

THE CARBON FOOTPRINT OF AN AVERAGE FOOD BASKET

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A study was conducted to assess the link between typical food baskets for households with different income levels and their potential carbon footprint. Other studies adopt a value chain approach when assessing the carbon footprint by looking at transportation, energy source used, how many members are in a household, income, food items consumed, etc.

This study confirmed the golden thread in most literature, which stated that “*carbon footprints increase with increasing incomes*” (Druckman & Jackson, 2016) but that other factors, such as household size and composition, rural/urban area, diet and type of energy supply used, also have an effect on the overall carbon footprint of a household.

Moreover, it was found that the average carbon footprint of a household comprises of three components, namely; transportation, housing and food. Focusing only on the food component, the literature indicates that the diet has a significant impact on the individual's carbon footprint (Centre for Sustainable Systems at the University of Michigan, 2021). Other articles indicate that meats are the higher emitting food group (56%), followed by dairy (18%) and beverages, and fish and seafood (6% for each food category) (Barends-Jones, 2022).

The lower food emitting groups were fruits and grain products (both food groups emitting around 2%), followed by vegetables and eggs (both groups emitting around 3% of total food emissions in the human diet). This shows that when lower emitting food groups (fruits and vegetables) are

consumed, the lower the food carbon footprint will be for households or individuals (Eini-Zinab, et al., 2021).

The study done by *Eini-Zinab, et al (2021)* also found that a healthy food basket consists of more plant-based foods, like vegetables and fruits, as well as dairy products. This statement is important, as the aim of the study is not only to identify lower-emitting foods but also to take into consideration a nutritious and sustainable food basket that is also affordable.

In this study, the aim was to determine the effect of household income and typical food basket on food carbon emission among different households in the City of Cape Town using secondary data obtained in a study entitled “The State of Household Food Security in Cape Town, South Africa” about different household income groupings (Crush, 2018).

This information was adapted to form three main household income categories (see Table 1). Using the BFAP (2019) income segments grouping by food types, three typical food baskets based on household income were identified (see Table 2). Tables 1 & 2 were integrated to form Table 3.





TABLE 1: INCOME CATEGORIES

Income categories	Household income group (monthly income)
Low Income	R0 - R7 500
Middle Income	R7 501 – R19 270
High/affluent income	More than R19 271

Source: Own Compilation (2021), BFAP (2019)

According to BFAP (2019), the top five food expenditure items are chicken, beef, maize meal and bread for the low and middle-income segments and beef, chicken, milk, sheep meat

and sugar-rich food for the affluent segment. Table 2 highlights these food items for the different income groups.

TABLE 2: TOP FIVE FOOD EXPENDITURE

Variable	Low-income segment	Middle-income segment	High/affluent segment
Top 5 food expenditure items	Chicken Maize meal Brown bread Beef	Chicken Beef Maize Meal Brown bread White bread	Beef Chicken Milk Sheep meat (lamb) Sugar-rich food (chocolate)

Source: BFAP (2019)

Table 3 shows the top food items that fall in the different income groups' food expenditures. The data used is from the international food carbon calculator and the figures for each food item in the calculator are based on global averages per serving and are on par with the United Nations Intergovernmental Panel on Climate Change (IPCC). A life cycle analysis approach was used in the calculator and it takes into account land use, farm, animal feed, processing, transport, retail and packaging (Neufeld, 2020).

The assumption made for the study is that each food item is consumed only once a day. Chicken and beef are the common food type that occurs in all three different income segments. The lowest emission from the different food items is bread (0.058 kgCO₂/serving) followed by milk (0.63 kgCO₂/serving) and chicken (1.36 kgCO₂/serving). Comparing the meat types (beef, chicken and lamb) chicken is the meat with the lowest emissions and beef the highest emitter.

TABLE 3: ANALYSIS OF POTENTIAL FOOD BASKET CARBON FOOTPRINT PER INCOME GROUP

Low-income segment		Middle-income segment		Affluent segment	
Food item	kgCO ₂ /serving	Food item	kgCO ₂ /serving	Food item	kgCO ₂ /serving
Chicken	1.36 kg	Chicken	1.36 kg	Beef	7.73 kg
Maize meal	1 kg ¹	Beef	7.73 kg	Chicken	1.36 kg
Brown bread	0.058 kg	Maize meal	1 kg ²	Milk	0.63 kg
Beef	7.73 kg	Brown Bread	0.058 kg	Sheep meat (lamb)	4.33 kg
		White bread	0.058 kg	Sugar-rich food: Chocolate (milk) Chocolate (dark)	1.03kg 1.49kg
Total	9.15 kgCO₂e/ servings per day³	Total	9.15 kgCO₂e/ servings per day⁴	Total	15.54 kgCO₂e/ servings per day⁵

Source: Stylianou, et al. (2019); Own Compilation (2022); BFAP (2019)

The household income study looked at 2 500 households throughout the City of Cape Town and had four household classifications for the household groupings. Female-centred⁶, male-centred⁷, nuclear⁸ and extended households⁹. (Table 4 gives a summary of the household categories and the percentage of participants for the different household income groups.

Female-centred households compared to the other household categories are earning the least and represent the low-income segment with 75.9%. Focusing on the affluent-income segment, female-centred households are only representing the population by 7% compared to the other household categories.

TABLE 4: HOUSEHOLD CATEGORIES AND THEIR PERCENTAGE SHARE TOWARDS THE DIFFERENT HOUSEHOLD INCOME GROUPINGS

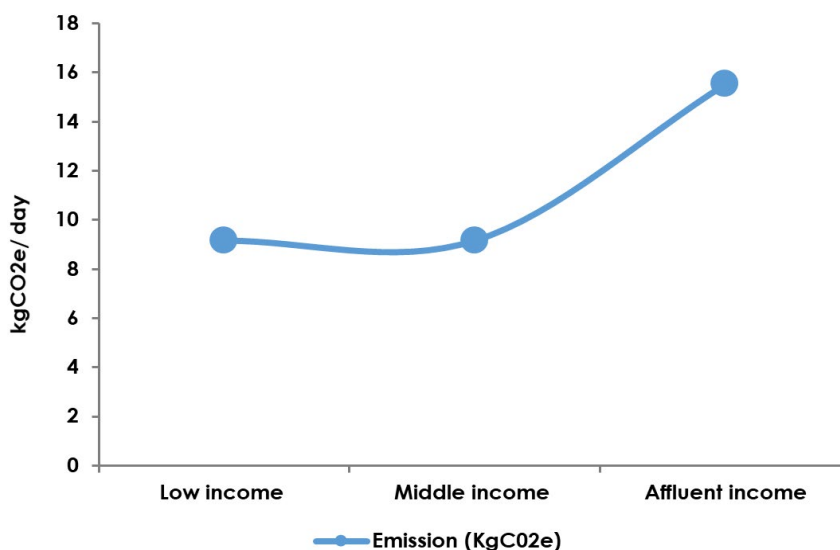
	Female-centred household	Male-centred household	Nuclear household	Extended household
Low-income segment	75.9%	59.2%	50.3%	55.4%
Middle-income segment	17.1%	26.5%	20.6%	22.8%
Affluent-income segment	7%	14.4%	29.1%	21.8%

Own Compilation (2023) based on the "The State of Household Food Security in Cape Town, South Africa" study by Crush et al. (2018)

Figure 1 shows that the consumption of food items in the lower and middle-income segments is generating lower emissions than the affluent income segment¹⁰.

The assumption is made that lower and middle-income groups' emissions are the same, but this is due to the calculation method used.

FIGURE 1: FOOD BASKETS' CARBON FOOTPRINTS FOR LOW, MIDDLE AND AFFLUENT HOUSEHOLDS



Source: Own compilation based on Stylianou, et al. (2019); Own Compilation (2022); BFAP (2019)

In conclusion, the study should be expanded to represent the whole Western Cape. Primary data should be collected and the lifecycle analysis method used to calculate the carbon emissions of food items. Also, a carbon emission database should be developed for South Africa, especially for food carbon; the mapping of carbon emissions across the value chains of food is of importance.

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- ¹ This figure is GHG emissions per 1kg produced – maize crop
- ² This number is GHG emissions per 1kg produced – maize crop
- ³ For the lower income quintile, maize meal is excluded from the total, as the emission given was for 1kg of maize crop produced and not the value-added product, which is maize meal per serving. The reason is that maize meal is not globally consumed; therefore, it is not recognised in this calculator.
- ⁴ Only one bread loaf type is accounted for in the calculation and the maize meal figure is excluded from the total.
- ⁵ Dark chocolate is used for the total calculation.
- ⁶ Female-centred household refers to a household where the female is the head of the household, there is no spouse or partner, and this household may include children and relatives (Crush, et al., 2018).
- ⁷ The male-centred household is just the opposite of the female-centred household, meaning the male is the head of the household and all the other components are the same.
- ⁸ The nuclear household, on the other hand, is also called a basic social unit, meaning a couple, consisting of a head of the household and a spouse or partner, and may include children.
- ⁹ The extended household also consists of a couple (a head of the household with a spouse or partner), which may also include children, as well as other relatives and non-relatives (Crush, et al., 2018).
- ¹⁰ Note that only the top food items were looked at to measure the emissions. Also, the method of cooking these food items was not taken into consideration.