January 2020

Relationship Between Food Craving And Food Selection

Elizabeth Marie Raiff
bethraiff.13@gmail.com

Relationship Between Food Craving and Food Selection

Completed By: Elizabeth Raiff, MPH Candidate 2020

Completed: May 2020

Yale School of Public Health, Division of Social and Behavioral Sciences

Primary Adviser: Marney White, PhD

Committee Members: Janet Lydecker, PhD

Abstract

Objective: The primary aim of this study was to determine the influence of craving on food selection.

Research Methods and Procedures: A total of 95 viable participants completed the food craving inventory (FCI), a restaurant meal selection questionnaire, and various demographic questions. Linear regression modeling was used to analyze the relationship between FCI craving score and various forms of caloric intake. Logistic regression models were utilized to analyze the relationship between "high-craving" status and food selection.

Results: No significant findings resulted from modelling the relationship between craving category FCI scores and craved caloric intake using Pearson's coefficient. Likewise, no significant relationships were observed between craving category FCI scores and total caloric intake. Various significant relationships resulted from modelling the relationship between "high-craver" status and food selection. "High-craver" status for CARB and SWEET were significant predictors of choosing a high-fat meal. "High-craver" status for FFF was found to be a significant predictor of choosing a high-FFF meal. "High-craver" status for FFF and SWEET were significant predictors for choosing a high-carb meal.

Discussion: While no significant associations were observed using linear regression to model the relationship between FCI score and caloric intake, these insignificant relationships may not hold true when more robust dietary measures for food selection are utilized and a larger sample size is polled. A number of significant relationships were elucidated using logistic regression to assess the relationship between "high-craver" status and food selection. Some of these relationships were positive and others inverse; however, important ideas concerning craving and food choice can be garnered from each of these.

Conclusion: There are a number of limitations associated with this study; however, despite these limitations, this study provides an important base for the relationship between the magnitude of an individual's craving score and food selection. With more robust studies centering around the same topic matter, it is possible that more concrete relationships between craving and food selection can be illuminated.

Table of Contents

Background

Obesity (defined as a BMI > 30.0) is the second leading cause of preventable death in the United States[7]. A multitude of dire health consequences have been linked with obesity including cardiovascular disease, cancer, and diabetes[14]. The economic burden associated with obesity and its affiliated health consequences increases astronomically by year. By 2030, these costs are estimated to jump by $48-66 billion dollars per year[14]. Considering the salience of obesity as an issue in Americans' lives, it is an important problem to address through a variety of avenues. Food craving has been associated with both excessive food consumption and addictive behaviors[7,9]. While some studies question the validity of food addiction as a construct, others have demonstrated similar biological and psychological symptoms in individuals experiencing food craving as in individuals experiencing drug craving and addiction[2,9,13]. Food addiction and excessive food consumption have been positively associated with body mass index (BMI), thus making craving a possible avenue through which to address obesity on the individual level.

Craving can broadly be defined as an insistent yearning for a distinct substance[15]. Common substances studied in relation to craving include alcohol, tobacco, drugs, and food[7]. For the purpose of this study, craving will be looked at in terms of how it relates to food. Food craving is distinct from hunger in that it involves yearning for a specific food or food category, whereas hunger may be alleviated through consumption of any food class. Individuals experiencing food craving often experience a loss of control that leads to consumption of that specific food item, or a similar food item from the same pattern of craving[7]. As defined by the Food Craving Inventory (FCI) there are four specific patterns of craving that each item included on the FCI can be categorized into. These areas of craving are: Fat, Fast Food Fat (FFF), Carb, and Sweet[16]. These craving areas were defined using participants' perceived similarities between specific foods as opposed to macronutrient data. The FFF category was a surprise to investigators as many of the foods included in this category were similar in

nutrient composition to items included in the 'Fat' category[16]. The separation between foods sorted into FFF versus those sorted into FAT appeared to be due to ease of availability[16]. Cravings can be even more specific than those outlined by the four FCI patterns. An example of this would be endorsing a craving for bacon; this craving would fall into the craving pattern of FAT and the more specific craving category 'Bacon'.

Food craving has been studied in relation to a variety of conditions and experiences including craving in relation to menstrual cycles, pregnancy, mood or affect, and eating disorders[1,13]. Additionally, an important body of work has been established concerning the association between food cravings, consumption, and body weight[5,6]. Previous work done by Martin et al.[5] demonstrated that higher craving scores within a larger craving pattern (e.g. high craving for sweets) was significantly correlated with higher consumption of specific foods enveloped within this category (e.g. M&Ms, jellybeans, etc.)[5]. Martin has also produced work contradicting previous thought in the field that restrictive diets led to increased strength of craving. His work has shown that restricting consumption (whether it be of specific foods or total caloric intake) is actually associated with decreased craving incidence[5,6]. Despite the previous important work produced surrounding craving, little work has been done to study the driving force of craving in relation to food selection. This study aims to determine the significance of specific craving experience in driving both caloric intake and selection of meals in a restaurant setting.

Methods

This was a cross-sectional study using data collected in 2017 from a food cravings and aversions questionnaire. Participants included 154 restaurant patrons and individuals who completed a survey online via Qualtrics. Qualtrics is a secure interface protected by firewall systems with scans performed regularly to guarantee that any errors in the system are repaired quickly, thus ensuring that data confidentiality is maintained. Furthermore, tests on the system are routinely performed by third-party

organizations to ensure there is no bias in reporting system safety[10]. When the dataset was cleaned to eradicate any responses with missing meal selection answers, 95 viable participants remained. These 95 participants completed a number of anonymous assessment relevant to food selection and preferences including the following relevant measures to this study: the Food Craving Inventory (FCI)[16], a restaurant food selection questionnaire, and a number of demographic questions to provide an overall description of the study sample.

Measures.

Food Craving. The FCI was developed to assess both specific food cravings as well as larger craving patterns. In the creation of this scale, factor analysis was used to determine relationships between each of the specific food items on the craving inventory, thus illuminating larger craving patterns[16]. Factor analysis established these categories by using intercorrelations between individual food items on the scale, allowing each item to 'load' onto an existing craving pattern[16]. Using the aforementioned statistical properties, the FCI illuminated four craving patterns: high fat (FAT), high fast food fat (FFF), high carbohydrate (CARB), and high-sugar (SWEET)[16]. The scale was assessed for reliability, using coefficient-α, concurrent validity, and discriminant validity. Concurrent validity was examined using the conceptual craving scale (CCS)[3] as well as the disinhibition and perceived hunger scales from the three factor eating questionnaire (TFEQ)[12]. Discriminant validity was assessed using the restraint scale from the TFEQ[16]. The total reliability score for the FCI is 0.93 and the four craving patterns fall within acceptable ranges as well[16].

FCI scores for each specific food item span from 1 to 5, asking the participant how often during the past month they have experienced craving for the food item in question. A response of 1 equates to having never experienced a craving, a score of 2 equates to rarely experiencing a craving, a score of 3 equates to sometimes experiencing a craving, a score of 4 equates to experiencing a craving often, and a

score of 5 equates to experiencing a craving always/almost every day. An individual's "craving score" for one of the four craving patterns (FAT, FFF, CARB, or SWEET) is calculated by taking the mean of the specific food items loading onto a particular subscale, producing a craving score out of 5 possible points for the craving pattern in question.

Restaurant Food Selection. Participants were asked to describe their most recent restaurant meal choice using a free-form text response. Measurement of food selection was represented using these recent restaurant selections recorded by participants. The restaurant selections were categorized into one of the four subscale options associated with the FCI: high-fat, high-FFF, high-carb, and high-sweet meals. For food items that were not included on the original FCI, three independent raters evaluated the food to determine its classification as FAT, FFF, CARB, or SWEET. Inter-rater analysis (Cohen's kappa) was used to evaluate inter-rater agreement; only foods demonstrating high rater agreement were included in analysis. Likewise, for meals that are composed of more than one subscale component inter-rater analysis (Cohen's kappa) was used to determine which subscale category provided the most representative capture for the meal. If high agreement between raters was not achieved (i.e. all three raters did not agree on placement), the data point in question was excluded from analysis.

Caloric intake of target meal. Total caloric intake, as well as intake of the "craved" component of the meal (e.g. the fatty components of a meal categorized as "high-fat"), were calculated using values derived from calorieking.com. For restaurants not included on the interface, the most representative restaurant was selected based on the meal description. Further detail regarding calorieking.com and restaurants used for each meal can be found in the Appendix.

Analytic plan. Statistical analyses were conducted using SAS software. Linear regression was used to create modes analyzing the correlation between specific food craving score and the total caloric intake of a recently selected meal as well as "craved" caloric intake. Likewise, linear regression was used to

analyze the relationship between general craving score (i.e. craving score of all four subscales combined) and total caloric intake. Logistic regression was used to determine the relationship between being stratified as a "high-craver" for a specific category (FAT, FFF, CARB, SWEET) and likelihood of selecting a meal representative of each of the craving categories. Due to the small sample size and novel nature of the study, a significant level of 10% ($p = 0.10$) was chosen for analysis. "High-craving" status for a subscale category was defined as experiencing craving above the mean craving score for all of the participants in the study. A similar approach was used in a 2002 study to describe "specific" vs. "non-specific" food cravers[16].

Results

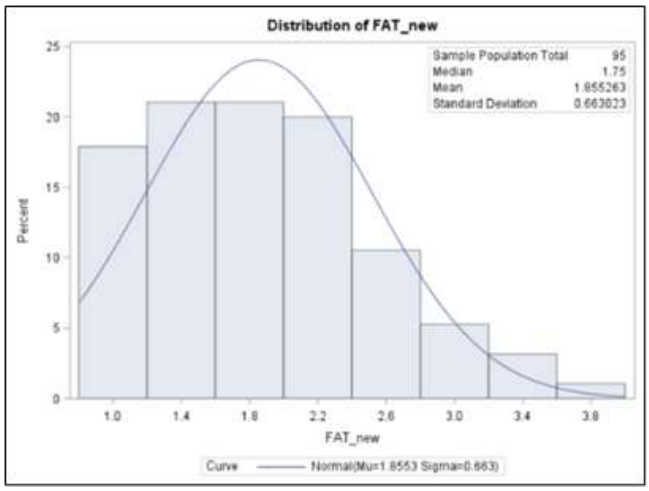
Distribution of FCI craving scores among participants varied across the four craving categories: FAT, FFF, CARB, and SWEET. The Anderson-Darling test was used to assess for normal distribution of the sample among each of the craving categories. Craving scores within the FAT and CARB categories were not distributed normally ($p < 0.05$). These distributions are pictured in Figure 1. Craving scores within the FFF and SWEET categories were distributed normally ($p > 0.05$). These distributions are visually represented in Figures 1. Distribution of "high" vs. "low" cravers favored "high" craving in every craving category barring FAT. The sample distribution of "high" vs. "low" cravers is pictured in Figure 2. The cut-off point for being classified as a "high craver" was 1.86/5.00 for FAT, 2.73/5.00 for FFF, 2.01/5.00 for CARB, and 2.35/5.00 for SWEET.

No significant findings resulted from linear regression modelling of the relationship between total craving score and total caloric intake. Similarly, no significant findings resulted from the model describing the relationship between craving category FCI scores and craved caloric intake using Pearson's coefficient in both the adjusted and unadjusted models. This also held true for the linear

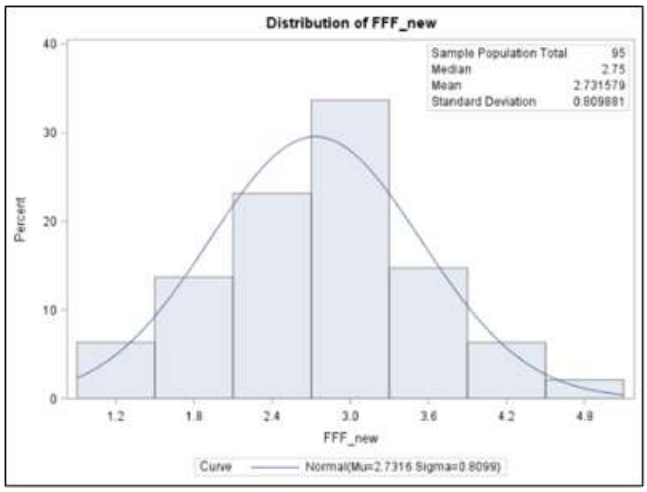
regression model describing the relationship between craving category FCI scores and total caloric intake.

"High-craver" status for FAT was not found to be a significant predictor of choosing a "high-fat' meal in the unadjusted model. Interestingly, "high-craver" status for CARB and SWEET were significant predictors of choosing a high-fat meal. "High-craver" status for FFF was found to be a significant predictor of choosing a high-FFF meal in the unadjusted model. Unfortunately, this relationship did not hold true in the fully adjusted model. Much like "high-craver" status for FAT, "high-craver" statuses for CARB and SWEET were not significant predictors for choosing high-carb and high-sweet meals respectively in each unadjusted model. This insignificant relationship held true in the "high-sweet" fully adjusted model. However, various compelling relationships were elucidated in the "high-craver" for CARB adjusted model. While "high-craver" status for CARB was still not a significant predictor of choosing a high-carb meal in the adjusted model, "high-craver" status for FFF and SWEET were significant predictors for choosing a high-carb meal. Furthermore, these were the most significant relationships produced by the various aforementioned logistic regression models. Odds ratios and associated p-values for each of the relationships mentioned here can be seen in Table 3.

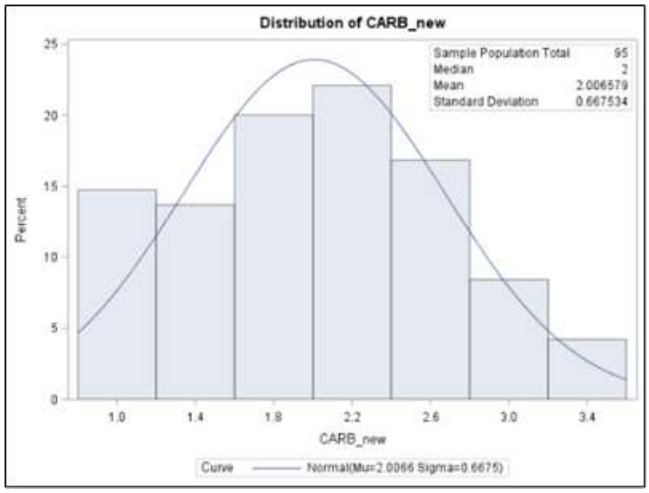
Figure 1



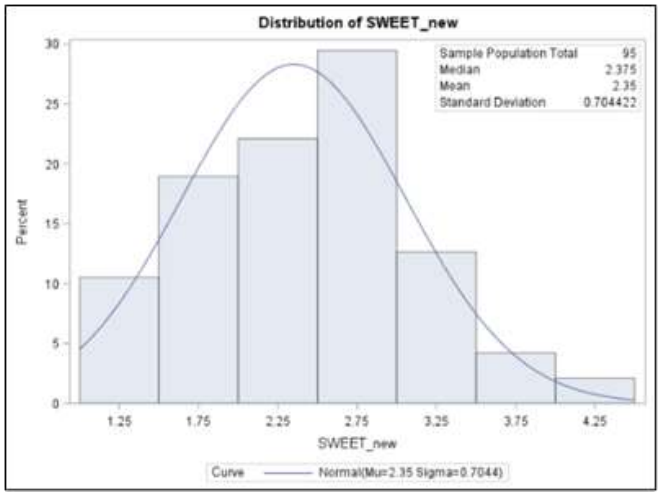
FAT FCI Craving Score Distribution



FFF FCI Craving Score Distribution



CARB FCI Craving Score Distribution



SWEET FCI Craving Score Distribution

Description of Study Sample	
Characteristic	**m ± sd**
Age (years)	44.1 ± 16.7
Sample Total	n = 95
	n (%)
White	89 (94.7%)
Gender	
Female	62 (66.7%)
Male	31 (33.3%)
Educational Level	
1	1 (1.1)
2	7 (7.5)
3	13 (13.8)
4	40 (42.6)
5	28 (29.8)
6	5 (5.3)

Table 1: Description of Study Sample

Association Between Craving Category and Craved Caloric Intake				
Craving Category	Pearson Correlation Coefficient: Craved Calories	p-value	Pearson Correlation Coefficient: Total Calories	p-value
FAT	-0.021	0.849	-0.088	0.418
FFF	0.113	0.297	0.059	0.586
CARB	-0.022	0.840	-0.053	0.624
SWEET	0.051	0.639	-0.046	0.668
TOTAL SCORE	0.045	0.681	-0.034	0.752

Table 2: Relationship between FCI craving score and caloric intake

Associations Between "High-Craving" and Likelihood of Meal Selection Craving Subscale				
	OR (95% Confidence Interval)			
FAT High-Cravers	Unadjusted	p-value	Adjusted	p-value
High-Fat Meal	1.17 (0.47 - 2.90)	0.736	1.19 (0.41 - 3.47)	0.744
High-FFF Meal	1.47 (0.61 - 3.53)	0.393	1.38 (0.41 - 4.63)	0.602
High-Carb Meal	0.63 (0.25 - 1.57)	0.322	2.71 (0.74 - 9.87)	0.100*
High-Sweet Meal	1.21 (0.07 - 19.90)	0.896	0.21 (0.06 - 0.71)	0.013**
FFF High-Cravers				
High-Fat Meal	1.23 (0.49 - 3.09)	0.653	1.13 (0.43 - 2.97)	0.799
High-FFF Meal	2.18 (0.87 - 5.43)	0.096*	2.02 (0.67 - 6.04)	0.211
High-Carb Meal	0.42 (0.17 - 1.04)	0.061*	0.72 (0.23 - 2.23)	0.563
High-Sweet Meal	0.79 (0.05 - 13.07)	0.87	1.63 (0.55 - 4.80)	0.379
CARB High-Cravers				
High-Fat Meal	1.41 (0.56 - 3.52)	0.465	0.73 (0.26 - 2.03)	0.551
High-FFF Meal	1.34 (0.55 - 3.23)	0.519	0.36 (0.12 - 1.11)	0.076*
High-Carb Meal	0.60 (0.24 - 1.46)	0.26	0.58 (0.18 - 1.89)	0.368
High-Sweet Meal	0.87 (0.05 - 14.36)	0.922	3.06 (0.90 - 10.42)	0.074*
SWEET High-Cravers				
High-Fat Meal	0.47 (0.18 - 1.12)	0.086	1.41 (0.06 - 30.93)	0.827
High-FFF Meal	1.88 (0.77 - 4.63)	0.168	0.75 (0.02 - 24.09)	0.871
High-Carb Meal	1.28 (0.52 - 3.14)	0.591	0.99 (0.03 - 36.76)	0.996
High-Sweet Meal	0.83 (0.05 - 13.70)	0.896	0.85 (0.03 - 24.97)	0.923

Table 3: Logistic regression models highlighting relationships between "high-craving" status and meal selection

* indicates significance at the 0.1 level, ** indicates significance at the 0.05 level

High cravers were defined using a mean split (i.e. "high-cravers" are defines as those who scored above the mean craving score for a category within the sample population while "low-cravers" are defined as those who scored below the mean craving score. Precedence for this was set in a previous 2002 study validating the use of the Food Craving Inventory utilized in this study[12].

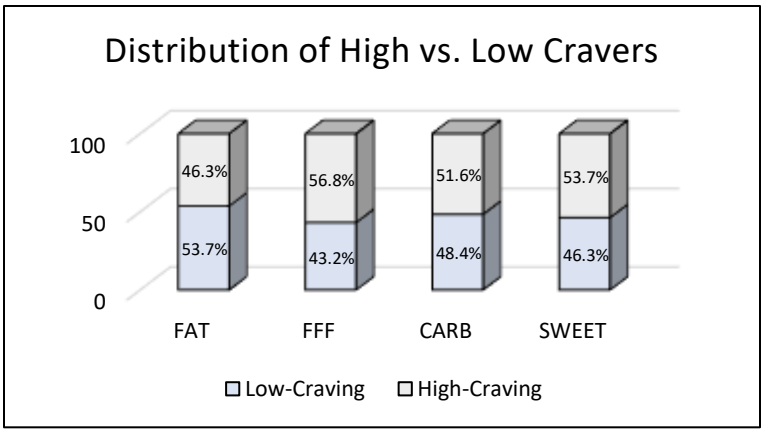


Figure 2: "High" vs. "Low" Craver Status Across Craving Category

Discussion

The chief objective of this study was to determine the magnitude specific craving experience plays in driving both caloric intake and selection of meals. Magnitude of craving experience was defined as both a continuous and binary variable and used in linear and logistic regression models. When individuals were grouped into "high" and "low" craving categories using a mean split the distribution of cravers was pretty well centered around the mean with about half of individuals falling above the mean mark and about half falling below. Distribution slightly favored "high-cravers" for the FFF, CARB, and SWEET, craving categories while the opposite was true for the FAT category. This split was to be expected as the division was determined using the population mean craving score for each of the four categories. In future studies, a more precise route to define "high" vs. "low" cravers may be to create a higher mark (e.g. upper quartile) for definition of "high cravers".

No significant association was observed using linear regression to model the relationship between FCI score and craved caloric intake. Nor was a significant relationship observed using linear regression to model the relationship between FCI score and total caloric intake. Models were created to analyze the relationship between specific craving category scores and craved caloric intake as well as total caloric intake. Models were also created to analyze total craving score (i.e. combined FCI score from each of the four specific craving categories) in relation to total caloric intake. These insignificant relationships are all detailed in Figure 2. There are a number of possible reasons these relationships were not significant; an integral one being an individual's most recent meal selection at a restaurant may not be the most representative capture of their regular food selection. Other factors come into play at restaurants that may cause individuals not to give in to cravings they are experiencing. Just a few examples of these extraneous factors include fear of public judgement and cost of the meal. Additionally, there was no measure of the amount of food consumed during the restaurant meal. Calorie

estimates were calculated with the assumption that the entire meal was consumed, which likely introduced significant measurement error in the primary outcome. Furthermore, even individuals who experience craving at a higher magnitude do not make every meal choice based on those cravings. It is possible that a number of the high FCI scoring individuals chose meals that were not representative of their general food intake or craving experience. An interesting route in future studies may be to use more involved dietary assessments. While this increases respondent and analysis burden; it is possible integral relationships between craving score and caloric intake could be elucidated using these methods.

While no significant relationships resulted from the linear regression models, a number of interesting significant relationships arose from the logistic regression models. Detailed odds ratios and p-values for the subsequent relationships can be found in Table 3. Individuals scoring as FAT "high-cravers" had 2.71 times the odds for choosing a high-carb meal and 0.21 times the odds to choose high-sweet meals when compared with individuals scoring as FAT "low-cravers". Essentially, fat high-cravers were significantly more likely to choose high-carb meals and significantly less likely to choose high-sweet meals when compared with fat low-cravers. This was an unexpected finding and warrants further exploration to assess for continuity in this trend across larger and more diverse sample sizes. It is important to note that specific craving categories were determined using rater perception rather than macronutrient data. It is possible this relationship between high-fat craving and selection of high-carb meals and deterrence from high-sweet meals can be explained on a macronutrient level when the specific foods within each of these categories are analyzed for nutritional composition. Furthermore, several of the restaurant options could be classified as "combination meals" – i.e., they included foods spanning multiple categories (such as CARB and FAT). Therefore in determining a food's classification, raters were instructed to identify the primary category even though a combination food may have qualified for inclusion on a different subscale. Therefore it is possible that craving for a HIGH FAT, for

example, was associated with ordering a CARB due to its being paired with a HIGH FAT menu item. An example would be someone craving steak (HIGH FAT) and ordering this with a baked potato (CARB).

Individuals scoring as FFF "high-cravers" had 2.18 times the odds for choosing a high-FFF meal and 0.42 times the odds to choose high-carb meals in the unadjusted model when compared with individuals scoring as FFF "low-cravers". Essentially, high-FFF cravers were significantly more likely to choose meals of the same designation (high-FFF meals) and significantly less likely to choose high-carb meals when compared with FFF low-cravers. It is important to note that neither of these significant relationships held true in the fully adjusted models, indicating that an individual's craving scores across each of the specific craving categories may play an important role in FFF meal selection rather than an individual's specific FFF craving score in isolation.

Individuals scoring as CARB "high-cravers" had 3.06 times the odds of choosing a high-sweet meal and 0.36 times the odds of choosing a high-FFF meal when compared with CARB "low-cravers" in the fully adjusted models. Essentially, high-carb cravers were significantly more likely to choose meals comprised primarily of high-sweet components and significantly less likely to choose meals comprised primarily of high-FFF components. While this may seem like an odd finding initially, after careful inspection of the FCI some potential reasons for this come forth. While most of the FFF foods on the FCI have higher carb components (French fries, pizza, chips, etc.) the CARB foods included on the FCI are comparatively blander in nature (pasta, rice, sandwich bread, etc.). Thus, while the macronutrient composition of these foods may be similar in some aspects (high carbohydrate concentration), the inverse relationship between CARB "high-cravers" and likelihood of selecting "high-FFF" meals solidifies the importance of thinking about craving from a perception standpoint in addition to a macronutrient standpoint. The FCI is a useful tool in this regard.

Conclusion

Overall, some interesting findings were illuminated regarding the interaction between magnitude of specific food craving score and likelihood of specific food selection. Some of the significant findings were unexpected and would be important to explore further with more robust methods. While all findings regarding craving score magnitude and caloric intake (both craved and total) were insignificant, it is possible that more robust measures of food selection are necessary to elucidate a significant relationship between these variables. Future studies of this nature may wish to use data collection methods such as 24 hour food recall interviews or 3-day food diaries. There are of course pros and cons to these methods as well that would need to be considered.

The overall generalizability of this study is questionable due to the largely white, female population and smaller sample size (n=95). Instead of having to classify meals as "high-fat", "high-FFF", etc., it would be an interesting exercise to stratify cravings by specific food items rather than specific food categories (e.g. "high-craver" for bacon as opposed to "high-craver" for 'Fat'). A much larger sample size with diverse FCI scores would be needed to conduct this exercise.

Despite these limitations, the findings of this study provide an interesting jumping off point for further use of the FCI and other such scales in craving work. Elucidating how cravings drive food selection is an important public health initiative and has the potential to help create healthier eating habits for individuals struggling with craving, thus creating a potential avenue to help decrease rates of obesity.

Citations

1. Bayley M., Dye, L., Jones, S., Debono, M., & Hill, A. J. (2002). Food cravings and aversions during pregnancy: Relationships with nausea and vomiting. Appetite, 38(1), 45-51. doi:10.1006/appe.2002.0470

2. Gordon, Ariel-Donges, A., Bauman, V., & Merlo, L. (2018). What is the evidence for "food addiction?" a systematic review. Nutrients, 10(4), 477. doi:10.3390/nu10040477 – 6

3. Hill, A. J., Weaver, C. F., & Blundell, J. E. (1991). Food craving, dietary restraint and mood. Appetite, 17(3), 187-197. doi:10.1016/0195-6663(91)90021-j

4. Kahathuduwa, C. N., Binks, M., Martin, C. K., & Dawson, J. A. (2017). Extended calorie restriction suppresses overall and specific food cravings: A systematic review and a meta-analysis. Obesity Reviews, 18(10), 1122-1135. doi:10.1111/obr.12566

5.Martin, C. K., O'Neil, P. M., Tollefson, G., Greenway, F. L., & White, M. A. (2008). The association between food cravings and consumption of specific foods in a laboratory taste test. Appetite, 51(2), 324-326. doi:10.1016/j.appet.2008.03.002

6. Martin, C. K., Mcclernon, F. J., Chellino, A., & Correa, J. B. (2011). Food cravings: A central construct in food intake behavior, weight loss, and the neurobiology of appetitive behavior. Handbook of Behavior, Food and Nutrition, 741-755. doi:10.1007/978-0-387-92271-3_49

7. Meule, & Kübler, A. (2012). Food cravings in food addiction: The distinct role of positive reinforcement. Eating Behaviors, 13(3), 252-255. doi:10.1016/j.eatbeh.2012.02.001 – 4

8. Mokdad H. (2004). Actual causes of death in the United States, 2000. Jama, 291(10), 1238. doi:10.1001/jama.291.10.1238 – 7

9. Pelchat L. (2009). Food addiction in humans. The Journal of Nutrition, 139(3), 620-622. doi:10.3945/jn.108.097816 – 5

10. Security statement. (2020, January 30). Retrieved April 25, 2020, from https://www.qualtrics.com/security-statement/

11. Stokes, A., Ni, Y., & Preston, S. H. (2017). Prevalence and trends in Lifetime obesity in the U.s., 1988–2014. American Journal of Preventive Medicine, 53(5), 567-575. doi:10.1016/j.amepre.2017.06.008 -1

12. Stunkard, A. J., & Messick, S. (1985). The three-factor eating questionnaire to measure DIETARY RESTRAINT, disinhibition and hunger. Journal of Psychosomatic Research, 29(1), 71-83. doi:10.1016/0022-3999(85)90010-8

13. Vanderbroek-Stice, L., Stojek, M. K., Beach, S. R., Vandellen, M. R., & Mackillop, J. (2017). Multidimensional assessment of impulsivity in relation to obesity and food addiction. Appetite, 112, 59-68. doi:10.1016/j.appet.2017.01.009 – 2

14. Wang, Y. C., Mcpherson, K., Marsh, T., Gortmaker, S. L., & Brown, M. (2011). Health and economic burden of the projected obesity trends in the USA and the UK. The Lancet, 378(9793), 815-825. doi:10.1016/s0140-6736(11)60814-3

15. Weingarten P., & Elston, D. (1990). The phenomenology of food cravings. Appetite, 15(3), 231-246. doi:10.1016/0195-6663(90)90023-2 – 3

16. White A., Whisenhunt, B. L., Williamson, D. A., Greenway, F. L., & Netemeyer, R. G. (2002). Development and validation of the food-craving inventory. Obesity Research, 10(2), 107-114. doi:10.1038/oby.2002.17

Appendices

i. Food Craving Inventory

ii. Conceptual Craving Scale

iii. Three Factor Eating Questionnaire

iv. Inter-Rater Analysis: Individual Food Items

v. Inter-Rater Analysis: Representative Meal Captures

vi. Calorie and Restaurant Information

i. FOOD CRAVING INVENTORY II - SCORING

Items are scored 1 to 5, as indicated on column headings. Subscale scores are means, so subscale scores should be between 1 and 5.
Example: The FFF score (Fast Food Fats) is a mean of the scores of items 2, 7, 11, and 20.
There are 4 subscales: Fats, Sweets, Carbohydrates/Starches, and Fast Food Fats.
Total Craving score is the mean of all items.

		1	2	3	4	5
		Never	Rarely (once or twice)	Sometimes	Often	Always/ Almost every day
		1	2	3	4	5
SWEET	Cake	( )	( )	( )	( )	( )
FFF	Pizza	( )	( )	( )	( )	( )
FAT	Fried Chicken	( )	( )	( )	( )	( )
FAT	Gravy	( )	( )	( )	( )	( )
CARB	Sandwich Bread	( )	( )	( )	( )	( )
FAT	Sausage	( )	( )	( )	( )	( )
FFF	French fries	( )	( )	( )	( )	( )
SWEET	Cinnamon Rolls	( )	( )	( )	( )	( )
CARB	Rice	( )	( )	( )	( )	( )
FAT	Hot dog	( )	( )	( )	( )	( )
FFF	Hamburger	( )	( )	( )	( )	( )
CARB	Biscuits	( )	( )	( )	( )	( )
SWEET	Ice cream	( )	( )	( )	( )	( )
CARB	Pasta	( )	( )	( )	( )	( )
FAT	Fried fish	( )	( )	( )	( )	( )
SWEET	Cookies	( )	( )	( )	( )	( )
SWEET	Chocolate	( )	( )	( )	( )	( )
CARB	Pancakes or waffles	( )	( )	( )	( )	( )
FAT	Corn bread	( )	( )	( )	( )	( )
FFF	Chips	( )	( )	( )	( )	( )
CARB	Rolls	( )	( )	( )	( )	( )
CARB	Cereal	( )	( )	( )	( )	( )
SWEET	Donuts	( )	( )	( )	( )	( )
SWEET	Candy	( )	( )	( )	( )	( )
SWEET	Brownies	( )	( )	( )	( )	( )
FAT	Bacon	( )	( )	( )	( )	( )
FAT	Steak	( )	( )	( )	( )	( )
CARB	Baked potato	( )	( )	( )	( )	( )

ii. <u>Conceptual Craving Scale (CCS)</u>[4]

The original scale, designed for a 1991 study conducted by Hill et al., consisted of a series of 100 mm visual analogue scales relating to the characteristics of food cravings.

- Two scales asked about the frequency of food cravings experienced by participants
- Three scales asked about the intensity of the food cravings experienced by participants

The word craving was not used until the end of the questionnaire; rather, subjects were asked about the frequency and intensity of "a strong urge to eat a particular food".

- Exact wording for craving frequency questions was:
    - "How often do you experience strong urges to eat particular types of food?"
        - Response: Never/All of the time
    - "On average, how often do you experience a strong urge to eat a particular type of food?"
        - Response: Several times a day/Once a month
- For craving strength (intensity), exact wording of questions were:
    - "How strong are these urges you experience to eat particular types of food?"
        - Extremely weak/Extremely strong
    - "Are the experiences of strong urges to eat a particular food always of the same strength?"
        - Never/Always
    - "How easy is it to ignore this strong urge to eat a particular food?"
        - Very easy/Impossible

The final two questions asked:

- Is "a strong urge to eat a particular food" the same as "a craving for food"
- If no to the above question, in what way is it different?

iii. <u>Three Factor Eating Questionnaire (TFEQ)</u>[12]

Description:

The Three Factor Eating Questionnaire (TFEQ-18) is an 18-item, self-administered questionnaire with Likert-style questions.

Protocol:

1. When I smell a sizzling steak or juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

2. I deliberately take small helpings as a means of controlling my weight.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

3. When I feel anxious, I find myself eating.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

4. Sometimes when I start eating, I just can’t seem to stop.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

5. Being with someone who is eating often makes me hungry enough to eat also.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

6. When I feel blue, I often overeat.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

7. When I see a real delicacy, I often get so hungry that I have to eat right away.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

8. I get so hungry that my stomach often seems like a bottomless pit.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

9. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

10. When I feel lonely, I console myself by eating.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

11. I consciously hold back at meals in order not to weight gain.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

12. I do not eat some foods because they make me fat.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

13. I am always hungry enough to eat at any time.

[ ] definitely true (4)

[ ] mostly true (3)

[ ] mostly false (2)

[ ] definitely false (1)

14. How often do you feel hungry?

[ ] Only at meal times (1)

[ ] sometimes between meals (2)

[ ] often between meals (3)

[ ] almost always (4)

15. How frequently do you avoid "stocking up" on tempting foods?

[ ] Almost never (1)

[ ] seldom (2)

[ ] usually (3)

[ ] almost always (4)

16. How likely are you to consciously eat less than you want?

[ ] Unlikely (1)

[ ] slightly likely (2)

[ ] moderately likely (3)

[ ] very likely (4)

17. Do you go on eating binges though you are not hungry?

[ ] Never (1)

[ ] rarely (2)

[ ] sometimes (3)

[ ] at least once a week (4)

18. On a scale of 1 to 8, where 1 means no restraint in eating (eating whatever you want, whenever you want it) and 8 means total restraint (constantly limiting food intake and never "giving in"), what number would you give yourself.

Scoring:

The 1-2 scores were coded 1; 3-4 scores were coded 2; 5-6 scores were coded 3; 7-8 scores were coded 4. The cognitive restraint scale was composed of items 2, 11, 12, 15, 16, and 18. The uncontrolled eating scale was composed of items 1, 4, 5, 7, 8, 9, 13, 14, and 17. The emotional eating scale was composed of items 3, 6, and 10.

iv. Inter-Rater Analysis: Individual Food Items

Of the three individual raters at least two individuals rated each of the food items up for debate in the same category. This produced a Cohen's kappa value of 0.865 which indicated a strong level of agreement between raters. For optimal results we decided to only include food items upon which all three raters agreed resulting in the following seven items being added to the FCI.

- Cheese - **FAT**
- Butter – **FAT**
- Potatoes – **CARB**
- Avocado – **FAT**
- Ranch – **FAT**
- Mayonnaise – **FAT**
- Pie – **SWEET**

v. Inter-Rater Analysis: Representative Meal Captures

To keep consistent with the first inter-rated analysis completed for individual food items, only meals upon which all three independent raters agreed were included in the data analysis. Data points with meal captures that could not be agreed upon were excluded from analysis. Representative meal captures that were agreed upon and included in data analysis are listed below with their corresponding specific craving category.

- Turkey Reuben (rye bread, deli turkey, sauerkraut, swiss cheese, and russian dressing = mayo, ketchup, onion, pickles, vinegar) – **FAT**
- Roast Beef Sandwich (roast beef sandwich= roast beef, swiss, pretzel bun) and French fries – **FAT**
- Fish and Chips – **FAT**
- Buffalo chicken sandwich buffalo (fried chicken breast, buffalo sauce, pretzel bun) and Potato Salad (mayo, potatoes, celery, green onion, yellow mustard, pickles, hard boiled eggs) – **FAT**
- Buffalo chicken quesadilla and French fries and Broccoli salad (broccoli, bacon, pecans, onion, cheddar cheese, mayo, sugar, cider vinegar) – **FAT**
- Omelet (ham and cheese) with Toast – **FAT**
- Onion casserole (onion, mayo, cheese, butter) and French Fries – **FAT**
- Sausage, Scrambled eggs, and Toast – **FAT**
- Meatball parm. sub and French fries – **NO AGREE**
- Crab mac n' cheese – **CARB**
- General Tso's chicken, Beef lumpia, and Rice – **NO AGREE**
- Chipotle burrito bowl and Tortilla chips – **CARB**
- Fettuccine Alfredo – **CARB**
- Crab cakes, Blooming onion, Bread (from table basket) – **NO AGREE**
- Shrimp quesadilla (shrimp and cheese), Rice, and Tortilla chips – **NO AGREE**
- Country fried steak, Scrambled eggs, Grits and Toast – **FAT**
- Wendy's chicken sandwich and Frosty – **FFF**

vi. Calorie and Restaurant Information

Specific Craving	General Craving	Total Calories	Craved Calories	Restaurant (from Calorie Tracker)
Pork	FAT		460	Bojangles
Pork	FAT	680	540	Bojangles
Hamburger	FFF	1450	620	McDonalds (hamburger), BWW (fried pickle)
Hamburger, Fries	FFF	1385	1385	Ruby Tuesday
Sausage	FAT	690	380	Perkins
Hamburger, Fries	FFF	1131	1131	Ruby Tuesday
Ranch	FAT	610	145	California Pizza Kitchen
Hamburger, Fries	FFF	1131	1131	Ruby Tuesday
Fried Chicken	FAT	850	630	Bob Evans
Bread	CARB	860	799	Bruegger's
Biscuit	CARB	715	320	Cracker Barrel (biscuit), Avg. all brand (blueberry muffin), Ryan's (tomato slices)
Bacon	FAT	293	113	Perkins (bacon), Avg. All Brands (screwdriver)
Biscuit	CARB	905	320	Cracker Barrel (biscuit), Friendly's (omelet), Ryan's (tomato), Avg. all brands (bloody mary)
Sandwich bread	CARB	872	250	Friendly's (toast and omelet), Avg. all brands (broccoli, mimosa)

Fries	FFF	945	511	WAWA (tuna), Ruby Tuesday (fries), Potbelly (chickpea salad)
Fried fish	FAT	811	811	Ruby Tuesday
Pasta	CARB	897	630	Bob Evans (chicken parm pasta), Souplantation (broccoli salad)
Steak	FAT	1050	829	IHOP
Hamburger	FFF	1050	1050	Red Robin
Fried fish	FAT	811	811	Ruby Tuesday
Sausage	FAT	841	124	Average All Brands
Hamburger	FFF	620	470	Ruby Tuesday's (cheeseburger), Ore-Ida (tater tots)
Sandwich bread Cheese	FAT	950	950	McAlister's Deli
Fries	FAT	1024	511	Ruby Tuesday (fries), Potbelly (roast beef sandwich)
Fried Fish	FAT	970	870	Red Lobster
Fried Chicken	FFF	1387	1030	Sandella's (BBQ sandwich), Avg. all brands (potato salad)
Fries	FAT	1181	600	WAWA (BBQ quesadilla), Souplantation (broccoli salad), Ruby Tuesday (fries)
Cheese	FAT	859	137	Avg. all brands
Cheese	FAT	805	137 (cheese), 250 (toast)	Avg. all brands (cheese, tea), Friendly’s (omelet, toast)

Pancakes	CARB	523	253	Avg. all brands (pancakes), Cracker Barrel (ham)
Fries	FAT	1131	731	Open Nature (onion casserole), WAWA (tuna salad), Ruby Tuesday (fries)
Cheese	FAT	680	220	Open Nature (onion casserole), Dr. Praeger's (salmon cakes), Avg. All Brands (asparagus)
Fried Chicken	FFF	1080	760	Buffalo Wild Wings
Sausage	FAT	827	380	Perkins (sausage), Friendly's (toast), Avg. All brands (egg)
Pasta	CARB	1871	500	Avg. all brands (roll, pasta, tiramisu, crème brulee), Olive Garden (eggplant pasta meal)
Pasta	CARB	790	630	Bob Evans (chicken parm pasta),Chick-Fil-A (salad)
Pasta	CARB	789	500	Avg. all brands (pasta, sauce), Chick-Fil- A (salad)
Fried Chicken	FFF	1020	1020	Buffalo Wild Wings
Bread	CARB	770	770	Buffalo Wild Wings
Fried Chicken	FFF	440	117	Chick-Fil-A (chicken sandwich), Avg. all brands (bun)
Fries	FFF	620	620	Chick-Fil-A
Fries	FFF	810	810	Chick-Fil-A
Fries	FFF	800	800	Chick-Fil-A
Pasta	CARB	1603	1603	Rock Bottom Restaurant
Rice	CARB	1550	1550	Chipotle
Rice	CARB	800	800	Chipotle
Bun	CARB	740	117	BBW(whole burger), Avg. All Brands (bun)

Hamburger, Fries	FFF	1131	1131	Ruby Tuesday
Cheese	FAT	793	300	Avg. all brands (nachos, margarita), Old El Paso (fajitas)
Fried Fish	FFF	912	290	Avg. all brands (sushi), Ajinomoto (shrimp shumai)
Fried Chicken	FFF	497	497	Bojangles
Bread	CARB	966	330	Avg. all brands (eggs, english muffin), Taylor Farms (potatoes), Tim Hortons (Nutella croissant)
Fried Chicken	FFF	660	660	Harris Teeter
Toast	CARB	150	150	Avg. all brands
Hamburger	FFF	620	620	Ruby Tuesday
Cheese, Pasta	CARB	803	659	Buitoni (cheese tortellini, sauce)
Steak	FAT	1355	760	Taco del mar-380 (steak tacos), El Monterey (chicken tamale) Pepe's Mexican Restaurant (pork tamale), Chipotle (chips and guacamole)
Bread	CARB	685	410	Jimmy Johns
Cheese, Pasta	CARB	603	603	Avg. all brands
Steak	FAT	1178	599	Longhorn Steakhouse
Pizza	FFF	736	736	California Pizza Kitchen (pizza), Ruby Tuesday (fries)
Pizza	FFF	1200	1200	Marco's Pizza
Potatoes	CARB	1147	267	Avg. all brands (potatoes, eggs over hard, crab cakes), Eat N' Park (eggs benedict)
Bacon	FAT	570	420	McDonalds

Sausage	FAT	550	400	McDonalds
Cheese	FAT	550	550	Del Taco
Potatoes	CARB	580	350	Saladworks (chicken), O' Charley's (smashed potatoes)
Cheese, Avocado	FAT	1228	1228	Moe's
Chips	FFF	822	360	Moe's
Rice	CARB	515	515	Avg. all brands
Pizza	FFF	815	815	Avg. all brands
Steak	FAT	1400	1400	Outback Steakhouse
Pasta	CARB	1295	1039	Trader Joe's (gnocchi), Avg. all brands (marinara sauce), Monica's pizza (mozzarella)
Pie	SWEET	952	304	Avg. all brands
Pizza	FFF	815	815	Avg. all brands
Steak	FAT	850	850	Shari's (steak salad)
Ice Cream	SWEET	893	420	Potbelly
Hamburger, Fries	FFF	1131	1131	Ruby Tuesday
Rice	CARB	490	300	Avg. all brands (rice), Panda Express (spring rolls)
Cheese	FAT	550	550	Del Taco
Rice	CARB	180	180	Avg. all brands
Bread	CARB	734	134	Avg. all brands (crab, english muffin), Eat N' Park (eggs benedict)
Fried Fish	FFF	250	250	Avg. all brands
Hamburger, Fries	FFF	1131	1131	Ruby Tuesday

Steak	FAT	880	390	KFC (steak), Avg. all brands (grits, toast, eggs)
Rice	CARB	1132	242	Rubio’s (tacos), Avg. all brands (rice)
Hamburger, Potatoes	FFF, CARB	730	730	Carl's Junior
Rice	CARB	535	370	PF Chang’s (sushi)
Bread	CARB	350	350	WAWA
Hamburger, Fries	FFF	1131	1131	Ruby Tuesday
Fried Chicken, Bread, Ice Cream	FFF	770	330	Wendy's
Cheese	FAT	960	360	Red Lobster (caprese), California Pizza Chicken (buffalo cauliflower)
Rice	CARB	600	600	PF Chang’s
Fried Squid	FFF	723	435	Avg. all brands (veal marsala), Olive Garden (calamari)
Pasta	CARB	1330	779	Trader joes (gnocchi), Avg. all brands (basil pesto)
Pizza	FFF	990	815	Avg. all brands
Pizza	FFF	815	815	Avg. all brands