Climate Impacts of High-Protein Diets

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Introduction

With the increasing prevalence of high-protein diets, whether from overconsumption or for improved athletic performance, production and transportation costs are undoubtedly going to increase. Included in those costs are the environmental costs from increased greenhouse gas emissions. In this project, those environmental costs were evaluated using a life cycle assessment framework, and greenhouse gas emissions for high-protein diets were calculated. This study set out to answer the following questions:

- **What are the climate impacts of high protein diets?**
- **What protein foods will have the least impact on the climate?**

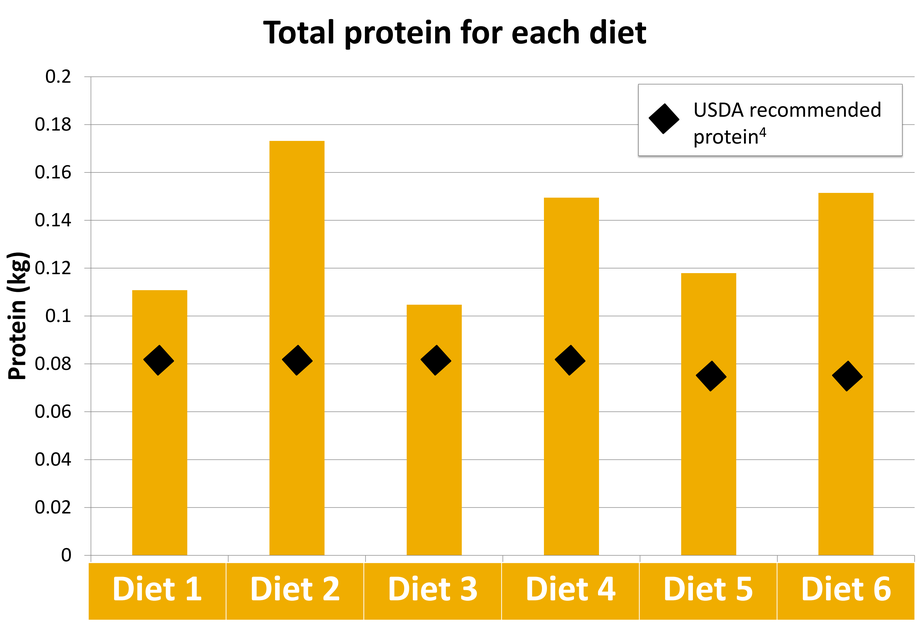
Methodology

My first step was to compile per kilogram greenhouse gas emissions for 31 different foods (listed below) using production and transportation emission data from foodemissions.com[1]. The 31 different foods included representative foods from each food group. From there, I compiled multiple average daily diets (calculating kilograms of each food) to analyze for protein content and greenhouse gas emissions from production and transportation. The different diets were based on USDA recommendations and calorie and protein intake data from the USDA's Agricultural Research Service's survey, *What we eat in America*[2].Three different diets were constructed, the first being USDA recommendations for daily diets, the second a typical diet for a 20-29 year-old male, and the third a typical diet for a 70+ year-old female. High-protein food sources (meats, beans, nuts) for each of the diets were doubled in the high-protein version of those diets. I then calculated production and transportation emissions (with the assumption that the food would travel 1,000 miles) for each component of each diet, and came up with total kilograms of greenhouse gases emitted for each diet.

Considerations for organic vs. conventional foods and restaurant foods were excluded from the study.

Foods used (kg protein per kg food)

Dry Beans (.24)*	Apples (.00)	Peanuts (.17)*
Tofu (.08)*	Bananas (.01)	Butter (.01)
Cheese (.25)	Grapes (.01)	Vegetable Oil (.00)
Milk (.03)	Flour (.10)	Broccoli (.03)
Yogurt (.05)	Rice (.03)	Cabbage (.01)
Salmon (.25)*	Beef (.17)*	Carrots (.01)
Shrimp (.23)*	Chicken (.31)*	Lettuce (.01)
Tuna (.24)*	Eggs (.10)*	Potatoes (.03)
Oranges (.01)	Pork (.27)*	Tomatoes (.01)
Peaches (.01)	Turkey (.22)*	
Strawberry (.01)	Almonds (.21)*	**denotes protein food*



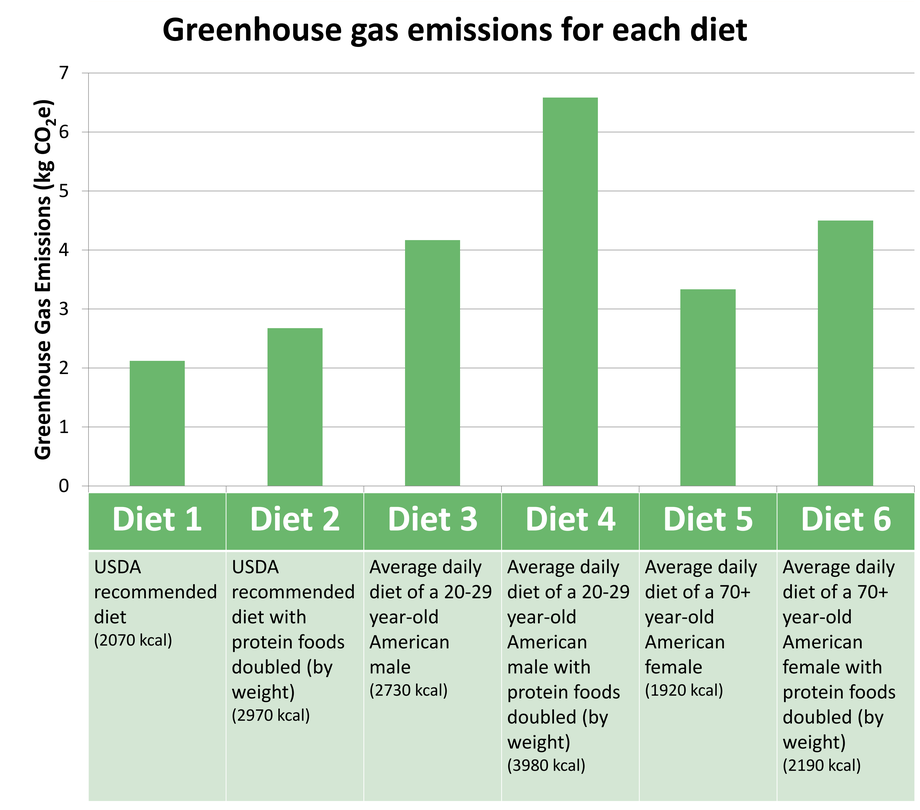


Figure 1: Diets were constructed based on USDA recommendations and calorie and protein intake data from the USDA's Agricultural Research Service's survey, *What we eat in America* [2]. Each diet was compiled using 31 different foods that were representative of each food group. Emissions for each diet were calculated using the data on foodemissions.com[1].

Results and Analysis

After evaluating greenhouse gas emissions for the three different diets, it was found that on average, kilograms of GHGs increased by 40 percent. The smallest increase was in the USDA recommended diet, which did not include beef.

Depending on the source of the protein, it is entirely possible to increase protein in our diets without drastically impacting the environment. Out of the protein foods, beef had the highest greenhouse gas emissions, and thus had the largest impact when used as a source of protein. Per kilogram emissions for beef came out to 16 kg, while for peanuts (another high-protein food), the emissions per kilogram were 1 kg. Peanuts are also a more efficient source of protein, with more than 8 times as many grams of protein per gram of food than beef.

Conclusions

The questions listed in the conclusion were answered in my research:

- High protein diets can increase greenhouse gas emissions by an average of 40 percent. Food production accounts for up to 30 percent of the world's emissions[3]. Increasing that by 40 percent would have a huge impact on the state of our climate.
- As was discussed in the analysis, meats have the most impact on climate change as compared to sources of protein such as nuts and beans. Low-impact, high-protein diets can be achieved by minimizing meat content of the diet

In conducting this research, it was found that the typical American consumes much more protein than is necessary. An interesting area for further study would be to investigate just how much. Studying climate impacts of organic foods would also be an interesting area for further research.

References

[1] "Food Carbon Emissions Calculator by CleanMetrics." *Food Carbon Emissions Calculator by CleanMetrics*. N.p., n.d.
[2] U.S. Department of Agriculture, Agricultural Research Service. 2008. Nutrient Intakes from Food: Mean Amounts and Percentages of Calories from Protein, Carbohydrate, Fat, and Alcohol, One Day, 2005-2006.
[3] Vermeulen, Sonja J., Bruce M. Campbell, and John S.I. Ingram. "Climate Change and Food Systems." *Annual Review of Environment and Resources* 37 (2012): 195-222.
[4] U.S Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans*, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010.

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