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CHAPTER 1: Introduction

Weight gain and chronic disease development are mediated by interactions between genetic and environmental factors (1, 2). However, the increasing prevalence of overweight in recent decades has been attributed mainly to environmental and behavioral factors related to energy intake and physical activity levels (3). Environmental factors that promote excess energy intake may include widespread availability of low-priced, energy dense foods available in large portions (4), while advances in technology reinforce sedentary leisure activity and workplace physical inactivity (3). Urban planning and developments have increased automobile reliance, thereby decreasing energy expenditure in transportation (3). In our environment, characterized by excess food availability coupled with a decreased need for physical activity, cognitive control of energy intake and expenditure is necessary to prevent weight gain (4).

As the prevalence of overweight and obesity continues to increase worldwide, the latest data from 2003-2004 indicated that 66.3% of adults in the United States (US) were overweight (BMI ≥ 25 kg/m²), and of those, 32.2% were obese (BMI ≥ 30 kg/m²) (5). Since 1960, the prevalence of overweight and obesity has steadily increased across all demographic groups (6). This trend seems to be persisting, as the average American adult continues to gain weight at a rate of about two pounds (~0.9 kg) per year (4). Hill et al. (4) projected that if weight gain continued at this rate, about 39% of the US population would be obese by 2008.

Overweight and obesity are associated with an increased risk of high blood pressure, high cholesterol, type 2 diabetes, stroke, gallbladder disease, arthritis, sleep disturbances, problems breathing, and certain types of cancers (7). Obese individuals also suffer from social stigmatization, discrimination, and lowered self-esteem (8, 9). Obesity is the second leading preventable cause of death in the US, with an estimated mean of 324,940 annual attributable mortalities (10). In addition to human suffering, morbidities and mortalities

associated with obesity generate significant health care costs. In 2002, the estimated annual cost of overweight and obesity was \$78.5 billion (11).

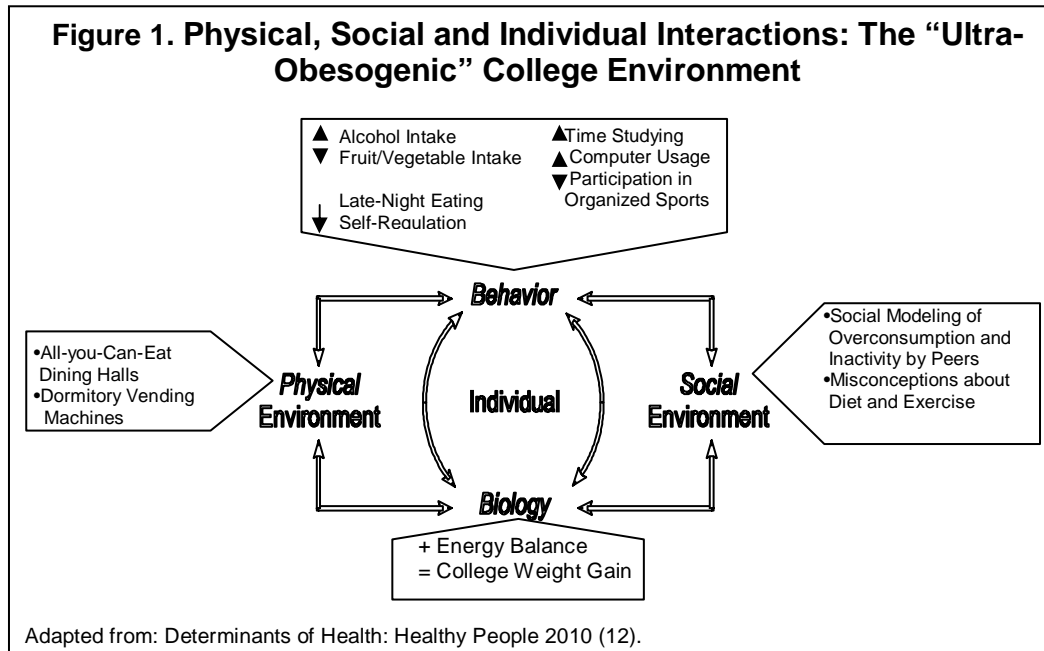
The Surgeon General has declared obesity an epidemic, and many public health campaigns are underway to combat this uncontrolled weight gain (12, 13). One objective of *Healthy People 2010* is to reduce the portion of obese adults to a targeted 15% by 2010 (12). As the prevalence of obesity continues to increase, it appears that current policies and intervention efforts are inadequate to achieve this objective. Thus, an epidemic of this magnitude needs to be approached from multiple directions in order to meet public health goals. While efforts for improving weight loss methods are needed, weight loss maintenance is often an ineffective process (1). Alternatively, weight gain prevention might be a more effective and more easily disseminated approach (14, 15); however, its efficacy as an obesity primary prevention strategy remains uncertain.

Both *Healthy People 2010* (12) and the 2005 *Dietary Guidelines for Americans* (16) recommend small, sustainable increases in physical activity and small decreases in energy intake to help prevent weight gain. Hill et al. (4) estimated that the observed weight gain trend can be accounted for by an energy excess of ~100 kcal/day. By this estimate, either reducing energy intake or increasing energy expenditure by 100 kcal/day would prevent weight gain in a majority of the population.

Curbing the weight gain trend would protect both normal weight individuals and overweight individuals from incurring additional weight-related health risks (14, 15). Recently, a report from the Coronary Artery Risk Development in Young Adults (CARDIA) Study (15) indicated that weight gain yielding an increase of ≥ 2 kg/m² over 15 y placed young adults at markedly increased risk for cardiovascular disease compared to those with a stable or decreased BMI. These effects persisted independent of baseline BMI, which suggested that weight stabilization in early adulthood may be an important factor in chronic disease risk reduction for both normal and overweight individuals.

Young adulthood appears to be a critical period in the progression of weight gain and therefore may be an important stage for the primary prevention of overweight and obesity. In an earlier CARDIA study (17) observing 10-year trends in weight change, it can be estimated from the data that 64.2% of young adults (18-30 y) gained ≥ 5 kg (~11 lbs), and of those, 56.9% gained ≥ 11 kg (~24.2 lbs). In an evaluation of changes in the prevalence of obesity from 1991-1998, Mokdad et al. (18) found the greatest increases in prevalence were among young adults (18-29 y) and those with higher education levels. McTigue and colleagues (19) found that most individuals who became obese did so in early adulthood, before reaching age 35. Young adults attending college appeared to gain weight more rapidly than the general population, having gained a mean of ~1.7-4.2 kg (~3.7-9.2 lbs) during their first year at college (17, 20, 21). Unfortunately, there was no evidence of compensatory weight loss in later years (17). While weight gain persists across all demographic groups (18), young adults may be particularly vulnerable to the physical and social mediators driving the obesity epidemic.

Healthy People 2010 presented a systematic approach to improve the Nation's health status by tracking progress toward defined health-related goals and objectives (12). Their strategy for improving health addressed the complex interactions between the environment, behavior, and biology that determine an individual's health status. As illustrated in Figure 1, college students may be particularly vulnerable to weight gain due to the "ultra-obesogenic" college environment. Figure 1 presents some of the potential mediators that may lead to pronounced weight gain in this population.



The transition from high school to college requires many young adults to begin making more of their own lifestyle choices, including eating and physical activity habits. The college environment includes new freedoms and responsibilities that expose students to situations that may lead to a positive energy balance and subsequent weight gain. For example, risks in the college physical environment may include ‘all-you-can-eat’ dining halls (22), availability of dormitory vending machines (22), increased access to energy dense foods (e.g., fried foods), and decreased access to cooking equipment. These factors can lead to unhealthy eating behaviors such as overeating, consuming high calorie snacks, and decreasing fruit and vegetable consumption. Without compensating for increased energy intake by increasing energy expenditure, a positive energy balance over time will lead to weight gain.

The college social environment may also contribute to a positive energy balance. The social environment may reinforce physical inactivity, irregular eating patterns, and alcohol consumption. Social factors such as these may encourage behaviors like excessive television watching/video game playing, late-night eating, and binge drinking. Energy

expenditure may decrease due to more time studying, increased computer usage, and less time spent in organized sports. These dietary and physical activity patterns predispose many college students to weight gain, and possibly future health complications (23).

The commonly reported weight gain during college suggests that students may not have the skills to successfully maintain their body weight in this new environment. Levitsky et al. (22) estimated that 174 kcal/day in excess would account for the more rapid weight gain trajectory observed in college students compared to the general adult population. Preventing weight gain during this vulnerable time is dependent upon many factors, including an individual's ability to anticipate and overcome high-risk situations (20). To provide young adults with the proper skills to make healthy choices in this "ultra-obesogenic" environment, interventions must target their particular needs. However, specific mediators of college weight gain must first be identified to develop effective intervention strategies. Furthermore, learning healthy lifestyle behaviors might enable young adults to successfully manage their weight throughout adulthood.

Previous research in weight gain prevention has revealed important considerations. Successful studies have been costly (24, 25), short-term (26), and without long-term follow-up (24, 26). Other studies have targeted educational strategies rather than a comprehensive approach based on behavior change theory (27) or lacked frequent and individualized treatment (25, 27). These findings support conclusions by Perri and Corsica (28), who recommend continuous, intensive, and individualized treatment with sustained follow-up care for successful long-term health behavior change. Future interventions should incorporate these recommendations, yet must be cost-effective and be theoretically based to be effective and disseminable. One successful intervention was limited to females of unreported race who were self-selected for weight gain prevention (26). Yet previous weight gain prevention interventions have demonstrated sex differences in treatment effects (24). Furthermore, recent evidence shows that males and African American females may be more

susceptible to weight gain as young adults (5, 17). Thus, in addition to being cost-effective and theory-based, future interventions for college students should include these vulnerable populations, and include students whom are representative of the general college population, i.e., not more weight- or health-conscious than the typical college student.

Interventions focused on weight gain prevention in the college population may be ideal for subsequent weight gain prevention dissemination efforts. More than half of US adults have attended some college by the age of 24 (29), suggesting that the point of college entry may include a large portion of the population. With such distributed potential across the population, successful weight gain prevention in young adults attending college may have a substantial impact in the fight against obesity. Adapting a successful intervention to other colleges would likely require only minor adaptations for regional and demographic differences. Furthermore, if college weight gain is an amplification of the same processes occurring among society as a whole, strategies successful for weight management in college may also be effective for the general public (22).

In summary, the morbidities and mortalities associated with overweight and obesity are significant public health concerns that necessitate primary prevention strategies (30). Weight gain in the college years appears to be more rapid than the weight gain observed across the general population (20-22). This tendency is likely due to multiple interactions between environmental, physiological, and psychological influences (1). The mediating factors involved in this process are uncertain and must be identified to design an intervention for this particular population. Furthermore, such an intervention may provide young adults the skills to prevent future weight gain.

The purpose of this project was to examine the social, environmental, and behavioral factors that mediate college weight gain. We identified potential targets to improve health behaviors in college students by assessing lifestyle habits, behavioral habits, psychological constructs (e.g., perceived barriers, facilitators, social support, outcome expectations, self-

efficacy), and physiological characteristics of first and second year college students. The results will provide the basis for a Social Cognitive Theory (SCT)-based intervention to improve health behaviors, and consequently prevent weight gain in young adults attending college.

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CHAPTER 2:

Weight Gain Prevention: Identifying Targets for Health Behavior Change in Young Adults Attending College

ABSTRACT

Background: Young adults attending college are more vulnerable to weight gain than the general population. To instill effective weight gain prevention strategies in college students, interventions must be developed to counteract the ultra-obesogenic college environment.

Objective: We sought to identify the mediators of weight gain in college freshmen and sophomores living on-campus. Based on the social cognitive model for health behavior change, we investigated the health-related lifestyle habits, psychological, behavioral, and physiological characteristics of the target population.

Design: Forty-three college students (18.3 ± 0.1 y) completed a series of laboratory-based quantitative assessments and structured qualitative assessments. Quantitative assessments included body mass and composition, cardiorespiratory fitness ($VO_2\max$), habitual dietary intake and physical activity habits, resting blood pressure, and questionnaires to measure social cognitive health belief constructs. Participants then completed either a structured elicitation interview ($n=30$) or a focus group discussion ($n=13$) to provide insight into the routine behaviors, personal and environmental factors of college students.

Results: Participants were of normal body composition and high cardiorespiratory fitness level. Healthy eating and physical activity behaviors were secondary to other responsibilities (i.e., academics and socializing). Despite ample free time, enjoyment of physical activity, and a desire to exercise more, participants have difficulty exercising regularly and spend a considerable amount of time in sedentary activity. Eating habits generally met recommendations but were high in sodium and low in fiber, vitamin C, and vitamin E. Psychosocial correlates for eating and physical activity self-regulation and self

efficacy were correlated with dietary carbohydrate quality, daily step counts, and minutes spent in moderate- to high-intensity physical activities. Social support for physical activity was correlated with daily step counts and inversely correlated with sedentary activities. Barriers to eating healthy foods on-campus were poor dormitory kitchen facilities, dining hall hours, and palatability. Before college, healthy meals and regular exercise were part of a regular routine. Students may not have adequate skills in goal setting, planning, and self-monitoring to maintain healthy behaviors in the college environment. Perceived benefits to healthy behaviors include improved energy levels, psychological health, weight management, and being more fit or competitive.

Conclusion: These findings will be used to develop a behavioral theory-based weight gain prevention intervention for this target population.

KEY WORDS

Weight gain prevention, college weight gain, young adults, behavior change, diet, physical activity, social cognitive theory

INTRODUCTION

The persisting increases in the prevalence of obesity has led to public health initiatives for more preventive action (31-33). Historical trends in adults indicate that obesity develops through gradual weight gain during early adulthood (34, 35), with most obese individuals becoming so before age 35 (34). Between 1991-1998, the greatest increases in the prevalence of obesity were among young adults (18-29 y) and those with higher education levels (36). Hill et al. (37) estimated that the average American adult gains weight at a rate of ~2 lbs (~0.9 kg) per year. However, young adults attending college appear to gain weight more rapidly than the general population, with a mean weight gain of ~3.7-9.2 lbs (~1.7-4.2 kg) during their first year at college (38-40), without evidence of compensatory weight loss in later years (39). Perpetual weight gain yielding an increase of ≥ 2 kg/m² over 15 years placed young adults at markedly increased risk for cardiovascular disease compared to those with a stable or decreased body mass index (BMI, kg/m²) (41). These effects persist independently of baseline BMI, which suggest that weight stabilization in early adulthood may be an important factor in chronic disease risk reduction for both normal and overweight individuals.

Healthy People 2010 presented a systematic approach to improve the Nation's health status which addressed the complex interactions between the environment, behavior, and biology (42). The college food environment may be conducive to overconsumption, with readily available energy-dense foods and limited cooking facilities. Academic pressures may lead to increased time studying and computer usage while devaluing exercise and organized sports participation. College students may be particularly vulnerable to weight gain due to the "ultra-obesogenic" college environment, and interventions to prevent weight gain must be specialized to their needs. Thus, specific mediators causing college weight gain must first be identified in order to develop a targeted intervention.

Previous research has revealed important considerations for future weight gain prevention interventions. Successful studies have been costly (43, 44), short-term (45), and without long-term follow-up (43, 45). Other studies have targeted educational strategies rather than a comprehensive approach based on behavior change theory (46) or lacked frequent and individualized treatment (44, 46). These findings support conclusions by Perri and Corsica (47), who recommend continuous, intensive, and individualized treatment with sustained follow-up care for successful long-term health behavior change. Future interventions should incorporate these recommendations, yet must be cost-effective and be theoretically based to be disseminable and effective. In addition, future interventions for college students should include populations seemingly more vulnerable to weight gain in young adulthood, such as males, African American females, Hispanic females (39, 48). Participants should be representative of the college population, i.e., not more weight- or health-conscious than the typical college student, rather than self-selected for weight gain prevention (45). In descriptive studies on college weight gain and weight gain prevention interventions, researchers have examined selected constructs within a behavior change theory (40, 49-51) or implemented interventions based on components of behavior change (44, 52). However, the relative influences of theoretical factors underlying health behaviors and health behavior change among college students remain illusive.

We sought to identify potential targets to improve health behaviors in college students through an empirical investigation of the transition to college life based on the social cognitive model for health behavior change (53). Under Bandura's premise of "reciprocal determination" (54), we explored the interactions between behavioral, environmental, and personal factors of college lifestyles that mediate weight gain. We further characterized the modifiable personal factors within the social cognitive model including psychosocial correlates of health behavior change (i.e., self-regulation, social support, self-efficacy, and outcome expectations) and physiological characteristics of first

and second year college students. (53). The results will provide the basis for a SCT-based intervention aimed at improving health behaviors, and preventing weight gain in young adults attending college.

METHODS

Participants were recruited to undergo two sessions of laboratory testing and either an elicitation interview or a focus group discussion. Participants were first and second year college students, living on-campus, and ≥ 18 years of age. Students majoring in Human Nutrition, Foods and Exercise were excluded, as their health habits may not be representative of the general college population. Eligible participants did not have a history of depression, eating disorders, or major chronic diseases (e.g., cardiovascular disease or diabetes). The Centers for Epidemiological Studies Depression Scale (CES-D) (55) and the Eating Attitudes Test (EAT-26) (56) were used to assess symptoms of depression and disordered eating, respectively. Participants with scores ≥ 35 on the CES-D and ≥ 20 on the EAT-26 were excluded. Females were not pregnant during the course of the study.

Sixty-three participants were recruited via campus advertisements for a “Lifestyles of College Students Study” during the fall 2006 and spring 2007 semesters; advertisements were placed in the University newspaper and an introductory Biology course for non-life science majors. Of those, four were ineligible based on CES-D or EAT-26 scores, nine were not present for scheduled appointments, seven chose not to complete the study due to the spring 2007 semester ending earlier than anticipated, and 43 participants completed the study. Participants provided informed consent prior to their participation in the investigation. The protocol and consent form were approved by the Institutional Review Board at Virginia Tech (see *Appendix A*).

Procedures

Quantitative Assessments

Participants completed a series of questionnaires to assess psychosocial constructs related to health behaviors. The Health Beliefs Survey (HBS, *see Appendix B*) (57), developed at the Virginia Tech Center for Research in Health Behaviors, measured SCT-based determinants of eating behaviors. SCT-based determinants for physical activity behaviors were assessed with tools developed and used by Rovniak et al. (58). The SCT-based determinants for eating and physical activity behaviors were as follows: 1) *self-regulation*, or the deliberate thoughts and behaviors used to maintain a behavior, including goal setting, planning, tracking, self-monitoring, and self-evaluation; 2) *social support*, or the perceived support for a behavior from friends and family, including modeling and feedback; 3) *self-efficacy*, or confidence in an ability to regularly engage in a behavior despite challenges and motivations; and 4) *outcome expectations*, or the perceived positive and negative consequences of a behavior. For HBS eating constructs, the internal consistencies were adequate to high, ranging from $\alpha=.68-.90$ (57). For HBS physical activity constructs, internal consistencies were high, ranging from $\alpha=.83-.91$ (58). The Three-Factor Eating Questionnaire (TFEQ) (59) was used to provide information regarding three dimensions of human eating behavior: dietary cognitive restraint, disinhibition, and perceived hunger. In addition, elicitation interview participants ($n=30$) completed a questionnaire prioritizing common daily activities (*see Appendix C*).

Laboratory measurements included assessment of body mass and composition, waist circumference (WC), resting casual blood pressure (BP), and cardiorespiratory fitness (VO_2max). Height was measured to the nearest cm, without shoes, using a wall-mounted stadiometer (Scale-tronix, White Plains, NY). Body mass was measured without shoes, in light clothing to the nearest 0.1 kg using a digital scale. BMI was calculated as weight (kg)/height (m^2). WC was measured to the nearest 0.5 cm at the umbilicus using a Gulick tape measure; the mean of two measurements within $\pm 5\%$ was reported. BP was measured using an automated Dinamap XL vital signs monitor (model 9300, Johnson & Johnson

Medical, Tampa, FL). Participants were instructed to abstain from caffeine 2-3 h prior to having their BP measured. BP measurements were made in a quiet environment after a seated 5-minute rest period. Appropriate BP cuff sizes were used according to established measurement guidelines (60). BP was determined using an average of two consecutive readings within 5 mmHg taken on two separate laboratory visits. Maximal oxygen consumption (VO_2 max) was used to assess cardiorespiratory fitness, which was determined during graded treadmill running to exhaustion using indirect calorimetry (TrueMax 2400, ParvoMedics, Salt Lake City, UT). VO_2 max (ml/kg/min) measurements were used to determine age- and sex-specific American College of Sports Medicine (ACSM) VO_2 max percentile ranking (61). Body composition was measured using dual energy X-ray absorptiometry (DEXA) (GE Lunar Prodigy Advance, Madison, WI).

Habitual physical activity level was measured with 7-day activity logs of self-reported time spent engaged in physical activity (see *Appendix D*) and verified 7-day pedometer (Accusplit Eagle 120XL, San Jose, CA) step counts. Activity logs also included minutes spent watching television and playing video games, minutes spent on the computer, bed time (time of day), wake time (time of day), minutes spent napping, and types of physical activities with intensity ratings. To determine habitual dietary intake, 4-day food intake records were obtained. Participants were instructed in methods to accurately record their food and beverage intake.

Qualitative Assessments

A series of 30 elicitation interviews followed by two focus groups were conducted to characterize the routine behaviors, environmental factors, and personal factors related to health function of first and second year college students. All interactions were conducted by one investigator (*K. Strong*), and a second investigator (*B. Davy, S. Parks*) was present to take written notes and make observations without participating. Upon participant authorization, the sessions were recorded and written transcripts were generated.

Semi-structured interviews elicited information about students' daily routine, dietary and physical activity habits. Participants responded to questions about their usual activities and experiences related to psychosocial correlates of health behavior change (see *Appendix E* for interview questions). Psychosocial correlates included self-efficacy, self-regulation, social support, and outcome expectations for diet and physical activity behaviors. More pointed questions were asked as necessary to clearly identify specific themes, behaviors, lifestyles, and motivations. Conducting 30 elicitation interviews allowed the investigators to reach a point of "response saturation" (i.e., no new revealing information, informational redundancy). Following the completion of the elicitation interviews, and determination themes in each topic area, two focus groups were conducted (n=13) (see *Appendix F* for focus group questions) for peer-validation and discussion of interview findings. The focus groups provided insight into the authenticity and credibility of the interview findings.

Data Analysis

Elicitation interviews were systematically analyzed (62) to identify major and minor themes. "Major themes" were defined as responses given by $\geq 50\%$ of participants, and "minor themes" were defined as responses given by 25-49% of participants. One investigator (*K. Strong*) tabulated individual responses by reviewing interview transcripts and written notes; any discrepancies were further clarified with audio recordings. Similar responses were grouped, and response frequencies were calculated to detect major and minor themes. The tabulations and groupings were independently reviewed by two researchers (*B. Davy and S. Parks*). Major and minor themes were organized according to SCT components (54): behaviors, environmental factors, and personal factors including self-regulation, social support, self-efficacy, and outcome expectations. Thematic content from focus groups were analyzed using published guidelines (63). The investigators independently analyzed the focus group discussions and later met to confirm findings.

Four-day diet records were reviewed for accuracy and completeness prior to analysis using the NDS-R 2006 nutritional analysis software program (University of Minnesota, Minneapolis, MN). Reported energy intakes <1,200 kcal/day were excluded (n=2), as they likely represented significant underreporting using the Goldberg cutoff (64). Statistical analysis was conducted using SPSS statistical analysis software (SPSS v.12.0 for Windows). Analyses included descriptive statistics (means, standard error, and frequencies) and Pearson's correlations. Sex differences were determined using Independent Samples t-tests. The alpha level was set *a priori* at $P < 0.05$. Data are expressed as mean \pm SEM.

RESULTS

Participant Characteristics

The sample population was predominately white, freshmen, and of normal BMI classification (mean of 22.2 ± 0.4 kg/m²) (Table 1). Participants' majors included University Studies (n=13); Engineering (n=10); Business (n=9); Biology, Chemistry, or Geosciences (n=7); English (n=1); International Studies (n=1); Psychology (n=1); and Sociology (n=1). The mean age was 18.3 ± 0.1 y. Results of laboratory-based assessments of male and female participants are presented in Table 2. Mean values for the sample are as follows: WC, 77.9 ± 0.9 cm; systolic BP, 121.8 ± 1.5 mmHg; and diastolic BP, 63.1 ± 872 mmHg. For the activity prioritization questionnaire, daily activities ranked from most important to least important in the following order: 1) "going to classes," 2) studying, 3) "hanging out with friends," 4) sleeping, 5) exercising, 6) dating or meeting partners, 7) eating healthy foods, 8) work, 9) "having an ideal body", 10) surfing the internet, and 11) "going to a great party." Additional self-reported priorities included reading, writing, sports, family, ipod, and domestic activities.

Physical Activity Behaviors

In general, participants had a high level of cardiorespiratory fitness (mean VO_{2max} of 50.5 ± 1.5 ml/kg/min) with 73.2% of the sample \geq the ACSM VO_{2max} 70th percentile. Participants reported a mean of 35.4 ± 5.0 min/d of moderate- and high-intensity physical activity. Moderate- and high-intensity activities included vigorous calisthenics, weight lifting, running, cycling, and organized or pick-up sports (e.g., basketball, football, ultimate Frisbee). The sample daily step count mean was $11,412 \pm 657$ steps/d, which slightly exceeds the step count equivalent to the *Dietary Guidelines for Americans, 2005* (65) physical activity recommendations to reduce the risk of chronic disease in adulthood (10,000 steps \approx daily activity including 30 min moderate intensity physical activity) (66, 67). However, minutes in moderate- to high-intensity was below the recommendation to engage in 60 min most days of the week in moderate- to vigorous-intensity activities to manage body weight and prevent weight gain (65). On average, students slept 8.0 h/night (± 10 min), with an average bedtime of 1:16 am (± 9 min), and wake time of 9:13 am (± 8 min). Students took ~ 1 (0.9 ± 0.2) nap per week with a mean duration of 48.9 ± 12.5 min per nap, spent 150 ± 18 min/d watching television and playing video games, and 162 ± 12 min/d on the computer.

Dietary Behaviors

Habitual dietary energy and macronutrient intakes for males and females are provided in Figure 2. Males consumed significantly more energy than females, consuming $2,236 \pm 112$ and $1,711 \pm 90$ kcal/d, respectively ($p=0.001$). However, there were no significant differences between percent of energy from macronutrients by sex. Energy from alcohol contributed $0.6 \pm 0.5\%$ of total energy intake. Total fiber intake was considerably lower than the Dietary Reference Intakes for ages 19-30 (DRI) of 38 g/d for males (15.0 ± 6.1 g/d) and 25 g/d for females (13.3 ± 4.9 g/d) (68). In general, participants met DRI micronutrient recommendations for vitamin A (69) (DRI for males=900 μ g, mean for males was 876 ± 185 μ g; DRI for females=700 μ g, mean for females was 724 ± 78), vitamin D (70) (DRI=5 μ g,

sample mean was $3.8 \pm 0.4 \mu\text{g}$), folate (71) (DRI=400 μg , sample mean was $399 \pm 23 \mu\text{g}$), and calcium for males (70) (DRI=1,000 mg, mean for males was $924 \pm 89 \text{ mg}$). Micronutrient intakes were below the DRI for vitamin C (72) (DRI for males=90 mg, mean for males was $58 \pm 8 \text{ mg}$; DRI for females=75 mg, mean for females was $65 \pm 9 \text{ mg}$), vitamin E (72) (DRI=15 mg, sample mean was $5.7 \pm 0.3 \text{ mg}$), and calcium for females (70) (DRI=1,000 mg, mean for females was $786 \pm 69 \text{ mg}$). Sodium intake was $3.53 \pm 0.16 \text{ g}$, which was well above the DRI tolerable upper intake level of 2.3 g/d (73).

SCT Determinants of Diet and Physical Activity Behaviors

Scores for SCT determinants for health behavior change are provided in Table 3. Habitual dietary intake and physical activity behaviors were significantly correlated with respective SCT determinants of eating and physical activity behavior change. Daily step counts were correlated with physical activity constructs for *self-regulation for goals* ($r=.451$, $p=0.003$), *self-regulation for planning* ($r=.530$, $p<0.001$), *friend social support* ($r=.411$, $p=0.007$), *self-efficacy* ($r=.431$, $p=0.004$), and *outcome expectations* ($r=.447$, $p=0.003$). Sedentary activities were negatively correlated with *friend social support*: minutes spent watching television and playing video games ($r=-.309$, $p=0.046$) and minutes spent using a computer ($r=-.455$, $p=0.002$). Minutes spent in moderate- and high-intensity physical activities was correlated with *self-regulation for planning* ($r=.448$, $p=0.005$), *self-efficacy* ($r=.488$, $p=0.001$), and *outcome expectations* ($r=.334$, $p=0.030$). ACSM VO_2max percentile was correlated with *self-regulation for goals* ($r=.540$, $p<0.001$) and *self-efficacy* ($r=.520$, $p<0.001$). Total energy intake (kcal) was correlated with *regulating kcal and fat* ($r=-.416$, $p=0.007$) and *planning and tracking* ($r=-.409$, $p=0.008$). As indicators of dietary carbohydrate quality, correlates for % energy from added sugar and fiber (g) per 1,000 kcal are listed in Table 4. *Social support for fiber, fruit, and vegetables* was correlated with fiber intake (g) ($r=.425$, $p=0.006$) and micronutrients including folate, calcium, iron, and potassium

(data not shown). Sodium intake was negatively correlated with *regulating kcal and fat* ($r=-.317, p=0.044$).

College Lifestyle: Behaviors, Personal Factors, and Environmental Factors

The elicitation interviews revealed several major* and minor† themes pertaining to participants' behaviors, personal factors, and environmental factors. The transition to the college environment has resulted in considerable behavior changes. Compared to high school, students generally have fewer responsibilities* and a more lenient schedule. In college, they spend less time in class,* have less busy work for school,* play fewer organized sports,† exercise less,* and eat more.* They sleep more,* wake up later,* and stay up later.† Students regularly have free time during the day and evenings,* generally ≥ 5 hours free each weekday.* Almost all of weekends are free time* where students sleep more,* eat less, eat later in the day,* and spend more time on leisure and social activities.* In their free time, students socialize;* watch television, surf the Internet, play video games;* and play sports, exercise, or other physical activities.* Students spend $\sim 2-4$ h/d on the computer,* which includes school-related activities (i.e., assignments,* online classes,* and course websites*) and leisure activities (i.e., online social networking,* surfing the internet,* and games†).

Themes related to dietary habits in the college environment were identified. Students often skip breakfast† or have something they can prepare in their dorm room, eat quickly, or carry to class (e.g., cereal, oatmeal, bagel, or granola bar).* Lunch generally consists of sandwiches, salads, or wraps* but is often fast-food type meals like burgers, pizza, or French fries.* For dinner, students have entrées like pasta, meat and potatoes, salad, burgers, and sandwiches.* Most meals are from à la carte dining halls,* with a few students eating at all-you-can-eat facilities.† Most students snack on chips or crackers* and sweets* that they keep in their dorm rooms. Other snacks include cereal or cereal bars,† fruits and vegetables,† and small prepared meals like ramen or macaroni and cheese.† Snack foods come from an off-campus grocer,* and rarely vending machines.* Students

generally drink water,^{*} juice,[†] or sweetened beverages.^{*} When short on time (generally ≥ 1 -3 times per week^{*}), students were more likely to eat something quickly, often fast food-type foods.^{*} After 8 pm, the only food option on campus is a fast food-type facility without healthy options.^{*} To cook and store food, students generally use a mini refrigerator^{*} and microwave^{*} in their rooms. Most students either never use their hall kitchen or do not have one available.^{*} Students often microwave shelf-stable foods (e.g., popcorn, macaroni and cheese, or ramen),^{*} but do not keep fresh fruits and vegetables in their dorms as they often spoil.^{*} When asked to describe her abilities to cook and store food, one freshman female said, "I know there's a small kitchen on like the fourth floor. The knobs ... are there, but people mix them around, and the kitchen is just generally not good. I don't have any pots and pans. I can kind of steam vegetables in my microwave with a bowl and some saran wrap, but that's about it."

About two thirds of participants consumed alcohol while at college.^{*} Of those students who drink, most drink more alcohol in college than they did in high school.^{*} They drink one or two nights per week or more,[†] consume at least 5-6 drinks per night,^{*} and generally drink beer^{*} and/or liquor.^{*} While drinking, students often eat pizza, fast-food^{*} or party snacks such as chips or sweets.[†]

Themes for physical activity habits within the college environment emerged from elicitation interviews. Students generally participate in aerobic fitness,^{*} pick-up games,^{*} intramural or organized sports,[†] and strength training[†] about two to three times per week.^{*} Compared to high school, many students exercise less.^{*} Workouts are less intense, less structured, and consist of voluntary activities rather than activities required for organized practices.^{*} Students walk more in college than in high school[†] and view walking as physical activity.^{*}

Themes for personal factors related to diet and physical activity change, including self-regulation, social support, self-efficacy, and outcome expectations are presented in

Table 5. For perceived diet quality, participants believe a “healthy meal or diet” includes foods as follows: fruits, vegetables, or salads;* meat, chicken, or protein;* grains, breads, or pasta;* foods low in fat or not fried;† and foods low in sugar or carbohydrates.† These beliefs are generally consistent with what their parents, especially mother, taught them at home.* Most students thought they ate too few fruits* and vegetables† and thought they ate the right amount of whole grains,* fast food,* fried foods,* desserts,* soft drinks,* and late-night eating.* Among those who ate dessert daily or more, almost all were female and thought they were eating too much dessert. Most students use prepaid meal plans; thus, money does not affect most students’ food choices.* Some eat poorly when their meal plans are low on money, particularly at the end of the semester.†

DISCUSSION

While most research on college weight gain has been limited to females, 22 of the 43 participants (~51%) in this study were males. Minority populations were included in our sample; however, future research is necessary to identify the specific needs among minority populations, who may be more vulnerable to weight gain as young adults. The sample population was generally of normal BMI classification and above average cardiorespiratory fitness level. Seven of the 43 participants (16.3%) were classified as overweight ($BMI \geq 25 \text{ kg/m}^2$) which is somewhat lower than overweight prevalence in other studies with university students (38, 40, 74). According to ACSM body composition (% body fat) rankings for ages 20-29, males were between the 40th and 50th percentiles (61). The mean % body fat for females was much higher relative to ACSM body composition references, as they ranked between the 10th and 20th percentiles for their age group (61). Although females had a relatively high % body fat, both males and females were within the satisfactory range for % body fat (61).

Two studies on freshmen concluded that much of the college weight gain can be attributed to substantial decreases in physical activity behaviors. Over five months, Butler et al. (49) detected significant decreases in physical activity and an increase in leisure activity among freshmen females. Despite a concurrent decrease in energy intake, participants' body mass, BMI, % body fat, and fat mass increased while fat-free mass decreased. During the first 16 weeks at college, Hajhosseini et al. (75) observed significant increases in body mass and % fat mass, decreases in % lean body mass, and no change in energy intake among freshmen females. Changes in body weight were significantly correlated with change in resting metabolic rate (RMR), although RMR decreases did not reach a level of significance. While our cross-sectional design could not detect changes over time, our participants' habitual physical activity was well below the *Dietary Guidelines for Americans, 2005* recommendations to prevent weight gain in adulthood (65). Additionally, the combined averages for time spent watching television, playing video games, and computer usage totaled ~312 min/d (~5h and 12 min/d) of sedentary activity. Preventing college weight gain may require students to increase energy expenditure by both reducing sedentary activities and increasing physical activities; preventing lean body mass losses may necessitate incorporating vigorous physical activity into the college lifestyle.

Improving dietary carbohydrate quality by increasing dietary fiber consumption and decreasing energy from added sugars may be important for weight gain prevention in the target population. Our participant's fiber intake was considerably low compared to DRIs and was consistent with population estimates of dietary fiber intakes. A CARDIA study (76) found that dietary fiber was protective against cardiovascular disease risk factors including obesity and weight gain in young adults. Participants consuming more dietary fiber gained less weight despite dietary fat intake and potential confounding variables (e.g., age, sex, energy intake, and physical activity) over a 10 year period. In a group of 159 college students similar to our cohort, Rose et al. (74) found an inverse association between fiber

intake (g fiber/1000 kcal) and risk for overweight and obesity. One study by West et al. (50) on self-reported beverage intake among college students estimated that sugar-sweetened beverages contributed an average of 796 kcal/d among African Americans and 397 kcal/d among whites (50). On average, our predominantly white sample consumed ~321 kcal/d (80.3±6.1 g/d) from all added sugars, including beverages. Although somewhat lower than intakes reported by West et al. (50), energy from added sugar consumption among our participants was almost twice the excess of 174 kcal/d that Levitsky et al. (77) estimated to account for their observed college weight gain.

Self-regulation to limit added sugars may be an effective dietary strategy to reduce energy intake among college students, particularly among African Americans. Increasing dietary fiber through fruit, vegetable, whole grain, and legume consumption may contribute to weight maintenance through several proposed mechanisms, including increasing satiety and decreasing energy density [see review articles (78, 79)]. More apt self-regulatory skills and self-regulatory efficacy were associated with diets low in added sugar and diets high in fiber. Thus, interventions designed to increase self-regulatory skills and self-regulatory efficacy behaviors such as tracking added sugars and planning to incorporate fiber-rich foods into routine diets may aid in weight gain prevention among college students.

SCT-based Health Behavior Change

Bandura proposed that behaviors are adopted along a continuum of initiation, establishment, and maintenance phases (53). Individuals proceed through these phases when reinforced by favorable interactions among perceived self-efficacy, self-regulation, and outcome expectations for a given behavior. While self-efficacy has frequently been associated with behavior change, SCT identifies efficacy for self-regulation and self-regulatory skills as the driving forces underlying health behavior change through their impact on self-efficacy (80). Social support is also proposed to impact health behavior change via self-efficacy. Outcome expectations have shown limited effects on the SCT model (58), yet

unrealistic outcome expectations for dramatic results may predispose participants to disappointment and hinder satisfaction levels (81).

Before college, many students' physical activity and dietary habits were performed in response to a structured environment. Almost all interview participants were involved with organized sports in high school, while parents, often mothers, provided regular meals and food. Maintaining healthy behaviors within this environment may have required minimal self-regulatory skills. Without these structures in place, college students may not have the motivation, the self-regulatory skills, or outcome satisfaction necessary to engage in their prior behaviors within their new environment. Based on the SCT model (53), interventions designed to assist students with setting attainable goals, supporting the planning and tracking processes, and monitoring meaningful changes may help students learn self-regulatory skills to and ultimately augment self-efficacy; developing autonomous self-regulatory skills and confidence in maintaining these skills may be paramount to health behavior change in the transition to adulthood.

From our findings, those students with higher *regulating kcal and fat* and *planning and tracking* scores consumed fewer kilocalories, less added sugar, and more fiber. Higher scores for *regulating kcal and fat* indicated more frequent behaviors including limiting high fat foods, avoiding fast food restaurants, and minding portion sizes while *planning and tracking* indicated more frequent behaviors like monitoring whole grains, fruits, vegetables, and sweets. Those with high physical activity *self-regulation* scores had higher daily step counts, more minutes in moderate- and high-intensity physical activities, and higher ACSM VO₂max percentile rankings. These individuals reported confidence in planning and scheduling exercise despite time restraints.

Levitsky et al. (45) successfully prevented weight gain in freshmen by having students self-monitor and report daily weights, interpret feedback estimating their energy imbalance, and engage in behaviors to correct the imbalance. This presents a convenient,

disseminable, and cost effective strategy, yet may not be adequate for individuals lacking self-efficacy, motivation, or knowledge of effective weight loss strategies. Nevertheless, this study highlights the importance of self-regulatory behaviors. Our participants rarely engaged in self-weighing, generally weighing themselves once or twice per month or less. Students did not have scales in their dorm rooms or suites, and most used on-campus gym scales. Weight-regulatory interventions among college students should consider participants' access to scales, encourage frequent weighing, and provide individualized feedback.

Within the self-regulatory process, self-monitoring for the effects of a given behavior provides a basis for an individual to evaluate that behavior, and subsequently decide whether it should be maintained, terminated, or modified (80). Without adequate self-monitoring strategies, behavioral evaluations can be erroneous or nonexistent, leaving behaviors unregulated. Without frequent monitoring of weight, college students may not recognize a weight gain or its causal behaviors. One theme that emerged from a focus group discussion was the light-hearted social acceptability of college weight gain. Some of these participants felt that weight gain was expected during the freshman year. One sophomore male commented, "It's socially acceptable to gain weight your first year. If you don't, you're kind of the odd man out. You go home and people are like, [teasing] 'Oh, the freshman 15!' I'm not saying it's good ... or that I want to, but it's acceptable." These perceptions may undermine self-evaluative efforts if students consider weight gain to be commonplace, and interventions should address such misconceptions.

Social support for health behaviors changes during the transition to college. Students feel that their families no longer influence their food choices when away from home. Friends have a stronger influence over college food choices, mainly because they are around their friends more. Students will choose to eat with their friends even when they think the food is unhealthy. When friends offer unhealthy snacks, students are more likely to

eat whatever is offered. However, this powerful social influence may be useful to encourage health behaviors. Physical activity *friend social support* was positively associated with daily step counts and negatively associated with sedentary activity, suggesting social support may be useful for encouraging physical activity. One internet-delivered intervention to improve health behaviors among a group of adults (median age 53) found that those with a network of social support were more likely to maintain behaviors over time compared to a control, and showed better intervention adherence than the intervention only (57). Interventions encouraging social networking, group goal setting, and incorporating friends into plans to engage in healthy behaviors may be particularly effective within the socially-focused college environment.

CONCLUSION

This investigation of college weight gain incorporated physiological assessments and structured qualitative research methods to characterize college students according to SCT determinants of health behavior change. Healthy eating and physical activity behaviors were secondary to other responsibilities, including academics and socializing. Despite enjoyment of physical activity, a desire to exercise more and ample free time, participants had difficulty exercising regularly and spent a considerable amount of time in sedentary activity. Eating habits generally met recommendations but were high in sodium and low in fiber, vitamin C, and vitamin E. Psychosocial correlates for eating and physical activity self-regulation and self efficacy were correlated with dietary carbohydrate quality, daily step counts, and minutes spent in moderate- to high-intensity physical activities. Social support for physical activity was correlated with daily step counts and inversely correlated with sedentary activities.

Decreases in energy expenditure through considerable declines in physical activity and concurrent increases in sedentary activity likely contribute to college weight gain. In

light of decreased energy expenditure, energy consumption must be closely regulated to prevent overconsumption and energy expenditure through physical activity must be encouraged. Behaviors such as increasing dietary intake of fruits, vegetables, and fiber while limiting high-fat foods and added sugars may aid in weight gain prevention and subsequently improve overall diet quality. Before college, healthy meals and regular exercise were part of a regular routine. Interventions should instill skills in goal setting, planning, and self-monitoring, while incorporating social support to facilitate adherence and the long-term adoption of healthy behaviors.

NOTES

* Represents a “major theme,” defined as a response given by $\geq 50\%$ of interview participants.

† Represents a “minor theme,” defined as a response given by 25-49% of interview participants.

Table 1. Participant demographic characteristics

	n	% of sample
Sex		
Male	22	51.2
Female	21	48.8
Race		
White	36	83.7
Non-white ^a	7	16.3
Academic year		
Freshman	32	74.4
Sophomore	11	25.6
BMI^b classification		
Underweight (BMI<19)	3	7.0
Normal (BMI=19-24.9)	33	76.7
Overweight (BMI≥25)	7	16.3

^a Asian (n=3), African American (n=4).

^b BMI=body mass index, kg/m².

Table 2. Quantitative descriptive characteristics of male and female college students

	Male (n=22)	Female (n=21)	
	Mean±SEM^a	Mean±SEM	<i>P</i>
Age, y	18.6±0.1	18.1±0.1	0.008*
Height, cm	177.2±0.8	164.0±1.4	<0.001*
Weight, kg	71.0±1.8	60.2±1.3	<0.001*
Body Mass Index (BMI), kg/m ²	22.5±0.6	21.9±0.6	0.525
Waist Circumference (WC), cm	79.0±1.3	76.7±1.2	0.206
Body Fat, %	15.0±1.2	29.9±1.3	<0.001*
Systolic Blood Pressure, mmHg	124.2±2.2	117.1±1.7	0.016*
Diastolic Blood Pressure, mmHg	62.3±1.3	63.4±1.2	0.741
VO ₂ max, ml/kg/min	55.4±1.5	44.8±2.0	<0.001*
Dietary Cognitive Restraint	6.23±1.0	7.67±1.0	0.310
Disinhibition	3.68±0.4	4.81±0.5	0.080
Feelings of Hunger	4.36±0.9	5.05±0.3	0.450

^a SEM=standard error of the mean.

* Statistically significant difference, males vs. females, $P < 0.05$ using an independent t-test.

Table 3. Social cognitive determinants of eating and physical activity behaviors

	Mean score \pm SEM ^a	Range
Dietary Strategies: ^b		
Regulating calories and fat ^c	2.4 \pm 0.2	1.0-4.6
Planning and tracking ^c	2.1 \pm 0.1	1.0-4.4
Regulating fiber, fruit and vegetables ^c	3.6 \pm 0.1	1.7-5.0
Dietary Social Support: ^b		
Fat Support ^c	2.8 \pm 0.1	1.3-4.3
Fiber, fruit, and vegetable support ^c	2.8 \pm 0.1	1.7-4.7
Dietary Self-Regulatory Efficacy: ^b		
Planning and tracking ^d	73.4 \pm 2.9	16.7-100.0
Decreasing fat ^d	76.1 \pm 3.0	10.0-100.0
Increasing fiber, fruit, and vegetables ^d	71.7 \pm 3.0	23.9-98.3
Reducing sugar ^d	75.1 \pm 2.7	21.7-100.0
Dietary Outcome Expectations: ^b		
Positive expectations ^c	4.2 \pm 0.1	2.2-5.0
Negative expectations ^c	2.4 \pm 0.1	1.0-4.3
Physical Activity: ^e		
Self-regulation for exercise goals ^c	2.9 \pm 0.1	1.0-4.9
Self-regulation for exercise plans ^c	2.8 \pm 0.1	1.3-4.4
Social support from friends ^c	2.7 \pm 0.2	1.0-5.0
Self-efficacy ^c	3.5 \pm 0.1	1.3-4.9
Outcome expectations ^f	5.8 \pm 0.1	4.1-7.0

^a SEM=standard error of the mean.

^b Reference (51).

^c Scored on a scale of 1-5.

^d Scored on a scale of 0-100.

^e Reference (52).

^f Scored on a scale of 1-7.

Table 4. Pearson's correlations of % kcal from added sugar and fiber (g) per 1,000 kcal with social cognitive determinants for dietary behavior change

Determinant	% kcal from added sugar		Fiber (g) per 1,000 kcal	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Regulating kcal and fat	-0.365	0.019*	0.463	0.002*
Planning and tracking	-0.329	0.036*	0.576	<0.001*
Regulating fiber, fruit, and vegetables	-0.449	0.003*	0.673	<0.001*
Self-regulatory efficacy for planning and tracking	-0.349	0.026*	0.369	0.018*
Self-regulatory efficacy for increasing fiber, fruit, and vegetables	-0.372	0.017*	0.505	0.001*
Positive outcome expectations	-0.221	0.164	0.327	0.037*
Negative outcome expectations	0.366	0.019*	-0.418	0.007*

* $P < 0.05$

Table 5. Interview response themes for personal factors of health behavior change

Psychosocial Major and minor[†] themes

Self-regulation

To manage their time, students make lists of their short-term responsibilities from a long-term planner. Some keep mental lists and do not need to use written lists. They use paper calendars or planners, post-it notes,[†] or electronic planners. Students weigh themselves about 1-2 times per month or less. Some only weigh themselves a few times per year.[†] They use the on-campus gym scales or the bathroom scales at home.[†] Most students believe they know their weight within a few pounds.

I[‡]: *What tools do you use to manage your time and responsibilities? P[§]₁: I have a [computer] calendar that I keep everything written down on – all my tests, all my quizzes. I have a computer Post-it that I have all my stuff written down for each class. P[§]₂: My hand. Sometimes if I have to remember something I'll write it on my hand. –two Freshmen males*

I: *How often do you weigh yourself? P:* *I weigh myself when I go home or if I get curious, but that's about it. I don't have a scale anymore. The last time I weighed myself at home I was 140 [lbs] and then you guys weighed me and I was 137 [lbs]. I had Thanksgiving so I don't know. –Freshman female*

Diet

In high school, most students' mothers cooked healthy, balanced meals for them^{*} and provided most available food.[†] With autonomous dietary regulation in the college environment, students believe they eat less healthy and eat more overall.^{*} Some students feel no health-related effects due to dietary changes since college.[†] However, some feel they have gained weight, have lower energy levels, and more psychological distress due to dietary changes.[†] Most students want to eat more regular, balanced meals,^{*} eat more fruits and vegetables,[†] or reduce unhealthy foods and drinks.[†] However, students do not plan any of their meals and snacks in advance. Some use the University online nutrition information to view % daily values of on campus foods. Yet, many students do not know this resource exists or never use it. College students do not track calorie or fat gram intakes. On Nutrition Facts labels, students look for sugar or carbohydrate values, calories,[†] or fat.[†] However, these facts generally did not influence students' decisions to consume foods; the most prevalent reason for reading labels was out of boredom or curiosity, without purpose.

I: *How are your meals and snacks different from your routine at home? P:* *At home my mom always made me breakfast like orange juice and an egg. I had the same lunch in high school all four years – turkey sandwich on a bagel with cheese and mustard. For dinner it ... varied a lot. Sometimes it would be pasta, sometimes chicken. [This year] is definitely different. –Freshman male*

I: *Do you read the nutrition information on foods? P:* *Every once in awhile. If it's something really, really sweet. I will glance at the back and see how much sugar is in it. I don't normally do that because I don't know what to watch. –Freshman female*

Physical activity

Most students participated in an organized sport in high school but not in college. They no longer have regular required practices as part of their schedule and must rely on their own regulatory skills to be physically active. College students found advantages to working out both alone and with friends. Students are concerned that their fitness levels are diminishing due to decreases in physical activity. Of the few with concerns, most had not implemented changes to their physical activity habits. Most students would like to exercise a specified number of times per week, run a specified distance,[†] or gain muscle overall.[†] However, most students do not keep track of their exercise beyond a mental count.

I: *How have your physical activity habits changed between this year and high school? P:* *[I exercise] way less now. I miss having a coach yell at me and tell me to run and stuff. I mean, I still run but I don't run as hard as I could. I'll never workout to a point where I'm dying. So, that's really different. I miss that a lot.*

Social support

Diet

Before college, students' parents provided them with regular, balanced meals. In college, students do not feel that their families influence their food choices^{*} but would occasionally try to eat healthier, like at home.[†] Most felt that their friends influence food choices more in college than high school^{*} because they were around their friends more so in college. Students generally eat every meal, with the exception of breakfast, with their friends.^{*} Three minor themes emerged for the perceived influence of friends on eating habits: 1) friends have no influence their food choices,[†] 2) friends influence the location but not the food choice itself,[†] and 3) friends make available unhealthy foods that students generally do not consume.[†] Some students believe their friends are healthy eaters[†] while others believe their friends eat too much in general, too much fast food, or not enough fruits and vegetables.[†]

I: *How do your friends influence your food choices?* **P:** *I guess sometimes I eat their food. Actually, a lot of times if I'm going to make ramen noodles, and one of my friends recently had a birthday, so she had like two birthday cakes sitting in the room. So she was like, "eat some more cake!" So like, in that way they influence me. But when we're eating out, I'm not like, "oh my gosh, they're not going to like me 'cause I got this." So not in that way. –Freshman female*

Physical activity

Having social support from friends encouraged students to be more physically active.^{*} Almost all college students have friends that exercise or play a sport.^{*} Males in particular are more likely to play pick-up sports if a friend invites them.^{*} Some students feel that exercising with friends is socially rewarding.[†]

I: *Do [your friends' gym habits] affect your habits?* **P:** *Yes. Usually we work out together. It's like, we set a time to go. If one goes, the other has to. If not they'll make you feel bad and you end up going anyway. –Freshman male*

Self-efficacy

Students view themselves as having effective time management skills,^{*} although some acknowledge their skills could be improved.[†] When busy, students eliminate activities such as television or internet surfing, socializing, sleeping and eating,^{*} homework not due,[†] and exercise.[†] Regular class times are a main scheduling priority,^{*} affecting wake and meal times,[†] as are work and organized sports.[†] **I:** *What kind of things do you drop from your schedule when you have a lot to get done?* **P:** *Probably going to the gym because that takes time. Talking on the phone. [Talking with friends.] –Freshman male*

Diet

Compared to high school, students perceive that unhealthy foods are more available and healthy foods are less available.^{*} Students believe there are healthy options on campus;^{*} however, it would be easier to eat healthy foods with improved taste and availability^{*} or making unhealthy choices less convenient.[†] Most students would wait in a longer line^{*} and pay more for healthy food.^{*} However, if their friends were eating somewhere unhealthy, almost all students would choose to eat with their friends.^{*} Students are interested in learning about eating healthy^{*} and believe they are capable of improving their diets, if needed.^{*} Their average confidence level for improving dietary habits was 7.5 on a scale of 1-10. The major incentive for improving their diets would be the onset of a diet-related disease or illness.^{*} Most students think they have the skills to improve their eating habits, yet some would prefer assistance.^{*} Few students have lost or gained weight.^{*} Those who have successfully lost or gained weight did so for a sport like football or wrestling.[†] They reported that an illness or disease related to diet would motivate them to change their eating habits.

I: *What would you change to make it easier to eat healthy?* **P₁:** *There's not really that large of a vegetable section here ... Like if I get a sandwich I can't say "oh I'll have vegetables too." You have to go somewhere else and get [them] at another station. I don't do that. **P₂:** *I feel like I always had a lot of fruit in our house and here it's either apples or bananas. We always had pears ... we had everything. So I definitely used to snack a whole lot on fruits and vegetables whereas here it's almost impossible. –two Freshman females**

I: *What would you like to change about your eating habits?* **P:** *I would like to eat at least three fruits and vegetables a day. I know it's not going to happen but I try. I wish there was like an Easy-mac of healthy mix. There's no easy mix but it would be nice. –Freshman female*

Physical activity

Working out is not difficult when part of a routine, but becomes a challenge with other responsibilities, lack of accountability, and feelings of laziness. Students were fairly confident that they could work out more if they needed to. On average, the participants' confidence level was 7.3 on a scale of 1-10. As motivators to workout more, they reported body dissatisfaction (e.g., weight gain, clothes not fitting)[†] and a competition or a friend working out more[‡] as motivators. Almost all students believe they know how to improve their fitness levels and have enough time to do it. Students believed the available facilities were acceptable, but would like them to be more numerous or convenient.[‡]

I: *Is working out regularly difficult for you?* **P₁:** *[It's difficult] to go to the gym by myself but I really enjoy going to volleyball practice regularly.* –*Sophomore female* **P₂:** *If I have a lot of stuff to do, then yeah, it's difficult. You have to get dressed, you have to go, come back, shower. Yeah, so it's a lot to do.* –*Freshman male*

Outcome expectations

Diet

When they eat healthy, most students feel better in general, more energized, or better psychologically. Eating unhealthy or fatty foods makes them feel tired, sluggish, or uncomfortable. Most students believe healthy foods are worth the money, whether or not they think healthy foods are more expensive. They believe improving their habits would make them feel better, function better, or have more energy. Others believed it would help them lose or manage weight. Many students reported avoiding sugar or sweets. Most students avoid these foods and others to avoid immediate physical discomforts, such as headaches, stomachaches, and intolerances. Some avoided foods because of preference or taste aversion,[‡] yet few (<25%) avoided foods because of anticipated weight gain or disease development. The most common effect of alcohol consumption the following day is feeling overly tired. Others feel no effects after drinking,[‡] feel less motivation,[‡] or eat less.[‡] Most feel that drinking does not affect their health, although some feel their health has diminished as a result.[‡] Many feel that drinking contributes to weight gain in general;[‡] however, few believe that drinking has contributed to personal weight gain.

I: *How does what you eat affect your health or how you feel?* **P:** *I know if I eat bad, I feel sluggish ... If you eat really bad, it drains your energy and you feel bad about yourself ... So you generally don't feel energized.* –*Freshman male*

Physical activity

Being physically active is important to college students, and many would like to work out more. They believe that the positive outcomes of being physically active are improved health or normal function, improved psychological health, being in better shape or more competitive,[‡] and social benefits.[‡] Since coming to college and being less physically active, most students have concerns about their fitness level dropping. Yet, many students have no concerns about their fitness level.

I: *What are the benefits of being physically active?* **P:** *For me, a huge stress reliever. It's something I've always done with other people so I get to know [them] better and make friendships. And I just feel better.* –*Freshman female*

* Represents a "major theme," defined as a response given by ≥50% of participants.

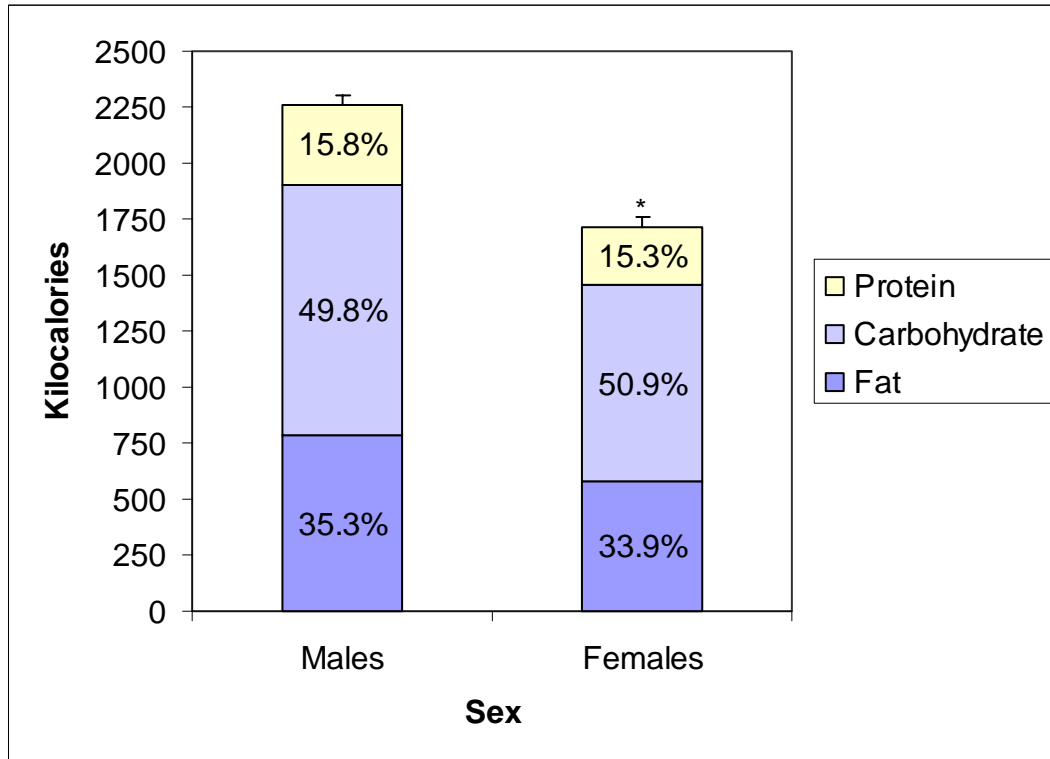
† Represents a "minor theme," defined as a response given by 25-49% of participants.

‡ I=interviewer

§ P=participant

** Available: <http://foodpro.studentprograms.vt.edu/foodpro3/location.asp>

Figure 2. Habitual dietary energy and macronutrient intakes of college students



* Significant difference, males vs. females, $P < 0.05$.

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CHAPTER 3:

Conclusions and Implications for Future Research

Young adults attending college are more vulnerable to weight gain than the general population. Effective and disseminable interventions must be developed to counteract the obesogenic college environment and meet public health goals. Students reported that factors such as weight gain, decreasing fitness levels, and social influences would motivate them to change their eating and physical activity habits. Barriers to eating healthy foods on-campus were poor dormitory kitchen facilities, dining hall hours, and palatability. Physical activity barriers included lack of motivation, other responsibilities (i.e., academic and social), and laziness. Students do not appear to have adequate self-efficacy and self-regulation skills to engage in healthful behaviors despite these barriers. Interventions should be individualized to increase self-regulatory skills based on current needs and abilities. Tailoring interventions to individual needs requires offering a variety of dietary and physical activity approaches to achieving energy balance. However, investigations on college weight gain have implicated decreases in physical activity for a majority of observed weight gain (82, 83), and therefore should be a main focus of the intervention.

Internet-delivered interventions may have several advantages over in-person interventions including cost-effectiveness, dissemination, convenience, privacy, and individualization (84). College students are computer savvy and reported using the computer for a variety of activities. However, focus group participants (n=13) completed a free-response survey to provide insight into perceptions of potential delivery mechanisms for learning about health behaviors. Potential mechanisms included a traditional classroom setting, a standard online class, and an interactive online class with personalized feedback. The responses are presented in Table 6. Students overwhelmingly preferred the traditional classroom setting (n=10) compared to a standard online class (n=1) and an interactive online class (n=2). For a traditional classroom setting, students valued the personal

interactions between teachers, but had concerns regarding time efficiency. For an online learning setting, students preferred a tailored program but a few still thought personal contact was important. Additional online learning concerns included maintaining motivation and using a computer.

These respondents felt that personal contact in a classroom setting would be an ideal intervention delivery mechanism. However, this learning-theory based intervention provides individualized treatment and personal feedback. These activities would not be feasible without several instructors; thus, the cost would be prohibitive, and students' concerns about boredom would be tried while waiting for individualized instruction. As a medium, the Internet is often used for social networking among college students. The intervention should incorporate social networks through online message boards, chat rooms, and links to websites. The Internet can provide conveniences, tailoring, tracking tools, and cost effectiveness unmatched by the classroom. Behavior change requires adaptability in many settings, such as on-campus, at home, and during travel. Classroom-based programs may not be able to serve as a resource or support mechanism during school breaks, travel, and between semesters as the Internet could. Online interventions may be more realistic considering that effective behavior change takes extended, intensive treatment and often lasts only as long as the treatment (85).

When asked what incentives would be necessary for them to participate in an intervention to improve health habits, major themes included money, course credit, and an effective program. While either money or course credit would be feasible incentives, offering course credit may result in the best adherence and minimize attrition, as "attending classes" and "studying" were student's top priorities. Although most participants initially preferred a traditional classroom setting, we believe that an online intervention would meet their needs for personal interaction by providing personalized advice, support, and feedback, while facilitating a social network.

Table 6.^a College student perceptions of three potential intervention delivery mechanisms

Traditional Classroom Learning	
<u>Perceived Facilitators</u>	<u>Perceived Barriers</u>
Preferred learning environment (n=9)	Less convenient than online classes (n=10)
Contact and interaction with peers (n=7)	Class might be boring (n=3)
Immediate answers from instructor (n=6)	
Traditional Online Class	
<u>Perceived Facilitators</u>	<u>Perceived Barriers</u>
More convenient than a traditional classroom setting (n=12)	Difficult to self-motivate (n=7)
Self-paced (n=5)	No instructor or classroom setting (n=4)
Easier for shy people to ask questions (n=1)	Not personalized (n=4)
Fewer distractions (n=1)	No social interaction (n=3)
	Computer usage is inactive, unhealthy (n=2)
Personalized, Internet-based Program	
<u>Perceived Facilitators</u>	<u>Perceived Barriers</u>
Tailored to personal needs (n=9)	No in-person contact (n=4)
More convenient (n=3)	May be difficult to stay motivated (n=2)
More accountability (n=3)	Technical barriers (n=2)
Self-paced (n=1)	A lot of work (n=1)
Easier for shy people to ask questions (n=1)	A lot of time on the computer (n=1)

^a Summary of responses from 13 focus group participants. Some participants provided more than one written response to an item, resulting in a sum >13 responses for some items.

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APPENDIX A

Institutional Review Board Approval



Office of Research Compliance
Institutional Review Board
1880 Pratt Drive (0497)
Blacksburg, Virginia 24061
540/231-4991 Fax: 540/231-0959
E-mail: moored@vt.edu
www.irb.vt.edu

FWA00000572(expires 7/20/07)
IRB # is IRB00000867.

DATE: March 15, 2006

MEMORANDUM

TO: Brenda M. Davy
Richard A. Winett
Kathryn Strong

Approval date: 3/13/2006
Continuing Review Due Date: 2/26/2007
Expiration Date: 3/12/2007

FROM: David M. Moore 

SUBJECT: **IRB Full IRB Approval:** "Weight Gain Prevention in College Students", IRB # 06-075

The above referenced protocol was submitted for full review and approval by the IRB at the March 13, 2006 meeting. The board had voted approval of this proposal contingent upon receipt of responses to questions raised during its deliberation. Following receipt and review of your responses, I, as Chair of the Virginia Tech Institutional Review Board, have, at the direction of the IRB, granted approval for this study for a period of 12 months, effective March 13, 2006.

Approval of your research by the IRB provides the appropriate review as required by federal and state laws regarding human subject research. As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.
2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.
3. Report promptly to the IRB of the study's closing (i.e., data collecting and data analysis complete at Virginia Tech). If the study is to continue past the expiration date (listed above), investigators must submit a request for continuing review prior to the continuing review due date (listed above). It is the researcher's responsibility to obtain re-approval from the IRB before the study's expiration date.
4. If re-approval is not obtained (unless the study has been reported to the IRB as closed) prior to the expiration date, all activities involving human subjects and data analysis must cease immediately, except where necessary to eliminate apparent immediate hazards to the subjects.

Important:

If you are conducting **federally funded non-exempt research**, this approval letter must state that the IRB has compared the OSP grant application and IRB application and found the documents to be consistent. Otherwise, this approval letter is invalid for OSP to release funds. Visit our website at <http://www.irb.vt.edu/pages/newstudy.htm#OSP> for further information.

cc: File

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE UNIVERSITY AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

DATE: March 12, 2007

MEMORANDUM

TO: Brenda M. Davy
Richard A. Winett
Kathryn Strong

FROM: David M. Moore 

Approval date: 3/13/2007
Continuing Review Due Date: 2/25/2008
Expiration Date: 3/12/2008

SUBJECT: **IRB Full Review Continuation 1:** "Weight Gain Prevention in College Students",
IRB # 06-075

This memo is regarding the above referenced protocol which was previously granted approval by the IRB. The proposed research, having been previously approved at a convened IRB meeting, required full IRB review prior to granting an extension of approval, according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. The above referenced protocol was submitted for full review continuation and approval by the IRB at its most recent meeting. Pursuant to your request, I, as Chair of the Virginia Tech Institutional Review Board, have, at the direction of the IRB, granted approval for this study for a period of 12 months, effective March 13, 2007.

Approval of your research by the IRB provides the appropriate review as required by federal and state laws regarding human subject research. As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.
2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.
3. Report promptly to the IRB of the study's closing (i.e., data collecting and data analysis complete at Virginia Tech). If the study is to continue past the expiration date (listed above), investigators must submit a request for continuing review prior to the continuing review due date (listed above). It is the researcher's responsibility to obtain re-approval from the IRB before the study's expiration date.
4. If re-approval is not obtained (unless the study has been reported to the IRB as closed) prior to the expiration date, all activities involving human subjects and data analysis must cease immediately, except where necessary to eliminate apparent immediate hazards to the subjects.

cc: File

Invent the Future

APPENDIX B

Health Beliefs Survey

Center in Research for Health Behavior
Virginia Tech

Health Beliefs Survey

Food Beliefs

Healthier Food Strategies

Please, tell us what you have done in the past 3 months to eat healthier foods.

Use this scale to tell us how often in the past 3 months you did the following:

	1 Never	2 Seldom	3 Occasionally	4 Often	5 Repeatedly
In the past 3 months how often did you:					How Often (1-5)
1. Remind yourself that high-fat foods have more calories than low-fat foods.					
2. Tell yourself that every calorie counts.					
3. Remind yourself that "fat-free" does not mean "calorie-free."					
4. Eat out less often.					
5. Avoid going to restaurants where you eat too much.					
6. Avoid fast-food restaurants.					
7. Eat whole grain foods.					
8. Eat more vegetables.					
9. Eat more fruit.					
10. Pay closer attention to serving sizes.					
11. Keep track of how many high-fat foods you eat each day.					
12. Eat smaller portions.					
13. Avoid ice cream and other high-fat dairy foods.					
14. Avoid high-fat beef.					
15. Eat low-fat toppings for potatoes and other vegetables.					
16. Eat low-fat salad dressing.					

Food Beliefs
Healthier Food Strategies

Use this scale to tell us how often in the past 3 months you did the following:

	1 Never	2 Seldom	3 Occasionally	4 Often	5 Repeatedly
In the past 3 months how often did you:					How Often (1-5)
17. Choose low-fat foods in fast-food and other restaurants.					
18. Eat 3 meals a day.					
19. Eat no more than 3 snacks a day.					
20. Plan to eat only a certain number of calories a day.					
21. Keep track of the number of calories in the foods you eat.					
22. Plan to eat at least 5 servings of fruits and vegetables each day.					
23. Keep track of how many servings of fruits and vegetables you eat each day.					
24. Plan to eat 3 servings of whole-grains food each day.					
25. Keep track of how many sweets you have each day.					
26. Plan to eat fewer sweets					
27. Keep track of how many servings of whole-grains foods you eat each day.					
28. Plan to eat fewer high-fat foods at meals.					
29. Keep track of how many sodas and other sugared beverages you have each day.					
30. Plan to drink fewer sodas and other sugared beverages.					
31. Plan to eat fewer high-fat chips and crackers.					
32. Keep track of how many servings of high-fat chips and crackers you eat each day.					

Food Beliefs
Healthier Foods Social Support

What do the members of your family do and think about eating healthy foods? We just want your opinion even if you are not sure.

Use this scale to tell us if you agree with the following statements:

- | | | | | |
|------------------------------|-----------------|--|--------------|---------------------------|
| 1 | 2 | 3 | 4 | 5 |
| <i>Strongly
Disagree</i> | <i>Disagree</i> | <i>Neither
Agree or
Disagree</i> | <i>Agree</i> | <i>Strongly
Agree</i> |

	<i>Agree or Disagree 1-5</i>
Members of my family	
1. keep track of the number of calories in the foods they eat..	
2. eat whole-grains cereal every day.	
3. don't drink many regular sodas or sugared drinks.	
4. eat 5 servings of fruits and vegetables every day.	
5. avoid high-fat snacks like chips and snack crackers.	
6. try to eat low-fat dairy foods.	
7. don't eat large portions of beef.	
8. eat whole-grains bread every day.	
9. cook with very little fat.	
10. eat lower-fat foods at fast-food restaurants.	
11. keep track of the food they eat each day.	

Food Beliefs
Healthier Foods Social Support

What do your closest friends do and think about eating healthy foods?
We just want your opinion even if you are not sure.

Use this scale to tell us if you agree with the following statements:

1 **2** **3** **4** **5**
Strongly *Strongly*
Disagree *Agree*

<i>My closest friends ...</i>	<i>Agree or Disagree 1-5</i>
12. keep track of the number of calories in the foods they eat.	
13. eat whole-grains cereal every day.	
14. don't drink many regular sodas or sugared drinks.	
15. eat 5 servings of fruits and vegetables every day.	
16. avoid high-fat snacks like chips and snack crackers.	
17. try to eat low-fat dairy foods.	
18. don't eat large portions of beef.	
19. eat whole-grains bread every day.	
20. cook with very little fat.	
21. eat lower-fat foods at fast-food restaurants.	
22. keep track of the food they eat each day.	

Food Beliefs

Healthier-Foods Efficacy

These questions ask how *CERTAIN* you are that you can do different things to eat healthier foods.

You will be asked to decide how certain or how sure you are that you can do these things on most days and in lots of different situations.

Think about times when it will be easy to do these things and when it will be harder.

When deciding how sure you are you can do these things, we want you to think about doing them:

ALL or MOST of the time, not just once or twice.

For a long time...until next year...or even longer!

In a lot of different situations - like when you are...

- deciding what to eat when at home, alone, watching TV or doing chores...
- eating with your family...
- eating out with friends or at a party ...
- at a fast-food restaurant...
- buying food at the grocery store

Food Beliefs
Healthier Foods Efficacy

Use any number from 0 to 100 on the following scale to tell how certain you are that you can - all or most of the time:

0 ----- 50 ----- 100
Certain I CAN NOT **Somewhat certain I can** **Certain I CAN**

KEEPING TRACK	
How certain are you that you can, every day, keep track of the...	How certain? (0-100)
1. calories in the foods you eat?	
2. fruits and vegetables you eat?	
3. high-fat, high-calorie snacks you eat?	
4. high-fat, high-calorie dairy foods you eat?	
5. sweets you eat?	
6. the amount of whole grain foods you eat?	
7. the calories and fat in your fast-food meals?	
8. the regular sodas or other sweet beverages you drink?	
9. high-fat, high-calorie meats you eat?	
How certain? (0-100)	
FRUITS AND VEGETABLES	
10. bring fruit to work or school for a snack every day?	
11. eat at least 5 servings of fruits and vegetables every day?	
12. eat vegetables (like carrot or celery sticks) for a snack?	
13. eat fruit for a snack?	
14. have a side salad instead of French fries when dining out?	
15. drink fruit or vegetable juice at meals?	

Food Beliefs
Healthier Foods Efficacy

How certain are you that you can, every day...	How certain? (0-100)
DAIRY FOODS	
16. drink 1%, $\frac{1}{2}$ %, or fat-free (skim) milk?	
17. switch to low-fat or fat-free ice cream or frozen yogurt?	
18. switch to low-fat or fat-free ice cream bars?	
19. eat low-fat cheese?	
BREADS AND CEREALS	
20. eat whole-grains bread for lunch?	
21. bring whole grain cereal to work or school for a snack?	
22. bring a slice of whole-grains bread to work or school for a snack?	
23. eat 1 slice of whole-grains bread every day?	
24. eat 2 slices of whole-grains bread every day?	
25. eat at least 3 slices of whole-grains bread every day?	
26. eat at least 3 servings of whole-grains breads and cereals a day?	

Food Beliefs
Healthier Foods Outcomes

Now, tell us what you expect will happen when you eat healthier foods.
Use this scale to tell us if you agree the following will happen:

1
2
3
4
5
Strongly
Disagree
Strongly
Agree

If I eat healthier foods every day, I expect:	Do you agree? (1-5)
1. I will have more energy.	
2. I will lose weight.	
3. I will feel healthier and happier.	
4. I will live longer.	
5. I will feel better in my clothes.	
6. I will be hungrier.	
7. I will be unhappy and irritable.	
8. My health will improve.	
9. I will miss eating the foods I love.	
10. I will have healthier skin, hair, or teeth.	
11. I will be less likely to get cancer or heart disease.	
12. Shopping for healthy foods will be a lot of trouble.	
13. I will be bored with what I have to eat.	
14. I will have to change a lot of my favorite foods.	
15. I won't be able to eat the same foods as the rest of my family.	
16. I will have to spend too much time keeping track of what I eat.	
17. The food I eat will not taste good.	
18. It will take too long to prepare meals and snacks.	
19. I will have to plan my meals too far in advance.	
20. I will be more attractive.	
21. I will be doing what I know I should.	
22. I won't be able to stick with it - I'll just go back to my old habits.	

**Physical Activity Beliefs
Self Regulation**

The following questions refer to how you set exercise goals and plan exercise activities.

Please indicate the extent to which each of the following statements below describes you:

1 **2** **3** **4** **5**
Does not *Describes me* *Describes me*
Describe me *Moderately* *Completely*

	<i>Describes you? 1-5</i>
1. I often set exercise goals.	
2. I usually have more than one major exercise goal.	
3. I usually set dates for achieving my exercise goals.	
4. My exercise goals help to increase my motivation for doing exercise.	
5. I tend to break more difficult exercise goals down into a series of smaller goals.	
6. I usually keep track of my progress in meeting my goals.	
7. I have developed a series of steps for reaching my exercise goals.	
8. I usually achieve the exercise goals I set for myself.	
9. If I do not reach an exercise goal, I analyze what went wrong.	
10. I make my exercise goals public by telling other people about them.	

Physical Activity Beliefs

Self Regulation

The following questions refer to how you fit exercise into your lifestyle.
 Please indicate the extent to which each of the following statements below describes you:

1	2	3	4	5
<i>Does not Describe me</i>		<i>Describes me Moderately</i>		<i>Describes me Completely</i>

	<i>Describes you? 1-5</i>
1. I never seem to have enough time to exercise.	
2. Exercise is generally not a high priority when I plan my schedule.	
3. Finding time to exercise is difficult for me.	
4. I schedule all events in my life around my exercise routine.	
5. I schedule my exercise at specific times each week.	
6. I plan my weekly exercise schedule.	
7. When I am very busy, I don't do much exercise.	
8. Everything is scheduled around my exercise routine - both classes and work.	
9. I try to exercise at the same time and same day each week to keep a routine going.	
10. I write my planned activity sessions in an appointment book or calendar.	

Physical Activity Beliefs
Social Support: Friends

The following questions refer to how often other people have done or said the following statements.

Use this scale to tell us how often each statement occurred in the past MONTH:

- | | | | | |
|--------------|----------------------|----------------------|-----------------------|-------------------------|
| 1 | 2 | 3 | 4 | 5 |
| <i>Never</i> | <i>About 4 times</i> | <i>About 8 times</i> | <i>About 12 times</i> | <i>16 or more times</i> |

<i>In the past month, my friends, acquaintances, or coworkers...</i>	<i>How often? 1-5</i>
1. Exercised with me.	
2. Offered to exercise with me.	
3. Gave me helpful reminders to exercise.	
4. Gave me encouragement to stick with my exercise program.	
5. Changed their schedule so we could exercise together.	

Salis et al. (1988) Table 1: Self-efficacy for Exercise Behaviors Scales

**Physical Activity Beliefs
Efficacy**

Please rate how confident you are that you could really motivate yourself do things like these consistently, for at least 6 months.

Use this scale to tell us how sure you are:

1 **2** **3** **4** **5**
I know I *I know I*
CANNOT **CAN**

RESISTING RELAPSE	
<i>For 6 months, you could consistently...</i>	<i>How sure? 1-5</i>
1. Stick to your exercise program when your family is demanding more time from you.	
2. Stick to your exercise program household chores to attend to.	
3. Stick to your exercise program even when you have excessive demands at work.	
4. Stick to your exercise program when social obligations are very time consuming,	
5. Read or study less in order to exercise more.	
MAKING TIME FOR EXERCISE	
6. Get up early, even on weekends, to exercise.	
7. Get up earlier to exercise.	
8. Stick to your exercise program after a long, tiring day at work	
9. Exercise even though you are feeling depressed.	
10. Set aside time for a physical activity program, that is, walking, jogging, swimming, biking, or other continuous activities for at least 30 minutes three times per week.	
11. Continue to exercise with others even though they seem too fast or too slow for you.	
12. Stick to your exercise program when undergoing a stressful life change (e.g. divorce, death in the family, moving).	

**Physical Activity Beliefs
Outcomes**

Please rate how you feel about the physical activity you have been doing.

1	2	3	4	5	6	7
I enjoy it						I hate it
1	2	3	4	5	6	7
I feel bored						I feel interested
1	2	3	4	5	6	7
I dislike it						I like it
1	2	3	4	5	6	7
I find it pleasurable						I find it unpleasurable
1	2	3	4	5	6	7
I am very absorbed in this activity						I am not at all absorbed in this activity
1	2	3	4	5	6	7
It's no fun at all						It's a lot of fun
1	2	3	4	5	6	7
I find it energizing						I find it tiring
1	2	3	4	5	6	7
It makes me depressed						It makes me happy
1	2	3	4	5	6	7
It's very pleasant						It's very unpleasant
1	2	3	4	5	6	7
I feel good physically while doing it						I feel bad physically while doing it
1	2	3	4	5	6	7
It's very invigorating						It's not at all invigorating
1	2	3	4	5	6	7
I am very frustrated by it						I am not at all frustrated by it
1	2	3	4	5	6	7
It's very gratifying						It's not at all gratifying

Physical Activity Beliefs						
Outcomes						

1	2	3	4	5	6	7
It's very exhilarating					It's not at all exhilarating	
1	2	3	4	5	6	7
It's not at all stimulating					It's very stimulating	
1	2	3	4	5	6	7
It gives me a strong sense of accomplishment					It does not give me any sense of accomplishment	
1	2	3	4	5	6	7
It's very refreshing					It's not at all refreshing	
1	2	3	4	5	6	7
I felt as though I would rather be doing something else					I felt as though there was nothing else I would rather be doing	

APPENDIX C

Priority List Worksheet

Daily Activities Priority List

How important are the following behaviors to you?
Rank each item from 1-11, with 1=highest priority and 11=lowest priority.

There are no right or wrong answers. Please be honest and rank every item.

___ hanging out with friends

___ going to a great party

___ dating / meeting partners

___ attending all (or most) of your classes

___ studying

___ working / earning money

___ Internet surfing / playing computer games

___ sleeping

___ eating healthy food

___ exercising / working out

___ having the figure or physique that you want

___ *other things that are priorities to you that were not listed above
(specify): _____

___ *other things that are priorities to you that were not listed above
(specify): _____

**Rank items from 1-12 or 13 if you list 'other' items.*

Are there other things not listed above that you think are priorities for other college students? (describe)

APPENDIX D

7-Day Physical Activity Record

7-Day Physical Activity Record

Today's Date _____ Day ____ of 7

Sleep Habits:	I went to sleep last night at _____ AM / PM	I woke up today at _____ AM / PM
Pedometer Step Count:	Today's beginning step-count* _____	Today's ending step-count* _____
*Do not reset pedometer. Maintain a running total for the 7-day period. <u>Notes / special circumstances:</u>		
Did you take your pedometer off at any time? Describe:		
Other Activities on This Day:	Total time watching TV, movies, and playing video games _____ hr. _____ min.	
	Total time spent on a computer _____ hr. _____ min.	

	Office use	Time of Day	Description of Activity	Duration	Intensity Rating
			<ul style="list-style-type: none"> • List and describe all of your activities and exercises for today -Examples: walking to class, activities at work, aerobics class, weight lifting, etc. • Be specific. If possible, include name of activity, where you were, and how far -e.g. 'Ran 2 miles on the treadmill at the gym, speed 4.0' • Include naps – record the Time of Day and Duration; Intensity = 0 • List separate entries for each activity • Use as many forms as you need 	How many minutes?	from 1-10 1=easy 10=very hard
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			
		AM			
		PM			

APPENDIX E

Elicitation Interview Script

Introduction

My name is Katie Strong and this is Dr. Brenda Davy, and we are from the Human Nutrition, Foods, and Exercise department. The purpose of this interview is to gather information about health-related behaviors in freshmen and sophomores at college. I will ask questions and take notes while Dr. Davy will observe.

May I record the interview, so I do not have to write everything down? (Begin recording after participant provides verbal agreement to record.)

Please answer the questions honestly. If you do not understand a question, ask me to clarify. This is not a “formal” interview. You may refrain from answering any of the questions if they make you uncomfortable. Tell me to skip the question and we will move on.

None of the information you share with us will be associated with your name or any other identifiable information. We will only use an ID number to identify you. For example, there are some questions about alcohol, and all of our participants are under 21. We will not share any of this information about you with third parties and again, your name will not be associated with your answers.

Do you have any questions before we begin?

Part 1: Daily Routine

1. I would like to get an idea of what your daily routine is like. Will you describe what a typical weekday is like for you this semester?

a. General description from participant.

Probe:

b. What time do you wake up?

c. What times do you eat meals and snacks?

i. Breakfast

ii. Lunch

iii. Dinner

d. What time do you go to sleep?

2. How does the schedule you just described compare to a typical weekend day?

3. Is this your freshman or sophomore year?

4. How has your routine changed from last year in high school to this year?

Probe: compared to last year,

a. Do you sleep more or less this year?

b. Do you have more or less free time this year?

c. Do you wake up earlier or later this year?

d. Do you exercise more or less this year?

e. Do you have more or less school work this year?

- f. Do you eat more or less this year?
5. Total, how much time do you spend watching TV, movies, and playing video games each day?
- Probe: number of hours or minutes:*
- a. How much time do you spend on a computer?
 - i. How much of your computer time is for school work?
 - ii. How much of your computer time is for fun?
6. What kinds of school work do you do on the computer?
- a. What kinds of fun activities do you do on the computer?
(*If they need prompting:* for example, email, *Facebook*, instant messaging, shopping, playing games, downloading music, etc)
 - b. What entertainment, like, movies, internet, or video games, distract you from more important things like sleep and school work?
7. Describe how you manage or organize your time and responsibilities.
- a. What tools or strategies do you use to manage your time? For example, do you use a date book, calendar, or post-it notes?
 - b. Do you use anything electronic? For example, a personal digital assistant (PDA), online planner, outlook, etc.?
 - c. How good or effective are your time management skills?
 - d. How would you rate your time management skills on a scale of 1-10, with one being you never get things done and 10 being you always get everything done?
8. Do you feel like you have enough time to get all your work done and still have free time for other things like hobbies, friends, and exercise?
9. When you get really busy, how do you make sure you get everything done?
- a. When you are really busy, and cannot get everything done, what do you “drop” from your routine?
 - b. What situations prevent you from getting everything done?

Part 2: Dietary Habits

10. Tell me about the meals and snacks you generally eat throughout the day; including what times you eat them and what types of foods:
- a. General description:
- Probe for each meal:*
- b. Time of day
 - c. Types of foods eaten
11. What foods do you snack on?
12. What do you drink:
- a. with your meals?
 - b. between meals?
13. How are your meals and snacks different on weekdays versus weekends?
14. How are your meals and snacks at college different from your meals and snacks at home before college?

15. What does a “healthy diet” or a “healthy meal” consist of to you?
 - a. Do you consider your regular meals to be “healthy”?
16. How does what you eat affect your health or how you feel?
17. Are there any foods or drinks that you avoid?
 - a. Why do you avoid these foods and drinks?
18. Where do you get most of your meals? I.e. what dining facilities?
 - a. Where do you get snacks?
19. When do you use vending machines?
20. Are you aware of the online Virginia Tech dining nutrition information?
 - a. If so, what about it do you find useful?
21. How often do you eat meals with friends?
 - a. How often do you eat meals alone?
 - b. Do you think you eat healthier foods when you eat alone or with friends?
 - c. Are your friends “healthy eaters”?
22. Do your friends influence your food choices?
 - a. Do your friends influence your food choices more or less than they did in high school?
23. Did your family influence your food choices in high school?
 - a. Do they influence your choices this year?
24. Where are the best places on campus to get healthy food?
25. What would make it easier for you to eat healthy meals and snacks on campus this semester?
26. Would you eat at a place you thought was healthier if:
 - a. there was a longer line?
 - b. it was more expensive?
 - c. your friends were eating somewhere else?
27. When you are rushed or in a hurry, how does it affect what you eat?
 - a. How often are you rushed or in a hurry?
28. How do the dining hall’s hours of operation affect your food choices when you are busy?
29. I’m going to name some foods. Describe how often you eat each of these foods this semester. For example the number of times per day, per week, per month, never, or whatever applies to you.
 - a. Fruit.
 - b. Vegetables.
 - c. Whole grains: for example, whole wheat bread, oatmeal, popcorn, and cereals like Cheerios or raisin bran.

- d. Fast foods: including things like burgers and fries, even if it is from a dining hall.
 - e. Fried foods.
 - f. Dessert.
 - g. Soft drinks (specify diet or regular).
 - h. Coffee shop drinks (specify diet or regular, whole or skim milk): for example, lattes or frappuchinos.
 - i. Late-night delivery (pizza, etc).
30. For each of the foods listed above (#29, a-i), do you think your intake of this is
- a. too high?
 - b. too low?
 - c. okay?
 - d. not applicable.
31. Do you plan ahead of time, more than a day or two, any of the meals and snacks you eat?
- If so:*
- a. What meals and snacks do you plan?
 - b. How far in advance?
32. Do you keep a grocery list for any foods or snacks?
- If so:*
- a. What usual items do you buy?
33. Do you get extra food at a dining hall for future meals and snacks?
- If so:*
- a. What usual items?
34. Describe your abilities to cook and store food in your dorm this semester.
- Probe, do you use:*
- a. a hall kitchen?
- If so:*
- i. how often?
 - ii. what types of foods?
- b. a refrigerator?
- If so:*
- i. how often?
 - ii. what types of foods?
- c. a microwave?
- If so:*
- i. how often?
 - ii. what types of foods?
35. Do you buy groceries?
- If so:*
- a. Where? For example Kroger, Dietricks, Walmart, at home?
36. Do you keep fresh fruits and vegetables in your dorm room?
37. How have your food choices and when you eat changed from high school to this year?
- a. How has your health or how you feel changed as a result?

38. How satisfied are you with your current food choices and their convenience?
39. How does time affect your eating habits?
40. How does money affect your eating habits?
41. Are healthy foods more expensive?
a. Are healthy foods worth the money?
42. What would you like to change about your eating habits?
a. How would you benefit from making those changes?
43. What would you change about campus to make it easier for you to eat healthier on campus this semester?
44. Are you interested in learning more about how to eat healthy?
If so:
a. What would be the best or most useful way for you to get this information? For example, taking a class, on the Internet, written information, email, or other.
45. If you wanted to eat healthier, would you know what to do?
46. Could you change your eating habits if you wanted to?
a. On a scale of 1-10, how confident are you that you could change your eating habits if you wanted to, with one being you could not make these changes, and 10 being you could definitely make these changes?
47. What situation or event would motivate you to change your eating habits?
48. Do you:
a. count calories?
If so:
i. How many calories do you try to eat?
b. count fat grams?
If so:
i. How many fat grams do you try to eat?
c. read nutrition information on labels?
If so:
i. What information do you look for on labels?
ii. Why do you do this?

Part 3: Alcohol Consumption

49. Do you ever drink alcohol?
*If participant does not drink alcohol, skip to **Part 4: Physical Activity Habits.***
50. How many nights per week do you drink alcohol?
51. How many drinks do you have per night?

52. What types of drinks do you have? For example, beer, wine, liquor, or a mix?
53. How does drinking affect your routine the following day?
- How does it affect your exercise routine or motivation to exercise?
 - How does it affect your food choices?
54. How has your alcohol consumption changed between this semester and high school?
- How have these changes made you feel about your health right now?
55. Do you think alcohol consumption affects your weight?
56. Do you think alcohol consumption affects your health?
57. Do you eat when you are drinking?
- If so:*
- What types of foods?

Part 4: Physical Activity Habits

58. Is being physically active important to you?
59. What kind of exercise and physical activities have you participated in regularly this semester?
- Where?
 - How often?
 - With whom?
60. Do you participate in any organized sports like intramurals?
- If so:*
- Which ones?
61. Do you view walking as exercise?
62. What other physical activities do you participate in? For example, hiking, biking, or seasonal activities.
- If so:*
- How often?
63. What kind of exercise, sports or other activities do your friends at Virginia Tech participate in?
64. How does your friend's participation affect your habits?
65. Do you find it difficult to exercise regularly?
- Why do find it difficult or not difficult?
66. If you needed to work out more, would you be able to?

- a. On a scale of 1-10, how confident are you that you could work out more, with one being you could not work out more and 10 being you definitely could work out more?
67. What situation or event would motivate you to change your workout routine?
68. What is your opinion about the available on-campus facilities?
69. What are the benefits to being physically active?
- a. Are these benefits important to you?
70. Do you keep track of how much physical activity or exercise you do?
71. If you wanted to improve your fitness level, would you be able to?
- a. Would you know specifically what to do?
 - b. Would you have the time to do it?
72. What would you change about the college campus that would make it easier for you to be more physically active?
73. What kind of sports and exercise did you participate in during high school?
74. Have your physical activity habits changed between this year and high school?
- a. How have these changes made you feel about your current PA habits?

Part 5: Priorities

75. Considering your responsibilities and available free time, how important is it for you to eat well?
- a. On a scale of 1-10, how important is it for you to eat well, with one being not important at all, and 10 being essential?
76. Do you have any goals related to your diet?
- If so:*
- a. What are your goals?
 - b. On a scale of 1-10, how confident are you that you will be able to reach these goals, with one being certain you cannot, and 10 being certain you can?
77. What concerns do you have about your body weight?
- If participant has no concerns related to body weight, skip to **question #78**.*
- a. Have you made any changes to what you eat as a result?
- If so:*
- i. What changes have you made?
 - ii. Are you satisfied with the results of these changes?
78. Have you ever intentionally lost or gained weight?
- If participant has never intentionally lost or gained weight, skip to **question #79**.*
- a. What motivated or caused you to change?
 - b. What specific changes did you make in order to gain/lose the weight? For example, how did your diet, exercise, other things change?

79. Considering your responsibilities and available free time, how important is it for you to get exercise?
- On a scale of 1-10, how important is it for you to get exercise, with one being not important at all, and 10 being essential?
80. Do you have any goals related to your fitness level?
*If participant has no goals related to their fitness level, skip to **question #81**.*
- What are your fitness goals?
 - On a scale of 1-10, how confident are you that you will be able to reach these fitness goals, with one being certain you cannot, and 10 being certain you can?
81. What concerns do you have about your physical fitness level?
*If participant has no concerns related to physical fitness level, skip to **question #82**.*
- Have you made any changes to what your work out routine as a result?
If so:
 - What changes have you made?
 - Are you satisfied with the results of these changes?
 - How did you go about making these changes? For example did you plan differently, get help from friends, or other?
82. Considering your responsibilities and available free time, how important is it for you to have the figure or physique that you want?
- On a scale of 1-10, how important is it for you to have the figure or physique that you want, with one being not important at all, and 10 being essential?
 - Do you think there is a relationship between having the body that you want and being healthy?
83. Do you have any goals related to your body size or shape?
*If participant has no concerns about their body size or shape, skip to **question #84**.*
- What are your body size or shape goals?
 - On a scale of 1-10, how confident are you that you will be able to reach these body size or shape goals, with one being certain you cannot, and 10 being certain you can?
84. Do you know how much you weigh now?
If so:
- How much do you think you weigh?
85. Do you weigh yourself regularly?
- How often?
 - What scale do you use?
86. Would you be interested in participating in an Internet-based program that would offer information and support for healthy eating and exercise?
87. What incentives would you like to make participating in this program worthwhile? For example, would course credit, money, ipods, cell phones, or other incentives make it worth the extra effort?
88. What incentives made you decide to participate in this study?

89. Do you have any questions for us?

90. Would it be okay with you if we contacted you in the future to see how you are doing?

Conclusion

Thank you for your help with our project. We will provide you with your information we gathered. (Provide participant with compensation and obtain their signature verifying project completion.)

APPENDIX F

Focus Group Script

Introduction

(Begin the meeting by creating name cards with all participants' and facilitators' first names.)

Over the past school year, we have been interviewing college freshmen and sophomores about their lifestyle. We have talked about things like their normal routine, the foods they eat, and what kind of exercise they participate in regularly.

The purpose of this focus group is to get your opinion about some of the things we have learned, like whether or not you agree with them and why.

I'll be asking you some questions while Dr. Davy observes.

I'll tell you some things we learned and ask whether or not you each agree. Then I'll try to get you to discuss with each other the reasons why you agree or disagree.

I'll usually start with a blanketing statement. If you disagree with the premise, please address that. For example, if I begin saying, "college students generally wake up early to get a head start on the day. What types of activities do you like to accomplish before an 8am class?" You should let me know if you disagree with that statement.

We will use your first names to identify you today. We will not share your identity with anyone, all your information is kept confidential and not associated with your name.

You don't have to answer anything you don't want to. You are free to skip any question without giving a reason.

Is it okay with everyone if I record us?

Are there any questions before we get started?

Part 1: Daily Routine

Changes in free time and responsibilities

1. Your schedules in college seem to be much less structured than they were in high school, with considerably more free time for leisure and social activities. For example,
 - a. People generally wake up later and stay out later.
 - b. People eat meals at variable times and sometimes skip meals.
2. What kinds of scheduling changes or changes in responsibilities have allowed for all this free time?

Verify themes:

- a. Not stuck in classes all day long, like in high school.
- b. Not as much busy work for school.

- c. No organized sports after school/in the evening.
3. People said that most – or almost all – weekends were free. [R18-I] They slept in [R8-a], had fewer responsibilities [R8-I]. Does this sound accurate?
 4. Do you agree that generally, in their free time, college students:
 - a. Hang out with friends.
 - b. Exercise or do something active.
 - c. Watch TV, movies, and surf the internet.

Time management strategies

5. We found that people will manage their daily responsibilities in one of two ways. They will:
 - a. Maintain a scheduler (like a paper calendar) and make lists of what they need to do.
 - b. Remember in their heads and won't write anything down.

Is this what you do or do you use different strategies?

6. Do you use any strategies that help you find time to eat healthy or exercise?

Part 2: Dietary Habits

Changes since living with parents

7. Let's talk about why your eating habits have changed since coming to college. We found that:
 - a. In high school, people pretty much ate whatever their parents had around the house and whatever they cooked for dinner.
 - b. Now, people have more choices about what they eat.
8. What kinds of thought processes or outside influences account for you eating different foods in college? Or, why do you eat different foods here?

Verify themes:

- a. Mom was a major influence, and is not around now (in college)
 - b. There is more variety here, more options.
 - c. Students don't have access to home cooked meals or certain foods like at home.
9. How has your family's influence on your eating habits changed since coming to college?

Friends and food choices

10. We found that people don't think their friends influence what they choose to eat but influence the location. What dining halls offer both healthy choices and good food that your friends would like?

Verify themes:

- a. Friends influence the location, not the choice.
- b. Most places have healthy options.

Perceived benefits of improving diet

11. This stack of cards contains statements about what might happen if you ate better. As a group, decide which statements you agree with and why. (Have participants pass the stack of cards around the table.)

List of statements:

- a. I would feel better than I do now.
- b. I would have more energy.
- c. I would have to spend too much money.
- d. I would have to eat foods that I don't enjoy.
- e. I may not experience any difference.
- f. I would lose weight.
- g. I would be in better health.
- h. I would not be able to eat with my friends.

Food availability and satisfaction

12. People generally said that they don't do a lot of cooking on campus.

- a. They get most meals at a dining hall.
- b. They can microwave something prepackaged in their dorm. Is this the case?
- c. Also, they didn't store fresh foods like fruit and vegetables in their dorm because they would go bad.

13. How do you think the college environment makes it easier or harder for you to eat healthy on campus?

Part 3: Physical Activity

Social support and motivators

14. Let's talk about physical activity, whether it's planned or unplanned. Such as going to the gym to work out but also walking around campus or getting exercise at your job. College students we talked with said that:

- a. It was important to be physically active.
- b. Many people work out regularly, ~2 or more x per week.
- c. They like to do a variety of activities including walking.

How does that sound to you?

15. People reported that they work out with their friends, roommates, or suite mates. Yet many people also worked out alone. What are the advantages and disadvantages of working out alone versus with friends?

Verify themes:

- a. Encouraged or motivated by friends.
- b. Enjoy social benefits when working out with friends.

Barriers to physical activity

16. College students seemed to think it was not usually difficult to exercise regularly.
- Things like lack of motivation and other responsibilities made it difficult at times.
 - Some also said it was difficult without routine accountability.

Are there other reasons that it is difficult to work out regularly?

17. Many people felt out of shape and wanted to exercise more. Also, they believed they could exercise more if they needed to.
- They said they had plenty of time.
 - The facilities are fairly good.

What do you think makes it so difficult for people to workout, considering they have everything they need, like the desire, the time, and the place to do it?

Verify themes:

- There could be more facilities.
 - Facilities could be closer.
18. Most college students participated in several organized sport in high school. What about college makes people not want to participate in organized sports once they get here?
19. What situation or occurrence might cause you to work out more even though you have to overcome these things? (list barriers discussed)

Verify themes:

- Personal discontent (e.g. weight gain/unhappy with body)

Benefits to being physically active

20. These are some possible benefits to exercise that our participants talked about. If you all agree with these statements (on cards), put them in order from most important to least important. Talk about why one is more important than the other.

List of statements:

- My normal health and daily function will improve.
- I will be more physically fit.
- I will feel better mentally: better mood, less depressed, better self-esteem, less stress.
- I would experience social benefits.
- Are there other major benefits not mentioned?

Part 4: Weight Gain Perceptions

21. College students were concerned either that they had gained a few pounds or might gain weight in college. What about college might make people feel like they're gaining weight?

22. While many people are concerned with weight gain, people rarely weigh themselves. Do you agree?
- a. How would you know if you've gained weight?
 - b. At what point would you decide to make a change, like go on a diet?

Part 5: Intervention Design

Computer usage and acceptability

23. You seem to have a lot of schoolwork and classes online, at least a few hours a day. Does that sound accurate?
24. I'd like you to take a minute and write out what you think the some of the advantages and disadvantages of these formats when learning about how to be healthier.
- a. Going to a class and learning in person.
 - b. Taking a traditional online class.
 - c. Learning through an internet-based program where you enter information about what you've done and it gives you feedback.

What were the advantages and disadvantages you listed? Feel free to add anything discussed that you didn't think about earlier. Put a star by the method you would prefer.

Incentives for intervention participation

25. We would like to design an intervention that would provide students with information and support for healthy eating and exercising. Considering that this would involve a considerable time commitment and effort, people said that money and course credit would be good incentives.

Are there other incentives that would be better?

Conclusion

Does anyone have any questions?

Would it be okay with everyone if we were to contact you at a later date to check on you?

Thank you for your help with our project. We will provide you with your information we gathered. (Provide participant with compensation and obtain their signature verifying project completion.)