Effectiveness of an Online Nutrition Course on Emotional Health and Energy levels

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ABSTRACT:

Background: Rates of mental health disorders have rapidly increased over the past decades.[1] It is thought that 1 in 4 adults will experience a mental health disorder each year.[1] Emerging evidence suggests a positive association of unhealthy diet habits and obesity with depression.[5] On the other hand, there is growing evidence that a diet higher in fruit and vegetable consumption can help improve emotional health and energy status.[3,5,11,13]

Objective: To evaluate the effectiveness of an Online Nutrition course designed to improve dietary habits, emotional health, and energy status.

Design: Quasi-experimental

Setting: Virtual/ Online

Participants: SUNY Empire State College employees.

Intervention: Study subjects were instructed to complete an online course, Nutrition Essentials. Subjects were also instructed to complete 15 logs (3 logs per week) tracking their regular dietary habits.

Methods: Dietary habits and sleeping patterns were tracked using the ASA24 database. Nutrition analysis focused on fruit and vegetable intake. Change in emotional health/energy statuses was evaluated by comparing the results of the pre and post intervention SF-36 Health Questionnaires. Descriptive statistics, such as means ± standard deviations, were used to present the demographic characteristics of the study participants. Repeated measures ANOVA and paired t-tests were used to compare continuous variables. Wilcoxon rank-sum test was used to compare differences in ordinal variables. A P value of < 0.05 was considered statistically significant. All statistical analyses was performed using SPSS 22.0, (SPSS, Inc., Chicago, IL, USA).

Results: The intervention was effective in increasing energy/fatigue scores in those who completed the intervention ($P = 0.0004$). All other results were not considered statistically significant.

Conclusion: Future studies on this topic should utilize the randomized clinical trials method (intervention vs. control group). Future intervention groups should be instructed a to consume 5 servings of fruits and vegetables each day to fully assess if they have an impact on mood/energy status.

INTRODUCTION:

Emotional health plays an essential role in an individuals' overall wellbeing and health. Emotional health is one aspect of mental health that helps individuals become aware of their emotional state. It also controls how someone copes with both positive and negative emotions. In fact, individuals who are considered "emotionally healthy" are thought to have better control over their thoughts, feelings, behaviors, and life challenges.[1] Not only does emotional health impact emotions, but it is also tied to physical health. Individuals who experience great amounts of stress and negative emotions will sometimes develop other health problems.[1] These problems are not caused directly by the negative feelings, but by behaviors that negative emotions can influence due to a lack of emotional regulation.[1] Taking into consideration the fact that mood disorders, such as anxiety and depression, are the most common mental illnesses in the United States, this is quite the concerning revelation. Approximately 9.5% of persons living in the United States over the age of 18 years old suffer from a major depressive illness each year, while 20% of the adult population are diagnosed with an anxiety disorder.[2] Together, this is approximately 30% of persons in the United States have been diagnosed from either anxiety or depression, and many persons may go undiagnosed. This value translates into millions of persons impacted by mood disorders such as depression and anxiety, and as more research has shown, this puts these individuals at an elevated risk of developing chronic, potentially debilitating diseases. This being the case, it is important that the population as a whole is educated on ways to improve and promote a positive emotional health status.

While it has been proven that stress levels, lifestyle habits, physical activity and personal relationships all have an influence over our emotional wellbeing, more recent research has shown that our dietary habits can impact our emotional heath as well.[3] Current research has shown that a poor diet is directly associated with higher inflammation and oxidative stress, which can lead to the development of mental disorders.[3] More specifically, a diet that consists of refined or simple sugars (baked goods, white flour products, soft drinks, etc.) or unhealthy fats (saturated fats, trans fats, etc.) is proven to be positively correlated to rates of anxiety and depression as well as poor sleeping patterns.[3] Another study found that obesity (BMI > 30 kg/m^2) and a diet consisting of foods with a high glycemic index is also positively corelated with rates of anxiety and depression.[4] With approximately one third of the population considered obese, this is again of great concern.[5] On the other hand, it has also been found that a diet higher in polyphenols high lead to decrease in depressive episodes and an increase in hours slept at night, leading to an increase in energy levels.[6] Polyphenols are a category of plant compounds that are found in fruits, vegetables, cereals, dry legumes, chocolate, olive oil and herbs (ex: ginger, turmeric).[7] When consumed on a regular basis, polyphenols are thought to also provide production again heart disease, type two diabetes, certain types of cancers and improvements in digestion.[3] This being the case, the purpose of this study was to evaluate the effectiveness of an online nutrition course designed to improve dietary habits, emotional health, and energy status among SUNY Empire College employees.

METHODS:

Study Design:

The study is quasi-experimental using a pre-test, post-test design. Participants were instructed to complete the SF-36 Health Survey prior to and after the intervention was completed. Participants were also instructed to complete three dietary and sleep habit logs via the Automated Self-Administered 24-Hour Dietary Assessment Tool (ASA24) each week (for a total of 15 logs by the end of the intervention). Finally, each week participants were assigned to complete 3-4 modules from the online nutrition education course, Nutrition Essentials. Participants would then meet with the research team via Microsoft Teams at the beginning of each week to review information taught within each module.

Prior to this intervention beginning, this research obtained approval from Oneonta's IRB to conduct the study. Participants were instructed to fill out and sign the informed consent documentation prior to the intervention beginning. The research team received no funding from outsides sources to conduct this intervention.

Intervention:

Prior to the intervention beginning, the research team sent a recruitment letter via email to the employees of SUNY Empire State College. A recruitment meeting via Microsoft Teams was then held by the research team on 1/14/22 to discuss the purpose of the intervention in greater detail. Participants were made aware that their information/data would be de-identified and that they would be provided their own private identification code. After the meeting concluded, fifty individuals provided their email contact information and were recruited into the study. All participants received their identification code, informed consent documentation, ASA24 log in information and the pre-intervention SF-36 Health Survey. The SF-36 Health Survey was used to determine participants energy status and emotional health prior to and at the end of the intervention. Participants were informed that they would receive their Nutrition Essentials log in information from the American Society for Nutrition (ASN) in a separate email. Participants also received the International Physical Activity Questionnaire (IPAQ) via email and were asked to complete the document and send it back to the research team during the first week of the intervention. BMI, height, weight, age, and gender data was also gathered. Participants were instructed to complete 3 dietary (for a total of 15 logs by the end of the intervention) and sleeping habit logs via the ASA24. The research team used these logs to determine if dietary or sleeping habits changed throughout the intervention as well. In addition, participants participated in the online course, called Nutrition Essentials developed by ASN. Nutrition Essentials consists of 13 modules. The course focuses on evidence-based nutrition recommendations; skillfully integrates content to facilitate active learning; and includes activities to assess knowledge. Participants were assigned specific modules to complete by the end each week and course modules were able to be accessed asynchronously. Each course module took about 15-20 minutes to complete. At the beginning of the following week of the intervention, participants took part of a 30-minute meeting, hosted by the primary researcher, which consisted of a lesson plan based on the Nutrition Essentials modules that is assigned for that week. This weekly meeting was also a chance for participants to chat with each other, share how they are doing and what they feel like is working/ not working. It should be noted that out of the 50 individuals originally recruited, 29 completed the entirety of the intervention. It should also be noted that for two of this scheduled meetings, fellow Dietitians who work in the community volunteered their time to provide heart healthy nutrition education and two virtual cooking demos. They did not receive any financial compensation for their time as again, all participation from Dietitians outside of this study was on a voluntary basis.

The intervention schedule for the Nutrition Essentials online course consisted of Week 1 (1/31-2/6): What is Healthy Eating; Portions Matter; and Healthy Eating Patterns; Week 2 (2/7-2/13): Nutrients; Carbohydrates, Fats and Proteins; Dietary Fiber; and Sugar; Week 3 (2/14-2/20): Good Fats; Water; Nutrient and Calorie Density; and Dietary Guidelines and Nutrients of Concern; Week

4 (2/21-2/27): Digestion; Absorption and Metabolism; and Energy Balance; and Week 5 (2/28-3/4): Wrap up. Intervention meetings occurred every Monday via Microsoft Teams during the intervention to discuss and review the information provided in the Nutrition Essentials modules that were assigned for the week. A follow up email was after the online meetings. The weekly online meeting times were scheduled as follows: Monday 1/31/22: from 12:00-12:30 PM EST – Review intervention guidelines, health survey questionnaire in Forms, ASA24 and Nutrition Essentials online course; Monday 2/7/22: from 12:00-12:30 PM EST – Review What is Healthy Eating; Portions Matter; and Healthy Eating Patterns with PPT. Also, f/u with any questions regarding the intervention; Monday 2/14/22: from 12:00-12:30 PM EST – Guest Speaker and f/u with questions regarding the intervention. Guest speaker: Fran Weiss, MS, RDN, CDN who is a registered dietitian/nutritionist with Hannaford presented on "Heart Healthy Eating Tips" since February 14 is Valentine's Day and February is Heart Month; Monday 2/21/22: from 12:00-12:30 PM EST – Guest Speaker and f/u with questions regarding the intervention. Guest speakers: Annemarie Groepler RDN and Sara Turnasella RDN, Retail Dietitians, Shoprite: Two 15 minute quick and easy recipe demos, one savory and one sweet featuring fruits and veggies; and Monday 2/28/22: from 12:00-12:30 PM EST – Review Nutrition Essentials course with PPT and wrap up. Encouraged participants to finish up ASA24 and fill out end of intervention SF-36 Health Survey. Weekly reminder emails were sent out after each meeting.

Participants:

Recruitment for this study was targeted towards employees who worked at SUNY Empire State College. Inclusion criteria included adults 18 years of age or older who are employees at SUNY Empire State College. A recruitment meeting was held via Microsoft Teams on January 28th for potential participants. At the information session, the requirements of the study, the time commitment, and risk and benefits was described in detail. Participants were informed that participation is completely voluntary, and they may withdraw from the study at any time. Participants were also informed that their identity would remain confidential during this study, and they would be assigned a personal ID code in order to deidentify themselves. Fifty participants were originally recruited for the purpose of this study, of this number, only twenty-nine completed the entirety of the intervention.

Tools:

36 item Short Form Health Survey (SF-36): Consisting of 36 multiple choice questions, the SF-36 Health Survey has been validated for measuring health related quality of life in several different countries. Created by RAND, SF-36 is used to determine the health status of particular populations, to help with service planning and to measure the impact of clinical and social interventions.[7]

ASA24: Or Automated Self-Administered 24-hour Dietary Assessment Tool is a free, web-based tool. ASA24 enables multiple, automatically coded, self-administered 24-hour diet recalls and/or single or multi-day food records, also known as food diaries. A relatively new component of ASA24 is the ability to track one's sleeping habits/ patterns. This database is also accredited as a validated tool, developed by the National Cancer Institute. It is reported to have an

80% accuracy when it comes to dietary analysis.[8]

Nutrition Essentials: Developed by the American Society for Nutrition. Nutrition Essentials consists of 13 modules. The course focuses on evidence-based nutrition recommendations; skillfully integrates content to facilitate active learning; and includes activities to assess knowledge.[9]

International Physical Activity Questionnaire (IPAQ): The IPAQ is a 27-item self-reported measure of physical activity for use with individual adult patients aged 15 to 69 years old. The IPAQ can be used clinically and in population research that compares physical activity levels between populations internationally.[10]

Data Analysis:

Data analysis began once the intervention was completed. Anthropometric data of participants was first analyzed. Descriptive statistics, such as means ± standard deviations, were used to present the demographic characteristics of the study participants. The SF-36 Health Survey was scored using the accredited SF-36 Health Survey scoring rubric. The results from both the pre and post SF-36 Health Surveys were then compared together to determine if a change in emotional health or energy status occurred throughout the intervention. Repeated measures analysis of variance (ANOVA) and paired t-tests were used to compare changes in continuous variables. The Wilcoxon rank-sum test was used to compare differences in ordinal variables. All statistical analyses was performed using SPSS 22.0, (SPSS, Inc., Chicago, IL, USA). *P* values of < 0.05 were considered statistically significant.

RESULTS:

Participant Characteristics:

Fifty potential study participants provided informed consent and met all the inclusion criteria. Seven participants withdrew from the study and fourteen participants did not complete the SF-36 Health Survey, the Automated Self-Administered 24-Hour Dietary Assessment Tool (ASA24) and the International Physical Activity Questionnaire (IPAQ). A total of 29 participants completed the study protocol's SF-36 Health Survey, the ASA24 with the sleep module and the IPAQ. Of the 29 participants, 35% (n=10) completed 100%, 7% (n = 2) completed 75%, 44% (n = 13) completed less than 50%, and 14% (n = 4) never started the Nutrition Essentials four-week online course, respectively.

The baseline characteristics of the 29 participants included in the final data are presented in Table 1. Participants were obese as determined by body mass index. The IPAQ showed that 72% (n = 21) of participants were minimally active and 28% (n = 8) were active.

Table 1. Characteristics of study participants at baseline[1]

Variable	Total	Women	Men
Age (years)	52.5 ± 10.3	51.2 ± 10.3	59.0 ± 7.7
Height (inches)	65.2 ± 3.9	64.1 ± 3.0	70.9 ± 2.1
Weight (pounds)	192.4 ± 49.2	183.6 ± 39.9	234.6 ± 71.5
Body mass index (kg/m^2)	32.0 ± 8.0	31.7 ± 7.2	33.3 ± 12.1

[1]All values are means ± SD; n = 29 (24 women, 5 men).

Fruit and Vegetables Intake:

Fruit and vegetable intake were not significantly different after the four-week online nutrition intervention (Table 2).

Table 2. Participant fruit and vegetable intake[1]

	Week 1	Week 2	Week 3	Week 4	*P*
Fruit servings	0.6 ± 0.5	0.9 ± 0.9	1.0 ± 0.7	1.0 ± 0.7	0.242
Vegetable servings	1.8 ±1.1	1.7 ±1.0	1.8 ± 0.9	1.8 ±1.2	0.795

[1]All values are means ± SDs; statistical comparisons were made by repeated measures ANOVA; n = 29 (24 women, 5 men).

Sleep Patterns:

Hours of sleep were not significantly different after the four-week online nutrition intervention (week 1: 7.4 ± 1.8 hours vs. week 4: 7.5 ± 1.3 hours, P = 0.842). Sleeping pattern results showed no statistically significant difference on how participants felt after waking up yesterday, though was a trend for feeling more refreshed with less participants being tired after four-week online nutrition intervention (P = 0.066) (Figure 1). In addition, results show no statistically significant difference on how well participants slept (P = 0.929) (Figure 2) or how participants felt waking up today (P = 0.839) (Figure 3) after the four-week online nutrition intervention.

Figure 1. How did you feel when you woke up yesterday? From the ASA24 sleep module; statistical comparisons were made by Wilcoxon rank-sum test; n = 29 (24 women, 5 men). 80% of participants reported feeling "Somewhat refreshed" and "Refreshed" at the one-week mark vs. 95% at the four-week mark.

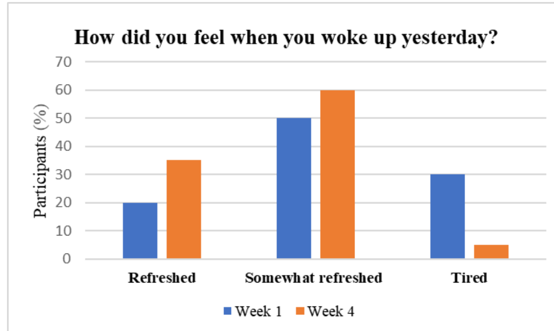
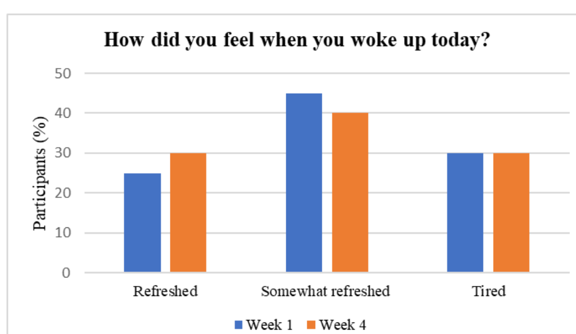


Figure 2. How well did you sleep last night? from the ASA24 sleep module; statistical comparisons were made by Wilcoxon rank-sum test; n = 29 (24 women, 5 men). 60% of participants reported feeling "Very good" and "Good" at the one-week mark vs 55% at the four-week

Figure 3. How did you feel when you woke up today? From the ASA24 sleep module; statistical comparisons were made by Wilcoxon rank-sum test; n = 29 (24 women, 5 men). 70% of participants reported feeling "Somewhat refreshed" and "Refreshed" at both the one-week mark as well as the four-week mark.



Health Survey:

Higher scores of the SF-36 Health Survey indicate a more favorable health state. The energy/fatigue category was significantly improved after the four-week online nutrition intervention. Other categories in the SF-36 Health Survey showed no statistically significant differences (Table 3).

Table 3. SF-36 Health Survey[1]

	Week 1	Week 4	*P*
Physical functioning	83 ± 22	89 ± 18	0.08
Role limitations due to physical health	87 ± 26	88 ± 28	0.703
Role limitations due to emotional problems	79 ± 36	79 ± 31	0.902
Energy/fatigue	49 ± 20	59 ± 18	0.0004
Emotional well being	74 ± 12	73 ± 14	0.605
Social functioning	86 ± 19	84 ± 24	0.598
Pain	82 ± 18	80 ± 19	0.59
General health	66 ± 16	69 ± 16	0.427

[1] All values are means ± SDs; statistical comparisons were made by paired t-tests; n = 29 (24 women, 5 men).

DISCUSSION:

Energy/Fatigue, Sleep Patterns and Dietary Intake:

This quasi-experimental study assessed the health effects, sleep patterns and dietary intake of individuals participating in a four-week online nutrition intervention. Per the findings of the current study, the intervention was effective in increasing energy/fatigue scores in those who completed the intervention. Results showed during week one of the intervention, participants average score for the energy/fatigue category of the SF-36 Health Survey was 49 ± 20. During week four of the intervention, the average energy/fatigue score increased to 59 ± 20 showing statistically significant results. A similar study, whose focus was to determine if an increase in consumption of healthy meals, snacks and water would positively impact hospital employee's mood, fatigue, and reaction time, found similar results at the end of their study.[11] By the end of this particular study, it was found that the intervention group had a 31.1% lower fatigue-inertia score (P = 0.003) and 42.7% lower total mood disturbance score (P = 0.017) compared with the control period.[11] Fat intake (P = 0.030) was found to be lower while carbohydrate intake (P = 0.008), fiber intake (P = 0.031) and water intake (P < 0.001) were found to be higher in the intervention group vs the control group as well.[11]

Another study found evidence that suggests that dietary patterns that favor high complex carbohydrate intake are associated with reduced sleep-onset latency, slow wave sleep, and increased REM, whereas high healthy fat intakes promote lower sleep efficiency, REM and higher slow wave sleep and arousals (P < 0.005).[12] Put in lamix terms, this study found that those who had a diet higher in fat did not fall into as deep of a sleep as those whose diet was higher in fruits and vegetables. Individuals who had a diet higher in fat were more likely to experience restless sleep and wake up more often throughout the night.[12] It was also found that consumption of a diet similar to the Mediterranean diet more likely lead to >7 hours of sleep while a diet high in saturated fat and refined sugars lead to < 7 hours of sleep.[12] Per the results of the present study, quantity of hours slept did not change significantly between week one and week four of the intervention. Quality of sleep did not significantly change as well, although for the question "How did you feel when you woke up yesterday?" a higher percentage of participants reported to feel "Somewhat Refreshed" and "Refreshed" at the four-week mark vs the one-week mark (95% vs 80% of participants). This being the case, this research team is unable to determine if our research findings support the findings in published research studies. The results from the study listed above found that a diet higher in fruits and vegetables lead to an increase in energy/fatigue status because individuals reported to have an increase in amount of time slept at night. However, in this present research study, energy and fatigue levels improved while amount of hours slept each night and fruit/ vegetable intakes remained relatively unchanged from week 1 to week 4 of the intervention. Therefore, it is difficult to determine which component contributed to an increase in participant energy and fatigue levels.

Impact of Fruit and Vegetable Consumption on Energy Status and Emotional Health:

The results of previous studies attributed an increase in energy levels and fatigue to an increase in healthier eating habits.[11,12] This being the case, the current research focused on fruit and vegetable intake as a study outcome throughout the course of the intervention. Another previous study instructed participants who were placed in the intervention group to consume 480g of fruit, vegetables, and fruit juice (300mL) daily for a total of 12 weeks.[13] It was found that fruit and vegetable intake significantly increased from < 3 servings to 8.4 servings by the end of the intervention.[13] While this study did conclude that the increased intake of fruit and vegetable consumption would be associated with improved health outcomes, secondary to the increased amount of essential nutrients circulating around the blood stream, they were unable to conclude if there was a positive impact on emotional and mental health as well.[13] Our study was unable to associate any positive health benefits to a change in fruit or vegetable consumption after a four week online nutrition course. Perhaps if participants were instructed to consume at least 4-5 servings of fruit or vegetables per day similar to the previous study, this may have had an impact on energy/fatigue and emotional health.

Emotional Health and Dietary Intake:

A component of this research study was also to analyze participants' emotional and mental health. This is because 1 in 4 adults aged 18 years and older suffer from a diagnosable mental disorder in a given year.[14] Since the start of the pandemic, this value has thought to increase to an even higher value.[14] Bereavement, isolation, loss of income and fear have all exacerbated or trigged mental health conditions. This in turn, has led to an increase in levels of alcohol and drug use consumption as well as insomnia, depression, and anxiety.[14] More specifically, one study found that a diet high in sugars has been linked to cognitive impairments, negative neuroplasticity and emotional disorders like anxiety and depression.[14] An additional study found that a diet that was low in ligan and high in cholesterol were also associated with poor mental health and cognitive recall ($P < 0.05$).[15] However, the authors did admit that poor cognitive function and emotional health could be in part attributed to by participants low socioeconomic status, low literacy and education status.[15] This being the case, it was the goal of this present study to determine if an online nutrition course and change in dietary habits would have a positive impact on emotional and mental health. However again, after analyzing the results from the pre and post SF-36 Health

Survey, it was evident that there was no significant change in emotional health by the end of the intervention. As mentioned above, fruit and vegetable intake did not change either throughout the course of this intervention. Perhaps, if participants were instructed to eat a certain amount of fruits and vegetables each day results may have shown a positive change in energy and fatigue as well as emotional health.

Strengths:

By the end of this study, results did indicate that participants' energy/fatigue scores did significantly improve. Only peer reviewed validated tools and questionnaires were utilized for the purpose of this study. ASA24, is a validated tool, developed by the National Cancer Institute. It is reported to have an 80% accuracy when it comes to dietary analysis.[8] The SF-36 Health Survey has been found to be reliable and valid for measuring health related quality of life in several different countries.[7] During our week four online nutrition intervention meeting, participants who completed the study reported to thoroughly enjoy the experience. Participants reported learning new information in-regards to healthy eating patterns by the end of the intervention and some reported that they would attempt to permanently adhere this new knowledge to everyday life.

Limitations:

Results of this study could have been potentially skewed as participant retention gradually declined throughout the course of the intervention. Of the 50 individuals originally recruited, 61% (n = 29) completed the pre and post intervention health survey and the ASA24 dietary logs. Of that amount, only 35% (n = 10) completed the entirety of the online Nutrition Essentials course. Participants noted throughout the study that ASA24 was not very "user friendly" and expressed frustration at being unable to find certain foods within the database. Reporting bias is also a possibility as participants were responsible for logging their dietary logs. Finally, this intervention only lasted four weeks, which is relatively short, thus making it difficult to create permanent behavior changes within our participants.

CONCLUSION:

Participants reported that their energy/fatigue levels did improve by the end of the intervention, however, it is difficult to determine which component of this study contributed to the reported change in energy level. Fruit and vegetable intake did not significantly change throughout the course of the intervention; therefore, we are unable to attribute energy/fatigue improvements to dietary changes. At the end of this study, participants did admit that tracking their dietary/ sleeping habits and participants in Nutrition Essentials each week did make them more conscious about what they were eating and how much time they spent sleeping at night. This being the case, many did report that efforts were made to increase amount of time slept at night and to watch what was eaten on a day-to-day basis. However, as mentioned above, there were no significant changes in sleeping habits or dietary habits by the end of this intervention, therefore it is difficult to attribute a positive change in energy/fatigue status to either one of these categories as well. Previous studies did see a change in mood, energy, and emotional health secondary to changes in dietary habits. From the results of the pre and post health survey, participants' emotional health did not significantly change throughout the course of the intervention as well. With results from other studies finding that dietary habits, particularly an increase in fruit and vegetable intake, could potentially benefit emotional health, mental health and energy levels, further studies should be conducted on this topic. Future research should include a larger sample size of participants and longer intervention periods. Also, future research should use randomized clinical trials which assign participants to control and intervention groups. The intervention group should then be instructed to eat a specific amount of fruits and vegetables each day to fully determine if dietary intake impact aspects of mental health.

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APENDX A: Anthropometric data and Short Form Health Questionnaire

Anthropometric data:

ID#:

Age:

gender:

height(inches):

weight(lbs):

36-SF Survey questions: (check the answer that best pertains to you)

1. In general, would you say your health is

    1. ☐Excellent
    2. ☐Very good
    3. ☐Good
    4. ☐Fair
    5. ☐Poor

2. Compared to one year ago, how would you rate our health in general now?

    1. ☐Much better than one year ago
    2. ☐Somewhat better now than one year ago
    3. ☐About the same
    4. ☐Somewhat worse now than one year ago
    5. ☐Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your health now limit you in these activities if so, how much?

	Yes, limited a a lot	Yes, limited a little	No, not limited at all
3. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	☐1	☐2	☐ 3
4. Moderate activities, such as moving as moving a table, pushing a vacuum cleaner, bowling or playing golf.	☐1	☐2	☐3

5. Lifting or carrying groceries	☐1	☐2	☐3
6. Climbing several flights of stairs	☐1	☐2	☐3
7. Climbing one flight of stairs	☐1	☐2	☐3
8. Bending, kneeling, or stooping	☐1	☐2	☐3
9. Walking more than a mile	☐1	☐2	☐3
10. Walking several blocks	☐1	☐2	☐3
11. Walking one block	☐1	☐2	☐3
12. Bathing or dressing yourself	☐1	☐2	☐3

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
13. Cut down the amount of time you spend on work or other activities	☐1	☐2
14. Accomplished less than you would like	☐1	☐2
15. Were limited in the kind of work or other activities	☐1	☐2
16. Had difficulty performing the work or other activities (for example, it extra effort)	☐1	☐2

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
17. Cut down the amount of time you spend on work or other activities	☐1	☐2
18. Accomplished less than you would like	☐1	☐2
19. Didn't do work or other activities as carefully as usual	☐1	☐2

20. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

    1. ☐None
    2. ☐Very mild
    3. ☐Mild
    4. ☐Moderate
    5. ☐Severe
    6. ☐Very severe

21. How much bodily pain have you had during the past 4 weeks?
    1. ☐None
    2. ☐Very mild
    3. ☐Mild
    4. ☐Moderate
    5. ☐Severe
    6. ☐Very severe

22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?
    1. ☐Not at all
    2. ☐A little bit
    3. ☐Moderately
    4. ☐Quite a bit
    5. ☐Extremely

How much of the time during the past 4 weeks:

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
23. Did you feel full of pep?	☐1	☐2	☐3	☐4	☐5	☐6
24. Have you been a very Nervous person 40	☐1	☐2	☐3	☐4	☐5	☐6
25. Have you felt so down in the dumps that nothing Could cheer up?	☐1	☐2	☐3	☐4	☐5	☐6
26. Have you felt calm and peaceful?	☐1	☐2	☐3	☐4	☐5	☐6
27. Did you have a lot of energy?	☐1	☐2	☐3	☐4	☐5	☐6
28. Have you felt downhearted and blue?	☐1	☐2	☐3	☐4	☐5	☐6
29. Did you feel worn out?	☐1	☐2	☐3	☐4	☐5	☐6
30. Have you been happy person?	☐1	☐2	☐3	☐4	☐5	☐6
31. Did you feel tired?	☐1	☐2	☐3	☐4	☐5	☐6

32. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)
    1. ☐All of the time
    2. ☐Most of the time
    3. ☐Some of the time
    4. ☐A little of the time
    5. ☐None of the time

How true or false is each of the following statements for you?

	True	Mostly true	Don't know	Mostly false	False
33. I seem to get sick a little easier than other people	☐1	☐2	☐3	☐4	☐5
34. I am as healthy as anybody I know	☐1	☐2	☐3	☐4	☐5
35. I expect my health to get worse	☐1	☐2	☐3	☐4	☐5
36. My health is excellent	☐1	☐2	☐3	☐4	☐5

Apendex B: ASA24

Supplemental Figures 1-8 are snapshots of how the ASA24 database works.

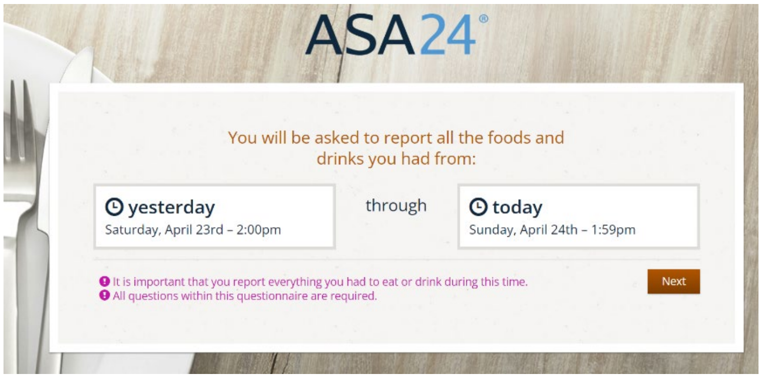


Figure #1 shows the screen of ASA24 after the indivual logs in. It shows the dates and times that indivduals are loing for

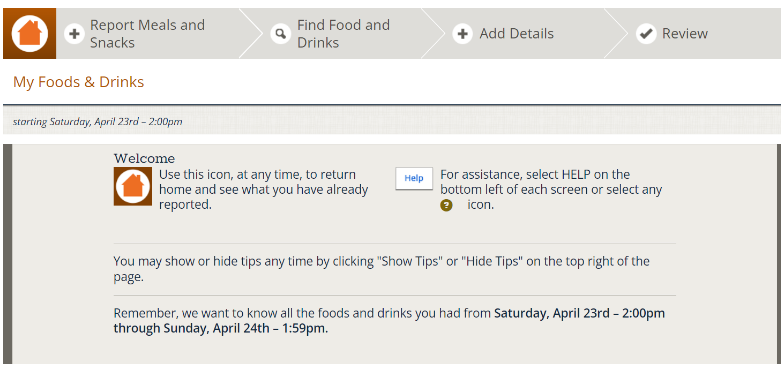


Figure #2 shows the home screen of ASA24. The individual using the database would click the button in top left corner labled "Report Meals and Snacks" to start their dietary log.

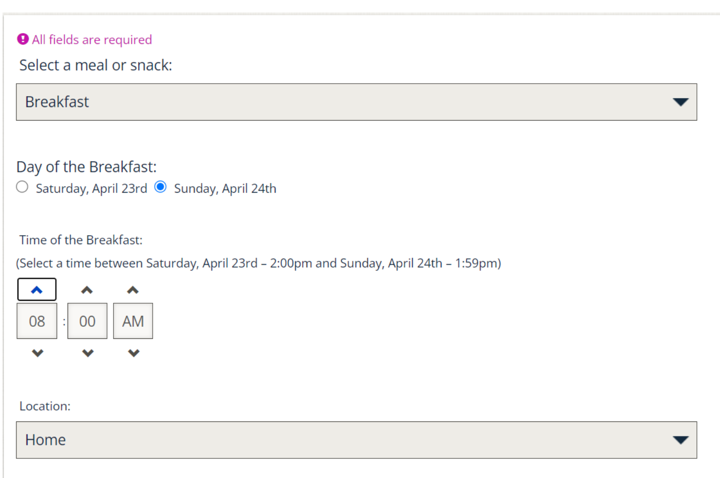


Figure #3 shows screen that pops up after an individual hits “report meals and snacks”. The individual is then instucted to select the meal they are reporting, which day is being reported on, the time the meal was consumed and the location in which the individual consumed it.

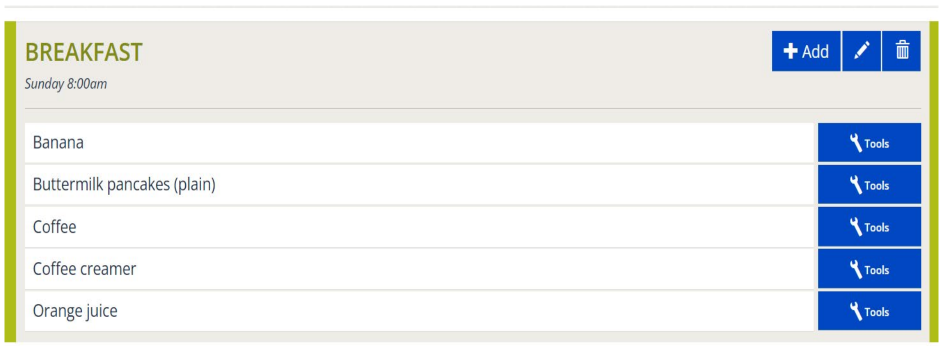
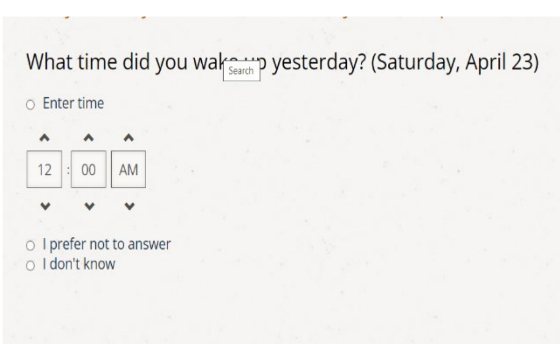
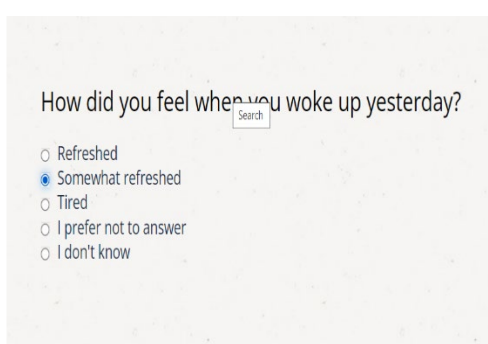


Figure #4 shows the list of all foods that were consumed during the 24hr period. The research team just entered items for breakfist for the purpose of this example, but the ASA24 dietary list for participants of this study included foods from breakfast, lunch, dinner and snack periods.

Figure #5 shows the next step of ASA24 which was to select the serving size of each meal item and report how much was actually consumed.





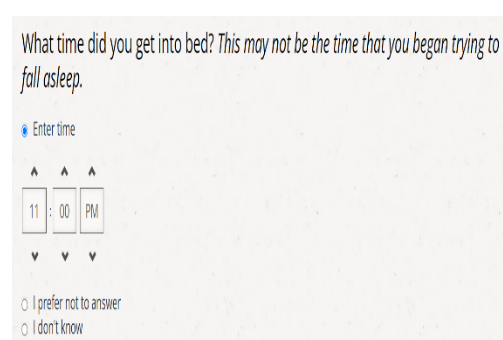
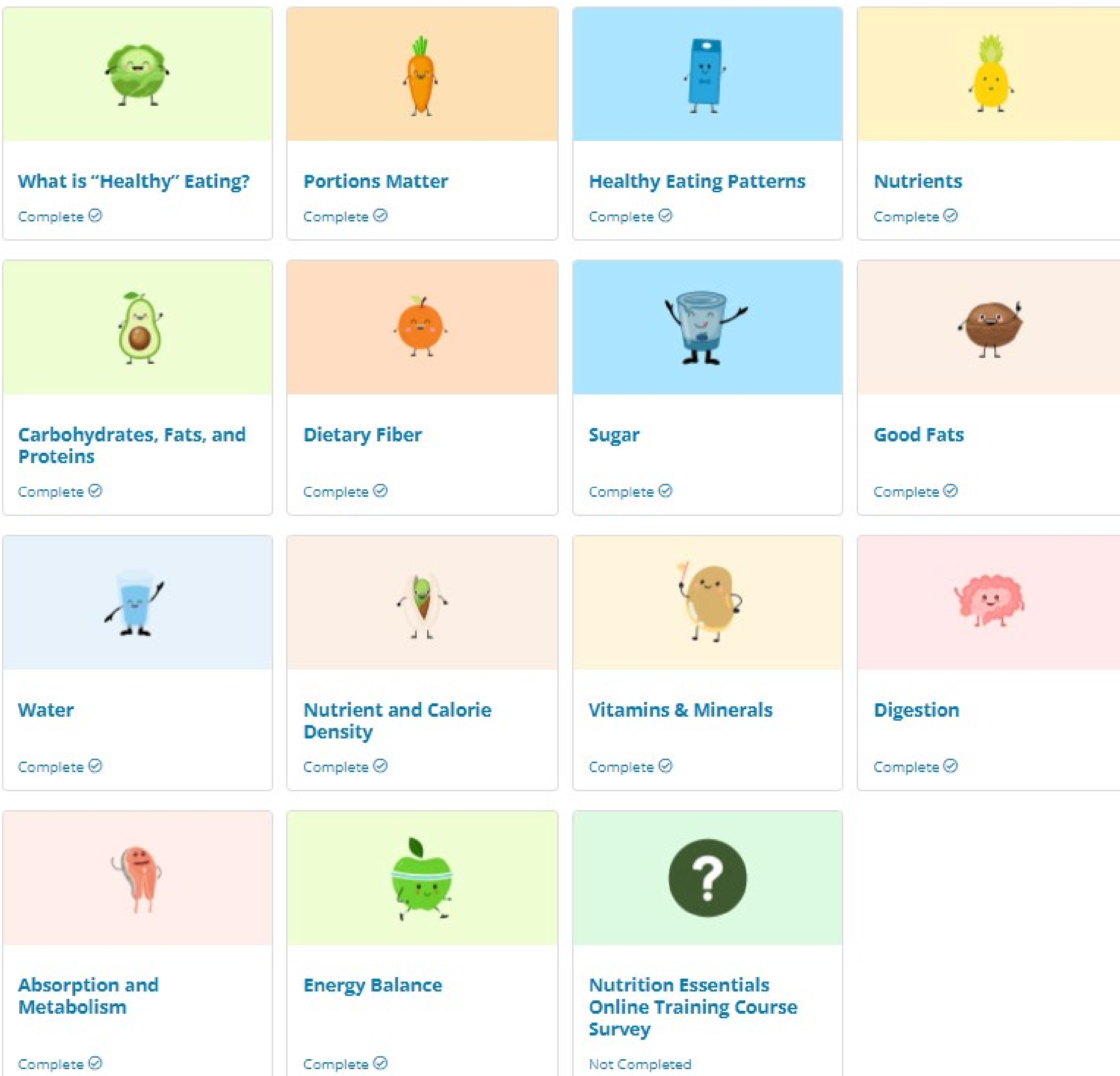


Figure #6-8 shows the questions ASA24 asked individuals regarding sleeping habits. The question in Figure #6 asks “ what time did you wake up yesterday?”, the question in Figure #7 asks “how did you feel when you woke up yesterday?” and finally, Figure #8 asks “what time did you get into bed”? The next three set of questions not shown on this appendex then as the same questions but regarding the present day (What time did you wake up today?, How did you feel when you woke up this morning? What time did you get into bed last night?).

<u>Apendex C: Nutrition Essentials Modules</u>

Supplemental figure #9 shows snap shots of the home screen for the ANS Nutrition Essentials online course. Shown below are each one of the modules participants of this present study were assigned each week. Paricipants simply had to click on the picture of the modules that were do that week, and each module would then begin. Each module also had minature quizes at the end, which was an effective way of determining if participants retained any of the modules information.



Appendix D: International Physical Activity Questionnaire (IPAQ)

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.