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Chloe G. Parsons

University of Northern Colorado, pars5161@bears.unco.edu

Christina Kuchmaner

Duquesne University, kuchmanerc@duq.edu

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Food Insecurity in an Anthropogenic Age: An Analysis into how Consumer Demand Will Shift During Climate Change

In the age of the Anthropocene, civilizations will endure climate change-related events that humanity has never seen before. Currently, humanity is living in the era of climate change, also known as an anthropogenic age (Behnassi et al., 2011). During this era, it is hypothesized that civilizations will be exposed to consecutive record-breaking temperatures and severe weather events (e.g. wildfires, droughts, and hurricanes); however, it has been noted that the consequences of these events can threaten our survival as a species along with other animal species. Further, the consequences of climate change can trigger a domino effect across business supply chains that leaves humanity with unprecedented levels of food insecurity, which may leave many people starving and desperate for food (Behnassi et al., 2011). A rise in scarcity of resources could yield a lack of sustainable produce and meat for consumers. Thus, leading to an increase in consumer demand for produce and meat markets.

This study evaluates how consumers will shift consumer preferences in light of the anthropogenic age. The purpose of this research is to quantitatively explore how consumers will shift their preferences during crisis events that are curated by the anthropogenic age, in which we are currently living. While there is a plethora of research regarding supply and food insecurity, this research analyzes how consumer demand responds to food insecurity. The first research question studied how consumers in rural and urban communities responded to food insecurity caused by a crisis. The second research question analyzed if consumers would shift from grocery store purchasing to purchasing from local food vendors. Lastly, If the crisis is bad enough, would consumers travel further distances for food. The dependent variables are the likelihood to switch food sources or migrate. The first hypothesis of the study stated that food insecurity will increase the likelihood that consumers would shift food purchasing from grocery stores to local vendors.

The second hypothesis stated that food insecurity would increase the likelihood of food miles or migration.

Literature Review

Anthropocene Background

Climate change has become an issue subject to heated debate over the last several years. Climate change began to occur in the late eighteenth century due to “human activities associated with the industrial revolution” (Behnassi et al., 2011, p. 234). During the anthropogenic age, it is projected that there will be a rise in scarcity of resources and gradual extinction of species, including our own (Baldwin et al., 2019). As climate change worsens, we are more likely to see observable changes affecting “rain patterns, snow, ice cover, and sea-level”; further these changes ultimately impact the ability to grow sustainable food products for consumers (Behnassi et al., 2011, p. 234). To further note, these detrimental changes in seasonal patterns are partially due to the weakening of the Pressure Gradient Force (PGF), which also has devastating consequences for crop production across the United States.

The changes are notable in other countries. In other countries, they have already had to deal with the consequences of climate change. For instance, low and middle-income countries had to make “systemic and transformational patterns of production, distribution, and consumption of food” (Vermeulen et al., 2012, p. 131).

Climate Warming and Food Supply Chain Functions

Furthermore, the weakening of the PGF has led to later wildfire seasons in Southern California, which further decreases vegetation on the land for crop production (Guzman-Morales & Gershunov, 2019). The increase in wildfires increases the greenhouse gas effect and has adverse impacts on crop production. California is an area prone to wildfires and is the main

cropland in the United States. For example, California farms are one of the biggest suppliers of tomatoes and are disproportionately impacted by greenhouse gases (GHG) (Brodt et al., 2013). Due to drought caused by emissions of GHG, California's production of quality tomatoes has been impaired. This and other events related to climate change negatively impact traditional national food supply chains within the United States, which may lead to food insecurity for American consumers.

Food insecurity threatens the opportunity to provide a sustainable and healthy future for communities due to "insufficient agricultural development and low levels of education" (Behnassi et al., 2011, p.173). Based on previous research, American Indians and Alaskan Natives (AI/AN) were impacted by food insecurity in urban and rural areas; however, urban communities were subjected to more food insecurity compared to rural AI/AN (Jernigan et al., 2017). In their study, they alluded to the fact that food insecurity derives from limited availability for food consumption and selection among food products and reinforces the systemic food insecurity issues among minority status individuals.

The Gap: How Consumer Demand Responds to Food Insecurity

Current research has focused on how climate change impacts food supply chains and distribution (e.g., Brodt's article about California tomatoes), but there is little research on how consumers respond to these changes in logistics and food access. This research aimed to fill the gap through an analysis of how consumers in urban and rural areas of the United States respond to food insecurity caused by crisis events (e.g., pandemics); however, the participation rate in urbanized areas was substantially higher than in rural areas. Therefore, this research furthered its research to understand how consumer demand in food-insecure conditions would develop during the process of climate change and crisis events at large. Further, this research provided a deeper

understanding of how food consumption behavior may change during times of crisis and what the psychological underpinnings of these may be indicative of.

The first research question asks how consumers in rural and urban communities responded to food insecurity caused by a crisis. Secondly, the research investigated if consumers would respond to food insecurity by shifting food purchasing from traditional outlets (e.g., grocery stores and supercenters), to local food sources (e.g., local farms and food producers). Finally, the study determined if consumers would engage in migratory behavior (e.g., move to a different location) to be closer to local food sources under conditions of extreme food insecurity (Baldwin et al., 2019). A comparison was made among consumers in the Midwest region of the United States in comparison to those in the East, West, and South regions to determine if purchasing behavior differs for consumers in areas where local food sources are more well-known and accepted.

Evolutionary Psychology Perspective and Purchasing Behavior

From the evolutionary psychology perspective, the aforementioned research questions were investigated. Based on the evolutionary psychology theory, one's "physical and social environment" has a heavy influence on our consumption behaviors (Cohen & Bernard, 2013, p. 388). Therefore, negative circumstances in one's physical and social environment can cause changes in consumer behaviors, which become more evident during stressful periods. For example, the panic of the COVID-19 pandemic yielded a shortage in consumer food products such as milk, eggs, canned goods, yeast, and rice. Consumers saw scarcity as a threat to their livelihood and stockpiled resources in the event of potential long-term shortages (Goldsmith et al., 2021).

In response, consumers engaged in various purchasing behaviors such as bulk purchasing and hoarding of goods. Historically, when the market becomes volatile, low-class households tend to spend more in the present on tangible goods and high-class individuals invest their financial resources into retirement strategies. However, food markets cannot simply be invested and accrued interest on, one must be there at the right time to purchase the goods. Food insecurity will be non-discriminatory in its scarcity over the long term; however, may have socioeconomic impacts at the beginning of the scarcity. Further, one may not see the threat if they are born into a middle or high-class category of people. In time, food scarcity may be an equal field where the lack of freedom in choice may promote an environment that recommends taking what you can get, as evident in panic buying. From the perspective of evolutionary psychology, these are responses to conditions of resource scarcity in western culture (Goldsmith et al., 2020).

The mentality of *taking what you can get* is rooted in the western philosophy of rugged individualism (Czarnecka., et al 2020). Further, this behavior of impulse buying was evident during the COVID-19 Pandemic when individuals stockpiled canned goods and frozen foods; however, this event left food-insecure individuals with fewer resources to buy. For example, individuals stockpiled boxes of cheap goods and left food insecure and poor individuals with a lack of means to purchase necessary foods. Concerning the current Anthropocene age, food availability will likely be reduced, particularly fresh produce foods. Those with fewer resources will need to resort to readily available foods. This may include the consumption of non-perishables; therefore, yielding potential higher healthcare costs (Berkowitz., et al 2018). The rise in healthcare concerns due to higher healthcare prices because of food insecurity may

serve as a purpose for consumers to increase the distance traveled for food to obtain a healthier and more sustainable lifestyle.

Additionally, similar purchasing behaviors in the COVID-19 pandemic could occur during the process of climate change in response to food insecurity caused by a warming climate. During the process of climate change, consumers could engage in more local food purchasing, be willing to make longer commutes for fresher products, or purchase food goods that have a longer shelf-life or that are non-perishable. These consumer decisions will be guided by the desire to access more and better resources to maintain survival. According to the Protection Motivation Theory, consumers and households take precautionary measures to safeguard their resources that ensure their chance for survival (e.g., maintaining food, water, and shelter) (de Koning., et al 2019). For some consumers, that may mean relocating to gain better access to food, which is why some regions are adapting to “rural to urban migration” instead of natural disasters (Wolsko & Marino, 2016).

This research offers several important insights in the following areas: First, this research has several economic implications. If consumers shift their food purchasing dollars from large-scale, national food producers and distribution centers to local food producers, that means that more money will be kept in local economies. This will also shift the competitive landscape of the food industry. If climate change heightens or eliminates competition, customers may pay a lower or higher price for food products. This scenario is noted in the Midwest along the Mississippi River Basin, where corn and soy will be too expensive to grow and consumers need to make the ultimatum to pay higher prices for those items or find substitutes for those food products (Xie et al., 2019). Second, if this local food purchasing shift occurs, consumers will be eating fresher foods, which can lead to positive physical outcomes (e.g., obesity, diabetes) and mental health

outcomes. In conclusion, this research further supports why economic and government policies surrounding food insecurity are critical to the well-being of our country through physical, mental, emotional, and financial health.

Methodology

Overview of Study

This research consists of one experimental study. Experiments in which participants are randomly assigned to different treatment conditions allow researchers to establish causal relationships among variables. In this study, perceptions of food insecurity were manipulated. The experimental design of the study was a one-factor, two-level between-subjects design – 2 (food insecurity: present vs. absent) – with participants randomly assigned to each condition. This setup allows me to examine whether conditions of food insecurity lead to perceptions of resource scarcity and if these perceptions, in turn, lead consumers to switch from purchasing foods through traditional channels, such as grocery stores, to purchasing from local food sources, such as farms and farmers markets. Further, this research investigated whether consumers are willing to travel longer than usual distances to reach local food sources. Therefore, this study tests all hypotheses.

Procedure

For this study, an online survey in which the experimental manipulation was embedded was created in Qualtrics. The Qualtrics survey was distributed to participants via the Amazon Mechanical Turk service. The ultimate purpose of the survey was kept vague, stating that the research was studying food purchasing behaviors, to reduce participant misrepresentation. An approval rating of 90% or more was specified. A payment of \$1.00 was offered for taking the study. Once MTurkers elected to take the study, they were redirected to the Qualtrics survey.

After agreeing to the consent document, participants viewed one of two food insecurity conditions. After viewing this prompt, participants went on to complete the variable measures.

Food Insecurity Stimuli

The stimulus for this study was inspired by national media coverage of shortages of food products and other essential items in stores due to supply chain disruptions caused by the global COVID-19 pandemic and the “panic buying” that resulted. Therefore, the manipulation of food insecurity was particularly timely because the study participants may have personally experienced one of these conditions in the recent past. Participants were randomly assigned to see one of two food insecurity prompts.

In the food insecurity present condition, participants read the following:

“Imagine that your area is being affected by a global crisis. You have heard that this crisis has disrupted the ability of many companies to produce and distribute food products to retailers that provide food and grocery items. You experience this problem firsthand when you go to your regular grocery store and find rows of empty shelves – the essential food items that you need are sold out and no longer in stock. The grocery store employees do not know if these products will be available again or when. The store employees tell you that they expect a low supply of many key items will be a problem for the foreseeable future. You decide to check a couple of other stores in your area and discover the same situation. **You are worried** about being able to find healthy and nutritious food for your household.”

In contrast, in the food insecurity absent condition, participants read the following:

“Imagine that your area is being affected by a global crisis. You have heard that this crisis has disrupted the ability of many companies to produce and distribute food products to retailers that provide food and grocery items. You are worried about experiencing this problem firsthand when

you go to your regular grocery store. However, you find rows of fully stocked shelves – the essential food items that you need are all in stock and there seems to be plenty to go around. The store employees tell you that they expect a normal supply of many key items and no supply problems for the foreseeable future. You run to a couple of other stores in your area and discover the same situation. **You are not worried** about being able to find healthy and nutritious food for your household.”

Variables and Descriptions

A brief description of each variable measure is provided below. Unless otherwise noted, all items were measured on a seven-point Likert-style scale with endpoints strongly disagree–strongly agree.

Dependent Variables. The first set of dependent variable questions analyzed the consumer’s likelihood to switch from purchasing food from traditional grocery stores to purchasing from local food sources. For the first dependent variable, we asked how likely participants would be to seek out local food sources and purchase food from them instead of traditional grocery stores and measured this variable with a three-item bipolar scale with options ranging from probable/ improbable, unlikely/likely, no chance/certain. The Cronbach’s alpha (), which is an indicator of scale reliability, for this variable is 0.985, which is above the acceptable minimum of 0.700.

A secondary dependent variable asked how likely participants would be to travel long distances to go to all types of food stores (e.g., local sources and traditional grocers) to find the food items they need. This variable was measured using the same bipolar scale described above

($\alpha = 0.985$). We also asked how far they would be willing to travel in minutes to acquire necessary food items. This was measured on a sliding scale ranging from 5 minutes to 90 minutes.

Mediating Variable. The mediating variable of perception of resource scarcity was assessed with a three-item scale that included items about the uncertainty of food availability increasing, food items becoming scarce, and not enough food items for everyone (Mittal et al. 2020).

Manipulation Check. The food insecurity manipulation was checked with an eight-item scale that included items about being worried about not having enough food, having to eat a limited variety of foods, having to eat fewer meals, having little or no food to eat, and not having enough healthy and nutritious food ($\alpha = 0.973$). We also ensured that the scenario described to participants was perceived as realistic with a 2-item measure ($\alpha = 0.888$).

Control Variables. Potential control variables were pulled from the Fanta Project's Household Food Insecurity Access Scale (HFIAS), which measures food insecurity and food access experienced by individual households (Fanta, 2007). Scales were also pulled from the Perceived Nutritional Environment Measures Survey (NEMS-P), developed by researchers at the University of Pennsylvania, which is a survey that evaluates individuals' perceptions of their nutritional environment, food shopping behaviors, and eating behaviors. Specific questions asked in our survey included things like if the participant made the food purchasing decisions in their household, their food shopping behavior, and local food shopping behavior.

Given the context of the research, participants were also asked about their attitude toward climate change, the COVID-19 pandemic, and food shortages. We also used the PANAS scale

(Watson., et al, 1988.) to measure negative emotions since the stimuli and following questions could induce negative emotions in participants. Lastly, we asked a variety of demographic questions including age, gender, ethnicity, location, education level, and income.

Results & Discussion

Sample

Two hundred and eight Amazon MTurkers qualified to take the study. After removing participants who did not pass the attention check questions, the final sample size was 195 (47.2% male, age range 18-78, average age 42, all U.S. residents). Participants were paid \$1.00 for taking the survey, which took 10 to 15 minutes. Participants came from all regions of the United States, with 36 from the Midwest, 49 from the Northeast, 79 from the South, and 31 from the Western United States. Overall, the sample had a negative attitude toward climate change ($M = 2.25$, $SD = 1.54$) and perceived climate change to be a severe issue ($M = 5.54$, $SD = 1.71$). However, participants reported a low level of worry about food shortages in the past 12 months ($M = 2.97$, $SD = 1.72$), and food shortages were perceived as not very threatening ($M = 3.36$, $SD = 1.75$).

Participants that were the primary party responsible for food purchases in their home made up 75%, with 41.5% shopping for groceries at least once per week. Participants also perceived fresh food categories as more essential, with fruits and vegetables as the most valued category (89.7%), followed by eggs and dairy (87.7%), grains (80.5%), meat and seafood (79.5%), canned items (59.5%), baked items (23.6%), and snack items (13.3%). Participants also selected the most important factors when determining where to shop for groceries, reporting that the quality of foods was the most important factor ($M = 5.75$, $SD = 1.13$),

followed by price of foods ($M = 5.69$, $SD = 1.32$), selection of foods ($M = 5.55$, $SD = 1.28$), and store location near to home ($M = 5.45$, $SD = 1.43$).

The manipulation check showed that, as anticipated, perceptions of food insecurity were higher in the food insecure condition ($M = 5.33$, $SD = 1.20$) as compared to the food secure condition ($M = 2.61$, $SD = 1.56$) based on ANOVA results ($F(1, 193) = 185.94$, $p = .000$). Therefore, the manipulation was successful, and I was able to move forward with the analysis.

Results and Discussion

The study first examined whether or not consumers would be willing to travel longer distances for scarce food items, regardless of whether they would be bought at a local or traditional retailer. Food insecurity did not have a significant direct effect on likelihood to travel longer distances for food ($\alpha = 0.10$, $t = 0.29$, $p = 0.77$), but it did have a positive indirect effect on travel through perceptions of resource scarcity ($\alpha = 1.10$, $CI\ 95\% = [0.62, 1.58]$). This means that experiencing food insecurity alone is not enough to get a consumer to travel longer distances for food. However, consumers will travel longer distances if food insecurity induces perceptions of resource scarcity. This supports the first hypothesis. Further, T-test results show that participants in the food insecure condition reported being willing to travel farther in minutes for food than participants in the food secure condition ($M = 38.2$ vs. 22.2 , $F(1, 193) = 34.77$, $p = .000$). Interestingly, T-test results show that participants in the food insecure condition reported being willing to pay *less* for food than participants in the food secure condition in this case ($M = 42.2$ vs. 67.5 , $F(1, 130) = 12.97$, $p = .03$). This may be because individuals who have to travel long distances for food spend more time, effort, and gas money to obtain the food items.

In terms of the likelihood to switch to local food sources, participants had a positive attitude toward local food sources overall ($M = 6.16$, $SD = 1.02$); however, participants were not very familiar with local food sources ($M = 3.80$, $SD = 1.73$) and did not shop at local outlets often ($M = 2.73$, $SD = 1.37$). Mediation results show that food insecurity had a direct positive effect on likelihood to switch to purchasing from local food sources ($\alpha = 1.44$, $t = 5.26$, $p = .000$) and a positive indirect effect through perceptions of resource scarcity ($\alpha = 1.01$, $CI\ 95\% = [0.57, 1.46]$). This means that experiencing food insecurity alone is enough to get a consumer to shop with local food sources instead of traditional grocery stores. However, food insecurity also increases perceptions of resource scarcity which, in turn, makes a consumer more likely to switch shopping venues. This supports the second hypothesis.

Limitations to Study

When the study was administered at the end of January 2021, perceptions of climate change events that induced food insecurity may have not been the most relevant within the media and the general public's knowledge. Furthermore, a certain snowstorm in Texas, in February 2021, impaired the ability of supply chains to meet customer demand, which left people without the resources they needed to sustain themselves (Romo, 2021). Most notably, people in Texas were left without water and food; therefore, people were left food-insecure and unsure of when they would be relieved of the situation. Although 79% percent of our participants resided in the south, this event did not happen until after our survey was administered. Furthermore, the study was unable to capture those viewpoints of food insecure participants in Texas.

Additionally, consumers may have viewed climate change, the COVID-19 pandemic, and food insecurity as three separate issues, rather than interlinked issues. This perception may have

contributed to the way participants answered the survey questions as well. While participants agreed that COVID-19 and climate change were important issues, they may have viewed the two crisis events that are separate from each other and have different consequences in their circumstances. As this study explores, it is noted that pandemics and food insecurity are part of living through the Anthropocene era (Neuman, 2020). Therefore, this study reveals some of the perceptions surrounding pandemics and food insecurity and how such events may be rare but may not be atypical events. Furthermore, it ought to be noted that being a consumer and a person in this world requires overcoming harsh events without recognizing the potential bigger issue at large, which in this case is potentially climate change. Food insecurity and pandemics can exist on their own due to a variety of causes; however, as individuals living through the era of Anthropocene, we may experience exasperated and more frequent food insecurity events and pandemic-related events due to lack of biodiversity.

Lastly, the research question regarding how consumers in rural and urban communities respond to food insecurity had to be omitted due to a majority of individuals residing in either urban city areas or urbanized clusters. Furthermore, leaving this research question in may have been inaccurate due to the number of individuals that responded from urbanized geographical regions. Therefore, the survey delivery was unable to capture a 50% split between urban and rural areas.

Ramifications and Impacts

While climate change is presented as an issue of concern for participants, the severity of climate change may not appear to impact the macro-level food supply chain; therefore, consumers are content with the availability of food at their market. Furthermore, participants did not perceive climate change to impact their ability to obtain fresh foods at their grocery stores of

choice. This may be an indicator that supply is still matching customer demand within the market, despite the few delays or limited available market. If a grocery store is out of their product, they may be able to go to another store and find the product due to international and national trade the United States has with other countries, which may provide a potentially false sense of security for consumers within the market. However, this case of a limited market was evident during the month of 2021 when Texas received one of its biggest snowstorms on record, where the food supply market did not meet customer demand due to infrastructural barriers (Romo, 2021). Lastly, such topics as climate change's impact on food availability may not be covered by the media outlets that the participants watch or view. Furthermore, individuals may have a limited scope and view about said topics due to having limited exposure to climate change-induced food insecurity.

Future Research Opportunities

This research is open to opportunities that further expand upon the research questions and the previous findings in the study. It is being discussed to further research the perceptions of food insecurity within urban and rural communities. My mentor and I are discussing the best methods to ensure that the Amazon Mechanical Turk platform can ensure an even participant number that measures 50% of participant count in urban and rural areas.

Conclusion

While climate change was presented as an important issue of the time, participants did not perceive climate change to impact the ability to obtain fresh and clean foods. However, if we look at the Texas snowstorm of February 2021, it is evident that Texans were not structurally prepared to deal with such a big snowstorm (Romo, 2021). Further, this left many Texans without access to electricity, food, and water. Therefore, food supply markets could not meet the

customer demand market in Texas and left many Texans cold, thirsty, and hungry. Typically, we think of climate change impacting us during the summer months; however, the weakening of the pressure gradient force can yield negative consequences during the winter months (Guzman-Morales & Gershunov, 2019). Thus, the weakening of the pressure gradient force led to a historic snowfall that Texas was not prepared for regarding infrastructure and economic matters. Furthermore, food insecurity was exasperated in this condition.

Additionally, the United Nations reported in July of 2020 that climate change will increase the rise in infectious diseases jumping from animal to animal and animal to human due to diminishing biodiversity and habitat loss (Neuman, 2020). Diseases jumping from animal to human is the reason why the COVID-19 pandemic came into existence. Therefore, as climate change continues to persist and grow worse, more pandemics continue to occur. Thus, more pandemics will continue to make people sick. As of July 2021, the United States has lost more than 600,000 lives due to COVID-19 (Neuman, 2021). Ultimately, this matters because we deserve to consume plenty of produce and meat that does not make us ill. Further, these conditions of pandemics and lack of biodiversity may indicate that humans ought to migrate and relocate to a food and water source with better quality.

While this information is available to the public, the severity of climate change may not appear to impact the macro-level food supply chain. Additionally, the supply may still match consumer demand within the market despite the few delays or limited market. Lastly, such topics similar to climate change's impact on food availability and food supply may not be covered in the media outlets that consumers choose to watch, read, or listen to. Therefore, consumers do not perceive climate change to be increasing food insecurity because the conditions are not yielding

insecurity that would cause a large panic. Further, the severity is not severe enough for there to be a perceived threat.

In conclusion, food insecurity in the Anthropogenic age determines how much humans pay for fresh produce and meat and can also determine the quality and quantity of food humans have access to. Therefore, it is vital to conduct research along the business side to advocate for potential climate action. This action ensures that consumers can consume food such as meat and produce at an affordable price, without sacrificing the quality of their food.

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