Foods Skills and Resilience:

An Exploration of Self-Sufficiency During the Coronavirus Pandemic

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Approved October 2020 by the
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ARIZONA STATE UNIVERSITY

December 2020

ABSTRACT

This study was designed to examine the associations between food skills, resilience, and coping during the Covid-19 pandemic. Between April and June of 2020, a sample of 154 students, faculty, and staff from Arizona State University were surveyed. Each respondent was administered a survey containing demographic questions, a food skill questionnaire, and the 14-item Resilience Scale (RS). Results indicate that food skill was correlated with resilience ($p < 0.001$) at an $r = 0.364$ and $r^2 = 0.1243$ and that resilience was correlated with coping during the Covid-19 pandemic ($p < 0.001$) at an $r = 0.455$. Correlations were also run between resilience score and the separate domains of food skill score: all domains remained significantly associated with resilience score ($p < 0.001$) with a $r = 0.340$ and $r^2 = 0.1173$ for 'Food Selection and Planning,' $r = 0.312$ and $r^2 = 0.0958$ for 'Food Preparation,' and $r = 0.294$ and $r^2 = 0.0767$ for 'Food Safety.' Data seems to be consistent with contemporary research suggesting positive associations between diet quality and physiological resilience and positive associations between resilience and coping during the Covid-19 pandemic.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Overview

On March 12th, 2020, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) was declared a global pandemic by the World Health Organization (WHO)--preceding this declaration, China and Italy had already begun to quarantine and lockdown parts of their countries. Although the definite mode of transmission has not been determined, it is suspected that droplet or short-range aerosol transmission are the probable modes of transmission. Furthermore, due to a latency period between two and fourteen days, infected persons can unknowingly transmit the disease to others. The first confirmed case of the SARS-CoV2, otherwise known as Covid-19, was confirmed in the United States (U.S.) as of January 2020 (Holshue et al., 2020). After the first diagnosis, community transmission became widespread and as of March, the U.S. has had the most confirmed, reported cases of Covid-19 in the world. As the crisis continued to develop, federal and state governments have enacted guidelines to promote social distancing and slow the transmission of COVID-19.

Specifications vary by state; however, the federal government expects countrywide adherence to the President's Coronavirus Guidelines for America (The President's Coronavirus Guidelines for America, 2020) if there is evidence of community transmission within the state. One of the guidelines enacted by the federal government encourages citizens to avoid eating or drinking in bars, restaurants, and food courts; however, dine-out options are still permitted. In accordance with this guideline, on March 31st, the governor of Arizona enacted an executive order titled, "Stay Home, Stay Healthy,

Stay Connected," which requires foodservice operations that have not transitioned to drive-thru, pickup, or delivery to suspend operations (Exec. Order No. 2020-18, 2020). The limitations and regulations were placed on the food industry help to enforce social distancing, and yet it is important to note that these options do not negate risk of viral transmission. Due to contamination risk, consumers are advised to discard packaging and transfer dine-out foods into separate containers—studies from the National Institutes of Health have suggested that Covid-19 can remain on surfaces such as cardboard for 24 hours and plastics for 2-3 days (van Doremalen et al., 2020). Hence, the safest option is to prepare food at home; however, a large portion of the population is accustomed to eating out and may lack cooking skills.

According to data published by the United States Department of Agriculture (USDA) on consumption of food-away-from-home (FAFH), young adults (25-44 years of age) are the age group mostly likely to eat FAFH (Saksena et al., 2018). Data collected in 2015-2016 from the National Health and Nutrition Examination Survey (NHANES) suggests that males and females, 20-49 years of age, consume 34-42% of their daily energy from food and beverages consumed away from home (U.S. Department of Agriculture, 2018). Due to changes within the food environment and limited options for FAFH, many Arizonans likely transitioned to preparing more foods at home. Consequently, the conflux of legislation mandating the closure of many foodservice facilities and the inherent threat of consuming FAFH provides an opportunity to examine the relationship between food skills, resilience, and coping within the Covid-19 pandemic.

Food skills are waning among young Americans. University students self-rated their ability to peel, chop, and slice at 79.7% (out of 100) and their ability to plan weekly meals at only 56.1% (Wilson, et al. 2017). Not only are food skills declining in young Americans, the desire to cook is dwindling, likely a consequence of long work hours. Parents estimated that preparing and eating a meal at home took significantly more time than driving and eating out (80.7 minutes vs. 30.3 min, $p<0.001$) (Robson, et al. 2016). The simplicity of relying on FAFH is bolstered not only because it is a time saving process, but it can be less expensive than cooking at home (Seid, 2020). The reliance of Americans for FAFH has been abruptly challenged by the "Stay Home" mandate by the federal and state governments that may be creating challenges for many Arizonans. Utilizing a validated food skill questionnaire, this research will assess the cooking literacy of a convenience sample of young adults, which will then be measured against a validated resilience questionnaire to examine relationships between food skills and coping during the Covid-19 crisis.

Research Aim and Hypotheses

The objective of this cross-sectional study is twofold. First, survey data was evaluated to see if a relationship exists between food skill and resilience scores. Second, these data will be compared to self-reported coping during the coronavirus pandemic.

H_1: Food skill score will correlate to resilience score and to coping during the
coronavirus pandemic.

H_2: Resilience will correlate to coping during the coronavirus pandemic.

Definition of terms (including the operational definitions of variables)

Food Skill: knowledge and behaviors related to the selection, planning, preparation, safety, and storage of foods (Kennedy et al., 2019)

Resilience: the ability to recover and adapt following adversity; which is influenced by characteristics such as flexibility, optimism, and coping efficacy (Wagnild & Collins, 2009)

Delimitations and limitations

Delimitations for this study include survey site, population of respondents, and use of close-ended survey responses. The survey will be administered to students, faculty, and staff at Arizona State University, reflecting a southwestern, urban/suburban environment. Additionally, because the survey was administered at a university the data may not be generalizable to a non-campus population. Data were collected during a global virus pandemic, and in Maricopa county the Arizona county with the greatest number of reported Covid-19 infections, which may have impacted participant responses. Finally, close-ended responses will be used for this survey which limits information gathered from participants.

Limitations for this study include convenience sampling, self-reported participant characteristics, and small sample size. Participants receiving the survey self-reported data including age, gender, student status, weight, height, physical activity level, living situation, meal plan status, ethnicity, and employment status. Finally, the small sample and low response rate to the administered questionnaire may influence the data.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as

Covid-19, was declared a global pandemic on March 11, 2020 (WHO, 2020). At the time

of this writing the precise mode of transmission had not yet been identified; however,

observational studies have found that a physical distance of greater than one meter lowers

viral transmission (Chu et al., 2020) and it seems the virus spreads mainly through close

person-to-person contact. To prevent and slow rates of transmission, emergency

lockdowns have been declared in most areas of the United States. For example, in

Arizona the statewide stay-at-home order began on March 30th and continued through

May 15, 2020. Covid-19 has caused not illness and death, but the isolation due to the

lockdowns also presents challenges associated with changes to lifestyle and employment

status. Surveys administered both pre- and during pandemic can assist investigators in

examining the impact of Covid-19.

Food Acquisition During Covid-19

Before the onset of Covid-19 in the United States, the National Poll on Healthy

Aging, administered by the University of Michigan Institute for Healthcare Policy and

Innovation, surveyed 2,048 adults aged 50 to 80 regarding cooking and grocery shopping.

Although this poll was conducted in December of 2019, it has information on how

elderly Americans were eating and obtaining groceries pre-pandemic. In regards to

eating, results from the poll indicate that in the previous week 47% of respondents ate at

home between six to seven days, 42% ate at home between 3-5 days, and 11% reported only zero to two days' worth of eating at home (Wolfson et al., 2020a). Eating meals prepared in the home so often may have been beneficial for these adults because they would have been less impacted by closures to restaurants. In terms of grocery acquisition, results indicated that only 5% of the respondents were familiar with curbside pickup at time of survey administration (2020). Low utilization rate and unfamiliarity with this shopping tool may have negatively impacted elderly adults because they are a high-risk population and shopping presents an additional exposure to Covid-19. Since the pandemic onset, the American Association of Retired Persons (AARP) has announced plans for research to examine changes in eating habits of the elderly due to the pandemic (University of Michigan School of Public Health, 2020).

An annually administered national survey has collected data to enable comparisons of pre- and during pandemic grocery shopping frequency and food habits: *Food and Health Survey*. Survey data suggests that in-person, once weekly grocery shopping has decreased since 2019 (International Food Information Council, 2020). Additionally, online grocery shopping has increased from 27% in 2019, to 33% in 2020 (International Food Information Council, 2020). Of those who indicated they were shopping online: 53% reported they were concerned about consuming foods prepared outside the home, and 41% were concerned with in-person food shopping (International Food Information Council, 2020). This survey was collected by the International Food Information Council (IFIC) from April 8-16th, 2020. In total, 1,011 Americans aged 18-80 were surveyed and results were weighted by age, education, gender, race/ethnicity, and religion to reflect the United States population. Additionally, eight in ten survey

respondents indicated their food habits had changed due to the pandemic--women and respondents younger than 35 were more likely to have made changes (International Food Information Council, 2020). Respondents reported the following: cooking at home more, snacking more, washing produce more, thinking about food more than they usually did, eating healthier than usual, eating more than usual, eating more pre-made meals from the pantry or freezer, getting more meals delivered/take-out, eating less healthy than usual, snacking less, thinking about food less than usual, etc. These data and other quantitative studies conducted throughout the globe suggest that the pandemic has impacted food habits.

Food Habits During Covid-19

Researchers in Spain administered a survey to examine respondents' perception of their food habits during the Covid-19 pandemic. Respondents were sent the Dutch Eating Behavior Questionnaire (DEBQ) and a separate survey with questions regarding consumption frequencies of various food categories, perceived increase or decrease in these categories compared with pre-pandemic consumption, food and cooking habits, and inquiries about habits developed that respondents would like to maintain. The survey was administered in April of 2020, during the 6th week of confinement in Spain. There were 600 respondents aged 18-68 at a mean age of 42.58 years. Respondents were grouped into categories which reflected eating behaviors. There were three eating behavior groups measured by the DEBQ: external, restraint, or emotional. The following changes were reported by each eating behavior group: external eaters tended to select responses indicating that healthful foods were a priority; restraint eaters tended to select responses

7

indicating low engagement with cooking; and emotional eaters reported an increase in snacking, consumption of processed foods, felt hungrier, and ate more often (Romeo-Arroyo et al., 2020). Data also indicates that around 50% of respondents were eating different quantities of certain food categories when compared to pre-pandemic conditions (Romeo-Arroyo et al., 2020). These survey results suggest that eating behavior could have influenced behavior change regarding food habits and indicates at least half of respondents changed their eating habits since pandemic onset.

Cross-sectional research conducted by Ruiz-Roso *et al.* aimed to assess the effect of confinement, as a result of Covid-19, on adolescent nutrition in Spain, Italy, Brazil, Chile, and Columbia. A 30-question, web-based questionnaire was sent to participants between April 17th and May 25th of 2020. The questionnaire asked about sociodemographic, lifestyle, and dietary patterns of the respondent. Diet was measured via the National School Health Survey-PeNSE (Oliveira, et al., 2017); respondents were asked to record how many days per week that they consumed different categories of food before and during confinement. In total 820 adolescents between 10 and 19 years of age participated. Results from the surveys indicated that adolescents aged 14 and older had increased consumption of legumes, vegetables, and fruits: for females trends indicated an increase in vegetable and fruit ($p<0.0001$) during the time of the confinement versus pre-confinement; males demonstrated an increase in vegetable intake ($p=0.0007$) and an increase in processed meat intake ($p=0.0182$) during confinement as compared to pre-confinement (Ruiz-Roso, et al., 2020). Survey results from adolescents younger than 14 years of age showed an increase in fried foods ($p=0.0025$) and sweets ($p=0.0386$) during the time of the confinement (Ruiz-Roso, et al., 2020). Investigators also noted that the

country of residence did influence dietary modifications, possibly due to different cooking behaviors, fads, or traditions within the country. These data suggest that within the five countries surveyed, respondents made dietary modifications within the period of confinement caused by Covid-19.

Food Skill and Healthy Eating

Food skill encompasses the combination of knowledge and abilities required to select, purchase, prepare, and consume meals; examples of this skill include label reading, budgeting, nutrition knowledge, and cooking skill (Fordyce-Voorham, 2011; Lavelle et al., 2017; Porter et al., 2000). Previous research seems to suggest that food skill impacts the quality of one's diet. For example, greater food preparation ability has been positively associated with intake of fruit and vegetables and negatively associated with intake of processed, convenience meals and fast foods (Hartmann et al., 2013; Murray et al., 2016; Utter et al., 2018).

The afore cited study by Hartmann *et al.* had a population based longitudinal study design and surveyed a Swiss population of 4,436 participants to see if a relationship existed between participant's self-evaluated cooking skill and their food choices. A questionnaire was sent to participants which included a food frequency questionnaire (FFQ) and questions on cooking skills, psychological, and sociodemographic variables. Within the questionnaire, cooking skill was measured by asking the participants to evaluate their ability to prepare different categories of food, such as, hot meals without a recipe, bread, gratin, cake, soup, or sauce. Participant data were stratified, and separate

models were used for the male and female participants due to differences within the two groups cooking skill. Study results suggest a positive correlation between cooking skill and consumption of vegetables and a negative correlation between cooking skill and frequency of convenience food consumption (Hartmann et al., 2013). Mean participant age and use of self-reported data were limitation to this study. Mean participant age within the was 55.5 years, SD 14.6 years (2013). Although participants from 20-80 years of age were sampled and included in the analysis, the mean age of participants is not within the age range of participants pooled for the current study.

Furthermore, a literature review by McGowan *et al.* aimed to examine the association between cooking skill and food skill in relation to dietary patterns. The review included data from 11 peer-reviewed, cross-sectional studies published prior to 2013; 7 of the 11 studies found associations between greater cooking skill and greater food skill in relation to healthier dietary patterns (McGowan et al., 2017). Limitations to this review include the lack of validated instruments to measure cooking and food skill existing during the time period captured in the review. Due to this limitation, it was noted different assessment techniques were used to assess food skill and cooking skill between studies.

In 2018, Wolfson *et al.* administered a web-based survey to examine the relationships between food agency, cooking skill, and food skill amongst parents of children aged two through nine in the United States. The term food agency encompasses the ability to learn cooking skill and put those skills in practice in one's environment (Trubek et al., 2017). Food agency was measured via the Cooking and Food Provisioning Action Scale or CAFPAS (Lahne et al., 2017); whereas cooking skill and food skill were

measured with the validated questionnaire created by Lavelle *et al.* (2017). A sample of 1,399 individuals completed the survey. In the parent sample, in terms of food agency the following trends were observed: females had higher food agency than males ($p = 0.002$); older individuals aged 45-65 years had a higher food agency than those aged 18-29 years ($p = 0.03$); respondents with college or graduate degrees had higher food agency compared to those without ($p<0.001$); and stay at home parents also had a higher food agency compared to working parents ($p<0.001$) (Wolfson et al., 2020b). Additionally, investigators found that food and cooking skill accounted for 41.5% of the variance in food agency scores ($r^2=0.415$), which increased to 71.3% when cooking confidence, attitude, and perception was included in the model (Wolfson et al., 2020b). Wolfson *et al.* also found that higher food agency was associated with more frequent bouts of cooking in both parents and adults, higher intake of fruit and vegetable, and lower consumption of fried foods and potatoes (2020b). Strengths of this study included a large sample size and use of validated questionnaires; however, it is limited due to a non-generalizable sample, self-reported data, and cross-sectional design. Although investigators had tried to survey a sample that was reflective of the United States population, only 79.7% responded and not all individuals met inclusion criteria which limited the overall generalizability (2020b). Self-reported data given by respondents may also have introduced bias and all surveys were self-reported. Furthermore, since no FFQ was administered, investigators cannot directly assess true intake in comparison to food agency. Finally, cross-sectional data cannot demonstrate causality or show why food agency, cooking skill, and food skill relate. Although results from the study seem to indicate that food agency is related to food skill, directionality of this relationship cannot directly be assumed.

Barriers to Cooking

Undergraduate as opposed to graduate students appear to share some common barriers to cooking. In a study by Murray *et al*. involving 24, independently living, college-aged students from New Jersey focus groups were conducted to evaluate barriers to cooking. Common barriers included lack of cooking skill, financial instability, and inadequate access to healthy foods (Murray et al., 2016). A separate study by Greaney *et al*. also conducted focus groups to identify commons barriers or enablers for weight management amongst college students. In total, 115 college students from eight universities across the United States were surveyed. College students identified limited knowledge in relation to shopping or preparing meals, temptation towards unhealthful food, and a reliance on convenience or unhealthy foods as barriers to cooking and weight management (Greaney et al., 2009).

Colton *et al.* who investigated the factors which influenced dietary habits of graduate students from a chiropractic doctoral program. The study aimed to evaluate the cooking skill, perception of healthful eating, and influence of nutrition curriculum on diet. A convenience sample of 178 students completed a food frequency questionnaire (FFQ) and survey with questions on cooking skill and perceived health habits. Results from the survey indicated that barriers to healthful eating included a lack of time and money (Colton & Nightingale, 2020). These findings may signify that within graduate student, time and funds may be the main determinant of dietary choices.

Using a cross-sectional study design, Wolfson *et al.* administered a web-based survey in 2015 to assess how income and food access affected cooking frequency. A

sample of 1,112 adults from the United States completed the survey. Respondents were then stratified into three household income categories: <$25,000, 25,000-59,000, and >60,000. Investigators then examined behaviors and cooking frequency within each stratum. Price and lack of time were the barriers most often reported by survey respondents in all three income categories (Wolfson et al., 2019). Although inferences from this data are limited due to lack of objective measurements, respondent perceptions were elucidated.

Lavelle *et al*. conducted qualitative research in 2016 to explore participant perception on cooking from scratch (CFS) along with the associated barriers or facilitators of this habit. Semi-structured, one-on-one interviews were given to 27 participants ranging from 18-58 years of age. Participants self-reported a mean CFS skill score of 4.6 with a standard deviation of 1.6 on a scale from 1-7. Following interviews results were coded thematically. Thematic barriers to CFS were time pressure, desire to save money, desire for effortless meals, family food preferences, and effects of kitchen disasters (Lavelle et al., 2016). Facilitators included desire to improve health and well-being, creative inspiration, ability to plan or prepare meals ahead of time, and greater self-efficacy in cooking ability.

With a cross-sectional study design, Fernandez *et al.* aimed to examine the relationship between employment status, food skill, and diet quality. A web-based survey was sent to a sample of 767 Canadian parents from April through August of 2014. The survey collected data: sociodemographic information, diet measured via food frequency questionnaire (FFQ), and food skills questions from the Canadian Community Health

Survey (CCHS). Data from the FFQ was then assessed using the healthy eating index (HEI) to assess diet quality. Results revealed no significant differences between food skill and parent's employment status or diet quality and employment status; however, full-time parents had greater odds of identifying time as a barrier than stay-at-home-parents (OR=3.82; CI 2.44-5.99, p<0.001) (Fernandez et al., 2019).

In a longitudinal study design, Bertrand *et al.* examined Canadian undergraduate students' perception of their food skill after taking an 11-week foods course. A web-based survey was administered to students both pre- and post-course in 2017. In total, 47 students completed the pre- and post-survey which collected demographic information and asked food skills questions (FSQ). Post-course students scored significantly higher on FSQ than pre-course (p<0.05) (Bertrand et al., 2018). These results seem to indicate that an 11-week foods course was effective in improving undergraduate students' food skill.

Due to the Covid-19 pandemic, it is plausible that these barriers may have become more pronounced due to disruption of family life and periods of food scarcity. Lack of food skill, in combination with the unique circumstances in which the United States population finds itself during the pandemic could cause differences in the resilience and coping abilities of those with low versus intermediate or high food skill.

Measuring Food Skill

Previous studies have assessed cooking and food skill separately, however, cooking skill is a component of food skill (Fordyce-Voorham, 2011; Lavelle et al., 2017;

Porter et al., 2000). Furthermore, measuring these concepts independently may be ineffective due to qualitative research suggests that 'cooking' is not a universally understood or uniformly defined concept. Qualitative research was conducted by Wolfson, *et al*. in urban neighborhoods of Baltimore, Maryland which examined how a sample of Americans viewed and defined cooking. Data were collected from seven, semi-structured focus group sessions in both high and low-socioeconomic neighborhoods. In total 53 participants were sampled: mean age of participants was 50 years of age, and participants prepared dinner at home an average of 4.3 days out of the week. Results were analyzed using grounded theory. Analysis of the seven sessions seems to indicate that perceptions of cooking ranged from scratch cooking to any foodstuffs prepared at home-- for example warming pre-packaged macaroni in the microwave or preparing spaghetti from noodles, ketchup, and cut-up hotdogs. Key themes which emerged from this research indicate that time constraints and affordability were perceived as barriers to cooking more; whereas, time management strategies, organization, and a desire to eat healthier facilitated the behavior (Wolfson et al., 2016). Limitations from this research include the qualitative design, a non-randomized participant pool, and selection of participants from only an urban environment. As exploratory research, this qualitative study cannot demonstrate causality nor directionality; however, it did help to elucidate participant's perception of cooking. Non-randomized selection method and recruitment via flyers also introduced bias, because participants were more likely to have had strong opinions on cooking. Although this survey was one of the first to explore American's attitudes towards cooking, generalizability to the American population is limited due to the urban environment from which the sample of participants was gathered.

15

The validated questionnaires on cooking skill and food skill developed by Lavelle *et al.* in Ireland are applicable for future research and function within various socio-demographic levels. Researchers prepared four studies with different aims: study 1 evaluated the classification of questions into the appropriate category and tested convergent validity; study 2 examined temporal stability; study 3 documented the discriminant validity between those with high versus low cooking and food skill; and study 4 tested the mode of administration of the questionnaire. Study 1, the largest of the four, consisted of 1049 participants at an average age of 39.7 years. Based on the results of this sub-study, it was determined that the questions designated to gauge cooking and food skill were reliable measures to measure those skills at a Cronbach's alpha of >0.70 in both cohorts. The subsequent sub studies had fewer participants. Study 2 which used a test-retest assessment to evaluate the temporal stability, observed no differences in the mean scores of the 20 participants in the cooking skill or the 13 in the food skill assessment groups. When testing for discriminant validity, study 3 observed significant differences in the scores of 'Food preparation novices' versus 'Experienced food preparers,' with the second group scoring significantly higher on the questionnaire for cooking skills (p of <0.05) and for food skill (p of <0.01). Study 4 measured differences in the mode of administration as either 'Computer Assisted Personal Interviewing' (CAPI) or 'Paper and Pen' (P/P). From this forth study, researchers suggested administering the questionnaire in the CAPI form due to possible inflations in scoring when administering the P/P method (Lavelle et al., 2017). Although this study was able to produce a validated questionnaire for both food skills and cooking skills, it separated

16

the two into distinct categories; researchers such as Kennedy *et al.* have suggested that cooking skill is in fact an integral component of food skill.

In Canada, Kennedy *et al.* designed a subsequent study to prepare a validated questionnaire that measured a participant's food skill. This questionnaire was developed to measure the following domains of food skill: 'Food Selection and Planning,' 'Food Preparation,' 'Food Storage,' and 'Food Safety.' Development of this questionnaire was undertaken in four phases. In phase 1, researchers developed the questionnaire and categorized questions into the appropriate domains. Then in phase 2, seventeen experts within the field of nutrition were invited to assess the content validity of the questionnaire. Lawshe's content validity ratio (CVR) was used to see if the questions were essential. CVR values of greater than 0.49 were required for the question to remain in the questionnaire. Twenty undergraduate students, with basic to intermediate food skills, were then sampled in phase 3 to evaluate the face validity of the questions. Inter-item and test-retest reliability were then measured within phase 4, undergraduate students were sampled. In total 189 participants responded to the survey at time one, with 148 of those participants completing the questionnaire. An overall Cronbach's alpha of 0.90 was calculated for the overall questionnaire and a coefficient of 0.77 was calculated for 'Food Selection and Planning,' 0.88 for 'Food Preparation,' and 0.67 for 'Food Safety and Storage' (Kennedy et al., 2019). Two weeks after questionnaire administration, participants from time one were again sampled. In the test-retest participant pool, 165 participants responded, from those a total of 126 participants who completed at least half the questionnaire were used to assess the intraclass correlation coefficient (ICC). An ICC coefficient of 0.90 was calculated for 'Food Selection and Planning,' 0.93 for 'Food

Preparation,' and 0.86 for 'Food Safety and Storage' (Kennedy et al., 2019). Results of these analysis suggest that the questionnaire developed by Kennedy, *et al*. has both content and face validity, in addition to inter-item and test-retest reliability when measuring food skill. Limitations of this study include a high sampled proportion of females, lack of generalizability due to low response rate, and lack of assessment of criterion validity. Generalizability towards males is limited because all of the study phases had higher percentages of female respondents; however, there does appear to be a cooking gender-bias (Daniels et al., 2012). A diverse population of undergraduate students that was sampled, however, a low response rate of 9% further limits generatability (Kennedy et al., 2019). Criterion validity was not able to be assessed by investigators because there is no prior research which demonstrates the relationship between self-reported food skill and actual food skill. Unable to find studies that utilize this questionnaire due to recency in publication.

Resilience

Resilience is postulated to be a positive personality trait that helps to abate effects of, or aid in adaptation to stress and can also be thought of as emotional stamina (Wagnild & Young, 1993; Wagnild & Young, 1990). Following qualitative research conducted by Wagnild and Young in 1990, five constituents of resilience were identified: equanimity, perseverance, self-reliance, meaningfulness, and existential aloneness. According to Scoloveno, equanimity is "a balanced perspective of life experiences," perseverance is "persistence in face of adversity," self-reliance is "a belief in one's capabilities," meaningfulness is "realization that individual contributions are valued, and existential aloneness refers to the concept "that some experiences must be faced without

others" (Scoloveno et al., 2018). These themes were identified after asking 24, pre-screened women to identify how they managed themselves following a 'self-identified loss.' From this qualitative data, the 25-item Resilience Scale was developed (Wagnild & Young, 1990).

In order to validate the 25-item Resilience Scale (RS), Wagnild and Young sampled 810 community-dwelling adults in the Northwest region of the United States in 1993. Participants ranged from 53-95 years of age, mean age of 71.1 years, were 62.3% female, and a majority of respondents were ethnically white. Investigators hypothesized that higher resilience score would be correlated with greater moral and life satisfaction, better physical health, and lower levels of depression because those were the theoretically relevant constructs pertaining to resilience. Participants were mailed five questionnaires: the 25-item RS, the 20-item Life Satisfaction Index (LSI-A), the 17-item Philadelphia Geriatric Center Morale Scale (PGCMS), the 13-item Beck Depression Inventory (BDI), and a physical health scale in which participants ranks their overall health from 1-5. Construct validity was demonstrated for the 25-item RS after alpha coefficients were calculated. Results from the study indicate alpha coefficients of 0.77 for the LSI-A, 0.78 for the PGCMS, and 0.78 for the BDI (p <0.001) (Wagnild & Young, 1993). Additionally, overall the alpha coefficient for the internal consistency of this study was 0.91 (Wagnild & Young, 1993). These results demonstrate concurrent validity and show that the RS can be used as a measure of the constructs which resilience encompasses. Furthermore, by combining and analyzing results from other studies which had previously used the RS, investigators found a range of internal consistency of 0.76-0.91 and a test-retest reliability of 0.67-0.84 (p<0.01) (Wagnild & Young, 1993). Since its

development, the 25-item RS has been used as a validated assessment tool to identify individual resilience scores of participants; however, a shorter 14-item RS has since been released (Wagnild, 2009).

The 14-item Resilience Scale (RS), developed by Wagnild is less burdensome and less time consuming for respondents as it contains only 14-items from the original 25-item RS. Comparison of the two resilience scales has found that the alpha coefficient for the 14-item RS is 0.93 in comparison to the 25-item RS and that it correlates at an r of 0.97 with the original assessment tool (Wagnild, 2009). Since its development, the 14-item RS has been used extensively and more information has been collected by investigators.

In a meta-analysis of the 14-item Resilience Scale (RS), prepared by Miroševič *et al*., a review was conducted to evaluate the internal reliability, repeatability, concurrent validity, and restrictions of the 14-item RS as computed from fourteen research articles. An analysis on internal reliability found the Cronbach's alpha ranged from 0.76 to 0.96 within the studies and in terms of repeatability test-retest reliability fell between 0.70 and 0.83 (Miroševič et al., 2019). Additionally four articles administered both the 25-item and 14-item RS, the Pearson correlation coefficient was calculated to be r = 0.92 (Miroševič et al., 2019). Studies which used the 14-item RS conducted by Tian & Hong and Kwon & Kwon will be analyzed in the following paragraphs to discuss how the scale is utilized.

Tian and Hong examined the validity and reliability of the 14-item resilience scale (RS) in China. The sample consisted of 625 respondents who were collected from cluster sampling in Fuzhou City. Respondents were administered the Short Form-36 Health

Survey (SF-36) and the 14-item RS. Correlation between the two instruments was 0.82 and showed significance (p<0.001) (Tian & Hong, 2013). The 14-item RS demonstrated good internal consistency as it had a Cronbach's alpha of 0.93 (Tian & Hong, 2013).

In Korea the 14-item resilience scale (RS) was administered to a sample of 273 university students in 2012. The sample had both male (50.9%) and female respondents, of all grade classifications, who were between 18 to 37 years of age. Rosenberg's Self-Esteem Scale and a modified Center for Epidemiologic Studies Depression Scale (CES-D) were used to assess concurrent validity. In terms of concurrent validity: the correlation between the 14-item RS and the self-esteem scale was r=0.48, indicating that there was a positive correlation between resilience and self-esteem in the sample; the correlation between the 14-item RS and the CES-D was r=-0.45, indicating a negative correlation between resilience and depression (Kwon & Kwon, 2014). Cronbach's alpha was also assessed to examine internal validity. At an α=.905, the study demonstrated high internal validity (Kwon & Kwon, 2014).

Resilience and Diet Quality

There are both cross-sectional and longitudinal research to suggest that a relationship exists between diet quality and the development of psychiatric symptoms such as depression and anxiety (Lai et al., 2014). A new field called nutritional psychiatry aims to assess the relationships between dietary intake and psychiatric conditions; for example, current research suggests that depression is associated with an inflammatory response (Berk et al., 2013; Dowlati et al., 2010). These associations are important to

investigate because depression, as measured by both the 25-item and 14-item resilience scale, are inversely related to resilience (Wagnild, 2009).

Depression and Diet Quality

Epidemiological research has shifted from assessments regarding single nutrients, to assessments of overall dietary patterns and associated health risks. Lai, *et al*. prepared a meta-analysis of studies published before August 2013 to examine the relationships between dietary patterns and depression in adults. The following measures were used as inclusion criteria: whole diet quality had to be assessed through diet quality scores, indexes, or statistical methods; the primary or secondary outcome measure must include dysthymia, depressive symptoms, or depressive disorder; and the population needed to be community-dwelling adults, who were representative of the population. Methodology was then assessed using the Academy of Nutrition and Dietetics Quality Criteria Checklist for primary research. Articles were considered methodologically rigorous if all four relevance questions and six of the validity questions could be answered with a "yes." After analyzing the available literature, 21 articles were found which met the aforementioned criteria, 20 observational studies and 1 randomized controlled trial; however, due to incompatible definitions of dietary patterns only 13 observational studies were able to be included in the meta-analysis results. An odds ratio (OR) of 0.84 [0.76, 0.92] means that participants with a higher adherence to the healthy diet had a 16% lower odds of developing depression (Lai et al., 2014). Healthy dietary patterns were those which had high intake of fruit, vegetable, fish, and whole grain. Additionally, the meta-analysis stated that there seemed to be an association between a higher consumption of

the Western diet and depression; however, the result was not significant, and few studies were included in the analysis. Synthesis of the studies evaluating dietary patterns and risk of depression published prior to August 2013, seem to suggest a protective effect from the consumption of fruit, vegetable, fish and whole grain. Following the publication of this meta-analysis, research has continued to be published regarding the effect of dietary patterns on depression risk.

Research published by Akbaraly, *et al.*, in 2016, examined the relationship between the Dietary Inflammatory Index (DII) and recurrence of depressive symptoms (DepS). The aim of this study was to examine the effects of the inflammatory potential of the dietary pattern on a cohort of 4,246 British participants over a span of 5 years. Participants were between 35-50 years of age and did not have any DepS at the time of study onset. Dietary pattern was assessed using a 127-item food frequency questionnaire (FFQ). DII score was then calculated using 27 of the 45 parameters measurable by the FFQ including energy, carbohydrate, protein, total fat, trans fat, saturated fat, polyunsaturated fatty acid, monounsaturated fatty acid, cholesterol, alcohol, fiber, omega-3, omega-6, selenium, niacin, riboflavin, thiamin, vitamins A, B12, B6, C, D, and E, folic acid, iron, magnesium, and zinc. Higher DII score was indicative of a higher proinflammatory diet. Analysis on males and females were conducted separately after a logistic regression found sex interaction ($p<0.056$) --there were 3,178 males and 1,068 females. After adjustment, results from the analysis found that women in the highest tertile for DII score had higher odds of DepS over the 5 years compared to the women in the lowest tertile of DII score at an odds ratio of 2.83 [CI: 1.48-5.42] (Akbaraly et al., 2016). No significant associations were found in data from male participants. There were

23

several limitations in this study caused by the two assessment tools: The Center for Epidemiologic Studies Depression Scale (CES-D) and FFQ. Although the CES-D is validated and reliable it cannot compute the severity of DepS. Additionally, FFQs are prone to measurement bias due to self-report. Strengths of the study include large sample size, a relatively long follow up period of five years, and results in agreement with concurrent studies published on dietary patterns and depression risk.

The Mediterranean lifestyle also appears to have an inverse impact on the risk of depression. A prospective cohort study which aimed to assess the relationships between adherence to a Mediterranean lifestyle and risk of depression was conducted by Sánchez-Villegas, *et al*. The study was conducted in Spain, amongst a sample of university graduates from Seguimiento Universidad de Navarra from December of 1999 through June of 2014, there was a mean follow up of 8.5 years and 806 cases of depression were reported. In total, 11,800 participants were included in the analysis. A questionnaire was administered at baseline and a follow up was sent out biennially for the fourteen-year duration of the study; included in the questionnaire was a 136-item, validated, semi-quantitative FFQ, a physical activity questionnaire, and a social activity questionnaire. Adherence to the Mediterranean lifestyle was calculated by relative percentage adherence to the Mediterranean diet, physical activity level, and social activity. High versus low adherence to the Mediterranean lifestyle score was determined after calculating the relative adherence to diet, physical activity, and social activity score--higher scores indicated higher adherence. Participants were then stratified into tertiles based upon overall adherence to the Mediterranean lifestyle and hazard ratios were calculated using the lowest tertile as a reference group. An inverse relationship was found between the

three exposure variables and depression risk. Calculated hazard ratios and 95% confidence intervals of the exposure variables revealed 0.82 [0.69, 0.97] for Mediterranean diet adherence, 0.81 [0.69, 0.97] for the physical activity, and 0.77 [0.64, 0.93] for social activity (Sánchez-Villegas et al., 2016). Participants with the highest adherence to the Mediterranean lifestyle as compared to the lowest adherence had a further reduction in risk of depression at a HR of 0.50, [0.32, 0.81] (Sánchez-Villegas et al., 2016). The results of this study are in accordance with prior research which related adherence to the Mediterranean diet with lower risk of depression (Rienks et al., 2013; Skarupski et al., 2013). Strengths of this study include the large participant pool, a 90% participant retention rate, concurrent validity deemed by accordance with other recently published literature, a biological gradient, plausibility, and measurement of factors such as physical activity. Limitations include use of self-reported data via surveys.

Resilience and Food Skill

There appears to be a direct relationship between food skill and diet quality and inverse relationships between diet quality and depressive symptoms. Because depression has an inverse relationship with resilience, it is possible that there will also be relationships between food skill and resilience. After a comprehensive database search for studies related to food skill and resilience or physiological health only the following was found.

In Sejong, South Korea, Lee *et al.* aimed to assess the effect of a mother-child farming programs on communication and psychological health within the mother-child dyad. Dyads participated in six, 90-minute sessions in 2018. Previous research suggests

that farming programs have been found to reduce cortisol levels and promote cognitive function (Lee et al., 2018). Within this study, researchers hypothesized that the farming activities in combination with integrated communication lessons could improve depressive symptoms and resilience in mothers and help the children with emotional intelligence. Farming activities included plotting, planting, harvesting, and cooking crops. To help with communication between the dyads, before each session a communication lesson was given, and mothers were then asked to practice that skill throughout the session. Mothers were in turn then praised and reinforced throughout the session by a horticultural therapist who would observe the participants. The following surveys were administered before and after the intervention to assess changes in communication, depressive symptoms and resilience, and emotional intelligence of the child: Parents and Children Communication Inventory, the Korean Beck Depression Inventory, the Korean Connor-Davidson Resilience Scale, and the Emotional Intelligence Rating Scale for Preschool Children. An analysis of aforementioned surveys revealed the following trends: mother-child communication increased ($p=0.024$), resilience improved ($p=0.028$), maternal depression decreased ($p=0.003$), and children had improvements to emotional intelligence ($p=0.018$) (Lee, et al., 2019). Results from this intervention appear to indicate that the farming program was effective. A limitation of this study is the small sample size with only 16 mother-child dyad participants. Although results seem to agree with other contemporary studies, it is not clear which aspect of the program caused an increase in mother's resilience.

Summary

Given the unique circumstances caused by the Covid-19 pandemic, researchers are presented with the unique opportunity to examine a sample of people experiencing a shared stressor. Due to data suggesting an inverse relationship between resilience and depression (Wagnild & Young, 1993), an inverse relationship between depression and diet quality (Lai et al., 2014) and positive associations between diet quality with food skill (Hartmann et al., 2013; Murray et al., 2016; Utter et al., 2018), there may be associations between resilience and food skill.

CHAPTER 3

METHODOLOGY

Participants and Study Design

Students, faculty, and staff at Arizona State University were targeted for this study in April thru June of 2020. Participants were 18-45 years of age, living independently (e.g., not living with parents) with access to a kitchen, and responsible for acquiring/preparing their meals. Email notices and social media messaging were used to advertise the study and recruit participants. Interested individuals clicked on the link to complete the 10-minute survey. Data were collected on participant age, gender, student status, weight, height, physical activity level, living situation, meal plan status, ethnicity, and employment status.

All participants provided consent (indicated by survey participation). Additionally, the study was approved by the ASU Survey Review Committee (**Appendix A**) and exemption was granted by the Institutional Review Board at Arizona State University (**Appendix B**).

Study Measures

The study variables are food skill score, resilience, and coping. Food skill and resilience were measured using validated questionnaires, while coping was measured via a self-reported Likert scale. Following the perceptions noted in a study by Wolfson *et al.* it is important to assess cooking and food skills via a validated assessment (2016)—since respondents may have differing ideas as to what cooking entails. The food skills portion of the survey administered to participants within the current study, came from the previously validated questionnaire by Kennedy *et al.* (2019). Food skill is composed of

three aspects: food selection and planning, food preparation, and food safety/storage (2019). The food skills questionnaire developed by Kennedy *et al*. demonstrates content validity, face validity, and inter-item reliability, as such, this questionnaire can be used to evaluate basic through intermediate food skills. Resilience was measured using the 14-item resilience scale created by Wagnild (2009). The scale was validated against the 25-item resilience scale (Wagnild & Young, 1993) and demonstrates both internal reliability and test-rest validity (Miroševič et al., 2019). In addition to these measures, the Likert scale used to assess coping asked respondents the questions: "I was able to manage myself during the Coronavirus Pandemic" (7-point answer from 'strongly disagree to strongly agree') and "I tested positive (or was presumed positive) for COVID-19" (true or false). Participants were administered the questionnaires online via an electronic survey.

Statistical Analyses

At a 1% type 1 error and 4% precision (using published resilience data: mean±SD=134±17; see Losoi et al. 2013), a sample size of 77 was calculated using the equation:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^{2}\,SD^{2}}{d^{2}}$$

$Z_{1-\alpha/2}$ = Is standard normal variate

SD = Standard deviation of variable. Value of standard deviation can be taken from previously done study or through pilot study.
d = Absolute error or precision

(see Charan & Biswas, 2013). A sample size of 120 was targeted. Data analysis was conducted using the SPSS statistics software for Windows version 25 (IBM Corporation). Demographic data are reported as mean±SD. Data were tested for normality and transformed if necessary. The Spearman Correlation test was used to compare scores from the food skill questionnaire and the resilience questionnaire and to compare these data to coping during the coronavirus pandemic. Multiple regression analysis was applied to determine the factors associated with coping during the coronavirus pandemic. A p value less than 0.05 indicated significance.

CHAPTER 4

DATA ANALYSIS AND RESULTS

Demographics

Demographic information was collected on survey respondents. Separate analyses were conducted on male and female age, weight, height, and BMI which can be found in Table 1. There were 154 survey respondents, 27 male and 127 female. Mean age of participants was 29 years of age and did not differ significantly between males or females. Weight and height differed significantly between male and female respondents (p<0.001): means (±SD) for male participants were 202±54 lbs. and 70±3.5 inches; means for female participants were 152±33 lbs. and 65±2.8 inches. BMI also differed significantly between the two groups (p<0.05). Mean BMI for male participants was 28.4±5.8 kg/m² and 25.2±5.0 kg/m² for females.

Table 1 Sample Demographics

	Gender	n	Mean	Standard deviation	Sig. (2 tailed) p value	95% confidence Interval
Age	male	27	29.00	8.571	.664	-5.099, 3.257
	female	127	29.92	10.245	.627	-4.719, 2.876
Weight	male	27	202.04	53.961	<0.001	34.466, 65.939
	female	127	151.83	33.215	<0.001	28.166, 72.239
Height	male	27	70.30	3.451	<0.001	4.102, 6.543
	female	127	64.97	2.790	<0.001	3.881, 6.763
BMI	male	27	28.43	5.823	0.003	1.087, 5.379
	female	127	25.19	4.969	0.011	0.787, 5.679

Survey respondents were asked about their gender, student status, food restrictions, physical activity level, living situation, kitchen status, and kitchen appliances. There were more female respondents, 82.5%, than male respondents, 17.5%. Although the survey was administered through a university, 37.0% of respondents were not currently students due to online administration of the survey, 50.6% were undergraduates and 12.3% were graduates. At the time of survey administration, 66.9% of participants did not have dietary or food restrictions. Respondents were evenly distributed among physical activity levels: 27.9% were sedentary, 36.4% participated in moderate activity for 30 minutes on 5 days of the week, and 24.7% participated in moderate activity for 60 minutes on 5 days of the week. Living situations varied, 50.0% lived with a roommate or significant other and 19.5% lived with children. All respondents had a kitchen in their living space. Further information regarding the survey respondents can be found in Table 2.

Table 2 Student Status, Diet Habits, Living Situation, and
Kitchen Environment of Respondents

	n	%
*Male or female		
Male	27	17.5
Female	127	82.5
*Student Status		
Undergraduate student	78	50.6
Graduate student	19	12.3
Not currently a student	57	37.0
*Food Restrictions		
Food allergies	20	13

Vegetarian	16	10.4
Specific diet	27	17.5
No food restrictions	103	66.9
*Usual Weekly Physical Activity Level		
Sedentary	43	27.9
Moderate activity for 30 minutes on 5 days	56	36.4
Moderate activity for 60 minutes on 5 days	38	24.7
High intensity activity for 15 minutes on 5 days	3	1.9
High intensity activity for 30 minutes on 5 days	14	9.1
*Living Situation		
College dorm	15	9.7
Lives alone	21	13.6
Lives with roommate or significant other	77	50.0
Lives with parents	11	7.1
Lives with children	30	19.5
*Do you have a kitchen		
Yes	154	100
No	0	n/a
*Check which items you have in your kitchen		
Microwave	136	88.3
Stove top	142	92.2
Oven	142	92.2
Knives	142	92.2
Food thermometer	75	48.7
Variety of pots, pans, and cooking/measuring utensils	142	92.2
Crock-pot or slow cooker	113	73.4
Does not have a kitchen	0	n/a

* Multiple responses allowed

Results

       Spearman correlation was conducted between food skill score and resilience score

to analyze hypothesis 1 (H_1): food skill score will correlate to resilience score and to

coping during the coronavirus pandemic. In Figure A, food skill score was significantly

related to resilience score ($p<0.001$) ($r=0.364$ and $r^2=0.1243$) as seen in Figure 1. In

Figure B, correlations were run between resilience score and the separate domains of

food skill score: 'Food Selection and Planning,' 'Food Preparation,' and 'Food Safety.'

All domains were significantly associated with resilience score ($p<0.001$) with a $r=0.340$

and $r^2=0.1173$ for 'Food Selection and Planning,' $r=0.312$ and $r^2=0.0958$ for 'Food

Preparation,' and $r=0.294$ and $r^2=0.0767$ for 'Food Safety.'
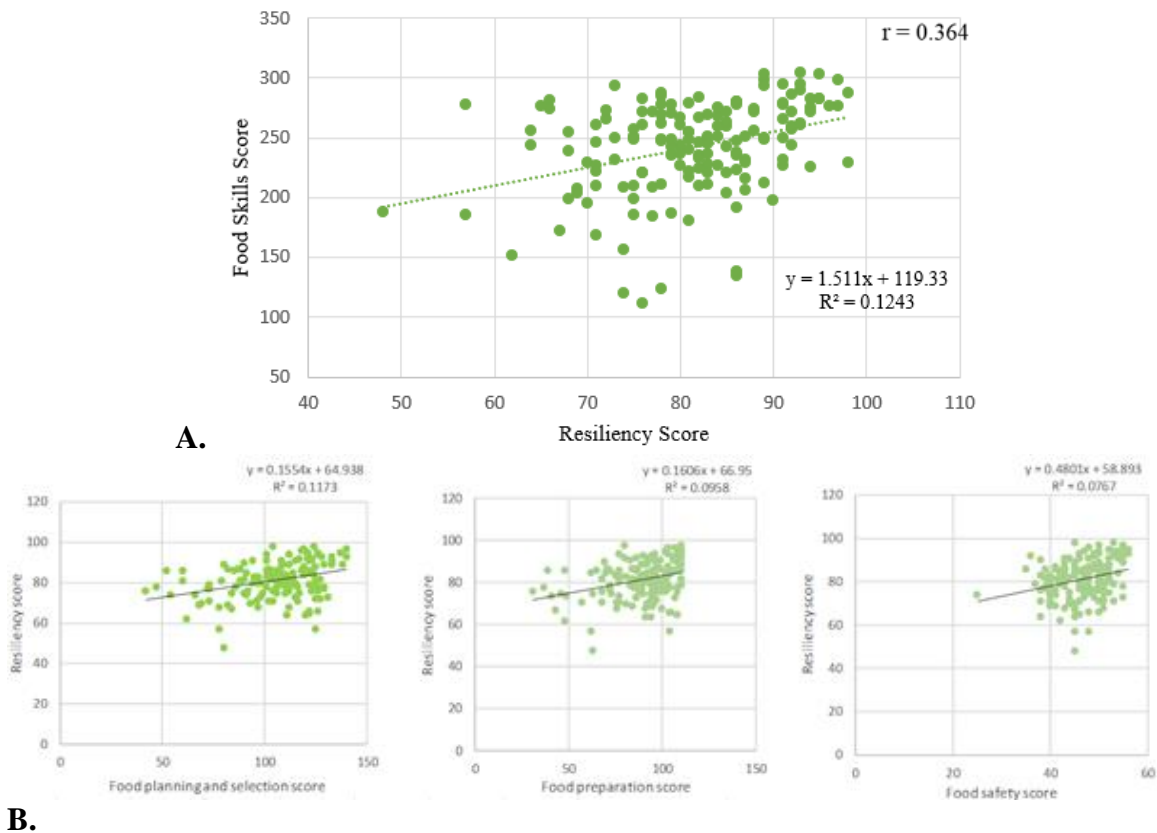

A.

B.

Figure 1. Correlation between (A) food skills score and resiliency score and (B)
components of food skills score and resiliency in respondents (n=154).

To analyze the second hypothesis, (H_2): resilience will correlate to coping during the coronavirus pandemic, the nonparametric Spearman test was used to run a correlation between resilience score and managing during Covid-19. Significant associations ($p < 0.001$) were found between the two scores, $r = 0.455$. Figure 2 shows the mean and 95% confidence interval for resilience score with the corresponding self-reported ability to manage during Covid-19. Survey respondents were asked how well they managed on a scale of 1-7 (1+strongly disagree; 4=undecided; 7=strongly agree).
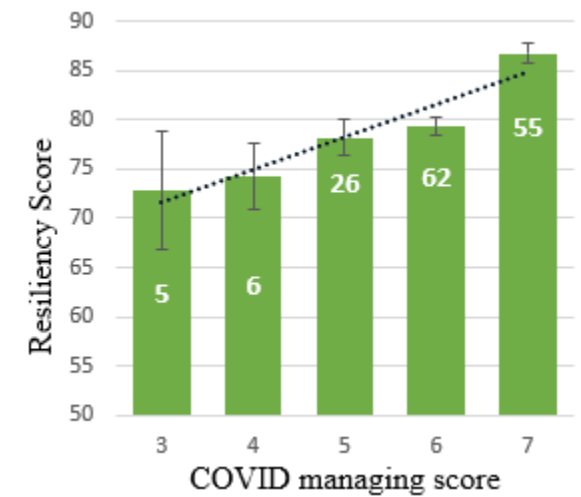

Figure 2. Relationship between resiliency score and coping data during the Covid-19 pandemic (data are mean±SE; <0.001 for linear association; n displayed in each bar). Score for question, *I was able to manage myself during COVID*: 1=strongly disagree; 4=undecided; 7=strongly agree.

Additionally, an analysis was conducted on food skill score and management during the Covid-19 pandemic. Significant associations ($p < 0.001$) were found between the scores, $r = 0.258$ as seen in Figure 3.
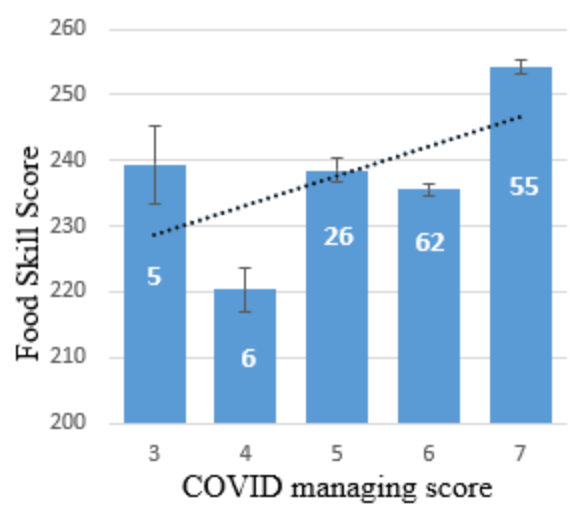
Figure 3. Relationship between food skill score and coping data during the Covid-19 pandemic (data are mean±SE; <0.001 for linear association; n displayed in each bar). Score for question, *I was able to manage myself during COVID*: 1=strongly disagree; 4=undecided; 7=strongly agree.

Analyses were also run to assess for potential confounders involving the passage of time and ability to purchase food. Because the study was administered in April through June of 2020, those that took the survey in the latter part of the administration period would have experienced Covid-19 for a longer period. Due to this variable, a partial correlation with time as a variable was run to evaluate if the passage of time affected outcome variables or participants' resiliency scores. No significant associations were found. One of the survey questions asked if Covid-19 had impacted participant's ability to purchase food. After controlling for participants' ability to purchase food, all correlations between food skills and resilience remained significant.

CHAPTER 5

SUMMARY AND DISCUSSION

Discussion

Based on a careful review of literature, this appears to be the first study evaluating

the relationship between food skill and resilience. Correlational analyses confirmed that

food skill scores were significantly correlated to resilience scores and to coping during

the Covid-19 pandemic. These results are important because an individual's food skill

can be improved and expanded. Due to scarcity of research involving food skills and

resilience, research evaluating the connection between diet quality and resilience was

used to assess concurrent validity. Food skill score has been positively associated with

diet quality in other studies (McGowan et al. 2017) and there are cross-sectional studies

relating diet quality to resilience (Bonaccio et al., 2018; Lutz et al., 2017; Springfield et

al., 2020).

An abstract published by Springfield, *et al*. observed a similar phenomenon. In a

cross-sectional analysis of 4,309 adults from the San Francisco Bay Area, there were

significant associations between diet quality and resilience after adjusting for perceived

stress and sociodemographic factors: $\beta=0.15\pm0.32$ in the 18-29 age range, $\beta=0.12\pm0.35$

in the 30-49 age range, and $\beta=0.9\pm0.34$ in the 50+ age range (2020). However, after fully

adjusting the model, the only significant associations remained in the youngest age group

$\beta=0.14\pm0.34$, p=0.02 (2020). Participants within this study were predominately college-

educated females, as were respondents in the current study.

In the Moli-Sani study, Bonaccio *et al.* found that higher adherence to the Mediterranean diet was associated with greater resilience--higher adherence to the Mediterranean diet would improve overall diet quality. There were 10,812 participants, all 35 years of age or older who participated in this study from 2005 to 2010. Results yielded a β=0.43 [0.19-0.66] (2018). Although this study investigates a specific dietary pattern, it also shows relationships between diet quality and resilience. Additionally, Lutz *et al.* found greater adherence to the dietary guidelines for Americans to be associated with resilience in young adults. After analyzing data from 656 participants, higher diet quality was found to increase odds of resilience OR=1.02 [1.01,1.04] (Lutz et al. 2017).

Better diet quality results in better nutrient intake resulting in higher intake of B vitamins or polyphenols which may improve brain function, improve brain health, and promote resilience (Ward & Pasinetti, 2016). Psychological resilience may be related to polyphenols, a compound found in fruit, vegetables, and teas, due to associated improvements to synaptic plasticity (Spencer, 2009). A review on adolescent obesity by Ruiz *et al.* from 2019 also highlights associations between diet quality, psychosocial health, and physical health.

Eating away from home has also been linked to weight gain and obesity (Ayala et al., 2018; Larson et al., 2011), as foods consumed away from home tend to be lower in fiber, higher in fat, and higher in calories than foods prepared at home (Guthrie et al., 2002). The type of restaurant frequented did impact associations of diet quality and weight status: greater intake from fast food establishments who served primarily burgers and fries was associated with higher weight status and poorer diet quality, greater intake from establishments who served subs or sandwiches was unrelated to weight status but

was associated with poorer diet quality, and greater intake from full-service restaurants was not associated with weight status but did seem to correlate with higher vegetable consumption (Larson et al., 2011). In the current study, for the majority of the survey period Arizona was in lockdown, March 30th-May 15th, and full-service restaurants were not open due to the "Stay Home, Stay Healthy, Stay Connected" mandate (Exec. Order No. 2020-18, 2020). Because of this factor respondents would most-likely not have had a healthy, away from home dining option and food skills would have impacted diet quality.

The secondary finding from the current study is that resilience was correlated with coping during the Covid-19 pandemic. Data collected in March of 2020, during the Covid-19 pandemic, by Havnen *et al.* also suggest that resilience moderated stress and anxiety symptoms in a sample of 617 Norwegians. Resilience was found to be inversely associated with anxiety β=-0.131 (p<0.001) and depressive symptoms β=-0.068 (p<0.05) and an index of moderated mediation IMM=-0.036, (p<0.001; [-0.055,-0.020]) (Havnen et al.,2020). These results show concurrent validity with the associations found between resilience and coping during the Covid-19 pandemic.

In 2012 researchers in Canada surveyed university students to see what their self-perceived food skills were. Results from the study by Wilson *et al.* indicated that females had significantly higher food skills than male (p<0.001), students who took a food or nutrition course had significantly higher food skills than those who did not (p<0.001), and that students living independently had significantly higher food skill score than those who lived in residence halls or with parents (p<0.001). Of the 5,838 respondents 65.2% were between 19-24 years of age, 72.9% were female, and 51.4% indicated living by

themselves or with a roommate in a house or an apartment (Wilson et al., 2017). Given that in the current study 62.9% of respondents were university students, 82.6% were female, and 83.1% of respondents were living independently from their parents and university residence halls, the higher total food skill scores observed within the sample would have been expected.

Although all three domains measured by total food skill score were significantly associated with resilience, the domain for food safety contributed the least to the amount of overall variance in resilience accounted for by total food skill score (r^2=0.0767). Low overall food safety scoring may be attributable to sample respondents' perception that they are unlikely to be at risk for foodborne disease. A study by Green and Knechtges which surveyed the food safety knowledge of a sample of American university students in 2013 found that of 786 respondents, 72% thought they were very unlikely or unlikely to contract a foodborne illness. Furthermore, results from a subsequent food safety quiz revealed respondents had limited food safety knowledge on average only scoring of 10.23 out of 24 possible points (Green & Knechtges, 2015). These findings and overall lower scoring within the food safety domain in the current study may indicate that respondents have less knowledge about this domain or perceive it to be a non-issue.

Additionally, there is cross-sectional data to support the relationship between food skill and diet quality. In an Australian cohort of 910 adults, higher diet quality was significantly associated with greater food skill confidence (p<0.001) (Lavelle et al., 2019). These data seem to indicate that improvements to food skill could modulate diet quality. Furthermore, contemporary research suggests there may be relationships between BMI, diet quality, and salivary cortisol levels (Karanian et al, 2020). Higher cortisol

40

levels may promote weight gain through hyperactivation of the hypothalamic-pituitary-adrenal (HPA) axis (Vicennati et al., 2012).

Study Limitations

Limitations from this study include no collection of respondent income, convenience sampling, unequal distribution of respondents within the Covid-19 management scores, self-reported data, and strength of evidence. Because respondent income was not assessed, this variable cannot be analyzed as a potential confounder. Generalizability is limited due to convenience sampling as sample demographics are not representative of the population and age-range was limited. Additionally, the Covid-19 transmission and restrictions in Arizona may be different from other areas in the United States and globally. There was an unequal distribution of respondents in each Covid-19 management score which lowers generalizability because responses scores may or may not have been typical and standard error within those data sets is larger. Finally, self-reported data was used which may have introduced bias into the results; however validated questionnaires were administered to the respondent pool. Due to the cross-sectional study design, cause and effect cannot be demonstrated by these results. Longitudinal and randomized controlled trials would be needed to further interpret the effect of food skill score on resilience.

CHAPTER 6

CONCLUSION

Research Implication

Primary analysis suggests that higher food skill score was significantly associated with resilience during the Covid-19 pandemic and secondary analysis suggests that resilience was related to coping during the Covid-19 pandemic. Due to design structure directionality is unknown; however, these results suggest that improvement to one variable would modulate the other. In addition to assessing the relationship of these to variables within other samples or populations, further research with more casual design structure is needed to assess the directionality. Additionally, researchers could administer questionnaires to determine if there is a specific domain from the five constituents of resilience that food skill is impacting.

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APPENDIX A

ASU SURVEY REVIEW COMMITTEE APPROVAL

University Office of
Evaluation and
Educational
Effectiveness

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MEMO

Date: 5/18/20

To: Carol Johnston, Ph.D., Associate Dean
       College of Health Solutions

From: Shelly A. Potts, Ph.D., Senior Director

       Re: Survey Review

On **5/18/20,** the ASU Survey Review committee reviewed the following request:

Title:	Foods Skills and Resilience: An Exploration of Self-Sufficiency during the Coronavirus Pandemic
Investigator:	Savanna Phares, Carol Johnston
Unit	College of Health Solutions
IRB ID:	STUDY00011858
Documents Reviewed:	Survey Review Form, Survey, IRB Application and approval form, consent form
Committee response:	Survey may proceed as planned.

cc: Susan Metosky
       Sheila Ainlay
       Savanna Phares

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

ASU Knowledge Enterprise
Development

EXEMPTION GRANTED

Carol Johnston
CHS: Health Solutions, College of
602/496-2539
CAROL.JOHNSTON@asu.edu

Dear Carol Johnston:

On 4/17/2020 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Foods Skills and Resilience: An Exploration of Self-Sufficiency during the Coronavirus Pandemic
Investigator:	Carol Johnston
IRB ID:	STUDY00011858
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Protocol, Category: IRB Protocol; • Recruitment email, Category: Recruitment Materials; • survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 on 4/17/2020.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc:
        Savanna Phares