Routledge
Taylor & Francis Group

Historical Methods: A Journal of Quantitative and Interdisciplinary History

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/vhim20

# Overflowing tables: Changes in the energy intake and the social context of Thanksgiving in the United States

Diana Thomas, Gail Yoshitani, Dusty Turner, Ajay Hariharan, Surabhi Bhutani, David B Allison, Amanda Moniz, Steven Heymsfield, Dale A Schoeller, Holly Hull & David Fields

**To cite this article:** Diana Thomas, Gail Yoshitani, Dusty Turner, Ajay Hariharan, Surabhi Bhutani, David B Allison, Amanda Moniz, Steven Heymsfield, Dale A Schoeller, Holly Hull & David Fields (2022): Overflowing tables: Changes in the energy intake and the social context of Thanksgiving in the United States, Historical Methods: A Journal of Quantitative and Interdisciplinary History, DOI: 10.1080/01615440.2021.2010153

**To link to this article:** https://doi.org/10.1080/01615440.2021.2010153

Published online: 25 Jan 2022.

HISTORICAL METHODS: A JOURNAL OF QUANTITATIVE AND INTERDISCIPLINARY HISTORY
https://doi.org/10.1080/01615440.2021.2010153



# Overflowing tables: Changes in the energy intake and the social context of Thanksgiving in the United States

Diana Thomas[a], Gail Yoshitani[b], Dusty Turner[c], Ajay Hariharan[a], Surabhi Bhutani[d], David B Allison[e], Amanda Moniz[f], Steven Heymsfield[g], Dale A Schoeller[h], Holly Hull[i], and David Fields[j]

[a]Mathematical Sciences, US Military Academy; [b]History, US Military Academy; [c]US Army Center for Army Analysis; [d]San Diego State University; [e]School of Public Health, Indiana University Bloomington; [f]Smithsonian Institution; [g]Pennington Biomedical Research Center; [h]University of Wisconsin-Madison; [i]University of Kansas Medical Center; [j]The University of Oklahoma Health Sciences Center

**ABSTRACT**

In the United States, recent studies have demonstrated weight gain over Thanksgiving contributing to a significant portion of annual national weight gain. Understanding the social context of how Thanksgiving celebrations were perceived is critical for preventing and reducing excess weight during this time. Energy intake from present-day data was back-calculated from body weight data collected in participants before and after Thanksgiving. Similar calculations were performed in studies that also included Christmas. A Latent Dirichlet Allocation analysis of topics scraped from Twitter under the hashtag #thanksgiving was performed. The top topics and search queries from Google Trends on Thanksgiving 2020 were also identified. Since 1621, the social context of Thanksgiving has evolved from a focus on prayer and celebrated gratitude to a focus on food, football, and retail. What is served on Thanksgiving and its energy content has not substantially changed since the late 18th century. On the other hand, body weights and mean energy intake have steadily increased over time with the most rapid increases occurring since 1941. The shift in the social context of Thanksgiving and other factors of an existing obesogenic environment have likely combined to generate increased energy intake and weight gain during Thanksgiving.

**KEYWORDS**

Energy balance equation; Thanksgiving; Waaler surface

## Introduction

Fall 2021 marks the quadricentennial of a harvest festival held in the autumn of 1621 by the English settlers in the original settlement of Plymouth Colony (Baker 2009; Bradford 2017; Wills 2003). We know about the event because one of the participants, Edward Winslow, wrote a letter back to a friend in England explaining, "Our harvest being gotten in, our governor [William Bradford] sent four men on fowling, that so we might after a special manner rejoice together after we had gathered the fruit of our labors." Winslow excitedly reported to his friend that in one day the four men brought in enough fowl, "with a little help beside" to feed "the company almost a week." This bounty allowed time for recreations, which included firing their arms and entertaining King Massasoit and ninety of his men for three days. While it is impossible to know exactly what was eaten, Winslow shares that Massasoit's men also "went out and killed five deer" and concluded, "And although it be not always so plentiful as it was at this time with us, yet by the goodness of God, we are so far from want that we often wish you partakers of our plenty." (Heath and Pre-1801 Imprint Collection (Library of Congress) 1963).

While Pilgrims, like Winslow, believed they were carrying out important work for God by coming to America to seek religious separation from the Church of England, they could not know that their first harvest festival would come to play an important part in the origin story of the United States of America. Winslow may be surprised to learn that his descendants live in a nation where not only is that festival annually commemorated, but that it also has come to create challenges to the good health of some Americans. Today, the cherished United States holiday brings to mind beautifully set tables laden with food and surrounded by family. The public may envision school day images of Pilgrims and Native Americans

CONTACT Diana Thomas diana.thomas@westpoint.edu Mathematical Sciences, US Military Academy, Thayer Road, West Point, NY, 10996-2101 USA

sitting together in peace at a table sharing a feast, but despite the positive sentiments that Thanksgiving may foster, the holiday also represents challenges involving unwanted weight gain.

Over the past few decades, Thanksgiving has been identified as a potential contributor to annual weight gain in the United States (Yanovski et al. 2000). Annual weight gain in the United States is estimated from 0.2–0.8 kg per year (Yanovski et al. 2000). The only existing study that measured body weight before and after Thanksgiving found an increase of 0.5 kg (Hull et al. 2006). Other studies that measured body weights pre-holiday and post-holiday (before Thanksgiving and after Christmas) have identified similar weight gain patterns during a longer 3 month period (Bhutani et al. 2020; Cook et al. 2012; Diaz-Zavala et al. 2017; Roberts and Mayer 2000; Schoeller 2014; Yanovski et al. 2000).

Biological and physiological explanations for Thanksgiving and holiday weight gain were explored by Bhutani et al. (Bhutani et al. 2020) who measured total energy expenditure (TEE) using the doubly labeled water (DLW) method and circulating blood levels of appetite-regulating hormones, ghrelin, leptin, PYY, and insulin. Bhutani et al. found no statistically significant difference in TEE and appetite-regulating hormones over the holiday season suggesting that a reduction in energy expenditure and/or alteration of appetite-regulating hormones do not appear to be responsible for holiday weight gain (Bhutani et al. 2020). Instead, Bhutani et al. objectively calculated energy intake using the intake-balance method (Gilmore et al. 2014) and found that increased energy intake explained holiday weight gain. Other studies have demonstrated that both social environment with family and friends (De Castro 1994) and increased access to palatable energy dense foods (Rogers and Brunstrom 2016) both contribute to increased energy intake; these factors are present during Thanksgiving with an environment of family and friends and access to large volumes of palatable food.

In this study, we combined methods in mathematical modeling, machine learning, nutrition science, and history to explore Thanksgiving from the late 17th century to the present. This methodology afforded an opportunity to first perceive and then consider the important role the holiday's evolving social context has played in energy intake and body weight. In 1863, President Abraham Lincoln issued a proclamation calling for the last Thursday in November to be set aside for Americans to celebrate an annual day of "Thanksgiving and Prayer (Lincoln 1863)". Lincoln's holiday combined two historic New England traditions. One tradition was for leaders on occasion to call for a "thanksgiving," which was "a day of special religious observance" to be set aside to give "thanks for favorable providences," that did not involve a large meal; and another was for communities to celebrate annual harvest feasts, which did involve a large meal (Hall 2004; Curtin, Oliver and Plimoth Plantation Inc 2005; Pleck 1999). This study allows one to begin imagining ways in which the social context for the Thanksgiving holiday may be evolved yet again to help improve American health.

## Methods

### *Study design*

Thanksgiving and the holidays in general have been studied extensively by many scholars and numerous lenses such as (Pleck 1999; Schmidt 1995). We are adding to this body of scholarship focusing on the history of Thanksgiving's influence upon body weight and energy intake. This required identifying and threading multiple data sources which are outlined in Figure 1. First, the social context surrounding the main holiday meal is examined; then consumption trends in food items and food energy are analyzed. Next, a concomitant evaluation of trends in body weight and energy intake are performed for each period. Finally, current social perceptions of the holiday are considered to better understand what historical aspects of Thanksgiving were retained and how they play a role in current Thanksgiving eating behaviors.

To ascertain the social context surrounding the main holiday meal, U.S. newspapers from New England, the Northeast and the South were reviewed from 1758 to the present. Because of the disparate ways topics were discussed in the North versus the South, both prior to and during the American Civil War, the *London Times* was also reviewed as an external reference of the Thanksgiving from the late 1850s through the 1860s. White House menus and historical recipe or cookery books were used to identify what was served for Thanksgiving in Washington D.C. in Period 1 and 2 to determine if the food items and their energy density has changed at least in the post-Civil War period.

Reported heights from Revolutionary War Soldiers (New York (State). State Historian 2000) and mortality curves called Waaler surfaces (Fogel 2004) that link heights and mortality to weights were used to estimate average male body weight during the

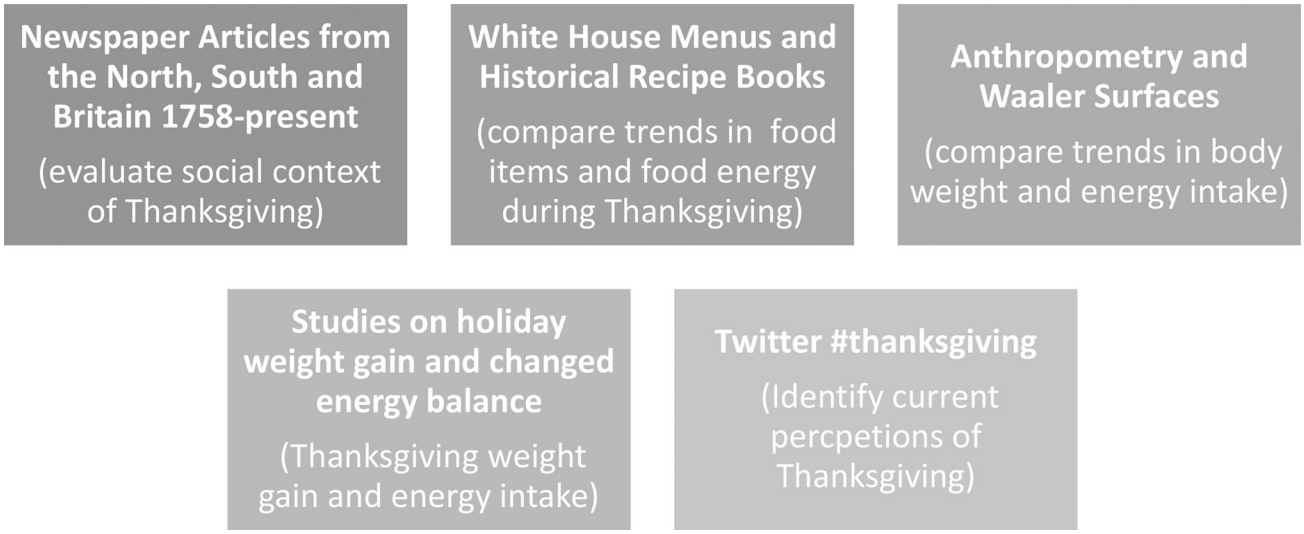


**Figure 1.** Sources used to evaluate trends in Thanksgiving's influence on body weight and energy intake.

Revolutionary War. Historical anthropometry data from (Gould 1869) was digitized in simple spreadsheets and averages were used to estimate male body weight during this time period. Recorded heights and weights were available after these early dates (Hathaway 1961) and through the Centers for Disease Control National Health and Nutrition Examination Survey (NHANES) (Cohen and National Center for Health Statistics (U.S.) 1987).

Finally, we wanted to know how the US public consumes food and perceives Thanksgiving today. Changes in twenty-first century energy balance over Thanksgiving were evaluated using the energy balance equation and objective measured data from studies that assessed Thanksgiving weight gain (Bhutani et al. 2020; Cook et al. 2012; Hull et al. 2006; Wagner, Larson, and Wengreen 2012; Yanovski et al. 2000). Only studies that measured participants in the United States and did not rely on self-report were included. It is also possible to compare how the perceptions and priorities surrounding Thanksgiving have evolved in the twenty-first century. Traditional methods, such as surveys, can assess how people view a holiday like Thanksgiving; however, surveys can be biased with participants either providing socially desirable responses (Thomas, Paliwoda, and European Marketing Confederation and Nima (Organization) 1997) or selecting central choices on Likert-type questions (Guilford 1954). To more objectively collect perceptions from large segments of the population today, we used natural language processing (NLP) to scrape and analyze Thanksgiving related tweets and trends in Google searches over Thanksgiving 2020.

### *Historical sources*

The largest historical dataset for this research was created from four historical newspapers spanning from the late eighteenth to the early twentieth centuries. The *New Hampshire Gazette* was searched for under the key word "Thanksgiving" from July 31, 1758 to November 4, 1864. A similar search was performed in the *New York Times* and in the *London Times* with no specific date restriction. Additional searches in the *New York Times* were performed under the two keywords "Parade" and "Macy's." A search was also made in the *New York Times* under the phrase "Black Friday." Searches were also performed for "Thanksgiving" in the southern newspaper, the *Columbus Daily Enquirer* from September 1858 to December 1922. In addition to reviewing newspapers, we also reviewed secondary sources such as books and journal articles on the history of Thanksgiving as an event, the food history of Thanksgiving, and the history of restaurants in the United States.

Thanksgiving energy customs and specific energy balances may be determined, at least in a prescriptive way, from historical state dinners and cookery books. White House Menus and information about food served at White House Thanksgiving dinners are available from 1865 to 2007 from the White House Historical Association website (whitehousehistory.org). For this study we compiled what was served for Thanksgiving from food descriptions for Presidents Lincoln (1861), McKinley (1897), Roosevelt (1902), Taft (1912), Wilson (1917), Roosevelt (1942), Reagan (1985), Clinton (1996), and Bush (2007). Thanksgiving recipes were extracted from cookery

**Table 1.** Three separate time periods were delineated and the social context, major key events, estimated average male height (cm), weight (cm), and energy intake (kcal/d).

| Time Period | 1620–1863 | 1863–1941 | 1941–present |
|---|---|---|---|
| Social Context | Newspapers contain governor proclamations in late November for a day of prayer and Thanksgiving. Sometimes called for a fast instead of a feast.<br>Tradition migrated from the New England states to other states.<br>1859 Thanksgiving tradition celebrated in thirty states, including twelve Southern states. | Thanksgiving tradition gradually transitions from religious to secular holiday and from one that involves much time outside the home to at home with extended family.<br>Sarah Josephine Hale romanticizes holiday as a "domestic festival" and teaches readers how to prepare the feast. | More families can afford car and travel to see family increases.<br>Domestic tradition continues, same menu items continue.<br>Increased number, access, and social acceptance for dining in restaurants.<br>Suburbanization. |
| Major Events | 1789 George Washington issues first Thanksgiving proclamation. | 1863 Sarah J. Hale asks President Abraham Lincoln to declare Thanksgiving a national holiday.<br>1876 The Intercollegiate Football Association scheduled its first championship game on Thanksgiving Day and institutionalized that practice in 1882.<br>1890s Progressive Era school teachers begin using the story of the Pilgrims and Thanksgiving Day to assimilate immigrant children.<br>1924 Macy's Thanksgiving Day Parade signaling commercialization of the holiday. | 1941 Franklin D. Roosevelt officially established the fourth Thursday in November as Thanksgiving Day.<br>1956 First nationally televised football game broadcast on Thanksgiving Day featuring the Packers and Lions.<br>1961 "Black Friday" phrase originates in Philadelphia. |
| Average Weight (kg) | 51 | 68 | 1955*: 76<br>1971–1975: 79<br>1976–1980: 79<br>1999–2000: 87<br>2015–2016: 92 |
| Average Height (cm) | 166 | 173** | 1955*: 173<br>1971–1975: 174<br>1976–1980: 175<br>1999–2000: 176<br>2015–2016: 175 |
| Estimated EI (kcal/d) | 2685 | 3062 | 1955*: 3280<br>1971–1975: 3349<br>1976–1980: 3337<br>1999–2000: 3542<br>2015–2016: 3690 |

books (Carter and American Imprint Collection (Library of Congress) 1772; Crowen 1866; Curtin, Oliver and Plimoth Plantation Inc 2005; Simmons 1796). Energy content for cranberry sauce and pumpkin pie were estimated from the recipes in the cookery books using the United States Department of Agriculture's (USDA) food composition data. We estimated the energy content for these two recipes because the amount of the ingredients were specified in the cookery books. Not all recipes had specific amounts for ingredients.

## Historical body weights, heights and energy intake

Historical body heights and weights prior to World War II (WWII) were measured and published only in adult males, specifically soldiers. In order to compare across time periods (see Table 1), we restricted recent data to adult male populations.

### Male body heights and weights period 1 (1620–1863)

Body heights were rarely measured and recorded in Period 1, 1620–1863. Data for enlisted male Revolutionary War soldiers' heights were recorded in the colonial muster rolls (New York (State). State Historian 2000). Average height in males ages 25–35 was estimated as 166.1 cm. There is a well-established association of body mass index (BMI) in kg/m$^2$ and mortality (Keith, Fontaine, and Allison 2013). In (Fogel 2004), the authors plot a 3-dimensional graph of this relationship by separating height and weight on the *xy*-plane and mortality on the z-axis. These graphs (Fogel 2004) were used for the case of the late 1700s to extrapolate body weight from height and mortality.

### Male body heights and weights period 2 (1863–1941)

Body weights were not routinely collected in the United States prior to the Civil War. Toward the end

of the Civil War, Fairbank's patented scales (1864) began to be more widely used (E. & T. Fairbanks & Co 1893) and was applied by Benjamin Apthorp Gould in an anthropometry study of 23,624 soldiers. In 1869, Gould prepared a statistical analysis that included heights and weights for the United States Sanitary Commission (Gould 1869). Because Gould's original calculations were computed manually and binned by age cohorts and by state of soldier origin, these data were digitized by our team and group mean heights, and body weights were re-calculated in Microsoft Excel for accuracy. Specifically, we took reported heights and weights for soldiers aged 30 and calculated the product of the reported mean for this age by the total sample size from each state. This gives us the sum of each height. We then computed the average over all the data of this age by taking this sum and dividing by the sum of the sample sizes by states. Because Gould did not report individual data, standard deviation of the sample could not be computed. Gould also did not report standard deviations since standard deviations were only formalized later by Pearson in 1894 (Pearson 1893). There is evidence that the Civil War was associated with poor access to food which resulted in lowered heights and weights (Komlos 1987). Later in Period 2, mean weights and heights from World War I US soldiers from 1917–1921 were reported by Love and Davenport (Love and Davenport 1921).

### Male body heights and weights period 3 (1941–present)

National body height and weight data were routinely collected in both males and females post-WWII. At the beginning of this period, height and weight data were aggregated from individual studies (Hathaway 1961) but starting in the late 1970s, the United States began to collect nationally representative samples under the National Health and Nutrition Examination Survey (NHANES) (Finucane and National Center for Health Statistics (U.S.) 1990). Since NHANES III (1988–1994), data summaries are reported annually and are publicly available for analysis. These data are reported here in adult males in the age range of 25–35 years old for comparison to past historical mean values.

To estimate energy intake over each period, we assumed weight stability, and we input body weight, height, gender (male) and the age of 30 into the validated energy requirements calculator. The energy requirements models (Plucker et al. 2018) used DLW measurements of total energy expenditure and do not require any knowledge of activity levels.

### Energy balance and energy intake over thanksgiving and the holidays

We evaluated studies that examined weight gain over Thanksgiving and the holiday season defined to begin at Thanksgiving (the last Thursday of each November) and end on New Year's Day. The studies that met our criteria for analysis obtained clinical measurements of body weight and reported change in body weight and days between measurements. These were studies by Hull et al. (2006), Bhutani et al. (2020), Yanovski et al. (2000), Wagner, Larson, and Wengreen (2012), and Cook et al. (2012).We did not include studies with self-reported weight gain as two studies (Bhutani et al. 2020; Wagner, Larson, and Wengreen 2012) found that when they asked participants how much weight was gained over the Holiday season, perceived weight gain was higher than measured weight gain.

There was only one study that measured body weights directly before and after Thanksgiving (Hull et al. 2006). A total of 94 college students from the University of Oklahoma had body weights measured within a week of Thanksgiving break and again between 5–7 days after Thanksgiving break. The mean time between measurements was $12.8 \pm 2.7$ days and the range of days between measurements was 5–17 days. The BMI range in the sample was broad, allowing for a comparison of weight gain in participants with obesity against participants of normal weight.

The study by Bhutani et al. (2020) evaluated weight gain in adults with obesity over the holiday season. The authors collected participant data during the 8-week pre-holiday period (study visits between September 15th and November 25th) and the 8-week holiday period (study visits between December 1st and December 23rd). During both periods, total energy expenditure was measured using the doublylabeled water method (DLW), body composition estimated from total body water measurements, and blood samples collected to assess the circulating levels of appetite hormones ghrelin, leptin, total PYY, and insulin. Surveys captured behavioral influences on eating.

During each 8-week period, participants were evaluated at the research center at three time points. In the pre-holiday period, the first and seconds visits were scheduled in the last two weeks of September,

and the first two weeks of October, respectively. Of highest significance to this analysis, the third visit was performed during the week before Thanksgiving, between November 9, 2015 and November 25, 2015. For the holiday period, the first visit was scheduled immediately after the Thanksgiving, between November 30, 2015 and December 16, 2016. We were provided access to the body weight data, giving us valuable information on objective measures restricted solely to Thanksgiving weight gain. For our analysis, we limited our analysis to the last visit in the pre-holiday period which was directly before Thanksgiving and the first visit after Thanksgiving which was within two and a half weeks after Thanksgiving and before Christmas. The body mass index range of this sample was 30.0–39.9 $kg/m^2$ which precluded running a comparison analysis on normal weight participants versus participants with obesity.

### Holiday weight gain and post-holiday weight retention

The Yanovski study (Yanovski et al. 2000) weighed 195 adults from the National Institutes of Health campus in Bethesda, MD. Participant weights were measured at four time points; pre-holiday (6–8 weeks before Thanksgiving), during the holiday season (Thanksgiving to mid-January), post-holiday (mid-January to early March) and the following year (September to October). The Wagner study (Wagner, Larson, and Wengreen 2012) measured body weight and body composition pre-holiday (Monday or Tuesday before Thanksgiving) and post-holiday (Monday or Tuesday after New Year's Day) in 34 adult participants. A total of 443 males and females between the ages of 40 and 69 years were enrolled in a study evaluating the accuracy of self-reported energy intake (Cook et al. 2012). The Cook study was a secondary analysis of these data restricted to the holiday season. Body weight and total energy expenditure by the DLW method was measured pre-holiday (September to October) and then again post-holiday (January to March).

### Estimation of changed energy intake during current thanksgivings

Energy intake can be estimated using the intake-balance method (Gilmore et al. 2014) as the sum of changed body energy stores and energy expenditure. The intake-balance method was applied to direct measurements (Bhutani et al. 2020).

In all other cases, we assumed that changed body energy stores accounted for increased energy intake. This is a reasonable assumption based on no change in energy expenditure during the holidays found in (Bhutani et al. 2020) and (Schoeller 2014).

In these cases, we used the energy balance equation which states that the rate of energy stored/lost, $ES$, is equal to the difference of rate of energy intake, $EI$, and the rate of energy expended, $EE$ : $ES = EI - EE$. Because $ES$ is equivalent to the difference between $EI$ and $EE$, $ES$ represents the energy gap (deficit if negative and surplus if positive) between intake and expenditures.

The model considered the rate of energy stored/lost as the rate of change of body weight, $W$ (kg). The energy density of $W$ is estimated as 7700 kcal/kg as in the dynamic model by Antonetti (Antonetti 1973). This is an assumption based on energy density calculations averaged over a few months; however, we note that there are different estimates during short-term changes in energy intake (Bhutani et al. 2017; Heymsfield et al. 2011). Hence:

$$ES = 7700\frac{\Delta W}{\Delta t}$$

where $\Delta W$ represents the change in weight from pre- to postmeasurement and $\Delta t$ is the number of days between measures.

It is assumed that participants are weight stable prior to any change in intake. This is referred to as baseline energy intake or baseline energy requirements.

Modern perceptions of Thanksgiving were ascertained through digital humanities research of publicly available data. The 'rtweet' package in the programming language R was used to develop a program that identifies 2020 tweets with the hashtag #thanksgiving. The number of tweets that can be scraped at one time are restricted by Twitter and therefore we scraped an allowable total of 90,000 tweets which were retained for analysis.

Latent Dirichlet Allocation (LDA) is an unsupervised machine learning method used to identify distinct topics in a set of documents (in our cases tweets). Each word in an entire dataset is assigned a probability of belonging to one of $k$ topics, where $k$ is set by the user. The R package "topicmodels" (Grün and Hornik 2011) was used to implement the LDA algorithm in a program written in the language R. LDA was performed for $k = 2, \ldots, 4$ and a plot of words with the highest probability of belonging to each respective topic was evaluated by topic number. The probability that each individual word belonged to topic k was calculated and a bar chart was developed by probability. Topics were named by observing what

words were grouped together by topic *k*. The "gtrendsR" package in the programming language R was used to obtain the Google Trends top topics United States population and search queries performed by the United States population on Thanksgiving 2020 (November 26, 2020). Google Trends is a tool developed by Google to quantify the top searches and search topics in a time range or under a key word (Choi and Varian 2012). We retained the "rising" search topics and queries which are searches categorized by the most recent increases.

## Results

### Reviews of books and newspapers

After careful review of the literature and newspaper articles, we identified three food intake and body weight related periods involving Thanksgiving. A summary of Thanksgiving during each period, major events, average male body weight (kg) and height (cm) and estimated energy intake appear in Table 1.

### Period 1 (1620–1863): celebrated gratitude

In the colonial period, Thanksgiving observances were set by both religious and civil authorities "in gratitude for or observance of great political or military events … as well as in gratitude for plentiful harvests" (Earle 1968). The purpose of the Thanksgiving observance determined whether it was appropriate to fast or feast (New Hampshire Gazette 1758, 1815, Portsmouth Journal of Literature and Politics 1838, The London Times 1862). Over time secular leaders came to regularly issue proclamations for a day of Thanksgiving in the autumn months. While food was part of these Thanksgiving celebrations, the focus of the proclamation was to give Americans time to express their gratitude through prayer, and it sometimes included a fast (New Hampshire Gazette, Mar 21, 1815 in Figure 2). In addition to expressing their gratitude, these celebrations allowed Americans time off to enjoy recreational activities.

One historian (Pleck 1999) captures the nature of Thanksgiving celebrations as they came to be by the early 19th century:

> " … Thanksgiving was a regional day, both secular and religious. In early nineteenth century New England Thanksgiving day might begin with a morning church service, followed by the large meal in the afternoon. Before or after attending church, men, musket in hand, might take aim at a wild turkey in the fields or paper targets. The winner usually won a turkey as his prize for good marksmanship. The food at the feast was bountiful but the setting was relatively modest. Most families did not own a long wooden dining table. They might have a smaller one, which was set up in a sitting room, parlor, or the bedroom – any room that could be kept warm in winter. There were probably only two courses to the meal, the food for the main meal spread on the table, and the desserts served later. Because the roads were poor, muddy or snow-covered, many relatives, eager to return home for the holidays, were unable to do so."

See Figure 2 for a collage of newspaper clippings about Thanksgiving from 1758–1924.

### Period 2 1863–1941: an emphasis on food and family

In the second half of the 19th century, writers like Sarah Josepha Hale and Harriet Beecher Stowe, helped center Thanksgiving on food and family by romanticizing images of family around a table sharing turkey and pumpkin pie with careful descriptions of Thanksgiving meals (Hale 1852; Stowe 1869). Hale, who served as the editor for a popular lady's magazine, *Godey's Lady's Book*, used that platform to describe how the holiday meal should be orchestrated and to express the value the holiday could play in unifying the nation and expressing American virtues and the importance of family. In addition to her editorials, Hale carried out an annual letter writing campaign calling upon state governors and eventually President Abraham Lincoln himself, to make Thanksgiving a legal holiday (Wills 2003; Pleck 1999; Curtin, Oliver and Plimoth Plantation Inc 2005). Coming off the Army of the Potomac's victory at Gettysburg in July 1863, President Abraham Lincoln asked Americans to be thankful for that victory and their other blessings and established the last Thursday in November as an annual national Thanksgiving holiday (Figure 2). "In reprinting recipes for the feast, and publishing stories of prodigals returning home" Hale ensured that Americans were ready for the annual celebration, which while still focused on gratitude now added food and family as key components (Pleck 1999).

### Period 2: the Plymouth thanksgiving story and roasted turkey

American schoolteachers during the Progressive Era began telling the story of the Pilgrim Thanksgiving story to help new immigrants learn how to assimilate and to celebrate the holiday (Pleck 1999). Thanksgiving dinner was even provided for free on Ellis Island. The 1922 Ellis Island Commissioner stated, "I want these men and women and children who are soon to take up the responsibilities and the honors of American citizenship, to join in the spirit of

New Hampshire Gazette Nov 18, 1758

PORTSMOUTH.
Thurſday next is appointed by AUTHORITY to be obſerved as a Day of PUBLICK THANKSGIVING thro'-out this Province.

First Proclamation by President George Washington
New Hampshire Gazette Oct 22, 1789

A General THANKSGIVING.
BY THE PRESIDENT OF THE UNITED STATES of AMERICA.
A Proclamation.

Thanksgiving Fast
New Hampshire Gazette March 21, 1815

THANKSGIVING and FAST.
The President of the United States has is-
d a proclamation, appointing Thursday the
h day of April next, as a day of Thanksgiving
roughout the Union—and the Governor of
is State has appointed the same day as a day
Fasting, throughout this State. As there is
much cause, at present, for thankfulness, we
esume there will be no scruple in obeying
e higher authority.—The proclamations of
ch are in type, but unavoidably omitted.

A Thanksgiving Festival
Portsmouth Journal of Literature and Politics
December 22, 1838

THANKSGIVING FESTIVAL EXTRAORDINARY.—This jubilee was celebrated at the Lunatic Hospital, Worcester, Mass. in great style. The maniacs feasted on Turkeys and mince pies, and in the evening to the number of 70 or 80 danced merrily in the great hall to their own musicians. One of the most furious of the lunatics led off the first waltz with Mrs. Woodward, lady of the physician. The whole affair had a most tranqualizing effect on the tenants of this establishment.

The London Times Thursday
April 24, 1862

President Lincoln has issued a proclamation for a day of thanksgiving and prayer for the late victories, and on account of the danger of foreign intervention and invasion having been averted from the country.

President Abraham Lincoln's National
Thanksgiving Proclamation
New York Times October 4, 1863.

A PROCLAMATION.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

The year that is drawing toward its close has been filled with the blessings of fruitful fields and healthful skies. To these bounties, which are so constantly enjoyed that we are prone to forget the Source

First Macy's Day Parade
New York Times Nov 27, 1924


A Thanksgiving Psalm
New York Times Nov 27, 1924

THE THANKSGIVING PSALM.

118th—Verse 24.
"This is the day that the Lord hath made, Let us rejoice and be glad thereon!"
Thus, the King's soul broke out into song,

Figure 2. Newspaper articles about Thanksgiving over time. Early articles were Proclamations and included celebrations, religious references and sometimes fasts. These articles evolved into secular celebrations and retail over time. During the Civil War, Thanksgiving was proclaimed twice by President Lincoln. The first was to celebrate a battle victory and the second was a peaceful shared national gathering.

the occasion and feel that, as they sit down to their Thanksgiving dinner, they are also sitting in with the great American family of democracy (Carroll 2013)." Pilgrims, one historian (Pleck 1999) explains, were used as an example of America's first newcomers and meant to serve as a welcoming example for the immigrants on how they too would become part of the American story, while roasted "turkey became the symbol of the dominant culture."

### *Period 2: the Macy's thanksgiving day parade and football*

In addition to adopting common foodways for the Thanksgiving holiday, Period 2 saw Americans begin to attach secular amusements to the holiday, such as attending football games and parades, which began to encroach on Thanksgiving services. On November 30, 1876, Princeton and Yale squared off at 2 pm in New Jersey for the first football game played on

Thanksgiving Day (*New York Times* 1876, Pleck 1999). The Intercollegiate Football Association settled on Thanksgiving Day for the league's annual championship game and "by the 1890s … the championship game, held on the Polo Grounds of New York City, was a premier event in the New York social season. *Area churches made sure that Thanksgiving services ended well before kickoff time. [authors' emphasis*] (Curtin, Oliver and Plimoth Plantation Inc 2005). On November 27, 1924, the first Macy's Day Parade was held (see Figure 2 *New York Times* 1924) and the Detroit Lions professional football team played its first annual Thanksgiving Day game in 1934, which was aired on the radio for families to listen to following dinner (Pleck 1999). "The Thanksgiving Psalm," printed in the *New York Times* on the same day Macy's launched its first parade, was on its way to becoming an anachronism (see Figure 2 *New York Times* 1924).

### Period 3 (1941–Present): suburban households, television, the automobile, and restaurants

Period 3 merges the secularization of Thanksgiving with the post-World War II era. The automobile allowed more families to drive and gather at one household during Thanksgiving. Increased driving during Thanksgiving weekend is evidenced by increased automobile accidents during this week (Ratnapradipa and Zhu 2020). The first football game was televised in 1956 and watching football on Thanksgiving Day became a new Thanksgiving tradition (Ranger and Hobsbawm 2012; Siskind 1992). Further in the results, we share a finding that weight gain during the holidays was associated with increased intake at sit-down restaurants. The proliferation of chain and sit-down restaurants took off during the 1950s (Pillsbury 1990), differentiating overall eating habits in Period 3 from Period 2.

## What is served and the energy content of foods for thanksgiving

Thanksgiving meals obtained from White House menus were remarkably consistent. Consistently available were turkey, mashed potatoes, cranberry sauce and pumpkin pie (whitehousehistory.org). Some Thanksgiving table requirements such as mincemeat pie (Simmons 1796) and celery (whitehousehistory.org) have been phased out. Turkeys became part of the standard Thanksgiving table in the early 19th century and turkey stuffing was added to the fare in the mid-19th century (Siskind 1992).

Recipes for cranberry sauce and pumpkin pie were similar over time periods, and we report a few representative estimates of energy content from various recipes here. The energy content of ½ cup cranberry sauce was 239 kcal (Curtin, Oliver and Plimoth Plantation Inc 2005). The same serving size of cranberry sauce but from (Parloa 1900) was 100 kcal. One-eighth of a pumpkin pie from (Simmons 1796) was 325 kcal; one-eighth of one pumpkin pie from (Curtin, Oliver and Plimoth Plantation Inc 2005) was 235 kcal; and one-eighth of pumpkin pie from the recipe on the back of a can of Libby's pumpkin puree was 316 kcal.

## Historical body weights, heights and energy intake

### Period 1: heights, weights and energy intake

From Colonial Muster Rolls 1664–1775 (New York (State). State Historian 2000) the average male soldier's height was calculated as 166.1 ± 6.9 cm. Life expectancy for males ranged between different colonies, and it should be noted that it was dependent on available food sources (Miller 1988). We settled on a rough average estimate of 36 years (Kunitz 1984). Life expectancy from France was slightly lower at around 30 years (Pomeranz 2000). Using Waaler-surface plots of Iso-Mortality Risk Curves during the late 18th century for France (Fogel 2004) and the average Colonial Muster recorded height, we back calculated weight to be approximately 51.1 kg. Energy intake from the Plucker model (Plucker et al. 2018) was 2685 kcal/d.

### Period 2: heights, weights and energy intake

The average height reported by Gould was 173 cm and the average weight was 68 kg. We note that the means that were reported could not be checked for accuracy because individual data was not available. From the Plucker model (Plucker et al. 2018), energy intake was 3062 kcal/d.

### Period 3: heights, weights and energy intake

Heights and weights in 1955 were reported in (Hathaway 1961). From this we extracted male heights and weights in the age range 25–29 as 76 kg and 173 cm (Table 1). NHANES weights and heights (Cohen and National Center for Health Statistics (U.S.) 1987) in males ages 20–39 were also extracted (Albanes et al. 1987; Braitman, Adlin, and Stanton 1985; Fryar et al. 2018). The trends over time starting with NHANES I are referred to as the "obesity epidemic" and obesity prevalence has been increasing

**Table 2.** Studies that measured body weight before and after Thanksgiving or the holiday season which begins at Thanksgiving and ends on New Year's Day. The average or scaled days between measurements, change in body weight (kg), change in estimated EI (kcal/d), mean BMI and main study conclusions are reported.

| Study | Days | ΔBody Weight (kg) | ΔEI (kcal/d) | Mean BMI kg/m$^2$ (Range) | Conclusions |
|---|---|---|---|---|---|
| (Hull et al. 2006) (N = 94) | 13 | 0.5 | 332 | 24.1 (18.4–35.9) | Higher weight gain in participants with overweight or obesity. Most weight gain was fat mass. |
| Thanksgiving (Bhutani et al. 2020) (N = 23) | 21 | 0.15 | 24 | 33.1 | Existence of weight gain over Thanksgiving period. |
| (Bhutani et al. 2020) (N = 23) | 90 | 0.41 | 80 | 33.1 (30.0–39.9) | Increased EI over the holidays explained weight gain. |
| (Yanovski et al. 2000) (N = 200) | 42 | 0.37 | 67 | 25.9 (17.8–46.8) | Holiday weight gain was the highest contributor to annual weight gain. |
| (Wagner, Larson, and Wengreen 2012) (N = 34) | 42 | −0.10 | −18 | 25.3 ± 5.3 | Did not see a significant increase in weight gain over the holidays, however, there was a tendency for participants with obesity to gain weight. |
| (Cook et al. 2012) (N = 443) | 90 | 0.9 Males<br>0.6 Females | 77 Males<br>51 Females | 27.0 ± 6 Males<br>28.0 ± 4 Females | Study was a secondary analysis in older adults and demonstrated weight gain during the holiday period independent of energy expenditure. |

since the 1970s (Flegal et al. 2012; Flegal et al. 2010; Flegal et al. 2002). The first average male weight is 79 kg in the 1971–1975 NHANES data and the most recent is 92 kg in the 2015–2016 NHANES data (Table 1). Increased energy intake has risen from 3280 kcal/d at the beginning of Period 3 to 3690 kcal/d (Plucker et al. 2018).

## Changed body weight and energy intake during current thanksgivings and the holidays

A summary of findings in the selected studies over Thanksgiving and the Holiday season appear in Table 2.

### Thanksgiving weight gain

Overall change in body weight was 0.5 ± 1.5 kg with an increased energy intake of 331.8 ± 919.3 kcal/d. Males in the Hull sample consumed 397 ± 1155 kcal/d over baseline for a total of 3291 ± 1174 kcal/d and females consumed 292 ± 679 kcal/d over baseline for a total of 2579 ± 778 kcal/d. When separated into normal weight (BMI $<$ 25 kg/m$^2$) and overweight or obese classifications (BMI $\geq$ 25 kg/m$^2$), normal weight males consumed 261 ± 1441 kcal/d over baseline for a total of 3003 ± 1437 kcal/d while males with BMI over 25 consumed 545 ± 733 kcal/d over baseline for a total of 3608 ± 700 kcal/d. Normal weight females consumed 122 ± 602 kcal/d over baseline for a total of 2378 ± 610 kcal/d while females with overweight or obesity consumed 668 ± 655 kcal/d over baseline for a total of 3118 ± 793 kcal/d. The Levene's Test for Equality of Variances revealed that both groups (BMI $<$25 kg/m$^2$ and BMI $\geq$ 25 kg/m$^2$) had similar distributions ($F = 2.94$, $p = 0.09$ and $F = 0.94$ and $p = 0.34$ for males and females respectively). In comparing normal weight versus males with overweight or obesity, the t statistic was −0.81 with 42 degrees of freedom. However, the null hypothesis cannot be rejected because the difference was not statistically significant ($p = 0.42$; all reported p-values are two-tailed). In comparing normal weight females against females with overweight or obesity, the t statistic was −2.84 with 48 degrees of freedom. This difference was statistically significant ($p = 0.01$).

Average weight gain over Thanksgiving in the study by (Bhutani et al. 2020) was less than observed in the study by Hull et al. (2006). The mean weight gain was 0.15 ± 1.2 kg and estimated increased energy intake was 24.18 ± 193.4 kcal/d.

There was no statistically significant increase in eating out at restaurants of any type (e.g., sit-down, buffet, fast food) between the two visits.

### Holiday weight gain

There was only one study that reported no weight gain over the Holiday season (Wagner, Larson, and Wengreen 2012). The study by Wagner et al. found a −0.10 kg degree in body weight which corresponds to negligible change in EI of −18 kcal/d. All other studies reported weight gain ranging from 0.37 to 0.90 kg with a corresponding increased EI of 67 to 80 kcal/d.

The Bhutani study (Bhutani et al. 2020) found that participants increased their frequency of eating at sit-down restaurants during the Holiday season. Moreover, the frequency of eating out was positively correlated with caloric intake during this period.

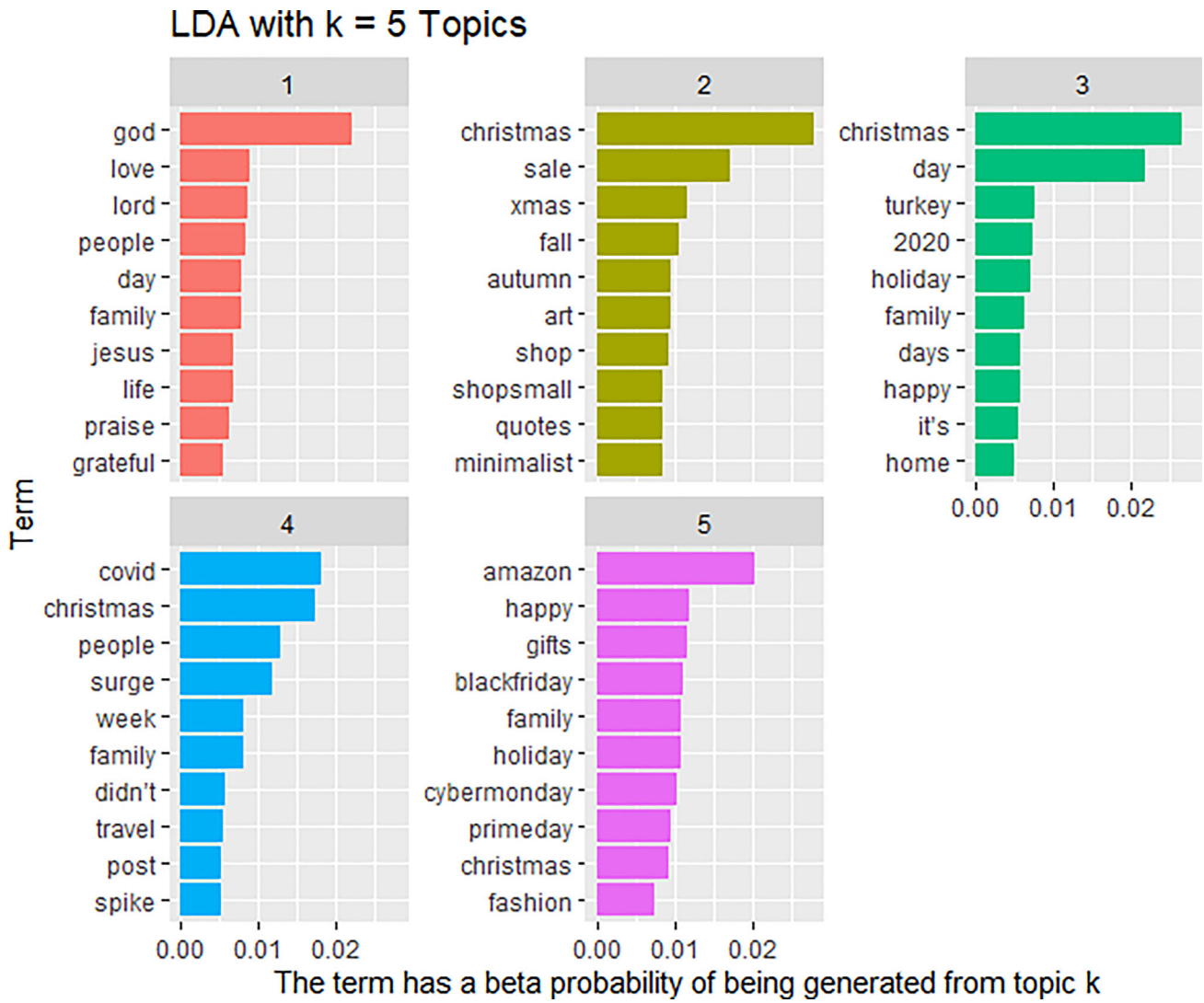


**Figure 3.** Results of the LDA with five topics of the scrape of 90,000 tweets under #thanksgiving revealed five distinct topics. The first was COVID-19 related, evidenced by the words COVID and surge. The second was Thanksgiving meal related evidenced by "turkey" and "pumpkin". The third was family and religion evidenced by the words God, family and love. The fourth was retail evidenced by Black Friday, Cyber Monday and Prime Day and the last was shopping safely on site during the pandemic.

### *Observations of present conceptions of thanksgiving from twitter and google*

Five distinct topics were identified by LDA analysis of Twitter. The identified topics and probabilities of words belonging to this topic appear in Figure 3. The first topic was COVID-19 related, evidenced by the words COVID and surge. The second was Thanksgiving meal/food related evidenced by the words "turkey" and "pumpkin". The third was family and religion evidenced by the words "God", "family" and "love". The fourth was retail evidenced by "Black Friday", "Cyber Monday" and "Prime Day" and the last topic involved shopping safely at stores on site during the pandemic.

Google topics and Google key word searches were supported by the findings of the Twitter analysis (Table 3). Food and retail appeared in Google topics and search queries. New topics that appeared from Google trends were the Macy's Day Parade, NFL and a history. The history of Thanksgiving and history as a field of a study were both high ranked topics and queries.

## Discussion

Weight gain during the Holiday Season, which begins with Thanksgiving, accounts for the majority of total annual weight gain in the United States(Yanovski et al. 2000) resulting in multiple developed strategies designed specifically to prevent and reduce Holiday weight gain (Fahey et al. 2019; Hirsh et al. 2019; Mason et al. 2018). To date, there have been no

**Table 3.** Top 15 Google Trends Rising Search Topics and Search Queries on Thanksgiving 2020 (November 26, 2020).

| Rising Topics | Rising Search Queries |
|---|---|
| Detroit Lions | history of thanksgiving |
| History | nfl games today |
| Macy's Thanksgiving Day Parade | adrian peterson |
| Dallas Cowboys | macys parade 2020 |
| Retail | happy thanksgiving gif |
| Macy's Backstage | washington vs cowboys |
| Dollar General | stores open on thanksgiving |
| Thanksgiving | texans vs lions |
| Gravy | texans |
| Temperature | kane brown |
| Cooking | football today |
| Grocery store | walmart open on thanksgiving |
| NFL | feliz dia de accion de gracias |
| Liquor store | happy thanksgiving 2020 |
| Mashed potato | walmart thanksgiving hours |

identified physiological or hormonal causes for weight gain during Thanksgiving (Bhutani et al. 2020) suggesting that the reasons for weight gain are primarily due to social and environmental cues. Because Thanksgiving in the United States is a historical celebration, we explored the evolved social context of Thanksgiving and its role to body weight since early Thanksgiving celebrations by the Puritans in the 1600s.

The original Puritan Thanksgiving celebrations were focused on prayer and reflection and while food may have been part of the celebrations, food was not the emphasis. The shift to a more central role for food occurred during the 1860s with descriptions of New England Thanksgiving feasts by Sarah Josepha Hale (Hale 1852) and Harriet Beecher Stowe (Stowe 1869). Original Thanksgiving celebrations also included sports and competitions. No change in measured total energy expenditure has been observed during the present day Thanksgiving weekend(Bhutani et al. 2020; Cook et al. 2012). Taken together with our analysis of Twitter and Google suggest that this focus has shifted from participating in competitions to watching competitions like football on television. This shift was made possible by televised football games starting in Period 3.

Foods served during the 17th century were unlikely to be the ones served in the 18th century. Most early American Colonialists obtained food that was available. That is, Colonists obtained local food that could be hunted or grown(Miller 1988). This changed in the 1700s with an increased reliance of consumer goods (Shammas 1993). An analysis of recipes and types of food served during Thanksgiving indicates that energy content of each food and types of food did not greatly change since the late 1700s. On the other hand, records of average male body weight increases and weight gain during Thanksgiving and the Holidays suggest that we are simply eating more because of the relationship between weight and energy requirement and the above summary of evidence of increasing weight gain during Thanksgiving with increasing body mass index (Costa 2015). This may be because Thanksgiving yields access to palatable foods (Rogers and Brunstrom 2016) and provides social cues from gathering with family and friends (De Castro 1994). Eating at restaurants has also been demonstrated as a contributor to weight gain (Bhutani et al. 2018). Interestingly, one study found an increase in frequency of eating at sit-down restaurants during the holidays, which positively correlated with an increase in energy intake during the festive season. In our current period, Period 3, there has been a substantial increase in the number of restaurants (Pillsbury 1990) and automobile ownership permitting easier and socially acceptable access to restaurants.

Although not related to weight gain, we also found an evolving emphasis on retail which may have been defined with events like the first 1924 Macy's Day parade. Our analysis of Twitter and Google found top mentions of Black Friday, Prime Day, Cyber Monday and Amazon. Our analysis of Twitter also identified God and family as high probability words within topics suggesting that while there have been shifts in the perception of Thanksgiving, original context of prayer and gratitude still are high priorities.

Our study has several strengths. To our knowledge this is the first time body weight and energy estimates were examined in relation to the history of Thanksgiving. We used a variety of tools in history, clinical nutrition, and machine learning to understand the context of Thanksgiving over time.

Despite these strengths, early estimates of body weight have limitations. We do not know the precision with which heights from Colonial Muster Rolls (New York (State). State Historian 2000) may have been collected. Moreover, this sample may have been biased and not representative of the male population at the time. Finally, Waaler Surfaces only give a rough estimate of weight from height and mortality. The second set of body weights collected in 1864 by Gould (Gould 1869) appear much more reliable and the manually calculated averages recorded by Gould are remarkably close to our replications performed in Excel. These body weights and heights, although they appear to be measured with precision, could also be biased estimates of the overall population because they are from samples of Civil War Soldiers.

A second limitation surrounds weight gain studies during Thanksgiving. The Hull study (Hull et al.

2006) is the only existing study that measured body weights directly before and after Thanksgiving. Our reanalysis of the weight data for the truncated Thanksgiving period alone from the Bhutani study (Bhutani et al. 2020) had two visits which bookended Thanksgiving without Christmas include participants whose weight was measured the day after Thanksgiving and some who were measured as far out as December 16th making it difficult to understand the role of Thanksgiving Day alone. While measuring body weights before and after Thanksgiving may seem simple, the short time window for bringing in participants on the Monday or Tuesday before Thanksgiving and again on the Monday and Tuesday after Thanksgiving as in (Hull et al. 2006) is challenging. Participants are volunteers and are in general busy during this week. In addition, collecting other measurements requires the clinic staff's and technicians' time. That is, participants have to be carefully scheduled over several days so that they are not waiting around to be measured. Studies like (Bhutani et al. 2020) that collect more information like total energy expenditure and survey data require even more careful scheduling and participant time. Despite this, our analysis and those of others suggest a replication of studies like (Hull et al. 2006) are important to provide more data points and insight into Thanksgiving weight gain. Additionally, the preliminary findings in Bhutani et al. (2020) on the role of the increase in eating at sit-down restaurants and weight gain should be explored preferably objectively. It may be possible to use global position system (GPS) data from participants to determine restaurant eating frequency.

A strength of our study is also the objective information on Thanksgiving perceptions we obtained by scraping Twitter and evaluating Google Trends. However, Twitter users tend to be younger and more democratic. Additionally, 10% of Twitter users generate 80% of total tweets (Wojcik and Hughes 2019). On the other hand, Google Trends captures information from all google searches performed by anyone with access to a computer and is more nationally representative than the population of Twitter users.

## Conclusions

Although the traditional foods US consumed during Thanksgiving have not changed dramatically over time, the context of Thanksgiving have evolved to focus more on food and other social cues that are conducive to weight gain. Furthermore, the general trend of increased in average body weight and the associated increase in energy requirement for maintain that increased body weight has influence energy consumption. In addition, among those who are already carrying excess body weight display increased weight gain compared to those whose weight in the healthy range suggest that social expectations and interactions, and access to restaurants are possibly may be further contributing to weight gain over Thanksgiving.

## Acknowledgements

We are grateful to COL Raymond Kimball (United States Military Academy, History) for suggesting our title.

## ORCID

Diana Thomas http://orcid.org/0000-0003-2641-9304
Dusty Turner http://orcid.org/0000-0003-2998-8799

## References

Albanes, D., D. Y. Jones, M. S. Micozzi, and M. E. Mattson. 1987. Associations between smoking and body weight in the US population: Analysis of nhanes ii. *American Journal of Public Health* 77 (4):439–44.

Antonetti, V. W. 1973. The equations governing weight change in human beings. *The American Journal of Clinical Nutrition* 26 (1):64–71.

Baker, J. W. 2009. *Thanksgiving: The biography of an American holiday Revisiting new england: The new regionalism*. Durham, NH, Hanover NH: University of New Hampshire Press, University Press of New England.

Bhutani, S., E. Kahn, E. Tasali, and D. A. Schoeller. 2017. Composition of two-week change in body weight under unrestricted free-living conditions. *Physiological Reports* 5:13.

Bhutani, S., D. A. Schoeller, M. C. Walsh, and C. Mcwilliams. 2018. Frequency of eating out at both fast-food and sit-down restaurants was associated with high body mass index in non-large metropolitan communities in midwest. *American Journal of Health Promotion* 32 (1):75–83. doi: 10.1177/0890117116660772.

Bhutani, S., N. Wells, G. Finlayson, and D. A. Schoeller. 2020. Change in eating pattern as a contributor to energy intake and weight gain during the winter holiday period in obese adults. *International Journal of Obesity* 44 (7): 1586–95.

Bradford, W. 2017. *Of plymouth plantation*, 1. New York: Dover Publication.

Braitman, L. E., E. V. Adlin, and J. L. Stanton. 1985. Obesity and caloric intake: The national health and nutrition examination survey of 1971–1975 (hanes i.). *Journal of Chronic Diseases* 38 (9):727–32.

Carroll, A. 2013. *Three squares: The invention of the American meal*. New York: Basic Books, A Member of the Perseus Books Group.

Carter, S. and American Imprint Collection (Library of Congress). 1772. *The frugal housewife, or complete woman cook*. London, Boston: Printed for F. Newbery, Re-printed

and Sold by Edes and Gill. Page view http://hdl.loc.gov/loc.rbc/AmericanImprint.35668.1

Choi, H., and H. Varian. 2012. Predicting the present with google trends. *Economic Record* 88 (s1):2–9.

Cohen, B. B. and National Center for Health Statistics (U.S.). 1987. *Plan and operation of the nhanes i epidemiologic followup study, 1982-84 Series 1, programs and collection procedures*. Hyattsville, MD: U.S. Dept. of Health and Human Services, Public Health Service, National Center for Health Statistics.

Cook, C. M., A. F. Subar, R. P. Troiano, and D. A. Schoeller. 2012. Relation between holiday weight gain and total energy expenditure among 40- to 69-y-old men and women (open study). *The American Journal of Clinical Nutrition* 95 (3):726–31. doi: 10.3945/ajcn.111.023036.

Costa, D. 2015. Health and the economy in the united states, from 1750 to the present. *Journal of Economic Literature* 53 (3):503–70.

Crowen, T. J. 1866. *Mrs. Crowen's American lady's cookery book*. New York: Dick & Fitzgerald. http://hdl.loc.gov/loc.gdc/scd0001.00144881473.

Curtin, K., S. L. Oliver and Plimoth Plantation Inc. 2005. *Giving thanks: Thanksgiving recipes and history, from pilgrims to pumpkin pie*. 1st ed. New York: Clarkson Potter/Publishers. Contributor biographical information http://www.loc.gov/catdir/enhancements/fy0617/2004024373-b.html. Publisher description http://www.loc.gov/catdir/enhancements/fy0617/2004024373-d.html, Sample text http://www.loc.gov/catdir/enhancements/fy0617/2004024373-s.html.

De Castro, J. M. 1994. Family and friends produce greater social facilitation of food intake than other companions. *Physiology & Behavior* 56 (3):445.

Diaz-Zavala, R. G., M. F. Castro-Cantu, M. E. Valencia, G. Alvarez-Hernandez, M. M. Haby, and J. Esparza-Romero. 2017. Effect of the holiday season on weight gain: A narrative review. *J Obes* 2017:2085136. doi: 10.1155/2017/2085136.

E. & T. Fairbanks & Co. 1893. *Fairbanks' scales, the world's standard: Manufactured by e. & t. Fairbanks & co.* Chicago: Rand McNally.

Earle, A. M. 1968. *Customs and fashions in old new england*. Detroit,: Singing Tree Press.

Fahey, M. C., R. C. Klesges, M. Kocak, J. Wang, G. W. Talcott, and R. A. Krukowski. 2019. Do the holidays impact weight and self-weighing behaviour among adults engaged in a behavioural weight loss intervention? *Obesity Research & Clinical Practice* 13 (4):395–97.

Finucane, F. F. and National Center for Health Statistics (U.S.). 1990. *Plan and operation of the nhanes i epidemiologic followup study, 1986 Vital and health statistics series 1, programs and collection procedures*. Hyattsville, MD.: U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics.

Flegal, K. M., M. D. Carroll, B. K. Kit, and C. L. Ogden. 2012. Prevalence of obesity and trends in the distribution of body mass index among us adults, 1999-2010. *JAMA* 307 (5):491–7.

Flegal, K. M., M. D. Carroll, C. L. Ogden, and L. R. Curtin. 2010. Prevalence and trends in obesity among us adults, 1999-2008. *JAMA* 303 (3):3: 235–41. no

Flegal, K. M., M. D. Carroll, C. L. Ogden, and C. L. Johnson. 2002. Prevalence and trends in obesity among us adults, 1999-2000. *JAMA* 288 (14):1723–7.

Fogel, R. W. 2004. *The escape from hunger and premature death, 1700-2100: Europe, America, and the third world Cambridge studies in population, economy, and society in past time*. Cambridge; New York: Cambridge University Press. Publisher description http://www.loc.gov/catdir/description/cam041/2003069577.html. Table of contents http://www.loc.gov/catdir/toc/cam041/2003069577.html. Contributor biographical information http://www.loc.gov/catdir/enhancements/fy0732/2003069577-b.html

Fryar, C. D., D. Kruszon-Moran, Q. Gu, and C. L. Ogden. (2018). Mean body weight, height, waist circumference, and body mass index among adults: United states, 1999-2000 through 2015-2016. *National Health Statistics Reports* 122:1–16.

Gilmore, L. A., E. Ravussin, G. A. Bray, H. Han, and L. M. Redman. 2014. An objective estimate of energy intake during weight gain using the intake-balance method. *The American Journal of Clinical Nutrition* 100 (3):806–12. doi: 10.3945/ajcn.114.087122.

Gould, B. A. 1869. *Investigations in the military and anthropological statistics of american soldiers*. New York,: U.S. Sanitary Commission.

Grün, B., and K. Hornik. 2011. Topic models: An r package for fitting topic models. *Journal of Statistical Software* 40:1–30. doi: 10.18637/jss.v040.i13.

Guilford, J. P. 1954. *Psychometric methods Mcgraw-Hill series in psychology*. 2d ed. New York: McGraw-Hill.

Hale, S. J. B. 1852. *Northwood; or, life and north and south: Showing the true character of both*. New York: H. Long & Brother. http://name.umdl.umich.edu/ABW3653.

Hall, D. D., ed. 2004. *Puritans in the new world: A critical anthology*. Princeton, NJ: Princeton University Press.

Hathaway, M. L. 1961. Heights and weights of adults in the United States. *Nutrition Reviews* 19:193–5. doi: 10.1111/j.1753-4887.1961.tb01966.x.

Heath, D. B. and Pre-1801 Imprint Collection (Library of Congress). 1963. *A journal of the pilgrims at Plymouth; mourt's relation, a relation or journal of the English plantation settled at Plymouth in New England, by certain English adventurers both merchants and others. Edited from the original printing of 1622, with introd. and notes. The american experience series*. New York: Corinth Books;.

Heymsfield, S. B., D. Thomas, A. M. Nguyen, J. Z. Peng, C. Martin, W. Shen, B. Strauss, A. Bosy-Westphal, and M. J. Muller. 2011. Voluntary weight loss: Systematic review of early phase body composition changes. *Obesity Reviews* 12 (5): E348–61.

Hirsh, S. P., M. Pons, S. V. Joyal, and A. G. Swick. 2019. Avoiding holiday seasonal weight gain with nutrient-supported intermittent energy restriction: A pilot study. *Journal of Nutritional Science* 8:e11. doi: 10.1017/jns.2019.8.

Hull, H. R., D. Radley, M. K. Dinger, and D. A. Fields. 2006. The effect of the thanksgiving holiday on weight gain. *Nutrition Journal.* 5:29. doi: 10.1186/1475-2891-5-29.

Keith, S. W., K. R. Fontaine, and D. B. Allison. 2013. Mortality rate and overweight: Overblown or underestimated? A commentary on a recent meta-analysis of the associations of bmi and mortality. *Molecular Metabolism* 2 (2):65–8. doi: 10.1016/j.molmet.2013.03.005.

Komlos, J. 1987. The height and weight of west point cadets: Dietary change in antebellum america. *The Journal of Economic History* 47 (4):897–927.

Kunitz, S. J. 1984. Mortality change in America, 1620-1920. *Human Biology* 56 (3):559–82.

Lincoln, A. 1863. Abraham lincoln's thanksgiving proclamation. In *Harper's Weekly*, 658.

Love, A. G., and C. B. Davenport. 1921. *Army anthropology: Based on observations made on draft recruits, 1917-1918, and on veterans at demobilization, 1919*, ed. A. G. Love and C. B. Davenport. Washington: Govt. Print. Off.

Mason, F., A. Farley, M. Pallan, A. Sitch, C. Easter, and A. J. Daley. 2018. Effectiveness of a brief behavioural intervention to prevent weight gain over the Christmas holiday period: Randomised controlled trial. *BMJ (Clinical Research ed.)* 363:k4867. doi: 10.1136/bmj.k4867.

Miller, H. M. 1988. An archaeological perspective on the evolution of diet in the colonial chesapeake, 1620–1745. In *Colonial Chesapeake society*, ed. L. G. Carr, P. D. Morgan and J. B. Russo, 176–99. Chapel Hill: Published for the Institute of Early American History and Culture, Williamsburg, Virginia, by the University of North Carolina Press.

New York (State). State Historian. 2000. *New York colonial muster rolls, 1664-1775: Report of the state historian of the state of New York*. 2 vols. Baltimore, MD: Genealogical Pub. Co.

Parloa, M. 1900. *The original appledore cook book; containing practical receipts for plain and rich cooking*. New ed. New York: The author.

Pearson, K. 1893. Contributions to the mathematical theory of evolution. [abstract]. *Proceedings of the Royal Society of London* 54:329–33.

Pillsbury, R. 1990. *From boarding house to bistro: The American restaurant then and now*. Boston: Unwin Hyman.

Pleck, E. 1999. The making of the domestic occasion: The history of thanksgiving in the United States. *Journal of Social History* 32 (4):773–89.

Plucker, A., D. M. Thomas, N. Broskey, C. K. Martin, D. Schoeller, R. Shook, S. B. Heymsfield, J. A. Levine, and L. A. Redman. 2018. Adult energy requirements predicted from doubly labeled water. *International Journal of Obesity* 42 (8):1515–23.

Pomeranz, K. 2000. *The great divergence: China, Europe, and the making of the modern world economy The Princeton economic history of the western world*. Princeton, N.J.: Princeton University Press. Book review (H-Net) http://www.h-net.org/review/hrev-a0b9x8-aa. Publisher description http://www.loc.gov/catdir/description/prin031/99027681.html. Book review (H-Net) http://www.h-net.org/review/hrev-a0c0c0-aa. Table of contents http://www.loc.gov/catdir/toc/prin032/99027681.html

Ranger, T. O., and E. J. Hobsbawm. 2012. *The invention of tradition Canto classics*. Cambridge UK: Cambridge University Press. https://ezproxy.cul.columbia.edu/login?qurl=https%3a%2f%2fsearch.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3de025xna%26AN%3d909820%26site%3dehost-live%26scope%3dsite.

Ratnapradipa, K. L., and M. Zhu. 2020. Increased motor vehicle fatalities tuesday through thursday during the us thanksgiving holiday (1980-2018). *Preventive Medicine Reports* 20:101245. doi: 10.1016/j.pmedr.2020.101245.

Roberts, S. B., and J. Mayer. 2000. Holiday weight gain: Fact or fiction? *Nutrition Reviews* 58 (12):378–9. doi: 10.1111/j.1753-4887.2000.tb01839.x.

Rogers, P. J., and J. M. Brunstrom. 2016. Appetite and energy balancing. *Physiology & Behavior* 164 (Pt B): 465–71. doi: 10.1016/j.physbeh.2016.03.038.

Schmidt, L. E. 1995. *Consumer rites: The buying & selling of American holidays*. Princeton, NJ: Princeton University Press.

Schoeller, D. A. 2014. The effect of holiday weight gain on body weight. *Physiology & Behavior* 134:66–9. doi: 10.1016/j.physbeh.2014.03.018.

Shammas, C. 1993. Changes in English and Anglo-American consumption from 1550 to 1800. In *Consumption and the world of goods*, ed. J. Brewer and R. Porter. London; New York: Routledge.

Simmons, A. 1796. *American cookery; or, the art of dressing viands, fish, poultry & vegetables; and the best mode of making pastes, puffs, pies, tarts, puddings, custards, & preserves, and all kinds of cakes from the imperials plumb to plain cake, adapted to this country & all grades of life*. Hartford, New York: Printed by Hudson & Goodwin West Virginia Pulp and Paper Co.

Siskind, J. 1992. The invention of thanksgiving: A ritual of American nationality. *Critique of Anthropology* 12 (2): 167–91.

Stowe, H. B. 1869. *Oldtown folks*. Boston: Fields, Osgood & co. http://purl.dlib.indiana.edu/iudl/wright2/wright2-2396.

Thomas, M., S. J. Paliwoda, and European Marketing Confederation and Nima (Organization). 1997. *The international encyclopedia of marketing*. Oxford: Butterworth-Heinemann.

Wagner, D. R., J. N. Larson, and H. Wengreen. 2012. Weight and body composition change over a six-week holiday period. *Eating and Weight Disorders* 17 (1):e54–6.

Whitehousehistory.Org. Thanksgiving at the white house. https://www.whitehousehistory.org/press-room-old/thanksgiving-at-the-white-house.

Wills, A. B. 2003. Pilgrims and progress: How magazines made thanksgiving. *Church History* 72 (1):138–58.

Wojcik, S., and A. Hughes. 2019. Sizing up twitter users. https://www.pewresearch.org/internet/2019/04/24/sizing-up-twitter-users/.

Yanovski, J. A., S. Z. Yanovski, K. N. Sovik, T. T. Nguyen, P. M. O'neil, and N. G. Sebring. 2000. A prospective study of holiday weight gain. *New England Journal of Medicine* 342 (12):861–7.