

# Food as fuel: investigation of the flammability and heat produced of household foodstuff

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## Introduction

- Hypothermia represents a greater threat to life than starvation or dehydration depending on environmental conditions
- The goal of the study was a preliminary investigation into the ideal foodstuff to serve as a fuel source

## Methods

- 20 foods were chosen based on availability, likelihood of being present in a typical household or taken on an outdoors trip, and likelihood of flammability
- Testing conducted during a single day:
  - 31.1° C
  - 50% humidity
  - 2pm wind speed
- 10g of food placed on a ceramic tile
- Aluminum can filled with 100ml of water placed 4.4cm above the tile
- Three attempts were made to ignite the food with a match
- If the food did not ignite after three matches it was determined to be non-flammable
- If the food ignited, the following were measured:
  - Number of matches required for ignition
  - Length of time the food burned
  - Heat produced using  $Q = mc\Delta T$  with 4.182 J/g°C as the specific heat capacity of water
  - Peak temperature of the burning food
- Data analyzed using Microsoft Excel

## Results

- 9 of 20 foods tested ignited
  - All (4) chip-type foods ignited
  - Two out of four granola/protein bars ignited
  - A chip-type food burned the longest and produced the most heat
  - No flammable food required more than two matches to ignite
- Nutritional content did not appear to affect flammability
  - Non-flammable foods tended to be less calorically dense and contain more protein
  - Of flammable foods, those with less saturated fat tended to reach higher temperatures and burn longer

## Discussion

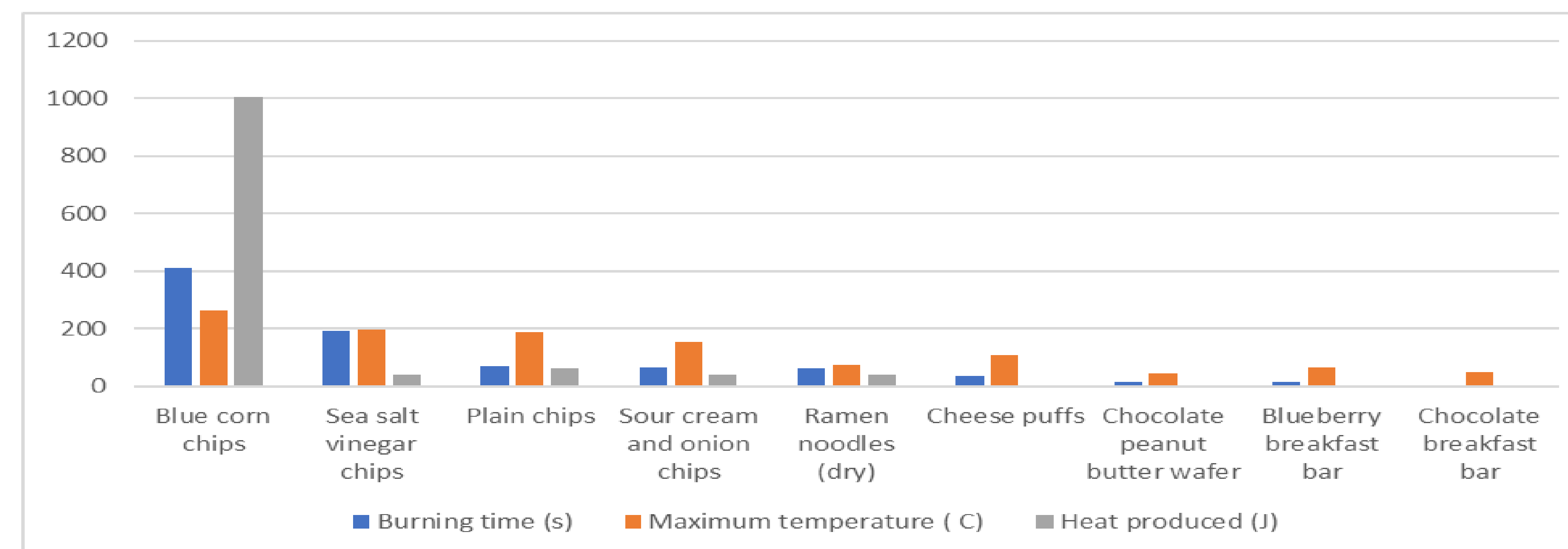
- Nutritional content did not appear to have a significant impact on flammability of foods
- Chip-type foods all ignited and burned the longest and produced the most heat
- Limitations include use of single trial for each food, small selection of food types

**Table 1.** Nutritional characteristics and results data of flammable food

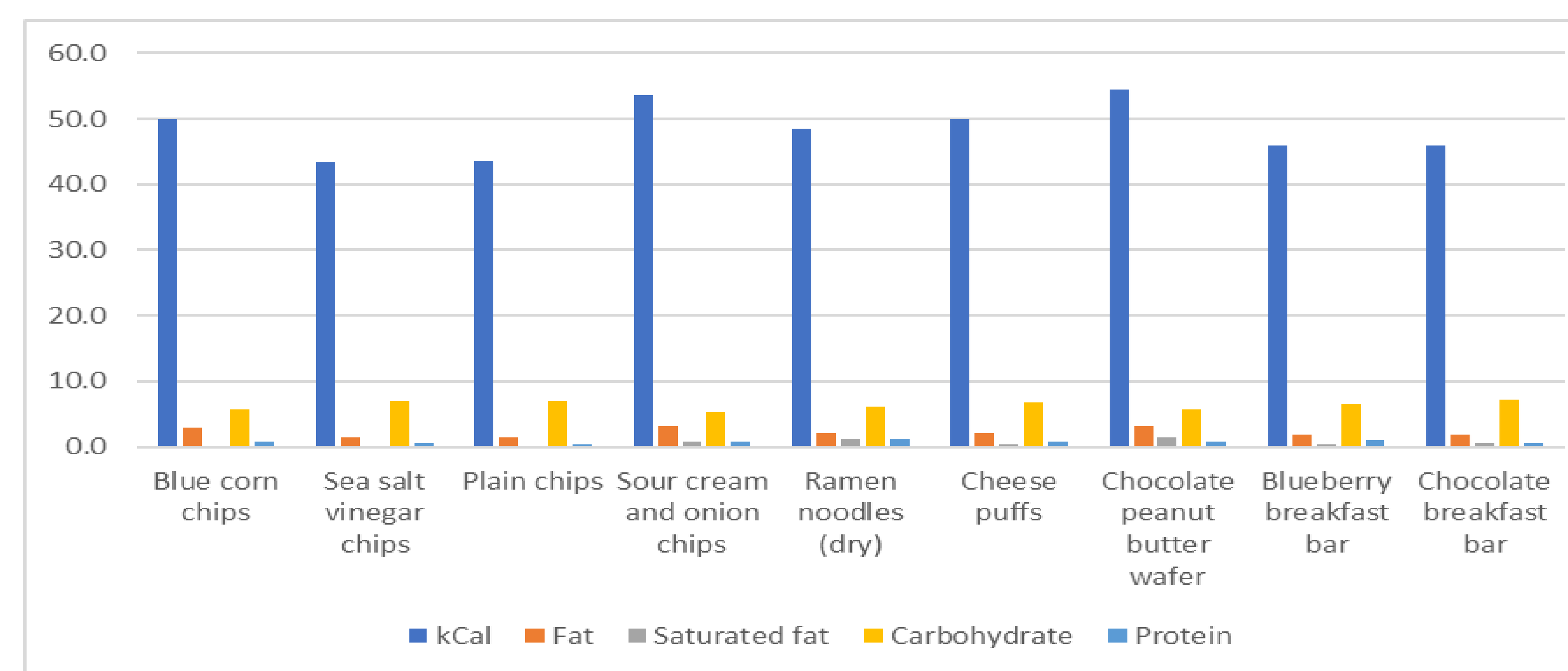
Food	kCal	Fat (g)	Saturated fat (g)	Carbohydrate (g)	Protein (g)	Matches used	Burning time (s)	Maximum temperature (°C)	Temperature change water (°C)	Heat produced (J)
Blue corn chips	50.0	2.9	0.2	5.7	0.7	1	412	265	24	1003.7
Sea salt vinegar chips	43.3	1.5	0.0	7.0	0.7	1	192	198	1	41.8
Plain chips	43.5	1.5	0.0	7.0	0.4	1	71	187	1.5	62.7
Sour cream and onion chips	53.6	3.2	0.7	5.4	0.7	1	67	155	1	41.8
Ramen noodles (dry)	48.5	2.1	1.2	6.1	1.2	2	64	75	1	41.8
Cheese puffs	50.0	2.1	0.4	6.8	0.7	2	38	107	0	
Chocolate peanut butter wafer	54.4	3.2	1.4	5.6	0.7	2	17	45	0	
Blueberry breakfast bar	46.0	1.8	0.4	6.6	1.0	1	17	65	0	
Chocolate breakfast bar	46.0	1.8	0.5	7.2	0.6	2	5	50	0	

Non-flammable foods: plain and sweet crackers, potato and white flour, granola bar, banana protein bar, peanut butter chocolate nougat bar, peanut butter chocolate candy, pepperoni, cheddar cheese, peanut butter

**Figure 1.** Results data of flammable food



**Figure 2.** Nutritional content of flammable food



Fat, saturated fat, carbohydrate, and protein content in grams

## Take Home Points

- 'Chip'-type foods were most likely to ignite, burned the longest, and produced the most heat
- Chips may represent useful tools for starting and evening fueling cooking and heating fires
- May be prudent to include chips in emergency supply kits and when going into the wilderness