

2001

The Effects of Smoking Cessation on Fat Intake During the Luteal Menstrual Phase

Carly E. Farrell

Follow this and additional works at: https://digitalcommons.lsu.edu/honors_etd



Part of the [Medicine and Health Sciences Commons](#)

Running head: SMOKING CESSATION AND FAT INTAKE

The Effects of Smoking Cessation on Fat Intake During the Luteal Menstrual Phase

Carly E. Farrell

Louisiana State University

This study tested 18 women for differences in fat intake and total caloric intake pre- and post- smoking cessation. These women consumed two test lunches: one precessation and one postcessation. Both lunches occurred exclusively during the luteal phase of their respective menstrual cycles. The luteal phase has been implicated in increased caloric intake and weight gain. The test lunches relied on the reliability and validity of the Macronutrient Self-Selection Paradigm (MSSP) which varies the fat content of commonly consumed foods.

Results indicated that fat intake does increase following smoking cessation in women in the luteal phase ($T(17) = .85 < 1.740$; alpha level = .05). Total caloric intake did not significantly increase ($T(17) = 2.53 > 1.740$; alpha level = .05); however, a further examination of a larger number of subjects is necessary before a conclusion can be made.

The Effects of Smoking Cessation on Fat Intake During the Luteal Menstrual Phase

Cigarette smoking continues in the United States, despite alarming connections with cancer of the lung, oral cavity, larynx, and esophagus, and chronic diseases such as coronary artery disease and emphysema (U.S. Department of Health and Human Services, 1979). It has been estimated that 25% of the adult population smokes in the U.S. (Talcott, Fielder, Pascale, Klesges, Peterson, & Johnson, 1995), and that 30% of all deaths in this country are smoking related (Klesges & Klesges, 1988). Women who smoke are significantly and appreciably at greater risk for the development of lung cancer than men who smoke comparable amounts (Risch, Howe, Jain, Burch, Holowaty, & Miller, 1993; Harris, Zang, Anderson, & Wynder, 1993). In fact, since 1987 lung cancer has been the leading cause of cancer death in American women (Ogden, 1994) and this has been attributed to smoking (Weiss, 1997).

To understand why women smoke and have difficulties quitting, one must examine the benefits of smoking. Ogden and Fox (1994) have suggested that the sociocultural pressure to be thin may promote smoking in women. Many women report that they smoke to help control their appetite and body weight (Knobf & Morra, 1983; Sorenson & Pechacek, 1987; Pirie, McBride, Hellerstedt, Jeffrey, Hatsukami, Allen, & Lando, 1992). Smoking as a weight control strategy begins as early as high school when one-fourth of regular smokers acknowledge that smoking helps control weight (Perkins, 1993). Young female smokers are especially aware of nicotine's weight-suppressing effects (Hall, Tunstall, Vila, & Duffy, 1992). Smoking for weight control becomes even more prevalent in college as one-third of regular smokers acknowledge that smoking helps to control their weight (Perkins, 1993); and again, female smokers are much more likely than male smokers to report that they are using smoking as a weight control strategy (Perkins, 1993). A study by Klesges, Mizes, and Klesges (1987) reported that, among a

university population, 21% of females endorsed that they smoked cigarettes and/ or drank caffeinated beverages to lose weight. In addition, 20% of overweight females reported that they initially began smoking for weight control (Klesges & Klesges, 1988).

It is well documented that women smokers gain significantly more weight, including major weight gain (>13 kg) (U.S. Department of Health and Human Services, 1988), than male smokers after quitting (Williamson, Madans, Anda, Kleinman, Giovino, and Byers, 1991). Pirie et al. (1992), have suggested that weight gain may be a major reason why women often do not attempt to quit or relapse after a quit attempt. Moreover, one of the primary nicotine withdrawal symptoms differentiating men and women is increased appetite in women (Price et al, 1992; Swan, Ward, Carmelli, & Jack, 1993). Results of studies using self reports have suggested that there is a postcessation increase in intake of foods that are high in sugar and other carbohydrates (CHO); these typically have a high-fat content (Grunberg, 1982; Grunberg, Bowen, Maycock, & Nespor, 1985; Perkins, Epstein, Sexton, & Pastor, 1990). Foods that are high in sugar and fat are likely to be associated with weight gain (Geiselman, 1995). High-sugar/ high-fat foods have been linked to hyperphagia, or overconsumption. The link between high-sugar/ high-fat foods and overeating is explained with their decreased ability to satiate or suppress appetite (World Health Organization, 1997). Human subjects ate significantly more calories when presented high-sugar/ high-fat foods than when presented savory/ high-fat foods or savory/ high-complex carbohydrate (CHO) foods (Green & Blundell, 1996).

Previous tests, designed to measure fat intake, did not significantly and systematically vary the fat of other macronutrient content of food. The Macronutrient Self-Selection Paradigm (MSSP) was developed to allow subjects to identify foods commonly consumed in his/ her own diet (Geiselman, Anderson, Dowdy, West, Redmann, & Smith, 1998). The MSSP allows subjects

to choose among 9 high-fat foods, 18 total foods.

The menstrual cycle may be an additional complicating factor for smoking cessation in young, weight-concerned women. Women are especially vulnerable to overeating and weight gain during the luteal phase (post-ovulation/ premenstrual) of the menstrual cycle (Geiselman, 1995; Geiselman, 1998). The daily caloric increase during the luteal phase of the menstrual cycle has shown to be at 500 kcals for normal weight, nonsmoking women (Dalvit, 1981). This premenstrual caloric intake is attributed to a significant increase in intake of fat (Tarasuk & Beaton, 1991). It should be noted that fat has a considerably higher caloric density with nine kcals per gram, compared to only four kcals per gram for both protein and carbohydrate. Therefore, a significant increase in fat is a significant increase in calories.

To help weight-concerned women stop smoking, attention must be given to this postcessation caloric increase that is further exacerbated by the luteal phase caloric increase. Talcott et al. (1995) have reported that a program combining a limitation of high-fat foods and an increase in physical activity was moderately successful in attenuating weight gain postcessation. Also, recent programs aimed at changing health behaviors have proposed that interventions tailored for the individual may be more effective in achieving behavioral change. Programs adapted to each individual have been recommended for weight maintenance strategies, such as diet choices and exercise (Calfas, Long, Sallis, Wooten, Pratt, & Patrick, 1996; Brownell & Cohen, 1995).

Specific Aims

The purpose of this study was to examine the change in the percentage of fat and total caloric intake consumed during the luteal phase of the menstrual cycle, pre- and post- smoking cessation in young, weight-concerned women. It was hypothesized that fat and total caloric

intake would increase postcessation in the luteal phase.

The purpose of measuring (exclusively) during the luteal phase rests on a large body of evidence that suggests that this is the phase when women are most likely to gain weight and overeat (Geiselman, 1995; Geiselman, 1998). Since weight gain and overeating have been implicated as common behaviors when in a smoking abstinence program, the present study sought to examine the effects on fat and total caloric intake when the proposed effects of the luteal phase are combined with the suggested effects of smoking cessation.

Method

Participants

Subjects were Caucasian women (aged 18-38), recruited from the Baton Rouge, LA area. These women had their menstrual cycle physiologically (lasting 25-35 days). These women were regular smokers, defined as 1) smoking more than 10 cigarettes per day, 2) expired carbon monoxide (CO) greater than 10 ppm, and 3) salivary cotinine levels greater than 10 ng/ ml. Each woman was questioned on weight concern. Every woman who went through the screening process reported weight concern. However, any woman with a history of, or the presence of, an eating disorder was excluded from the study.

Parent Study

This study was a subset of a larger parent study entitled S.T.O.P., or Smoking Treatment and Obesity Prevention. S.T.O.P. used a multi-disciplinary approach to establish a smoking cessation program that assisted women in stopping smoking, avoiding weight gain, and avoiding relapse. This approach involved clinical psychologists, a registered dietitian, and an exercise physiologist. These professionals worked with the women on coping skills, exercise integration, and developing healthful eating skills. However, the exercise and eating components did not

begin until after the women had completed the postcessation testing portion of this study.

The women attended an orientation meeting the week prior to their Monday quit date. They were instructed to reduce the amount of cigarettes smoked on the Saturday and Sunday preceding the quit date. During the two-week cessation period, the women met for approximately two hours on six separate occasions. These meetings were conducted by a clinical psychologist and a S.T.O.P. graduate student. In these sessions, the women were taught cognitive and behavioral coping responses when experiencing smoking urges.

In addition, each woman was required to purchase an over the counter nicotine patch with her doctor's approval.

Study Design

This study involved a within-subjects (pre- and post- smoking cessation) t-test. The data came from within-subject differences. Precessation occurred before a subject received any information about smoking cessation, while the subject was still smoking. Postcessation occurred during the immediate first luteal phase postcessation.

The primary dependent variable was the percentage of fat intake, pre- and postcessation. The secondary dependent variable was the change in total caloric intake, pre- and postcessation.

Menstrual Cycle Assessment

The precessation test using the MSSP (Geiselman, et al, 1998) was conducted after the subject's menstrual cycle had been tracked for one month. The subject was responsible for calling and reporting the onset and offset of menses and the occurrence of ovulation. Each subject was provided with home ovulation kits or basal body thermometers, free of charge, to allow her to monitor the onset of these menstrual events.

Each subject was required to track her menstrual cycle until after her second testing,

which occurred during her first luteal phase after she had stopped smoking.

Macronutrient Self-Selection Paradigm

Dr. Paula Geiselman, the physiological psychologist in charge of the larger study, selected which foods were used for each individual subject on the MSSP. The MSSP is comprised of specific foods into 6 cells: High Fat/ High Sugar, High Fat/ High Complex CHO, High Fat/ Low CHO, Low Fat/ High Sugar, Low Fat/ High Complex CHO, Low Fat/ Low CHO/ High Protein. Three foods from each of the 6 cells were selected, for a total of 18 foods. To select which foods will be used in the MSSP, each subject completed three scales, prior to the lunch preparation and presentation. All three scales consist of 94 foods, with each of the three scales listing the foods in the same order. These are foods in which fat is commonly consumed in the everyday American diet, easy to prepare, and generally consumed as snack food. The first scale requires the subject to give hedonic ratings to each food; the second scale asks the frequency that the subject eats each food; and the third scale questions, if cost were not a problem, how frequently would the subject prefer to eat each food. The subject rated each individual food on a Likert scale (ranging from 1 to 9). The foods that were selected were those with the mean rating of each cell.

Large portions of the 18 foods were prepared, according to protocol. The same commercial brand of food was used consistently across subjects. Most of the foods were presented in a variety of ways, such as wedged, cubed, or sliced. This assured that foods were not selected because of presentation styles. Each food was weighed, prior to being served. Food intake was measured as weight at preparation, minus the weight of each food after being presented to the subject.

The MSSP was designed to provide data for analysis of macronutrient intake, specifically

fat, protein, simple sugars, and complex carbohydrate. For each type of food, there was a high-fat and low-fat option. For instance, a subject might have chosen between a high-fat bread (ex. croissant) and low-fat bread (ex. whole wheat bread). The differences in fat were easy to visually detect (e.g. large amounts of white in high-fat meats instead of pinker lean meats).

The MSSP has demonstrated validity in measuring acute macronutrient intake with respect to long-term intake and strong test-retest reliability, in women and men.

Procedure

When each individual subject scheduled her lunch, she was told not to eat or drink (except water) after 10 PM the night before testing. She was also to abstain from exercising that morning and from drinking alcohol within 24 hours.

The foods were presented in a small room; the subject sat at a table where the 18 foods were randomly arranged, along with the appropriate cutlery, a plate, napkin, glass, and a pitcher filled with water. The subject was not allowed to bring a bag, purse, or watch into the room. She was instructed to open the door upon completion, and was prevented from bringing any food, not consumed, out of the room.

Attrition

Fifty-four (54) women completed the precessation MSSP. From this original pool, nine (9) dropped out. The forty-five (45) remaining entered the two-week smoking cessation treatment program. Five women dropped out of the treatment program. Out of the remaining forty (40) women who completed the postcessation MSSP, twenty-two (22) could not be used in this study's data pool. The reasons for noninclusion include: having her menstrual cycle pharmacologically controlled; being tested in a different phase of her menstrual cycle other than the luteal phase; beginning the postcessation follow-up meetings before completing the

postcessation MSSP.

Statistical Analysis

Data were computed using two separate t-tests for related measures. This test was used to compare differences within-subjects in fat and total caloric intake, pre- and post- smoking cessation.

Subject Deposit and Payments to Subjects in Parent Study

In the parent study, each subject was required to make a \$50 deposit, to add an incentive to attendance to follow-up meetings after completing the smoking cessation program. This deposit was rebated back at follow-up meetings occurring at weeks 1, 3, 8, 16, and 36. In addition, subjects were paid \$30 for completing a precessation assessment and \$40 for completion of each of the subsequent assessments in the parent study 24- and 52-week assessments.

Results

The primary dependent measure was the percentage of fat, precessation and postcessation within the 18 subjects. The secondary dependent measure was total caloric intake, precessation and postcessation. The measurements were taken during two separate test lunches: precessation and postcessation. Both test lunches occurred during the luteal phase of the menstrual cycle.

The mean total caloric intake during precessation (mean = 833.94 kcals) was not significantly different ($T(17) = .85 < 1.740$; alpha level = .05) than during postcessation (mean = 914.22 kcals). However, an examination of the fat percentage increase precessation to postcessation demonstrates a significant difference ($T(17) = 2.53 > 1.740$; alpha level = .05). The difference in fat percentage at precessation (mean = 42.38%) to fat percentage at postcessation (mean = 48.0%) were significant.

Discussion

When starting this study, one would expect to find a clear difference in total caloric intake, pre- and post- smoking cessation. The investigator anticipated that both the total caloric intake and the percentage of fat would increase from the first measurement to the second.

It was impressive to see a statistically significant difference in the percentage of fat with such a small number of subjects. Eighteen subjects is not sufficient for the power variable. It is expected that a statistically significant difference will be demonstrated for total caloric intake once the power variable is reached.

With the findings of a nonsignificant difference in total caloric intake and a significant difference in fat percentage, one must assess what is different with these two measurements. While total caloric intake measures the complete meal consumed in the subject's self-selection, fat percentage measures the relative fat in the subject's self-selection. Therefore, these results suggest that subjects comprise their diets with more high-fat food choices after stopping smoking than they did before stopping smoking.

To know what role this may play in future weight gain in subjects, further examination must explore within-subject changes in women in smoking cessation programs. Over time, the increase of the percentage of fat in one's diet will likely lead to a greater overall caloric intake as fat is more calorically dense. Also, as previously discussed, high-sugar/ high-fat foods have decreased ability to satiate appetite and are linked with hyperphagia (World Health Organization, 1997).

The study sought to create a situation in which tailored macronutrient self-selection was taught, and individuals were educated about their own appropriate diet and exercise regimen that might help in avoiding the postcessation weight gain previously discussed. The goal was to

compare this condition to a control condition that would not receive this individualized information, but instead standard exercise and dietary advice and food pyramid guidelines. It was hypothesized that the tailored subjects would demonstrate lower fat intake, and thus, would have a lower fat and total caloric intake than the condition receiving the standard information. However, there was not sufficient data to compare the individualized and control groups.

In respect to insufficient data, many of the subjects would not comply with the test procedures. The study also had a major problem with subject attrition. Additionally, many subjects were not willing/able to come in for the postcessation testing during the luteal phase. These subjects were tested during different phases of their menstrual phase, for the purpose of acquiring data for the parent study. These subjects' data, therefore, did not meet the definable requirements for this study and were not used in data analysis. Subject attrition and subject unwillingness to comply to test procedures or participate when necessary contributed to a small data pool.

While this study did not demonstrate an increase in total caloric intake with smoking cessation, it did demonstrate an increase in fat intake pre- to post- smoking cessation. This provides a possible explanation for the weight gain that almost invariably accompanies female smoking cessation. This study can lend itself to more in-depth research to ultimately aid female smokers quit their habit.

References

Brownell, K. D. & Cohen, L. R. (1995). Adherence to dietary regimens 2: Components of effective interventions. Behavioral Medicine, 20, 155-164.

Calfas, K. J., Long, B. J., Sallis, J. F., Wooten, W. J., Pratt, M. & Patrick, K. (1996). A controlled trial of physician counseling to promote adoption of physical activity. Preventative Medicine, 25, 225-233.

Dalvit, S. P. (1981). The effect of the menstrual cycle on patterns of food intake. American Journal of Clinical Nutrition, 34, 1811-1815.

Geiselman, P. J. (1995). Female sex hormones, specific macronutrients, taste, and other oral responsivity in the control of appetite, food intake, and body weight. Nutrition, Endocrinology, and Disease, 4, 202-214.

Geiselman, P. J. (1998). Female hormones in the control of food intake: Relationships to preferences for sweet tastants and fatty foods, especially chocolate. Women's Health: Prevention is the Best Medicine, in press.

Geiselman, P. J., Anderson, A. M., Dowdy, M. L., West, D. B., Redmann, S. M., and Smith, S. R. (1998). Reliability and validity of a macronutrient self-selection paradigm and a food preference questionnaire. Physiology and Behavior, 63, 919-928.

Green, S. M., and Blundell, J. E. (1996). Subjective and objective indices of the satiating effect of foods. Can people predict how filling a food will be? European Journal of Clinical Nutrition, 50, 798-806.

Grunberg, N. E. (1982). The effects of nicotine and cigarette smoking on food consumption and taste preferences. Addictive Behavior, 7, 317-331.

Grunberg, N. E., Bowen, D. J., Maycock, V. A., & Nespor, S. M. (1985). The importance of sweet taste and caloric content in the effects of nicotine on specific food consumption. Psychopharmacology, 87, 198-203.

Hall, S. M., Tunstall, C. D., Vila, K. L., & Duffy, J. (1992). Weight gain prevention and smoking cessation: Cautionary findings. American Journal of Public Health, 82, 799-803.

Klesges, R. C., & Klesges, L. M. (1988). Cigarette smoking as a dieting strategy in a university population. International Journal of Eating Disorders, 7, 413-419.

Klesges, R. C., Mizes, J. S., & Klesges, L. M. (1987). Dieting strategies in a college population. International Journal of Eating Disorders, 6, 409-417.

Knobf, M. K. T. & Morra, M. E. (1983). Smokers, former smokers, and nonsmokers: A correlational study of nurses in Connecticut. Oncology Nursing Forum, 10, 40-45.

Ogden, J. (1994). Effects of smoking cessation, restrained eating, and motivational states on food intake in the laboratory. Health Psychology, 13, 114-121.

Ogden, J. & Fox, P. (1994). Examination of the use of smoking for weight control in restrained and unrestrained eaters. International Journal of Eating Disorders, 16, 177-185.

Perkins, K. A. (1993). Weight gain following smoking cessation. Journal of Consulting and Clinical Psychology, 61, 768-777.

Perkins, K. A., Epstein, L. H., Sexton, J. E., & Pastor, S. (1990). Effects of smoking cessation on consumption of alcohol and sweet, high-fat foods. Journal of Substance Abuse, 2, 287-290.

Pirie, P. L., McBride, C. M., Hellerstedt, W., Jeffrey, R. W., Hatsukami, D., Allen, S., & Lando, H. (1992). Smoking cessation in women concerned about weight. American Journal of Public Health, 82, 1238-1243.

Pliner, P. & Fleming, A. S. (1983). Food intake, body weight, and sweetness preferences over the menstrual cycle in humans. Physiology and Behavior, 30, 663-666.

Risch, H. A., Howe, G. R., Jain, M., Burch, J. D., Holowaty, E. J., & Miller, A. B. (1993). Are female smokers at higher risk for lung cancer than male smokers? A case-control

analysis by histologic type. American Journal of Epidemiology, 138, 281-293.

Sorenson, B., & Pechacek, T. F. (1987). Attitudes toward smoking cessation among men and women. Journal of Behavioral Medicine, 10, 40-45.

Swan, G. E., Ward, M. M., Carmelli, D., & Jack, L. M. (1993). Differential rates of relapse in subgroups of male and female smokers. Journal of Clinical Epidemiology, 46, 1041-1053.

Talcott, G. W., Fielder, E. R., Pascale, R. W., Klesges, R. C., Peterson, A. L., & Johnson, R. S. (1995). Is weight gain after smoking cessation inevitable? Journal of Consulting and Clinical Psychology, 63, 313-316.

Tarasuk, V. & Beaton, G. H. (1991). Menstrual-cycle patterns in energy and macronutrient intake. American Journal of Clinical Nutrition, 53, 442-447.

U.S. Department of Health and Human Services. Office on Smoking and Health: Smoking and Health. A Report of the Surgeon General. DHEW Pub. No. PHS 79-55566 Washington, D.C.: Government Printing Office, 1979.

U.S. Department of Health and Human Services. The Health Consequences of Smoking: Nicotine Addiction. A Report of the Surgeon General. DHHS Publication (CDC) 88-8406 Washington, D.C.: Government Printing Office, 1988.

Weiss, W. (1997). Cigarette smoking and lung cancer trends. Chest, 111, 1414-1416.

Williamson, D. F., Madans, J., Anda, R. F., Kleinman, J. C., Giovino, G. A., & Byers, T. (1991). Smoking cessation and severity of weight gain in a national cohort. New England Journal of Medicine, 324, 739-745.

World Health Organization (WHO). (1997). Obesity: Preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva, Switzerland.