

Determining the Effect of Hormonal Changes Throughout the Menstrual Cycle on Food
Cravings and Eating Habits of Undergraduate University Females

by

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Determining the Effect of Hormonal Changes Throughout the Menstrual Cycle on Food
Cravings and Eating Habits of Undergraduate University Females

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TABLE OF CONTENTS

INTRODUCTION	1
REVIEW OF LITERATURE	2
METHODS	7
Statistical Analysis	7
RESULTS	9
Demographic Characteristics of Students	9
Food Cravings and Eating Habits Results	9
CONCLUSIONS.....	20
APPENDICES	21
Appendix A: Consent Form	21
Appendix B: Research Survey	24
Appendix C: Research Poster.....	27
REFERENCES	28
ABSTRACT.....	29

TABLE OF TABLES

TABLE 1.....	9
TABLE 2.....	11
TABLE 3.....	12
TABLE 4.....	13
TABLE 5.....	13
TABLE 6.....	14
TABLE 7.....	14
TABLE 8.....	15
TABLE 9.....	15
TABLE 10.....	16
TABLE 11.....	16
TABLE 12.....	17
TABLE 13.....	17
TABLE 14.....	18
TABLE 15.....	18
TABLE 16.....	19

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INTRODUCTION

The Determination of Effects of Hormone changes on Food Cravings and Eating Habits was conceived in 2011 as a research experience with the following objectives: (1) to fulfill TCU College of Science and Engineering and John V. Roach Honors College Laureate Award requirements for research development, analysis and presentation; (2) to broaden student's understanding of statistical analysis and research design in collaboration with faculty; (3) to determine if there is a correlation between estrogen release (an incline in estrogen secretion between first day of period and ovulation when estrogen secretion drops) and food habits/cravings; (4) to determine if there is a correlation between high levels of progesterone (high during days 20-24 of the average cycle) and food habits/cravings; (5) to determine the intensity of food habits/cravings that may occur during the menstrual cycle.

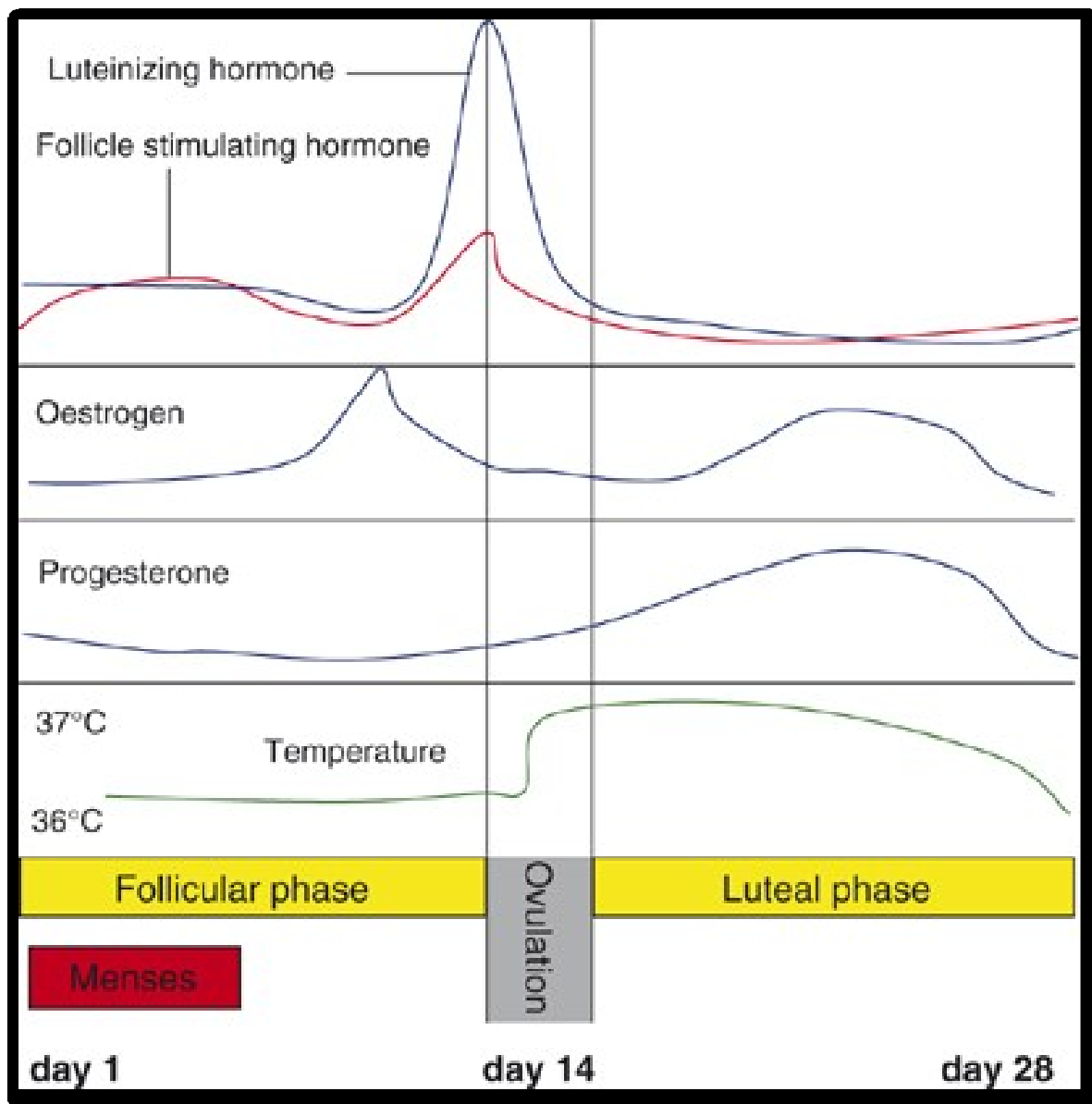
The nutritional application of this research is to determine if there is a correlation of food cravings and hormones released during the menstrual cycle. This information may be utilized by dietitians and other health professions counseling females in all stages of the menstrual cycle to identify and understand food cravings and eating behaviors. Understanding and management of these dietary practices and cravings would improve the nutritional quality of the diet and reduce risk of obesity and other chronic diseases including diabetes, cancer, and cardiovascular disease.

REVIEW OF LITERATURE

The female menstrual cycle is coordinated by the hypothalamic pituitary, which is linked with hormones released during the phases of the cycle. Research shows a relationship between the hormonal changes across the menstrual cycle and components of energy balance and food cravings (1). The average menstrual cycle for a woman is a twenty-eight day cycle, which may be divided into four phases: early follicular phase (days 1-4), late follicular phase (days 5-11), periovulation (days 12-15) and the luteal phase (days 16-28), more simply in two phases the follicular and luteal phases (1). The cycle is noted to begin on the first day of menstruation. This first day of menstruation marks the beginning of the follicular phase which spans from the first day of menstruation until ovulation (1). This phase is initiated by a rise in the FSH (Follicle Stimulating Hormone). During this time, the plasma LH (Leutenizing hormone), estradiol (form of estrogen) and progesterone are low. Throughout this time, the estrogen exerts positive feedback on LH (Leutenizing hormone). FSH promotes the development of graafian follicle and estrogen secretion by follicle cells. The combination of estrogen and LH results in stimulation of LH-FSH surge which induces ovulation, the release of an egg.

The body's cycle then enters the luteal phase, which is defined by the luteinization and the increase in progesterone secretion. High progesterone levels exert negative feedback and the FSH and LH secretion decreases until the hormones have reached their previous levels (Table 1).

Table 1



The focus of this research is not on the menstrual cycle itself, but the effect of the hormonal changes through the phases on the food cravings and choices of females experiencing the phases. The reasoning behind the idea that the hormones affect food choices and diet habits is grounded in the belief hormones secreted at different levels throughout the menstrual cycle cause physical, mental and emotional changes in the female. For instance, research indicates the time leading up to ovulation when estrogen levels are high a female, a female typically experiences higher energy levels, an increased sex drive and have peak physical ability (such as better workouts) during this time (2). During this time of peak levels of FSH, LH and estrogen the female body is preparing itself for ovulation to become physically ready for pregnancy, in which case her body is generally striving for optimum health (2). The survey in this research is designed to determine the phase of each participant and survey the types of food cravings the participants typically desire during each phase.

Research on this topic indicates there is a relationship between the hormones secreted during a menstrual cycle phase and the food cravings and eating habits of the female population. One study indicates that women increased their feeding behavior during the luteal phase when implantation of an egg was more likely to occur, to allow for the growth and development (2). In this research, participants completed questionnaires that obtained data on their eating behavior with each participant acting as her own control in regards to amount of food consumed, the number of sweet/salty cravings had experienced and whether they satisfied these cravings or not (2).

Research in this study indicated that all women perceived themselves as eating more food in the luteal and premenstrual phases, than in their menstrual, follicular and

ovulatory phases (2). More specifically, the research showed reports of women having increased cravings for sweets and chocolate during the phases leading up to menstruation (2). Further research conducted on premenstrual syndrome indicated a strong relationship between the phase pre-menstruation and increased food cravings (3). This was evidenced in a study conducted to determine the energy intake of females, which was reduced at time of ovulation and increased afterward at the time progesterone is highest (1). This research indicated that the hormone estrogen is an appetite suppressant and progesterone has appetite stimulating effects, specifically for carbohydrates and fats, termed “sweet-fat combination foods” (5).

This article also suggests that those women who satisfy these cravings experience improvement in moods, which may relate to the decreased hormones that typically improve mood such as serotonin as these foods replenish serotonin levels (4). The ingestion of carbohydrates, including simple sugars, leads to increased central production of serotonin, the calming and mood elevating neurotransmitter (6). Therefore, the craving of carbohydrates may be linked to a decreased serotonin during this phase and a physiological need to produce more (5). Findings indicated that a “withdrawal” from such sweets may lead to depression and irritability as a result of decreased serotonin levels, which may be seen in females who experience Pre-Menstrual Syndrome, as an explanation for food cravings (6). Furthermore, the consumption of carbohydrates increase blood glucose levels which causes the body to secrete insulin, which sensitizes amino acids that compete with tryptophan for receptors, which allows tryptophan to be utilized in the body which is also a mood enhancer (6).

The purpose of this research is to determine whether there is a relationship between phase of menstrual cycle and food cravings and if so, if there is a particular pattern of what type of cravings among female college participants. The study is designed to first determine the phase of the menstrual cycle of each participant. The participants will then be categorized into groups of the phase in which they fall into for the particular week in which they were surveyed. Next, data will be analyzed to track type and intensity of food cravings for each group of participants. The research and data analysis from the participant surveys is to determine whether food cravings and consumption habits follow the pattern of menstrual cycle phases and health. For example, does a woman crave healthier, more nutrient dense foods during ovulation when the female organs are preparing for optimum health compared to craving less nutrient dense foods and “mood enhancing” foods throughout the luteal phase of the menstrual cycle when “feel good” hormones are typically lower.

METHODS

In this research project, the student researcher developed a survey under supervision and instruction from research advisors. The first three questions of the survey were designed to obtain background information on demographic of the female undergraduate student participants on undergraduate classification, major, and age. The following eight questions pertained to typical eating /drinking habits and food cravings. The second page of the survey is a table requesting information on the previous foods and beverages regarding number of cravings that day and that week. It also requested the usual intensity of craving and whether or not it was craved more frequently during the week in which they completed the survey. The next questions of the survey gathered information on menstrual periods to determine which stage the participant was in during the time she completed the survey. The final question on the survey was to gather information on whether or not the participants are currently taking oral contraceptive with hormone. This survey appears in Appendix A.

Because the study required female subjects, women were selected through nutrition classes and campus sorority meetings. Subjects were instructed to raise a hand to signal the student investigator when they were finished completing the survey. Consent forms were collected first and not in any way associated with evaluation forms to assure anonymity of response. Surveys were then collected from each subject.

Statistical Analysis

Survey response data was entered into SPSS (SPPSS, 2007) for statistical analysis. Each food and beverage category was analyzed on responses “yes” to craving more frequent this week and compared for each stage of menstruation. The stages of

menstruation were determined comparing the date indicated of participant's most recent period to the date of survey completion. Less than six days was hormone category one, menses during which progesterone and estrogen are at lower levels. Days six through fourteen were in hormone category two, follicular stage, when there is a spike in estrogen levels. Greater than fifteen days was in hormone category three, the luteal stage of menstruation in which the progesterone is highest.

RESULTS

Demographic Characteristics of Students

A total of 323 subjects participated in the food cravings/eating habits evaluation survey. Subject gender is not included in demographics, because all subjects for this research are females. Subject classification (Table 2) was determined and consisted of predominantly freshman (49%) and sophomore (25.7%) subject volunteers.

Food Cravings and Eating Habits Results

The participants were divided into menstrual hormone categories based on their response to the question number of days since first day of most recent period (Table 3). Of the total participants (N=323) 17% were determined to be in menses stage, 29.7% were categorized to follicular stage, and 53% into luteal stage. Then, each food craving was evaluated on whether or not participants responded “yes” or “no” to having craved more frequently total and as individual menstrual stage hormone categories (Table 4-15). Lastly, these were compared as a whole based on food categories (Table 16).

As individual food cravings (Table 4-15), results indicate the highest percentage of participants responding “yes” to more frequently being in the menses stage of menstrual hormone levels. This is in results for all foods with the exception of tangy foods, such as lemon (Table 8) and meat (Table 12) which highest percentage of respondents was categorized in the follicular stage.

When all foods were considered, levels of more frequent percentages were compared with food categories (Table 16). In this study, the highest percentage of respondents in menses stage responded “yes” to chocolate (56.4%), sweets (47.3%) and fast food (40%). The highest percentage of respondents in follicular stage responded

“yes” to fruit (29.5%), caffeine (27.4%), and sweets (24.2%). The highest percentage of respondents in luteal stage responded “yes” to chocolate (35.3%), sweets (31.2%), and caffeine (25.3%).

Table 2

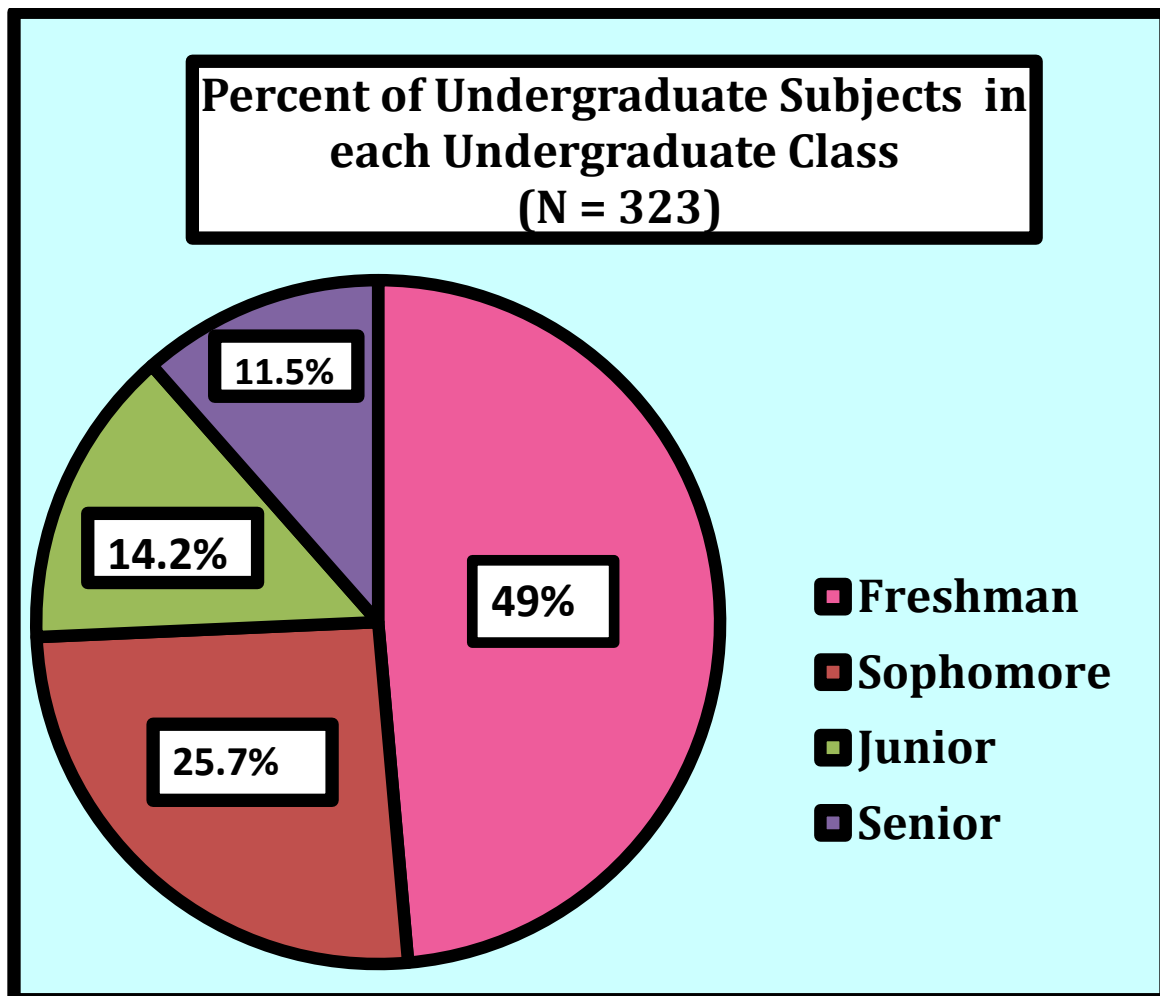


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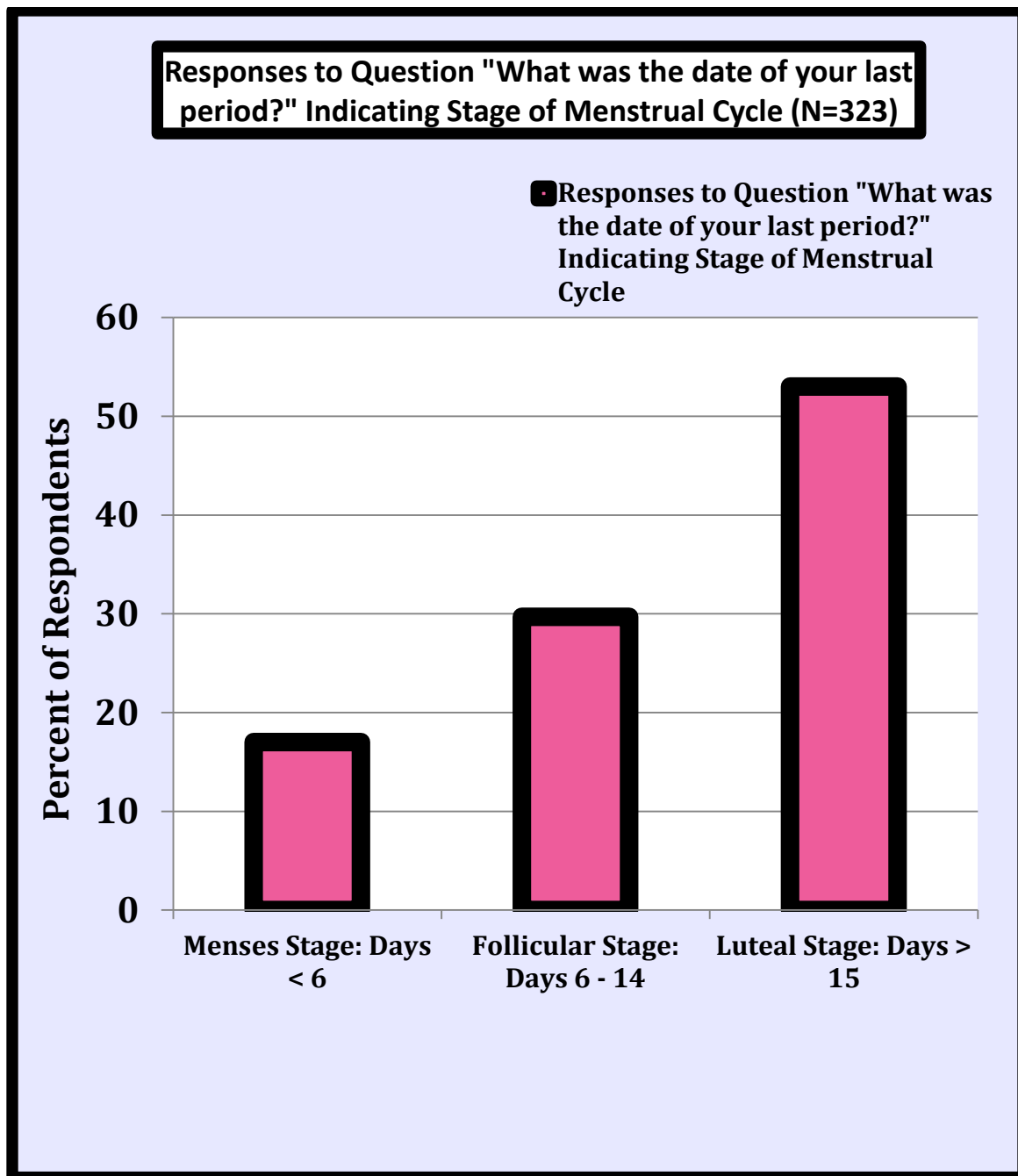


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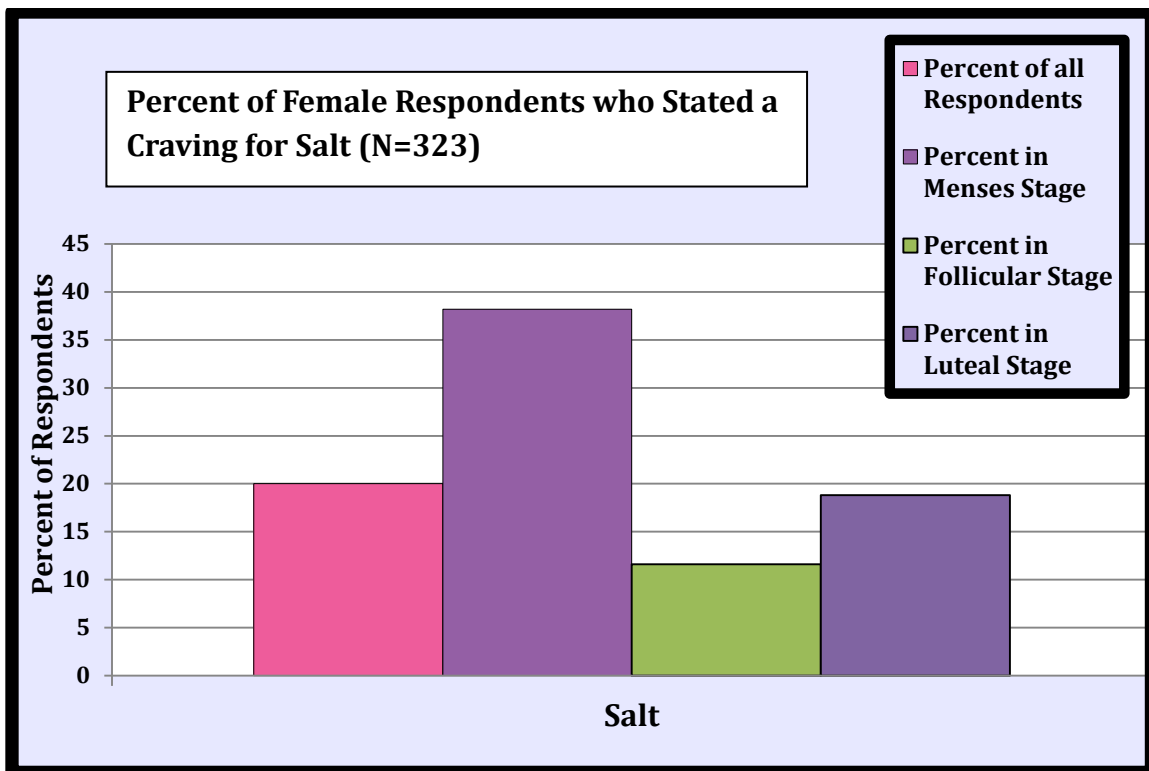


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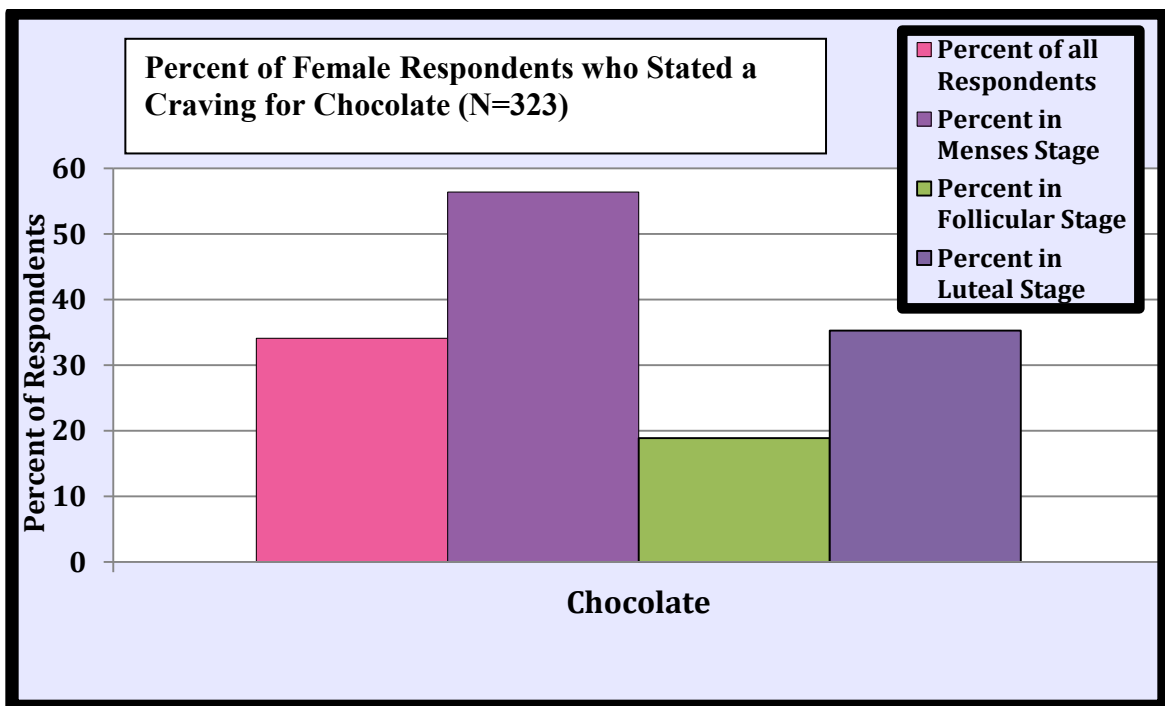


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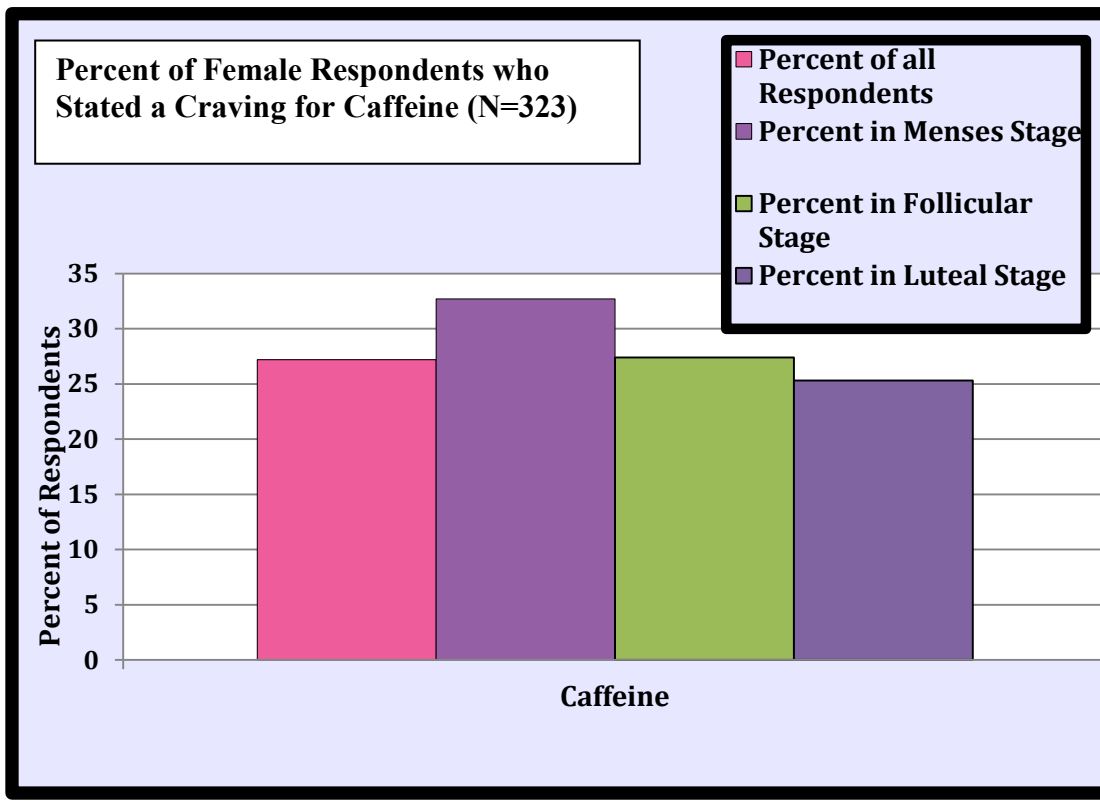


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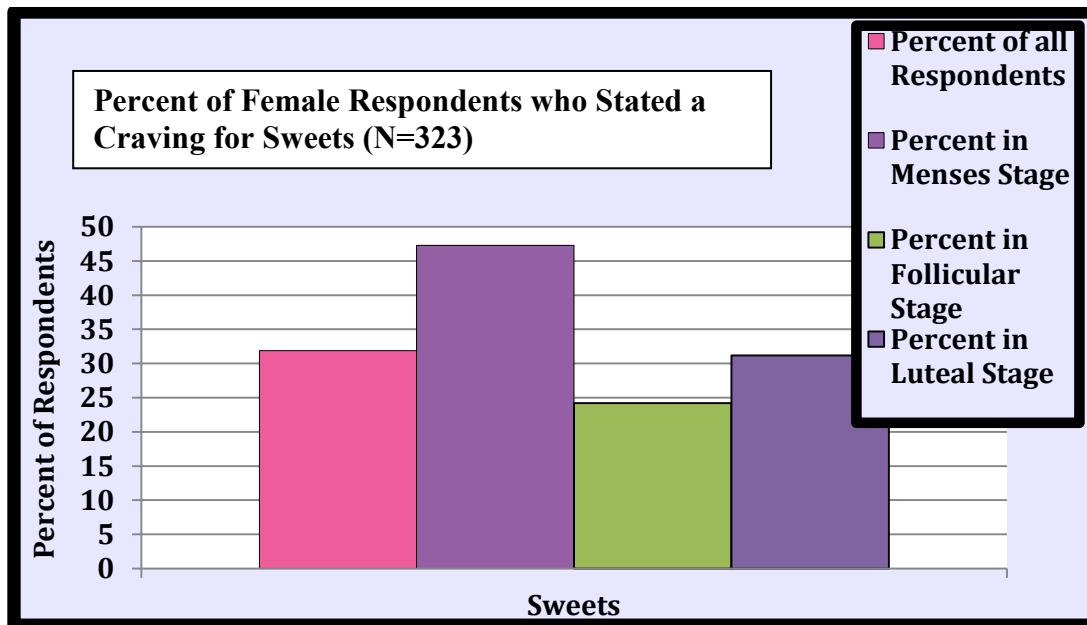


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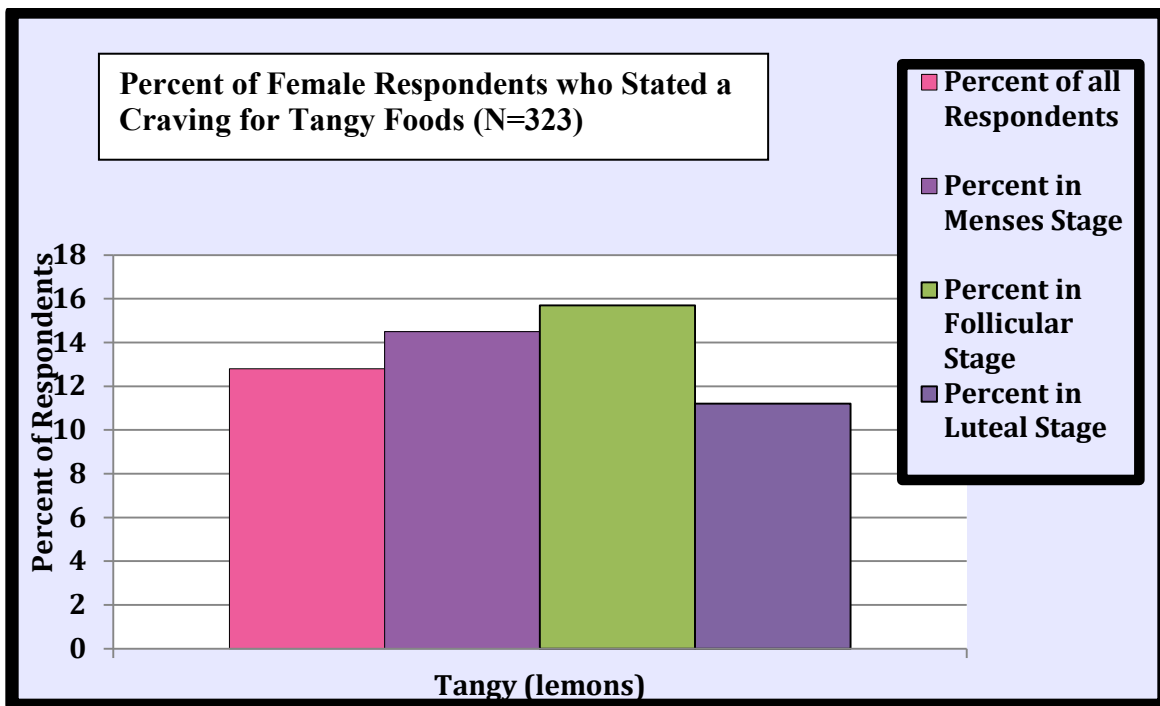


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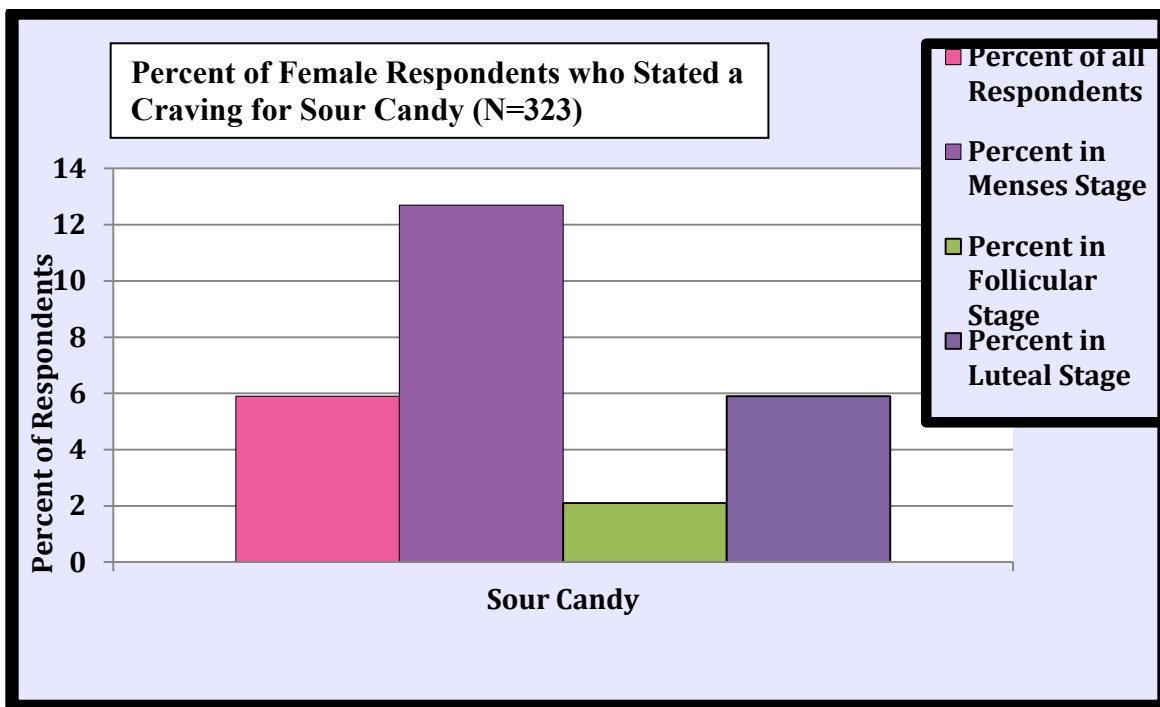


Table 10

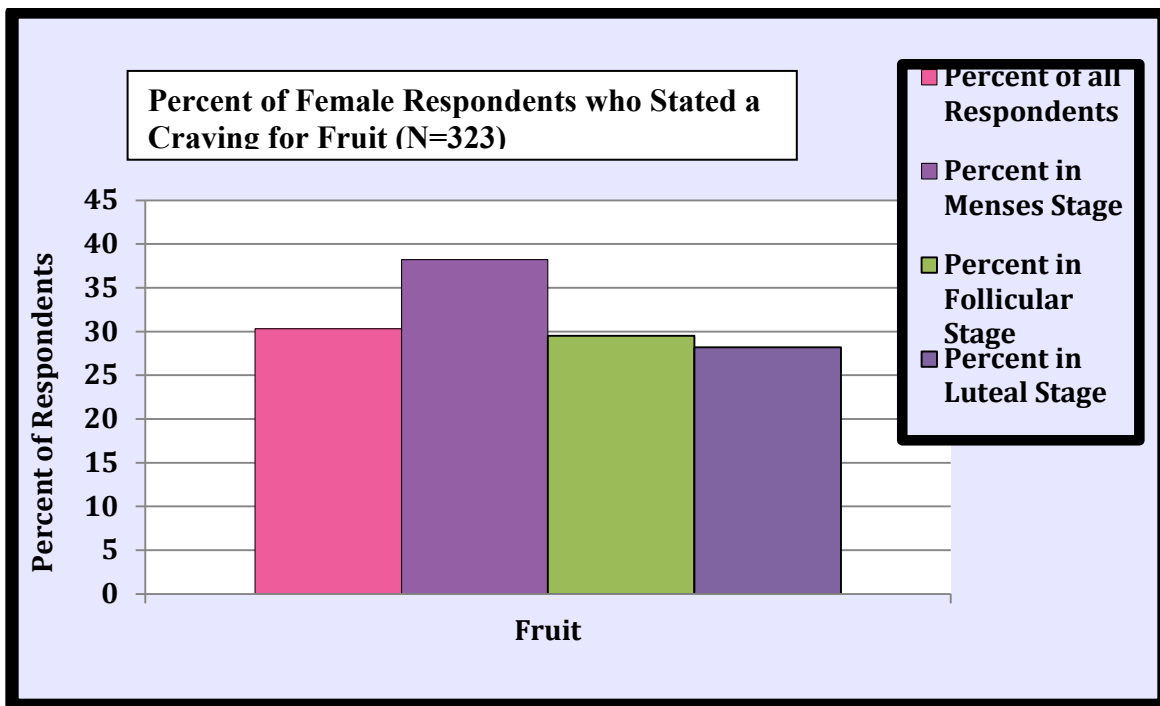


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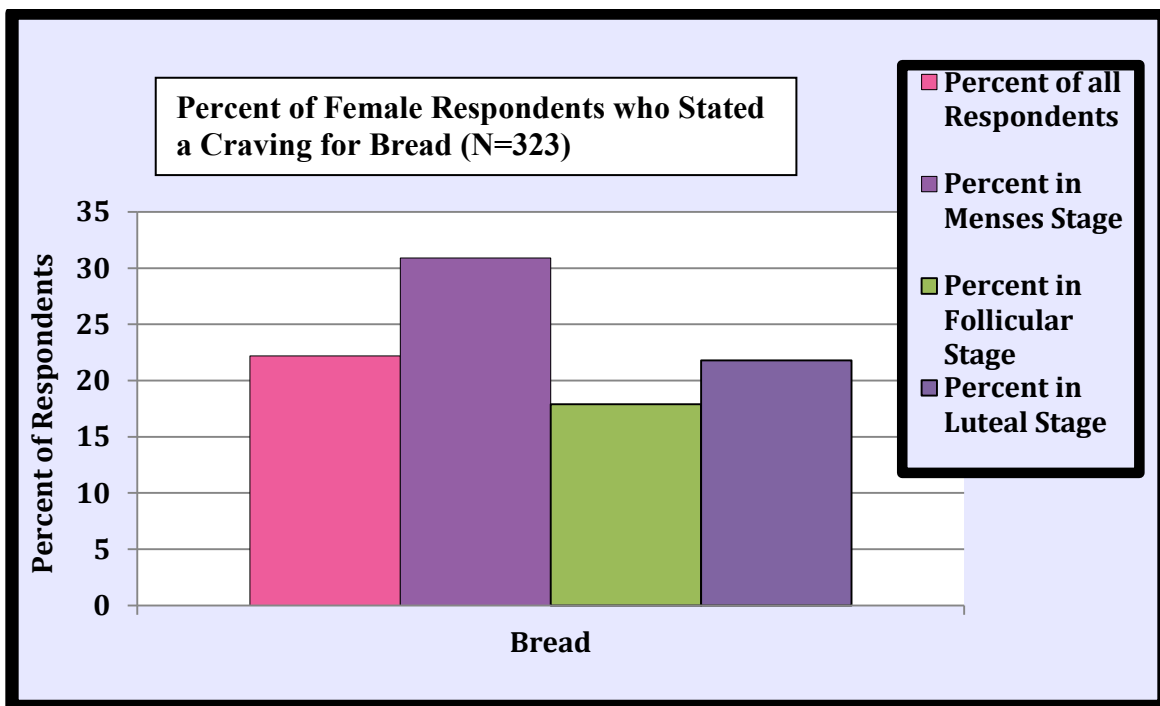


Table 12

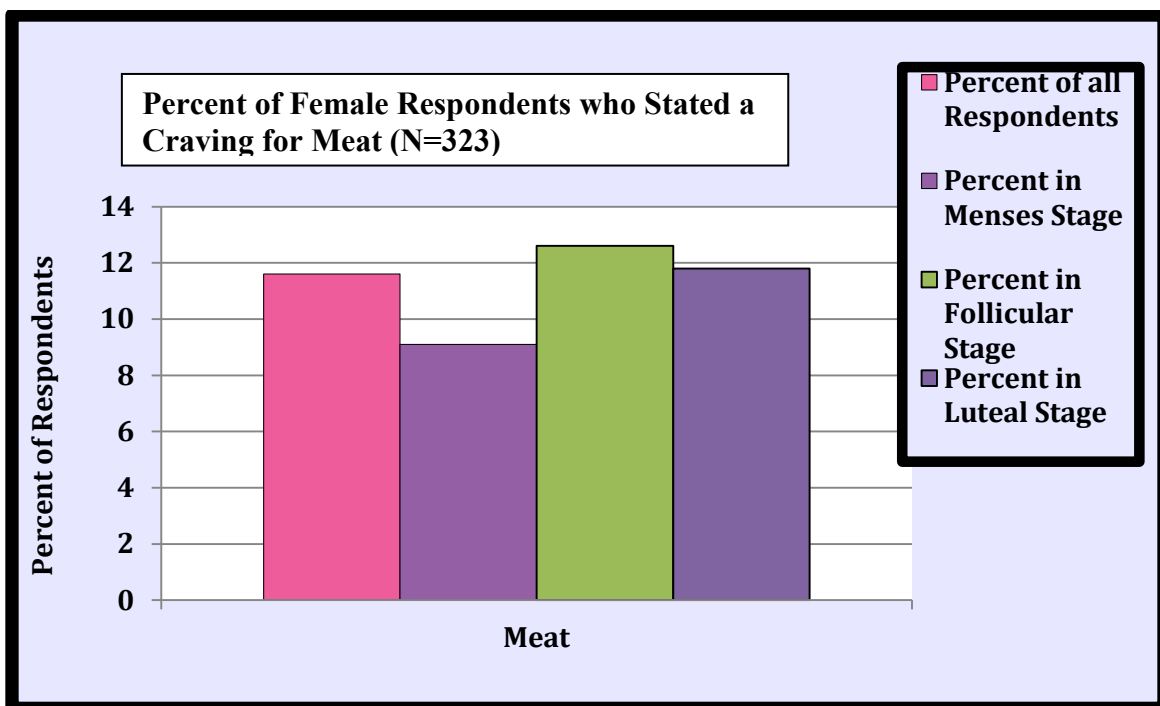


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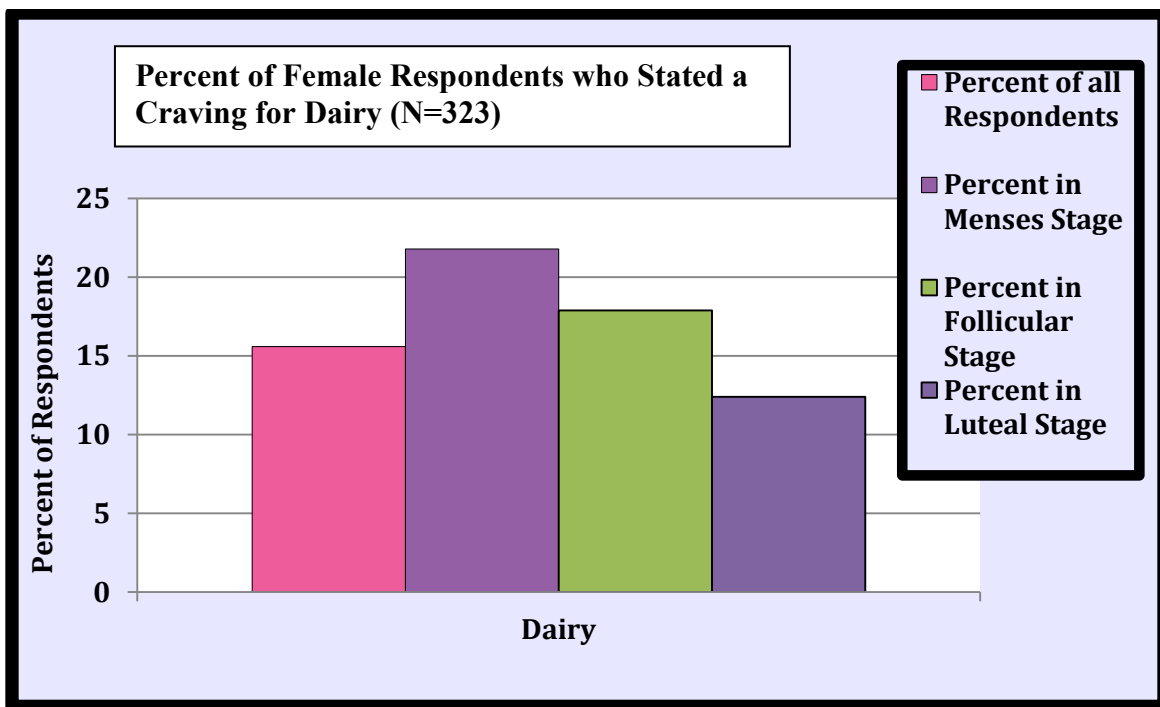


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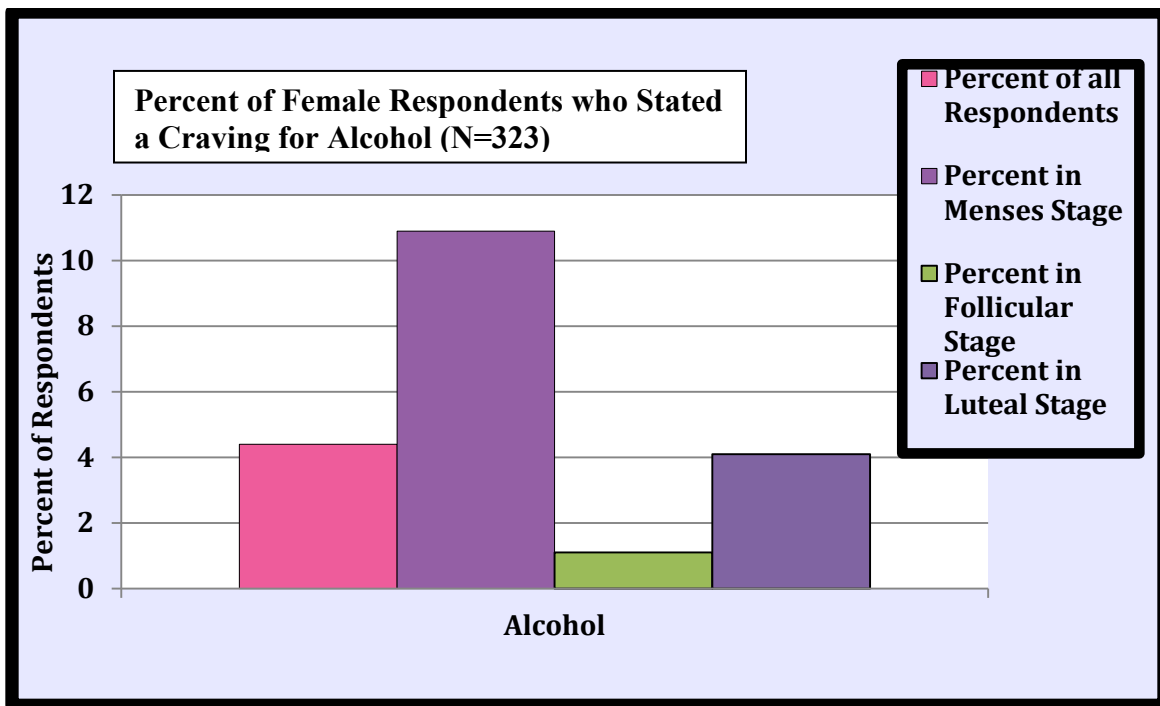


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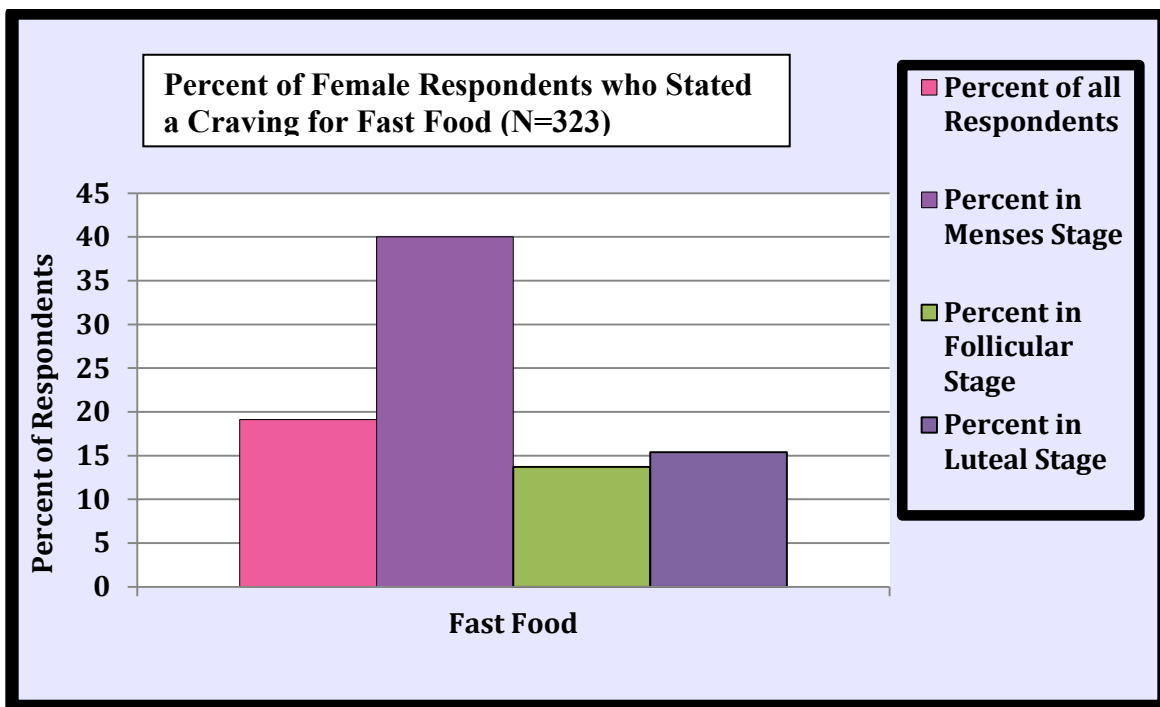
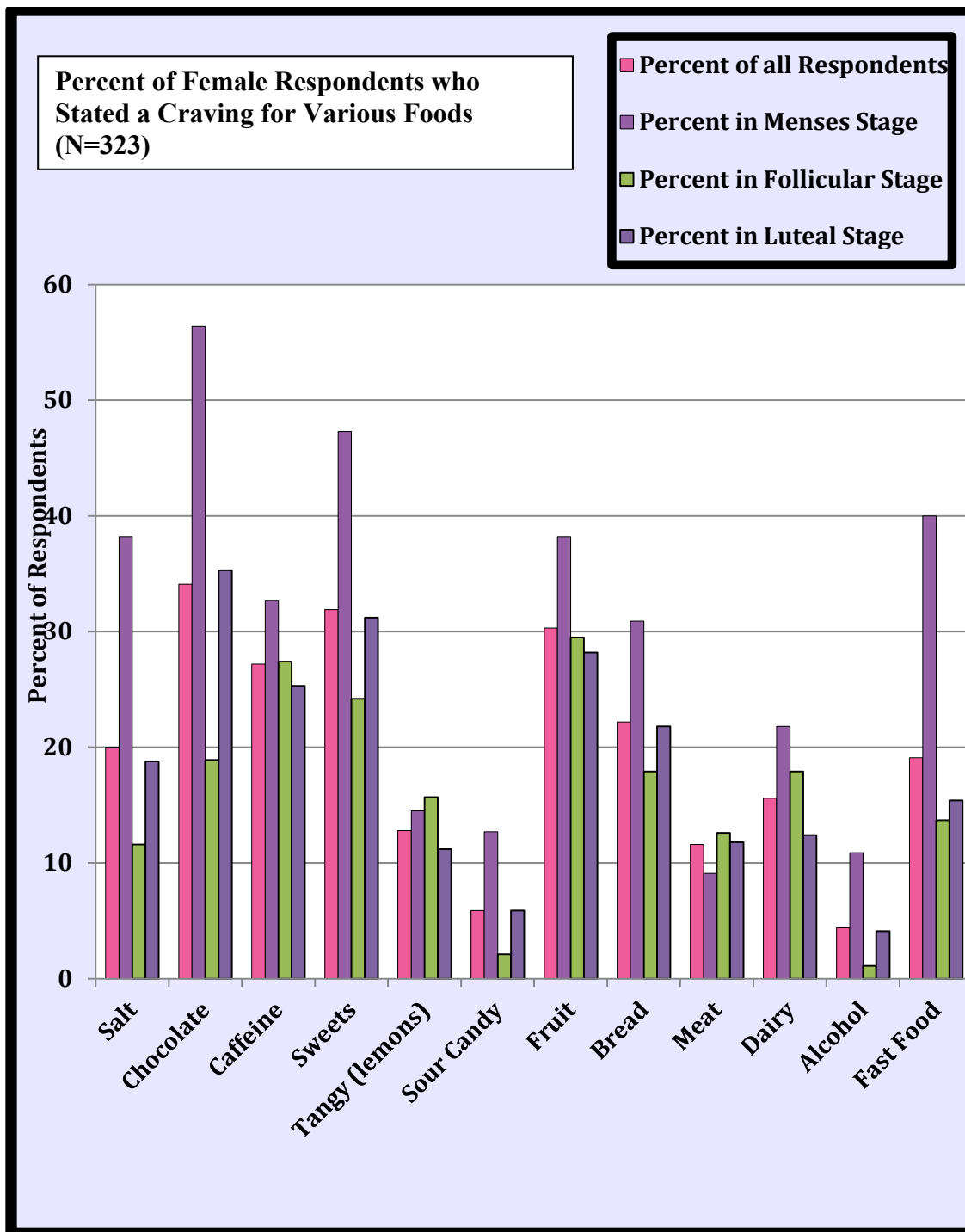


Table 16



CONCLUSIONS

Results of the present study indicated that university undergraduate female subjects crave categories of food more frequently during menses stage excluding tangy/citrus foods and meat, which are craved more frequently during follicular stage. This indicates for this sample that food cravings are at highest levels when females are going through menstruation when estrogen and progesterone are at lower levels. It also indicates for this sample, that craving for tangy/citrus and meat are at highest levels during follicular stage when progesterone is still at a lower level, but when there is a surge in estrogen production. Lastly, it indicates that the more consistent levels of craving foods during the luteal stage for this sample. During which both progesterone and estrogen levels steadily increase and decrease leading to menses stage again.

Results from this research may be utilized and applied to nutritional counseling females in all stages of the menstrual cycle to identify and understand food cravings and eating behaviors. This may also be utilized by females when experiencing such cravings to better understand the female physiology. Management of these dietary practices and cravings would improve the nutritional quality of the diet and reduce risk of obesity and other chronic diseases including diabetes, cancer, and cardiovascular disease.

Suggestions for further research include research to better understand why tangy/citrus foods and meat were craved more during follicular stage. Another important factor of further investigation is whether or not birth control affects food cravings.

APPENDICES

Appendix A: Consent Form

Department of Nutritional Sciences Research Review Board

**Texas Christian University
Fort Worth, Texas**

CONSENT TO PARTICIPATE IN RESEARCH

Title of Research: Determining the Effect of Hormonal Changes Throughout the Menstrual Cycle on Food Cravings and Eating Habits

Funding Agency / Sponsor: None

Study Investigators: Principal investigator Dr. Mary Anne Gorman, PhD, RD, LD, FADA, Alix Benear BS, RD, Dr. Ellen Broom, PhD, Dr. Anne Vanbeber, PhD, RD, LD, CFCS, Trish Ruzicka

What is the purpose of the research? The purpose of this research is to determine if there is a correlation between estrogen release and levels of progesterone in reference to the stages of the menstrual cycle and type and intensity of food habits/cravings.

How many people will participate? Depending on the amount of students enrolled in nutrition classes and sorority members decide to participate in the survey, greater than >100 people will participate.

What is my involvement for participating in this study? You will be asked to complete a questionnaire involving personal characteristics and food cravings. You will be asked to provide your age, the first day of your most recent menstrual period and how long your menstrual cycle typically lasts. You will then be asked a series of questions in relation to typical food cravings, type of food craving over the past day, the past week and the intensity of such food cravings.

How long am I expected to be in this study for and how much of my time is required? You will be expected to answer the questionnaire regarding food cravings, which will take approximately 5 minutes to complete. There is no follow up questionnaire or participation.

What are the risks of participating in this study and how will they be minimized?

Potential risks of participating in this study include discomfort disclosing information related to menstrual cycle, discomfort in disclosing information pertaining to food cravings and the intensity of food cravings. Risks will be minimized by de-identifying all questionnaires to ensure confidentiality. No questionnaires will be linked to you as a participant.

What are the benefits of participating in this study? The potential benefit of the research to the participants, to others with similar cravings and society is to gain knowledge and understanding of food cravings in order to better control cravings and health.

Will I be compensated for participating in this study? No, the participant will not be compensated for this research.

What is an alternative procedure(s) that I can choose instead of participating in this study? There is no alternative procedure that can be chosen instead of participating in the study.

How will my confidentiality be protected? All data will be kept confidential and only used for the purpose of this research. All questionnaires will not be associated with participants.

Is my participation voluntary? Yes

Can I stop taking part in this research? You may terminate participation in this research at any time.

What are the procedures for withdrawal? Withdrawal from participation in this research may be done at any point during the research. Termination of participation only involves not completing the survey and informing the investigator to shred and dispose of the signed consent document.

Will I be given a copy of the consent document to keep? Yes

Who should I contact if I have questions regarding the study?

Trish Ruzicka, Nutrition student
Email: p.ruzicka@tcu.edu

Alix Benear, RD, TCU Alumni
Email: alixbenear@gmail.com

Dr. Mary Anne Gorman, Department of Nutritional Sciences
Email: m.gorman@tcu.edu Phone: 817-257-6319

Who should I contact if I have questions regarding my rights as a study participant?

Dr. Lyn Dart, Chair, Department of Nutritional Sciences Research Review Board

Telephone 817-257-6321

Dr. David Cross, TCU Institutional Review Board,
Telephone 817 257-6416.

Your signature below indicates that you have read the information provided above, you have received answers to all of your questions and have been told who to call if you have any more questions, you have freely decided to participate in this research, and you understand that you are not giving up any of your legal rights.

Participant Name (please print): _____

Participant's Signature: _____ **Date:** _____

Investigator's Signature: _____

Revised July, 2012

Appendix B: Research Survey

**Determination of the Effect of Hormonal Changes Throughout the Menstrual Cycle
on Food Cravings and Eating Habits.**

Texas Christian University

Department of Nutritional Sciences

Today you will answer questions that provide information regarding your food cravings of various foods and the intensity at which you crave these foods at various times. Please answer each question to the best of your ability.

1. Classification: Freshman Sophomore Junior Senior

2. Major:

Nutrition

College of Science and Engineering
Sciences

College of Business

College of Nursing and Health Sciences

College of Fine Arts

College of Humanities/Social
Sciences

College of Communication

College of Education

3. How old are you?

4. Typically, do you crave salty foods? Yes No

5. Typically, do you crave sweet foods? Yes No

6. Typically, do you enjoy chocolate? Yes No

7. Do you eat fruit on a daily basis? Yes No

8. Do you regularly consume dairy products? Yes No

9. Do you typically consume caffeine during the day? Yes No

If so, how many cups of a caffeinated beverage? (ex: 8 oz cup of coffee, 12 oz
caffeinated soda, 6 oz cup of tea) _____

10. Do you consume alcohol weekly? Yes No

If so, how many servings per week? (1 serving = 12 oz beer, 5 oz of wine. or 1 oz of liquor) _____

11. How often do you typically consume fast food in a week? _____

For the following questions, please place a number the box on the table corresponding with number of times you have craved the food and in relation to the scale of intensity. The table relates to how many times you have craved the following foods **today, this week, and the intensity on a scale 1-10** (1 being “no craving”, 10 being “intense craving”). Please write yes or no in the final column, if the cravings you have experienced for the food category have been more frequent than usual.

Food	Times Today	Times This Week	Usual Intensity 1-10	Craving More Frequent This Week? (Yes/No)
Salty foods				
Chocolate				
Caffeine				
Sweets				
Tangy Foods ex: lemons, oranges				
Sour Candy				
Fruits				
Breads				
Meats				
Dairy				
Alcohol				
Fast Food				

12. Please indicate the first day of your most recent menstrual period (date) _____

Or circle: I do not know. I do not currently have a period.

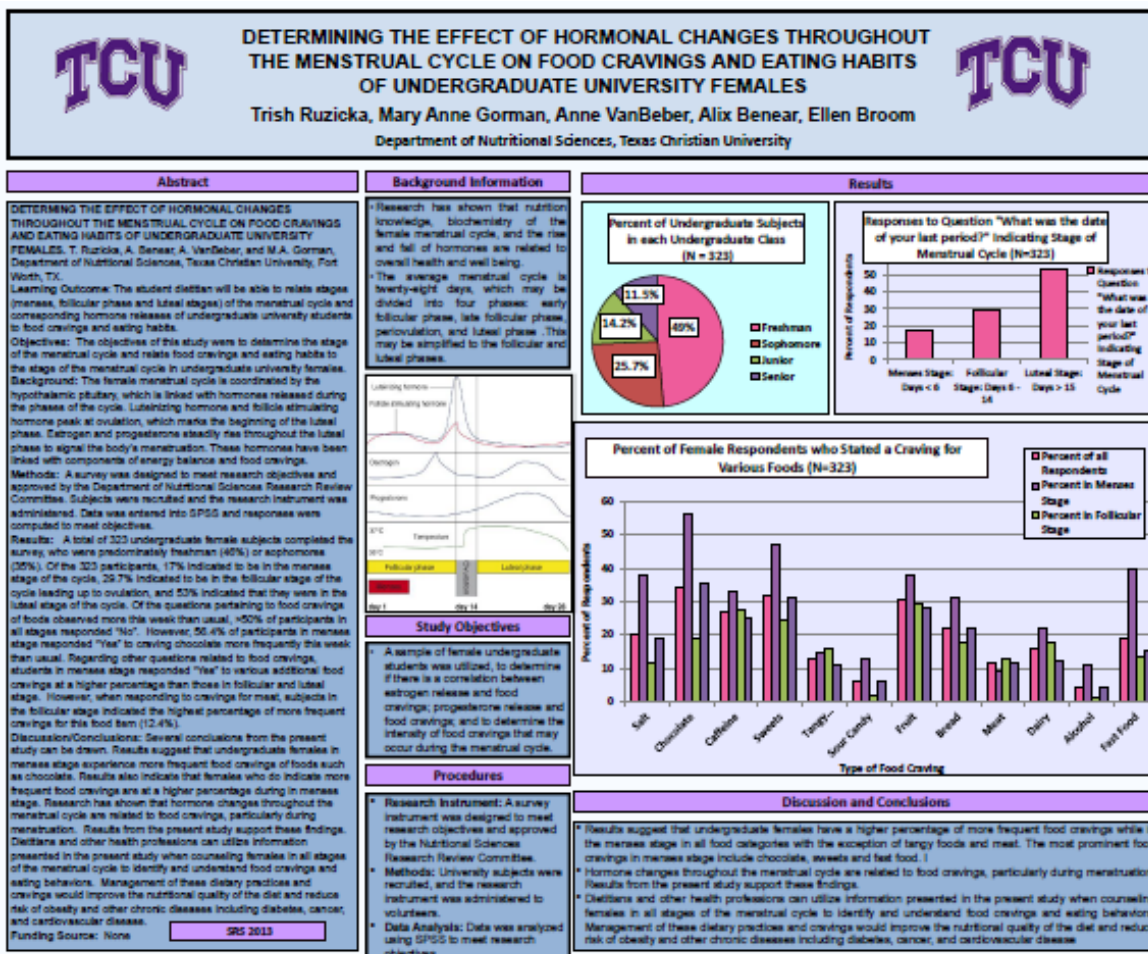
13. Are you currently using oral contraceptives (i.e. the pill)? Yes No

14. Please indicate how many days are usually between the first days of your menstrual periods?

≤ 25 26-27 28-29 30-31 ≥ 32 The days between my cycle are not consistent

Thank you for participating in this research!

Appendix C: Research Poster



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ABSTRACT

The student dietitian will be able to relate stages (menses, follicular phase and luteal stages) of the menstrual cycle and corresponding hormone releases of undergraduate university students to food cravings and eating habits. The objectives of this study were to determine the stage of the menstrual cycle and relate food cravings and eating habits to the stage of the menstrual cycle in undergraduate university females. A survey was designed to meet research objectives and approved by the Department of Nutritional Sciences Research Review Committee. Subjects were recruited and the research instrument was administered. Data was entered into SPSS and responses were computed to meet objectives. A total of 323 undergraduate female subjects completed the survey, 17% indicated to be in the menses stage of the cycle, 29.7% indicated to be in the follicular stage of the cycle leading up to ovulation, and 53% indicated that they were in the luteal stage of the cycle. Of the questions pertaining to food cravings of foods observed more this week than usual, >50% of participants in all stages responded “No”. However, 56.4% of participants in menses stage responded “Yes” to craving chocolate more frequently this week than usual. Regarding other questions related to food cravings, students in menses stage responded “Yes” to various additional food cravings at a higher percentage than those in follicular and luteal stage. Research has shown that hormone changes throughout the menstrual cycle are related to food cravings, particularly during menstruation. Management of these dietary practices and cravings would improve the nutritional quality of the diet and reduce risk of obesity and other chronic diseases including diabetes, cancer, and cardiovascular disease.