**How Mean BMI has Changed Overtime in Select Countries**

Taylor Jackson

MGT 581

Dr. Kimberly Ford

Colorado State University – Global Campus

January 16, 2022

**Abstract**

In an effort to reduce obesity rates worldwide (and the correlated health issues), this research project analyzes data on the mean body mass index (BMI) of several populations across the world. This research project references data provided by the World Health Organization on the mean BMI of populations around the globe. This data is analyzed using quantitative research methods and the tools SAS and Tableau. The results of this research project address the question, how has mean BMI changed for specific countries in recent years, specifically countries that have decreased ultra-processed food/drink consumption. The analysis shows there has been an increase in mean BMI for North American and Australian populations from 2014-2016 despite a decrease in ultra-processed food and drink sales (in these select countries). However, it is identified that there is a need for further research before a strong conclusion can be made regarding the correlation between mean BMI and ultra-processed food and drink consumption.

Table of Contents

Introduction 4

Organization Review 4

Objectives 5

Overview of Study 5

Research Hypothesis 6

Literature Review 6

**Research Design**10  
Methodology 10  
Methods 11  
Limitations 11  
Ethical Considerations 12

Findings 13

Conclusion 17

Recommendations18

References19

**Introduction**

The health of the world’s population has been in question for quite some time, especially when considering the improvements of medicine and the productivity of food. While advancements in medicine have helped humans live longer, the development and availability of processed food is argued to be detrimental to overall population health. In an effort to reduce obesity rates worldwide (and the correlated health issues), the World Health Organization has gathered data on the mean body mass index (BMI) of several populations across the world. This data set will be utilized to answer the question of how mean BMI has changed overtime in certain countries. The purpose, overview, and methodology of this research project are detailed below. With this understanding, a conclusion will be drawn regarding the mean BMI of populations in North America and Australia, specifically how it is related to processed food/drink consumption and overall health.   
**Organization Review**

The World Health Organization (WHO) was founded in 1948 within the United States and is built to champion health and a better future for all as noted in their article *About WHO* (World Health Organization, n.d.). More than 8000 persons work with the World Health Organization to provide expertise. This includes doctors, managers, scientists, and others that help both define and promote health guidelines and practices. The organization operates out over 150 different locations across 6 different regions (World Health Organization, n.d.). With so many persons and locations, the World Health Organization is dedicated to not only understanding health issues in the United States and beyond, but what factors affect health and how the health of all can be improved. In the spirit of these values, the dataset and intent of this project is designed to understand how mean BMI not only affects health but how it is changes and what powers are behind those changes.

**Objectives**

The focus of this analysis will be determining changes mean BMI in certain countries and groups (age or gender for example). To further demonstrate the importance of this analysis, one must understand what BMI is.

BMI is a useful measure of overweight and obesity. It is calculated from your height and weight. BMI is an estimate of body fat and a good gauge of your risk for diseases that can occur with more body fat. The higher your BMI, the higher your risk for certain diseases such as heart disease, high blood pressure, type 2 diabetes, gallstones, breathing problems, and certain cancers. (*U.S. Department*., n.d, para 2)

If it is shown that the mean BMI has increased over the last several years (as of 2016) in select countries, then this data could help prove that the advancements made in food production have increased obesity and other health risks within the general population.

**Overview of Study**

Knowing that BMI can affect one’s health indicates a need for continued review in itself. If it’s an indicator of cardiovascular health and risk of diabetes, organizations such as the World Health organization and other healthcare companies need to understand not only the effects of higher mean BMIs in populations around the world but what is affecting it as well. For example, millions of men and women are considered obese (highest BMI) worldwide (Finucane et al., 2012, para. 3). How can these cases be mitigated and prevented and therefore overall population health increased? This is the purpose of this research project along with those that are similar. By studying the changes in mean BMI overtime in select areas, especially in correlation with diet, an understanding of what causes higher BMIs can be built. This understanding can help the healthcare industry improve the lives of millions for decades to come.

**Research Hypothesis**

It is theorized that countries with higher Health Star Rating system (HSR) ratings and decreased ultra-processed food and drink consumption should show decreasing mean BMI trends overtime. Whereas countries with lower HSR ratings and increased ultra-processed food and drink consumption should show increasing mean BMI trends overtime. Based on the literature review analysis provided below, Western Europe, American, and Australia have shown higher HSR rates and lower ultra-processed food and drink sales from 2014-2016. This raises the research question, how has mean BMI changed for specific countries in recent years, specifically countries that have decreased ultra-processed food/drink consumption? Based on the provided literature review, the consequences of higher mean BMI for a population, and the outlined research question the following hypothesis is defined.

* **Alternative Hypothesis:** The mean BMI of North American and Australian populations has remained the same or decreased through 2014-2016 because of a decrease in ultra-processed food and drink consumption.
* **Null Hypothesis:** The mean BMI of North American and Australian populations has increased 2014-2016 despite a decrease in ultra-processed food and drink consumption.

**Literature Review**

As noted, the increase of one’s BMI increases the chances of health issues such as cardiac disease and diabetes. Which makes the increasing mean BMI of populations across the world is an important area of study. For example, a study published in the Lancet (Finucane et al., 2012) found that “In 2008, an estimated 1·46 billion adults (1·41–1·51 billion) worldwide had BMI of 25 kg/m2 or greater, of these 205 million men (193–217 million) and 297 million women (280–315 million) were obese”. They noted that both genders saw in increase in mean BMI each decade from 1980 to 2008 (Finucane et al., 2012, para. 3). This study also identified that there are limited studies of long-term trends of BMI and that updated data is needed in them. Furthermore, this study highlights that “Interventions and policies that can curb or reverse the increase and mitigate the health effects of high BMI by targeting its metabolic mediators, are needed in most countries” (Finucane et al., 2012, para. 4).

The National Institutes of Health outlines this in their article linking processed food consumption to weight gain (and therefore increased BMI). This article outlines a study of 20 individuals (10 men and 10 women) where participates ate either a highly processed diet or a minimally processed diet for two weeks –Both diets contained meals with the same number of calories, sugars, fiber, fat, and carbohydrates (*U.S Department*, 2019, paras. 3-4). However, participants could eat however little or much they wanted. The result was that those on the ultra-processed diet gained about 2 pounds on average and those on the minimally processed diet lost about the same amount (*U.S Department*, 2019, para. 6). In conclusion, these studies further solidify that increasing mean BMI’s is not only a prevalent issue across the world but is related to diet.

To continue demonstrating this correlation, a research study published in Obesity Review provides useful insight into the health profile of packaged food available to the public. This study compared the healthiness of packaged foods in 12 countries based on the HSR (Dunford et al., 2019, p.1). The study concluded that “The UK, USA, Australia and Canada ranked highest for overall nutrient profile (HSR2.74–2.83) and India, Hong Kong, China and Chile ranked lowest (HSR 2.27–2.44)” (Dunford et al., 2019, p.1). This means that the UK, USA, Australia, and Canada have packaged food with better nutrient levels (“healthiness”). In another study published in Obesity Reviews, the consumption of highly processed foods across 80 countries is correlated with average mean BMI. This study will be more useful than the first in defining an effective hypothesis because it considered what the population is buying compared to what is available.

Overall, this study determined that for every standard deviation increase in ultra-processed drink consumption, mean BMI increases by 4.62 lb.ft2 (pound square foot) in men and 1.70 lb.ft2 in women (Vandevijvere et al., 2019, p.1). Compared to ultra-processed food consumption, in which mean BMI increases by 7.49 lb.ft2 in men and is insignificant in women (Vandevijvere et al., 2019, p.1). When correlating this conclusion with the sales trends shown in Figure 1, one may expect that mean BMI has begun to decrease in Western Europe, Australia, and North America since the sales per capital rates have decreased.

Figure 1  
Processed Food and Drink Consumption Overtime by Country

**Graphical user interface, chart, application

Description automatically generated**

*Note*. Change in annual total volume sales (kg/capita/year) of ultra-processed food and drink process) by region (2002‐2016) (Vandevijvere et al., 2019, p.3)

**Research Design**

There are still key components that need to be outlined and reviewed to ensure results are comprehensive and valuable. The data utilized for this project is quantitative and therefore provides straightforward and numerical values to complete the analysis. As a result, research methodologies and methods are focused on analyzing the data through a series of tests in SAS and then visualizing the results in Tableau. The methodology, method and tools, challenges, and ethical considerations related to this research project are outlined in further detail below.

**Methodology**

The methodology of this project is rather simple as the survey data has already been collected. Furthermore, this data is consistent, from a reliable source, and easy to understand. As a quantifiable dataset, it provides straightforward and numerical values to complete the needed analysis. Despite these simplicities, there are still key aspects that need to be understood regarding the dataset and the research project to ensure the results are comprehensive and valuable. The first element of a research project is understanding the question(s) being asked. This element also requires that the researcher builds a strong understanding of the data and what value it has. In this case, the question has been defined as understanding how the mean of BMI of select countries has changed overtime.With the research question and hypothesis defined for this project, the research approach can be outlined.

This includes an overview of the research methodology and tools. The data is characterized by the individual’s location, sex, age, recorded year, and then their mean BMI. As a result, research methods are quantitative by design. As outlined by O’Leary (2019) quantitative research methods need to include decisions on the variables and population needed, how change is assessed, ethics, and environmental control. In this case, the dependent variable is defined as the mean BMI and the independent variable is time (years) and location (country).

**Methods**

To complete the analysis of the world’s mean BMI overtime the tools SAS and Tableau will be utilized. Within SAS, summary statistics are utilized on filtered data. In this case, data for each year, gender, and country is segmented and the mean is calculated. This provides insight into the mean of each country for every year and will allow a conclusion to be drawn regarding the alternative hypothesis that the mean BMI of North America and Australia has remained the same or decreased through 2014-2016. It’s important to note that males provide the most valuable insight into mean BMI relative to ultra-processed food consumption in select countries (based on the findings outlined in the literature review above) and therefore additional summary statistics and charts will be created for only Males in select countries. Tableau will then be used to summarize the findings in comprehensive and easy to consume visualizations. Overall, the methods utilized in this project are focused on isolating the needed results and deciding whether ultra-processed food and drink consumption does affect the mean BMI of selected countries.

**Limitations**

While the use of preexisting survey data decreases the need to complete additional data gathering and therefore streamlined the methodology process of this research project, it also results in less control and factor analysis. This provides challenges in understanding factors that may cause bias in the dataset and how additional research could be completed. Fortunately, it does not prohibit these aspects and only makes it more important to address in the final project. For example, when reviewing the dataset’s original source in NCD Risk Factor Collaboration research project *Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 206…* there is not a lot of information on the ethical concerns of the data collection or use of. Nor are the methodologies outlined in detail, therefore, it’s difficult to assess what factors may have affected mean BMI results (how was the population sample collected, was it properly varied, etc).

Another important and significant limitation is the lack of observations for selected populations. Observations for North America are limited to three examples for Canada, three for the United States, and three for Mexico. There are only three observations for Australian populations as well. This makes the amount of data lacking and would require additional observations and research in order to draw reliable conclusions regarding the alternative hypothesis. Overall, these are limitations of this research project that must be considered when determining if the hypothesis should be accepted or rejected.

**Ethical Considerations**

This dataset has been anonymized and in its current state doesn’t threaten any person’s privacy (there is no way to link a row back to a single participant). However, this dataset originated from the completion of another research project as mentioned in the research project limitations. Which in turn, received this data from another database of population data related to cardiometabolic risk factors collected by the Non-communicable Disease Risk Factor Collaboration (NCD-RisC) (Abarca-Gómez et al., 2017, p.2631). Therefore, this arises questions around whether the participants permitted their information to be stored and utilized for those projects. To address this, future projects (such as this one) should ensure they adhere to the scientific value of the original collection source and ensure participants are continuously respected (*U.S. Department of Health*, 2016).

The data included in the dataset used for this data analysis project was originally intended to provide insight into cardiometabolic risk factors. This is a scientifically valid purpose and is being continuously upheld through future projects. This research project relates to the original intent because obesity is linked to cardiovascular health issues. The scientific validity is also established in this project; where mean BMI is analyzed over time by country in comparison to processed food and drink consumption. In this case, the project will help assess cardiometabolic risk based on mean BMI. In conclusion, while there is not a way to review original consent from participants, using the data for its intended scientific purpose helps ensure the data is used ethically. This respects the participants involved as well.

With the foundations of the research project set –including the purpose, overview, and research methodology– the data analysis components are ready to be completed. This includes execution of the methods and statistical tests outlined in order to determine whether the hypothesis should be accepted and rejected. Therefore, providing valuable insight into how mean BMI has changed (decreasing, increasing, or remaining static) overtime and within individual countries. By defining the research question and plan beforehand, the research project is setup for success. Not only is the focus clarified, but the value in the results is also outlined. These results will be outlined as the findings of the research project. A conclusion and recommendations sections will also be outlined to help ensure valuable use of the results and the dataset moving forward.

**Findings**

After completing summary statistics there is no evidence that mean BMI decreased (or remained the same) in the years 2014-2016 for either Australian or North American populations. This result was also found when looking only at mean BMI changes for men in the same locations (which studies show see greater BMI changes than women). The mean BMI of North Americans increased from 27.81 to 27.92 (27.80 to 27.86 in Males only). The mean BMI of Australians increased from 27.10 to 27.13 (27.50 to 27.60 in Males only). While these changes are not drastic, they do not show a decrease or maintenance of mean BMI and therefore the alternative hypothesis cannot be accepted and the null hypothesis is not rejected. See Tables 1-5 for detailed accounts of the mean BMI across the selected countries and years.

Table 1  
Mean BMI of North Americas Populations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Number of Observations** | **Mean BMI** | **Min BMI** | **Max BMI** |
| 2014 | 9 | 27.81 | 26.50 | 28.8 |
| 2015 | 9 | 27.86 | 26.60 | 28.800 |
| 2016 | 9 | 27.92 | 26.6 | 28.90 |

Table 2  
Mean BMI of Australian Populations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Number of Observations** | **Mean BMI** | **Min BMI** | **Max BMI** |
| 2014 | 3 | 27.10 | 26.70 | 27.50 |
| 2015 | 3 | 27.10 | 26.70 | 27.50 |
| 2016 | 3 | 27.13 | 26.70 | 27.60 |

Table 3  
Mean BMI of Males in North Americas Populations

|  |  |  |
| --- | --- | --- |
| **Year** | **Number of Observations** | **Mean BMI** |
| 2014 | 3 | 27.80 |
| 2015 | 3 | 27.83 |
| 2016 | 3 | 27.86 |

Table 4  
Mean BMI of Males in Australian Populations

|  |  |  |
| --- | --- | --- |
| **Year** | **Number of Observations** | **Mean BMI** |
| 2014 | 1 | 27.50 |
| 2015 | 1 | 27.50 |
| 2016 | 1 | 27.60 |

Table 5  
Selected Location, Year, and Mean BMI

**Text, letter

Description automatically generated**

An important note on the changes of mean BMI over time is the rate of growth.

A possible limitation of this research project was how growth rates have changed over the years. For example, if mean BMI did grow between 2014-2016 but at a much slower rate than between 2012 and 2014, it may indicate that the alternative hypothesis could be accepted with further research. However, table 5 appears to dismantle this possibility due to the small changes that occurred year over year between 2012 and 2016 for all the selected countries. Figures 2 and 3 highlight these findings by showing the growth in mean BMI. Notice that the changes are not drastic but do make it easy to see the changes year of year in the selected countries.

Figure 2  
Mean BMI for select Countries 2012-2016

Chart, bar chart

Description automatically generated

Figure 3  
Mean BMI for Males Sorted by Year and Location

Chart, bar chart

Description automatically generated

**Conclusion**

The findings conclude that the null hypothesis cannot be rejected, and the results demonstrated an increase in mean BMI in North American and Australian populations between 2014-2016. This increase was consistent across all genders and then exclusively in males. These changes are notably small and there are significant limitations to this study –Therefore, the null hypothesis shouldn’t necessarily be accepted either. There is a need for further analysis and research into the subject especially before a conclusion on the alternative hypothesis can be drawn confidently. These studies should continue to analyze how mean BMI has and is changing especially in correlation with ultra-processed food and drink consumption. Organizations like the World Health Organization will continue to need the support of these studies to give guidance on health habits and guidelines around the world. Studies regarding this subject are required to support those statements and help improve the health of the populations around the world.

**Recommendations**

As identified in the literature review, there are many studies regarding the mean BMI of populations around the world over time along with the studies of ultra-processed food and drink consumption. These studies highlight that the research question addressed in this project is an important area of study and should continue to be studied. While the alternative hypothesis that North American and Australian populations have seen no change or a decrease in mean BMI between 2014-2016 cannot be accepted, there are many limitations to this study that require further analysis. For example, with less than 100s of observations, the growth of mean BMI in these countries from 2014-2016 could be by chance. Future studies should require many more observations and perhaps data from various or new sources.

Another consideration is how long it takes for diet changes to affect mean BMI? According to the study published by the National Institutes of Health, changes in weight could be seen within just 2 weeks of eating a certain way (in which the two groups either lost or gained weight) (*U.S. Department*, 2019). However, if these populations only started to decrease consumption in ultra-processed foods and drinks in 2014 the changes may take more time to show. Future studies should consider this issue when analyzing changes in mean BMI overtime.

**References**

Abarca-Gómez, L., Abdeen, Z. A., Hamid, Z. A., … Ezzati, M. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *The Lancet*, 390(10113), 2627–2642. https://doi.org/10.1016/s0140-6736(17)32129-3

Dunford, E. K., Ni Mhurchu, C., Huang, L., Vandevijvere, S., Swinburn, B., Pravst, I., Tolentino‐Mayo, L., Reyes, M., L'Abbé, M., & Neal, B. C. (2019). A comparison of the healthiness of packaged foods and beverages from 12 countries using the health star rating nutrient profiling system, 2013–2018. *Obesity Reviews*, 20(S2), 107–115. https://doi.org/10.1111/obr.12879

Finucane, M. M., Stevens, G. A., Cowan, M. J., Danaei, G., Lin, J. K., Paciorek, C. J., Singh, G. M., Gutierrez, H. R., Lu, Y., Bahalim, A. N., Farzadfar, F., Riley, L. M., & Ezzati, M. (2011). National, regional, and global trends in body-mass index since 1980: Systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9·1 million participants. *The Lancet, 377(9765*), 557–567. https://doi.org/10.1016/s0140-6736(10)62037-5

O’Leary, Z. (2021*). The essential guide to doing your research project.* (4th ed.). SAGE Publishing.

U.S. Department of Health and Human Services. (n.d.). *Assessing your weight and health risk.* National Heart Lung and Blood Institute. Retrieved November 29, 2021, from https://www.nhlbi.nih.gov/health/educational/lose\_wt/risk.htm

U.S. Department of Health and Human Services. (2019, May 21). *Eating highly processed foods linked to weight gain*. National Institutes of Health. Retrieved January 10, 2022, from https://www.nih.gov/news-events/nih-research-matters/eating-highly-processed-foods-linked-weight-gain

U.S. Department of Health and Human Services. (2016, March 16). *Guiding principles for ethical research*. National Institutes of Health. Retrieved December 19, 2021, from https://www.nih.gov/health-information/nih-clinical-research-trials-you/guiding-principles-ethical-research

Vandevijvere, S., Jaacks, L. M., Monteiro, C. A., Moubarac, J. C., Girling‐Butcher, M., Lee, A. C., Pan, A., Bentham, J., & Swinburn, B. (2019). Global trends in ultraprocessed food and drink product sales and their association with adult body mass index trajectories. *Obesity Reviews*, 20(S2), 10–19. https://doi.org/10.1111/obr.12860

World Health Organization. (n.d.). *About WHO*. World Health Organization. Retrieved January 15, 2022, from https://www.who.int/about

World Health Organization. (n.d.). *Mean Bmi (kg/m²) (age-standardized estimate)*. World Health Organization. Retrieved November 28, 2021, from https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mean-bmi-(kg-m-)-(age-standardized-estimate)