Food and Nutrition Sciences, **2011, 2, 482-485**
doi:10.4236/fns.2011.25069 Published Online July 2011 (http://www.SciRP.org/journal/fns)

The Effect of Dietary & Transportation Choices on Climate Change

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Received April 21st, 2011; revised May 26th, 2011; accepted June 3rd, 2011.

ABSTRACT

Goals: *Many health organizations encourage people to use human-powered transportation "because it is better for your health and the environment". However, the greenhouse gas* (*GHG*) *emissions produced to iso-calorically replace the energy expended in human transportation could make this potential environmental benefit incorrect*; *our study tests this truism. Methods*: *Holding other* (*e.g., electricity consumption, consumer goods, household size*) *sources of GHGs constant, we varied transportation mode* (*walking, biking, or driving*) *and diet type* (*to reflect differing % of calories from meat, as calories from meat require higher GHG production*). *Principle Results*: *The pounds of carbon dioxide emitted per mile by vegan vs beef-eating bicyclists, walkers, and car drivers are*: *vegan bicyclist* 0.1 *lbs/mile, vegan walker* 0.3 *lbs/mile, beef-eating bicyclist* 0.4 *lbs/mile, car driver* 1.1 *lbs/mile, beef-eating walker* 1.3 *lbs/mile. Major Conclusions*: *Our data suggest that if you eat a very high meat diet, walking may be worse for the environment than driving. Since eating less meat is healthier, and walking and biking are also clearly typically better for an individual's health than is driving, we encourage people to make it more likely that walking and bicycling are also better for planetary health, by eating less meat and then using human-powered transportation.*

Keywords*: *Nutrition, Exercise, Food Choice, Greenhouse Gas, Climate Change

1. Introduction and Purpose

There have been multiple scientific reports [1,2] on the strong relationships between human dietary choices and climate change, and transportation choices and climate change, but few have examined the interrelationship between human dietary choices, transportation choices, and climate change. While people may change their diets to promote personal health, or change their car to promote planetary health, people rarely consider changing their diets to make their transportation choices better for planetary health. In fact, both scientists [3,4] and environ- mental activists [5] routinely praise the merits of human-powered transportation as a greenhouse gas (GHG) saver, without considering the GHG costs of fueling human-powered transport.

The average Canadian [6] consumes 56 kgs of (carbon-intensive [7]) red meat per year, a much higher level than that encouraged by health authorities, and an amount that has changed little in the last several years [6]. Our study tests and demonstrates the extent to which dietary choices (such as selecting red meat versus other, less carbon-intensive foods for calories), and transportation choices (biking, for example, being a more efficient human transport method than walking) together affect greenhouse gas emissions.

2. Methods

We reviewed the literature on the GHG effects of dietary and transportation choices. As a complementary data source, we also derived new data from national-level governmental statistics, [6] entering data into web-based software for identification of personal GHG contributions (carbon calculators), reflecting the consumption patterns of low-, average-, and high-consuming North Americans. We reviewed the top 30 web-based GHG calculators, and included in our analysis any calculators not already listed, but recommended by expert sources (such as the Suzuki Foundation).

From these lists we identified the few calculators that included food in their GHG determinations, and also were reliably sourced: those from the Nature Conservancy [8], the World Wildlife Foundation [9], and the

UC Berkeley Institute of the Environment [10]. We calculated the GHG emissions of various forms of transportation, depending on the diet of the person being transported, holding non-food (e.g., transportation, household heating, consumer goods) sources of GHGs constant, and isocalorically changing diet to reflect high, average, low, and no-meat consumption.

3. Results

Figure 1 shows the GHG emissions of various forms of transportation, varying the diet of the person being transported. In the carbon calculators we examined, food consumption was rarely even considered. When food consumption was included, the relative calculated contributions of high vs. average meat consumption ranged from 2% to 6%, depending on the carbon calculator used.

Driving 1 mile in a 21 mpg vehicle (with the U.S. fleet averaging 19 miles/gallon creates 1.1 pounds of CO_2 per mile travelled [11]. According to the American Heart Association [13], a 150 pound person walking at 3 miles/hour consumes 320 calories/hour (107 calories/mile), and bicycling at 12 miles/hour consumes 410 calories/hour (34 calories/mile).

Biking 1 mile takes 34 calories (2010) [13]. Since there are 88 calories/126 gms of tofu [12], if those 34 calories come from tofu, this equals 48.7 gms of tofu, or 0.107 pounds of tofu. At 0.81 lbs of CO_2 created/lb of tofu consumed [14], this equals 0.087 pounds of CO_2 to bike a mile. Since there are 259 calories/100 gms of ground beef [12], if those 34 calories come from beef, this equal 13.1 gms of beef, or 0.029 pounds of beef. At 14.8 lbs of CO_2/lb of beef [7], this equals 0.428 pounds produced of CO_2 to bike a mile.

Walking 1 mile takes 107 calories (American Heart Association 2010). Since there are 88 calories/126 gms of tofu [12], if those 107 calories come from tofu, this equal 153.2 gms of tofu, or .34 pounds of tofu. At 0.81 lbs of CO_2/lb of tofu [14] this equals 0.27 pounds of CO_2 produced to walk a mile. Since there are 259 calories/100 gms of ground beef [12], if those 107 calories come from beef, this equals 40.8 gms of beef, or .09 pounds of beef. At 14.8 lbs of CO_2/lb of beef [7], this equals 1.33 pounds produced of CO_2 to walk a mile.

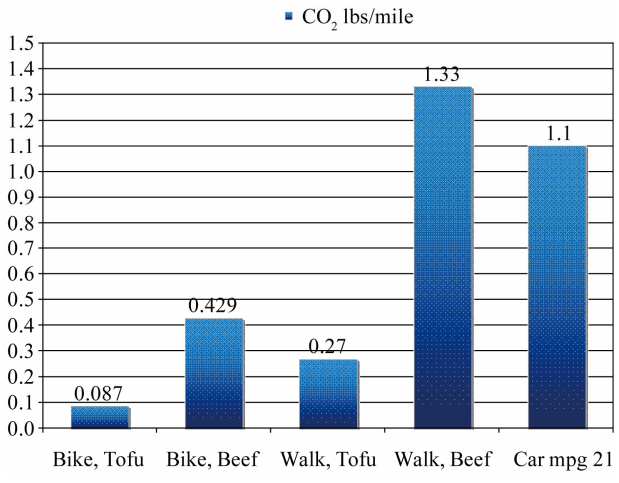

Figure 1. CO_2 pounds emitted per mile by tofu-eating vs. beef-eating bicyclists, walkers, and car drivers.

The pounds of carbon dioxide emitted per mile by vegan vs. omnivorous bicyclists, walkers, and car drivers are therefore: tofu-eating bicyclist 0.1 lbs/mile, tofu-eating walker 0.3 lbs/mile, beef-eating bicyclist 0.4 lbs/mile, car driver 1.1 lbs/mile, beef-eating walker 1.3 lbs/mile. Of course more-efficient or higher-occupancy vehicles emit fewer pounds of CO_2 per person-mile of transportation.

4. Discussions

There are many recommendations regarding ways to decrease carbon emissions, but food consumption, and the increase in that consumption with physical activity is almost always disregarded in such recommendations. A point consistently unaddressed by recommendations to walk or bike instead of driving to reduce GHGs, is that bicycling and walking are responsible for the creation of GHG emissions, because the calories burnt in exertion are usually isocalorically replaced. For example, in the important article "Carbonless footprints: promoting health and climate stabilization through active transportation" [3], there were no estimates of the emissions produced by active human transportation, not even in the limitations section [3]. We believe that this is most likely attributable to an oversight by people who do not consider the complexity of food related-issues when thinking about improving the environment. In fact, food accounts for 22% of global greenhouse gas (GHG) emissions, and 18% of that 22% is attributable to livestock [15].

There are a few other interesting common assumptions about food and the environment that warrant more consideration. One concerns organic farming, often assumed to be "good for us and good for the environment". In actuality, organics aren't always a clear "win-win", as many factors play into the environmental costs of organic farming. While most reputable studies reported organic farming to be environmentally beneficial overall, not all do [16]. For example, cows eating organic fodder were found in one study to produce more methane (CH_4) than those fed conventional diets, with methane being a GHG 20 times more potent than CO_2 [17]. And the absence of pesticides, the smaller-scale plantings, and other characteristics of organic farming may create less opportunity for densely cropped plants, and typically require more labor-intensive farming (therefore requiring more carbon-containing foods be fed to the laborers). However,

any variables with negative GHG effects may be outweighed by the fact that the absence of pesticides allows soil to be more carbon-absorbing (and likely biodiversity-promoting, and human health-enhancing). These are important areas for future research, as there are few conclusive data on these topics [15]. Another related issue is assumptions about eating local diets, although food transportation averages only 11% of the GHGs required to bring food to the typical North American table (with food transportation therefore causing 2.4% of total GHGs) [18]. Because transport is only 1/9th of agriculture's GHG, becoming a locavore reduces fewer GHGs than does avoiding red meat [18]. A final small point to be made from our findings is that it is much more environmentally-friendly if one is trying to lose weight to eat fewer calories than to perform nontransporting exercise.

We recognize that actual diets are neither exclusively tofu, nor exclusively meat, and that there are other uncounted externalized costs of gasoline use (e.g., toxic spills, money for military protection of oil-rich areas, the embodied energy of vehicles, political suppression associated with oil exploration) and of exercising (e.g., GHGs emitted when washing clothes, or buying exercise equipment), that people burn small amount of calories when at rest in a car, that people do not necessarily isocalorically replace calories, and that there may be other small confounders of our data.

5. Conclusions

Our data suggest that if you eat a very high meat diet, walking can actually be worse for the environment than driving. In terms of personal health and broader policy implications, since walking and bicycling are typically considerably better for human health than is driving, we would encourage people to also make walking and bicycling better for planetary health, by eating less meat and then using more-efficient human-powered transportation. To be clear, we do not intend to encourage driving instead of human-powered transportation—we recognize that most omnivore diets are more efficient than this extreme example, and that exercise is essential for human health. However, these findings should stimulate a more sophisticated consideration of the common encouragement to use human-powered transportation to lessen people's carbon footprint.

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