THE EFFECTS OF GRAZING ON DAILY CALORIC INTAKE AND DIETARY QUALITY

DS201: FINAL PROJECT REPORT

Submitted By

Team07

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December 5, 2022

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Keywords NHANES · Caloric intake · Grazing · Dietary quality · BMI · Eating patterns

1 Introduction

Of the elements causing poor nutritional quality in humans has been identified as the length and frequency of eating occasions. Grazing (in this context) describes about the unusual eating habits of the people whose food consuming frequency is more than three times a day. The main objective of this study is to examine whether grazing affects total daily caloric intake and dietary quality using Healthy Eating Index (HEI) methodologies.

Adult food quality is a major public health problem since poor diet quality increases the risk of a wide range of illnesses, such as heart disease, stroke, Type II diabetes, and various cancer types.The prevalence of overweight and obesity, which has become a huge concern especially after the covid-19 pandemic where people had been restricted to reside in their homes and not to step out results in significant financial and medical expenses, is a result of poor dietary quality. Overweight or obesity affects 53.

The year 2020 is marked as the first year wherein, the length and frequency of eating events, as well as their impact on nutritional quality and health outcomes, were studied by the Scientific Advisory Committee. To make recommendations on dining occasion frequency in the final Dietary Guidelines, the DGA Committee determined that there was insufficient information on the connection between eating occasion frequency and health. The DGA Scientific Advisory Committee concluded that there is an "urgent need for additional research" on the subject and that "this question is crucial to address in future cycles.

In the medical community, grazing has been characterized as eating “not in response to hunger and satiety cues” — with “compulsive and non-compulsive” components. These different definitions prevent the accurate measurement of “grazing” and render it difficult to compare data across studies Several studies have analysed the impact of frequency and duration of eating occasions on dietary quality — a few of which have specifically looked at “grazing.” It has been found that snacking frequency and an increased percentage of calories from snacks (as opposed to “meals”) decreases the likelihood of obesity among adolescents. So, a detailed study of all these reports has to be made to draw a conclusion and wrestle with this problem.

Utilizing data from the 2007–18 National Health and Examination Survey, we examine dietary intake across [2days] (NHANES). With the help of this innovative statistical technique, we can take into consideration dietary preferences and individual food intake to precisely calculate the effects of grazing.

2 Materials & Methods

The National Center for Health Statistics, part of the Centers for Disease Control and Prevention, conducts the National Health and Nutrition Examination Study (NHANES), a yearly continuous survey of the non institutionalized U.S. civilian population. To evaluate the health and nutrition of Americans, the survey gathers food recall data from respondents in addition to demographic, medical, and physiological data.

From NHANES we need to download dietary datasets of day1,2 from 2007-18 .The downloaded datasets present in (XPT FILES), we need to convert (XPT FILES) to (CSV files) .we are downloading datasets of two days because "What we eat in America (WWEIA) survey," which is part of the NHANES dietary recall component, is administered over two days. Day 1 of the survey administration takes place in person at the NHANES Mobile Examination Center; Day 2 takes place over the phone . In that survey there should be count what they ate and at what time in 24hrs . The USDA Automated Multiple-Pass Method is used by NHANES to increase the recall procedure’ accuracy.

In this investigation,we have considered only people above 18 age and how participated in both day data collection ,we also eleminated pregnant women , we employ a criterion of > 9 kcal.As a result, we did robustness tests with three alternative calorie thresholds: > 0 kcal, > 49 kcal, and > 199 kcal. We adjusted for average calories per eating occasion in our regression and accounted for average calories per eating occasion in our analysis.In grazing we can’t show difference between breakfast and meals. So did not specifcally look at grazing when analyzing the impact of meal and snack frequency on dietary quality. We counted the total number of eating occasions on both day 1 and day 2 for each participant, and grazers were identified as individuals who recorded more than three eating occasions on one or both days of dietary intake data collection. We also compared the total caloric intake and dietary quality of morning grazers to that of evening grazers. Individuals were defined as morning grazers if they reported more than two eating occasions between

Table 1 :Means and standard errors of demographic characteristics by eating pattern over 2days, adults age 18 and older

	All		Grazers both days		Grazers 1 day		Non Grazers	
	MEAN	SE	MEAN	SE	MEAN	SE	MEAN	SE
Male	48.25	0.0376	48.46	0.0470	47.99	0.0680	48.01	0.0667
Age (years)	48.55	0.1389	48.98	0.1743	49.74	0.2495	47.99	0.2433
Married or living with partner	56.35	0.0192	57.36	0.0243	58.14	0.0343	54.92	0.0338
Hispanic	9.96	0.0089	9.86	0.0111	9.92	0.0158	10.24	0.0159
Non-Hispanic, White	45.37	0.0154	46.30	0.0194	46.92	0.0282	43.97	0.0268
Non-Hispanic, Black	21.37	0.0094	20.68	0.0116	20.42	0.0167	22.36	0.0170
Less than high school	23.72	0.0119	23.79	0.0148	22.62	0.0210	23.67	0.0211
High school graduate or GED	21.61	0.0138	21.63	0.0173	20.22	0.0243	21.36	0.0245
Some college or AA degree	27.63	0.0142	27.33	0.0177	28.61	0.0261	28.32	0.02545
College graduate or above	21.98	0.0107	22.35	0.0133	24.19	0.0193	21.36	0.0190

3:00a.m. and 2:59p.m. Individuals were defined as evening grazers if they reported more than one eating occasion between 3:00p.m. and 2:59am.

The sum of all reported calories was used to determine the daily caloric intake. We divided the total number of calories ingested during the day by the number of calories consumed at food-awayfrom-home (FAFH) establishments to arrive at the ratio of calories from FAFH establishments. By dividing the total daily calories eaten by the total daily eating occasions, we were able to determine the average number of calories consumed per meal event.

We try add the WWEIA survey to the Food and Nutrient Database for Dietary Studies, which will allow us to examine the nutritional makeup of people's diets using the 2015 Healthy Eating Index score, to quantify nutritional quality (HEI-2015). In the nutrition world, the HEI score is regarded as a valid indicator of nutritional quality since it assesses how well people adhere to the USDA Dietary Guidelines for Americans (DGAs) .

But as we are unable to calculate the HEI scores of dataset using the SAS-macro code provided in the website we instead take BMI as our criteria to calculate peoples conditions with there diet.

We present summary statistics for day 1, day 2, and both days of data collection in Table-1. We calculated the proportion of grazers, morning grazers, and evening grazers, and calculated average total calories in the Table-2

To estimate effects of grazing we use calculated BMI for grazers and non grazers and also calculated for the morning and evening grazers to find how the eating timings effect on the BMI values(Table-3).We also plotted a barplot so that we can visullay say the differences in BMI for different ones.

Table 2: Summary of intake measures from NHANES, day 1 and day 2, adults age 18 and older

	Day-1		Day-2	
	Mean	SE	Mean	SE
Grazers	80.91	0.5136	86.58	0.5897
Morning grazers	71.93	0.579	79.78	0.6524
Evening grazers	70.61	0.4663	77.31	0.4862
Total energy content	2229.84	1.5975	2067.67	1.4265
Total energy content by Grazers	2235.22	2.0514	2071.48	1.7869
Total energy content by morning Grazers	2246.01	3.6919	2068.11	2.8801
Total energy content by evening Grazers	2234.59	3.8464	2070.39	3.2017

Finally, we graphically explored the relationship between grazing, caloric consumption, and time of day. We calculated the percentage of individuals in our sample (i.e., those who grazed 1 day and did not graze the other day) that ate at each hour of the day, broken down by the day they grazed and the day they did not graze . We also calculated the average number of calories consumed by individuals in our sample engaged in eating at each hour of the day, broken down by the day they grazed and the day they did not graze . We conducted the same graphical analysis for individuals who grazed both days, and individuals who did not graze on either day .

3 Results

Sample demographics

In our sample the mean age of our study participants was 48years old, and 48.25 percentage of participants were male. 45.37 percentage identified as non-Hispanic white, 21.37 percentage as non-Hispanic black, and 9.96 percentage identified as Hispanic. 56.35 percentage of our sample indicated they were married or living with partner. 23.72 percentage recorded their highest level of education as less than high school, 21.61 percentage as high school graduate or GED, 27.63 percentage as some college or AA degree, and 21.98 percentage as college graduate or above(Table-1).

Comparing grazers on both days, to grazers on 1day, and to non grazers

Individuals who grazed on 1day were diferent from those who did not graze either day. Individuals who grazed on 1day were on average older, more educated, more likely to be married, and more likely to be non-Hispanic White than those who did not graze .Similarly individuals who grazed on both days show similar results as non grazers when compared to the individuals who grazed on 1day.

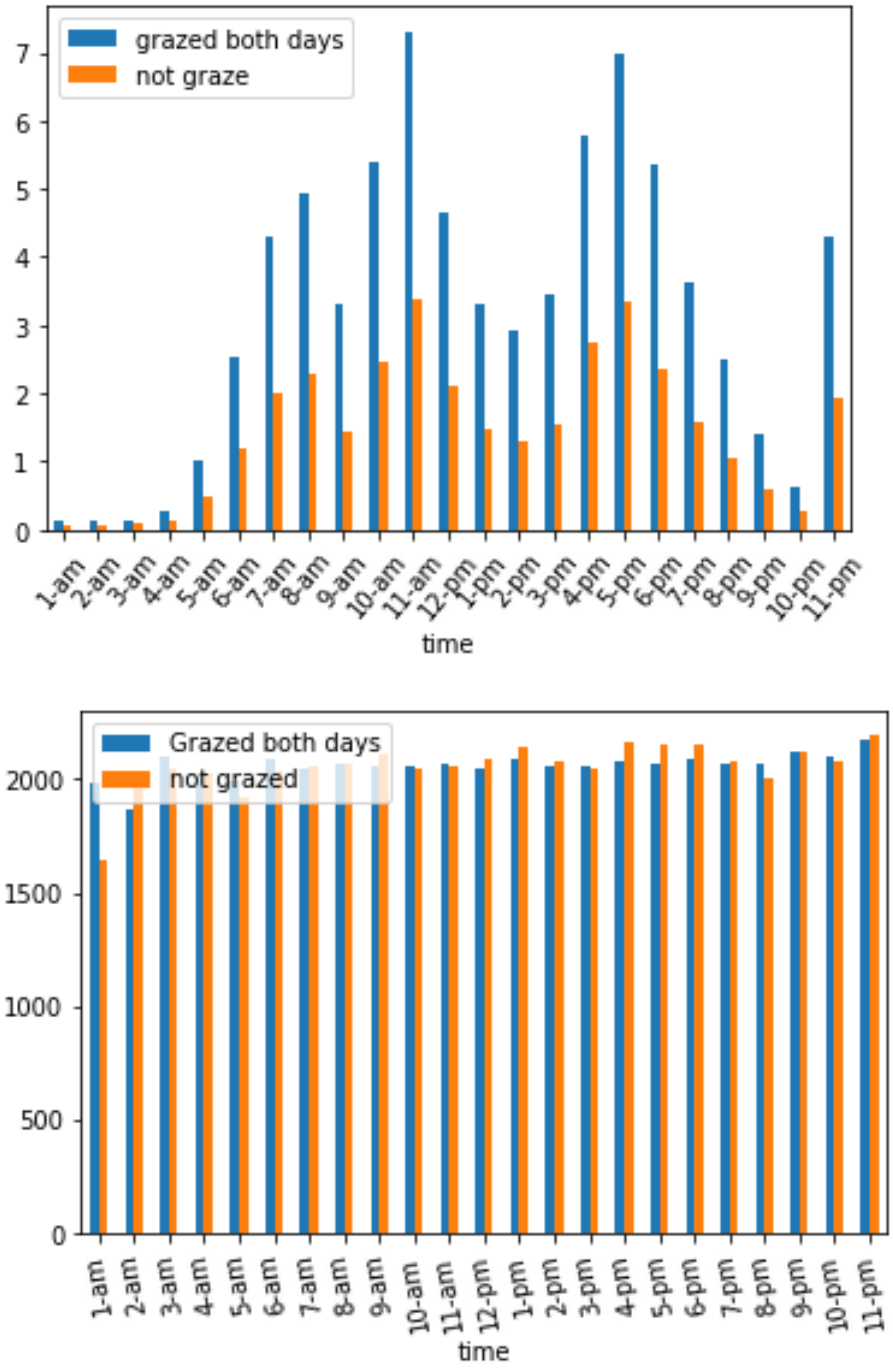

Fig. 1 Percentage of Americans who engaged in eating and average calories when engaged in eating, by the time of day, on an average day in 2007-18, age 18 and older, and those who grazed 1day and did not the other day. Fig-1(a) Percent engaged in eating. Fig-1(b) Average calories when engaged in eating. Notes: Weighted means reported. NHANES dietary intake day 2 weights (wtdr2d) were used to compute nationally representative estimates. Source: Authors' calculations using data from the 2007-18 National Health and Nutrition Examination Survey (NHANES)

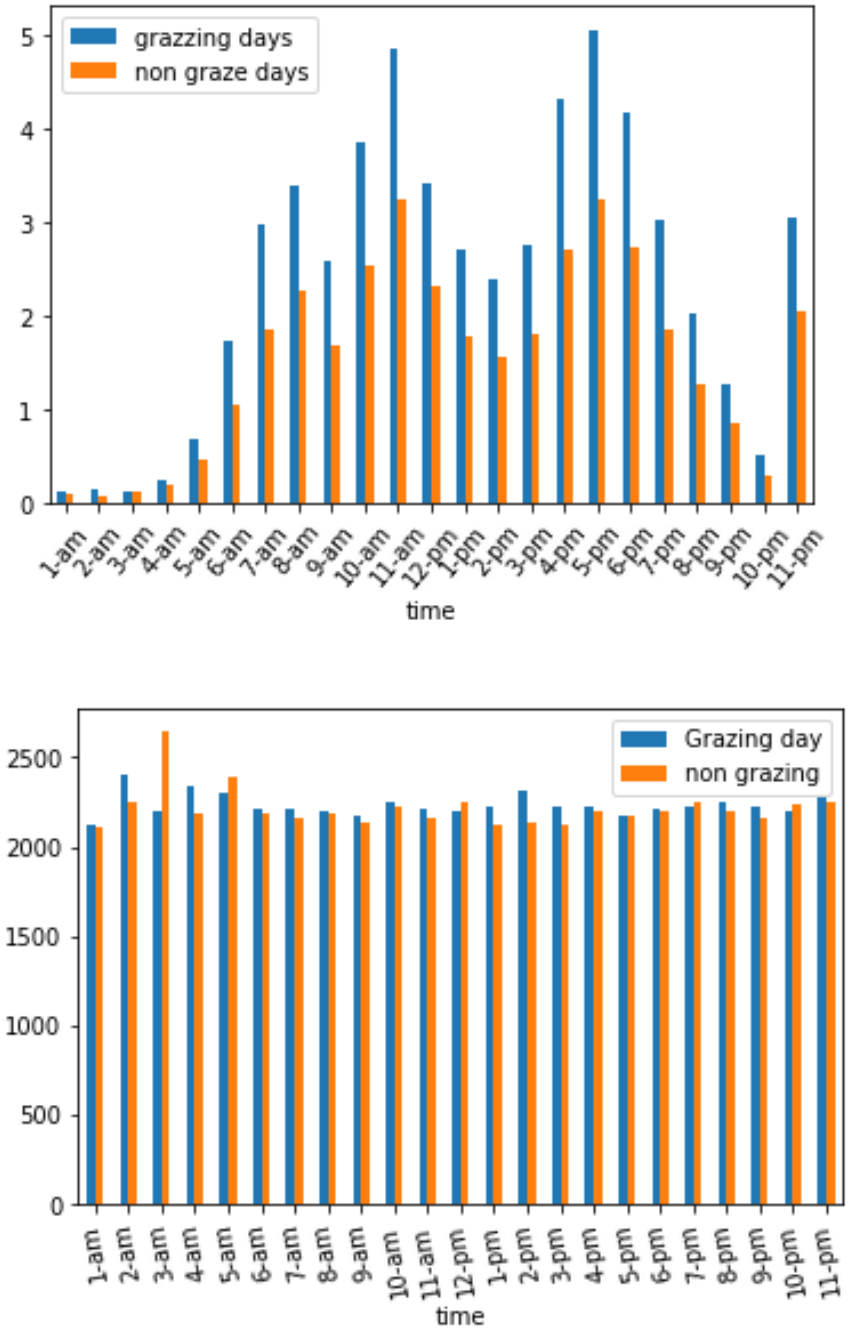

Fig. 2 Percentage of Americans who engaged in eating and average calories when engaged in eating, by the time of day, on an average day in 2007-18, age 18 and older, and those who grazed 1day and did not the other day. Fig-2(a) Percent engaged in eating. Fig-2(b) Average calories when engaged in eating. Notes: Weighted means reported. NHANES dietary intake day 2 weights (wtdr2d) were used to compute nationally representative estimates. Source: Authors' calculations using data from the 2007-18 National Health and Nutrition Examination Survey (NHANES)

Table 3: BMI values of Grazers,non-Grazers,morning Grazers,evening Grazers from NHANES data in 2007-18, age 18 and older.

	BMI values of Day-1		BMI values of Day-2	
	Mean	SE	Mean	SE
All	28.6414	0.0594	28.6812	0.0570
Grazers	28.6331	0.0660	28.6145	0.0610
Non- Grazers	28.6175	0.0753	28.6728	0.0766
Morning grazers	28.6096	0.0704	28.6084	0.0639
Evening grazers	28.6541	0.0710	28.6667	0.0648

Summary of intake

On average, 80.91 percentage of all individuals grazed the first day, and 86.58 percentage grazed the second day. Most grazing happened in the morning. When looking at day 1, 70.61 percentage grazed in the evening compared to 71.93 percentage who grazed in the morning. Day 2 follows a similar pattern: 79.78 percentage of American adults grazed in the morning and 77.71 percentage grazed in the evening(Table-2) .Mean caloric intake of day 1 is higher than day 2 this also carries same with the grazers and type of grazers .

Effects of grazing

The BMI value of day 1 is 28.6414 which is smaller than the BMI value of day 2 which is 28.6812.The grazers have an high BMI value than the non grazers in day1 which is quite opposite to day 2.But when it comes to the comparision of morning and evening grazers the morning grazers have low BMI compared to the evening grazers in both the days(Table-3).Even from the graph of BMI we can se the above results.

Finally, we graphically depicted the relationship between grazing, caloric consumption, and time of day. Fig. 1a displays the percentage of individuals in our sample that ate at each hour of the day, broken down by "grazed both days " and "not graze". Figure 1a shows the percentage of individuals in our sample that ate at each hour of the day is higher by "grazed both days" more than "not graze" for all hours of the day . As depicted in Fig. 1a, the eating pattern of the "not graze" followed a trimodal, or three-peaked, distribution, with the percentage of people engaging in eating peaking between 8 and 8:59 a.m., then again between 11:00and 11:59 p.m., and then once more between 5 and 5:59 p.m. The first of these three peaks, however, was smaller than the second and third. The eating pattern of the"grazed both days" was different: it followed a binomodal, or two-picked, distribution, with the percentage of people engaging in eating peaking between noon and 11:59 p.m. and then again between 5 and 5:59 p.m. Figure 1b shows the average number of calories individuals in our sample consumed at each hour of the day, broken down by "grazed both days " and "not graze". The average number of calories was higher by the "not graze" more than the "grazed both days" for all hours of the day except for the 1:00a.m.hour. The figure shows the highest peaks of caloric consumption by "not graze" occur between noon and 1:59p.m and between 4 and 6:59p.m. This makes sense, as these times are associated with the consumption of lunch and dinner. By the "grazed both days" the highest peaks of caloric consumption are still at typical times associated with a three-eating-occasion per day pattern, but the values are not as high as for "not graze" The difference between the average calories consumed at each hour by the"grazed both days " and "not graze" was larger during the hours of 1:00a.m. - 12:00p.m. We

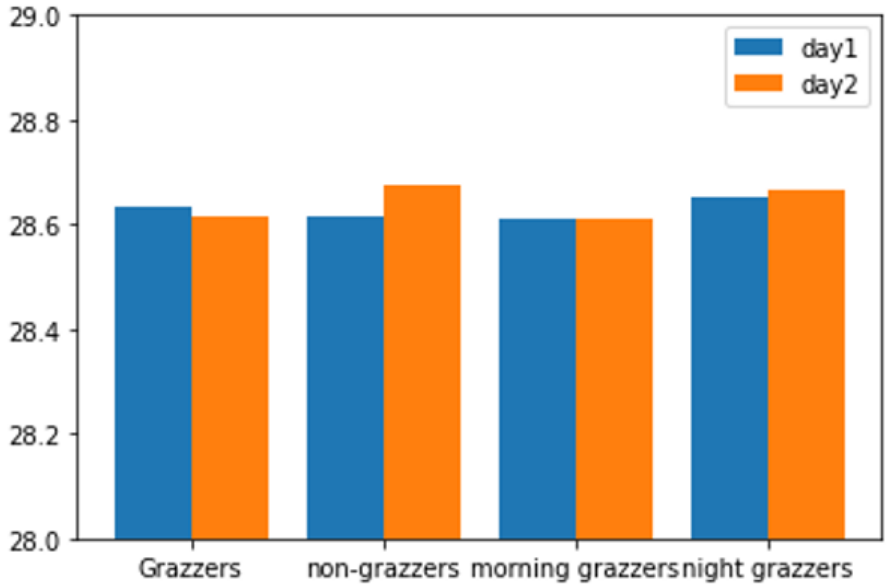

Fig. 3 BMI of Americans , by the divisons of what type of eaters they are, on an average day in 2007-18, age 18 and older.

replicated this graphical analysis for the days as “Grazing day “and “non graze day”(Fig. 2) . “Grazing day” refers to the day out of the 2 days of dietary intake in which the individual grazed; “non-grazing day” refers to the day out of the 2 days of dietary intake in which the individual did not graze.We found our results were consistent with the analysis of individuals who grazed 1day and not the other.The graphs were similar to the first graphs .The total calories taken on “non graze day” is higher that “Grazing day “the peak “non graze day” occours at 3:00am it is also the difference is high between them(Figure 2b).

4 Discussion

In the study, we examined the influence of the grazers who participated in a dietary pattern characterized by the continuous ingestion of calories throughout the day on the total daily caloric intake and dietary quality. Our study also compares the dietary intake of the individuals who graze 1 day and not on the second day but not between the individuals who graze and who don’t graze. The results we got align with the dietary quality of food away from home and the caloric intake observed from the collection of data done by NHANES. According to our study, on an average, individuals consumed mare calories of lower nutritional values when they are away from home and the individuals consumed more calories on day 1 more than day 2 based on the data collected. One of the limitations to our research analyzes the effect of grazing regardless of the intention of the individual to graze. Another limitation to our study is the inclusion of shift workers. The data from NHANES doesn’t have caloric intake of shift workers because the shift workers consume more calories at late night of lower dietary quality than morning. The healthy Eating Index (HEI) is a measure of diet quality used to access how well a set of foods aligns with the 2015-2020 Dietary Guidelines for Americans. HEI score is calculated using the mean ratio for each component and the total score is calculated by summing the scores over all the components.But as we are unable to calculate and study about he HEI score we take BMI as an alternative, Generally, BMI is defined as a person’s weight in kilograms (or pounds) divided by the square of the height in meters (or feet). However, when separating grazers into “morning grazers” and “evening grazers” we observed the BMI value of evening grazers are high . To define alternative definitions

of eating occasions, we have conducted robustness checks where we changed the calorie threshold to define an eating occasion from 0kcal to 9kcal, 9kcal to 49kcal and 49kcal to 199kcal. Our results were same in all the three scenarios. This lead to change the definition of grazing as participating in more than four eating occasions per day but the results were same. The time cutoffs for categorising "morning" and "evening" grazers were another element of the definition of grazing that might have had an impact on our findings. Our decision not to distinguish “meals” from “snacks” in our analysis also could have impacted our result ans the increasing of snacking frequency is associated with lower dietary quality, whereas increased meal frequency is not however, both meal frequency and snack frequency are associated with overweight and obesity. Additional research is recommended to further explore the relationship between “meals,” “snacks,” “grazing,” and dietary quality.The data we used is from NHANES which has limited our analysis to U.S consumers only. . Exploring the impact of grazing on the dietary quality of subgroups within populations is also important.

Conclusions

In aggregate, grazing — as defined as participating in more than three eating occasions per day — increases daily caloric intake and dietary quality as measured by the BMI score. However, grazing in the morning — defined as consuming more than two eating occasions between 3:00 a.m. and 2:59 p.m. — has good BMI score . Grazing does not appear to be an effective calorie reduction strategy, in aggregate, or even an effective strategy at improving most individual components of dietary quality. It is important to note, though, that morning grazers still increased their overall caloric intake compared to non-grazers, even though they consumed foods that stabilized there BMI score . It appears grazing does not replace consuming lunch, and dinner (calorie-dense eating occasions) at conventional times; however, these eating occasions have fewer calories, on average, than when individuals do not graze.Also grazing in the evenings led to increase in BMI values which lead to obesity and overweight. Our results contribute to the literature on eating patterns and dietary quality, and specifically shed light on grazing, where there is currently no conclusion on its impact on caloric intake and dietary quality. In addition to providing analysis to answer this question, we raised critical points in how to define grazing. While these findings may be useful for forming future recommendations concerning “grazing,” there is still a need for additional research to inform dietary policy recommendations. Consistent definitions for “eating event,” “snack,” “meal,” and “grazing” are needed, as well as additional geographically and culturally diverse research

Acknowledgements

Dr. Nitin Khanna

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