental impacts and healthiness of the foods we eat is an important start. For most of us, following healthy guidelines for a balanced diet would go a long way to improving health and environmental sustainability.

For those eating a lot of meat and dairy, especially beef, considering cutting down on these foods and replacing them with other sources of protein, such as beans, fish, or even chicken or pork. Also make sure you get enough

portions of fruit and vegetables daily.

As we pointed out above, the relationship between food and the environment can sometimes be complex. Finding out where your food comes from, and investigating how it's grown, can be a useful way of learning about the food system in your area and understanding its impacts on the environment.

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Glossary of Key Terms

Box and whisker plot – A graphical representation of a range of data points. The box represents the middle half of the values (if you were to line all the values up in order, from $\frac{1}{4}$ to $\frac{3}{4}$ of the way through), and the whiskers show the full range of the data values. Dots outside the whiskers show outliers that are unusually low or high in the data set.

Environmental footprint – A measurement of the natural resources (like water and land) and environmental impacts (like greenhouse gas emissions) that a person or population requires to support their lifestyle.

Greenhouse gases – Gases that contribute to global warming by trapping heat from the sun in the atmosphere close to the Earth, including carbon dioxide, methane, and nitrous oxide.

Median – In a set of numbers or data points, the median is the number that falls exactly in the middle; half the numbers in a data set are higher and half are lower than the median.

Outlier – A data point in a set of data that is much bigger or much smaller than the rest of the set.

Pescatarian diet – A vegetarian diet that also includes fish and other seafood.

Scientific review article – A scientific article that compiles past research on one topic to analyze trends and assess the current state of knowledge on that topic.

Vegan diet – A diet that does not include any animal products like meat, fish, cheese, eggs, or dairy.

Vegetarian diet – A diet that does not include meat or fish, but that does include animal products like eggs, cheese, and dairy products.

Check your understanding



- 1 How would you define “environmentally sustainable food production”?
- 2 This paper explores three environmental impacts of food production: greenhouse gas emissions, land use, and water use. What are some other environmental impacts of food production that we should be aware of?
- 3 Give three examples of how specific production practices and conditions would impact food’s environmental footprint.
- 4 Why do you think eating beef and dairy from cows that are fed corn and soy has such a high environmental impact compared to eating vegetables?
- 5 Think about what you eat on a typical day. How could you change your diet, specifically, if you wanted it to be more environmentally sustainable?
- 6 Does reducing meat intake always make your diet healthier?