

**Eating occasion need states and weight gain
prevention in midlife women**

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ABSTRACT

Midlife years (age 40-60) are a critical time period for many women because of elevated risk of overweight and obesity. Women often experience age-related weight gain based on both physiological and environmental changes that occur with age. The physiological changes experienced by women can contribute to weight gain, but weight gain can also be due to both environmental and behavioral factors that influence eating behavior. This project was based on a multidisciplinary approach involving nutrition and marketing expertise to address the situational context of eating occasions. The project was conducted in two phases; a descriptive research phase (Phase I) which provided information to inform the development of a controlled intervention phase (Phase II). The objective of the descriptive research phase I was to identify distinct need states based on rational and emotional needs surrounding specific eating occasions experienced by midlife women and determine how eating behavior including energy, food and nutrient intakes, and BMI differed by need state. Data from 5,556 eating occasions experienced by a US national sample of 1,663 women (40-60 years) were used in the segmentation analysis. Six need states were identified: healthy express, comforting interludes, indulgent escapes, nurturing family meals, sensible meals, and fast fueling. Each of the six need states had different energy and food and nutrient intake characteristics. The objective of the controlled-intervention phase II was to implement and evaluate the effectiveness of a nutrition counseling intervention tailored to eating occasion need states to prevent weight gain compared to a control group of midlife women. Participants in the intervention group received ten hours of nutrition counseling over six months based on commonly experienced needs within specific eating occasions. The control group

received no counseling. Although not significant, women in the intervention group gained 0.2 kg over the two year period, while women in the control group gained 0.4 kg. Energy intake did not differ significantly between the intervention and control group at any time point, however decreases were observed in total- ($p=0.02$) and saturated fat intakes ($p=0.06$), and cholesterol ($p=0.01$) intake over the two-year period in the intervention compared to control group. Over the two-year period compared to the control group, the intervention group increased intakes of fruit ($p=0.02$) and low/reduced fat dairy products ($p=0.04$) and decreased intakes of sugars and candy ($p=0.002$). Subgroup analyses of women experiencing less-healthy need states (intervention $n=71$; control $n=59$) showed results similar to the overall sample regarding weight change. Subgroup analyses of overweight and obese women (Intervention $n=116$; Control $n=103$) showed different patterns of change with weight decreasing in the intervention group (86.0 to 85.5 kg) and increasing in the control group (82.8 to 83.4 kg). This study provides evidence that tailoring nutrition education according to most frequently experienced eating occasion need states may, over time, lead to improved weight outcomes in overweight or obese women who often experience less-healthy need states. However, the intervention approach may be less helpful for normal weight women already experiencing healthy need states.

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Chapter I: General Introduction

GENERAL INTRODUCTION

INTRODUCTION

The prevalence of overweight and obesity has been steadily increasing over the past few decades (Flegal 2005). Overweight and obesity are controllable risk factors for major chronic diseases such as atherosclerotic cardiovascular disease (De Michele et al. 2002), type 2 diabetes (Carr et al. 2004), and metabolic syndrome (National Cholesterol Education Program 2002). Several prospective and longitudinal studies (Lee et al. 2010; Nooyens et al. 2009; Sternfeld et al. 2004) have demonstrated that women tend to gain 0.2-1.0 kg/year during their midlife years (40-60 years). The risk of weight gain increases in women in midlife because energy expenditure decreases with age (Hill et al. 2003) while energy intake may remain the same or increase. Age effects on body weight and BMI may be due to physiological and psychosocial changes within individuals that occur as a result of aging (Dare 2011). Midlife is a critical time for women as they experience hormonal changes due to menopause. Family structure may change during this time as grown children leave the home or elderly parents require more care. Midlife adults may also begin preparing for retirement and find they have more or less time available for physical activity or cooking. Together, these changes, along with the inverse relationship between total energy expenditure and age may help to explain the age-related weight gain. Given the likelihood of weight gain and changes in body composition during the midlife years, weight gain prevention is important for prevention of adverse health outcomes. Weight gain in this age group is progressively related to higher absolute risk of disease and mortality (Gostynski et al. 2004). Prevention of weight gain in this group may also result in better health outcomes in the short term.

A number of factors affect food choice in midlife women including social, environmental, and personal influences that may contribute to positive energy balance, leading to an increase in weight. Eating occasions for midlife women are unique, multifaceted, and encompass many needs and attitudes that underlie food choices; however few studies have examined eating occasions by the social and behavioral contexts that surround them and how these contexts influence food choice. According to market research, purchase and consumption decisions are influenced by “need states,” defined as rational and/or emotional needs within specific situations (Leith and Riley 1998). Applied to eating occasions, rational and emotional needs based on situational context can affect what and how much is eaten. Segmentation analysis is one method of understanding the differences in consumer behaviors and attitudes regarding food intake and health (Byrd-Bredbenner et al. 2008; NPD Group 2011). Segmentation is based on the rationale that subdividing a large heterogeneous population into smaller, more homogeneous segments allows for more effective targeting by group. Segmentation of eating occasions according to need states may improve the understanding of motivations that drive behavior, thus facilitating development of tailored interventions. Effective programs to prevent weight gain with age can be an important factor in lowering obesity prevalence and associated risk of chronic disease. To foster behavioral change, it is important that interventionists understand physiological and behavioral factors, and social cues and habits involved in food choice based on the diversity of midlife women. Segmentation of eating occasions is an innovative approach that holds promise for understanding motivations that drive behavior in specific eating situations toward or away from a focus on health. The segmentation approach involving eating occasions

may allow for an improved conceptualization of the influence of situational context to better understand eating behavior in midlife women. Further study of needs that surround eating occasions experienced by midlife women are warranted to provide information to develop tailored intervention programs. Tailored nutrition education improves long-term diet quality in adults (Eyles and Mhurchu 2009), and experiencing a high frequency of less-healthy eating occasions may lead to weight gain over time. Therefore, an intervention tailored to eating occasion need states experienced by midlife women may be effective in preventing weight gain.

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Chapter II: Review of Literature

REVIEW OF LITERATURE

OBESITY

Overweight and obesity are major health concerns in the United States and throughout the world. The prevalence of overweight and obesity has been steadily increasing over the past few decades (Flegal 2005). According to current National Health and Nutrition Examination Survey data (Centers for Disease Control and Prevention 2011), it is currently estimated that approximately two-thirds of the adult population in the United States are overweight or obese with a body mass index (BMI) $>25.0 \text{ kg/m}^2$ with nearly one-third being classified as obese with a BMI $\geq 30.0 \text{ kg/m}^2$ (Ogden et al. 2006). The obesity prevalence in adults has doubled over the last twenty years (Flegal 2005). While many factors may contribute to the development of overweight and obesity, such as genetics (Vogel et al. 2009), altered metabolic hormones (Fang and Sweeney 2006), and behavioral and environmental influences (Li et al. 2009), the sharp increase in prevalence suggests that behavioral and environmental factors may predominate over biological and metabolic factors.

Current Recommendations

The current BMI recommendations used to identify overweight and obesity are 25.0-29.9 and $>30.0 \text{ kg/m}^2$, respectively (World Health Organization 2000). Sex-specific cutoffs can be used to determine relative risk of the development of obesity-associated risk factors in most adults. A waist circumference (WC) greater than 102 cm for men or greater than 88 cm for women indicates high risk (Grundy et al. 2005). Similarly, a waist-to-hip ratio (WHR) greater than 0.9 in men or greater than 0.85 in women also

indicates abdominal obesity and increased risk of chronic disease (World Health Organization 2008).

Consequences

Mortality

Obesity has been associated with an increased risk of mortality in both men and women. Several large studies (Kim et al. 2000; Pischon et al. 2008) have shown significant associations between body weight or BMI and mortality. A large European study (Pischon et al. 2008) examined associations between BMI, WC, and WHR and risk of death in over 350,000 men and women. The lowest risk of death was associated with a BMI of 25.3 kg/m² for men and 24.3 kg/m² for women. After adjusting for BMI, a strong association existed between WC and WHR and risk of death. Men and women were divided into quintiles for both WC and WHR. Relative risk of death for the highest quintile of WC was 2.05 in men and 1.78 in women. Similarly, men and women in the highest WHR quintile had a relative risk of 1.68 and 1.51, respectively. These findings indicate that both general adiposity and abdominal adiposity are associated with increased mortality.

Results from a large cohort study (Gu et al. 2006) of nearly 150,000 Chinese men and women aged 40 years or older showed a similar association between weight and mortality. After adjusting for age, sex, cigarette smoking, alcohol consumption, physical activity, education, geographic region, and urbanization, a U-shaped association was observed between BMI and all-cause mortality ($p \leq 0.001$). When a BMI of 24.0-24.9 kg/m² was used as a reference range, a relative risk of all-cause mortality of 1.15 and 1.29 was observed in the overweight group (BMI 27.0-29.9 kg/m²) and obese group

(BMI >30.0 kg/m²), respectively. It was noted that relative risk was 1.69 for BMI <18.5 kg/m², illustrating the U-shaped association between BMI and mortality. This may have been due to malnourishment or an underlying disease.

Morbidity

Obesity is also a known risk factor for many diseases and conditions including coronary heart disease (De Michele et al. 2002), type 2 diabetes (Carr et al. 2004), stroke (Bodenant et al. 2011), osteoarthritis (Rai and Sandell 2011), sleep apnea and other breathing problems (Dzieciolowska-Baran et al. 2010), some forms of cancer (Friedenreich et al. 2007; van Dijk 2004), dementia (Fitzpatrick et al. 2009), and decreased physical function (Woo et al. 2007). The location or distribution of fat plays a major role in determining morbidity risk associated with increased body fat. Centrally located fat, or fat in the abdominal region is associated with greater disease risk than overall body fat. Several studies (Hadaegh et al. 2007; Pischon et al. 2009; Yusef et al. 2005) have shown that indices of abdominal obesity such as WHR or WC are better predictors of disease risk than BMI alone.

Atherosclerotic Cardiovascular Disease

The INTERHEART study (Yusef et al. 2005) was a case-control study conducted in more than 27,000 participants in 52 countries. After adjusting for BMI and height, WC was still a strong predictor of myocardial infarction risk. When the group with the greatest (>97.4 cm in women and >99.0 cm in males) versus the smallest (<78.5 cm in women and <80.5 cm in men) WC was compared, the odds ratio of having a myocardial infarction was 1.77 ($p \leq 0.001$). As WHR increased, the risk of myocardial infarction also increased, with no evidence of a threshold. In contrast, BMI showed only a modest

correlation with myocardial infarction risk indicating that WHR and waist and hip circumferences were better predictors of cardiovascular disease than BMI alone.

Farag et al. (2004) demonstrated that a positive correlation existed in postmenopausal women between WHR and total cholesterol ($p=0.03$), triglycerides ($p\leq 0.0001$), diastolic blood pressure ($p=0.03$), and total peripheral resistance index ($p=0.03$). The results from this study support other findings published in the literature (Chadha et al 2009; Piche et al. 2005) suggesting that greater central adiposity in women can lead to adverse hemodynamic and metabolic characteristics.

Type 2 Diabetes and Metabolic Syndrome

Central adiposity, independent of overall obesity, is not just a risk factor for cardiovascular disease but also may lead to insulin resistance, glucose intolerance, and type 2 diabetes (Favier et al. 2005). Overall obesity, along with centrally distributed adiposity, is the most common clinical state characterized by insulin resistance (Ness-Abramof and Apovian 2008). The relationship between central adiposity and type 2 diabetes has been known for decades. The San Antonio Heart Study (Haffner et al. 1987) examined the effects of WHR on the risk of developing type 2 diabetes in more than 730 Mexican Americans. Type 2 diabetics had greater values on anthropometric measures than nondiabetics. It was also noted that WHR, independent of BMI, was positively associated with type 2 diabetes prevalence. In this study, WHR was a statistically significant ($p\leq 0.01$) independent predictor of type 2 diabetes with an odds ratio of 1.77. Both WHR and prevalence of type 2 diabetes were associated with elevated triglycerides and low concentrations of high-density lipoprotein cholesterol, possibly leading to an

increased risk of cardiovascular disease. The difference in triglyceride concentration between type 2 diabetics and nondiabetics was 24.1 mg/dl.

Obesity, high blood glucose concentration, and insulin resistance, along with high triglycerides, low concentrations of high-density lipoprotein cholesterol, and hypertension, are the defining characteristics of metabolic syndrome (National Cholesterol Education Program 2002). Park et al. (2003) estimated that 20-30% of the middle-aged population is affected by metabolic syndrome. After adjusting for age, BMI, household income, and physical activity, middle-aged women had a 60% increased risk of developing the syndrome after menopause.

The relationship between WC and risk of type 2 diabetes is consistently strong. Klein et al. (2007) showed that WC is a better predictor of diabetes than BMI. In a longitudinal study Hadaegh et al. (2007) followed 4,479 non-diabetic men and women aged ≥ 20 years for 3.6 years. A total of 166 new cases of type 2 diabetes were diagnosed throughout the study time period. In participants < 60 years, general obesity and high WHR were the best predictors of diabetes even after accounting for other anthropometric measurements such as waist and hip circumference and common diabetes risk factors such as age, family history, hypertension, elevated triglycerides, and low high-density lipoprotein cholesterol. The odds ratio for general obesity and WHR in these participants was 2.4 ($p \leq 0.001$) and 2.6 ($p = 0.0001$), respectively. However, in subjects ≥ 60 years high WC was the only independent predictor of diabetes after adjustment for other anthropometric measurements and common diabetes risk factors with an odds ratio of 3.8 ($p = 0.01$). Based on this evidence, general obesity and high WHR are important

independent predictors of type 2 diabetes in people <60 years while WC may be a better predictor in those ≥ 60 years.

Although central adiposity has been shown to be a risk factor for both cardiovascular disease and type 2 diabetes, the INTERHEART study (Yusef et al. 2005) demonstrated a trend toward lower risk of myocardial infarction as hip circumference increased and remained highly significant after adjustment for BMI and height. When those in the lowest quintile (≤ 90 cm for women and ≤ 89 cm for men) were compared to those in the highest quintile (>109.8 cm for women and >105 cm for men), hip circumference was associated with an odds ratio of 0.73 ($p \leq 0.0001$) for myocardial infarction. Similarly, Snijder et al. (2005) demonstrated that a large thigh subcutaneous fat area was independently associated with a more favorable lipid profile in women and more favorable glucose concentration and lipid profile in men. This may suggest that fat in the thigh region exerts a different effect metabolically than fat in the abdominal region.

Dementia

Recently, it has been shown that high adiposity during the midlife years may be related to greater risk of dementia in later years. Researchers in Finland (Kivipelto et al. 2005) examined data derived from random, population-based samples of participants who had previously completed a survey four times over a fifteen-year time period. Data were then collected from 1,449 participants 21 years after the end of the fifteen years. Obesity (BMI >30 kg/m²) during midlife was associated with an increased risk of dementia and Alzheimer disease. The association remained significant after adjusting for socioeconomic status with an odds ratio of 2.4 (95% confidence interval (CI) 1.2-5.1).

After adjusting for midlife blood pressure, total cholesterol, and smoking, the odds ratio (2.1, 95% CI 0.8-4.6) was attenuated but remained significant.

In a longitudinal population-based study (Whitmer et al. 2005) over 10,000 middle-aged men and women were followed for 27 years. During the study time period, 6.9% of the participants developed dementia. After adjusting for age, sex, race, education, smoking, alcohol use, marital status, and other comorbidities such as diabetes, hypertension, hyperlipidemia, stroke, and ischemic heart disease, obese individuals (BMI $>30 \text{ kg/m}^2$) had a 74% increased risk (hazard ratio 1.74, 95% CI 1.3-2.3) for developing dementia compared to normal weight individuals (BMI 18.6-24.9 30 kg/m^2). Similarly, overweight participants (BMI 25.0-29.0 kg/m^2) had a 35% increased risk (hazard ratio 1.35, 95% CI 1.1-1.6) compared to those of normal weight.

Soreca et al. (2009) similarly showed a decrease in grey matter volume as BMI increased. Forty-eight women took part in a longitudinal epidemiological investigation between 1983 and 1984. The same women participated in a brain-imaging study between 2005 and 2006. Many variables, including premenopausal BMI, number of years postmenopause, perceived life stress, blood pressure, cerebral volume, and white matter hyperintensities—an indicator of age-related silent cerebrovascular disease—were able to explain 22% of the variance in the total grey matter volume. The change in BMI pre- and postmenopausally explained an additional 15% of the variance, such that an increase in BMI predicted a greater reduction in grey matter volume. The researchers concluded that weight gained during the menopausal transition and beyond may be associated with reduced grey matter volume, which may lead to higher incidence of dementia.

In summary, with the rise in the prevalence of overweight and obesity over the past few decades, it is important to accurately assess the risks and complications related to excess weight. Because of the strong association between abdominal fat and the risk of certain diseases, such as diabetes and cardiovascular disease, appropriate methods to assess adiposity are important for use in population-based studies.

ASSESSMENT OF BODY COMPOSITION

Body composition assessment methods are commonly used in public health and clinical nutrition research. The method of assessment can vary depending on the desired outcomes of the study. While some studies are designed to screen for the presence of under- or overnutrition, others may be designed to assess different body constituents—fat, muscle, or bone. Accurate assessment of body composition is important for determining its relationship with disease risk.

Anthropometric measurements, such as height, weight, and waist and hip circumferences are commonly used to calculate BMI and WHR, respectively, as indirect indices of overweight and obesity in adults. These simple, standardized, and non-invasive measurements work well for large epidemiological studies. They also tend to be more precise and require less training than skinfold thickness; however, they remain crude indices of body composition. However, BMI does not necessarily reflect overall body fatness and does not indicate fat distribution. While WHR reflects body fat distribution, it does not distinguish between fat and lean tissue and does not reflect overall body fatness. This explains why many clinical-based studies include more precise body composition assessments, such as dual-energy X-ray absorptiometry (DXA), quantitative computerized tomography, hydrodensitometry (underwater

weighing), and magnetic resonance imaging to reflect disease risk. Nevertheless, anthropometric measurements have been found to be good predictors of cardiovascular disease (Dalton et al. 2003) and other causes of mortality, such as type 2 diabetes mellitus (Hadaegh et al. 2007), stroke (Yatsuya et al. 2010), and certain types of cancer (Friedenreich et al. 2007; van Dijk 2004).

Body Mass Index (BMI)

A common, relatively unbiased index of obesity in adults is BMI, which correlates well with other measures of adiposity in most individuals (Chen et al. 2006). Most population studies define overweight and obesity by using BMI, which is a measure of weight adjusted for height, calculated as weight in kilograms divided by height in meters squared. The World Health Organization (2000) task force and the National Institute of Health (2000) both specify guidelines for normal, overweight, and obesity cutoffs. A normal BMI is between 18.5 and 24.9 kg/m², while between 25 and 29.9 kg/m² is considered overweight, and >30 kg/m² indicates obesity. While BMI may correlate well with other adiposity indices, this may not be the case with muscular subjects with high BMIs but low body fat mass or with elderly subjects where BMI may underestimate body fat mass due to a decrease in lean tissue (Wannamethee et al. 2007; Woo et al. 2002).

Flegal et al. (2009) determined Pearson correlations between BMI and percentage of body fat measured by DXA in a nationally representative sample of 12,901 US men and women ranging from 20 to ≥80 years of age. The correlations for men ranged from 0.79 (20-39 years) to 0.72 (≥80 years). The corresponding values for women ranged from 0.85 to 0.72, indicating that BMI was a relatively good predictor of fat mass.

However, the relationship between BMI and body fat is both age- and sex-dependent, as the correlations decreased in both men and women as age increased. Nevertheless, BMI does not distinguish between fat mass and lean mass and does not reflect body fat distribution.

Waist Circumference (WC)

Girth measurements, such as waist and hip circumferences and subsequent WHR are better indicators of body fat distribution than BMI, although they also do not distinguish between fat and lean mass. However, they are better indicators of visceral fat than BMI alone. Visceral fat technically includes adipose tissue found in the intrathoracic, intraabdominal, and intrapelvic cavities (Shen et al. 2003), although most researchers focus only on the intraabdominal tissue compartment. Accurate measurements of visceral fat can be expensive and not feasible in many research studies, therefore WC is often used as a surrogate marker of abdominal obesity. Abdominal obesity, often an indicator of visceral fat, is a risk factor for many diseases (Hadaegh et al. 2007; Pischon et al. 2009; Yusef et al. 2005). The cutoffs for normal WC chosen by the National Heart, Lung, and Blood Institute are <102 cm in men and <88 cm in women, independent of BMI or ethnicity (Grundy et al. 2005). In a study conducted by Shen et al. (2006) in 1,010 healthy Caucasian and African American men and women, WC was found to be the strongest predictor of health risk compared to BMI and body fat percent measured by DXA.

A number of anatomic landmarks have been used to measure WC, including just below the lowest rib, the midpoint between the lowest rib and the iliac crest, just above the iliac crest, the umbilicus, and the narrowest or widest WC. The Anthropometric

Standardization Reference Manual (Lohman et al. 1991) recommends measuring the natural waist, which is the narrowest part of the torso. Recently, a review by Ross et al. (2008) evaluated the different sites of WC measurement and their relationship to morbidity and mortality. According to their review, the site of measurement did not influence outcomes of cardiovascular disease, cardiovascular disease mortality, all-cause mortality, or diabetes mellitus.

Waist-to-Hip Ratio (WHR)

Another common anthropometric measure of abdominal or central obesity is WHR, which can be used to distinguish between gynoid and android fat. The World Health Organization (2008) defined a WHR >0.90 in men and >0.85 in women as a predictor of metabolic complications. Several large studies (Farag et al. 2004; Favier et al. 2005) have shown that high WHR increased risk of cardiovascular disease and diabetes mellitus. Both WC and WHR are measures of abdominal adiposity and correlate well with risk of cardiovascular events. Ashwell et al. (2011) found that WHR may be more accurate than WC or BMI when predicting cardiovascular risk. It is important to note that because WHR is a ratio, it can be difficult to include in some statistical analyses, complicating interpretation.

Body composition has a profound influence on many weight-related diseases. Accurately assessing body composition can help to more accurately predict disease risk, especially in midlife when body composition changes, both in regard to weight and fat distribution.

WEIGHT GAIN IN MIDLIFE WOMEN

Weight tends to gradually increase with age (Field et al. 2007; Gonzalez et al. 2006; Sternfeld et al. 2004). This age-related weight gain is often due to physiological and environmental changes that occur with age. Recent studies have shown that an energy gap exists between the average energy intake and energy expenditure in all age groups, which can lead to weight gain over time (Hill et al. 2003). Brown et al. (2005) examined the energy gap in middle-aged women in Australia over a five-year period and determined that the average weight gain was roughly 0.5 kg/year based on an accumulation of approximately 10 kcal/day. The average weight gain in Americans younger than 60 years of age ranged from 0.25 to 0.54 kg/year between 1971-1992 (Sheehan et al. 2003). Gonzalez et al. (2006) demonstrated that women tend to gain 5.1-6.9 kg over a ten year period. A prospective population-based cohort study followed 4,070 men and women (20-59 years) for 11 years (Nooyens et al. 2009). The mean BMI of subjects within different age cohorts (20-29, 30-39, 40-49, 50-59, 60-69 years) was followed over time using longitudinal data. At the 11-year time period, the mean body weight increase in women aged 40-49 years was 4.7 kg which corresponded to an increase in BMI by 1.8 kg/m^2 . Although not as drastic, the increase in weight during the study in women aged 50-59 years was 2.8 kg, corresponding to an increase in BMI by 1.3 kg/m^2 . When BMI was modeled as a function of age, independent of cohort, BMI did not decline before the age of 70 years in women. Analyses also showed that overweight and obese women at baseline had higher increases in BMI at follow-up compared to normal-weight women.

Juhaeri et al. (2003) followed 14,500 white and African-American men and women (45-64 years) for nine years in a longitudinal closed cohort study to examine the effects of aging and birth cohort on BMI. Among white women, 9 years of aging was associated with an increase in BMI of 1.0, 1.5, and 1.9 kg/m² for those born between 1920-1930, 1930-1935, and 1935-1945, respectively. African-American women showed a similar increase in BMI of 0.3, 0.7, and 1.7 kg/m² indicating that aging is associated with increased BMI and the associations between aging and BMI are stronger among younger birth cohorts.

Age effects on body weight and BMI may be due to physiological and psychosocial changes within individuals that occur as a result of aging (Dare 2011). A critical time for women is midlife (40-60 years) as they experience hormonal changes due to menopause. Family structure may change during this time as grown children leave the home or elderly parents require more care. Midlife adults may also begin preparing for retirement and find they have more or less time available for physical activity or cooking. A strong inverse relationship between total energy expenditure and age exists in midlife women (Roberts and Dallal 2005; Toozee et al. 2007), which may help to explain the age-related weight increase.

Family Structure Changes

Many women face social changes including family structure changes as they experience their midlife years. The midlife-family definition has changed over the years as divorce and remarriage have become more common. Couples are having children later in life. It is not uncommon for a midlife woman to have both a newborn at home and need to care for an elderly parent at the same time. A recent national survey conducted

by AARP (2001) found that 44% of people 45-55 years had at least one living parent and a child under the age of 21 years. Although only 7% had three generations living in the same home, the amount of time and money spent providing support also needs to be considered. More people are raising both their grandchildren and children simultaneously (Pierret 2006), while others may be coping with an empty nest as their grown children are now leaving the home (Dare 2011). The role and relationships that women hold with their children, spouse, or parents can change and evolve during these important years and can have an impact on the social aspect of their lives. The women who have children later in life and have young children at home may find themselves busier during their midlife than in their younger years (Dziegielewska et al. 2002). This busy lifestyle has the potential to lead to poor food choices with decreased time to prepare nutritional food and an increased reliance on convenience foods (Bava et al. 2008). Those who are experiencing the empty-nest syndrome may find that they have more free time and more money available than they did when children were at home. Others may find increased stress in needing to care for an elderly parent or a sick spouse and may now find themselves back in the caregiver role (Pierret 2006). This can lead to decreased disposable income which can then affect food choices (Darmon et al. 2006).

Energy Expenditure Changes

Energy expenditure begins to decline as a woman ages and actually starts to decrease as early as after age 20 (Dziegielewska et al. 2002). Lovejoy et al. (2008) conducted an observational, longitudinal study to examine the changes in body composition, fat distribution, and energy balance in 156 perimenopausal women over a period of four years. Both body fat and weight increased over the course of the four

years in all women (pre-, peri-, and postmenopausal) but was most significant in those women who became postmenopausal (n=51) by year 4, increasing from 70.8 ± 1.8 kg to 73.1 ± 2.2 kg ($p < 0.0001$). Lovejoy et al. (2008) also measured free-living energy expenditure over four days by accelerometer and found that it decreased significantly in perimenopausal women. In the women who transitioned to menopause during the four-year study, activity counts dropped by half from four years prior to menopause to menopause onset. Free-living energy expenditure was similar at the four- and three-year periods prior to menopause at about 210% of the menopause-onset level. However, this had dropped by one-year prior to menopause onset and remained at this lower level throughout two years following menopause onset. These data suggest that not only age but also menopausal transition plays a role in decreased energy expenditure.

Whole-room calorimetry was also done in a subset of women (n=34) at baseline and at four years to measure changes in 24-hour energy expenditure (Lovejoy et al. 2008). Of this subset, 17 women had become postmenopausal and 17 remained premenopausal at the four-year follow-up. After adjusting for lean mass, total daily energy expenditure and sleeping energy expenditure decreased significantly ($p < 0.01$) in both groups of women over time; however, the percent change was greatest in the women who became postmenopausal compared to those who remained premenopausal (-9.3 vs. -7% for 24-h energy expenditure and -7.9 vs. -5.3% for sleeping energy expenditure, respectively), although this difference was not statistically significant. Planned physical activity in the whole-room calorimeter remained constant from baseline to follow-up; however, spontaneous physical activity (fidgeting or non-exercise activity thermogenesis)

declined by 30-40% in both groups. Again, this decrease was significant ($p<0.01$) in both groups but the differences between the groups were not.

Tooze et al. (2007) also found an inverse relationship between total energy expenditure and age. Total energy expenditure was measured using doubly labeled water. While total energy expenditure was not significantly different between pre- and postmenopausal women, BMI values were significantly ($p<0.05$) higher on average in postmenopausal women than in premenopausal women. After adjusting for height and weight, total energy expenditure was significantly higher (91 kcal/day, $p<0.01$) in premenopausal women compared to postmenopausal women. However, after adjusting for fat-free mass, which itself was not significantly different between pre-and postmenopausal women, total energy expenditure did not differ by menopausal status. Total energy expenditure was also negatively associated with age in a linear manner with a mean (\pm SE) estimated slope for age of -13 ± 3 kcal/year for women.

A review by Roberts and Dallal (2005) supported previous findings with respect to total energy expenditure and age. Total energy expenditure declined with age with data indicating decreases in both intentional and spontaneous physical activity in free-living adults. It progressively fell from approximately 20 years of age throughout the entire range of life averaging approximately 150 kcal per decade. Physical activity level also decreased as age increased from an average of 1.78 in women in their twenties to 1.64 in women in their sixties. It is not currently known, however, if physical activity level decreases linearly with age. Cross-sectional data suggests that physical activity level may be relatively constant between 20 and 50 years and then decrease drastically after the age of 50 years.

Basal metabolic rate has also been shown to decline with age. Basal metabolic rate is the largest part of total energy expenditure comprising roughly 50-70% in most adults (Roberts and Dallal 2005). Basal metabolic rate declines approximately 1-2% per decade based on longitudinal measurements (Keys et al. 1973). Recently, it has been suggested that this decline with age may not be linear, with a more rapid decline in the later stages of life (Ruggiero et al. 2008). Further research is needed to fully understand the relationship between age and changes in basal metabolic rate.

Hormonal and Body Composition Changes

During the midlife time frame, menopause usually occurs, typically between the ages of 45-50 years. It marks an important stage in every woman's life and is a universal transition during the aging process. Menopause is identified as the permanent cessation of ovarian function and is marked by alterations in hormone concentrations, thereby ending a woman's reproductive ability (Sherman 2005). These hormone alterations include decreased estrogen and increased follicle-stimulating and luteinizing hormones (Grady 2006). While these hormonal aberrations may drive the symptoms associated with the menopausal transition, they may also be present for many years postmenopausally. The decrease in estrogen may be associated with an increased risk of metabolic syndrome that may lead to diseases such as atherosclerotic cardiovascular disease and type 2 diabetes. During the postmenopausal period, estrogen is produced in small amounts by peripheral fat tissue during the metabolism of androstenedione to estrone (Grady 2006).

Postmenopausal women often experience unfavorable changes in body composition. These changes in body weight and fat distribution have gained much

attention recently because they can contribute to an increased risk of cardiovascular disease in women. Koskavá et al. (2007) followed 146 women across the four reproductive stages (fully reproductive, pre-, peri-, and postmenopausal) for three years and found that BMI, body fat percent, WC, and WHR all increased significantly in the perimenopausal group. This group had the greatest weight gain suggesting acceleration during menopause. After correcting for age and body weight, Toth et al. (2000) reported that body weight was 6% higher and body fat was 17% higher in postmenopausal women compared to premenopausal women of similar age.

Fat is typically distributed in one of two areas—the central or androidal region and the gluteal-femoral or gynoidal region. Because estrogen may promote fat accumulation in the gluteal-femoral region (Mayes and Watson 2004), the decrease in estrogen in postmenopausal women plays a role in fat accumulation. This leads to an increase in central adipose tissue (Carr 2003) and is not without consequences. Studies have shown that an increase in fat in the abdominal region is associated with an increased risk of metabolic syndrome (National Cholesterol Education Program 2002), heart disease (De Michele et al. 2002), non-insulin-dependent diabetes (Carr et al. 2004), and stroke (Bodenant et al. 2011). Guthrie et al. (2004) demonstrated that women who gain weight and abdominal fat during the menopausal transition have increased cardiovascular disease risk. This may suggest that the weight gain associated with menopause, specifically weight gained in the central region, is responsible for the increased risk of cardiovascular disease in postmenopausal women. Alternatively, hormonal changes are thought to increase disease risk (de Lecinana et al. 2007; Peng et al. 2003) based on the belief that longer lifetime exposure to endogenous ovarian estrogens may protect against

cardiovascular disease risk factors and the decline in estrogen after menopause may lead to a higher incidence of these risk factors.

Lean body mass decreases with age and may be associated with menopause. Using DXA, Gambacciani et al. (2001) demonstrated that healthy early postmenopausal women not receiving hormone therapy had a significant decrease in total lean mass and central lean mass over the course of three years. Douchi et al. (2002) similarly demonstrated that postmenopausal women tend to lose lean mass following menopause compared to premenopausal women. The decrease in lean body mass may be due to the effects of aging or menopausal status, however, regardless of the cause, a loss in lean body mass may play a role in the altered metabolism seen in aging adults.

Metabolic Changes

The body's ability to metabolize fuel, specifically dietary fat, can be a critical factor in determining one's risk of weight gain and fat accumulation because dietary fat that is not oxidized is stored. Evidence suggests that fat oxidation may decrease with age. A number of reasons may contribute to this decline. Lean body mass declines with age (Gambacciani et al. 2001; Douchi et al. 2002), and skeletal muscle mass is the primary site for fat oxidation. Also, because physical activity decreases with age (Dziegielewski et al. 2002; Roberts and Dallal 2005), the extent to which fat oxidation occurs may be suppressed. Dietary factors, such as increased intake of saturated fat and cholesterol after menopause (Lovejoy et al. 2008) may also affect the ability to oxidize fat.

Lovejoy et al. (2008) observed a significant ($p < 0.05$) drop in fat oxidation (~26g/day) in postmenopausal women compared to premenopausal women. This is

consistent with findings from a study (Solomon et al. 2008) in obese individuals, which showed that basal fat oxidation decreased by approximately 22% ($p=0.03$) in older adults compared to younger adults and correlated strongly to age ($r=-0.61$, $p=0.003$). This decrease in fat oxidation may play a role in the weight gain seen in aging individuals.

Results indicating alterations in protein and carbohydrate oxidation due to aging are conflicting. Lovejoy et al. (2008) found a significant increase in protein oxidation in women over time; however, the results were greater and more significant in postmenopausal women (41.4% increase; $p<0.01$) compared to premenopausal women (35.9% increase; $p<0.05$). No changes were seen in carbohydrate metabolism with age or menopausal status.

Some researchers argue that prevention of weight gain is more important for younger adults compared to middle-aged adults (Gostynski et al. 2004) because of the stronger chance that behavioral changes will carry through adulthood. Given the likelihood of weight gain and changes in body composition during the midlife years, weight gain prevention is still important for prevention of adverse health outcomes. Weight gain in this age group is progressively related to higher absolute risk of disease and mortality. Given the combination of the observed weight gain in midlife adults, prevention of weight gain in this group may result in better health outcomes in the short term.

PREVIOUS APPROACHES TO PREVENT WEIGHT GAIN

Obesity rates rose over the past few decades, suggesting that the current programs and interventions for weight gain prevention or weight loss are not successful in addressing this epidemic. Long-term weight loss and weight gain prevention require

permanent lifestyle changes regarding both diet and physical activity, which may be one reason why it is difficult to maintain weight loss. More effective programs to prevent weight gain with age can be an important factor in lowering obesity prevalence and associated risk of chronic disease.

Dietary Approaches

Many dietary strategies have been proposed for weight loss and weight maintenance including energy restriction, decreased fat intake, increased protein intake, and decreased carbohydrate intake. Others include eating more fruits and vegetables or whole grains. In one study (Howard et al. 2006), postmenopausal women were randomized to either a control group, which received diet-related education materials, or an intervention group, where women attended both group and individual sessions aimed at promoting a decrease in fat intake and an increase in fruit and vegetable consumption. After the first year of the study, the intervention group lost a mean of 2.2 kg of weight ($p < 0.001$) which was 1.9 kg more on average than the control group ($p < 0.001$). The intervention group also maintained a lower weight over the next 7.5 years compared to the control group (difference, 0.4 kg; $p = 0.01$). The intervention group showed no tendency to gain weight over the study period overall or when stratified by age, ethnicity, or BMI. The study also demonstrated that the weight lost in both groups was highly correlated to a lower fat consumption. Similarly, weight maintenance was correlated to increased fruit and vegetable consumption. Another study (Lesser et al. 2002) examined the effects of a low-fat diet on weight regain in women after losing weight by following a very low calorie diet regimen. Healthy women with a BMI $> 30 \text{ kg/m}^2$ were asked to follow a very-low-calorie diet for 26 weeks, which included 12 weeks of an 800 kcal/day

liquid formula, 6 weeks of gradual refeeding, and 6 weeks of energy stabilization at 1,200-1,500 kcal/day. Subjects lost an average of 20.7 kg (-19.2%) during the 26-week study period. After a 3-year follow up, women had regained 13.9 kg. Fat intake was positively associated with weight regain at 3 years ($r=0.66$; $p=0.0004$). Less weight regain was seen in those who had a lower fat intake ($r=-0.55$; $p=0.004$). Women in the lowest tertile of reported fat intake (<25% of energy) regained the least amount of weight ($p=0.05$). Physical activity was also negatively correlated with weight regain ($r=-0.53$, $p=0.05$). These results suggest that both a diet low in fat and maintaining regular physical activity after weight loss promotes weight maintenance.

One suggested dietary approach for reducing risk of weight and fat gain is increasing total fiber intake. A prospective cohort study (Tucker and Thomas 2009) examined 7-day weighed food records from 252 women. After a 20-month follow-up period, nearly 50% of the women had gained weight (0.7 kg) and fat (1.0%). However, those women who had increased their total fiber intake experienced a decrease in weight by 0.25 kg ($p=0.0061$) and a decrease in body fat by 0.25% ($p=0.0052$). Confounding factors such as age, energy intake, physical activity, and season were taken into account. Fiber types (soluble and insoluble) were borderline predictors of weight and fat changes. An increase in dietary fiber significantly reduced the risk of weight and fat gain in women.

High calcium intake has also been proposed as a method for minimizing weight gain in women. A randomized, double-blinded, placebo-controlled trial (Caan et al. 2007) conducted in postmenopausal women demonstrated that 1,000 mg of calcium plus 400 IU of cholecalciferol resulted in a minimal but significant favorable difference (-0.13

kg, $p=0.001$) in weight change compared to the placebo group after a 7-year follow up period. Women who received the calcium supplement were also 11% less likely to experience small weight gains (1-3 kg) and 11% less likely to gain more moderate amounts of weight (>3 kg, $p=0.008$). These results suggest that calcium with cholecalciferol supplementation can have a small effect on weight gain prevention in postmenopausal women.

A 5-year lifestyle intervention aimed at preventing an increase in low-density lipoprotein cholesterol concentrations, preventing weight gain, and increasing leisure-time physical activity was conducted in 260 middle-aged women (Kuller et al. 2001). Participants were asked to lower their dietary fat intake to 25% of total dietary energy intake, lower saturated fat to 7% of total calories, and lower cholesterol to 100 mg daily. All women were encouraged to lose up to 5-15 lb of weight and to reduce caloric intake to 1300 kcals per day until this weight goal was achieved. A lifestyle approach to increase physical activity to 1,000-1,500 kcal/week was also used to assist in weight control. Results were then compared to a control group which consisted of 275 middle-aged women. At the 54-month follow-up examination, weight decreased by 0.01 kg in the intervention group and increased in the control group by 2.36 kg ($p=0.000$). The intervention group also had a decrease in WC by 2.9 cm compared to a 0.5 cm decrease in the control group ($p=0.000$). While the authors noted that the intervention was labor-intensive, the prevention of weight gain is an important means to reduce risk of chronic disease.

Small-Changes Approach

Making permanent changes to one's diet or physical activity routine can often be difficult. Many people have trouble maintaining healthy dietary and physical activity patterns because modern culture encourages excessive energy consumption and discourages physical activity (Peters et al. 2002). The changes that were initially made to lose weight need to be continued to prevent further weight gain. Hill et al. (2003) suggest that interventions should focus on promoting small lifestyle changes to prevent gradual weight gain that most people experience with age, rather than focusing on weight loss. The authors propose that over time, this will lead to observable decreases in the prevalence of obesity. Making small changes in lifestyle may produce better outcomes regarding weight and are more feasible to achieve and maintain compared to large changes (Hill 2009).

America On the Move is a national weight gain prevention initiative that promotes small lifestyle changes by reducing energy intake by about 100 kcal/day and increasing energy output by walking 2,000 more steps/day. Stroebele et al. (2009b) examined the impact of these small changes in a cross-sectional study of 116 overweight adults aged 18-60 years during both an intervention and non-intervention week. Total energy intake was lower during the intervention week with an average decrease of 414 kcal/day ($p < 0.01$). Steps/day were higher in the intervention week with an average increase of 1,454 steps ($p < 0.01$). If these results are sustainable, making small lifestyle changes could be effective in preventing weight gain.

Another recent study (Lutes et al. 2008) examined the effects of small but cumulative changes in both diet and exercise on weight reduction and weight

maintenance. Fifty-nine overweight or obese sedentary adults were randomized into one of three groups. One group received a standard educationally-based treatment where participants met with a nutritionist for 20 minutes every week. These participants were given handouts relating to fitness and food. Another group met with a lifestyle coach for 20 minutes per week and set small, participant-chosen nutrition and physical activity goals that were both challenging and achievable. These small behavioral changes accumulated over the 16-week study period. Both groups participated in the same exercise program with a personal trainer focusing on both aerobic and resistance training. A control group was asked to continue life as usual during the 16-week period. The small-changes group lost significantly more weight than both the standard and control groups (-4.4 vs. -1.1 and +0.1 kg, respectively; $p < 0.002$). Three months after the study ended, the small-changes group had maintained their weight loss at -4.1 kg. Although the follow-up period was short, these results suggest that small behavioral changes can result in modest and sustainable weight loss and may help in developing effective weight loss programs.

Another study by Rodarmel et al. (2006) based on a small changes approach was conducted in families with at least one school-aged child who was overweight or at risk of overweight. Participants were asked to make two small changes which included eating cereal for breakfast and increasing physical activity by 2000 steps/day for a 14-week period. Compared to the control group, children in the intervention group had a significantly ($p < 0.05$) lower increase in BMI-for-age. Mothers of the children in the intervention group also experienced a favorable and significant reduction in weight (-1.04

kg; $p=0.0271$) and BMI (-0.394 ; $p=0.0274$). Mothers experienced a significant decrease in body fat percent as well ($-0.49 \pm 0.91\%$; $p=0.0001$) when compared to the control group.

Other small changes such as reductions in portion size can have a large impact on decreasing energy intake. The food industry has helped to embrace the small-changes approach by offering snacks in 100 kcal packages, which have been shown to reduce total intake when compared with standard snack packages (Stroebele et al. 2009a). This is based on research showing higher energy intakes when food is presented in larger portions (Rolls et al. 2004). These small reductions in portion size can decrease energy intake without stimulating hunger (Jeffery et al. 2007).

Given the number of previous approaches taken to prevent weight gain in midlife women and the fact that overweight and obesity rates remain high, an intervention is warranted that focuses on nutrition education that involves dietary information along with small behavioral changes that can be maintained. To foster behavioral change, it is important that interventionists understand the diversity of women and the physiological, behavioral, and social cues and habits that are involved in food choice.

APPROACH IN QUESTION

Segmentation is a tool that has been used successfully by market research practitioners to influence consumers to buy products and by researchers to intervene regarding health outcomes (Newby and Tucker 2004). Market researchers aim to simplify the diversity of consumers by segmenting them into distinct groups which can be targeted to make marketing more relevant and effective. Segmentation is based on the rationale that subdividing a large heterogeneous population into smaller, more homogeneous segments allows for more effective targeting by group.

Kolodinsky and Reynolds (2009) used segmentation analysis to target the overweight US population with messages and media aimed at moving Americans toward a healthier weight. Based on both food and lifestyle behaviors, participants were clustered into five categories based on risk level. Those in the highest risk group were overweight and performed the least amount of physical activity. The “at risk” group was overweight and almost half rarely or never read food labels. Another cluster characterized as the “right behavior/wrong results” segment were familiar with the food pyramid but remained overweight despite eating the fewest fast food meals compared to any other segment. Those who were getting the best results read food labels, prepared meals from scratch, and had the least percentage of overweight people. The cluster group that was “doing okay” was still 18% overweight but watched the least amount of television and reported the most meals made from scratch. The results from this study demonstrated that segmenting large populations into smaller marketable clusters can help interventionists target segments with relevant guidance based on differences in behavior between segments. Buckley et al. (2007) segmented 1,000 consumers who identified themselves as the primary grocery shopper and cook in the household into four categories based on convenience lifestyle factors to better understand the convenience food market. The four segments were 1) food connoisseurs, 2) home meal preparers, 3) kitchen evaders, and 4) convenience-seeking evaders. The two latter segments were identified as the most convenience-seeking segments. By understanding the lifestyles of consumers, food manufacturers can have insight into what motivates individuals to purchase convenience foods.

A number of research articles examine segmentation in relation to consumer behaviors and attitudes (Ronteltap et al. 2009; Zhao et al. 2007), as well as to health behaviors and risk factors (Moss et al. 2009; Weber et al. 2007). However, few studies examine the segmentation of eating occasions in relation to individual's food choice and food intake. Segmentation of eating occasions is an innovative approach that holds promise for understanding motivations that drive behavior in specific eating situations toward or away from a focus on health. The segmentation approach involving eating occasions may allow for an improved conceptualization of the influence of situational context to better understand eating behavior in midlife women.

Behavioral and Situational Contexts within Eating Occasions

The idea that the situation surrounding an eating occasion plays a part in both what a person eats and how much she eats has been an increasingly popular topic currently addressed by behavioral and social scientists (Jaeger et al. 2009; Stroebele and de Castro 2006). Market researchers define need states as inner and outer influences that impact purchase and consumption decisions (Leith and Riley 1998). They may be based on rational and/or emotional needs and ultimately determine food choice within specific situations. The individual can interpret both internal and external triggers and perceive them in different ways leading to different need states. The situational context of need states may play a role in the differences in intake of food groups, nutrient, and energy across the type of eating occasion. Sudo et al. (2009) described six different need states by clustering eating occasions experienced by 200 midlife women (n=559 occasions). Women kept a three-day dietary record and completed eating occasion questionnaires (EOQs) which included a battery of questions based on dimensions such as convenience,

taste, health, and comfort. Based on the results from the cluster analysis, six need states were identified: routine family meal, healthy regimen, comforting personal time, fast fueling, family ritual, and indulgent escape. “Routine family meal” fulfilled the woman’s perceived role as meal provider for her family. Women who experienced the “healthy regimen” need state proactively placed a high importance on health and nutrition. An individual who wanted to have a moment of personal time during their eating occasion would have experienced the “comforting personal time” need state. The “fast fueling” need state satisfied the need to eat immediately and quickly. An eating occasion described as the “family ritual” need state was characterized by a need to strengthen the sense of family identity among its members. A woman who experienced an “indulgent escape” sought a brief diversion from the day’s activities and stresses through eating. By understanding the needs surrounding eating occasions, health professionals can develop more tailored interventions to improve food choice and dietary intake.

In a recent study, 25 Norwegian mothers with young children were interviewed about how they think and act in their everyday dinner routine to understand the practices and values of preparing a hot meal (Bugge and Almås 2006). Interviews were conducted to further understand needs surrounding the eating occasion involving the dinner meal. Despite the advancing equality between the sexes, tasks connected with food, such as grocery shopping, preparing, cooking, and serving food, and cleaning up after the meal were often the responsibility of the woman in the household. These women indicated that they desired to cook proper meals for their family to care for them. The mothers also felt cooking for the family played an important part in understanding their own identity and an implicit part of striving for the ideal family and home. Typically the women cook

to care for children and to ensure their emotional and social well being. They also saw cooking as part of the production of a good family and home. Women chose food for the meal based on the time of day, whether it was a weekday or weekend, and the location of the meal, indicating that choice of dishes was often associated with social and cultural constraints. Data revealed three dinner types – traditional, trendy, and therapeutic. Each dinner type was characterized by its own desired goals and outcomes. The traditional meal was based on values such as tradition and family belonging. The trendy meal focused on food-cultural competence and class association and typically involved at least two courses. The therapeutic meal focused on high nutritional value and the importance of health. These three meal types showed that dinner cannot be good or bad in itself, but only in relation to the values and goals the mother wished to achieve with that meal. These data demonstrate that the shaping of a dinner meal depends on a number of subtle rules and codes determined by both social and cultural context and that the goals set out for the meal often dictate the foods chosen for that meal.

A similar study grouped 201 mothers of young children into clusters based on multiple psychographic food decision influencers such as outlook on life, health characteristics, food-related activities, interest in learning about meals, food characteristics, eating/food relationship characteristics, and family meals (Byrd-Bredbenner et al. 2008). Four unique clusters were identified: happy, healthy, food-involved mothers; working, convenience-driven mothers; healthy, free of food price, taste, convenience, and advertising effects mothers; and stressed, emotional eating, time-conscious mothers. Each cluster differed in nutrition intake and nutrient content of the participants' household food supplies and could be used to predict dietary quality. These

data suggest that tailored education matching the attitudes and motivations of mothers may be beneficial in improving the nutritional quality of mothers and their families.

A further study that focused on contextual factors surrounding a dinner meal occasion was conducted by Blake et al. (2008). Behaviors were categorized into “strategies” for determining food choice for an evening meal. Social and behavioral processes used in food choices for the evening meal were examined using qualitative interviews with 32 participants. By describing goals and desired outcomes and normal scenarios for this meal, including time of day, emotions, level of satisfaction, and the context of the experience, participants demonstrated that evening meal food choices were determined by dominant values and general expectations about food. Eight different strategies emerged from the data: provider, family cook, head of the table, egalitarian, struggler, just eat, anything goes, and entertainer. In the “provider” strategy, a woman with children typically cooked and then ate dinner together as a family. The “egalitarian” strategy included both men and women who split the tasks of shopping, cooking, and cleaning up with their partner. Men and women both fall into the “struggler” strategy. They tried doing different tasks in order to have a nice meal, but the partner did not cooperate. Those participants who fell into the “anything goes” strategy did not place a lot of emphasis on having an evening meal and tended to eat when they wanted without planning. The “family cook” and “head of the table” strategies both included men with children living at home, but the “family cook” tended to do most of the planning and cooking, while the “head of the table” let the partner complete most of the meal duties. The “entertainer” strategy included both men and women who tended to live alone and have friends or family over for dinner and tried to meet the needs of their guests. Only

men fell into the “just eat” strategy and described dinner as a time to eat, not to socialize. Categorizing people into the above strategies provides insight into the connections between cognitions and behaviors that influence food choice and dietary intake. It improves the understanding of how individuals cognitively construct food choice by demonstrating how one’s values and expectations relate to the sequences of behavior. Bisogni et al. (2007) also characterized eating occasions with respect to situational dimensions including: food and drink, time, location, activities, social setting, mental processes, physical condition, and recurrence. Each dimension overlapped and interacted with other dimensions. Together, these dimensions represented clusters that were used to characterize each eating occasion. A framework was developed to present the eight dimensions emphasizing that eating occasions are integrated into a person’s physical and social surroundings and that person-environment interactions are dynamic and reciprocal. While the food and drink dimension - the type of food, amount consumed, and nutrients from the food - is important, the primary dimension in a particular eating occasion for a person may be her activities at the time of eating, presence of others, mental processes, the goals she wants to accomplish, or emotional needs. All of these dimensions and features may affect the occasion more than the food and drink dimension alone.

Eating occasion data were also examined in a study involving 831 Spanish men and women aged 25-49 years (Jaeger et al. 2009). Online 24-hour food recalls were used to collect data for more than 3,000 eating occasions. This study focused on the type of food eaten during specific meal occasions. Cereal was most often eaten with breakfast. This first meal of the day also typically included hot drinks and sweet breads or bakery goods. Mid-morning snacks and lunch often consisted of hot meat, hot carbohydrates,

and vegetables. When alcohol was consumed, it was typically done during the last eating occasion of the day. Data differed from weekday to weekend as well. Hot carbohydrates were more typically consumed during the weekend, while meals containing yogurt or fruit were consumed more often on weekdays compared to weekends. The consumption of water and hot beverages was also higher during the week. Hot carbohydrates and hot meats were often eaten during “formal meals” which took place with friends or family, and sandwiches or sweets and chocolate were often consumed during “casual” eating occasions. These casual sessions took place while in front of a computer or at work and often took place while the individual was alone. The data showed that eating occasions that took place sitting down were typically either “formal” or took place in the evening in front of a television and often included pizza or pie and consumption of alcohol. These data enhance knowledge about the contextual influences on food choice demonstrating that meals are often complex and share contextual characteristics.

The context of the eating occasion, including both physical and social surroundings also plays a role in food intake and food choice. It has been shown that various external factors such as the presence of other people, sound, temperature, color, smell, time of day, and distraction can all affect food choice (Stroebele and de Castro 2004). The presence of other people at a meal significantly increases the amount of time spent at the meal. The amount of food ingested can increase up to 44% with having just one other person present (de Castro 1997) and is typically higher when the people present or the subject discussed are familiar to the participant (Stroebele and de Castro 2004).

Results from these research studies demonstrate that both social and behavioral context affect food choice. Desired goals and outcomes with a particular meal or eating

occasion also affect food choice. By understanding the importance of these integrated concepts and the different dimensions that affect food choice, health professionals can more fully appreciate the relationship between food intake and eating occasion context and better promote healthy eating and weight control.

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Chapter III: Study Overview

STUDY OVERVIEW

Midlife years (age 40-60) are a critical time period for many women because of elevated risk of overweight and obesity. Women often experience age-related weight gain based on both physiological and environmental changes that occur with age. The physiological changes experienced by women can contribute to weight gain, but weight gain can also be due to both environmental and behavioral factors that influence eating behavior. This study was based on a multidisciplinary approach involving nutrition and marketing expertise to address the situational context of eating occasions. This project was conducted in two phases; a descriptive research phase (Phase I) which provided information to inform the development of a controlled intervention study (Phase II).

DESCRIPTIVE RESEARCH PHASE (PHASE I)

The primary objective of the descriptive research phase was to identify distinct “need states” based on eating occasions experienced by midlife women to serve as a basis for the development of a tailored, controlled intervention to prevent age-related weight gain. A quantitative segmentation study was conducted to describe the range of “need states” as defined by needs of the individual in the situational context surrounding specific eating occasions. Need states were based on eating occasions driven by both the rational and emotional needs that underlie food choice among midlife women.

Hypotheses

While the primary objective was to describe the range of need states experienced by midlife women related to eating occasions, the quantitative segmentation study allowed for testing of several hypotheses regarding energy and nutrient content of the foods consumed during specific eating occasions. These included:

- 1) Energy content of eating occasions will differ according to the need for convenience or indulgence versus a health orientation.
- 2) Fat, fiber, and added sugar content of eating occasions will differ based on the need for convenience, indulgence, or comfort compared to an orientation to health or weight control.
- 3) Fruit, vegetable, and whole grain content will differ based on need to nurture family versus a health orientation.

CONTROLLED INTERVENTION PHASE (PHASE II)

The second phase of the project was a controlled intervention phase which utilized findings from the descriptive research phase to develop and implement a tailored intervention to prevent age-related weight gain in midlife women. A team of registered dietitians developed and delivered a tailored intervention program for midlife women over a six-month period followed by regular follow up contacts for a total of two years. The main objective of this phase was to determine intervention-dependent change in weight, which was the primary outcome variable. Change in eating behavior of the individual was also determined. Physical activity was monitored throughout the two-year study period.

Hypotheses

It was hypothesized that participation in a six-month intervention tailored to address distinct need states would result in no change in weight in midlife women over a two-year period compared to women in a control group who did not participate in the intervention. It was also hypothesized that waist circumferences would not change in women in the intervention group over the two-year study period compared to women in

the control group. Effectiveness of the intervention was also evaluated among two subgroups of women—those reporting commonly experiencing less-healthy need states at baseline and those with a body mass index (BMI) ≥ 25 kg/m² at baseline.

**Chapter IV: Eating Behavior and BMI Based on Eating Occasion
Needs Among a Cross-Sectional Sample of US Midlife Women:
Implications for Prevention of Weight Gain**

Authors: Courtney D. Perry, PhD; Dennis Degeneffe, PhD;
Noriko Sudo PhD; and Marla Reicks, PhD, RD

**EATING BEHAVIOR AND BMI BASED ON EATING OCCASION
NEEDS AMONG A CROSS-SECTIONAL SAMPLE OF US MIDLIFE WOMEN:
IMPLICATIONS FOR PREVENTION OF WEIGHT GAIN**

Objective: To identify distinct need states based on rational and emotional needs surrounding specific eating occasions experienced by midlife women and determine how eating behavior including energy, food and nutrient intakes, and BMI differ by need state.

Design: A cross-sectional, quantitative segmentation study of eating occasions was completed. Participants were mailed a survey packet including four eating occasion questionnaires and a 24-hour food record booklet with an instructional video.

Setting: Dietary and survey data from the mailed packet were used in the analyses.

Subjects: National sample of US midlife women (40-60 years).

Results: Data from 5,556 eating occasions experienced by 1,663 women (40-60 years) were used in the segmentation analysis. Six need states were identified: healthy express, comforting interludes, indulgent escapes, nurturing family meals, sensible meals, and fast fueling. Differences in energy and food and nutrient intakes by need state segment were determined. Lower fat and higher fruit and whole grain intakes characterized health-oriented occasions, whereas energy, vegetable, and refined grain intakes were highest in nurturing family meals (60% as dinner meals). Indulgent escapes, fast fueling, and nurturing family meal occasions were highest in fat intake. Indulgent escape occasions were also characterized by higher sucrose compared to several other segments. The number of less healthy eating occasions experienced (indulgent escapes, fast fueling, nurturing family meals) was positively associated with BMI.

Conclusions: Education regarding weight gain prevention can be tailored to eating occasion segments among US midlife women to address food choice based on need states.

INTRODUCTION

Several studies (Brown et al. 2005; Field et al. 2007) have demonstrated that midlife women (40-60 years) tend to gain 0.4-1.0 kg/year. Age-related weight gain is due to physiological (Carr 2003) and behavioral changes resulting from shifts in family structure and time available for physical activity or food preparation (Pierret 2006). A better understanding of influences on food choice during this period may be beneficial in preventing weight gain among midlife women.

The Social-Ecological Model organizes influences on food choice among women according to individual, physical-, and socio-environmental categories, and broader sectors of influence such as the food industry (Story et al. 2008). Within specific eating occasions, influences from several levels can impact food choice including the situational context and the characteristics of the individual experiencing the eating occasion.

According to market research, purchase and consumption decisions are influenced by “need states,” defined as rational and/or emotional needs within specific situations (Leith and Riley 1998). Applied to eating occasions, rational and emotional needs based on situational context can affect what and how much is eaten. For example, the presence of others or time of day can determine needs regarding food selection and consumption decisions (Jaeger et al. 2009; Stroebele and de Castro 2004). A woman may feel the need to nurture others when preparing a dinner meal with children and may select foods that children like but that she may not prefer. Another may feel a need to eat something quickly with the choice dependent on speed and not a health orientation. Therefore, the type of need state experienced may affect the nutritional profile of what is consumed

during the eating occasion. If need states associated with intakes of less healthy, energy-dense, low-nutrient foods are experienced often, weight gain may result.

Segmentation of eating occasions according to need states may improve the understanding of motivations that drive behavior, thus facilitating development of tailored interventions. Segmentation simplifies the diversity of consumers by dividing them into distinct groups that can be targeted with relevant marketing messages. Previous studies have segmented individuals according to consumer and health behaviors and attitudes and risk factors (Ronteltap et al. 2009; Moss et al. 2009). However, segmentation of actual eating occasions or “usage situations” by need states that affect food choice and intake is less common. A previous feasibility study identified six different need states experienced by a small regional sample of midlife women (n=200): routine family meal, healthy regimen, comforting personal time, fast fueling, family ritual, and indulgent escape (Sudo et al. 2009). Food group, nutrient, and energy intakes based on food records differed according to need state segments with some need states having less healthy nutrition profiles compared to others. Further confirmation of these differences based on a larger sample and broader representation of midlife women is needed. The relationship between body mass index (BMI) and experiencing need states characterized by less healthy eating patterns also needs to be addressed. This will allow health professionals to better promote healthy eating and weight control based on need states.

The purpose of this study was to segment eating occasions of midlife women, determine differences in energy, food, and nutrient intakes by need state, and evaluate the relationship between BMI and report of experiencing less healthy need states.

EXPERIMENTAL METHODS

Participants and Sampling

Survey packets were mailed to a cross-sectional sample of women members (40-60 years) of the TNS™ Global mail panel which is a commercial marketing research company. The mail panel consists of 500,000 households including 1.3 million individuals in the United States (US). Panel members are recruited via lists collected through subscriptions and registration cards. Demographic and household information is collected by TNS™ Global and updated yearly.

TNS™ Global selected the sample from the panel such that it was balanced to the demographic characteristics of the US census data (United States Department of Commerce 2006) based on the nine geographic regions of US metropolitan and micropolitan statistical areas (Office of Management and Budget 2000), age, income, household size and composition, and race/ethnicity. The study was approved by the University of Minnesota Institutional Review Board prior to data collection. In return for completing the survey packet, participants received monetary compensation from TNS™ Global.

An initial recruitment letter and consent form were sent to 8,000 households in the mail panel known to include women 40-60 years of age. Women (n=2,713 or 33.9%) who returned a postcard agreeing to participate were sent a survey packet. Of these packets, 1,634 (60.2%) were returned. To recruit additional women within the time frame of the study, a recruitment letter, consent form, and survey packet were mailed simultaneously to an additional 1,200 households selected from the TNS™ Global mail panel balanced to the same demographic characteristics, and 292 (24.3%) completed

packets were returned by the specified cut-off date. Based on both recruitment methods, responses were obtained from a total of 1,926 women, representing 7,630 eating occasions.

Data Collection

Survey packets included an instructional letter (See Appendices 1.A), four eating occasion questionnaires (See Appendices 1.B), a one-day food record booklet (See Appendices 1.C), and a general questionnaire. All components of the packet and instructions were pilot-tested twice with approximately 120 midlife women outside of the current study. Questions asking women to self-report height and weight were included in the general questionnaire for calculation of BMI. Demographic information was obtained from TNS™ Global.

Eating occasion questionnaires

Participants were instructed to complete an eating occasion questionnaire containing 88 need-state items after four eating occasions (breakfast, lunch, dinner, and snack) during a one-day period. An initial battery of need statements (n=129) was developed using qualitative data according to functional needs, such as meeting external demands of time, and emotional needs, such as reinforcing family identity (Vue et al. 2008). Need statements were based on 1) needs surrounding the eating occasion prefaced with “I wanted to...” (e.g., “treat myself” and “eat quickly”) and 2) benefits sought in the food/beverages consumed prefaced with “I wanted something that...” (e.g., “is really indulgent” and “is easy to prepare”). Women were asked to rate their agreement with the items using Likert-style 6-point agree/disagree scales. These initial 129 need statements were used in an eating occasion questionnaire tested with 200 midlife women in a

previous segmentation study (Sudo et al. 2009). Principal components analysis placed 90 of the 129 need statements within nine components: health, convenience, price, portability, nurturance, reward, enjoyment, tradition, and weight, all with Cronbach α coefficients >0.70 . For the current study, the battery of 90 statements was slightly revised by deleting three items with low loadings on two of three components and adding one statement, resulting in 88 need statements. These 88 need statements served as segmentation variables for the subsequent cluster analysis procedure. In addition to the need statements, questions regarding situational context were also included, such as the presence of others, who prepared the food, preparation and eating times, and activities engaged in during the occasion.

One-day food record

The survey packet included a food record booklet with instructions based on those used by others (Kolar et al. 2005), instructing women to describe all foods, beverages, and amounts consumed immediately after eating. Women were also instructed to record time eaten, type of occasion, and preparation methods/recipes. The food record booklet included reduced-scale photographs of representative foods and serving sizes (Kolar et al. 2005) and an example of a completed one-day record that described the foods in adequate detail. An 11-minute instructional DVD accompanied the food record booklet.

Instructions to complete the packet on a weekday (M-Th) or weekend (F-Su) were included in 57% and 43% of survey packets, respectively. Data from the food record booklet were entered into the Nutrition Data System for Research software program (NDSR) (version 2008, Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, USA) by nutrition students trained in the use of NDSR. A certified

NDSR registered dietitian entered ~20% of the food records a second time to monitor data entry to standardize and improve quality of data entry.

Serving sizes for the food groups were determined as indicated by NDSR and were grouped by combining similar foods according to MyPyramid food groups (United States Department of Agriculture 2009). Fruits included whole, canned, or dried fruit, 100% fruit juice, and avocado. Vegetables included all raw or cooked (not including fried) vegetables, potatoes and other starchy vegetables, legumes, and vegetable juice. Grains (refined or whole grain) were represented by breads, crackers, pasta, cereals, cakes, cookies, snack bars, popcorn and chips. Two dairy groups included 1) regular dairy (whole and non-reduced fat milk, cheese, and yogurt) and 2) reduced-fat dairy (reduced-fat and fat-free milk, cheese, and yogurt). Added fats included regular margarine, oil, shortening, butter and animal fats, salad dressings, and gravy.

Data Analysis

SAS software was used for all data analyses (SAS Institute Inc., 2002-2008, Cary, NC, USA). Prior to segmentation analysis, 834 occasions were excluded because the majority of data were missing on the eating occasion questionnaire. Another 500 occasions were excluded because $\geq 90\%$ of the items were considered constantly rated. After exclusions, a total of 6,296 occasions from 1,823 women were used in segmentation analysis as described previously (Sudo et al. 2009) based on the 88 segmentation variables. All variables were standardized to mean zero and standard deviation (SD) one (SAS PROC STANDARD). PROC CLUSTER in SAS was used to identify seeds for a k-means clustering procedure. With the cluster means as starting points, SAS FASCLUS was used to perform a k-means clustering based on a nearest

centroid sorting method (Aldenderfer and Blashfield 1984) and Euclidean distances (Anderberg 1973) to produce the final clustering. The cluster procedure produced six different cluster solutions ranging from three to eight clusters. Each solution was evaluated with respect to the range in ratings exhibited across measures and the descriptive clarity of the pattern of responses. Indexes were used to compare responses from women for groupings of eating occasions belonging to each of the resulting clusters in that solution relative to the total sample of eating occasions. These indexes were based on the percent of respondents who selected the top two points of the rating scales (Reicks et al. 2011). After considering each solution, the six-cluster solution was selected because 1) it was judged to be the most meaningfully different across segments, 2) the distance to the nearest cluster values indicated a reasonable separation between cluster centroids, and 3) it resulted in adequate sample sizes for further analysis of study results. The six cluster solution proved to be reasonably stable as indicated by an 85% correct reclassification rate in a discriminant analysis.

The six clusters were given descriptive names and described according to patterns that distinguished them from one another according to the calculated indexes. Those >1.20 and <0.80 were considered higher and lower, respectively, than the average for the total sample. For example, cluster 1 yielded high indexes of 1.53 for eat responsibly, 1.62 for eat quickly, and 1.51 for feel good about what I eat, etc., and low indexes of 0.53 for treat myself, 0.30 for feel like a good mom, and 0.24 for have a fun/festive time, etc., reflecting a clear theme around eating healthfully and quickly. Based on this pattern, cluster 1 was named “Healthy Express.”

After segmentation analysis, meal times recorded on the eating occasion questionnaire were matched with those on the food record booklet. Eating occasion data were excluded from 187 eating occasions (mostly snacks) when no time was recorded or times did not match and from 553 eating occasions where food record information was incomplete or missing. The exclusions resulted in food group and nutrient intake data available from 1,663 women (5,556 eating occasions) for further analyses.

Differences in categorical variables (contextual factors) by need state segment were determined using chi-square tests. Because eating occasions in some need state segments were more often meals, whereas others were likely to be snacks, all nutrient intake data were standardized and reported on a 1,000 kcal basis. Differences in mean nutrient and food group intake variables were evaluated using ANOVA with post-hoc Duncan's Multiple Range testing. Means and standard error (SE), p-values, and effect sizes for the ANOVA F-tests are reported primarily to show the effect of need states on each variable. Some nutrient and food group intake variables were not normally distributed, therefore the non-parametric Kruskal-Wallis procedure was used to confirm ANOVA results. Multiple linear regression analysis was used to determine associations between BMI (dependent variable), a less healthy need state score, and individual and household variables (independent variables). The less healthy need state score was calculated by assigning 0.25 points for each of the four eating occasions experienced as an indulgent escape, nurturing family meal, or fast fueling need state and summing across all four for a possible range of 0-1 points. These need states were selected as less healthy based on their general pattern of high fat, refined grain, and regular fat dairy intakes and low intakes of fiber, fruit, and whole grain compared to health-oriented need states.

Individual and household variables were modeled as multi-level categorical-, dichotomous, or indicator variables. Statistical significance level was set at 0.05 for all analyses.

RESULTS

Participants

Mean age of the women was 49.6 years with 3% falling outside the age range of 40-60 years. Approximately one quarter of the participants (26%) were considered overweight and 35% considered obese. Mean household size was three people. Most women were non-Hispanic white, married and living with their spouse, employed, and had completed some college or had a college degree (Table 4.1). Total household income for most women was >\$35,000/year (76.4%). Mean BMI was in the overweight range (28.9 kg/m²).

Cluster Analysis

Cluster analysis identified six distinct need state segments that occurred across both meals and snacks: healthy express, comforting interludes, indulgent escapes, nurturing family meals, sensible meals, and fast fueling. Healthy express was the most frequent need state (n=1,271; 23%); comforting interludes occurred least often (n=693; 12%). Based on responses to need statements, healthy express (23%) and fast fueling (15%) occasions were driven by the need to eat quickly with minimal effort, planning, and preparation. Although healthy express occasions also focused on controlling calories, balancing food groups, and healthy eating, fast fueling occasions focused more on time and portability. Sensible meals (16%) also had healthy and balanced meal components but were less centered on time and convenience than healthy express

occasions. Comforting interludes (12%) were based on the need to enjoy a personal moment, relax, or unwind but also had a health orientation. Indulgent escapes (16%) were typically driven by the need for indulgence in rich foods and came with a perceived emotional benefit of treating or rewarding oneself. Nurturing family meal (18%) occasions demonstrated the need to show love, have time together, and provide food that would generate minimal complaints which could cause women to overlook their own nutritional needs.

Situational Context

Although all eating occasions occurred across main meals and snacks, they differed somewhat in their tendency to occur for breakfast, lunch, dinner, or snacks. Healthy express and comforting interludes occasions most often occurred during breakfast, while fast fueling tended to occur during lunch (Table 4.2). Nurturing family meals (60%) and sensible meals (35%) were most often dinner meals. A higher proportion of indulgent escapes (53%) were snacks compared to other need states.

The location of the eating occasion and presence of others also differed by need state. Most eating occasions within all need states were reported to take place at home (65-89%). A fairly high proportion of eating occasions within all need state segments occurred with no other adults (41-69%) or children (76-92%) present, with the exception of nurturing family meals, which often had at least one other adult (~50%) or child (54%) present during the occasion.

Most of the food preparation for all eating occasions occurring at home was done in whole or in part by the participant, with limited preparation, eating, and clean-up times. In half of all occasions, women reported that they decided what to eat

immediately before eating. The foods/beverages consumed in the majority of healthy express, comforting interludes, sensible meals, and fast fueling occasions took less than five minutes to prepare; many of the indulgent escapes (~42%) took no preparation time. Nurturing family meals occasions had the longest preparation times (80% >11 minutes) and, for 70% of these occasions, women decided what to eat earlier in the day. With the exception of nurturing family meals, eating time in more than half of all eating occasions in each segment was reported to be <15 minutes, and the amount of time spent cleaning up was less than five minutes. Conversely, eating time was estimated to be >15 minutes in 62% of nurturing family meal occasions with clean-up time being 5-15 and >15 minutes, for nearly half and one-third of the occasions, respectively.

Within each need state segment, women reported engaging in other activities in addition to eating/drinking during the occasion. About one-third of eating occasions across all need states took place while the participant was reportedly watching television. Most (74%) of nurturing family meals, compared to one-third of all other eating occasions excluding healthy express, took place while conversing with others. Approximately 24% of healthy express and 20% of fast fueling occasions occurred while working or using the computer. Only about 10-15% of all eating occasions occurred while the participant reported doing nothing other than eating.

Energy and Nutrient Intake

Nurturing family meal occasions were more likely to be dinner meals, and therefore, had the highest energy content (mean of 645 kcal) (Table 4.3). Healthy express occasions were significantly lower in total-, saturated-, and trans fat intake than any other need state segment. Indulgent escapes, nurturing family meals, and fast fueling

eating occasions were highest in total fat intake, compared to other need states. Indulgent escape occasions were also highest in sucrose and lowest in protein intake. Healthy express and comforting interludes were highest in total carbohydrates, and along with sensible meals, were highest in fiber intake.

Food Group/Beverage Intake

Fruit intake was significantly higher in the need state segments with a health orientation (healthy express, comforting interludes, and sensible meals) compared to indulgent escapes and fast fueling eating occasions, whereas vegetable intake was highest in nurturing family meals (Table 4.3). Whole grain intake was also higher in the health-oriented need state segments compared to other need state segments, but refined grain intake was highest in nurturing family meals.

Women experiencing nurturing family meal occasions had significantly higher intakes of added fats compared to all other need state segments; healthy express occasions were lowest. The intake of regular dairy foods was higher in nurturing family meals, fast fueling, and indulgent escapes whereas intake of reduced-fat dairy products was highest in healthy express and sensible meals eating occasions.

Associations Between BMI, Need State Score, and Individual/Household Variables

About one-fourth (23%) of all women did not report experiencing any less healthy need states (indulgent escapes, nurturing family meals, fast fueling) on the day when eating occasion questionnaires and food records were completed, while 26%, 26%, 17% and 8% reported one, two, three, or four less healthy need states, respectively. A less healthy need state score ($p=0.001$) and age were positively associated with BMI, whereas

income, marital status, and being Asian were negatively associated. No relationship was observed between BMI and other individual or household variables.

DISCUSSION

Segmentation analysis resulted in six eating occasion need state segments driven by needs surrounding the behavioral and situational context of the occasions. Overall, segment differences in food group and nutrient intakes provided evidence to support the validity of the six-segment solution. For example, a health-oriented eating occasion typically resulted in lower fat and higher fruit intake. Food functioned in a variety of ways depending on the type of segment. Foods chosen in a health-oriented segment often served to provide specific nutrients while remaining fairly low in calories. In contrast, foods chosen in indulgent escapes eating occasions often functioned to provide sensory gratification or a reward. Fast fueling eating occasions often involved foods that served a function of convenience.

Segments also differed by situational context, consistent with differences in location, those present, and time to accomplish tasks. For example, eating occasions that were based on convenience required little time to prepare and consume. Similar findings of need states and their relationship to dietary intake observed in a previous feasibility study (Sudo et al. 2009) were confirmed in the current study in a substantially larger population of midlife women. In the current study, less healthy compared to health-oriented need states were more likely to be experienced by women with a higher BMI, providing support for the existence of relevant subgroups of eating occasions. This evidence provides a potential basis for tailored education regarding energy, food, and nutrient consumption within the less healthy need states.

The results of the present study also indicate that several levels of influence according to the Social-Ecological Model may be involved in food choice based on needs. For example, nurturing family meal occasions are based on serving children and adults in the household (socio-environmental factors), while fast fueling occasions are centered on eating quickly from what is available (physical-environmental factors). Healthy express eating occasions may be influenced by the individual's motivation and confidence to choose healthy foods (individual level factors). Other studies have also related dietary intake and quality among women to individual and environmental factors (Pinto et al. 2002; Tucker and Bates 2009; Thornton et al. 2010).

While the underlying standard deviations were large and the effect sizes were small for each variable, the mean differences were relevant and worth discussing for their practical and clinical significance. Food group intakes followed expectations regarding need state segments but were also influenced by contextual factors including meal type. Fruit and whole grain intakes were higher in health-oriented need state occasions, but vegetable intake was highest in nurturing family meal occasions which tended to be dinner meals compared to other segments. The primary need expressed in this segment was related to being a caregiver. Nurturing family meals were centered on the need to have a balanced meal, and vegetables are often considered a component of a complete meal (Derrickson et al. 2001). Previous research (Hammons and Fiese 2011; Neumark-Sztainer et al. 2010) has shown that frequency of family meals is related to improved dietary intake in children and adolescents; whereas, little research has examined effects on adult diet quality. In the current study, foods sought in this segment were those that would please others, produce minimal complaints, and contribute to a pleasant social

occasion. These motivations may explain why intake of fat, refined grains, and regular dairy products, were higher in these occasions compared to other need state segments. This finding is consistent with NHANES III data showing that children in the household were associated with significantly higher consumption of total- and saturated fat among adults (Laroche et al. 2007).

In addition to meal type, it was expected that location and the presence of others would also contribute to the manner in which need states would affect intake in the current study. For example, indulgent escapes were likely to occur away from home more often than other segments and generally occurred with no one else present, supporting the descriptive need to briefly escape from the normal stresses and activities of everyday life. Considering that these occasions were typically snacks, energy, fat, and sucrose intakes were fairly high compared to other need state segments. This is consistent with findings demonstrating that stressed emotional eaters were more likely to eat sweet, high fat, and energy-dense foods compared to unstressed and non-emotional eaters (Oliver et al. 2007). In a laboratory setting, food intake was also shown to be increased by environmental, non-food-related stimuli (such as watching television), compared to control conditions (Bellisle et al. 2009). In about 40% of the indulgent escape occasions in the current study, women reported watching television, which may have provided a stimulus that accounted for overconsumption. Because restraint in eating was associated with a lower risk of weight gain among midlife women (Tucker and Bates 2009), the frequency of and foods consumed within indulgent escape occasions should be modified to control energy, fat, and sugar intakes.

Driven by a need for convenient, portable foods, it was expected that fast fueling eating occasions would occur away from home. Surprisingly, only about 30% were experienced away from home, indicating that the overall negative nutrition profile was not solely due to eating outside the home, as has been previously observed (Bes-Rastrollo et al. 2010). Since many of the fast fueling occasions took place at home, it is apparent that food choices in this condition need to be improved. In another study, employed mothers addressed lack of time for food provisioning through efficient planning, organization, and prioritization (Jabs and Devine 2006). Thus, women experiencing fast fueling occasions may benefit from assistance in planning to have more healthful, convenient, and portable foods on hand for these occasions.

Many eating occasions experienced in the current study were driven by the need to eat quickly and accomplish other tasks simultaneously. This is consistent with a recent report indicating that trends in the food system include less time preparing foods and greater use of convenience products than in the past (Jabs et al. 2007). Time use survey results also support the fact that women multi-task during eating occasions, spending about 30 minutes per day eating as a secondary activity and 64 minutes per day eating as a primary activity (United States Department of Agriculture 2008). In two of the six need state segments, primary considerations were time and convenience. In healthy express occasions, the need for convenience was coupled with a need to eat healthy foods and resulted in a favorable nutrition profile. However, during fast fueling occasions, the need to eat healthy foods was not present, and the nutrition profile was negative. These findings support the concept that it is possible to prepare and eat meals quickly, yet maintain a healthful intake. Further studies are needed to examine the nature of

convenience foods within these two segments to fully understand how underlying motivations affect the type of food selected. The current time scarcity experienced by many women creates a high demand for convenience foods being met by the food industry with some offerings that are less healthy than others. Therefore, environmental changes that focus on having more healthful, convenience foods in the marketplace would be beneficial.

This study has several limitations. Mailed surveys were used to collect data, which may have resulted in problems regarding sampling in general. The mail panel was built to be nationally representative based on US census variables, but responding participants were more educated and had a higher income than the general population. The low response rate from the second form of recruitment is also a limitation that may have resulted in selection bias; therefore, results cannot be generalized to a broader group of midlife women. Furthermore, food records have been criticized as being less accurate when the participants are not trained and when the food records are not reviewed and corrected. However, in a previous study with midlife women, Sudo et al. (2010) demonstrated that adequacy of information provided in mailed food records based on the same one-day food record booklet used in the current study was not dependent on education level (high school or less vs. 4 year college degree). These results indicate that the directions may have been easy to understand which could have led to more accurate reporting. Kolar et al. (2005) also demonstrated good correlations for nutrients ranging from 0.87 to 1.0 between uncorrected and corrected mailed food records.

CONCLUSIONS

Six eating occasion need state segments were identified based on overall needs, such as health, convenience, indulgence, nurturing others, and comfort. Levels of influence based on the Social-Ecological Model were apparent within the six need state segments from the perspective of individual motivation and environmental influences. Energy, food group, nutrient intake, and situational context differed by need state segment and were consistent with identified needs. A positive association was observed between BMI and frequency of less healthy need state eating occasions. Therefore, tailored interventions specific to need states may serve to better address food choice behavior.

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Table 4.1 Demographic characteristics of women participants (n=1,663)

Variable (# women with data missing)	n	%
Race (1)		
White	1301	78.2
Black/African-American	256	15.4
Asian or Pacific Islander	82	4.9
American Indian, Aleut Eskimo	13	0.8
Other	11	0.7
Spanish Origin (1)		
Non-Hispanic	1449	87.1
Hispanic	214	12.9
Marital Status (1)		
Now Married	1199	72.1
w/ Children Present in Household	389	32.4
Divorced, Widowed, Separated	276	16.6
w/ Children Present in Household	55	19.9
Never Married	188	11.3
w/ Children Present in Household	22	11.7
Income (0)		
Under \$19,999	164	9.9
\$20,000-34,999	229	13.7
\$35,000-74,999	509	30.6
Over \$75,000	762	45.8
Education (22)		
Graduated High School	345	20.7
Some College - no degree	386	23.2
Graduated College - Associate's degree (2 year)	213	12.8
Graduated College - Bachelor's degree (4 year)	444	26.7
Post Graduate Degree	253	15.2
Employment (118)		
Full-Time	860	51.7
Part-Time	306	18.4
Retired	82	4.9
Not Employed	297	17.8

Table 4.2 Characteristics of eating occasions by six need state segments*

	Healthy Express n=1271		Comforting Interludes n=693		Indulgent Escapes n=860		Nurturing Family Meals n=1017		Sensible Meals n=904		Fast Fueling n=811		Total Occasions N=5556		P value (χ^2 test)	Effect size ϕ_c
	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
	Day of Week															
Weekday (M-Th)	811	63.8	418	60.3	465	53.8	611	60.1	566	61.5	465	57.3	3324	59.8	0.0002	0.066
Weekend (F-Su)	460	36.2	275	39.7	397	46.2	406	39.9	348	38.5	346	42.7	2232	40.2		
Meal Name																
Breakfast	473	37.2	237	34.2	90	10.5	175	17.2	272	30.1	227	28.0	1474	26.5	<0.0001	0.300
Lunch	397	31.2	167	24.1	161	18.7	174	17.1	240	26.6	281	34.6	1420	25.6		
Dinner	150	11.8	113	16.3	156	18.1	612	60.2	313	34.6	162	20.0	1506	27.1		
Snack	251	19.8	176	25.4	453	52.7	56	5.5	79	8.7	141	17.4	1156	20.8		
Place																
At Home	903	71.2	551	79.5	558	64.9	905	89.0	736	81.4	566	69.8	4219	76.0	<0.0001	0.191
Away from Home	365	28.8	142	20.5	302	35.1	112	11.0	168	18.6	245	30.2	1334	24.0		
Adults present																
No other adults	879	69.2	352	50.8	417	40.5	152	15.0	413	45.7	477	58.8	2690	48.4	<0.0001	0.182
1 adult	292	23.0	209	30.2	303	35.2	504	49.6	348	38.5	246	30.3	1902	34.2		
≥2 adults	100	7.8	132	19.0	140	5.3	361	35.4	143	15.8	88	10.9	964	17.4		
Children present																
No children	1173	92.3	528	76.2	714	83.0	465	45.7	782	86.5	658	81.1	4320	77.8	<0.0001	0.182
≥1 child	98	7.7	165	23.8	146	17.0	552	54.3	122	13.5	153	18.9	1236	22.2		

*Where frequencies do not add up to the total for each need state segment, data are missing.

Table 4.3 Energy, nutrient, and food group intake per eating occasion by six need state segments

Dietary Variable *	Healthy Express n=1271		Comforting Interludes n=693		Indulgent Escapes n=860		Nurturing Family Meals n=1017		Sensible Meals n=904		Fast Fueling n=811		P value (ANOVA) [†]	Effect Size η^2
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
Energy (kcal)	356 ^a	6.9	388 ^b	11.8	462 ^c	12.0	645 ^d	11.8	448 ^c	9.5	446 ^c	10.2	<0.0001	0.090
Total Fat (g)	29.9 ^a	0.6	34.3 ^b	0.9	42.1 ^c	0.7	41.5 ^c	0.5	36.1 ^b	0.7	40.3 ^c	0.7	<0.0001	0.050
Total Carbohydrate (g)	149.4 ^c	1.8	144.4 ^c	2.5	130.3 ^b	1.8	112.7 ^a	1.5	126.1 ^b	2.0	127.6 ^b	2.0	<0.0001	0.047
Total Fiber (g)	15.9 ^d	0.6	13.8 ^c	0.6	8.4 ^a	0.4	9.9 ^{ab}	0.3	14.5 ^{cd}	0.4	10.4 ^b	0.9	<0.0001	0.028
Sucrose (g)	26.6 ^d	0.9	25.2 ^{cd}	1.2	37.0 ^e	1.5	15.1 ^a	0.7	19.1 ^b	0.9	22.8 ^c	1.1	<0.0001	0.046
Total Protein (g)	43.7 ^c	0.8	37.2 ^b	0.8	27.8 ^a	0.7	45.1 ^c	0.6	47.9 ^d	0.8	36.7 ^b	0.7	<0.0001	0.075
Fruit[‡]	0.54 ^c	0.03	0.48 ^c	0.04	0.14 ^a	0.02	0.37 ^b	0.03	0.46 ^c	0.03	0.20 ^a	0.02	<0.0001	0.028
Vegetable[‡]	0.54 ^a	0.03	0.42 ^a	0.04	0.41 ^a	0.03	1.53 ^c	0.06	1.30 ^b	0.06	0.43 ^a	0.03	<0.0001	0.109
Whole Grains[‡]	0.45 ^c	0.03	0.34 ^b	0.03	0.21 ^a	0.02	0.20 ^a	0.02	0.43 ^c	0.03	0.23 ^a	0.02	<0.0001	0.017
Refined Grains[‡]	0.58 ^a	0.03	0.88 ^c	0.05	1.10 ^d	0.06	1.60 ^f	0.01	0.73 ^b	0.04	1.34 ^e	0.05	<0.0001	0.054
Regular Fat Dairy[‡]	0.09 ^a	0.01	0.10 ^a	0.01	0.12 ^{ab}	0.01	0.14 ^{bc}	0.01	0.09 ^a	0.01	0.16 ^c	0.01	<0.0001	0.006
Reduced Fat Dairy[‡]	0.29 ^c	0.01	0.23 ^b	0.02	0.14 ^a	0.01	0.22 ^b	0.02	0.25 ^{bc}	0.02	0.22 ^b	0.02	<0.0001	0.010
Added Fats[‡]	0.41 ^a	0.03	0.68 ^b	0.07	0.67 ^b	0.06	1.74 ^d	0.08	1.01 ^c	0.06	0.72 ^b	0.05	<0.0001	0.061

^{a,b,c} Mean values within a row with unlike superscript letters were significantly different ($p < 0.05$; Duncan Multiple Range Test).

*Nutrients, but not food groups, are standardized to amount per 1000 kcal.

[†]P values confirmed by nonparametric Kruskal-Wallis.

[‡]Serving sizes are based on the recommendations made by the Dietary Guidelines for Americans 2005 and the Food and Drug Administration.

**Chapter V: Individual, Situation-Based Nutrition Counseling in
Midlife Women**

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INDIVIDUAL, SITUATION-BASED NUTRITION COUNSELING IN MIDLIFE WOMEN

Objective: To implement and evaluate the effectiveness of a nutrition counseling intervention tailored to eating occasion need states to prevent weight gain compared to a control group of midlife women.

Design: Participants in the intervention group received ten hours of nutrition counseling over six months based on commonly experienced needs within specific eating occasions. The control group received no counseling. Anthropometric and three-day food record data were collected every six months for two years.

Setting: Counseling sessions were conducted in homes, coffee shops or community locations according to the preferences of participants. Anthropometric data were collected in campus or community center settings.

Subjects: A stratified-random sample of Twin Cities, MN metropolitan midlife women (40-60 years).

Results: Mean baseline BMI was in the overweight range for both the intervention (28.0 kg/m²; n=185) and control groups (27.5 kg/m²; n=169). Although not significant, women in the intervention group gained 0.2 kg over the two year period, while women in the control group gained 0.4 kg. Saturated fat intake was lower in the intervention group compared to the control group at 6-, 18-, and 24 months (overall p=0.02 over the two-year period). Subgroup analyses of women experiencing less-healthy need states (Intervention n=71; Control n=59) showed similar results regarding weight change to the overall sample. Subgroup analyses of overweight and obese women (Intervention n=116;

Control n=103) showed different patterns of change with weight decreasing in the intervention group (86.0 to 85.5 kg) and increasing in the control group (82.8 to 83.4 kg). *Conclusions:* This study provides evidence that tailoring nutrition education according to most frequently experienced eating occasion need states may, over time, lead to improved weight outcomes in overweight or obese women who often experience less-healthy need states. However, the intervention approach may be less helpful for normal weight women already experiencing healthy need states.

INTRODUCTION

Several prospective and longitudinal studies (Lee et al. 2010; Nooyens et al. 2009; Sternfeld et al. 2004) have demonstrated that women tend to gain 0.2-1.0 kg/year during their midlife years (40-60 years). Weight gain is a controllable risk factor for many major chronic diseases such as atherosclerotic cardiovascular disease (De Michele et al. 2002) and type 2 diabetes (Carr et al. 2004), which may lead to increased risk of premature mortality (Pischon et al. 2009). In addition, weight gain during midlife increases risk of stroke (Bodenant et al. 2011), some forms of cancer (Friedenreich et al. 2007), dementia later in life (Fitzpatrick et al. 2009), and decreased physical function (Woo et al. 2007).

Effective programs to prevent weight gain with age can be an important factor in lowering obesity prevalence and associated risk of chronic disease. To foster behavioral change, it is important that interventionists understand physiological and behavioral factors, and social cues and habits involved in food choice based on the diversity of midlife women. Segmentation analysis has been used to understand differences in consumer behaviors and attitudes regarding food intake and health (Byrd-Bredbenner et al. 2008; Blake et al. 2011). Another less common approach is to segment usage or eating occasions in relation to food choice and intake, as has been done by the food industry (NPD Group 2011). Nutrition researchers have also segmented eating occasions into need states (Sudo et al. 2009; Perry et al. 2010 – Chapter 4) which are defined as the inner and outer influences that impact purchase and consumption decisions (Leith and Riley 1998). A previous nationwide study based on 5,556 eating occasions from 1,663 midlife women (40-60 years) identified six distinct need states: healthy express,

comforting interludes, indulgent escapes, nurturing family meals, sensible meals, and fast fueling (Perry et al. 2010 – Chapter 4). Health-oriented occasions (healthy express, comforting interludes, and sensible meals) were characterized by lower fat and higher fruit and whole grain intakes, whereas less-healthy need state (indulgent escapes, fast fueling, and nurturing family meals) occasions were highest in fat intake, and often higher in energy, refined grain, and sucrose. The number of less-healthy eating occasions experienced was positively associated with body mass index (BMI). Similarly, in a small regional study, Sudo et al. (2009) observed that eating occasions with an orientation to family-nurturing were high in energy, total fat, and cholesterol. Those with a need for indulgence tended to be high in saturated fats and sugars compared to eating occasions based on health-oriented needs (Sudo, et al. 2009).

Tailored nutrition education improves long-term diet quality in adults (Eyles and Mhurchu 2009). Experiencing a high frequency of less-healthy eating occasions may lead to weight gain over time. Therefore, an intervention tailored to eating occasion need states experienced by midlife women may be effective in preventing weight gain. The primary objective of this study was to implement and evaluate the effectiveness of a six-month nutrition counseling intervention tailored to eating occasion need states to prevent weight gain over two years compared to a control group. Effectiveness was also evaluated among two subgroups of women—those reporting commonly experiencing less-healthy need states at baseline and those with a BMI ≤ 25 kg/m² at baseline.

EXPERIMENTAL METHODS

Participants and Sampling

Female participants (40-60 years) were randomly selected for recruitment representing race/ethnicity distributions of the Twin Cities, MN metropolitan area (United States Department of Commerce. Bureau of the Census, 2006) from a database maintained by a market research firm. The database included women who had expressed interest or participated in previous market research studies. A small number of participants ($n < 20$) were also recruited via word-of-mouth through other participants already enrolled in the study or through fliers posted on the University of Minnesota Twin Cities campus.

Sample size calculations indicated that for a two treatment parallel-design study, 304 women would need to be enrolled in the study with an 80% probability that a 1 kg difference would be detected between groups based on estimates of typical weight gain among midlife women (Brown et al. 2005; Milliken et al. 2006). Additional women were enrolled to compensate for a dropout rate of ~15%.

During September-October 2008 (cohort 1) and March-April 2009 (cohort 2), an initial screening call was made to potential participants by staff from the market research firm. Inclusion criteria were: 40-60 years of age; ability to speak/write English; no history of diabetes, heart disease, cancer, chronic pulmonary disease, or renal disease; not following a physician-prescribed diet; not pregnant or breastfeeding; and able to stand during anthropometric measurements. A stratified randomization procedure was used to assign participants consecutively to either control or intervention group so that equal numbers of women in each group were employed full-time, had children under the age of

12, and an annual household income \leq \$40,000. If a potential participant met the inclusion criteria and expressed interest in study participation, the study coordinator called to schedule a baseline/informational session. The protocol was approved by the University of Minnesota Institutional Review Board: Human Subjects Protection Committee prior to data collection. All women provided informed consent at a baseline/informational session. Women were compensated for their participation 5 times over the two year period.

Intervention Group Individualized Nutrition Counseling

Participants in the intervention group received individualized counseling from a registered dietitian in one-hour sessions every two weeks over a 6 month period. The intervention was planned so that one cohort received counseling during autumn and winter and the other received counseling during spring and summer to account for differences in seasonality. Counseling sessions were conducted in homes, coffee shops or community locations according to the preferences of participants.

At the initial session, needs assessment data were collected regarding the typical context surrounding meals and snacks, including time, location, presence of others and source of food. The second session provided foundational knowledge which focused on general nutrition information regarding dietary guidance recommendations, portion size, and food labels. The remaining lessons were tailored to each participant based on the need states they experienced most often as determined by an eating occasion typing tool designed for this study. The typing tool included a set of 20 need state items developed from an original battery of 88 need statements used to cluster/identify need states in previous research (Perry et al. 2010 – Chapter 4; Sudo et al. 2009). An iterative series of

discriminant analyses using fewer and fewer need statements (n=88, 30, 25 and 20) was conducted starting with the responses to the original 88 need statements in an effort to reduce the need statements to a set that could be more practically incorporated into the eating occasion typing tool. This was done so they could be used repeatedly for classifying respondent eating occasions. An algorithm using a final set of 20 need statements resulted in a 77.1% correct reclassification rate versus the original 88 need statements. Women selected strongly agree/strongly disagree responses to the 20 need statements regarding usual weekday and weekend breakfast, lunch, dinner and snack occasions over the previous week. The items were based on 1) needs surrounding the eating occasion prefaced with “I wanted to...” (e.g., “treat myself,” “eat quickly,” and “connect with others/family”) and 2) benefits sought in the food/beverages consumed prefaced with “I wanted something that....” (e.g., “is healthy to eat,” “is portable,” and “children will also eat”). Values assigned to agree/disagree responses were entered into the algorithm to indicate frequency with which women experienced need states.

Investigators and a team of five registered dietitians developed learning objectives and instructional activities for three lessons per need state according to the description of need state segments. The need state segments and corresponding lesson topics are described in Table 5.1. Need states were considered healthy or less-healthy based on typical energy, food and nutrient intakes according to a previous study (Perry et al. 2010 – Chapter 4). Healthy need states were healthy express, sensible meals, and comforting interludes, whereas less-healthy need states were nurturing family meals, indulgent escapes, and fast fueling. Along with the segment descriptions, the Social-Ecological Model (Story et al. 2008) was applied in the development of learning objectives. This

model served as the basis for understanding influences on food choice among women according to individual, physical-, and socio-environmental categories, and broader sectors of influence such as the food industry. Within specific need state eating occasions, influences from several levels may impact food choice including the situational context and the characteristics of the individual experiencing the eating occasion. For example, nurturing family meal occasions are based on serving children and adults in the household (socio-environmental factors), while fast fueling occasions are centered on eating quickly from what is available (physical environmental factors). Healthy express eating occasions may be influenced by the individual's motivation and confidence to choose healthy foods (individual level factors). At baseline, the most commonly experienced need state in both groups was nurturing family meals, followed by healthy express and indulgent escapes.

Instructional activities and handouts were based on existing nutrition education materials when available from various sources, such as government and public health agencies and organizations (Table 5.1). The lessons were interactive in nature, requiring participants to personalize content according to the situations they encountered in daily life and to complete homework to set goals and monitor progress between lessons.

Measurements

At baseline, 6-, 12-, 18-, and 24-month sessions, participants completed several questionnaires and underwent anthropometric measurements as follows:

General questionnaire and eating occasion typing tool

Information regarding menopausal status, use of hormone replacement therapy and vitamin or mineral supplements was obtained using a general questionnaire.

Participants were asked to rate their agreement with the 20 need-state items in the eating occasion typing tool using agree/disagree six-point scales for their typical weekday and weekend breakfasts, lunches, dinners, and snacks (See Appendices 2.A).

Leisure time exercise questionnaire

Data about frequency of physical activity including strenuous, moderate, and mild exercise, as well as leisure time were collected using a questionnaire developed by Godin and Shephard (1985) to monitor changes in physical activity throughout the two-year period. An activity score in arbitrary units was determined by summing the number of episodes of each type of activity multiplied by its assigned metabolic equivalents (9, 5, and 3 for strenuous, moderate, and mild activity, respectively).

3-day food record (FR)

Each participant was instructed to describe all foods and beverages consumed immediately after eating for three consecutive days including two weekdays (M-Th) and one weekend day (F-Su) using a food record (FR) booklet. The participant was also instructed to record time eaten, type of meal occasion, amount consumed, where and with whom the meal or snack was consumed, and preparation methods/recipes. The FR booklet included reduced-scale photographs of representative selected foods from serving size materials developed and used by others (Kolar et al. 2005) and also contained an example of a completed day's record which described the foods in adequate detail. The baseline session included an 11-minute instructional DVD video which reviewed the instructions according to the FR booklet and illustrated measurement and estimation procedures for example meals and snacks. Data from the FR booklet were entered into the Nutrition Data System for Research software program (NDSR) (version 2008 and

2009, Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN) by University of Minnesota nutrition students trained in the use of NDSR. For the follow-up sessions, participants were mailed the questionnaires and FR booklet prior to their scheduled session and asked to bring the completed forms to the session.

Serving sizes for food groups were determined as indicated by NDSR and were grouped by combining similar foods according to MyPyramid food groups (United States Department of Agriculture 2009). Fruits included whole, canned, or dried fruit, 100% fruit juice, and avocado. Vegetables included all raw or cooked (not including fried) vegetables, potatoes and other starchy vegetables, legumes, and vegetable juice. Grains (refined or whole grain) were represented by breads, crackers, pasta, cereals, cakes, cookies, snack bars, popcorn and chips. Two dairy groups included 1) regular dairy (whole and non-reduced fat milk, cheese, and yogurt) and 2) reduced-fat dairy (reduced-fat and fat-free milk, cheese, and yogurt). Added fats included regular margarine, oil, shortening, butter and animal fats, salad dressings, and gravy.

Anthropometric measurements

Height, weight, and waist circumferences were measured using a standardized protocol (Lohman 1991) by project staff trained in anthropometric data collection according to standard procedures (Centers for Disease Control and Prevention 2004). Height was measured barefoot using a stadiometer (Seca 202, Hanover, MD) to the nearest 0.1 cm. Weight was measured barefoot and in light clothing on a digital scale to the nearest 0.1 kg (Tanita BWB-800P Digital Medical Scale, Arlington Heights, IL). Scales were calibrated prior to use with standard weights (Mettler-Toledo Calibration weights, Columbus, OH). Waist circumference was measured to the nearest 0.1 cm with

waist measured at the narrowest point between the iliac crest and the lowest rib with a non-flexible tape measure. All measurements were done in the morning after an overnight fast in triplicate and a mean calculated for analysis. Body mass index was calculated by dividing weight (kg) by height (m) squared.

Data Analysis

Descriptive statistics for demographic characteristics of study subjects include means and standard deviations (SD) for quantitative characteristics and number (%) for categorical characteristics. At baseline, between-group differences were assessed with chi-square tests for categorical demographic characteristics and with two sample t-tests for age and household composition. Mixed linear models were used to account for the correlations between repeated measurements of the outcome variables (weight, BMI, waist circumference, and nutrient and food group intakes) within each subject in the study. The toeplitz covariance structure, appropriate for study designs with equal time intervals between measurements, was specified for these models. Results from the mixed models include Least Squares (LS) means (means adjusted for the within-subject correlation of the measurements) at each measurement time for each group; F-tests for the intervention effect on change in outcome variables over time (with p-values <0.05 for the group by time interaction indicating a significant intervention effect); and t-tests of between-group differences in LS means at each time point. Chi-square tests were also used to evaluate between-group differences in the proportion of women with improvement in need states from baseline to six months and 24 months. Significance was set at $p < 0.05$ for all tests. Statistical Analysis Software (version 9.2, copyright 2002-2008; SAS Institute, Cary, NC) was used for all statistical analyses.

Subgroup Analyses

Mixed models were used to determine intervention effects on weight, waist circumferences, BMI, and nutrient and food group intakes for each of the two subgroups, 1) women reporting experiencing less-healthy need states at baseline and 2) overweight or obese women at baseline. These two subgroups of women were of interest because of the possible higher risk of weight gain.

RESULTS

Participants

Most women in both groups were non-Hispanic white, married and living with a spouse, employed full or part time, and had completed some college or had a college degree (Table 5.2). Total household income for most women (79.4%) was >\$40,000/year. No significant differences were observed in menopausal status at baseline and no differences were observed between cohorts (data not shown). After adjusting for multiple comparisons, physical activity levels and activity scores were not significantly different between the intervention and control groups at baseline (data not shown).

Mean baseline BMI was in the overweight range for both the intervention (28.0 kg/m²) and control groups (27.5 kg/m²; Table 5.3). Women in the intervention group gained 0.2 kg over the two year period, while women in the control group gained 0.4 kg. Waist circumference decreased by 0.3 cm in the intervention group and by 0.1 cm in the control group. Over the two-year period, BMI increased by 0.1 unit in the intervention group and by 0.6 units in the control group. These differences were not significant over

the two year period or at any of the time points for those completing the study (weight measured at baseline and 24 months).

Throughout the course of the two years, 63 participants (17.8%) dropped out (no 24-month weight data) of the study; 48 participants (13.6%) between baseline and six months. Lack of time was the most common reason given. Participants who dropped out of the study between baseline and 6 months tended to have a higher weight ($p=0.01$), waist circumference ($p=0.007$), and BMI ($p=0.03$), lower levels of education ($p=0.02$) and income ($p=0.0001$), and were more likely to be nonwhite ($p=0.003$) compared to participants who completed the study.

Need States

The frequency of experiencing healthy versus less-healthy need states did not differ significantly between groups at baseline. From baseline to 6 months (immediately following the counseling intervention), a larger proportion (23.4%) of women in the intervention group reported an increased number of healthy need states compared to the control group (15.4%; $p=0.08$). However, significant differences between groups were observed at 12- ($p=0.03$) and 24-months ($p=0.02$) with the intervention group reporting more healthy need states than the control group (data not shown).

Energy, Nutrient, and Food Group Intake

Energy intake did not differ significantly between the intervention and control group at any of the time points (Table 5.4). Only a few changes were observed in nutrient intakes over the two-year period. Saturated fat intake was lower in the intervention group compared to the control group at 6, 18, and 24 months (overall $p=0.02$ over the two-year period). Total fat intake was similar with the intervention group

having lower intakes compared to the control group at 6 and 24 months ($p=0.06$). Total cholesterol at baseline was significantly higher in the intervention group compared to the control group. However, the intervention group decreased their intake at 6 months and at 24 months, which was less than the control group ($p=0.01$).

Several changes were observed in food group intakes. By 24 months, the intervention group had increased their intake of fruit servings from 1.5 servings/day at baseline to 2.0 servings ($p=0.02$) while fruit intake in the control group remained the same. Similarly, the intervention group increased their intake of low/reduced fat dairy products by 12 months from 1.1 servings at baseline to 1.3 servings at 12 months ($p=0.04$). A significant difference at baseline was observed in the number of servings of sugars and candy between the intervention and control group (1.4 vs. 1.1 servings/day, respectively); however, the intervention group decreased their number of servings by 6 months, while the control group intake remained the same (0.8 vs. 1.1 servings/day, respectively; $p=0.002$).

Less-Healthy Need States at Baseline Subgroup Analysis

At baseline, 130 women were identified as having two less-healthy need states (Intervention $n=71$; Control $n=59$). Similar to the mixed model results for all women, there was no statistically significant intervention effect on the primary outcomes of change in weight, waist circumference, or BMI. Over the course of the two years, weight decreased in the intervention subgroup from 78.7 to 78.4 kg, while weight in the control subgroup increased from 75.4 to 76.0 kg. A slight decrease in BMI was observed in the intervention subgroup from 29.2 to 29.1 kg/m^2 while BMI increased from 28.2 to 28.4

kg/m² in the control subgroup. Waist circumference decreased in both groups with a larger decrease in the intervention group (similar to the overall effect).

Overweight or Obese at Baseline Subgroup Analysis

At baseline, 219 women were identified as being overweight or obese (Intervention n=116; Control n=103). Mixed model results for the primary study outcomes of change in weight, waist circumference, and BMI were similar to the overall study results in that there were no significant intervention effects in these outcomes. However, the patterns of change from baseline were different in this subgroup of overweight and obese women in the intervention group compared to the control group. Weight decreased in the intervention group (86.0 to 85.5 kg) and increased in the control group (82.8 to 83.4 kg). Similarly, BMI decreased in the intervention group (31.4 to 31.2 kg/m²) and increased in the control group (30.8 to 31.1 kg/m²). Waist circumference decreased in the intervention group from 92.9 to 92.0 cm while no change was observed in the control group (90.5 cm).

DISCUSSION

This study evaluated the effectiveness of a six-month individual nutrition counseling intervention tailored to the most frequently experienced eating occasion need states to prevent weight gain in midlife women aged 40-60 years. Although the main goal of the study was to prevent weight gain, the mixed models analysis that accounts for repeated measures over time did not identify a significant intervention effect for any of the primary anthropometric measurements. Although not significant, small decreases in weight and BMI were observed in the intervention group at 6 months. Over the course of the two years however, both groups had only a slight increase in weight with the

intervention group having a smaller increase than the control group (0.1 vs. 0.2 kg/year respectively). Similarly both groups had decreases in waist circumference with the intervention group having a larger decrease than the control group (0.3 cm vs. 0.1 cm). While previous studies have documented weight gain in the range of 0.2-0.7 kg/year (0.4-1.4 kg/2 years) for women during their midlife years (Lee et al. 2010, Sternfield et al. 2004), weight gain in the intervention group in this study was less than what has previously been reported. Weight gain among women in the control group was closer to that reported previously. The lack of differences between the two groups could possibly be due to monitoring effects on the control group over the two year period.

While the subgroup analyses did not show significant intervention effects on weight outcomes the pattern of weight change in both subgroups, a decrease in the intervention group and an increase in the control group, was consistent with expected intervention effects. The same pattern was observed for BMI with a decrease in the intervention group and an increase in the control group among the overweight and obese subgroup. While these results were not significant, they are in the right direction for the intervention group, suggesting that need state interventions may be more effective in women who are overweight or obese or report less-healthy need states more frequently.

Possible intervention effects on changing less-healthy need states over time may be due to counseling. Need state intervention may increase the frequency of healthy need states by encouraging those who experience less-healthy need states to think more about health. For example, those often experiencing fast fueling occasions may still have the need to eat quickly but be more inclined to choose balanced and healthy foods. Similarly, women often experiencing nurturing family meals tend to focus on their family

and loved ones' needs and wants and sacrifice their own personal nutritional needs. The intervention may have helped to change their internal motivation to focus more on caring for themselves as in sensible meals occasions.

Over the course of the two years, the intervention group had a significant decrease in saturated fat, cholesterol, and servings of sugars and candy, as well as significant increases in fruit servings, while the control group remained the same in their saturated fat, fruit, sugars and candy intakes, and had an increase in cholesterol. Women in the intervention group were educated on healthier options and encouraged to switch to more whole grains, and reduce their fat and sugar consumption. Although no significant differences were observed in the number of whole grains consumed, a trend toward decreased refined grain consumption was observed in the intervention group with a significant difference between groups at 12 months. The shift toward a healthier need state may have played a role in this improvement in nutrient and food group intakes. Previous studies (Sudo et al. 2009, Perry et al. 2010 – Chapter 4) have demonstrated that need state occasions with a health orientation tend to be lower in calories and higher in fruits and vegetable than those with an emotional orientation (i.e. indulgent escapes).

Other studies have shown that the more tailored the program, the better successes people have. Allcock et al. (2010) were able to increase fruit and vegetable consumption in veterans by using tailored messages and motivating interviewing calls. The participants who perceived the messages as important, relevant to them, and applicable did better than those who did not receive tailored messages. Similarly, Kroeze et al. (2006) demonstrated in a systematic review that interventions tailored to the participants had better outcomes than participants given generic information. In the current study, a

majority of women indicated in post-intervention satisfaction surveys that lesson topics were relevant and provided information they could use to make eating behavior changes.

Study limitations include using self-reported dietary food records for food and nutrient data collections, which have often been criticized as being inaccurate (Hill and Davies 2001). However, an instructional DVD along with pictures to use as guides were provided to improve accuracy. Furthermore, participants were instructed to complete the food record during or immediately after food consumption to minimize error. In addition, the majority of records were checked with the participant present and all records were checked by a dietitian or by a nutrition student trained in FR data collection to get more detail on items where information may have been lacking. Similarly, data were collected for three days at each time point to obtain an average day's intake. The study aimed to enroll women by race/ethnic group proportions similar to census data from the Minneapolis/St. Paul metropolitan areas. However, participants were more educated and had a higher income than the general population; therefore, results cannot be generalized to a broader group of midlife women.

CONCLUSIONS

This study provides evidence that tailoring nutrition education according to most frequently experienced eating occasion need states may, over time, lead to improved weight outcomes in overweight or obese women who often experience less-healthy need states. However, the intervention approach may be less helpful for normal weight women already experiencing healthy need states. To the best of our knowledge, this is the only nutrition counseling intervention tailored to eating occasion need states instead of individual characteristics. Future application of this approach should include

consideration of current weight status and type of eating occasion need states commonly experienced.

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Table 5.1. Need state characteristics and lesson topics

Need State	Healthy			Less-healthy		
	Healthy Express	Comforting Interludes	Sensible Meals	Nurturing Family Meals	Indulgent Escapes	Fast Fueling
Defining needs	<ul style="list-style-type: none"> • Eat healthy and quickly • Balance and control food & calorie intakes • Minimize time and effort 	<ul style="list-style-type: none"> • Personal moment, relax/unwind • Enjoy light meal or snack • Sensory gratification • Easy • Somewhat healthy, eat light 	<ul style="list-style-type: none"> • Eat healthy and responsibly • Control weight • Control calorie, fat, cholesterol, carbohydrate intakes 	<ul style="list-style-type: none"> • Show love, driven by emotional needs as caregiver • Family time with minimal complaints • Likely forsaking personal nutritional needs 	<ul style="list-style-type: none"> • Indulgent treat/reward • Focus on taste experience • Sensory gratification • Emotional benefit 	<ul style="list-style-type: none"> • Catch a quick bite, on the run • Eat quickly • Eat while doing other things • Dictated by time
Foods sought	<ul style="list-style-type: none"> • Minimal effort, preparation, clean-up • Fast but still healthy • Low fat, sodium • Nutrient dense 	<ul style="list-style-type: none"> • Satisfies craving • Fun to eat • Easy and fast, portable • Somewhat healthy 	<ul style="list-style-type: none"> • Healthy • Low in calories, fat, cholesterol, carbohydrates • Nutrient dense 	<ul style="list-style-type: none"> • Enjoyed by everyone • Nutritionally balanced • Within family budget 	<ul style="list-style-type: none"> • Satisfies cravings • Readily available • Treat, rich/indulgent • Easy to eat • Nostalgic connection 	<ul style="list-style-type: none"> • Minimal effort, planning, preparation, clean-up • Fast and ready to eat/portable • Easy to eat
Situation	<ul style="list-style-type: none"> • Breakfast/lunch • Alone • Weekday • At home or carried along 	<ul style="list-style-type: none"> • Breakfast/snack • Alone or with other adults • At home or away 	<ul style="list-style-type: none"> • Main meals • Alone or with other adults • At home 	<ul style="list-style-type: none"> • Dinner • Other adults and children • At home 	<ul style="list-style-type: none"> • Snacks • Alone • At home or restaurant 	<ul style="list-style-type: none"> • Lunch • Alone • At home or carried along
Lesson topics	<ul style="list-style-type: none"> • Portion sizes • Time-saving strategies • Convenience foods • Nutrition information 	<ul style="list-style-type: none"> • Trigger identification, hunger scale use • Engage senses • Work/home environment changes • Alternative rewards 	<ul style="list-style-type: none"> • Perceived vs. actually healthy foods • Health/nutrition claims on labels • Weekly meal plan • Recipe makeovers 	<ul style="list-style-type: none"> • Need and barrier identification • Meal planning • Grocery shopping tactics • Compare labels 	<ul style="list-style-type: none"> • Emotional vs. physical hunger, hunger scale • Non-food rewards • Compensation • Healthier options • Strategies and plans 	<ul style="list-style-type: none"> • Healthy, on-the-go options, meal planning • Work/home environment changes • Nutritional cost of fast-food meals • Beverage calories

Table 5.2. Baseline demographic characteristics

Variable	All Participants n=354 n (%)	Intervention Group n=185 n (%)	Control Group n=169 n (%)	p Value (χ^2 test)
Race				
White	275 (77.7)	140 (75.7)	135 (79.9)	0.64
Black	32 (9.0)	20 (10.8)	12 (7.1)	
Asian	18 (5.1)	9 (4.9)	9 (5.3)	
Native American	1 (0.3)	1 (0.5)	0 (0.0)	
Other	28 (7.9)	15 (8.1)	13 (7.7)	
Spanish Origin				
Non-Hispanic	333 (94.1)	174 (94.1)	159 (94.1)	0.99
Hispanic	21 (5.9)	11 (5.9)	10 (2.8)	
Marital Status				
Never Married	29 (8.2)	17 (9.2)	12 (7.1)	0.42
Married	272 (76.8)	136 (73.5)	136 (80.5)	
Married, not Living with Spouse	4 (1.1)	3 (1.6)	1 (0.6)	
Divorced/Widowed	49 (13.9)	29 (15.7)	20 (11.8)	
Income				
<20K	16 (4.5)	9 (4.9)	7 (4.1)	0.88
20-40K	39 (11.0)	24 (13.0)	15 (8.9)	
40-60K	64 (18.1)	33 (17.8)	31 (18.3)	
60-80K	61 (17.2)	31 (16.8)	30 (17.8)	
80-100K	54 (15.3)	28 (15.1)	26 (15.4)	
>100K	103 (29.1)	53 (28.6)	50 (29.6)	
Refused	17 (4.8)	7 (3.8)	10 (5.9)	
Employment				
Full-time	171 (48.3)	85 (46.0)	86 (50.9)	0.07
Part-time	104 (29.4)	48 (25.9)	56 (33.1)	
Not Employed	37 (10.4)	23 (12.4)	14 (8.3)	
Homemaker	36 (10.2)	4 (13.0)	12 (7.1)	
Retired	6 (1.7)	5 (2.7)	1 (0.6)	
Education				
High School	25 (7.1)	13 (7.0)	12 (7.1)	0.39
Some College	86 (24.3)	51 (27.6)	35 (20.7)	
2-Year College	62 (17.5)	35 (18.9)	27 (16.0)	
4-Year College	144 (40.7)	70 (37.8)	74 (43.8)	
Graduate School	37 (10.4)	16 (8.7)	21 (12.4)	
Age (years)				
	Mean (SD)	Mean (SD)	Mean (SD)	p Value (t test)
Age (years)	50.1 (5.1)	49.9 (5.1)	50.4 (5.1)	0.31
Household Design				
	Mean (SD)	Mean (SD)	Mean (SD)	
# of Adults in Household	2.2 (0.8)	2.2 (0.9)	2.2 (0.7)	0.99
# of Children in Household	0.9 (1.2)	1.0 (1.2)	0.8 (1.1)	0.16

Table 5.3. Anthropometric data from women

	Baseline		6 months		12 months		18 months		24 months		Overall Mixed Model p Value (F test)
	Intervention mean (SE)	Control mean (SE)	Intervention mean (SE)	Control mean (SE)	Intervention mean (SE)	Control mean (SE)	Intervention mean (SE)	Control mean (SE)	Intervention mean (SE)	Control mean (SE)	
All women	(n=185)	(n=169)	(n=169)	(n=137)	(n=156)	(n=143)	(n=152)	(n=135)	(n=154)	(n=137)	
Weight (kg)	76.6 (1.3)	74.2 (1.4)	76.1 (1.3)	74.2 (1.4)	76.5 (1.3)	74.4 (1.4)	76.3 (1.3)	74.2 (1.4)	76.8 (1.3)	74.6 (1.4)	0.38
BMI (kg/m ²)	28.0 (0.5)	27.5 (0.5)	27.8 (0.5)	27.5 (0.5)	27.9 (0.5)	27.6 (0.5)	27.9 (0.5) [‡]	27.5 (0.5)	28.1 (0.5)	28.1 (0.5)	0.76
Waist circumference (cm)	85.4 (1.0)	83.7 (1.0)	84.5 (1.0)	83.2 (1.0)*	85.2 (1.0)	83.6 (1.0)	85.2 (1.0)	83.3 (1.0)	85.1 (1.0)	83.6 (1.0)	0.75
Women with 2 Problem Need States at Baseline	(n=71)	(n=59)	(n=61)	(n=43)	(n=58)	(n=47)	(n=54)	(n=44)	(n=56)	(n=45)	
Weight (kg)	78.7 (2.1)	75.4 (2.3)	78.4 (2.1)	75.7 (2.3)	78.7 (2.1)	75.6 (2.3)	78.4 (2.1)	75.4 (2.3)	78.4 (2.1)	76.0 (2.3)	0.36
BMI (kg/m ²)	29.2 (0.7)	28.2 (0.8)	29.2 (0.7)	28.4 (0.8)	29.2 (0.7)	28.4 (0.8)	29.0 (0.7)	28.2 (0.8)	29.1 (0.7)	28.4 (0.8)	0.67
Waist circumference (cm)	88.3 (1.6)	85.2 (1.7)	87.3 (1.6)	84.5 (1.7)	87.6 (1.6)	84.4 (1.7)	87.2 (1.6)	84.2 (1.8)	87.1 (1.6)	84.8 (1.8)	0.88
Overweight women	(n=116)	(n=103)	(n=104)	(n=78)	(n=95)	(n=83)	(n=91)	(n=79)	(n=93)	(n=80)	
Weight (kg)	86.0 (1.5)	82.8 (1.6)	85.2 (1.5)	82.7 (1.6)	85.5 (1.6)	82.8 (1.7)	85.2 (1.6)	82.6 (1.7)	85.4 (1.6)	83.4 (1.7)	0.41
BMI (kg/m ²)	31.4 (0.5)	30.8 (0.5)	31.1 (0.5)	30.7 (0.5)	31.3 (0.5)	30.7 (0.5)	31.1 (0.5)	30.7 (0.5)	31.2 (0.5)	31.1 (0.5)	0.41
Waist circumference (cm)	92.9 (1.1)	90.5 (1.2)	91.6 (1.1)	89.5 (1.2)	92.4 (1.1)	90.2 (1.2)	92.1 (1.1)	89.6 (1.2)	92.0 (1.1)	90.5 (1.2)	0.52

*n=138

Table 5.4. Energy, nutrients, and food groups

Dietary Variable ¹	Baseline		6 months		12 months		18 months		24 months		Overall Mixed Model P Value (F test)
	Intervention (n=174) mean (SE)	Control (n=148) mean (SE)	Intervention (n=167) mean (SE)	Control (n=139) mean (SE)	Intervention (n=152) mean (SE)	Control (n=138) mean (SE)	Intervention (n=151) mean (SE)	Control (n=133) mean (SE)	Intervention (n=154) mean (SE)	Control (n=135) mean (SE)	
Energy, Kcal	1776 (35.8)	1742 (38.6)	1654 (36.3)	1721 (39.4)	1683 (37.3)	1660 (39.4)	1673 (37.6)	1664 (40.0)	1623.2 (37.5)	1695 (40.0)	0.11
Total Fat, g	71.6 (2.0)	69.1 (2.1)	64.8 (2.0)	68.2 (2.2)	65.9 (2.0)	63.0 (2.2)	65.6 (2.1)	65.0 (2.2)	61.4 (2.1)	64.7 (2.2)	0.06
Saturated Fat, g	24.2 (0.7)	23.8 (0.8)	21.4 (0.7)	22.9 (0.8)	21.9 (0.8)	20.5 (0.8)	21.4 (0.8)	22.0 (0.8)	19.9 (0.8) [‡]	21.8 (0.8) [‡]	0.02
Cholesterol, mg	254 (9.2) [†]	212 (10.0) [†]	207 (9.4)	204 (10.2)	220 (9.8)	204 (10.3)	229 (9.8)	218 (10.4)	217 (9.7)	230 (10.4)	0.01
Sodium, mg	2976 (65.8)	2864 (71.1)	2746 (66.9)	2694 (72.8)	2871 (69.4)	2856 (73.1)	2944 (69.7) [‡]	2748 (74.3) [‡]	2742 (69.5)	2813 (74.1)	0.16
Total Carbohydrate, g	214 (5.0)	211 (5.4)	204 (5.0)	210 (5.5)	203 (5.2)	208 (5.5)	203 (5.2)	202 (5.5)	201 (5.2)	208 (5.5)	0.59
Total Fiber, g	18.1 (0.6)	19.1 (0.6)	19.4 (0.6)	19.6 (0.6)	18.7 (0.6)	18.7 (0.6)	18.7 (0.6)	18.5 (0.6)	18.6 (0.6)	19.3 (0.6)	0.63
Total Protein, g	71.3 (1.5)	68.6 (1.6)	69.2 (1.5)	68.1 (1.6)	72.0 (1.5) [†]	66.0 (1.6) [†]	70.7 (1.5)	67.7 (1.6)	69.6 (1.5)	69.5 (1.6)	0.13
Fruit²	1.5 (0.1)	1.6 (0.1)	1.7 (0.1)	1.8 (0.1)	1.6 (0.1)	1.5 (0.1)	1.7 (0.1)	1.5 (0.1)	2.0 (0.1) [†]	1.5 (0.1) [†]	0.02
Vegetable²	2.6 (0.1)	2.8 (0.1)	2.9 (0.1)	3.1 (0.1)	2.9 (0.1)	2.8 (0.1)	2.8 (0.1)	2.9 (0.1)	2.8 (0.1)	3.0 (0.1)	0.55
Whole Grains²	1.2 (0.1)	1.3 (0.1)	1.4 (0.1)	1.3 (0.1)	1.5 (0.1)	1.4 (0.1)	1.3 (0.1)	1.2 (0.1)	1.2 (0.1)	1.3 (0.1)	0.50
Refined Grains²	3.8 (0.1)	3.6 (0.2)	3.1 (0.1)	3.3 (0.1)	2.9 (0.2) [†]	3.4 (0.2) [†]	3.1 (0.2)	3.2 (0.2)	3.0 (0.2)	3.3 (0.2)	0.08
Regular Meat²	1.8 (0.1)	1.7 (0.1)	1.8 (0.1)	1.7 (0.1)	1.8 (0.1) [†]	1.4 (0.1) [†]	1.8 (0.1) [‡]	1.5 (0.1) [‡]	1.6 (0.1)	1.5 (0.1)	0.41
Lean Meat²	1.4 (0.1) [†]	1.1 (0.1) [†]	1.3 (0.1)	1.2 (0.1)	1.5 (0.1)	1.3 (0.1)	1.5 (0.1)	1.3 (0.1)	1.6 (0.1) [‡]	1.3 (0.1) [‡]	0.70
Whole Dairy²	0.4 (0.0)	0.4 (0.0)	0.4 (0.0)	0.4 (0.0)	0.4 (0.0)	0.4 (0.0)	0.3 (0.0) [†]	0.4 (0.0) [†]	0.3 (0.0)	0.4 (0.0)	0.11
Low/Reduced Fat Dairy²	1.1 (0.1)	1.1 (0.1)	1.2 (0.1)	1.1 (0.1)	1.3 (0.1) [†]	1.0 (0.1) [†]	1.2 (0.1)	1.1 (0.1)	1.1 (0.1)	1.1 (0.1)	0.04
Sugars and Candy²	1.4 (0.1) [†]	1.1 (0.1) [†]	0.8 (0.1) [†]	1.1 (0.1) [†]	0.9 (0.1)	1.0 (0.1)	1.0 (0.1)	0.8 (0.1)	0.9 (0.1)	1.0 (0.1)	0.002
Added Fats²	2.6 (0.1)	2.6 (0.1)	2.2 (0.1) [‡]	2.6 (0.1) [‡]	2.0 (0.1)	2.1 (0.1)	2.1 (0.1)	2.1 (0.1)	1.7 (0.1)	2.0 (0.1)	0.42

¹ Nutrients, but not food groups, are standardized to amount per 1000 kcal

² Serving sizes are based on the recommendations made by the Dietary Guidelines for Americans 2005 and the Food and Drug Administration.

‡p<0.10 between groups at that time point

†p<0.05 between groups at that time point

**Chapter VI: Individual, Situation-Based Nutrition Counseling in
Midlife Women Process Evaluation**

INDIVIDUAL, SITUATION-BASED NUTRITION COUNSELING IN MIDLIFE WOMEN PROCESS EVALUATION

INTRODUCTION

Weight gain during midlife (40-60 years) may increase risk of chronic diseases such as cardiovascular disease (De Michele et al. 2002) and type 2 diabetes (Carr 2003). Preventing weight gain during midlife can be an important factor in lowering prevalence of chronic disease.

Segmentation analysis is one method of understanding the differences in consumer behaviors and attitudes regarding food intake and health (Byrd-Bredbenner et al. 2008; NPD Group 2011). In addition to grouping people by behavioral and attitudinal characteristics, researchers have segmented eating occasions into need state segments (Sudo et al. 2009; Perry et al. 2010 – Chapter 4). Need states are defined as the inner and outer influences that impact purchase and consumption decisions (Leith and Riley 1998). Understanding need states relevant to specific eating occasions may be helpful in developing strategies to modify food choice decisions that result in intake of less healthy foods which could contribute to weight gain over time.

Tailored nutrition education has been shown to improve long-term diet quality in adults (Eyles et al. 2009). Therefore, an intervention tailored to eating occasion need states experienced by midlife women may be effective in preventing weight gain.

INDIVIDUALIZED SITUATION-BASED NUTRITION COUNSELING (INSNC)

Curriculum

A curriculum was developed for the InSNC intervention to tailor dietitian-led counseling to eating occasion need states experienced most often by InSNC participants.

Learning objectives were developed for three lessons for each of six need states based on the descriptions previously reported (Perry et al. 2010 – Chapter 4). These included: 1) healthy express; 2) comforting interludes; 3) indulgent escapes; 4) nurturing family meals; 5) sensible meals; and 6) fast fueling. Using the Social-Ecological Model as a theoretical framework (Story et al. 2008), instructional activities and handouts were developed by researchers using existing nutrition education materials available from various sources (Table 6.1). Lessons one and two were used to collect needs assessment data and deliver general/basic nutrition information, respectively. The following eight lessons were tailored to each participant based on the need states they experienced most often as determined by a typing algorithm. Healthy express lessons focused on changing current choices for foods that needed to be prepared and eaten quickly. Comforting interludes lessons connected healthier foods with comfort and relaxation and focused on eliminating overeating in the absence of hunger. Indulgent escape lessons helped women find healthier food options to satisfy emotional needs. Nurturing family meals lessons provided family-friendly menus and recipes that were more nutritionally balanced while sensible meals lessons provided healthy eating recommendations and tips for making weekday healthy meals easy. Fast fueling lessons focused on making healthy, on-the-go food and beverage selections and determining how to modify the home/office environment so that healthy foods were available.

Three lessons were delivered for each of the two need states experienced most often by the individual and two lessons for the third most commonly experienced need state. Homework was often assigned which usually involved having women try a

suggested strategy or record intake for meals or snacks, and participants were encouraged to set goals at the end of each lesson.

Process Evaluation

Lesson outcome forms

The curriculum was intended to be delivered through ten 1-hour individual sessions led by a registered dietitian over the course of six months. Dietitians completed a lesson outcome form after each lesson to document time and location, topic, meeting goals and whether the lessons were taught as intended or modified. More than 95% of intervention group participants attended at least nine lessons. The mean number of days between sessions was 15.7 ± 6.4 days with each lesson lasting approximately 64 ± 14 minutes. Most lessons (88%) took place in the morning or afternoon at the participant's home or nearby coffee shop. Nearly 88% of women reported achieving most or all of the goals they had set the previous week, and 91% of participants set future goals when applicable. Dietitians reported approximately 80% of the lessons being taught as intended. The most common reason for not teaching the lesson as intended was that the content was not relevant to the participant or lack of time during the session.

Observations of lessons by researchers

With permission from participants, researchers monitored the implementation of the intervention by observing fifteen lessons during each cohort. Each dietitian was observed by three researchers separately during one lesson for each cohort group to ensure that the lessons were being delivered as intended according to the lesson plan. The researchers took notes during the lesson and then discussed the manner in which the lesson was delivered with the dietitian following the lesson. Reasons for not teaching the

lesson as intended were discussed and documented in the lesson outcome form for that particular lesson.

Interview results

At the end of the intervention phase, 21 intervention group participants took part in an individual interview (from both cohorts 1 and 2). The individual interviews were conducted to explore how women experienced the intervention. Notes were taken during the interview and similar answers were grouped into like-responses for analysis. Overall, there was consensus among the respondents that the topics and activities were useful and relevant. Some qualified their responses as being mostly relevant because the information was not new to them, rather a “review of the basics”, “reminder”, or “reinforcement.” Approximately half found the process of setting goals and doing the assigned homework useful. Those who found the process useful indicated that they used the goal setting process to re-emphasize lesson content, think about choices, and plan ahead. Those who did not find the process useful indicated they had too little time or too many other activities and did not feel as though they could work on the goals they set.

Most women indicated their level of motivation to work on the goals was >5 on a scale of 1-10 where 1 was not at all motivated and 10 was highly motivated with a mean of 7.5. Overall, there was a consensus among the women that the topics were useful for making healthy changes to their diets. The most useful topics included portion/serving sizes, reading food labels, and making healthy choices by focusing on food pyramid group intake. Lack of time and motivation were the primary barriers preventing women from using the information provided. Most of the respondents (95% or n=20) indicated they kept the materials and about half indicated they referred back to them periodically.

A few participants reported posting the materials in a location where they could be easily accessed. Only two respondents did not keep the materials or could not find them.

Most respondents felt the length and frequency of the meetings were adequate. A few wanted to meet for longer than 10 weeks or for more than an hour at a time. The overall satisfaction with the study on a scale of 1-10 where 1 is not at all satisfied and 10 is very satisfied ranged from 5-10 with a mean of 8.7. Respondents told interviewers they learned a lot, the program was helpful and informative, and met their expectations. Approximately 95% (n=20) of the respondents reported that it was worth the effort to meet with the dietitian over the 10-week period, and all respondents told interviewers they would recommend the study to other women.

Survey results

Women from cohort 2 (n=89) were asked to complete a satisfaction survey (See Appendices 2.B). Survey questions and responses are listed in Table 6.2. Of those completing the survey (n=71; response rate = 80%), 99% of the women thought the information covered in the lessons was relevant to them. Although 63% reported that they had heard the information before, 86% indicated it helped them to make changes to eat healthier. Most (~95%) felt that the lessons helped to motivate them and gave them confidence (90%) in their ability to change their eating habits. Nearly all participants completing the survey indicated they intended to maintain the changes (97%) they made as a result of the lessons and would recommend (96%) the study to their friends and family.

IMPLICATIONS/CONCLUSIONS

The overall consensus among respondents was that the intervention was a positive experience. Most participants in the intervention group finished the six-month series of intervention sessions and reported that they would recommend participation to other women, indicating that the length and time commitment were feasible. Most participants indicated the topics were relevant to their lives, confirming the usefulness of determining need states and tailoring counseling to each woman based on her most frequently experienced need state. Other studies have shown that the more tailored the program is, the better successes people have. Allicock et al. (2010) were able to increase fruit and vegetable consumption in veterans by using tailored messages and motivational interview calls. The participants who perceived the messages as important, relevant to them, and applicable did better than those who did not receive tailored messages. Similarly, Kroeze et al. (2006) demonstrated in a systematic review that interventions tailored to participant's behaviors had better outcomes than when participants were given generic information.

To the best of our knowledge, this is the first nutrition education study based on the most common eating occasion need states rather than personal characteristics of participants. Segmenting eating occasions introduces a new way to approach the needs of midlife women in relation to food choice and offers an innovative way to tailor each nutrition education lesson toward the individual based on her behavior and the situational context of eating occasions. Overweight or obese women or those who experience less-healthy need states more frequently may benefit more from tailoring and may have

greater improvement in weight outcomes compared to normal weight women or those who experience healthy need states more often.

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Table 6.1. Lesson descriptions

Lesson Name	Objective	Activities
Needs Assessment	<ul style="list-style-type: none"> • For the researcher to understand the physical home and work environment as well as the social or family environment 	<ul style="list-style-type: none"> • Needs Assessment questionnaire: Household composition, employment, meal patterns, and eating out habits, and schedules and responsibilities related to food preparation and grocery shopping,
Basic Nutrition	<ul style="list-style-type: none"> • Learn basic nutrition information to give them a foundation of knowledge to build on in future lessons 	<ul style="list-style-type: none"> • Portion size visuals (balls, dice, cards, Serving Sizes are in your Hand) • Calorie budgeting • MyPyramid
Healthy Express 1	<ul style="list-style-type: none"> • Identify components of healthy and balanced meals • Plan menus for convenient healthy meals • Identify time-saving strategies for preparing meals • Modify home/work environment 	<ul style="list-style-type: none"> • Meal planning on-the-go (MyPyramid; Healthy Express calendar) • Putting the “Fast” in breakfast (Tips for Healthy Express Meals) • Go healthy and keep going (Fiber FAQs)
Healthy Express 2	<ul style="list-style-type: none"> • Assess on-the-go choices (fast food, convenience store) • Examine convenience items such as meal replacement bars/beverages • Recognize how beverages affect calorie intake 	<ul style="list-style-type: none"> • Stop-n-Go Eating Handout • Adding it up • Beyond fast food restaurants (Making Healthy Choices Worksheet) • Bar Exam (Snack bar comparison chart) • Rethink Your Drink handout
Healthy Express 3	<ul style="list-style-type: none"> • Find reliable web/print nutrition information • Incorporate foods made from new and healthy recipes into meals • Understand the benefits of eating organic foods and “superfoods” 	<ul style="list-style-type: none"> • Be Web Aware (Evaluating Health Resources on the Web Handout) • Using New Recipes (Tips for Healthier Substitutes) • Organic Foods 101 (Shopper’s Guide to Pesticides in Produce) • Superfoods handout
Comforting Interludes 1	<ul style="list-style-type: none"> • Describe the importance of eating a healthy breakfast and snacks • Make a list of comfort foods • Identify emotional and environmental triggers • Complete hunger scale 	<ul style="list-style-type: none"> • Breakfast and Snack benefits (Snack Scale Teacher Tool) • Comfort foods worksheet • Emotional triggers and environmental scan worksheets • Hunger scale and hunger/satiety cards
Comforting Interludes 2	<ul style="list-style-type: none"> • Describe 5/20 rule when reading labels • Eat a breakfast/snack with appropriate portion size • Plan healthy, convenient, and portable breakfast/snack 	<ul style="list-style-type: none"> • 5/20 rule description using a food label • Portion Distortion Quiz (Tips to Control Portion Size) • Menu Planner worksheet

Table 6.1. Lesson descriptions (Continued)

Lesson Name	Objective	Activities
Comforting Interludes 3	<ul style="list-style-type: none"> • Recognize how environment can affect food choices for comfort • Describe how modifying comfort foods improves diet quality • Choose healthier options for comfort food • Include other activities or rewards that provide comfort • Engage five sense when having a confronting eating occasion 	<ul style="list-style-type: none"> • Environmental Cleanup (Photos of kitchen, office, car) • Jumping Over the Candy Jar (Tips for Healthier Substitutes) • Healthy Breakfast and Snack ideas handout • Comfort Bank Handout (Piggy bank full of non-food rewards) • Pleasure of a Kiss (Learn to enjoy eating with all five senses)
Indulgent Escapes 1	<ul style="list-style-type: none"> • Identify characteristics of physical and emotional hunger • Recognize emotions before and after an indulgent escape • Use the hunger scale to track hunger and fullness • Create a list of non-food rewards 	<ul style="list-style-type: none"> • Emotions and hunger handout and Face-emotions handout • Hunger Scale with worksheet • Non-foods rewards, treat, and soothing activities worksheet
Indulgent Escapes 2	<ul style="list-style-type: none"> • Identify appropriate portion sizes for indulgent foods • Modify or choose an alternative food for a healthier indulgent escape • Plan compensation 	<ul style="list-style-type: none"> • Portion Detection (Serving size vs. portion size activities using chips, foam, and water) • Food Sensations (Food alternatives handout and food label reading) • Switch It, Change It, Rearrange It! (Given daily menus, rearrange meals to compensate for indulgent escapes)
Indulgent Escapes 3	<ul style="list-style-type: none"> • Create a plan to “forgive but not forget” • Identify personal triggers and create a plan to manage them • Have a strategic plan for social occasions • Modify the home environment 	<ul style="list-style-type: none"> • Paper box to hold “guilt slips” • My-Problem Solving worksheet to identify triggers and plans • Building a Tool Kit worksheet for social occasions • Healthy Kitchen, Healthy snack handout
Nurturing Family Meals 1	<ul style="list-style-type: none"> • Identify personal needs and wants surrounding family meals • Identify barriers to having regular family dinner meals • Identify benefits of family meals 	<ul style="list-style-type: none"> • What is Important to Me Worksheet • Concerns and Obstacles to Family Meals discussion • Benefits of Family Meals and Share Family Meals handouts
Nurturing Family Meals 2	<ul style="list-style-type: none"> • Describe basic meal planning tactics for healthy meals • Reformulate recipe for healthier substitutions • Construct easy, likable family meals • Demonstrate problem solving for difficult situations surrounding meals 	<ul style="list-style-type: none"> • Family Friendly Meal Planning and Ellyn Satter’s Cooking in a Hurry handouts • Meal Construction Worksheet and Healthy Substitution handout • Recipe booklet • Problem Solving Exercises worksheet
Nurturing Family Meals 3	<ul style="list-style-type: none"> • Describe basic grocery shopping tactics for healthy meals • Demonstrate ability to compare labels on similar products • Discuss ideas on how to save money 	<ul style="list-style-type: none"> • Grocery store tour (Grocery Store Pre- and Post-Quiz) • Label Comparisons in Different Food Aisles (Groceries to Try worksheet, Lean Beef Cuts handout, Color Quiz) • Money-saving tips given in different aisles

Table 6.1. Lesson descriptions (Continued)

Lesson Name	Objective	Activities
Sensible Meals 1	<ul style="list-style-type: none"> • Describe general principles of healthy eating • Differentiate between perceived- vs. actual-healthy foods • Define commonly used health and nutrition claims • Demonstrate knowledge of portion control 	<ul style="list-style-type: none"> • Variety, Moderation, Proportionality (MyPyramid) • Food Fraud handout, food examples, food labels • Nutrition and Health Claims handout • Portion Control (Plate division method of servings vs. portions)
Sensible Meals 2	<ul style="list-style-type: none"> • Construct a healthy weekly meal plan • Identify healthy cooking methods • Examine recipe makeovers using healthy substitutes 	<ul style="list-style-type: none"> • Making small steps to meet dietary goals (Small Steps and Quick-to-Fix Meals and Menu Ideas handouts, Healthy Eating Index teaching tool) • Cooking Healthier (Healthy Cooking Methods handout and Cooking Methods teaching tool) • Recipe Makeover (Modify a Recipe to make it Healthier and Tips for Healthier Substitutes handouts)
Sensible Meals 3	<ul style="list-style-type: none"> • Utilize web and print resources to find reliable nutrition and health information • Compare the risks and benefits of dietary supplements • Understand the benefits of eating organic or locally grown foods • Describe how “superfoods” enhance health 	<ul style="list-style-type: none"> • Articles to Review Comparisons teaching tool • Do I need a Supplement? questionnaire, What Do I Need to Know About Supplements handout, Supplement Scenarios teaching tools • Organic Foods 101 handout • Superfoods handout
Fast Fueling 1	<ul style="list-style-type: none"> • Make healthy, on-the-go food and beverage selections away from home • Recognize the nutritional cost of supersized/value meals 	<ul style="list-style-type: none"> • Restaurant Menu Print-Outs teaching tool, Nutrition Guidelines for Healthy Restaurant Meals handout, Tips for Eating Away from Home worksheet and handout, Convenience Food Choices handout • Super Size vs. Normal Size (Bad Bargains handout)
Fast Fueling 2	<ul style="list-style-type: none"> • Modify home environment to ensure healthy foods are kept on hand • Plan easy, healthy breakfasts and lunches • Choose healthier frozen meals 	<ul style="list-style-type: none"> • Kitchen Makeover (Kitchen Makeover handout with game pieces and Kitchen Photo teaching tool) • Easy, Tasty, Healthy Breakfast and Lunch and Storing Fresh Fruits and Vegetables handouts • 5/20 rule description, Healthier Frozen Foods handout
Fast Fueling 3	<ul style="list-style-type: none"> • Differentiate between perceived- vs. actual-healthy foods • Recognize how beverages affect calorie intake • Understand how modifying quick foods and beverages improves diet quality 	<ul style="list-style-type: none"> • Healthy? Not So Fast! (Rating Number Cards and Food Cards) • Rethink Your Drink and Count Your Beverage Calories handouts, Beverage Bottle/Can Nutrition Facts Panel, Soda bottle filled with table sugar • Drink Diary worksheet

Table 6.2. Survey results¹

Survey Question	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
1. Most of the time, the lessons covered information that was relevant to me.	0	0.0	1	1.4	41	57.8	29	40.8
2. Most of the time, the lessons covered information that was new to me.	3	4.2	42	59.2	24	33.8	2	2.8
3. Overall, the lesson covered information that helped me make changes to eat healthier.	0	0.0	4	5.6	46	64.8	21	29.6
4. Setting goals helped me make changes to eat healthier.	0	0.0	13	18.3	39	54.9	19	26.8
5. Participating in the lessons improved my motivation to eat healthy.	0	0.0	4	5.6	38	53.5	29	40.9
6. Participating in the lessons gave me more confidence in my ability to eat healthy.	0	0.0	7	9.8	43	60.6	21	29.6
7. Being accountable to my dietitian between lessons helped me make changes to eat healthier.	1	1.4	9	12.7	45	63.4	16	22.5
8. I intend to maintain the health eating changes I made as a result of participating in the lessons.	0	0.0	2	2.8	47	66.2	22	31.0
9. I would recommend that my friends and family participate in this study.	0	0.0	3	4.2	41	57.8	27	38.0

¹ The survey was mailed to 89 participants; 80% (n=71) returned completed surveys.

Chapter VII: Overall Conclusions and Implications

OVERALL CONCLUSIONS AND IMPLICATIONS

CONCLUSIONS

The food choice decisions and ultimately food intake of any eating occasion can be influenced by various external and social factors such as the presence of others, sound, ambient and food temperature, color, smell, time of day, and distractions (Stroebele and de Castro 2004). Internal factor such as desired goals and outcomes within a particular meal or eating occasion can also affect food choice. How an individual perceives these internal and external triggers can influence the type of eating occasion. By understanding how these concepts are integrated and the physiological, behavioral, and social cues and habits that affect food choice, health professionals can more fully appreciate the motivations that drive behavior in specific eating situations and, ultimately, better promote healthy eating and weight control.

This study was based on a multidisciplinary approach involving nutrition and marketing expertise to address the situational context of eating occasions. The Social-Ecological Model was used as a basis for understanding the influences on food choice among women according to individual, physical-, and socio-environmental categories, and broader sectors of influence such as the food industry (Story et al. 2008). Within specific eating occasions, influences from several levels can impact food choice including the situational context and the characteristics of the individual experiencing the eating occasion.

This research project consisted of two phases. The descriptive research phase (Phase I) aimed to identify distinct “need states” based on eating occasions experienced by midlife women. Need states were based on eating occasions driven by both the rational

and emotional needs that underlie food choice among midlife women. The controlled intervention phase (Phase II) utilized findings from the descriptive research phase to develop and implement a six-month tailored intervention to prevent age-related weight gain in midlife women. Participants were then followed by regular follow-up contacts for a total of two years.

Segmentation analysis in Phase I resulted in six distinct eating occasion need states: healthy express, comforting interludes, indulgent escapes, nurturing family meals, sensible meals, and fast fueling. These need states were driven by the behavioral and situational contexts of the occasions and the needs associated with them. Segments were based on needs such as health, convenience, indulgence, nurturing others, and comfort. Each of the six need states differed by energy, food group, and nutrient intake, as well as situational context. The six need states could be categorized into two groups: health-oriented or less-healthy need states. Health-oriented occasions (healthy express, comforting interludes, and sensible meals) were characterized by lower fat and higher fruit and whole grain intakes, whereas less-healthy need states (indulgent escapes, fast fueling, and nurturing family meals) occasions were highest in fat intake, and often higher in energy, refined grain, and sucrose. Less-healthy need states compared to health-oriented need states were more likely to be experienced by women with a higher BMI, providing support for the existence of relevant subgroups of eating occasions.

The data from Phase I suggest that the Social-Ecological Model may be involved in food choice and consumption behaviors as environmental factors (social and physical) and individual factors can all play a role in the needs surrounding an eating occasion. For example, the need to nurture is apparent in nurturing family meals where these occasions

are based on serving others (social environment). While nurturing family meals tended to be dinner meals, the presences of others and time of day could have, in part, contributed to the energy intake in this eating occasion. This is consistent with findings from other studies (Jaeger et al. 2009; Stroebele and de Castro 2004) that have demonstrated that these factors can determine needs regarding food selection and consumption decisions. Individual motivations are evident in indulgent escape occasions where an emotional need to briefly escape may be present. These findings from Phase I are similar to the findings from Oliver et al. (2007) demonstrating that stressed emotional eaters were more likely to eat sweet, high fat, and energy-dense foods compared to unstressed and non-emotional eaters. Physical factors such as time play a role in fast fueling eating occasions. Recent trends in food choice behavior show that people are spending less time preparing foods and using more convenience products than in the past (Jabs et al. 2007). These results demonstrate that diet quality and food intake among women are related to individual and environmental factors.

Based on the findings from Phase I, investigators and a team of five registered dietitians developed learning objectives and instructional activities for each need state according to the description of need state segments for the controlled-intervention Phase II. No significant differences were observed in anthropometric measurements (weight, waist circumference, and BMI) between the intervention and control groups at any time points throughout the study. Although not different at baseline, following the six month intervention, more women in the intervention group reported experiencing health-oriented need states more often compared to the control group. These differences remained throughout the study. While no changes were observed between the intervention and

control groups throughout the study in relation to energy intake and only a few changes in nutrient intake, several positive changes were observed in food group intake in the intervention group. The subgroup analyses showed similar results to the overall study results. However, a decrease in weight and BMI in the intervention group and an increase in the control group was consistent with expected intervention effects when subgroups based on weight status were compared. While these results were not significant, they are in the right direction for the intervention group, suggesting that need state interventions may be more effective in women who are overweight or obese or report less-healthy need states more frequently.

Overall, intervention participants indicated that the lessons were educational and relevant to their lives. They reported that the materials and dietitian-led counseling sessions motivated them to change their eating habits. Most indicated the intervention was worth the time and effort and described having positive experiences. Most participants would recommend the program to other individuals.

The midlife years are a critical time for women in relation to weight gain. Age effects on body weight and BMI in midlife women may be due to physiological and psychosocial changes within individuals that occur as a result of aging (Dare 2011). During these years, women often experience hormonal changes due to menopause and family structure changes due to children leaving the home. These years are a good time for interventions as the higher risk of weight gain could lead to earlier morbidity and mortality. Studies regarding midlife women and weight gain prevention are limited as many focus on children, adolescents, or the elderly and often pertain more to weight loss interventions. Reedy et al. (2005) used cluster analysis to segment individuals into non-

overlapping groups and have demonstrated positive results with respect to improving fruit and vegetable consumption. Rather than the typical segmentation of consumers into distinct groups, this project uses segmentation of eating occasions, which offers an innovative approach that holds promise for understanding motivations that drive behavior in specific eating situations toward or away from a focus on health.

Many dietary strategies have been proposed for weight loss and weight maintenance including energy restriction, decreased fat or carbohydrate intake, and increased protein, fiber, or calcium intake. Others include eating more fruits and vegetables or whole grains. Some of these methods have shown mixed results with respect to weight gain prevention in the long term because making permanent changes to one's diet or physical activity routine can often be difficult. It has been suggested that making small changes in one's lifestyle can produce better outcomes regarding weight and are more feasible to achieve and maintain compared to large changes (Hill 2009). This study focused on encouraging small, sustainable changes. By segmenting eating occasions, the participants can make changes regarding food intake in the need state occasions they experience most often, and these small behavioral changes may result in the sustainable prevention of weight gain.

This research project has several limitations that need to be considered when interpreting the findings. Generalizability of the results of these studies to a broader sample is limited. Although the mail panel in Phase I was built to be nationally representative, participants in both phases tended to be more educated and have a higher income than the general population. Similarly, food records have often been criticized as being inaccurate (Hill and Davies 2001). However an instructional video and pictures and

guides were included to improve accuracy, and food records from participants in Phase II were checked for accuracy and detail at the time of collection.

IMPLICATIONS FOR FUTURE RESEARCH

While the results of this study did not show many significant differences in the overall study groups, the results were more promising for overweight or obese women or those who experience less-healthy need states more frequently. These women may benefit more from tailoring and may have greater improvement in weight outcomes compared to normal weight women or those who experience health-oriented need states more often.

In conclusion, this study provides evidence that tailoring nutrition education according to most frequently experienced eating occasion need states may, over time, lead to improved weight outcomes in overweight or obese women who often experience less-healthy need states. To the best of our knowledge, this is the only nutrition counseling intervention tailored to eating occasion need states instead of to individual characteristics. Segmenting eating occasions offers a novel way to better understand the multi-faceted needs and characteristics surrounding eating occasions in midlife women.

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Appendices 1: Descriptive Research Phase (Phase I)

Appendix 1.A: Directions for Completing Survey Packet



P.O. Box 474 Toledo, OH 43654
Toll-Free Number: 1-800-537-4097
Mon – Fri, 8:00 AM to 11:00 PM EST
Sat, 10:00 AM to 6:00 PM EST
Contact Us: <http://mysurvey.com/contactus.cfm>
Privacy: <http://mysurvey.com/privacy.cfm>

Shaping the Future with Your Opinions

174075 - Weekday

General Instructions

Dear MySurvey Member,

Thank you for agreeing to participate in this study.

To the 40 to 60 year old women helping with this study:

This packet contains the following documents you need to complete for this study:

- One (1) Food Record Booklet (white booklet) and One (1) Food Record Booklet Instructional DVD 
- Four (4) Meal/Snack Questionnaires (Breakfast - yellow booklet, Lunch – pink booklet, Dinner – blue booklet, Snack – tan booklet)
- One (1) General Questionnaire (green booklet)
- One (1) Return envelope

For this study, we would like you to record everything you eat and drink in the Food Record Booklet for an assigned 24-hour period of time, fill out four questionnaires about meals and a snack, and fill out one general questionnaire.

**Your assigned 24-hour time period:
Begins at 4 AM on a weekday
(This could be a Monday, Tuesday, Wednesday, or a Thursday).**

For your assigned 24-hour period:

Record everything you eat and drink on the **Food Record Form** in the **Food Record Booklet** (white booklet). Carefully describe all foods and beverages and amounts consumed. To do this accurately, please follow the directions in the Food Record Booklet and watch the instructional video on the enclosed DVD or access the video on the website <http://courses.cfans.umn.edu/CFANSVideo/FoodRecordManual/>. The video lasts about 12 minutes. The success of this study depends on accurate food records, so please eat as you normally do and record all that you eat and drink immediately after eating or drinking.

Fill out the following four questionnaires throughout your assigned 24-hour period:

- 1) Fill out the yellow **Breakfast Questionnaire** after eating your morning meal.
- 2) Fill out the pink **Lunch Questionnaire** after eating your noon meal.
- 3) Fill out the blue **Dinner Questionnaire** after eating your evening meal.
- 4) Fill out the tan **Snack Questionnaire** after eating a snack. If you usually have more than one snack, fill out the form after eating a larger snack, for example chips and juice versus juice only.

You should keep the white Food Record Booklet and yellow, pink, blue and tan questionnaires with you throughout the day.

At the end of your assigned 24 hour period:

Fill out the green **General Questionnaire**.

Once you have completed the following items, please return them in the envelope provided.

- Food Record Booklet (white booklet)
- Breakfast Questionnaire (yellow booklet)
- Lunch Questionnaire (pink booklet)
- Dinner Questionnaire (blue booklet)
- Snack Questionnaire (tan booklet)
- General Questionnaire (green booklet)

It would be greatly appreciated if you could do this as soon as possible after you complete them. You do not need to mail back this letter.

Thank you for your help on this study.

Sincerely,

Carol Adams

Appendix 1.B: Example Eating Occasion Questionnaire (EOQ)



P.O. Box 474 Toledo, OH 43654
Toll-Free Number: 1-800-537-4097
Mon – Fri, 8:00 AM to 11:00 PM EST
Sat, 10:00 AM to 6:00 PM EST
Contact Us: <http://mysurvey.com/contactus.cfm>
Privacy: <http://mysurvey.com/privacy.cfm>

174075-1

[Please read the General Instructions before completing this form.]

Breakfast Questionnaire

(yellow booklet)

Instructions: Record everything you ate and drank for breakfast on your Food Record Form in the Food Record Booklet, then fill out this Breakfast Questionnaire.

If you don't eat Breakfast, do not fill out this Breakfast Questionnaire.

Please answer the following questions as they apply to you personally, and not for other members of your household. Thank you for taking the time to answer these important questions.

1. Which day of the week was this meal?(X ONE Box)

- 1 Monday
- 2 Tuesday
- 3 Wednesday
- 4 Thursday

2. What time of day did this meal occur? (Write the hour and minute and circle AM or PM)

For example if you ate at 8:00 AM, write:

Hour 8 Minute 00 AM PM

Hour _____ Minute _____ AM PM

4. Which of the following statements describe your **needs** surrounding **this meal**? What did you want to accomplish by eating at this particular meal? Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

I wanted to ...	← Strongly Disagree ————— Strongly Agree →					
	1	2	3	4	5	6
Avoid/reduce stress.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Control/limit my calorie intake1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do other things while eating.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reward myself.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Create/maintain a family tradition.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have a fun/festive time.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compensate for other things I have eaten or will eat1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Treat myself.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Serve others what is expected.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Really enjoy the moment.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have a balanced meal1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Minimize clean up effort1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not have to think/put forth effort.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teach others1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Care for myself.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Be thrifty/frugal1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Save money1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have some personal time alone.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Make children happy1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat light1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recall pleasant memories.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not feel guilty afterward1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feel like a good mom.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feel appreciated by others/family1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maintain a habit/tradition1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfy a craving.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do my own thing1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Refresh myself1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have a brief escape from the day1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have something to do to pass the time.....1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 4 Continued On Next Page →

Question 4 Continued.

	<u>Strongly Disagree</u>	←—————→				<u>Strongly Agree</u>
I wanted to ...	1	2	3	4	5	6
Eat responsibly.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Eat quickly.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Use willpower to keep from overeating.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Take food along with me to other places.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Eat immediately.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Really enjoy eating.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Re-energize myself.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Stick to a diet.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Take a break during/after a busy day.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Have a pleasant meal with others.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Reconnect myself with the past.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Minimize planning.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Set a tone for the day.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Show my love for others.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Feel better – less sad/stressed/angry.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Maintain my cultural heritage.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Feel good about what I eat.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Spread my calories across the day.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Minimize preparation effort.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Stay on a budget.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Connect with others/family.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Satisfy my hunger.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>

5. Which of the following statements describe the **benefits** you were seeking in the food and/or beverage you ate and/or drank at **this meal**? What did you want the food to do for you at this particular meal? Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (X ONE Box For EACH Statement)

	<u>Strongly Disagree</u>	←—————→				<u>Strongly Agree</u>
For this meal I wanted something that ...	1	2	3	4	5	6
Has fiber.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Tastes fresh.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is really indulgent.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is low in fat/cholesterol.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is really flavorful.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>

Question 5 Continued On Next Page →

Question 5 Continued.

	<u>Strongly</u> <u>Disagree</u>	←—————→				<u>Strongly</u> <u>Agree</u>
For this meal I wanted something that ...	1	2	3	4	5	6
Is not boring.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is healthy to eat.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Really tastes great1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is ready to eat, needs no preparation1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
I know will be good.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Looks appetizing1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is rich tasting1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is easy to prepare1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Children will also eat1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Provides specific vitamins/minerals/nutrients1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is low in salt.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Isn't messy1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Everyone will eat without complaints1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Can be eaten in a car.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Satisfies a craving.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is low in carbohydrates1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Was on sale, a good deal.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Reminds me of the past1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is low in calories.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is easy to clean up afterward1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Creates family ties.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is inexpensive.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Has calcium.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is easy to eat.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is fun to eat.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is a favorite of someone in the family1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is not time consuming to prepare and/or eat/drink1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is portable.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Won't make me feel sluggish1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Is natural/organic.....1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
Can be eaten with hands1	<input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>

6. Approximately how long did it take you or someone else to prepare the food and/or beverage for this meal? (X ONE Box)

- 01 No time
- 02 Under 5 minutes
- 03 5-10 minutes
- 04 11-15 minutes
- 05 16-20 minutes
- 06 21-30 minutes
- 07 31-45 minutes
- 08 46 minutes – 1 hour
- 09 1-2 hours
- 10 More than 2 hours
- 11 Don't know

7. Approximately how long did it take to consume the food and/or beverage for this meal? (X ONE Box)

- 1 Under 5 minutes
- 2 5-10 minutes
- 3 11-15 minutes
- 4 16-20 minutes
- 5 21-30 minutes
- 6 31-45 minutes
- 7 46 minutes – 1 hour
- 8 1-2 hours
- 9 More than 2 hours

8. Approximately how long did it take to clean up after consuming the food and/or beverage for this meal? (X ONE Box)

- 1 Under 5 minutes
- 2 5-10 minutes
- 3 11-15 minutes
- 4 16-20 minutes
- 5 21-30 minutes
- 6 31-45 minutes
- 7 46 minutes – 1 hour
- 8 1-2 hours
- 9 More than 2 hours

9. What activities were you engaged in during this meal? (X ALL That Apply)

- 01 Nothing else
- 02 Watching television
- 03 Conversation with others
- 04 Caring for others
- 05 Reading
- 06 Listening to the radio
- 07 Cooking
- 08 Using computer (non work-related)
- 09 Working (including on the computer)
- 10 Talking on phone
- 11 Traveling (driving)
- 12 Getting ready to leave
- 13 Other, please specify: _____

10. When did you decide what to eat and/or drink for this meal? (X ONE Box)

- 1 Someone else decided
- 2 Immediately before
- 3 A few hours before
- 4 Earlier in day
- 5 Yesterday
- 6 Before yesterday

11A. First, rate how satisfied you were with the food and/or beverage you consumed for this meal for each of the dimensions listed below using a 6 point scale where "1" means "Very Dissatisfied" and "6" means "Very Satisfied". (X ONE Box For EACH Under Column "A")

11B. Then in the last 3 columns, rate the importance for this meal. (X ONE Box For EACH Under Column "B")

	"A"						"B"			
	NA	Very Dissatisfied 1	2	3	4	5	Very Satisfied 6	Not Important 1	Important 2	Very Important 3
Tasted good	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Was convenient to obtain, prepare or eat and/or drink	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Was healthful.....	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Helped me maintain a tradition	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Comforted me.....	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Appealed to others present.....	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Was a good value	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Satisfied my hunger	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Helped me care for others present	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Made me feel rewarded or indulged	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
Helped control my weight.....	<input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

12. Where did this meal take place? (X ONE Box)
- 1 At Home → (Skip To Qu. 15)
 - 2 Away From Home → (Continue)
13. If this meal occurred away from home, what was the source of the food and/or drink you consumed? (X ONE Box)
- 1 Purchased and consumed in a restaurant/cafeteria → (Continue)
 - 2 Purchased in a restaurant/cafeteria and consumed elsewhere → (Continue)
 - 3 Brought/carried from home → (Skip To Qu. 15)
 - 4 Purchased in a store → (Skip To Qu. 16)
 - 5 Purchased from a vending machine → (Skip To Qu. 16)
 - 6 Other, please specify _____ → (Skip To Qu. 16)
14. If the food and/or beverage at this meal was purchased in a restaurant, what type of restaurant was it? (X ONE Box)
- 1 Fast Food
 - 2 Family
 - 3 Fine Dining
 - 4 Cafeteria
 - 5 Coffee Shop
 - 6 Deli
 - 7 Other, please specify _____
- (Skip To Qu. 16)
15. If this meal took place at home, or was carried from home, who prepared the food and/or beverage? (X ALL That Apply)
- 1 I did all the preparation
 - 2 I did some of the preparation
 - 3 Other adult(s) did the preparation
 - 4 A child did the preparation
16. Not including yourself, who was present at this meal? (Write In # or 0. If you ate out, please count only people sitting at the same table with you.)
- For example, if you ate a meal in your home with your 10 year old child and your spouse:*
- # 1 Adults living in household (not including yourself)
- # 1 Children (Under the age of 18) living in household
- # 0 Adults not living in household
- # 0 Children (Under the age of 18) not living in household
- # _____ Adults living in household (not including yourself)
- # _____ Children (Under the age of 18) living in household
- # _____ Adults not living in household
- # _____ Children (Under the age of 18) not living in household

Thank you for completing this questionnaire.

Appendix 1.C: Food Record Booklet



P.O. Box 474 Toledo, OH 43654
Toll-Free Number: 1-800-537-4097
Mon – Fri, 8:00 AM to 11:00 PM EST
Sat, 10:00 AM to 6:00 PM EST
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Shaping the Future with Your Opinions

174075

FOOD RECORD BOOKLET FOR ONE DAY

Please keep this booklet with you to record everything you eat and drink for your assigned 24-hour period.

We prepared a 12 minute video to help you describe the foods and beverages and the amounts you consume. Before completing the food record form, please watch the instructional video on the enclosed DVD or access the video on the website <http://courses.cfans.umn.edu/CFANSVideo/FoodRecordManual/>.

Note: The success of this study depends on the accuracy of your food record. We realize that it will be time consuming to keep detailed records and appreciate your help.

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GENERAL INSTRUCTIONS

- Record everything you eat and drink for your assigned 24-hour period on the Food Record Form (Find the form beginning on page 13 toward the end of this booklet).
- Print clearly with only one food or beverage item on each line.
- Record each meal/snack immediately after it is eaten.
- Leave one blank line between each meal/snack.

DETAILED INSTRUCTIONS BY COLUMN (See examples on pages 4-5)

Column 1 – Type of Occasion

1. Write what type of meal/snack this was (breakfast, lunch, dinner, or snack).

Column 2 – Time Eaten

2. Write the time of day that you ate or drank in the “Time Eaten” column.

Column 3 – Foods and Beverages

3. Fully describe all foods and beverages including water. Include details such as how a food was prepared and whether condiments or spreads were added. For example, if you ate a chicken thigh, write if you ate the skin. If you drank coffee, was it caffeinated or decaffeinated? Was your salad dressing low fat or regular?

INCLUDE	FOR EXAMPLE
How prepared	Fried, broiled, breaded, etc.
Added fats	Fried in butter
Brand name	Stouffer’s Frozen Lasagna

4. Include things that you added to the food or beverage at the table. Example: 1 Tbsp butter to a baked potato; 1 tsp sugar to coffee. Write what you added on separate lines.

Column 4 – Amount Eaten

5. Record exact amounts in the “Amount Eaten” column.
 - The number of pieces or slices
 - Weight: ounces or grams
 - Volume: cup, tsp (teaspoon), Tbsp (tablespoon), fluid ounce (fl oz), liters
 - Dimensions: inches or centimeters
 - Use pictures and guides on pages 7-12 to estimate amounts

Example

(3) FOODS AND BEVERAGES (preparation method, added fat, brand name, source of food)	(4) AMOUNT EATEN
<i>Chicken Caesar Salad</i>	
<i>Romaine lettuce</i>	<i>3 cups</i>
<i>chicken breast, (no skin) grilled</i>	<i>1 medium</i>
<i>Caesar dressing</i>	<i>¼ cup</i>
<i>parmesan cheese</i>	<i>2 Tbsp.</i>
<i>Croutons</i>	<i>6 large</i>
<i>Spaghetti & Meat Balls</i>	
<i>cooked spaghetti</i>	<i>1½ cups</i>
<i>Meatballs</i>	<i>4 (1" diameter)</i>
<i>Ragu meatless spaghetti sauce</i>	<i>½ cup</i>
<i>parmesan cheese</i>	<i>1 Tbsp</i>
<i>Soft Shell Chicken Tacos</i>	
<i>flour tortilla</i>	<i>1 (8" diameter)</i>
<i>Roasted, cubed chicken dark meat (no skin)</i>	<i>½ cup</i>
<i>Chopped lettuce</i>	<i>½ cup</i>
<i>Tomato salsa (chopped tomato, onion, jalapenos)</i>	<i>2 Tbsp.</i>

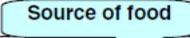
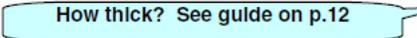
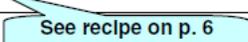
5. Describe each ingredient in a mixed dish or write recipes on pages 16-17. An example of a completed recipe is on page 6.
6. When you have finished recording what you ate and drank for each meal or snack, go back and review your list to see if you forgot any foods or beverages or anything you added at the table.

Example of Food Record Form for 24-hours

(Remember: Leave one blank line between each meal/snack.)

(1) TYPE OF OCCASION (breakfast, lunch, dinner, snack)	(2) TIME EATEN (Hour: Minute AM/PM)	(3) FOODS AND BEVERAGES (preparation method, added fat, brand name, source of food)	(4) AMOUNT EATEN
Snack	7:30 AM	Werther's original hard candy	1 piece (5 g)
		Amount or size	How many?
Breakfast	8:00 AM	Denny's buttermilk pancakes	2 pieces 5 in. diameter
		Butter, whipped	2 tsp
		Maple syrup	1/4 cup
		Bacon	2 strips 6" long
		Coffee, decaffeinated	2 cups
		Half & half	2 Tbsp
Snack	9:30 AM	Brownie (made at home from a mix with vegetable oil and real eggs)	2 pieces (2 in. wide x 2 in. long Thickness 5)
		How big?	
Snack	11:00 AM	Tall latte made with 2% milk	12 oz.
Snack	11:30 AM	Chips Ahoy chocolate chip Cookies	2 cookies 3 in. diameter

Example of Food Record Form for 24-hours (continued)
(Remember: Leave one blank line between each meal/snack.)

(1) TYPE OF OCCASION (breakfast, lunch, dinner, snack)	(2) TIME EATEN (Hour: Minute AM/PM)	(3) FOODS AND BEVERAGES (preparation method, added fat, brand name, source of food)	(4) AMOUNT EATEN
<i>Lunch</i>	<i>12:00 Noon</i>	<i>Ham sandwich</i> 	
		<i>Rye bread</i>	<i>2 slices</i>
		<i>Ham (from Albertson's deli)</i>	<i>3 slices</i>
		<i>Kraft American cheese slice</i> 	<i>1 slice</i> <i>Thickness 1</i>
		<i>Best Foods low fat mayonnaise</i>	<i>2 tsp</i>
		<i>Doritos regular tortilla chips</i>	<i>12 chips</i>
		<i>Senor Felix Salsa</i>	<i>1/4 cup</i>
		<i>Minute Maid lemonade</i>	<i>10 oz.</i>
<i>Dinner</i>	<i>6:00 PM</i>	<i>Beef Stew</i>	<i>1 cup</i> <i>(1 serving)</i>
		<i>Salad:</i> 	
		<i>Romaine lettuce</i>	<i>1 cup</i>
		<i>Tomato</i>	<i>1/4 medium</i>
		<i>Kraft Italian fat free salad dressing</i>	<i>1 Tbsp</i>
		<i>French bread</i>	<i>2 slices</i> <i>(1 slice = 3 in. length x 2 in. width x 3/4 in. thick)</i>
		<i>Butter, regular stick</i>	<i>2 tsp</i>
		<i>Water</i>	<i>12 oz.</i>
<i>Snack</i>	<i>8:30 PM</i>	<i>Dreyers Grand Chocolate ice cream</i>	<i>1 cup</i>

Recipe 1: (Write In) Beef Stew

Number of servings made: (Write In #) 6

Number of servings you ate: (Write In #) 1

Serving Size 1 cup

INGREDIENTS	AMOUNT
Stew beef, boneless chuck roast, trimmed	2 lbs (pkg weight)
Browned in oil	¼ cup
White flour	1 ½ Tbsp
Onion	1 large
Beef broth, canned	2 cups
Tomato sauce, canned	1 cup
Potatoes, medium sized, white, peeled	6
Carrots, fresh (each about 6 inches long)	6
Celery	1 stalk
Fresh parsley	¼ cup

PREPARATION
Beef browned in oil, not drained
All ingredients added raw to same pan
Simmered 2-3 hours

Beef, Pork, Chicken and Fish



1-1/2 ounces



3 ounces



6 ounces



9 ounces

2

Food Record Booklet

Cereal and Soup

1/2 cup



1 cup



1-1/2 cups



2 cups



3

7

1740

Vegetables such as Green Beans, Corn and Potatoes



1/4 cup



1/2 cup



1 cup

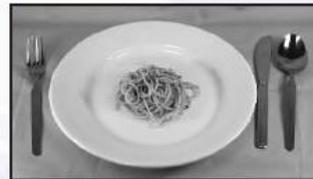


1-1/2 cups

4

Spaghetti and Casseroles

1/2 cup



1 cup



2 cups

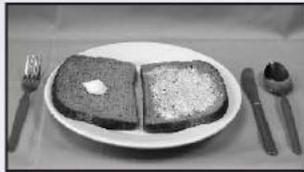


3 cups

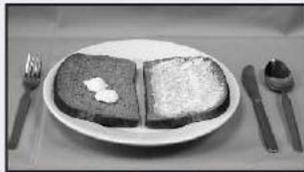


5

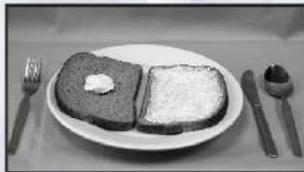
Spreads such as Butter, Margarine, Mayonnaise, or Peanut Butter



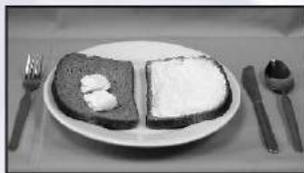
1 teaspoon (tsp)



2 teaspoons



3 teaspoons
= 1 Tablespoon



2 Tablespoons

6

Salad Dressing

1 Tablespoon (Tbsp)



2 Tablespoons



3 Tablespoons



4 Tablespoons
= 1/4 cup



7

Salads



1/2 cup



1 cup



1-1/2 cups



2 cups

8

Ice Cream, Mashed Potatoes, or Cottage Cheese

1/2 cup



1 cup



1-1/2 cups

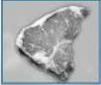


2 cups



9

Five Ways to Size Up Your Servings

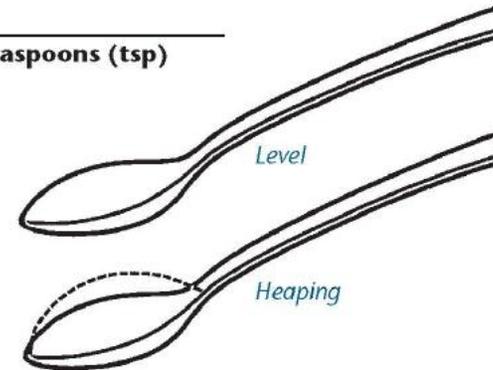
- 1** **3 ounces** of meat is about the size and thickness of a deck of playing cards or an audiotape cassette. 3oz.  = 
- 2** **1 ounce** of cheese is about the size of 4 stacked dice. 1oz.  = 
- 3** **1/2 cup** of ice cream is about the size of a racquetball or tennis ball. 1/2 c.  = 
- 4** **1 cup** of mashed potatoes or broccoli is about the size of your fist. 1 c.  = 
- 5** **1 teaspoon** of butter or peanut butter is about the size of the tip of your thumb. 1 tsp.  = 

10

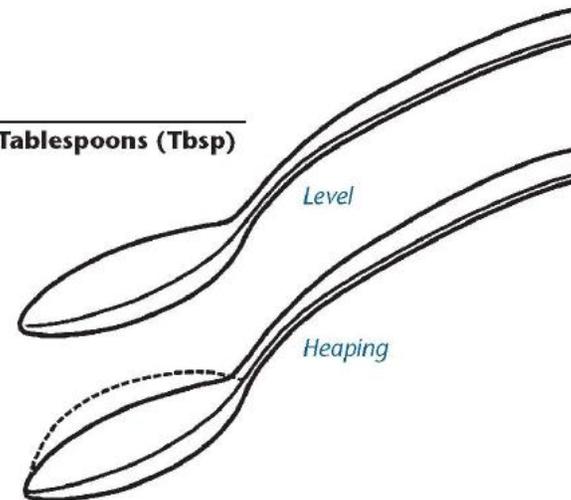
concept ©1996 National Dairy Council

Eating and Serving Spoons

teaspoons (tsp)

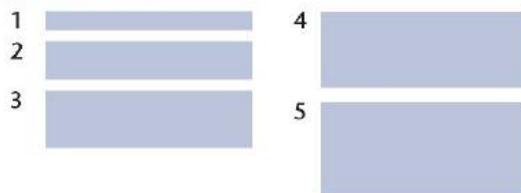


Tablespoons (Tbsp)

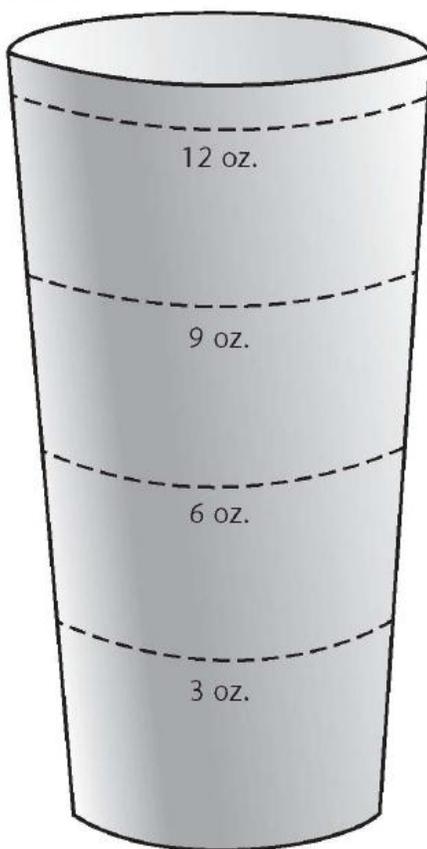


11

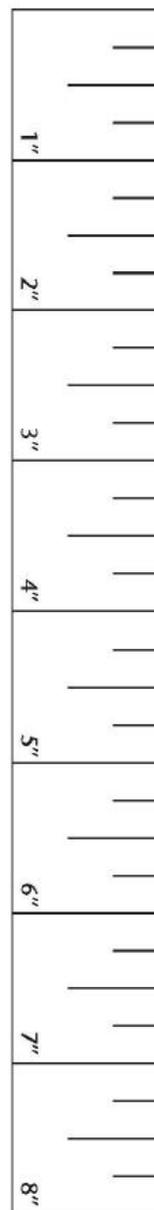
Thickness



12 fluid ounces



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Recipe 2: (Write In) _____

Number of servings made: (Write In #) _____ Number of servings you ate: (Write In #) _____

Serving size _____

INGREDIENTS	AMOUNT
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

PREPARATION

Appendices 2: Controlled Intervention Phase (Phase II)

Appendix 2.A: Eating Occasion Questionnaire

EATING OCCASION QUESTIONNAIRE

Usual Weekday Breakfast

Think about your typical weekday breakfast. Which of the following statements describe your **needs or benefits** surrounding **this meal**? What do you want to accomplish by eating your typical weekday breakfast? What do you want the food to do for you at this meal?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat this meal, go on to the next page.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←-----→				Strongly Agree
	1	2	3	4	5	6
Connect with others/family	<input type="checkbox"/>					
Is healthy to eat	<input type="checkbox"/>					
Is ready to eat, needs no preparation	<input type="checkbox"/>					
Treat myself	<input type="checkbox"/>					
Children will also eat	<input type="checkbox"/>					
Minimize preparation effort	<input type="checkbox"/>					
Is low in calories	<input type="checkbox"/>					
Creates family ties	<input type="checkbox"/>					
Is easy to clean up afterwards	<input type="checkbox"/>					
Control/limit my calorie intake	<input type="checkbox"/>					
Is portable	<input type="checkbox"/>					
Eat quickly	<input type="checkbox"/>					
Is really indulgent	<input type="checkbox"/>					
Feel appreciated by others/family	<input type="checkbox"/>					
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>					
Satisfies a craving	<input type="checkbox"/>					
Really enjoy the moment	<input type="checkbox"/>					
Feel good about what I eat	<input type="checkbox"/>					
Not have to think/put forth effort	<input type="checkbox"/>					
Create/maintain a family tradition	<input type="checkbox"/>					

In a normal week, how many weekday breakfasts do you normally have? _____

Of the weekday breakfasts you usually have, how many are similar to the typical weekday breakfast you rated above? _____

Usual Weekday Lunch

Think about your typical weekday lunch. Which of the following statements describe your **needs or benefits** surrounding **this meal**? What do you want to accomplish by eating your typical weekday lunch? What do you want the food to do for you at this meal?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat this meal, go on to the next page.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←—————→				Strongly Agree
	1	2	3	4	5	6
Connect with others/family	<input type="checkbox"/>					
Is healthy to eat	<input type="checkbox"/>					
Is ready to eat, needs no preparation	<input type="checkbox"/>					
Treat myself	<input type="checkbox"/>					
Children will also eat	<input type="checkbox"/>					
Minimize preparation effort	<input type="checkbox"/>					
Is low in calories	<input type="checkbox"/>					
Creates family ties	<input type="checkbox"/>					
Is easy to clean up afterwards	<input type="checkbox"/>					
Control/limit my calorie intake	<input type="checkbox"/>					
Is portable	<input type="checkbox"/>					
Eat quickly	<input type="checkbox"/>					
Is really indulgent	<input type="checkbox"/>					
Feel appreciated by others/family	<input type="checkbox"/>					
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>					
Satisfies a craving	<input type="checkbox"/>					
Really enjoy the moment	<input type="checkbox"/>					
Feel good about what I eat	<input type="checkbox"/>					
Not have to think/put forth effort	<input type="checkbox"/>					
Create/maintain a family tradition	<input type="checkbox"/>					

In a normal week, how many weekday lunches do you normally have? _____

Of the weekday lunches you usually have, how many are similar to the typical weekday lunch you rated above? _____

Usual Weekday Dinner

Think about your typical weekday dinner. Which of the following statements describe your **needs or benefits** surrounding **this meal**? What do you want to accomplish by eating your typical weekday dinner? What do you want the food to do for you at this meal?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat this meal, go on to the next page.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←-----→					Strongly Agree
	1	2	3	4	5	6	
Connect with others/family	<input type="checkbox"/>						
Is healthy to eat	<input type="checkbox"/>						
Is ready to eat, needs no preparation	<input type="checkbox"/>						
Treat myself	<input type="checkbox"/>						
Children will also eat	<input type="checkbox"/>						
Minimize preparation effort	<input type="checkbox"/>						
Is low in calories	<input type="checkbox"/>						
Creates family ties	<input type="checkbox"/>						
Is easy to clean up afterwards	<input type="checkbox"/>						
Control/limit my calorie intake	<input type="checkbox"/>						
Is portable	<input type="checkbox"/>						
Eat quickly	<input type="checkbox"/>						
Is really indulgent	<input type="checkbox"/>						
Feel appreciated by others/family	<input type="checkbox"/>						
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>						
Satisfies a craving	<input type="checkbox"/>						
Really enjoy the moment	<input type="checkbox"/>						
Feel good about what I eat	<input type="checkbox"/>						
Not have to think/put forth effort	<input type="checkbox"/>						
Create/maintain a family tradition	<input type="checkbox"/>						

In a normal week, how many weekday dinners do you normally have? _____

Of the weekday dinners you usually have, how many are similar to the typical weekday dinner you rated above? _____

Usual Weekend Breakfast

Think about your typical weekend breakfast. Which of the following statements describe your **needs or benefits** surrounding this meal? What do you want to accomplish by eating a typical weekend breakfast? What do you want the food to do for you at this meal?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat this meal, go on to the next page.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←-----→				Strongly Agree
	1	2	3	4	5	6
Connect with others/family	<input type="checkbox"/>					
Is healthy to eat	<input type="checkbox"/>					
Is ready to eat, needs no preparation	<input type="checkbox"/>					
Treat myself	<input type="checkbox"/>					
Children will also eat	<input type="checkbox"/>					
Minimize preparation effort	<input type="checkbox"/>					
Is low in calories	<input type="checkbox"/>					
Creates family ties	<input type="checkbox"/>					
Is easy to clean up afterwards	<input type="checkbox"/>					
Control/limit my calorie intake	<input type="checkbox"/>					
Is portable	<input type="checkbox"/>					
Eat quickly	<input type="checkbox"/>					
Is really indulgent	<input type="checkbox"/>					
Feel appreciated by others/family	<input type="checkbox"/>					
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>					
Satisfies a craving	<input type="checkbox"/>					
Really enjoy the moment	<input type="checkbox"/>					
Feel good about what I eat	<input type="checkbox"/>					
Not have to think/put forth effort	<input type="checkbox"/>					
Create/maintain a family tradition	<input type="checkbox"/>					

In a normal week, how many weekend breakfasts do you normally have? _____

Of the weekend breakfasts you usually have, how many are similar to the typical weekend breakfast you rated above? _____

Usual Weekend Lunch

Think about your typical weekend lunch. Which of the following statements describe your **needs or benefits** surrounding **this meal**? What do you want to accomplish by eating your typical weekend lunch? What do you want the food to do for you at this meal?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat this meal, go on to the next page.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←-----→					Strongly Agree
	1	2	3	4	5	6	
Connect with others/family	<input type="checkbox"/>						
Is healthy to eat	<input type="checkbox"/>						
Is ready to eat, needs no preparation	<input type="checkbox"/>						
Treat myself	<input type="checkbox"/>						
Children will also eat	<input type="checkbox"/>						
Minimize preparation effort	<input type="checkbox"/>						
Is low in calories	<input type="checkbox"/>						
Creates family ties	<input type="checkbox"/>						
Is easy to clean up afterwards	<input type="checkbox"/>						
Control/limit my calorie intake	<input type="checkbox"/>						
Is portable	<input type="checkbox"/>						
Eat quickly	<input type="checkbox"/>						
Is really indulgent	<input type="checkbox"/>						
Feel appreciated by others/family	<input type="checkbox"/>						
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>						
Satisfies a craving	<input type="checkbox"/>						
Really enjoy the moment.	<input type="checkbox"/>						
Feel good about what I eat	<input type="checkbox"/>						
Not have to think/put forth effort	<input type="checkbox"/>						
Create/maintain a family tradition	<input type="checkbox"/>						

In a normal week, how many weekend lunches do you normally have? _____

Of the weekend lunches you usually have, how many are similar to the typical weekend lunch you rated above? _____

Usual Weekend Dinner

Think about your typical weekend dinner. Which of the following statements describe your **needs or benefits** surrounding **this meal**? What do you want to accomplish by eating your typical weekend dinner? What do you want the food to do for you at this meal?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat this meal, go on to the next page.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←—————→				Strongly Agree
	1	2	3	4	5	6
Connect with others/family	<input type="checkbox"/>					
Is healthy to eat	<input type="checkbox"/>					
Is ready to eat, needs no preparation	<input type="checkbox"/>					
Treat myself	<input type="checkbox"/>					
Children will also eat	<input type="checkbox"/>					
Minimize preparation effort	<input type="checkbox"/>					
Is low in calories	<input type="checkbox"/>					
Creates family ties	<input type="checkbox"/>					
Is easy to clean up afterwards	<input type="checkbox"/>					
Control/limit my calorie intake	<input type="checkbox"/>					
Is portable	<input type="checkbox"/>					
Eat quickly	<input type="checkbox"/>					
Is really indulgent	<input type="checkbox"/>					
Feel appreciated by others/family	<input type="checkbox"/>					
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>					
Satisfies a craving	<input type="checkbox"/>					
Really enjoy the moment	<input type="checkbox"/>					
Feel good about what I eat	<input type="checkbox"/>					
Not have to think/put forth effort	<input type="checkbox"/>					
Create/maintain a family tradition	<input type="checkbox"/>					

In a normal week, how many weekend dinners do you normally have? _____

Of the weekend dinners you usually have, how many are similar to the typical weekend dinner you rated above? _____

Usual Weekday or Weekend Snack

Think about your typical weekday or weekend snack. Which of the following statements describe your **needs or benefits** surrounding **this snack**? What do you want to accomplish by eating a typical weekday or weekend snack? What do you want the food to do for you at this snack time?

Check how much you disagree or agree with each statement. If the statement does not apply to you, please select Strongly Disagree. (**X ONE Box For EACH Statement**)

If you never eat snacks, stop here.

For this meal I want to ... OR I want something that ...	Strongly Disagree	←-----→				Strongly Agree
	1	2	3	4	5	6
Connect with others/family	<input type="checkbox"/>					
Is healthy to eat	<input type="checkbox"/>					
Is ready to eat, needs no preparation	<input type="checkbox"/>					
Treat myself	<input type="checkbox"/>					
Children will also eat	<input type="checkbox"/>					
Minimize preparation effort	<input type="checkbox"/>					
Is low in calories	<input type="checkbox"/>					
Creates family ties	<input type="checkbox"/>					
Is easy to clean up afterwards	<input type="checkbox"/>					
Control/limit my calorie intake	<input type="checkbox"/>					
Is portable	<input type="checkbox"/>					
Eat quickly	<input type="checkbox"/>					
Is really indulgent	<input type="checkbox"/>					
Feel appreciated by others/family	<input type="checkbox"/>					
Provides specific vitamins, minerals, nutrients	<input type="checkbox"/>					
Satisfies a craving	<input type="checkbox"/>					
Really enjoy the moment	<input type="checkbox"/>					
Feel good about what I eat	<input type="checkbox"/>					
Not have to think/put forth effort	<input type="checkbox"/>					
Create/maintain a family tradition	<input type="checkbox"/>					

In a normal week, how many weekday or weekend snacks do you normally have? _____

Of the weekday or weekend snacks you usually have, how many are similar to the typical weekday or weekend snack you rated above? _____

Appendix 2.B: Survey about the Healthy Eating Lessons

Survey about Healthy Eating Lessons

Please circle or X the boxes below that indicate your disagreement or agreement with the following statements about the lessons you experienced as part of the University of Minnesota study about healthy eating.

1. Most of the time, the lessons covered information that was relevant to me.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

2. Most of the time, the lessons covered information that was new to me.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

3. Overall, the lesson covered information that helped me make changes to eat healthier.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

4. Setting goals helped me make changes to eat healthier.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

5. Participating in the lessons improved my motivation to eat healthy.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

6. Participating in the lessons gave me more confidence in my ability to eat healthy.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

7. Being accountable to my dietitian between lessons helped me make changes to eat healthier.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

8. I intend to maintain the health eating changes I made as a result of participating in the lessons.

Strongly disagree	Disagree	Agree	Strongly agree
--------------------------	-----------------	--------------	-----------------------

9. I would recommend that my friends and family participate in this study.

Strongly disagree	Disagree	Agree	Strongly agree
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Further comments about the lessons:
