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Changes in Adults' Eating Behaviors During the Initial Months of the COVID-19 Pandemic: A Narrative Review



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ABSTRACT

Factors such as regulations and health concerns shifted daily habits, including eating behaviors, during the early months of the coronavirus disease 2019 (COVID-19) pandemic. This comprehensive narrative review synthesizes research on eating behavior changes during the early months of the pandemic (February to June 2020), including changes in amount, rate, and timing of food consumption, types and healthfulness of foods consumed, the occurrence of other specified eating behaviors (eg, restrained eating or binging), and reasons for eating (eg, stress or cravings), among adults. A literature search using three EBSCOhost databases and Google Scholar was conducted to identify relevant articles made available in 2020. A total of 71 articles representing 250,715 individuals from more than 30 countries were reviewed. Findings show eating behaviors changed little during the early COVID-19 pandemic for most participants. Among those whose eating behaviors changed, increases in both intake and frequency of eating meals and snacks were more common than decreases. Findings on timing of eating and healthfulness of food consumed showed mixed results. However, when changes occurred in the type of food consumed, increases were more common for snacks, homemade pastries, white bread/pasta, legumes, and fruits/vegetables; decreases were more common for meats, seafood/fish, frozen foods, fast food, dark breads/grains, and dark leafy green vegetables. During the pandemic, binging, uncontrolled eating, and overeating increased, meal skipping decreased, and restrictive eating had mixed findings. Changes in factors such as emotions and mood (eg, depression), cravings, and environmental factors (eg, food insecurity) were related to changes in eating behaviors. Findings can inform clinical practitioners in efforts to mitigate disruptions to normal, healthy eating patterns among adults both in and outside of global health catastrophes.

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THE CORONAVIRUS DISEASE 2019 (COVID-19) pandemic caused an unprecedented upheaval of daily routines for individuals around the globe. Government efforts to mitigate the spread of COVID-19 have encompassed an array of responses, including mass quarantines, stay-at-home restrictions, closures of schools and businesses, and shutdowns of public transportation.

Like many other health behaviors, eating is heavily dependent on habit^{1,2} and, as such, has been significantly disrupted by COVID-19 and the restrictions used to quell outbreaks.³ For example, during the COVID-19 pandemic, 51% of individuals in the United States made the transition to working from home, thereby increasing their proximity to a primary food environment for longer periods throughout the day.^{3,4} In addition, unemployment in the United States rose from 3.5% to 14.7% during the early phase of the pandemic (between February and April 2020),⁵ which for some individuals led to both a greater time spent at home and

decreased purchasing power for balanced diets.^{6,7} However, for some individuals living in low-income households, the addition of unemployment benefits and federal supplements exceeded their prior wages.⁸

The closure of restaurants shifted meal sources, often leading to an increase in cooking behaviors, whereas the closure of schools produced issues of food access and insecurity for communities facing economic hardship and marginalization.^{9,10} Moreover, social isolation efforts and fears around virus exposure limited access to supermarkets and other food retailers.^{11,12} Whereas some individuals utilized online ordering, curbside pickups, and food/grocery delivery services to curtail these impacts, these services are not locationally or financially accessible to many individuals around the globe.^{13,14}

Stockpiling behaviors and breakdowns in the food supply chain also had an influence on peoples' eating behaviors during the pandemic.^{13,15} For those who could afford to

stockpile food during the pandemic, stockpiling increased their access to the food around them and influenced the types of food they purchased; for those who could not afford to stockpile food during the pandemic, others' stockpiling limited the amount of food available to them.^{13,16} Breakdowns in the supply chain also contributed to limitations in the food available during the pandemic.¹⁵

Beyond the regulatory, geographic, and financial obstacles influencing eating behaviors during the COVID-19 pandemic, many people have faced psychological and social stressors that can affect their relationship with food and the food environment.¹⁷ A large body of literature shows the influence of emotion, stress, and mood states—both positive and negative—on food selection and eating behaviors.¹⁸⁻²⁰ Depression, stress, and boredom, among other possible reactions to pandemic-induced lifestyle changes, are related to increases in food intake and frequency of eating as well as increases in consuming higher energy foods such as sweets, snacks, and fast food.²¹

However, it is unclear how eating behaviors have changed around the globe during the COVID-19 pandemic. For instance, whereas many factors seem to indicate a trend toward less healthful eating behaviors, it is possible that food selection and healthfulness could improve with increased time available for cooking.²² Moreover, evidence suggests that the best time to change habits is when other habits are changing as well,^{23,24} making the abrupt changes generated by stay-at-home orders fertile ground for eating behavior change among other health behavior changes.

Comparisons across similar public health crises and national disasters such as hurricanes and earthquakes show that eating behaviors are vulnerable to change during times of regional or international distress.^{25,26} Widespread crises disrupt food systems and the economies that allow individuals to purchase food, often leading to reduced food security and increased malnutrition.²⁷ Moreover, the heightened stress is related to decreased fruit and vegetable intake and, among emotional eaters, overeating behaviors.²⁶ In fact, watching news related to disasters such as earthquakes²⁸ or even reading narratives about devastating hurricanes²⁹ is associated with changes in eating behavior. Given the ubiquitous influences of the COVID-19 pandemic and the concomitant alterations of stress and other mood states, it is plausible that eating behaviors would change as a result.

Eating behaviors during the COVID-19 pandemic are a critical area of study given the clinical relevance of over- and undernutrition, both of which could result from dietary changes brought about by the pandemic. Researchers suggest that nutrition can be a key factor in COVID-19 immunity^{30,31} and predict that the pandemic will continue to cause a nutrition crisis given factors like job loss and the closing of public food supports.³²

Although several minireviews have communicated breaking findings throughout the early COVID-19 pandemic time points, as of this writing no review comprehensively captured the dietary influence of COVID-19 on a global scale.³³⁻³⁷ Moreover, recent reviews assessing eating behaviors are narrower in scope, with specific focus areas such as weight changes³⁸ and feeding children.³⁹

This narrative review offers a summary of key research question findings regarding changes in eating behaviors during the COVID-19 pandemic. Further, challenges to

RESEARCH SNAPSHOT

Research Question: Did adults' amount, frequency, and timing of eating, types and healthfulness of foods consumed, occurrence of specified eating behaviors (eg, binging), and reasons for eating change during the early coronavirus disease 2019 (COVID-19) pandemic?

Key Findings: Many eating behaviors remained stable. When changes occurred, eating more likely increased in amount/frequency. Changes in when and how healthfully individuals ate showed mixed results. Consumption of some foods decreased (eg, meat); others increased (eg, fruits). Binging, out-of-control eating, and overeating increased, meal skipping decreased, and restrictive eating had mixed results. Dietary changes were related to changes in mood and environment.

empirically studying eating during a pandemic, areas for future examination, and clinical implications are discussed.

Specifically, this review aims to address how the following eating behaviors compared during the early stages of the COVID-19 pandemic relative to before the pandemic began: the amount, frequency, and timing of food consumption; the types and healthfulness of foods eaten; the occurrence of specified eating behaviors (eg, restrained eating or binging); and reasons for eating (eg, emotions, cravings, and environmental factors).

The scope of this review includes international research published in English and made available in the year 2020 with samples that generalize to adults who have not been diagnosed with eating disorders. The aim is to characterize early-pandemic dietary changes for populations of individuals without pathological eating behaviors around the globe.

METHODS

An initial literature review assessing extant systematic, narrative, and scoping reviews of changes to eating behaviors during the COVID-19 pandemic was conducted in October 2020 using multiple EBSCOhost databases, including Academic Search Premier, Psychology and Behavioral Sciences Collection, and APA PsycInfo in addition to the Google Scholar database. Search terms included *eat**, *COVID-19*, *coronavirus*, *pandemic* and *review*. Five reviews were identified.³³⁻³⁷ Some of these reviews assessed eating behaviors in addition to other health behaviors such as sleep^{33,34} and physical activity.^{33,35} Given the rapidly evolving context and continued influx of eating-behavior-related studies, the need for a more comprehensive narrative review was apparent. The present review contributes a global perspective and covers a more extensive range of eating behaviors than previous studies. To set the scope of the review, all relevant articles written in English and published or made available online during the year 2020 were screened for inclusion.

Article identification and selection started in October 2020. Searches were performed using the same databases as the initial literature review and the search terms *COVID*, *COVID-19*, *sars-cov-2*, *coronavirus*, *pandemic* AND *eat**, *nutri**, *food*, *diet**, *grocer**. In addition, sources referenced in articles

accumulated during the database search were assessed and included as appropriate. Filters were applied to limit results to articles made available in 2020, and the final search for this review was conducted on February 8, 2021.

Article abstracts were screened to ensure relevance to eating behaviors during the early COVID-19 pandemic, especially during or following a period of lockdown and social distancing. The circumstances related to lockdowns varied globally, including the timeframe and extent of closure, so this was defined in each article relative to the geographic location and study population. A total of 138 relevant articles were gathered and assessed in their entirety for inclusion.

A final sample of 71 articles with 250,715 participants remained after 67 articles were eliminated. Studies were excluded if they did not measure or explicitly evaluate change in eating behaviors; focused on child and adolescent populations exclusively; focused on elderly populations exclusively; focused on individuals with eating disorders or other health conditions exclusively; were archival, not cross-sectional, or not longitudinal; and had not yet published preprints of their full articles. Please see [Figure 1](#) for a detailed visual summary of the articles included and excluded from the present study.

RESULTS

The 71 studies with 250,715 participants included in the final review consist of findings from 32 countries with the United States ($n = 11$), the United Kingdom ($n = 8$), Italy ($n = 5$), Spain ($n = 5$), and Turkey ($n = 5$) being the most studied. There were potentially more than 32 countries represented in these articles

as some samples were listed as coming from locations such as “Europe,” “Northern Africa,” or simply “Other.” Most studies were cross-sectional (66 studies; 93%), but five (7%) featured longitudinal designs. Nearly all studies (69; 97%; two were unspecified) reported on data collected between March 2020 and June 2020. [Table 1](#) categorizes articles by study outcomes and provides a summary of study characteristics.

Changes in Amount of Food Consumed

A total of 24 studies addressed changes to total food intake during the COVID-19 pandemic.^{13,42,45,46,50–53,64–66,68,69,73,76,79,81,85,86,89,91,92,100,102}

Twelve studies conducted in Poland,^{50,66} Italy,^{52,86} the United Kingdom,⁵¹ the Netherlands,⁸⁹ Spain,^{79,85} Greece,⁸⁵ Chile,⁹² Saudi Arabia,⁴⁶ Germany,⁶⁹ and the United Arab Emirates⁹¹ assessed self-reported changes in quantity of food consumed during (vs before) the pandemic using bipolar scales and response options, including decreased, no change, and increased.^{46,50–52,66,69,79,85,86,89,91,92} Given the synonymous nature of the items used, an aggregated analysis was conducted to capture the composite trends across studies ($n = 14,401$) ([Table 2](#)).

Across studies included in the aggregated analysis, the largest proportion of participants (44.9%) reported no change in their food intake during the pandemic. The next largest group of respondents (31.0%) indicated an increase in food intake, and the third largest group indicated decreased intake (24.1%). Results from Chenarides and colleagues¹³ were excluded from the analysis because the item measuring changes in the amount of food consumed included additional

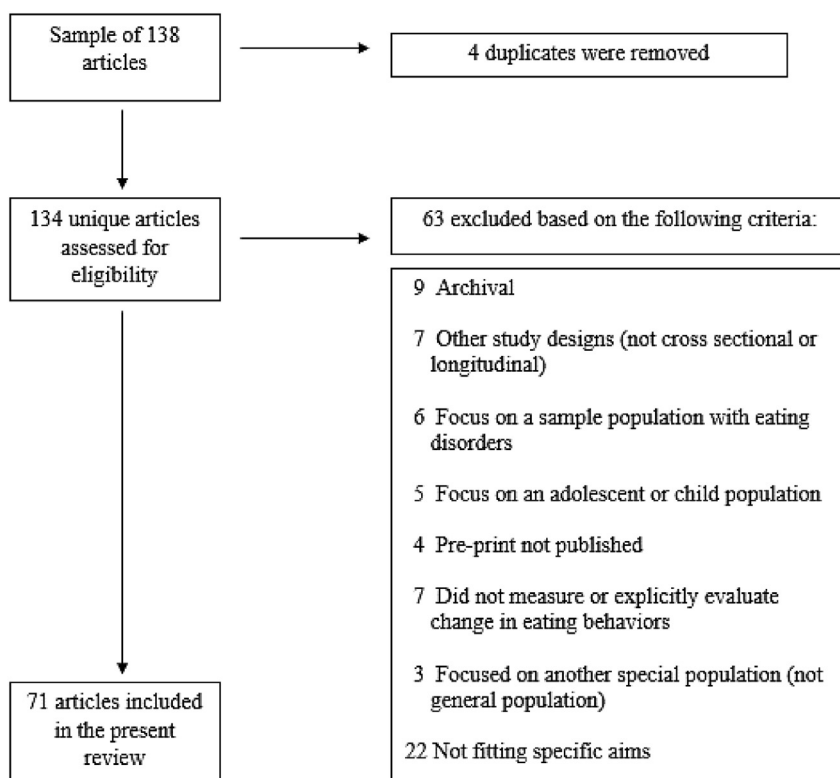


Figure 1. Flow diagram of the articles included and excluded from the present review of changes in adults’ eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Adams and colleagues, 2020 ⁴⁰	United States April 30-May 23, 2020 Cross-sectional survey	N = 584 parents Sex of parents: 94.5% female, 5.5% male Sex of children: 52.1% female, 47.9% male Mean age of parents: 40.4 ± 7.2 y Race and ethnicity of parents: 82.7% Caucasian/White, 6% African American, 4.3% Asian, 2.9% American/Indian, 6.5% other, 14.7% Hispanic/Latino Race and ethnicity of children: 82.4% Caucasian/White, 10.1% African American, 5.0% Asian, 3.3% American/Indian, 9.1% other, 19.0% Hispanic/Latino						X	X
Alhusseini and Alqahtani, 2020 ⁴¹	Riyadh Saudi Arabia May 5- May 15, 2020 Cross-sectional survey	N = 2,706 Sex: 54.2% female, 45.8% male Age: 70.2% 18-35 years Race and Ethnicity: 92.2% Saudi, 7.8% non-Saudi				X	X		
Aljohani, 2020 ⁴²	Saudi Arabia, Al Madinah city April-June 2020 Cross-sectional survey	N = 782 Gender: 52.2% female, 47.8% male Age: 41.9% 31-40 y	X	X					
Almandoz and colleagues, 2020 ⁴³	United States, Texas April 15- May 31, 2020	N = 123 patients with obesity Sex: 87% female, 13% male Mean age: 51.2 ± 13 y					X	X	X

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Ammar and colleagues, 2020 ⁴⁴	Retrospective cross-sectional survey 40% North Africa, 36% western Asia, 21% Europe, 3% Other April 1-6, 2020 Cross-sectional survey	Race and ethnicity: 49.2% non-Hispanic White, 28.7% non-Hispanic Black, 16.4% Hispanic, 5.7% "other" (multiracial or Asian) N = 1,047 Gender: 53.8% female, 46.2% male Age: 55.1% 18-35 y		X			X	X	
Antunes and colleagues, 2020 ⁴⁵	Portugal April 1-15, 2020 Cross-sectional survey	N = 1,404 Sex: 69.6% female, 30.3% male, 0.1% preferred not to specify Mean age: 36.4 ± 11.7 y	X	X					
Bakhsh and colleagues, 2021 ^{46b}	Saudi Arabia 2 weeks between June and early July 2020 Cross-sectional survey	N = 2,255 Sex: 64% female, 36% male Age: 24% 30-39 y Race and Ethnicity: 91% Saudi, 9% non-Saudi	X			X			
Bann and colleagues, 2020 ⁴⁷	United Kingdom May 2020 Cross-sectional survey	N = 13,283 Sex: 49.8% male, 50.2% female Age: 19-74 y				X			
Ben Hassen and colleagues, 2020 ⁴⁸	Qatar May 24- June 14, 2020 Cross-sectional survey	N = 577 Gender: 61.39% female, 38.61% male Mean age: 35.7 y		X		X	X		
Bin Zarah and colleagues, 2020 ⁴⁹	United States April-June 2020 Cross-sectional survey	N = 3,133 Sex: 79.4% female, 19.8% male, 0.8% other Age: 30.5% 30-49 y				X			

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
		Race and ethnicity: 5.1% African American, 2.9% Asian, 84.5% White, 2.8% Hispanic, 0.4% Native American, 4.3% other							
Błaszczyk-Bebenek and colleagues, 2020 ⁵⁰	Poland April 29-May 19, 2020 Retrospective cross-sectional survey	N = 312 Gender: 64.1% female, 35.9% male Mean age: 41.1 ± 13.1 y	X	X		X			
Buckland and colleagues, 2021 ⁵¹	Predominantly (82.5%) from United Kingdom May 15-June 27, 2020 Cross-sectional survey	N = 588 Sex: 69% female, 30% male, 1% nonconforming Mean age: 33.4 ± 12.6 y Race and ethnicity: 86% White, 7% Asian or Asian British, 3% mixed or multiple ethnic groups, 1% Black, African, Caribbean, or Black British, 1% prefer not to say, and 2% other	X			X			X
Cancello and colleagues, 2020 ⁵²	Northern Italy April 15-May 4, 2020 Cross-sectional survey	N = 490 Sex: 83.67% female, 16.33% male Age: 65.1% aged 31-60 y	X				X		
Carroll and colleagues, 2020 ⁵³	Canada April 20-May 15, 2020 Cross-sectional survey	Mothers: N = 235 Mean age: 37.5 y Race and ethnicity: 86.8% Caucasian, 0.9% African American, 3.0% Latin American, 4.7% Asian, 3.0% South/West Asian, 1.3% Other	X			X			X

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
		Fathers: N = 126 Mean age: 39.4 y Race and ethnicity: 88.1% Caucasian, 0.0% African American, 2.4% Latin American, 4.0% Asian, 3.2% South/West Asian, 0.8% Other							
Celik and Dane, 2020 ⁵⁴	Nigeria, Turkey, United States, Europe April 25-May 5, 2020 Cross-sectional survey	N = 411 Gender: 16.3% women, 73.7% men Age: 20-65 y				X			
Cheikh Ismail and colleagues, 2020 ⁵⁵	United Arab Emirates April-May 2020 Cross-sectional survey	N = 1,012 Gender: 75.9% female, 24.1% male Age: 29.1% 26-35 y		X		X		X	X
Cheikh Ismail and colleagues, 2021 ⁵⁶	Greater Middle East region (and North Africa), April 15-April 29, 2020 Cross-sectional survey	N= 2,970 Sex: 71.6% female, 28.4% male Age: 29.6% aged 18-25 y		X		X		X	X
Chenarides and colleagues, 2021 ¹³	United States: Detroit, MI, and Phoenix, AZ May 13-30, 2020 Cross-sectional survey	N = 861 Gender: 53% female, 46% male, 1% nonbinary Mean age: 53 y Race and ethnicity: 80.3% White, 11.3% Black	X			X			

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Di Renzo, Gualtieri, Cinelli and colleagues, 2020 ⁵⁷	Italy April 24-May 18, 2020 Cross-sectional survey	N = 602 Gender: 79.7% female Mean age: 38.2 y							X
Di Renzo, Gualtieri, Pivari, and colleagues, 2020 ⁵⁸	Italy April 5-24, 2020 Cross-sectional survey	N = 3,533 Gender: 76.1% female, 23.9% male Mean age: 40.0 ± 13.5 y		X		X	X	X	
Do and colleagues, 2020 ⁵⁹	Vietnam April 6-19, 2020 Cross-sectional survey	N = 5,209 health care workers Gender: 67.1% women, 32.9% men Age: 82.6% aged 21-40 y					X		
Duong and colleagues, 2020 ⁶⁰	Vietnam April 7-May 31, 2020 Cross-sectional survey	N = 7,616 nursing and medical students Gender: 62.5% women, 37.5% men Mean age: 21.4 ± 1.8 y					X		
Elmacloğlu and colleagues, 2021 ⁶¹	Turkey May 6-26, 2020 Longitudinal	N = 1,036 Gender: 79.8% female, 20.2% male Mean age: 33.1 y						X	X
Flanagan and colleagues, 2021 ⁶²	United States (n = 4,890), United Kingdom (n = 1,839), Australia (n = 497), Canada (n = 154), Other (n = 373)	N = 7,753 Sex: 80% female, 20% male Mean age: 51.2 ± 0.2 y Race and ethnicity: 89.6% White		X		X	X		

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Flaudias and colleagues, 2020 ⁶³	April 3-May 3, 2020 Cross-sectional survey								
	France March 26- 27, 2020 Cross-sectional survey	N = 5,738 students Sex: 74.6% female, 25.4% male Mean age: 21.2 y						X	X
Gallo and colleagues, 2020 ⁶⁴	Brisbane, Australia May 12-26, 2020 Longitudinal	2020 Females: ^c N = 84 Age range: 19-26 y Race and ethnicity: 32.1% Asian, 9.5% Asian subcontinental, 52.4% Caucasian, 2.4% Multi, 3.6% Other/not disclosed 2020 Males: N = 66 Age range: 19-27 y Race and ethnicity: 37.9% Asian, 9.1% Asian subcontinental, 43.9% Caucasian, 6.1% Multi, 3.0% Other/not disclosed 2019 Females: N = 108 Age range: 19-23 y Race and ethnicity: 25.9% Asian, 9.3% Asian subcontinental, 55.6% Caucasian, 5.6% Multi, 3.7% Other/not disclosed 2019 Male: N=77 Age range: 19-25 y Race and ethnicity: 23.4% Asian, 9.1% Asian subcontinental,	X	X		X			

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
		54.5% Caucasian, 1.3% Multi, 11.7% Other/not disclosed 2018 females: N=103 Age range: 19-26 y Race and ethnicity: 28.2% Asian, 2.9% Asian subcontinental, 63.1% Caucasian, 2.9% Multi, 2.9% Other/not disclosed 2018 Males: N = 71 Age range: 19-25 y Race and ethnicity: 32.4% Asian, 5.6% Asian subcontinental, 54.9% Caucasian, 2.8% Multi, 4.2% other/not disclosed							
Giacalone and colleagues, 2020 ⁶⁵	Denmark April 24-May 5, 2020 Cross-sectional survey	N = 2,462 Gender: 71.1% women, 28.7% men, 0.2% other Age: 37.2% 36-50 y	X	X		X			
Górnick and colleagues, 2020 ⁶⁶	Poland April 30-May 23, 2020 Cross-sectional survey	N = 2,381 Sex: 89.8% female, 10.2% male Age: 44.8% 30-39 y	X			X	X		
Haddad and colleagues, 2020 ⁶⁷	Lebanon April 3-18, 2020 Cross-sectional survey	N = 407 Gender: 51.3% female, 48.7% male Mean age: 30.6 ± 10.1 y						X	X
Herle and colleagues, 2021 ⁶⁸	United Kingdom March 28- May 29, 2020 Longitudinal	N = 22,374 Gender: 76% female, 24% male Age: 32% aged 46-59 y Race and ethnicity: 5% Black,	X						

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Huber and colleagues, 2021 ⁶⁹	German federal state Bavaria 2 wk during March and April 2020 Cross-sectional survey	Asian, and minority ethnicity, reference: White ethnicity N = 1,957 students Sex: 71.5% female, 28.5% male Mean age: 23.3 ± 4.0 y	X			X			
Husain and Ashkanani, 2020 ⁷⁰	Kuwait March 30- April 15, 2020 Cross-sectional survey	N = 415 Gender: 68.7% female, 31.3% male Mean age: 38.5 ± 12.7 y		X		X		X	X
Ingram and colleagues, 2020 ⁷¹	Scotland 5 wk during COVID-19 restrictions in Scotland Cross-sectional survey ^d	N = 399 Gender-sex: 56.4% female, 41.9% male, 1% nonbinary, 0.8% trans Mean age: 32.4 ± 11.4 y					X		
Jeżewska-Zychowicz and colleagues, 2020 ⁷²	Poland March 19-24, 2020 Cross-sectional survey	N = 1,033 Gender: 50.2% female, 49.8% male Mean age: 39.9 ± 13.1 y							X
Kansiime and colleagues, 2021 ⁷³	Kenya and Uganda April 18-27, 2020 Cross-sectional survey	Kenya: N = 313 Gender: 61% female Age: 63% youth (18-35 y), 37% "adult" Uganda: N = 129 Gender: 63% female	X			X	X	X	X

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Kaya and colleagues, 2021 ⁷⁴	Turkey April 15-30, 2020 Cross-sectional survey	Age: 38% youth (18-35 y), 62% "adult" N = 1,012 Gender: 81.7% female, 18.3% male Mean age: 28.3 ± 8.7 y						X	X
Khubchandani and colleagues, 2020 ⁷⁵	United States Last week of April 2020 Cross-sectional survey	N = 838 Sex: 52% female, 48% male Age: 34.4 ± 0.4 y Race: 63% White, 23% Asian, 7% Black, 5% Multiracial, 3% Other Ethnicity: 22% Hispanic, 78% Non-Hispanic					X	X	X
Kriaucioniene and colleagues, 2020 ⁷⁶	Lithuania April 14-28, 2020 Cross-sectional survey	N = 2,447 Sex: 87.8% female, 12.2% male Age: 40.1% 18-35 y	X			X			
Lamarche and colleagues, 2021 ⁷⁷	Québec, Canada, April 15-May 12, 2020 Cross-sectional survey	N = 853 Sex: 87.2% female, 12.8% male Age: 52.5% 50-69 y				X			
López-Bueno and colleagues, 2020 ⁷⁸	Spain March 22- April 5, 2020 Cross-sectional survey	N = 2,741 Gender: 51.8% women, 48.2% men Mean age: 34.2 ± 13.0 y				X			
López-Moreno and colleagues, 2020 ⁷⁹	Spain May 28-June 21, 2020 Cross-sectional survey	N = 675 Gender: 69.9% women, 30.1% men Mean age: 39.1 ± 12.9 y	X	X					

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Malta and colleagues, 2020 ⁸⁰	Brazil April 24-May 24, 2020 Cross-sectional survey	N = 45,161 Sex: 53.6% female, 46.4% male Age: 24.7% aged 18-29 y				X			
Marty and colleagues, 2021 ⁸¹	France April 30-May 1, 2020 Cross-sectional survey	N = 938 Gender: 78.5% female, 21.5% male Mean age: 38.7 ± 11.6 y	X				X		X
Matsungo and Chopera, 2020 ⁸²	Zimbabwe May 11-25, 2020 Cross-sectional survey	N = 507 Gender: 63.0% female, 37.0% male Age: 48.1% aged 31-40 y				X			
Murphy and colleagues, 2021 ⁸³	Island of Ireland, Great Britain, United States, and New Zealand May-June 2020 Cross-sectional survey	Island of Ireland: N = 538 Gender: 87.5% female, 12.5% male Mean age: 35.9 ± 12.5 y Great Britain: N = 961 Gender: 51.0% female, 48.7% male, 0.3% other Mean age: 50.7 ± 15.3 y United States: N = 381 Gender: 53.4% female, 46.1% male, 0.5% other Mean age: 53.7 ± 18.4 y New Zealand: N = 480 Gender: 51.9% female, 47.7% male, 0.4% other Mean age: 45.7 ± 17.2 y				X			

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Pakravan-Charvadeh and colleagues, 2021 ⁸⁴	Iran, Tehran province March 2020 Cross-sectional survey using both retrospective and current reporting	N = 292 families Mean age: 47.5 ± 13.5 y							X
Papandreou and colleagues, 2020 ⁸⁵	Spain and Greece April 23-May 3, 2020 Cross-sectional survey	N = 1,841 Spain: N = 1,002 Sex: 70.3% women Mean age = 46.1 ± 13.3 y Greece: N = 839 Sex: 66.7% women Mean age = 42.4 ± 11.7 y	X	X	X	X			
Pellegrini and colleagues, 2020 ⁸⁶	Italy April 14-21, 2020 Retrospective cross-sectional survey	N = 150 Gender: 77.3% female, 22.7% male Mean age: 47.9 y	X	X		X	X		X
Pham and colleagues, 2020 ⁸⁷	Vietnam February 14-May 31, 2020 Cross-sectional survey	N = 8,291 Gender: 53% women, 41% men Age: 43.6 ± 16.9 y					X		
Phillipou and colleagues, 2020 ⁸⁸	Australia April 1-4, 2020 Cross-sectional survey	N = 5,289 Sex: 80.0% female, 17.9% male, 2.1% preferred to self-describe or did not answer Mean age: 40.6 y N = 1,030 Gender: 50.5% female, 49.5%						X	
			X	X	X		X		X

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (continued)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Poelman and colleagues, 2021 ⁸⁹	Netherlands April 22-May 5, 2020 Cross-sectional survey	male Mean age: 49.9 ± 17.0 y							
Puhl and colleagues, 2020 ⁹⁰	United States (90% from Minnesota) April-June 2020 Longitudinal	N = 584 Gender: 64.2% female, 34.4% male, 1.4% another gender identity Mean age: 24.6 ± 2.0 y Race and ethnicity: 30.2% White, 16.8% African American/Black, 17.1% Hispanic, 24.3% Asian American, 11.6% Other						X	X
Radwan and colleagues, 2020 ⁹¹	United Arab Emirates May 5-18, 2020 Cross-sectional survey	N = 2,060 Gender: 75.1% female, 24.9% male Age: 31.7% between 18 and 30 y, 38.4% between 31 and 40 y, and 29.9% older than 40 y	X						X
Reyes-Olavarría and colleagues, 2020 ⁹²	Chile 8 wk: May-June, 2020 Cross-sectional survey	N = 700 Sex: 75.4% women, 24.6% men Median age: 31 y	X						
Robertson and colleagues, 2021 ⁹³	United Kingdom May 11-June 26, 2020 Cross-sectional survey	N = 264 Gender: 78% women Age: 42% 18-29 y, and 58% 30+ y Race and ethnicity: 92% White						X	X
Robinson and colleagues, 2021 ⁹⁴	United Kingdom April 28-May 22, 2020 Cross-sectional	N = 2,002 Gender: 61.7% female, 37.8% male, 0.5% prefer not to say		X			X	X	X

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Robinson and colleagues, 2020 ⁹⁵	United Kingdom April 19-22, 2020 Cross-sectional survey	or non-binary gender Age: 34.7 ± 12.3 y Race and ethnicity: 89.7% White N = 723 Gender: 67% female Mean age: 30.7 ± 9.6 y Race and ethnicity: 80% White, 20% non-White						X	
Rodríguez-Pérez and colleagues, 2020 ⁹⁶	Spain March 20- April 10, 2020 ^e Cross-sectional survey	N = 7,514 Gender: 71% female, 29.3% male, .07% other gender Age: 92% 31-65 y				X			
Rolland and colleagues, 2020 ⁹⁷	France March 25- 30, 2020 Cross-sectional survey	N = 11,391 Gender: 52.1% female, 47.5% male, 0.4% other Mean age: 47.5 ± 17.3 y							X
Rossinot and colleagues, 2020 ⁹⁸	France April 23-May 7, 2020 Cross-sectional survey	N = 1,454 Gender: 63.5% female, 36.0% male, 0.5% other Age: 27.0% 25-34 y, 29.4% 35-44 y, 28.2% 45-54 y, 15.5% 55-64 y					X		X
Sánchez-Sánchez and colleagues, 2020 ⁹⁹	Spain May 2020 Cross-sectional survey	N = 385 Gender: 72.8% female, 27.2% male Age: 38.7 ± 12.4 y				X	X		
Scarmozzino and Visioli, 2020 ¹⁰⁰	Italy April 3-15, 2020 Cross-sectional survey	N = 1,929 Sex: 67% female, 32.9% male, 0.1% not answered	X			X			X

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (continued)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
Sharma and colleagues, 2020 ¹⁰¹	United States: Houston; Dallas; Washington, DC; and southwest Florida April 2020 Cross-sectional survey	Age ^f : 63.1% aged 21-35 y, 9.6% aged 36-50 y, 11.4% aged 51-65 y, 14.4% < 20 y, 1.5% > 65 y N = 1,048 Sex: 97.0% female, 3% male Mean age: 36.7 ± 7.3 y Race and ethnicity: 7.1% Black or African American, 85.9% Mexican American, Latino, or Hispanic, 3.7% Non-Hispanic White, 3.4% Other						X	
Sidor and Rzymiski, 2020 ¹⁰²	Poland April 17– May 1, 2020 Cross-sectional survey	N = 1,097 Gender: 95.1% female, 4.9% male Mean age: 27.7 ± 9.0 y	X	X					
Şimsek and Şen, 2020 ¹⁰³	Turkey May 18-31, 2020 Cross-sectional survey	N = 397 Gender: 39.8% female, 60.2% male Age: 40.3% aged 36-50 y						X	X
Sutaria and colleagues, 2020 ¹⁰⁴	India April-July 2020 Cross-sectional survey	N = 422 Sex: 56.4% female, 43.6% males Age: 83.9% aged 20-50 y				X			
Wang and colleagues, 2020 ¹⁰⁵	China March 23- April 26, 2020 Cross-sectional survey	N = 2,289 Sex: 48.6% female, 51.4% male Mean age: 27.5 ± 12.0 y			X		X		
Werneck and colleagues, 2020 ¹⁰⁶	Brazil April 24-May 24, 2020 Retrospective cross-sectional survey	Without depression: N = 35,042 Sex: 50.8% women, 49.2% men Age: 48.2% aged 18-39 y With depression:						X	

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Table 1. Study characteristics and outcome variables for 71 studies reporting changes in eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Study characteristics		Change outcome variables						
	Location, dates, design	Sample characteristics ^a	Amount of food	Frequency of eating	Timing of eating	Types of food eaten	Healthy eating	Specified eating behaviors	Reasons for eating
		N = 6,881 Sex: 68.2% women, 31.8% men Age: 51.8% aged 18-39 y							
Yilmaz and colleagues, 2020 ¹⁰⁷	Turkey April 5-6, 2020 Cross-sectional survey	N = 866 students Sex: 78.2% female, 21.8% male Mean age: 21.2 ± 1.4 y		X		X			
Zeigler and colleagues, 2020 ^{108g}	United States Not specified Cross-sectional survey	N = 173 Sex: 55.5% female, 44.5% male Mean age: 28.1 ± 12.5 y Race and ethnicity: 66% White or Caucasian, 23% Hispanic, 4% African American, 4% Asian, 2% Hawaiian							X
Zhang and colleagues, 2020 ¹⁰⁹	China March and August 2020 Longitudinal	N = 1,994 Gender: 62.8% female, 37.2% male Age: 89% aged 18-45 y, 10.8% aged >45 y				X			

^aSome studies used terminology regarding sex (female, male) to describe gender. Similarly, some studies used terminology related to gender (women, men) to describe sex. This terminology was not edited in this review; gender and sex statistics are presented as they are described in the original article.

^bReferences with publication dates of 2021 were made available in the year 2020.

^cGallo and colleagues⁵⁴ included three cohorts of Australian university undergraduate students recruited over three different years (2018, 2019, 2020) and compared eating behaviors across men and women separately.

^dIngram and colleagues⁷¹ collected data at three time points described as Weeks 1, 3, and 5. However language related to healthy eating refers to levels before and during lockdown. It is assumed the data used are from Week 1 and thus these data are being treated as cross-sectional in nature.

^eRodríguez-Pérez and colleagues⁹⁶ list a beginning date; however, an end date is not precisely stated. The original reference states "The questionnaire was open from March 20, concretely 1 week after the Spanish COVID-19 outbreak confinement started. Data from the three first weeks of confinement were collected." The current authors have interpreted this as a 3-week long study ending on April 10, 2020.

^fThe original reporting by Scarmozzino and Visioli¹⁰⁰ did not include an age category that contained age 20 years.

^gStudy dates for Zeigler and colleagues¹⁰⁸ are not listed. The manuscript was received on May 12, 2020, and results discuss before and after lockdown, suggesting the study was conducted during the early months of the pandemic.

Table 2. Measures and findings for the aggregated analysis of amount of food eaten from 12 studies during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

Reference	M/I ^a and RO ^b	Study sample size	Findings ^c
Bakhsh and colleagues, 2021 ⁴⁶	M/I: "Quantity of consumed food" RO: D ^d /NC ^e /I ^f	2,255	NC: 878 (38.9) I: 894 (39.6) D: 483 (21.4)
Błaszczak-Bebenek and colleagues, 2020 ⁵⁰	M/I: "In your opinion, has your diet changed due to the social isolation" RO: No, I was eating the same kind and quantity of food/Yes, I was eating the same products, but in greater quantities/ Yes, I was eating the same products, but in smaller quantities/Yes, I have changed my product range without changing the quantities/Yes, I have changed my product range and I eat more/Yes, I have changed my product range and I eat less	312	NC: 149 (47.8) I: 102 (32.7) D: 61 (19.5)
Buckland and colleagues, 2021 ⁵¹	M/I: "Has the AMOUNT of food you have eaten changed since the lockdown?" RO: D/NC/I	559 ^g	NC: 141 (25.2) I: 268 (48.0) D: 150 (26.8)
Canello and colleagues, 2020 ⁵²	M/I: "Can you quantify how much you are eating during lockdown?" RO: More than usual/Less than usual/Like before/I don't know	481 ^h	NC: 211 (43.9) I: 206 (42.8) D: 64 (13.3)
Górnick and colleagues, 2020 ⁶⁶	M/I: "Has your total food consumption changed since the beginning of the pandemic (compared to the period before the pandemic)?" RO: I eat more/I eat the same/I eat less	2,381	NC: 1229 (51.6) I: 816 (34.3) D: 336 (14.1)
Huber and colleagues, 2021 ⁶⁹	M/I: "How has your diet changed since implementation of lockdown? Overall food amount" RO: Less/Unchanged/More	1,957	NC: 1019 (52.1) I: 610 (31.2) D: 328 (16.8)
López-Moreno and colleagues, 2020 ⁷⁹	M/I: "Do you think you are eating more or less than before?" RO: More/less/same	675	NC: 318 (47.1) I: 132 (19.6) D: 225 (33.3)
Papandreou and colleagues, 2020 ⁸⁵	M/I: "Has the amount of food increased during [lockdown]" RO: D/Same/I	Spain: 1,002 Greece: 839 Total: 1,841	Spain: NC: 143 (14.3) I: 114 (11.4) D: 745 (74.3) Greece: NC: 158 (18.8) I: 152 (18.1) D: 529 (63.1) Total: NC: 301 (16.4) I: 266 (14.4) D: 1274 (69.2)

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Table 2. Measures and findings for the aggregated analysis of amount of food eaten from 12 studies during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Study sample size	Findings ^c
Pellegrini and colleagues, 2020 ⁸⁶	M/I: "Have you changed eating habits during the lockdown period?" RO: No, I have maintained my eating habits/ Not too much, with a few exceptions/I eat more than before quarantine/I eat less than before quarantine	150	NC: 71 (47.3) I: 60 (40) D: 19 (12.7)
Poelman and colleagues, 2021 ⁸⁹	M/I: "Did you eat more or less than usual [during lockdown]" RO: More/No difference/Less	1,030	NC: 854 (82.9) I: 92 (8.9) D:84 (8.2)
Radwan and colleagues, 2020 ⁹¹	M/I: "Amount of food consumed during lockdown" RO: Decrease/ same/ increase	2,060	NC: 1061 (51.5) I: 655 (31.8) D:344 (16.7)
Reyes-Olavarría and colleagues, 2020 ⁹²	M/I: Perceived amount of food consumed ⁱ RO: Less than before/Same than before/ More than before	700	NC: 237 (51.3) I: 359 (33.8) D:104 (14.9)
Total weighted sample size and results		14,401	NC: 6,469 (44.9) I: 4,460 (31.0) D: 3,472 (24.1)
Total weighted sample size and results without Papandreou and colleagues ⁸⁵		12,560	NC: 6,168 (49.1) I: 4,194 (33.4) D: 2,198 (17.5)

^aM/I = measure/item.^bRO = response option.^cFindings are reported as n (%).^dD = decrease in amount of food consumed.^eNC = no change in amount of food consumed.^fI = increase in amount of food consumed.^gThe sample size reported for Buckland and colleagues⁵¹ corresponds to the number of participants who answered the item of interest. The total sample size for the overall study was 588 individuals.^hIn Cancellò and colleagues,⁵² 2% of the total study sample (490 adults) reported having "no idea" about changes in their food intake. The findings reported for this portion of the review reflect the responses of the participants reporting NC, I, or D. In rounding to establish whole numbers of participants given the percentages available in the original reference, sample sizes for all response options necessitated upward rounding. Thus, the total sample size is inflated to 491 participants with 481 represented in the current findings related to changes in food intake.ⁱReyes-Olavarría and colleagues⁹² reported the measure variable as "Among of consumption food, perception."

response options related to healthy eating and allowed respondents to select multiple answers. The question: "How much has your diet changed since COVID-19 started?" included the following response options: ate less, ate about the same, ate more, ate less healthy, and ate more healthy. Although excluded, the findings roughly mirrored the general pattern with 59.0% reporting they ate about the same diet, 21.4% reporting they ate more, and 13.5% reporting they ate less since COVID-19 started.¹³

It should be noted that the Papandreou and colleagues⁸⁵ study results differed considerably from the other studies that examined change in consumption quantity, with most respondents (69.2%) in this particular sample reporting a decrease in total intake. When this study's results are not included in the analysis, 49.1% of respondents report no change in intake, 33.4% report an increase, and 17.5% report a decrease. See Figure 2 for measures and finding for all studies not included in the aggregated analysis.

Six studies used unipolar measures assessing only whether participants were eating more during (relative to before) the pandemic.^{42,45,65,76,100,102} Most studies using this type of measure found high proportions of individuals responding "yes" to increased consumption. The highest percentage of individuals reporting more food intake came from a sample of adults in Al Madinah City, Saudi Arabia, with 63% reporting increased food intake.⁴² A study of Portuguese adults had the lowest reported increase with only 31.6% of individuals responding that they ate more during the pandemic.⁴⁵ A study based in Italy showed nuanced reporting of increased food intake, with 46.1% reporting "Yes, a bit more" and only 6.8% reporting "Yes, much more."¹⁰⁰ This distinction in the reported amount of increase highlights a key limitation of self-reported responses for food consumption; for most measures, it is unclear how much of an increase over normal habits respondents are indicating with their "yes" responses. Different perceptions and responses to forced-choice, binary

Reference	M/I ^a and RO ^b	Finding
Aljohani, 2020 ⁴²	M/I: "Has there been an increase in your food intake during the pandemic lockdown?" RO: Yes/ No/Maybe/ Sometimes/Prefer not to answer	63% Yes 22.1% No 5.75% Maybe 2.56% Sometimes 6.52% Prefer not to answer
Antunes and colleagues 2020 ⁴⁵	M/I: "Do you feel you eat more than usual?" RO: Yes/No	68.4% No 31.6% Yes
Carroll and colleagues 2020 ⁵³	M/I: If responded "yes" to changes in diet, asked in what ways has their diet (or their children's diet) changed. RO: Eating more/less food	Most common behavior changes were eating more food (mothers, 57%; fathers, 46%; children, 42%),
Chenarides and colleagues 2021 ^{13c}	M/I: "How much has your diet changed since COVID-19 started?" RO: Eat more, eat less, eat about the same, ate less healthy, ate more healthy Could select multiple answers	62.9% same 22.8% more 14.4% less
Gallo and colleagues 2020 ⁶⁴	M/I: 24-h recall task (Automated Self-Administered Dietary Assessment Tool –Australia 2016) Compared with previous years.	For women, total 24-h energy intake was 19.5% higher in 2020 compared with 2018-2019 ($P < 0.01$). No difference in males.
Giocalone and colleagues 2020 ⁶⁵	M/I: "Do you think that you are eating more than usual during the confinement?" RO: Yes/No	57.2% reported Yes 42.8% reported No
Herle and colleagues 2021 ⁶⁸	M/I: "Over the past week have you eaten ^d more than usual?" (At the very start of lockdown, longitudinally for 8 weeks) RO: Less than usual/About the same/More than usual	Latent profile analysis profiles 64%, had no change in eating throughout the observed period 9% reported persistently eating less 16% reported persistently eating more 8% showed an initial increase in reported eating then a steady decrease 4% reported no changes in first week and increased consumption over time
Kansiime and colleagues 2021 ⁷³	M/I: The Food Insecurity Experience Scale ¹¹⁰ In FIES: "You ate less than you thought you should?" In study: "Ate less amount of food" RO: Yes/No	Percent of people reporting eating less food during a "normal period" (not COVID-19 period) and during the COVID-19 period. All are significant ($P < 0.01$) In total sample: 23% normal period, 54% COVID-19 period Kenya sample: 24% normal period, 56% COVID-19 Uganda sample: 19% normal period, 48% COVID-19 period

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Figure 2. Measures and findings for changes in the total amount of food (nonaggregated studies) during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

Reference	M/I ^a and RO ^b	Finding
Kriaucioniene and colleagues 2020 ⁷⁶	M/I: "Perception of eating more during the quarantine" RO: Yes/No	50.6% No 49.4% Yes
Marty and colleagues 2021 ⁸¹	M/I: Validated food frequency measure to estimate energy intake	Average of 1,935 ± 656 kcal/d in first month in lockdown compared with 1,700 ± 596 kcal/d in the month before ($P < 0.001$)
Scarmozzino and Visioli, 2020 ¹⁰⁰	M/I: "Would you say that you are eating more during this lockdown?" RO: Yes, much more/Yes, a bit more/No	47.1% No 46.1% Yes, a bit more 6.8% Yes, much more
Sidor and Rzymiski, 2020 ¹⁰²	M/I: "Did you consume more food than usual during quarantine?" RO: Decidedly yes/Yes/Hard to decide/No / decidedly no	43.5% reported eating more
<p>^aM/I = measure/item. ^bRO = response options. ^cChenarides and colleagues¹³ used an item that allowed participants to select multiple answers, two of which were irrelevant to the current findings (those regarding healthiness). The findings reported here reflect only the responses to the items related to food intake amount, which were reported by 808 participants (the total sample was 861). Percentages are equal to 100.1% due to rounding. ^dThe original item reflected in Herle and colleagues⁶⁸ was "Over the past week have you eating more than usual?"</p>		

Figure 2. (continued) Measures and findings for changes in the total amount of food (nonaggregated studies) during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

appraisals of food consumption may lead to a distortion in the overall trends regarding food intake behaviors.

One study from Kenya and Uganda measured whether people ate less.⁷³ Significant increases in the amount of people reporting eating less food than they thought they should were found in the total sample (54% during the COVID-19 period, 23% during normal periods) and both subsamples (Kenya: 56% during COVID-19 period, 24% during normal periods; Uganda: 48% during COVID-19 period, 19% during normal periods). This question was part of a food insecurity questionnaire that, taken all together, showed significantly lower rates of food security during the COVID-19 period compared with normal periods before the pandemic.⁷³

Whereas the remaining four studies used unique measure formats or populations to study changes in food intake, results aligned with the findings obtained via the other measurement strategies. One study of Canadian families showed that the most common eating behavior change was an increase in eating, reported among 57% of mothers, 46% of fathers, and 42% of children.⁵³ Two studies used validated measures of energy intake. One found that on average, French participants reported eating significantly more (~235 kcal/day) during the first month of lockdown compared with the month before.⁸¹ Similarly, a longitudinal study of Australian adults showed that among females there was a significant increase (19.5%) in average 24-hour energy intake compared with reported levels from 2018 and 2019.⁶⁴ Lastly, Herle and colleagues⁶⁸ gathered longitudinal data to assess changes in

eating behaviors over the first 8 weeks of lockdown. Using latent profile analyses, they found the most common profile response (64%) to be one of no change in eating behaviors, followed by 16% reporting persistently eating more. About 9% reported persistently eating less, whereas 8% showed an initial increase followed by a steady decrease and 4% reported no changes in the first week and then a steady increase in consumption over time.⁶⁸

Changes in Eating Frequency and Timing

Eating frequency in the context of the present review relates to the number of total meals and snacks consumed daily, and whether or not this number has changed under the circumstances of the pandemic and the associated periods of home confinement that occurred globally. In total, 20 articles discussed the frequency of eating.^{42,44,45,48,50,55,56,58,62,64,65,70,79,85,86,89,94,102,105,107} Timing involves the intake of meals and snacks as it relates to the respondent's typical eating schedule over a 24-hour period. There were three articles that presented evidence of how meal timing has been influenced by the COVID-19 pandemic and the resulting disruptions to routines, patterns, and schedules.^{85,89,104} Meal skipping was determined to be a distinct, specified behavior and is thus covered in a later section. See Figures 3 and 4 for overviews of findings and measures used.

Frequency of Meals and Snacks. Meals. The predominant trend of the 13 studies reviewed^{42,44,45,50,55,56,58,70,79,85,94,105,107}

Reference	M/I ^a and RO ^b	Findings
Aljohani, 2020 ⁴²	<p>M/I: "In the occurrence of having an increase in your food intake, how many meals do you consume a day?"</p> <p>RO: 4-5 meals/6-7 meals/More than 7 meals</p> <p>M/I: "Have you started eating light meals after dinner (during the lockdown period)?"</p> <p>RO: Yes/No/Sometimes</p>	<p>63% reported an increase in their food consumption, and of those who increased their food consumption, 75% ate 6-7 meals a day, 14.4% ate more than 7 meals a day, and 9.9% ate 4-5 meals a day, respectively.</p> <p>Percent reporting light meals after dinner</p> <p>47.9% started eating during lockdown</p> <p>41.3% did not start eating during lockdown</p> <p>10.7% started eating sometimes during lockdown</p>
Ammar and colleagues, 2020 ⁴⁴	<p>Both measured as before and after lockdown</p> <p>M/I: "How likely are you to have a snack between meals or a late-night snack?"</p> <p>RO: Never/Sometimes/Most of the time /Always</p> <p>M/I: "How many main meals do you eat a day?"</p> <p>RO: 1-2/3/4/5/more than 5</p>	<p>Percentage of people reporting having a snack between meals or a late-night snack:</p> <p>Never: 19.77% before; 14.71% during</p> <p>Sometimes: 59.41% before; 45.56% during</p> <p>Most of the time: 13.85% before; 24.36% during</p> <p>Always: 6.97% before; 15.38% during</p> <p>Overall, there was a significant increase in snacking between meals or late-night ($P < 0.001$).</p> <p>Percentage of respondents reporting eating certain numbers of main meals:</p> <p>1-2 meals: 35.15% before; 29.99% during</p> <p>3 meals: 55.11% before; 46.42% during</p> <p>4 meals: 6.59% before; 14.52% during</p> <p>5 meals: 2.39% before; 6.30% during</p> <p>More than 5 meals: 0.76% before; 2.77% during</p> <p>There was a significant increase in the number of meals eaten</p>
Antunes and colleagues, 2020 ⁴⁵	<p>M/I: "Do you feel you eat more often than usual?"</p> <p>RO: Yes/No</p>	<p>45.2% reported a higher food frequency</p> <p>54.8% reported their food frequency was not higher</p>
Ben Hassen and colleagues, 2020 ⁴⁸	<p>M/I: Change of food-related activities during the COVID-19 pandemic. Eating between meals (eg, snacks)</p> <p>RO: Never /First time /Much less /Slightly less/About the same /Moderately more /Much more</p>	<p>Percent of respondent reporting on snacking between meals:</p> <p>4.7% reported never snacking</p> <p>0.50% reported their first time snacking</p> <p>6.8% reported snacking much less</p> <p>7.3% reported snacking slightly less</p> <p>45.5% reported snacking about the same</p> <p>23.3% reported snacking moderately more</p> <p>12% reported snacking much more</p>
Błaszczuk-Bebenek and colleagues, 2020 ⁵⁰	<p>Survey questions were adapted from the Dietary Habits and Nutrition Beliefs</p>	<p>Percentage of people reporting eating certain numbers of main meals before</p>

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Figure 3. Measures and findings for changes in the frequency of eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

Reference	M/I ^a and RO ^b	Findings
	<p>Questionnaire for people aged 15-65 y¹¹¹</p> <p>M/I: "How many meals do you usually consume daily?"</p> <p>RO: 1 meal per day/2 meals per day/3 meals per day/4 meals per day/5+ meals per day</p> <p>M/I: How often do you snack between the meals?</p> <p>RO: Not listed or Never/1-3 times per month/ Once per week/Few times per week/Once per day/Few times per day</p>	<p>and after lockdown:</p> <p>1 meal/d 0.6% before; 0.3% after (0.3% decrease)</p> <p>2 meals/d 7.1% before; 4.8% after (2.3% decrease)</p> <p>3 meals/d 32.1% before; 23.1% after (9% decrease)</p> <p>4 meals/d 40.4% before; 40.7% after (0.3% increase)</p> <p>5 meals+/d 19.9% before; 31.1% after (11.2% increase)</p> <p>The increase in 5+ meals/d was significant ($P < 0.001$)</p> <p>72.8% before and 77.9% during reported they regularly snacked (few times per week and more), This was a significant increase ($P = 0.0001$)</p>
Cheikh Ismail and colleagues, 2020 ⁵⁵	<p>M/I: How many meals did you eat per day before coronavirus pandemic?</p> <p>RO: 1-2/3-4/More than 5</p> <p>M/I: How many meals do you eat per day during coronavirus pandemic?</p> <p>RO: 1-2/3-4/More than 5</p>	<p>Percentage of respondents reporting eating certain numbers of main meals:</p> <p>1-2 meals: 46.4% before; 36.5% during</p> <p>3-4 meals: 51.5% before; 56.5% during</p> <p>5+ meals: 2.1% before; 7.0% during</p> <p>The increase in 5+ meals/d was significant ($P < 0.001$)</p>
Cheikh Ismail and colleagues, 2021 ⁵⁶	<p>M/I: How many meals did you eat per day before coronavirus pandemic?</p> <p>RO: 1-2/3-4/More than 5</p> <p>M/I: How many meals do you eat per day during coronavirus pandemic?</p> <p>RO: 1-2/3-4/More than 5</p>	<p>Percentage of respondents reporting eating certain numbers of main meals:</p> <p>1-2 meals: 45.6% before; 37.5% during</p> <p>3-4 meals: 52.2% before; 56.2% during</p> <p>5+ meals 2.2% before; 6.2% during</p> <p>The increase in 5+ meals/d was significant ($P < 0.001$)</p>
Di Renzo, Gualtieri, Pivari and colleagues, 2020 ⁵⁸	<p>M/I: "Did you change the number of daily meals, during this period?"</p> <p>RO: No, it didn't/Yes, I skip 1 or more of the main meals (breakfast, lunch, dinner)/Yes, I skip 1 or more of snacks between meals/ Yes, I added 1 or more of the main meals/ Yes, I added 1 or more of the snacks between meals/Yes, I eat out of the meals^c</p>	<p>57.8% did not change their number of daily meals</p> <p>17.5% skipped a meal or snack</p> <p>23.5% introduced a meal or snack</p>
Flanagan and colleagues, 2021 ⁶²	<p>M/I: Changes in dietary behaviors were assessed. The form included questions about cooking and eating out habits and snacking before and during the pandemic. Perception of overall healthy eating habits and weight change was asked</p> <p>The optional long form was a modification of the Rapid Eating Assessment¹¹²</p>	<p>25.8% reported an increase in healthy snacking</p> <p>43.5% reported an increase in unhealthy snacking</p>

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Figure 3. (continued) Measures and findings for changes in the frequency of eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

Reference	M/I ^a and RO ^b	Findings
Gallo and colleagues, 2020 ⁶⁴	M/I: 24-h recall task (Automated Self-Administered Dietary Assessment Tool-Australia 2016) Compared to previous years	Among males, there was no difference in the number of snack occasions between 2020 and 2018-2019 In women, there was an increase to two snack occasions in 2020 compared with one in 2018-2019 ($P < 0.05$)
Giocalone and colleagues, 2020 ⁶⁵	M/I: "Have you increased the frequency of snacking during the confinement compared to your usual intake?" RO: Yes. My snacking frequency is higher/ No. My snacking frequency is lower/My snacking frequency remains as usual"	41.7% snacked more frequently 47.5% snacked as frequently as usual 10.8% snacked less frequently
Husain and Ashkanani, 2020 ⁷⁰	M/I: How many times a day do you eat? RO: 1 time/2 times/3 times/4 times/5 times/6 or more	No significant changes in meal frequency. Percentage of respondents reporting eating a certain number of times per day: 1 time/d: 1.2% before; 1.0% during 2 times/d: 13.5% before; 10.4% during 3 times/d: 29.9% before; 27.0% during 4 times/d: 31.6% before; 25.1% during 5 times/d: 19.3% before; 21.4% during 6+ times/d: 4.6% before; 15.2% during
López-Moreno and colleagues, 2020 ⁷⁹	Asked for before and after lockdown M/I: How many intakes do you make per day of these top 5? Check the ones you usually do. RO: Before/during confinement: Breakfast/ mid-morning/Lunch/Snack/Dinner/ Bedtime snack	Before 1% reported eating 5 meals/d During 23% reported eating 5 meals/d
Papandreou and colleagues, 2020 ⁸⁵	M/I: The Dutch Eating Behaviour Questionnaire ¹¹³ was utilized to assess eating behaviors	59.8% of the Spain sample and 51.7% of the Greece sample reported that they follow same hours/number of meals during the pandemic 34.1% of the Spain sample and 40.8% of the Greece sample reported that they did increase the number of snacks between meals during the pandemic
Pellegrini and colleagues, 2020 ⁸⁶	M/I: "During the lockdown period, the number of snacks that you consume in a day" RO: I don't consume snacks usually/Is less than before quarantine/Is the same as before quarantine/Is more than before quarantine	28% "I don't consume snacks usually" 11.3% "is less than before quarantine" 28% "is the same as before quarantine" 32.7% "is more than before quarantine"

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Figure 3. (continued) Measures and findings for changes in the frequency of eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

Reference	M/I ^a and RO ^b	Findings
Poelman and colleagues, 2021 ⁸⁹	<p>M/I: Participants asked to identify if they ate differently than usual (with more awareness, taking more time, during different occasions, more often and snacking more frequently).</p> <p>RO: Fully disagree (1) to fully agree (5). Calculated the number of participants that (fully) agreed on each of the items (score 4 or 5)</p>	<p>14.2% ate more frequently 22.1% reported eating more sweets and snacks</p>
Robinson and colleagues, 2021 ⁹⁴	<p>M/I: "Compared to before the COVID-19 lockdown in the United Kingdom, I have: Eaten large meals or snacks"</p> <p>RO: A lot less/Less/A little less/The same amount/A little more/More/A lot more</p> <p>M/I: "Compared to before the COVID-19 lockdown in the United Kingdom, I have: Snacked"</p> <p>RO: A lot less/Less/A little less/The same amount/A little more/More/A lot more</p>	<p>Compared with before lockdown:</p> <p>3% ate a lot less large meals or snacks 8% ate less large meals or snacks 10% ate a little less large meals or snacks 34% ate the same amount of large meals or snacks 26% ate a little more large meals or snacks 14% ate more large meals or snacks 4% ate a lot more large meals or snacks. 5% snacked a lot less 8% snacked less 10% snacked a little less 22% snacked the same amount 27% snacked a little more 21% snacked more 8% snacked a lot more</p>
Sidor and Rzymiski, 2020 ¹⁰²	<p>M/I: "Indicate the number of meals eaten per day during quarantine"</p> <p>RO: 1/2/3/4/5/6 or more</p> <p>M/I: "Did you snack more frequently than usual during quarantine?"</p> <p>RO: decidedly yes /yes/hard to decide/ no/ decidedly no"</p> <p>M/I: "Indicate the number of snacks eaten per day during quarantine"</p> <p>RO: None/1/2/3/4 or more</p>	<p>51.8% snacked between meals more frequently</p> <p>Most frequent number of meals per day during quarantine: 3 (30.3%) 4 (39.3%)</p> <p>Most frequent number of snacks per day during the quarantine: 1 (28.3%) 2 (36.1%)</p>
Wang and colleagues, 2020 ¹⁰⁵	<p>M/I: Food consumption questionnaire adapted from the online nutritional survey of Guangdong Nutrition Society and Sun Yat-sen University [measure is not in English, but can be found here: https://www.wjx.cn/m/59273857.aspx]</p> <p>Translated: M/I: "Your staple food intake during the pandemic compared to before the pandemic"</p> <p>RO: Increase/Reduce/No significant changes</p>	<p>23.1% reduced their daily eating frequency 17.3% increased their daily eating frequency, and 60% reported no changes in eating frequency</p>

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Figure 3. (continued) Measures and findings for changes in the frequency of eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

Reference	M/I ^a and RO ^b	Findings
Yilmaz and colleagues, 2020 ¹⁰⁷	<p>M/I: Main meal in COVID-19 pandemic RO: Increased/Not changed/Decreased</p> <p>M/I: Snacks in COVID-19 pandemic RO: Increased/Not changed/Decreased</p> <p>M/I: Mean meal [daily number of meals consumed before the COVID-19 pandemic] RO: 1/2/3</p> <p>M/I: Snacks [daily number of snacks consumed before the COVID-19 pandemic] RO: 1/2/3</p>	<p>71% no change in the number of main meals 23% increased number of main meals 6% decreased in the number of main meals</p> <p>57.5% no change in the number of snacks 38% increased the number of snacks 4.5% decreased the number of snacks</p> <p>58.3% consumed two main meals per day and 43.9% consumed 1 snack before COVID-19</p> <p>During COVID-19, 23.0% reported an increase in the number of meals and 38.0% an increase of snacks</p>
<p>^aM/I = measure/item.</p> <p>^bRO = response options.</p> <p>^cThe response options stated here are quoted directly from reference 67. There was no reporting on the “Yes, I eat out of the meals” response option.</p>		

Figure 3. (continued) Measures and findings for changes in the frequency of eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.

was no change in the number of meals individuals reported consuming during the COVID-19 pandemic compared with prior.^{45,58,70,85,105,107} For example, the majority of cross-sectional study participants in Turkey (71%),¹⁰⁷ China (60%),¹⁰⁵ and Italy (58%)⁵⁸ reported no change in the number of meals consumed.

When the number of meals eaten throughout a given day did change, it largely increased.^{42,44,50,55,56,79,94} For example, an international survey with participants predominantly representing Western Asia, Northern Africa, and Europe found that the number of meals consumed per day significantly increased during the home confinement period ($t = -5.83$; $P < 0.001$; $d = 0.22$).⁴⁴ Specifically, there were increases in the number of participants consuming four meals, five meals, and more than five meals during confinement compared with before confinement. Similarly, studies in the United Arab Emirates and Middle East and North Africa regions found increases in the number of meals consumed per day with those consuming five or more meals per day increasing significantly.^{56,55} Furthermore, a study of Spanish adults found that the “pattern” of number of meals among the study population changed with more people consuming five meals a day during confinement (23%) compared with before (1%).⁷⁹

A UK-based study ($n = 2,002$) found that 44% of respondents increased meal frequency (26% reported a little more, 14% more, and 4% a lot more) followed by 34% reporting they ate the same number of meals.⁹⁴ These data once again illustrate the nuances in the magnitude of changes in the number of eating occasions that are not visible in measures that only consider overall increase or decrease.

The remaining studies evaluated frequency of meals utilizing measures that are less common in the literature. One study of 1,404 adults in Portugal reported that 55% of

participants did not eat at a higher frequency; however, the extent to which eating frequency stayed the same or decreased is unclear.⁴⁵

Snacks. Across the 12 studies that assessed snacking frequency,^{44,48,50,62,64,65,85,86,89,94,102,107} most found that individuals either reported an increase^{44,50,86,94,102} or no change^{48,65,107} in snacking frequency. For example, increased snacking was reported by 56% of a sample from the United Kingdom (27% a little more, 21% more, and 8% a lot more),⁹⁴ 51.8% of a sample from Poland,¹⁰² and 32.7% of a sample from Italy (28.0% indicated they do not consume snacks usually, and 28.0% reported no change).⁸⁶ Similarly, international samples from Western Asia, Northern Africa, and Europe reported a significant increase in the number of snacks and the proportion of participants snacking between meals or late-night snacking during home confinement compared with snacking behavior before the pandemic ($t = -6.89$; $P < 0.001$; $d = 0.30$).⁴⁴ Further, whereas studies from Turkey,¹⁰⁷ Denmark,⁶⁵ and Qatar⁴⁸ found that the most common response was no change (57.5%, 47.5%, and 45.5%, respectively), a large proportion of the samples also reported increased snacking (38%, 41.7%, and 35.3%, respectively).

Two studies assessed how the relationship between COVID-19 confinement and snacking frequency might be modified by other factors such as sex and snack healthfulness.^{62,64} One longitudinal study of university students in Australia found that levels of snacking were no different between 2018, 2019, and 2020 samples of men, but snacking increased among women.⁶⁴ In addition, in a study focused on Australia, the United States, the United Kingdom, and Canada, 25.8% of participants reported an increase in healthy

snacking, whereas 43.5% of participants reported an increase in unhealthy snacking.⁶²

Two studies measuring snacking frequency found snacking did not increase among their participants; however, the survey did not differentiate whether a “no increase” response meant that the respondents were eating the same amount as before or less than before.^{85,89} For example, one study reported that only 34.1% of a Spanish sample and 40.8% of a Greek sample answered “yes” to a measure of increased snacking.⁸⁵

Timing of Meals and Snacks. There is limited evidence available illustrating how timing of eating has been influenced by the COVID-19 pandemic. Three studies asked participants to indicate how their eating routines had changed during confinement compared with before.^{85,89,104} In a study of adults from India (n = 422), 50.2% of respondents reported their eating schedule did change, and 11.1% reported that their schedule might have changed.¹⁰⁴ Papandreou and colleagues⁸⁵ and Poelman and colleagues⁸⁹ both included measures of meal timing but did not explicitly ask their participants how they modified their meal schedules. As previously mentioned, Papandreou and colleagues⁸⁵ measured frequency and timing in the same question. They report that 59.8% of the sample from Spain and 51.7% of the sample from Greece did maintain the same hours and numbers of meals during the pandemic.⁸⁵ In addition, 16.9% of participants from the Netherlands reported that they “ate at different times” during the lockdown period.⁸⁹

Changes in Consumption of Specific Food Types

A total of 38 articles reported on changes in the consumption of specific foods.^{13,41,46,47,48,49,50,51,53,54,55,56,58,62,64,65,66,69,70,73,76,77,78,80,82–84,85,86,91,92,96,99,100,101,106,107,109} Through a thematic analysis of major food categories assessed, this review summarizes trends in consumption for the following: fruits and vegetables, breads and grains, meats and seafood, legumes, frozen foods, homemade foods, fast food, “snack” foods, and sweets and/or bakery products. See [Tables 3](#) and [4](#) for a summary of measures and findings.

Fruits and Vegetables. Thirty-one studies examined how the consumption of fruits and vegetables changed during the pandemic; 12 studies examined the consumption of fruits and vegetables together,^{13,46,47,48,53,78,82,86,92,100,101,106} whereas 20 studies examined fruits separately from vegetables.^{49,50,51,54,58,62,65,66,69,70,73,76,77,80,82–84,96,99,107} One of these studies examined fruits and vegetables both together and separately.⁸²

Of the 12 studies that measured fruit and vegetable consumption together using a single-item measure (increased, decreased, or remained the same during the pandemic), six studies from Brazil, Qatar, the United States, the United Kingdom, Canada, Italy (two studies), and Chile found that the largest group of participants (48.4% to 69.2%) reported that their consumption of fruits and vegetables did not change during the pandemic.^{13,47,48,86,92,100} The second most common response (22.1% to 32.4%) was an increase in fruit and vegetable consumption.^{13,48,86,92,100} Increased consumption was the most common response in studies from Saudi Arabia and Spain^{46,78} and a decrease in consumption

was the primary finding for studies from Brazil, Zimbabwe, and the United States.^{82,101,106} In one study from Canada, more fathers and children reported eating more (fathers: 32%, children: 24%) rather than less (fathers: 12%, children: 20%) fruits and vegetables during the pandemic; however, more mothers reported eating less (mothers: 22%) rather than more (mothers: 20%).⁵³

Fruits. Of the 20 studies investigating fruit consumption independently, 10 used a single-item measure (ie, increased, decreased, or remained the same).^{49,51,65,66,69,76,82,84,96,107} Seven of these 10 studies (from Poland, Denmark, Spain, Lithuania, Germany, Turkey, and the United States) found that the largest group of participants (49.4% to 68%) reported no change in fruit consumption during the pandemic.^{49,65,66,69,76,96,107} An increase in consumption was the second most frequently reported response (18% to 49.1%) for four of these studies,^{69,76,96,107} whereas a decrease was second most common (20.1% to 33.4%) in three studies.^{49,65,66} One study conducted in the United Kingdom primarily found an increase in consumption⁵¹ and one study from Zimbabwe reported decreases.⁸²

However, results suggest possible nuances in fruit consumption rates. For example, whereas fruit consumption in one study of Iranian adults was not significantly different before vs during the early pandemic, the researchers found a 2.8% increase in families who reported consuming “vitamin A-rich fruits” during the pandemic and a 2.2% decrease in families who reported consuming “fruits” during the pandemic.⁸⁴

Findings from studies using other measures of fruit consumption confer mixed results, including studies from Italy, Brazil, Kenya/Uganda, and Canada showing that fruit consumption decreased for more respondents than it increased,^{58,73,77,80} studies from the United States/United Kingdom/Australia/Canada/other, Kuwait, Nigeria, Island of Ireland/Great Britain/United States/New Zealand, and Spain showing the opposite pattern,^{54,62,70,83,99} and a study from Poland showing no change overall.⁵⁰

Vegetables. Nine of the 20 studies investigating vegetable consumption used a single-item measure (ie, consumption increased, decreased, or remained the same).^{49,51,65,66,69,76,82,96,107} Of these nine, six studies out of Lithuania, Germany, Denmark, Poland, Spain, and Turkey found that the majority of participants (53.5% to 71%) reported no change in their overall vegetable consumption during the pandemic^{65,66,69,76,96,107} with the second most frequently reported option being increased consumption (17% to 40.5%) in four studies^{69,76,96,107} and decreased consumption (19.4% to 19.5%) in two studies.^{65,66} The primary findings of studies from the United Kingdom and Canada were increases in consumption.^{51,77} Three studies from Iran, the United States, and Zimbabwe assessed specific vegetables with most reporting no change in consumption (ie, for vitamin A-rich vegetables, tubers, starchy and nonstarchy vegetables, dark green leafy vegetables and “other” vegetables) or decreased consumption (ie, for dark green leafy vegetables and vegetables in general).^{49,82,84}

Research using other measures of vegetable consumption is similarly mixed, with two studies from Poland and United States/United Kingdom/Australia/Canada/other reporting no change,^{50,62} three studies from Kuwait, Kenya/Uganda, and

Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
Alhusseini and Alqahtani, 2020 ⁴¹	M/I: "[Before the pandemic] How often do you eat home-cooked meals per week?" "[During the pandemic] How often do you eat home-cooked meals per week?" RO: 0, 1-2 times/wk, 3-6 times/wk, or daily	N/A ^c	N/A	Significant increase ($P < 0.001$)	N/A	N/A	N/A
Bakhsh and colleagues, 2021 ⁴⁶	M/I: How has your consumption of the following foods changed during the pandemic: ...dairy products, meat, fish, poultry...? RO: I ^d , D ^e , or U ^f	N/A	I = 26% U = 12% D = 62%	N/A	N/A	N/A	Meat/fish/poultry: I = 34% U = 57% D = 9%
Ben Hassen and colleagues, 2020 ^{48d}	M/I: How has your consumption of the following foods changed during the pandemic: ... Meat... Packaged frozen foods? RO: Much more, Moderately more, About the same, Slightly less, Much less, First time [meaning that their first time consuming the food was during the pandemic], or Never"	I = 14.8% U = 47.8% D = 21.8%	N/A	N/A	N/A	N/A	Meat general: I = 11.2% U = 72.6% D = 12.5%
Bin Zarah and colleagues, 2020 ⁴⁹	M/I: How has your consumption of the following foods changed during the pandemic: ...Sweets... Brown rice or whole-grain pasta, white rice or pasta... Dark bread, white bread, cold breakfast cereals... Processed meats, beef/pork/lamb, eggs/chicken/turkey... Dairy and dairy alternatives? RO: I, D, or U	N/A	Dairy and dairy alternatives: I = 8.3% U = 70.1% D = 21.6%	N/A	N/A	Brown rice or whole-grain pasta: I = 8.1% U = 76.8% D = 15.1% White rice or pasta: I = 26.8% U = 62.5% D = 10.7% Dark bread: I = 8.7% U = 77.2%	Processed meat: I = 19.9% U = 63.7% D = 16.4% Beef, pork, or lamb: I = 20.4% U = 64.3% D = 15.3% Eggs, chicken, or turkey: I = 11.1% U = 57.9% D = 31%

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
						D = 14.1% White bread: I = 19% U = 70.4% D = 10.6% Cold breakfast cereals: I = 22.3% U = 67.4% D = 10.3%	
Błaszcyk-Bębenek and colleagues, 2020 ⁵⁰	M/I: How frequently have you consumed the following foods before the pandemic and during the pandemic: white bread, whole-meal bread, white rice/white pasta, buckwheat/oats,...milk, fermented milk, fresh cheeses, cheeses, cold meats, red meats, white meats... pulses...tinned meats...? RO: 1 = Never, 2 = 1-3 times a month, 3 = Once a week, 4 = Few times a week, 5 = Once a day, 6 = Few times a day M/I: How many portions of each food did you consume both before and during the pandemic? RO: 1 = 0, 2 = Half a portion, 3 = 1, 4 = 2, 5 = 3, 6 = 4 or more	N/A	Frequency milk/fermented milk/cheese/fresh cheese/butter: No significant change Portion size milk/fermented milk/cheese/fresh cheese/butter: No significant change	N/A	Pulses frequency: No significant change Pulses portion size: No significant change	White bread portion size: Significant decrease ($P = 0.040$) White bread/whole-meal bread/white rice, white pasta/buckwheat oats frequency: No significant change Whole-meal bread/white rice, white pasta/buckwheat oats: Portion size: No significant change	Tinned meats frequency: Significant increase ($P = 0.0004$) Tinned meats portion size: Significant increase, ($P = 0.0390$) Red meats/white meats/cold meats frequency: No significant change Red meats portion size: Significant decrease ($P = 0.0199$) White meats/cold meats portion size: No significant change
Celik and Dane, 2020 ⁵⁴	M/I: Which foods did you have a preference to consume both before and during the	N/A	N/A	N/A	N/A	N/A	Meat general: Before = 29.2% During = 22.9%

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
	pandemic? RO: Meat						
Cheikh Ismail and colleagues, 2020 ⁵⁵	M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? RO: "Homemade, frozen ready-to-eat meals..."	Significant decreased consumption ($P = 0.032$)	N/A	Significant increased consumption ($P < 0.001$)	N/A	N/A	N/A
Cheikh Ismail and colleagues, 2021 ⁵⁶	M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? RO: "Homemade, frozen ready-to-eat meals..."	No significant change	N/A	Significant increased consumption ($P < 0.001$)	N/A	N/A	N/A
Chenarides and colleagues, 2021 ^{13g}	M/I: "How much more or less have you consumed these foods since COVID-19 started? for 10 major food groups:... dairy, meat, grains... frozen food..." RO: "A lot more (5), A bit more (4), About the same (3), A little less (2), A lot less (1), and Do not consume"	I = 25.43% U = 53.19% D = 16.49%	I = 19.16% U = 65.27% D = 12.66%	N/A	N/A	Grains: I = 28.69% U = 59.35% D = 10.22%	Meat general: I = 19.86% U = 54.36% D = 22.18%
Di Renzo, Gualtieri, Pivari, and colleagues, 2020 ^{58h}	M/I: "During this [quarantine] period, which of these foods are you consuming MORE than before?" RO: "None...pasta and cereals, bread, homemade pizza, homemade pastries... ham and processed meat, dairy products, cheese, cow's milk and yogurt... Legumes, white meat, red meat..." M/I: "During this [quarantine] period, which of these foods are you consuming LESS than before?"	N/A	Dairy products: Reduced intake = 4% Increased intake = 13.3% Milk and yogurt: Reduced intake = 4.0% Increased intake = 9.3%	Homemade sweets: Reduced intake = 4% Increased intake = 45.4% Homemade pizza: Reduced intake = 4.7% Increased intake = 35.4%	Reduced intake = 4.7% Increased intake = 15.3%	Fresh bread: Reduced intake = 9.3% Increased intake = 17.3% Cereals: Reduced intake = 5.3% Increased intake = 24.7%	Preserved meat: Reduced intake = 12.7% Increased intake = 13.3% Processed meat: Reduced intake = 6.7% Increased intake = 3.3% Red meat: Reduced intake = 8.0% Increased intake = 8.7%

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
	RO: "None...pasta and cereals/ bread/homemade pizza/ homemade pastries...processed meat/ dairy products/ cheese/cow's milk and yogurt,...legumes/ white meat/red meat..."						White meat: Reduced intake = 4.7% Increased intake = 12.0%
Giacalone and colleagues, 2020 ⁶⁵	M/I: How has your consumption of the following foods changed during the pandemic...red meat, legumes... pastries (homemade)...?	N/A	N/A	Homemade Pastries: I = 38.1% U = 53.8% D = 8.1%	I = 7.1% U = 84.4% D = 8.6%	N/A	Red meat: I = 11.5% U = 76.2% D = 12.3%
Górnick and colleagues, 2020 ⁶⁶	RO: Higher, Lower, or As before M/I: Has your consumption of the following foods changed during the pandemic:... whole-grain cereal products, low-fat meat and/or eggs... milk and milk products, processed meats... homemade meals...?	N/A	I = 20.8% U = 71.0% D = 8.2%	Homemade pastry: I = 39.9% U = 51.1% D = 9.0% Homemade meals: I = 48.0% U = 48.8% D = 3.1%	I = 13.9% U = 77.7% D = 8.5%	Whole-grain products: I = 16.3% U = 72.3% D = 11.4%	Low-fat meat and/or eggs: I = 15.7% U = 74.7% D = 9.7% Processed meat: I = 10.9% U = 71.4% D = 17.7%
Huber and colleagues, 2021 ⁶⁹	RO: "I eat more/I eat the same/I eat less/I didn't eat before and during the pandemic" M/I: How has your consumption of the following foods changed during the pandemic:... Bread, Meat, Dairy...?	N/A	I = 25% U = 58.5% D = 16.5%	N/A	N/A	Bread: I = 32.5% U = 40% D = 27.5%	Meat general: I = 16% U = 56.5% D = 27.5%
Husain and Ashkanani, 2020 ⁷⁰	RO: Increased, Decreased, or Unchanged M/I: How frequently do you eat each of the following foods: red meat, chicken... processed meat...? RO: "Never, less than 1/wk, 1-2/wk, 3-4/wk, 5-6/wk, 7 or more, I do not know, or none	N/A	Before: None = 23.4% Whole milk = 29.9% Semi-skimmed = 23.9% Skimmed = 13.5% Soy milk = 1.0%	N/A	N/A	Before: Other = 2.4% White = 42.9% Brown/brown seeds = 44.1% Whole wheat = 9.4%	Processed meat: Before: Never = 68.4% Less than 1/w = 17.8% 1-2/w = 9.2% 3-4/w = 3.1%

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
	M/I: What type of milk do you consume most frequently? RO: "None/whole milk/semi-skimmed/skimmed/soy milk/almond milk/other (rice/goat milk)/do not know"		Almond milk = 5.1% Other (rice/goat) = 2.7% During: None = 23.9% Whole milk = 30.8%			Seeds = 0.0% None = 1.2% During: Other = 1.7% White = 48.0% Brown/brown seeds = 39.5%	5-6/w = 0.5% 7 or more = 0.0% I don't know = 1.0% During: Never = 69.4% Less than 1/w = 16.1%
	M/I: What type of bread do you consume most frequently? RO: "Other/white/brown or brown seeds/ whole wheat/ [nonbrown] seeds/none"		Semi-skimmed = 24.8% Skimmed = 11.3% Soy milk = 1.2% Almond milk = 3.6% Other (rice/goat) = 3.1%			Whole wheat = 9.6% Seeds = 0.0% None = 1.2%	1-2/w = 7.0% 3-4/w = 5.1% 5-6/w = 1.0% 7 or more = 0.2% I don't know = 1.2% Red meat: Before: Never = 7.7% Less than 1/w = 17.3% 1-2/w = 49.4% 3-4/w = 22.7% 5-6/w = 1.2% 7 or more = 0.7% I don't know = 1% During: Never = 10.1% Less than 1/w = 20.7% 1-2/w = 47.5% 3-4/w = 18.1% 5-6/w = 2.2% 7 or more = 0.5% I don't know = 1% Chicken: Before: Never = 3.6% Less than 1/w = 4.3% 1-2/w = 35.9% 3-4/w = 41.4% 5-6/w = 10.6% 7 or more = 3.1%

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
							I don't know = 1% During: Never = 4.8% Less than 1/w = 6.5% 1-2/w = 34.5% 3-4/w = 39.5% 5-6/w = 11.3% 7 or more = 2.7% I don't know = 0.7%
Kansiime and colleagues, 2021 ^{73g}	M/I: How often did you consume the following foods both before the pandemic and during the pandemic: Meat (goat, beef, mutton, etc.), and poultry products? RO: "Rarely (once or twice a month), sometimes (3-10 times a month), and often (>10 times a month)"	N/A	N/A	N/A	N/A	N/A	Meat general: Percent of participants who reported a frequent consumption (>10 times/mo) Kenya: Before = 41.6% During = 16% Uganda: Before = 51.2% During = 22.4% Poultry: Percent of participants who reported a frequent consumption (>10 times/mo) Kenya: Before = 38.4% During = 19.2% Uganda: Before = 41.6% During = 28.8%
Kriaucioniene and colleagues, 2020 ⁷⁶	M/I: How has your consumption of the following foods changed during the	N/A	N/A	Homemade pastries such as cookies, custards, sweets,	Pulses: I = 9.1%	N/A	Red meats, hamburgers, sausages:

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
	pandemic... Pulses... Red Meats/Hamburgers/ Sausages... Homemade pastries such as cookies, custards, sweets, or cakes? RO: Higher, Lower, or As usual			or cakes: I = 37.7% U = 50.8% D = 11.5%	U = 82.4% D = 8.5%		I = 12.2% U = 69.9% D = 17.9%
Lamarche and colleagues, 2021 ⁷⁷	M/I: Which of the following foods did you eat in the last 24 hours? RO: Whole grains... refined grains... total dairy... total proteins?	N/A	Total dairy: Significant increased consumption	N/A	N/A	Refined grains: Significant reduced consumption Whole grains: Significant increased consumption	Total proteins: Significant increased consumption
Malta and colleagues, 2020 ⁸⁰	M/I: "Before the pandemic how many days a week did you usually eat any of the following foods: ...beans, frozen food...?" "During the pandemic, how frequently do you eat these foods now?" RO: "5 days or more; 2 to 4 days; 1 day or less"	Frozen food more than 2 d: Before = 10.0% During = 14.6%	N/A	N/A	Regular consumption of beans: Before = 43.3% During = 40.9%	N/A	N/A
Matsungo and Chopera, 2020 ^{82gh}	M/I: How has your consumption of the following foods changed during the pandemic: Meat and Meat Groups... Cereal Breads and Tubers... Dairy Products...Pulses/legumes...? RO: "1=less/decreased, 2=same/did not change, 3=more/increased, or 4=not applicable "	N/A	I = 8.3% U = 41.7% D = 45.9%	N/A	I = 16.7% U = 37.5% D = 33.4%	Cereal, breads, and tubers: I = 16.7% U = 37.5% D = 41.7%	Meat General: I = 8.3% U = 45.9% D = 41.7%
Pakravan-Charvadeh and	M/I: Which of the following foods did you consume before the pandemic?	N/A	Milk and milk products: No	N/A	Legumes, nuts, and seeds: Significant increased	Cereals: No significant change	Organ meat: Significant decreased

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
colleagues, 2021 ⁸⁴	Which of the following foods did you consume during the pandemic? Cereals...Organ meat, Flesh meats, Meats... Legumes/ Nuts/Seeds... Milk and milk products... RO: Yes or no		significant change		consumption ($P = 0.001$)		consumption ($P = 0.001$) Flesh meat: No significant change
Pellegrini and colleagues, 2020 ⁸⁶	M/I: Has your consumption changed: The number of snacks you consume a day, cereals (pasta, rice, other), sources of protein (meat, fish, eggs, cheese, legumes),...? RO: "I don't consume those foods usually, is less than before quarantine, is the same as before quarantine, is more than before quarantine"		N/A	N/A	Protein (meat, fish, eggs, cheese, legumes): Don't consume = 0.7% I = 27.3% U = 54% D = 18%	Cereals (pasta, rice, other): Don't consume = 2.7% I = 28% U = 53.3% D = 16%	Protein (meat, fish, eggs, cheese, legumes): Don't consume = 0.7% I = 27.3% U = 54% D = 18%
Reyes-Olavarria and colleagues, 2020 ⁹²	M/I: Was cooking performed more than before, less than before, or maintained? RO: "More than before/same [as] before/less than before"	N/A	N/A	I = 59.6% U = 34.7% D = 5.7%	N/A	N/A	N/A
Rodríguez-Pérez and colleagues, 2020 ⁹⁶	M/I: How has your fast-food frequency changed during the pandemic? How has your consumption of the following foods changed during the pandemic: Red meat... Legumes...? RO: Higher, Lower, As before	N/A	N/A	N/A	I = 15% U = 78% D = 8%	N/A	Red meat: I = 8% U = 68% D = 24%
Sánchez-Sánchez and colleagues, 2020 ⁹⁹	M/I: "How many portions of butter, margarine, or cream do you consume every day? Individual portion = 2 g" RO: "1 or less per day, 2 or more per day" M/I: "How many portions of	N/A	Butter, margarine, or cream: significant increased consumption ($P < 0.001$)	N/A	Significant increased consumption ($P < 0.001$)	N/A	Red meat, hamburger, sausages, or cold meat: Significant increased consumption ($P < 0.001$)

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Table 4. Measures and findings for changes in the consumption of frozen foods, dairy products, homemade foods, legumes, breads, grains, and meats during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Frozen food	Dairy products	Homemade foods	Legumes	Breads/grains	Meats
	legumes do you consume per week? (1 dish or portion is 150 g): RO: "2 or less portions per week, 3 or more portions per week" M/I: "How many portions of red meat, hamburgers, sausages, or cold meat do you consume every day? (Portion = 100-150 g)" RO: "1 or less per day, 2 or more per day"						
Yilmaz and colleagues, 2020 ¹⁰⁷	M/I: How has your consumption of the following foods changed during the pandemic: ...Red Meat/Chicken/Fish, Dairy Products...? RO: I, D, or U	N/A	I = 41.0% U = 58.5% D = 0.5%	N/A	N/A	N/A	Red meat, chicken, and fish: I = 32.1% U = 65.8% D = 2.1%
Zhang and colleagues, 2020 ¹⁰⁹	M/I: How has your consumption of the following food types changed during the pandemic: frozen food, imported frozen food...? RO: I, U, or D	Frozen food: I = 19% U = 40% D = 41% Imported frozen food: I = 3.3% U = 40% D = 57%	N/A	N/A	N/A	N/A	N/A

^aM/I = measure/items.^bRO = response options.^cN/A = not available.^dI = increased intake.^eD = decreased intake.^fU = no change in intake.^gFindings are presented only for response options related to an increase, decrease, or no change, thus percentages reported will not add to equal 100%. Remaining percentages align with the alternative response options noted in the measures section, including "never" and "first time" for Ben Hassen and colleagues,⁴⁸ "do not consume" for Chenarides and colleagues,¹⁵ and "not applicable" for Matsungo and Chopera.⁸²^hStudies where values were estimated from a figure.

Brazil reporting decreases,^{70,73,80} and four studies from Italy, Nigeria, Island of Ireland/Great Britain/United States/New Zealand, and Spain showing increases.^{54,58,83,99}

Bread and Grains. Eleven studies examined how the consumption of bread, grains, and/or cereals changed during the pandemic.^{13,49,50,58,66,69,70,77,82,84,86}

Five studies from Poland, the United States, Italy, Germany, and Kuwait looked at how the consumption of bread changed during the pandemic and results varied by bread type.^{49,50,58,69,70} When just asked about bread consumption in general, most participants reported either no change or increased consumption.^{58,69} White bread consumption tended to either remain stable or increase.^{49,70} One study based in Poland found no change in the frequency of consumption of white bread, but a significant decrease in the portion size of white bread.⁵⁰ Dark and brown/brown seed bread tended to either remain stable or decrease.^{49,70}

Considering grains, consumption tended to remain the same.^{13,50,66,77} Studies based in Poland and the United States found that the highest portion (59.35% to 72.3%) of participants reported no change in their consumption of grains and whole grains.^{13,66} Similarly, one Polish study found no significant change in the consumption of buckwheat oats.⁵⁰ Conversely, a study based in Canada found that there was a significant decrease in the consumption of refined grains and a significant increase in consumption of whole grains.⁷⁷

Four studies asked participants about their consumption of cereals (ie, pasta and rice).^{58,82,84,86} Two studies from Iran and Italy found that consumption of cereals did not change.^{84,86} When consumption did change, results were mixed, with one study from Italy finding that more people reported increased intake (24.7%) than reduced intake (5.3%)⁵⁸ and one study from Zimbabwe reporting that the highest portion of participants (41.7%) had a decreased consumption of cereals, breads, and tubers.⁸² One study from the United States found that white rice or pasta was either unchanged (62.5%) or increased (26.8%) and brown rice or whole-grain pasta was either unchanged (76.8%) or decreased (15.1%).⁴⁹ Similarly, a study from Poland found no significant change in the consumption of white rice and white pasta.⁵⁰

Meats. A total of 20 studies examined how the consumption of various types of meat changed during the pandemic.^{13,46,48,49,50,54,58,65,66,69,70,73,76,77,82,84,86,96,99,107} Overall, meat consumption remained the same as prepandemic levels or decreased.

Nine of the 20 studies asked participants about how their consumption of meat in general changed during the pandemic.^{13,46,48,54,69,73,77,82,86} Studies from Qatar, Germany, Zimbabwe, the United States, Saudi Arabia, and Italy found that for the majority of participants (45.9% to 72.6%) consumption did not change.^{13,46,48,69,82,86} The second most common response for studies from the United States, Germany, Qatar, and Zimbabwe was decreases in meat consumption.^{13,48,69,82} The second most common response for studies in Saudi Arabia⁴⁶ and Italy⁸⁶ was increases in protein consumption, although the study from Italy included nonmeat proteins. One study from Canada also found increases in protein consumption, including nonmeat sources.⁷⁷ On the other hand, studies from Kenya, Uganda, and Nigeria found that fewer respondents reported frequent

consumption of meat during the pandemic (16% to 22.4%) than before the pandemic (41.6% to 51.2%)⁷³ and fewer participants reported having a preference for meat during (22.9%) compared with before the pandemic (29.2%).⁵⁴

Six studies based in Poland, the United States, Kuwait, and Italy assessed changes in the consumption of processed meat during the pandemic and found that the majority of participants reported no change.^{49,50,58,65,66,70} When consumption did change, there were both increases^{49,50,70} and decreases^{58,66} reported.

Six studies conducted in Poland, Italy, Denmark, Lithuania, Kuwait, and Spain investigated how the consumption of red meat changed during the pandemic.^{50,58,65,70,76,96} The most common result was no change in red meat consumption; however, when red meat consumption did change, it tended to decrease.^{50,58,65,70,76,96}

Three studies from Kuwait, the United States, and Kenya/Uganda^{49,70,73} examined how the consumption of poultry products changed during the pandemic, with results indicating no change⁴⁹ or decreases in consumption.^{70,73}

Of the more specified measures of meat consumption, no change in intake was the most common response for low-fat meats (Poland),⁶⁶ flesh meats (Iran),⁸⁴ “red meat, chicken, and fish” (Turkey),¹⁰⁷ and “beef, pork, or lamb” (United States).⁴⁹ One study in Italy found that more participants reported an increased consumption of both white meat and preserved meat than a reduced consumption⁵⁸ and one study in Spain found that there was an increase in the percentage of participants who reported consuming two or more portions of “red meat, hamburgers, sausages, or cold meats” per day during the pandemic (17.3%) compared with 12.9% who did so before the pandemic.⁹⁹ Conversely, one study in Iran found a significant decrease in the consumption of organ meats.⁸⁴

Fish and/or Seafood. A total of 13 studies measured changes in consumption of fish and/or seafood during the pandemic.^{49,50,58,65,66,70,73,76,77,84,96,99,109} Studies from Poland, Denmark, Spain, Lithuania, Iran, and the United States found that the majority of participants (68.4% to 78.3%) reported that their consumption of fish and/or seafood remained the same during the pandemic.^{49,50,65,66,76,84,96} When consumption did change, it tended to decrease (14.3% to 21%).^{49,66,76,96} In fact, studies from Kuwait, China (longitudinal), Kenya, and Uganda found that a decrease in consumption was most common.^{70,73,109} However, increases in consumption were also reported in Canada and Spain.^{77,99} One study from Italy found that consumption changed by type of fish with an increase in preserved and frozen fish intake and a decrease in fresh fish intake.⁵⁸

Legumes. Eleven studies examined changes in the consumption of legumes during the pandemic.^{50,58,65,66,76,80,82,84,86,96,99} Overall, findings from Poland, Denmark, Spain, Lithuania, Turkey, and Zimbabwe suggest that intake of legumes remained at similar levels during compared with before the pandemic,^{50,65,66,76,82,96,107} although several studies (in Spain, Italy, and Iran) did report increased consumption,^{58,84,99} and one study (in Brazil) reported a decrease.⁸⁰ One study from Italy looked at proteins and included in this list was meat, fish eggs, cheese, and legumes.⁸⁶ They found that for most participants (54%) protein consumption was unchanged, with the second most common response being increased consumption (27.3%).⁸⁶

Frozen Foods. One longitudinal study¹⁰⁹ from China and five cross-sectional studies^{13,48,55,56,80} from the United States, Qatar, United Arab Emirates, Middle East and North Africa, and Brazil measured changes in frozen food consumption with mixed results suggesting an overall decrease^{55,109} or no change in intake.^{13,48,56} Conversely, in one study out of Brazil there was an increase in participants who reported consuming ready-to-eat frozen food (eg, frozen pizza and frozen lasagna) more than 2 days a week during (14.6%) compared with before (10.0%) the pandemic.⁸⁰

Fast Food. Ten studies examined how the consumption of fast food changed during the pandemic.^{13,50,53,55,56,62,65,66,76,96} Overall, consumption tended to remain the same^{65,66,76,96} or decrease^{13,50,55,56,62} in countries including the United States, United Kingdom, Australia, United Arab Emirates, Middle East and North Africa, Poland, Denmark, Spain, and Lithuania. In one study from Canada, more people reported eating less (mothers: 42%, fathers: 44%, children: 26%) rather than more (mothers: 10%, fathers: 13%, children: 8%) fast food during the pandemic.⁵³

Homemade Foods. Eight studies examined changes in consumption of homemade foods during the pandemic.^{41,55,56,58,65,66,76,92} In contrast to all other food categories, the overall consumption of homemade foods tended to increase during the pandemic; two studies found increases in the percentage of participants that reported homemade meals as one of their most consumed meals (Middle East and North Africa and United Arab Emirates).^{55,56} One study found a significant increase in the frequency of eating home-cooked meals (Saudi Arabia) and one study found that the majority of participants (59.6%) reported cooking at home more than before the pandemic (Chile).^{41,92} Furthermore, a study in Poland found the largest group of participants (48.8%) reported that their consumption of homemade meals remained the same; the second most endorsed option was nearly as common and was increased intake (48.0%).⁶⁶

Considering specific homemade foods, three studies from Poland, Denmark, and Lithuania found most participants (50.8% to 53.8%) reported no change in their consumption of homemade pastries; however, a considerable percentage of participants (37.7% to 39.9%) reported an increase.^{65,66,76} Further, in a study out of Italy, more participants reported increased than decreased consumption of both homemade sweets and homemade pizza.⁵⁸

Snack Food. Eighteen studies assessed how the consumption of snack foods changed during the pandemic.^{46,48,49,51,53,58,64,65,66,76,80,85,86,91,96,100,107,109}

One longitudinal⁶⁴ and eight cross-sectional^{46,53,65,76,85,86,96,107} studies showed that when measured as an overall category, snack food intake tended to increase or remain stable in Australia, Saudi Arabia, Canada, Lithuania, Spain, Greece, Italy, Denmark, and Turkey.

Considering specific snack foods, two studies conducted in Poland and the United States examined consumption of salty snacks (ie, potato chips, crackers, and popcorn)^{49,66} and one study from Italy assessed salty and sweet snacks together.¹⁰⁰ In the three studies, most participants (49.6% to 62.2%) reported that their consumption of salty snacks was unchanged.^{49,66,100} The second most common response was

increased consumption (23.5% to 37.4%) in the studies from Italy¹⁰⁰ and the United States⁴⁹ and decreased consumption (19.7%) in the study from Poland.⁶⁶ One study asked only about increased consumption with 21% of respondents from the United Arab Emirates reporting increased salty snack intake.⁹¹ However, results from a study conducted in Italy show more participants reported a reduced intake (12.7%) compared with an increased intake (9.3%).⁵⁸

Considering savory snacks (ie, peanuts or other nuts, cream crackers, cheese biscuits and cheese, chips, and salty biscuits), consumption tended to remain the same or increase.^{51,80} Two studies found the highest proportion of participants (40% to 49%) reported no change in consumption^{46,51} with the second highest portion of participants reporting increased consumption (28%) in the United Kingdom⁵¹ and equal portions reporting decreased consumption (30%) and increased consumption (30%) in Saudi Arabia.⁴⁶ In addition, a Brazilian study found more participants reported consuming savory snacks more than 2 days a week during the pandemic (13.2%) compared with before the pandemic (9.5%).⁸⁰

Two studies measured changes in consumption of sweet snacks (ie, chocolate, biscuits, cakes, ice cream, cupcakes, and cookies).^{51,91} One study from the United Kingdom found the highest portion of participants (46%) reported that their consumption was unchanged, and the second most common response (28%) was that consumption of sweet snacks increased.⁵¹ Another study from United Arab Emirates found that only 7.1% of participants reported consuming more sweet snacks during vs before the pandemic.⁹¹

One study from Qatar assessed snack consumption as the change in intake for both healthier snack foods and unhealthy snacks and found the largest portion of participants (41.1% to 57.7%) reported no change in consumption regardless of healthfulness.⁴⁸ When consumption did change, it tended to increase for healthy snacks (20.9%) and decrease for unhealthy snacks (32.4%). Finally, a longitudinal study from China examined the consumption of snacks and beverages together and found most participants reported either stable (38%) or decreased consumption (38%).¹⁰⁹

The results of all 18 studies that measured changes in snack food consumption indicate that, in general, the consumption of snack foods either remained the same or increased during the pandemic. The magnitude of the increased consumption was dependent on the type of snack food.

Sweets and/or Bakery Products. A total of 19 studies examined how the consumption of various types of sweets and/or bakery products changed during the pandemic.^{46,48,49,50,54,58,62,65,66,69,76,77,80,84,85,86,96,99,100} Overall, consumption of sweets and/or bakery products tended to either remain the same or increase.

Ten of the 19 studies asked participants about pandemic-related changes in their consumption of sweets in general or as a combined list of sweet foods (ie, a single item with multiple sweets listed).^{46,48,49,50,58,62,80,84,86,100} Studies from Saudi Arabia,⁴⁶ Poland,⁵⁰ Brazil,⁸⁰ Italy,⁸⁶ and a large international sample (United States/United Kingdom/Australia/Canada/other)⁶² found the most common response was an increase in sweets consumption (44% to 50%). One study from the United States, found nearly equal proportions of participants reporting increased (43.9%) or no change (43.5%) in

consumption.⁴⁹ Studies from Qatar⁴⁸ and Italy¹⁰⁰ found the most common response was no change in consumption (43.3% to 44%). Of these studies, the second most common response was decreased consumption (28.7%) for one study⁴⁸ and increased (42.5%) for the other.¹⁰⁰ Finally, one study from Iran found that there was a significant decrease in sweets consumption⁸⁴ and one study from Italy found more participants reported a reduced intake (16.7%) compared with an increased intake (11.3%) of sweets during the pandemic.⁵⁸

Five studies based in Denmark,⁶⁵ Poland,⁶⁶ Spain/Greece,⁸⁵ Spain,⁹⁶ and Lithuania⁷⁶ assessed changes in the consumption of pastries during the pandemic. For most participants (55.2% to 60.6%) consumption was unchanged.^{65,66,76,96} Similarly, when asked whether or not they consumed more pastries during the pandemic, 69.4% of participants from Spain and 62.2% of the participants from Greece responded they had not.⁸⁵ When consumption did change there were both reported increases^{65,96} and decreases.^{66,76}

Two studies from an international sample (Nigeria/Turkey/United States/Europe)⁵⁴ and Spain⁹⁹ examined how the consumption of bakery products in general changed during the pandemic. One found fewer participants reported preferring bakery foods during the pandemic (10%) compared to before (20%).⁵⁴ The other study found a significant increase in the consumption of bakery foods during the pandemic.⁹⁹

Two studies from Poland⁶⁶ and Germany⁶⁹ examined how the consumption of confectionaries changed during the pandemic. The largest group of participants from Germany (44.5%) reported increased consumption,⁶⁹ whereas the largest group of participants from Poland (48.7%) reported no change in consumption.⁶⁶

Two studies assessed more specified measures of sweets and/or bakery products.^{66,77} In Poland, the most common response was no change in the consumption of sweetened spreads (91.6%), ice cream and pudding (74.9%), and sweetened cereal and/or cereal bars (88.3%).⁶⁶ In addition, one study from Canada found a significant decrease in the consumption of added sugars.⁷⁷

Healthy Eating

A total of 21 studies addressed changes in the healthiness of food eaten during the pandemic.^{41,43,44,48,52,58,59,60,62,66,71,73,75,81,86,87,89,94,98,99,105} See Table 5 for a summary of measures and findings.

Seventeen studies used self-report measures to gauge perceived changes in healthy eating (eg, before and during the pandemic “How would you rate your overall habits of eating healthy foods?”).^{41,43,44,48,52,58,59,60,62,71,73,75,86,89,94,98,105} The most common finding was no change in the healthiness of foods eaten.^{48,52,58,59,71,86,89,98} When the second most common responses are considered for studies that had predominately no-change responses, results are almost equally mixed between increases and decreases in healthy eating. One study out of Qatar found large numbers of participants reported improved healthiness of their diets with 44.5% of respondents perceiving a decrease in unhealthy food consumption and 32.3% perceiving an increase in healthy consumption.⁴⁸ Concordantly, studies from Italy⁵² and France⁹⁸ found the second most common response behind no change (47% and 54%, respectively) was improved diet quality (34%)⁵² and a more balanced diet (29%).⁹⁸ However, the

second most common response in a study from Italy was a worsening in eating habits (37.2%)⁵⁸ and one large international study found more participants reported eating less healthfully (35.6%) than more healthfully (20.7%).⁶²

When the most common response was a change in self-reported perceptions of healthy eating (meaning more respondents indicated there was a change in the healthiness of their meals than not) changes were divided between increases and decreases in healthy eating. For example, one study from Saudi Arabia found that there was a significant increase in participants rating their food as good/excellent in healthiness (22.3% before to 29.5% during the pandemic).⁴¹ Similarly, a study from Vietnam found that 42.8% of respondents reported eating healthier in 2020 than before the pandemic.⁶⁰ Conversely, three studies tended toward decreases in healthiness during the pandemic relative to before; one international study with respondents from North Africa, Western Asia, Europe, and 3% “other” countries (not specified by the authors) found that there was a significant increase in participants reporting unhealthy eating from before to during the pandemic.⁴⁴ A study from Scotland showed 40.9% of respondents reported their diet was less healthy in 2020 than it was prepandemic⁷¹ and 61.2% of participants from a US study reported greater challenge in adhering to healthy diet plans during the pandemic relative to before.⁴³ Finally, 55% of a sample from Kenya and Uganda reported they were unable to eat healthy/nutritious foods during the pandemic, compared with 21% before.⁷³ Findings from the study suggests this limitation was related to participants experiencing higher levels food insecurity during the pandemic.

Emblematic of these mixed results, studies from the United Kingdom⁹⁴ and United States⁷⁵ found close to equal proportions of self-reported diet change. In the United States, 37% reported no change in overall diet, 32% reported a healthier diet, and 31% reported a worse diet compared with before the pandemic.⁷⁵ In the United Kingdom, 31% of participants stated there was no change in how often they ate healthy and balanced meals, whereas 35% reported eating healthier meals more frequently and 35% reported less.⁹⁴

Six studies used self-report plus researcher categorization of healthiness to assess changes during the COVID-19 pandemic (eg, participants would report their consumption of various categories of foods—fish, vegetables, and so on—and the researchers would use these self-report data to code the extent to which the participant followed the Mediterranean diet) with findings showing mixed results.^{58,62,66,81,87,99} For example, one study in Italy found that 37.4% reported eating more foods deemed to be healthy defined here by their adherence to the Mediterranean diet (eg, fruits and nuts) and 35.8% ate healthy foods less.⁵⁸ Moreover, one study in Poland generated three eating patterns based on consumption of healthy foods (eg, vegetables) and nonrecommended foods (eg, sweets). The “constant” pattern of relatively stable eating from before to during the pandemic included the largest portion of participants (53%), followed by the “prohealthy” pattern of eating (27.6%) characterized by increased intake of healthy foods and decreased intake of nonrecommended foods.⁶⁶ Three studies used validated measures of healthiness and found opposing results; a study from the United States, United Kingdom, Australia, Canada, and a small portion of other countries found a significant increase in overall healthy eating ($P < 0.001$).⁶²

whereas studies from France and Vietnam showed a significant decrease in healthy eating compared with before lockdown ($P < 0.001$).^{81,87} Lastly, one Spanish study measured healthy eating as high adherence to the Mediterranean diet, finding that there was an increase from 4.7% to 8% adherence from before to during the pandemic.⁹⁹

Eating Behaviors Not Otherwise Specified

This section reviews 19 articles addressing changes in four categories of key eating behaviors during COVID-19 compared with before: binge eating,^{63,88,90,95} uncontrolled/out of control eating,^{44,61,93,103} overeating,^{75,94} and restrictive eating behaviors, including meal skipping and fasting.^{40,43,55,56,58,61,63,67,70,73,74,75,88,94,103} See Table 6 for a summary of measures and findings.

Binge Eating, Uncontrolled Eating, and Overeating. Taken together, binge eating, uncontrolled/out-of-control eating, and overeating represent a similar set of disordered eating behaviors. Studying these behaviors in isolation can be hard for researchers because measures are not always consistent across studies. For example, in this review some studies measuring binge eating used full validated measures,^{63,88} a selected portion of a questionnaire on eating patterns,⁹⁰ and researcher-derived items such as “compared with before the COVID-19 virus crisis, I have binged on food.”⁹⁵ These differences not only provide a challenge to generalize across studies but also make it hard to differentiate between these related constructs. For instance, one study used the following two items to measure binge eating: “In the past month, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge-eating)?” and “During the times when you ate this way, did you feel you couldn’t stop eating or control what or how much you were eating?”⁹⁰ These items have strong conceptual overlap with out-of-control eating and overeating, which are themselves components of binge eating.

In the current review, we will be discussing the three constructs of binge eating, out-of-control eating, and overeating as described in the original studies. Details about each measure and their corresponding results can be found on Table 6.

Binge eating. Binge eating is defined as eating a large amount of food in a short period of time while feeling an inability to stop eating.¹¹⁷ Four articles specifically discussed binge eating and found that it generally increased or remained the same during the pandemic.^{63,88,90,95} For example, in a study from the United Kingdom, 49% of participants reported increases in binge eating compared with before the COVID-19 crisis (19% reported less and 33% reported no change).⁹⁵ A large proportion of participants (34.6%) in a study from Australia also reported increased binge eating behaviors during relative to before COVID-19 (60% reported no change).⁸⁸

Changes in binge eating were related to several factors. For instance, a longitudinal study from the United States found that binge eating was 2.88 times higher during the pandemic among individuals who experienced prepandemic weight stigma.⁹⁰ In addition, in one study from France, increases in binge eating at the start of the pandemic were higher among

those who had higher body mass index, perceived stress, stress related to lockdown, depression, and anxiety, as well as those who were women and had probable eating disorders.⁶³ Moreover, anticipated bingeing in the next 2 weeks during lockdown was associated with higher age, depression, stress related to lockdown, COVID-19 media exposure, and risk of eating disorders and lower body mass index, impulse regulation, and body satisfaction.⁶³

Uncontrolled/out of control eating. Uncontrolled eating can be described as the inability to control the amount or type of eating once started, regardless of how much was eaten.¹¹⁷ A total of four articles included uncontrolled eating as a reported measure of eating behavior change during the pandemic.^{44,61,93,103} Overall, there were increases in uncontrolled eating. For example, in one study from North Africa, western Asia, and Europe, there were more participants reporting eating out of control most of the time (20.4%) and always (9.6%) compared with before the pandemic (9.7% and 2.3% respectively).⁴⁴ Similarly, two studies from Turkey found increases in uncontrolled eating behavior compared with before COVID-19^{61,103}; one reported that increased uncontrolled eating was related to lower income (compared with higher income) and younger age (18 to 20 years old compared with above 35).¹⁰³ Lastly, the majority of participants in a study from the United Kingdom reported either agreeing (29.4%) or strongly agreeing (23.7%) that it was more difficult to control or regulate their eating during the pandemic than it had been before the pandemic.⁹³

Overeating. Two articles discussed overeating.^{75,94} One study from the United Kingdom found increases in overeating during lockdown compared with before, with increases related to being female, being younger, and a lower education, as well as a higher body mass index, having had COVID-19, and having negative mental health since lockdown or a previous psychiatric diagnosis.⁹⁴ In addition, a study from the United States found equal proportions of respondents reporting more (39%) and no change (39%) in overeating during the pandemic compared with before the pandemic.⁷⁵

Restrictive Eating. Six studies assessed changes in restrictive eating (outside of meal skipping) during the COVID-19 pandemic with mixed results.^{61,63,67,75,88,103} Two studies from Australia and the United States found that the majority of participants (59% and 52%, respectively) reported no changes in food restriction and restricted eating; however, the next largest portion of participants reported an increase (27.6%) of food restriction in the study from Australia⁸⁸ and a decrease (28%) of restricted eating in the study from the United States.⁷⁵ In one study from Turkey, cognitive restraint decreased during the pandemic,¹⁰³ and in another study, 9.1% of adults from Turkey reported increased restrained eating during the pandemic.⁶¹

Varying results in restrictive eating could be related to individual differences. One study from France looked at factors related to changes dietary restriction and found anticipated dietary restriction was higher among women, those whose body mass indexes were classified as “underweight” or “obese,” as well as those who had higher stress related to lockdown, were at risk of eating disorders, had higher levels

of body dissatisfaction, lower impulse regulation, and higher endorsements of appearance ideals.⁶³ Similarly, a study of Lebanese adults showed that higher restraint scores were predicted by greater fears related to COVID-19, higher body mass index, and more physical activity.⁶⁷

Meal Skipping and Fasting. Ten studies assessed meal skipping and fasting during the pandemic generally finding either no change or a decrease during the pandemic compared to before.^{40,43,55,56,58,70,73,74,75,94} For example, studies from the United States and United Kingdom showed predominantly no change (both 45%) or a decrease (30% to 31%) in meal skipping.^{75,94} In the same US-based study, the majority of individuals (54%) reported no changes in fasting, with 30% of participants reporting less fasting.⁷⁵ Still, two studies from the United Arab Emirates and Middle East and North Africa showed a significant decrease in meal skipping comparing levels before the pandemic (64.4% to 65.5%) and during the pandemic (45.1% to 46.2%).^{55,56} One study out of Kenya and Uganda did find that significantly more individuals skipped meals during the COVID-19 period compared with before.⁷³ However, there was a significant increase in food insecurity in this sample; skipping meals likely came out of necessity, which might be one possible explanation for the disparate findings.⁷³

There were differences in skipping depending on the meal. For example, one study from Kuwait found there was a decrease in the amount of people skipping the snack between breakfast and lunch and an increase in skipping lunch.⁷⁰ Similarly, during the pandemic, participants from Turkey reported skipping breakfast and snacks less and skipping lunch more compared with before the pandemic.⁷⁴ Finally, whereas 17.5% of people in a study from Italy reported skipping meals they normally ate, 23.5% reported they introduced a snack/meal.⁵⁸

People cited different reasons for meal skipping. In a US study, parents with financial concerns also reported cutting or skipping meals on more days per month during the pandemic (11.0 ± 7.5 days/month) compared with before the pandemic (2.9 ± 2.2 days/month).⁴⁰ Another US study also found that reports of meal skipping were related to financial strain (12.1% of participants), but overall, the majority (78.3%) of the sample was not food insecure.⁴³ Finally, studies from the United Arab Emirates and Middle East and North Africa found that reasons for skipping meals changed with fewer people reporting skipping meals due to lack of time and more in people citing: aims to lose weight (18.5% up to 23.6%), fasting (10.3% up to 25.7%), lack of appetite (27.7% up to 36.0%), and to reduce food intake (21.7% up to 29.1%).^{55,56}

Reasons for Eating

This section reviews changes in reasons for eating reported during the COVID-19 pandemic relative to before the pandemic from a total of 27 articles.^{40,43,51,53,55,56,57,61,63,67,70,72,73,74,75,81,84,86,89,90,93,94,97,98,100,103,108}

One's reasons for changes in eating behaviors can be related to psychological, social, and emotional states,^{118,119} all of which have been altered during the COVID-19 pandemic.¹⁷ In the studies reviewed here, three general themes encompass participants' reasons for changes in eating behavior: emotions and mood, cravings, weight control or body image,

and increased/decreased environmental opportunity. See Table 7 for a summary of measures and findings.

Emotions and Mood. In general, cross-sectional^{51,57,94,103} and longitudinal⁶¹ studies showed increases in emotional eating, which were usually related to increased eating. For example, a study from the United Kingdom found greater emotional overeating and lower emotional undereating behaviors were associated with increased eating overall.⁵¹ However, emotional eating did not look the same for all respondents; for example, in one study from the United Kingdom, 42% of individuals ate more and 26% ate less due to their feelings.⁹⁴ Considering general mood, 48% of participants from a study in France reported mood was of increased importance to their eating behaviors and this increased importance was associated with negative diet quality.⁸¹

The following subsections discuss specific mood and emotion-related reasons for changes in eating.

Depression and anxiety. Ten studies conducted out of France ($n = 3$),^{63,97,98} Turkey ($n = 1$),⁷⁴ Lebanon ($n = 1$),⁶⁷ the United States ($n = 1$),⁹⁰ the United Kingdom ($n = 1$),⁹³ and Italy ($n = 3$)^{57,86,100} found that depression and anxiety (and related factors) were related to changes in eating behaviors during the early COVID-19 pandemic. For example, 34.7% of participants from a study based out of Italy reported that anxiety and depression were the main reasons for changes in their eating habits.⁸⁶

Depression was investigated less than anxiety; however, findings suggest that increased depression and similar forms of negative mental health were related to specific changes in eating behaviors. A study conducted in France reported that negative changes in depression were associated with negative changes in nutrition.⁹⁸ Further, a longitudinal study from the United States found that experiences of weight stigma and weight-related teasing before the pandemic were related to greater depression scores and eating as a coping mechanism during the pandemic.⁹⁰ Two studies reported on factors related to depression. One study out of France found that those who reported increased consumption of higher caloric and salty foods had a higher likelihood of lower mental well-being.⁹⁷ In addition, one study from the United Kingdom found that psychological distress was associated with difficulties in eating regulation and control.⁹³

Anxiety was highly related to several different changes in eating behaviors. For example, one study from France found that higher anxiety was related to higher rates of both restriction and binge eating.⁶³ In a study from Lebanon greater anxiety was associated with higher participant eating concerns.⁶⁷ In addition, one study from Turkey found that higher anxiety was associated with increased consumption of certain types of food (eg, milk, cheese, meat, and bread).⁷⁴

In some cases, eating was the source of anxiety, and in others, food was used to quell anxiety. For example, one study conducted in Italy found 57.8% of their participants reported feeling anxious about their eating habits.⁵⁷ In the same study, participants reported eating as a response to anxious feelings (48.7%), eating more to feel better (55.1%), and excluding certain foods that specifically led to anxiety (20.3%).⁵⁷ In a similar study from Italy, 42.7% of participants reported that of stress, anxiety, and boredom among

quarantine were main reasons for their diet and that they ate more “comfort food” as a response to the anxiety.¹⁰⁰

Stress. Eleven studies representing the United States (n = 4),^{43,75,90,108} France (n = 3),^{63,97,98} Kuwait (n = 1),⁷⁰ Poland (n = 1),⁷² and the Netherlands (n = 1)⁵⁶ investigated stress and found increases in stress eating^{43,108} feelings of stress managed by eating,^{89,90} the percentage of participants reporting eating in response to stress,⁷⁰ and specific eating behaviors (eg, bingeing, restricted eating) related to stress.^{63,75} For example, 42.7% of participants in a study from Italy reported that increased stress, anxiety, and boredom, was a main reason for their changes in diet over quarantine.¹⁰⁰

Two studies from the United States found increases in the frequency of stress eating and⁴³ the amount of food eaten in response to stress.¹⁰⁸ In fact, there were many dietary changes in response to stress. Two studies from France found that stress was related to increased consumption of high calorie and salty food⁹⁷ and negative changes in diet nutrition.⁹⁸ Moreover, 19.2% of participants from a study from the Netherlands reported more stress was an important reason for eating unhealthier during the lockdown.⁸⁹

Stress is also related to maladaptive eating behaviors. For example, in the United States higher stress was related to changes in fasting, restricted eating, skipping meals, and overeating.⁷⁵ Moreover, a study from France found that participants with higher perceived stress and higher stress related to the COVID-19 lockdown had higher instances of binge eating.⁶³ Higher stress was related to the lockdown was also related to food restriction.⁶³

Fear and anger. Studies from Lebanon,⁶⁷ Turkey,⁷⁴ Poland,⁷² and Kuwait⁷⁰ found that fear of COVID-19 and anger were reasons for eating changes during the pandemic.^{67,70,72,74} Specifically, in a study out of Lebanon, fear of COVID-19 was related to higher scores in restrained eating, and anger and fear of COVID-19 were associated with higher eating concern scores.⁶⁷ In a study from Turkey, fear of COVID-19 was associated with increased eating of specific foods such as cakes, cookies, cheese, and dried fruit.⁷⁴ One study out of Poland explained that fear of limited access to food (reported by 39% of participants) was most strongly predicted by perceived changes in food availability.⁷² Finally, in a study out of Kuwait, a greater number of people who reported eating when they felt angry, stressed, unhappy, or bored was larger during the pandemic compared with before.⁷⁰

Boredom. Five studies found boredom to be a strong influence on eating behaviors during the COVID-19 pandemic.^{67,70,86,89,108} For example, one study from Italy found that boredom was a main reason for changes in eating behavior⁸⁶ and in another study from the United States, 73% of adults reported eating more when bored.¹⁰⁸ Studies from the Netherlands⁸⁹ and Lebanon⁶⁷ found that boredom was linked to increased eating concern⁶⁷ and was a reason for increased eating during lockdown compared with before.⁸⁹

Cravings. Three studies found that cravings increased or remained the same during the pandemic.^{51,93,108} A study based in the United Kingdom found 46% of participants reported an increase in cravings during (vs before) the

pandemic with only 23% reporting a decrease.⁵¹ Craving intensity was examined in the same study, although 41% reported no changes in craving intensity, the next largest group (36%) reported increased intensity of cravings. Moreover, a higher number of people reported lower craving control during COVID-19 compared with before.⁵¹ These results parallel findings from the United States in which 73% of participants reported an increase in “eating because [they] crave certain foods” during the pandemic relative to before.¹⁰⁸ Relatedly, in one study from the United Kingdom, most participants reported that they were more preoccupied with food and/or eating (37.8% agree, 21.8% strongly agree) during the pandemic compared with before.⁹³

Weight Control and Body Image. Four studies found that weight loss intentions, weight control, and body dissatisfaction contributed to changes in eating behaviors.^{81,56,55,63} For example, one study conducted in France assessing food choice motives found that higher perceived importance of weight control was related to decreased nutritional quality during the pandemic.⁸¹ Similarly, studies from the United Arab Emirates and Middle East and North Africa found increases in the amount of people citing weight loss intentions as a main reason for skipping meals (18.5% to 20.2% before and 23.6% to 23.8% during, respectively).^{56,55} Relatedly, a study out of France showed that greater feelings of body dissatisfaction and higher endorsement of ideal body stereotypes were related to both increased dietary restriction and binge eating during the pandemic.⁶³

Environmental Factors. Thirteen articles reported on environmental factors as reasons for eating.^{40,43,53,55,56,72,73,84,86,89,94,97,108} The specific social and physical environmental factors assessed are presented below.

Eating with family and friends. Four studies found that the presence or absence of family and friends influenced individuals' eating during the pandemic.^{86,89,97,108} In a study from Italy, 21.3% of participants reported family presence as influencing their eating behaviors.⁸⁶ These findings were consistent with a study out of the United States in which 59% of participants reported eating more often with friends and family during quarantine compared with before quarantine.¹⁰⁸ Similarly, on study conducted in France found that increased consumption of high calorie and/or salty food was related to being alone during lockdown and having a partner.⁹⁷ Moreover, 17.8% of participants from a study out of the Netherlands reported that fewer social contacts and feeling lonely were important reasons for their eating less healthfully during the lockdown.⁸⁹

Time. Changes in available time showed mixed influence on eating behaviors. Increased time for cooking was reported among 32.7% of individuals from Italy, and increased cooking time was cited as one of the main reasons for changes in eating behaviors during the pandemic.⁸⁶ One study from the United Kingdom found that 88% of participants had time to eat healthy.⁹⁴ This parallels find from one study from the Netherlands where participants reported that more time and head space to prepare healthy meals (30.3%) and more time

and head space to be conscious about healthy meals (26.3%) were some of the top reasons for eating healthier during lockdown.⁸⁹ However, in the same study, more leisure time (31.5%) and more time, head space, and opportunity to bake (19.2%) were some of the top factors for eating unhealthier during lockdown.⁸⁹ Lastly, those reporting a lack of time as a main reason for meal skipping decreased during the pandemic.^{55,56}

Increased exposure to food. Food availability and exposure to food cues were also related to changes in eating behaviors during COVID-19. For example, in an Italian sample, 19.3% of participants reported the continuous availability of food as a main reason for eating changes.⁸⁶ In a study from the Netherlands, 35.6% of participants endorsed an increase in unhealthy temptations at home as a main reason for less healthful eating during the lockdown; however, this same study also suggested decreased exposures to unhealthy food temptations at work, social events, and dinners were important reasons for eating healthier during the pandemic.⁸⁹ Finally, 65% of participants in a study from the United States reported increased eating in response to the sight and smell of food during COVID-19 compared with before.¹⁰⁸

Lack of Resources: Food Insecurity. Food insecurity and low food availability were further reasons for eating changes during the early months of the COVID-19 pandemic. In Kenya and Uganda, there was a 39% increase in food insecurity (16% increase in severe insecurity), and this was related to increases in worrying about not having enough food, being unable to eat healthy/nutritious foods, eating only a few kinds of foods, skipping meals, eating less food, running out of food, feeling hungry and not eating, and going without eating for a whole day.⁷³ Finding of food insecurity in the United States were mixed; one study reported that food security lowered by 17% and families with low food security increased by 20% during the pandemic.⁴⁰ Moreover, this same study explained that increases in skipped meals during the pandemic was related to decreases in available money.⁴⁰ However, another study from the United States found that 78.3% of the sample was not food insecure.⁴³ Moreover, one study conducted in Canada showed low reports of food insecurity in the past month (at the time of the study) and low expectations of food insecurity in the 6 months to come⁵³ and a study from Iran showed that food insecurity significantly reduced during the pandemic.⁸⁴ Lastly, a study from Poland found 87.4% of participants noticed changes in food availability, which was the strongest predictor of fear for limited food access (reported by 39%).⁷²

DISCUSSION

The COVID-19 pandemic has caused an unprecedented upheaval in the everyday experiences of individuals around the world. The virus and the widely mandated lockdowns used to prevent its spread left people with limited access to care and support, caused a host of economic and social stressors, and affected mental health around the world.^{17,120} These combined outcomes as well as the disruptions to daily routines can influence eating behaviors in unexpected ways. It is important to understand how eating behaviors have changed

during the pandemic not only because of the well-established links between nutrition and a wide variety of chronic diseases, but also because of newly emerging evidence linking diet with COVID-19 susceptibility.^{30,31}

This narrative review sheds light on how key eating behaviors changed globally during the early stages of the COVID-19 pandemic for adults without eating disorders. In general, most studies showed that dietary behaviors were more likely to remain the same during the pandemic than they were to change. However, where behaviors like food intake did change, they tended toward increased consumption. For example, aggregated analysis of total intake showed that 44.9% of individuals reported no change in the amount of food consumed during the COVID-19 pandemic, and the next most common response (31%) was an increase in consumption. Similarly, frequency of consuming meals and snacks generally remained the same, with the next highest response being an increase in the number of meals and snacks consumed. These results are complicated by the use, in many studies, of simplified measures that assessed only increase, decrease, or no change.

Regarding changes to types of foods consumed during the pandemic, intake largely remained the same for most food groups, but trends did vary by food category. For fruits and vegetables, legumes, white breads/pastas, homemade pastries, and snacks (general as well as sweet, savory, and salty), participants reported stable or increased consumption. Decreased consumption was reported for specific vegetables such as dark green leafy vegetables. For dark breads/grains, meats (including red meats and processed meats), seafood/fish, frozen foods, and fast food, participants tended to either report no change or decreased consumption. Many of these increases and decreases could be at least partly explained by reduced access to restaurants during COVID-related lockdowns.¹²¹ Indeed, increased consumption was found for homemade foods in general (and for specific types of homemade foods measured separately, such as pizza and sweets). However, purchasing and consumption behaviors might have shifted more minutely in certain categories due to perceptions of COVID-19 and transmission. For example, people fearing COVID-19 infection may be less likely to buy fruits and vegetables with porous and/or edible skins but may also be keener to purchase and consume peelable vitamin A-rich fruits.⁸⁴ In fact, it should be noted that, as detailed above, many other social, psychological, and environmental factors also influenced dietary behaviors during the pandemic.^{40,43,51,53,55,56,57,61,63,67,70,72,73,74,75,81,84,86,89,90,93,94,97,98,100,103,108}

As discussed, location and food security, among other factors, influence the types of foods one is able to obtain. These factors are particularly important to consider in the case of fruits and vegetables and fish/seafood as access can differ considerably by region.

Results concerning changes in healthy eating were decidedly mixed. Most self-reported perceptions of changes showed stable levels of healthy eating; however, when eating behaviors did change or were assessed with researcher-generated measures, a similar number of studies reported increases and decreases in eating healthy during the pandemic compared with before. Differing definitions and perceptions of healthfulness as well as the use of measurements derived from various recommendation standards, often communicated on a country-by-country basis, may

explain some of these inconsistencies. Moreover, self-reported responses may be more prone to biases due to social desirability and the desire to showcase a healthy lifestyle.^{122–124}

Findings show that binge eating, uncontrolled/out of control eating, and overeating tended to increase during the COVID-19 pandemic compared with before. Mixed findings were found for restrictive eating. In general, meal skipping and fasting decreased; however, this varied by region. Some findings indicate increases in meal skipping, often due to financial concerns and food insecurity. Of note, there have been several reviews of disordered eating behaviors published before this review that lend more detailed findings and additional context to these types of behaviors.^{125–128}

Considering reasons for eating, emotions, and moods such as depression, stress, fear, anger, and boredom were all related to changes in eating behaviors, often being an increase in consumption. Cravings, weight control, and body image were also associated with eating behavior changes. Eating more frequently with family and friends and increased exposure to food cues were both related to an increase in food consumption, whereas food insecurity was typically related to a decrease in food consumption. Increases in available time showed mixed results because some individuals reported cooking healthier meals more often and skipping meals less often, whereas others used their leisure time to bake, which was one of the top-reported factors for eating less healthfully during the pandemic.

The overwhelming majority of the research studies reviewed here show, for most people, eating behaviors did not seem to change a great deal in the early periods of the COVID-19 pandemic. This dietary consistency even in the face of a pandemic could be because eating behaviors are largely based in routines and other automatized behaviors.¹²⁹ Although daily life changed for many, evidence shows that these habitual behaviors have remained intact.⁸⁹

For those whose eating behaviors did change, they tended to increase in amount and frequency of eating. Similarly, increases were noted for consumption of fruits and vegetables, legumes, white breads/pastas, homemade pastries, and snacks, and for behaviors such as binge eating, uncontrolled eating, overeating, and dietary restraint. Notable decreases were found in amount of food for those who were more food insecure and more generally in the consumption of dark green leafy vegetables, dark breads/grains, meats, seafood/fish, frozen foods, and fast food.

Strengths and Limitations

As of this writing, this is the first comprehensive international narrative review of changes in eating behaviors during the COVID-19 pandemic. This review synthesizes results from 71 articles from more than 30 countries worldwide.

The inclusion of data from many countries is a strength of this research but also means that readers must be aware that some data may not represent the patterns of dietary change that may be prevalent in their home regions. For instance, all of the studies that reported on the overall consumption of homemade foods were from countries in the Middle East; this leaves a substantial gap in the current understanding of

consumption of homemade foods in other areas of the world. It could be erroneous to assume similar pandemic experiences across different regions and countries; thus, it is important to consider the context of the studies reporting on the various dietary behaviors included in this review when attempting to make inferences about any specific geographic region.

Including only studies published or online-published in 2020 lends some benefits in comparability among the studies published during this time frame; in general, most studies describe the time period between April and June 2020. However, this scope provides limited understanding of how eating behaviors progress as pandemic life becomes the new normal. Future reviews and research studies should seek to longitudinally assess changes in eating behaviors over the course of the pandemic to clarify whether or not the changes in eating behaviors reported relatively early in the pandemic and reviewed here persist, cease, or otherwise change.

Moreover, the limited scope of this review necessitated the omission of numerous biopsychosocial correlates of eating behaviors that were undoubtedly influential during the pandemic. Previously existing inequities in health and well-being were exacerbated by the COVID-19 crisis particularly in areas of food insecurity.¹³⁰ For instance, food insecurity during the COVID-19 pandemic may have influenced people to redistribute their food budgets to maximize their purchase in ways they might not have previously done (eg, calories/cost and storage-ability) ultimately resulting in an increased or decreased consumption of certain foods.^{40,73,131} It is critical to study the intersecting disadvantages faced by individuals who have been socially marginalized because they are often overlooked in mainstream research despite their relevance to public health policy.¹³²

Challenges to Studying Eating during the COVID-19 Pandemic

Disruptions along multiple facets of the research process have generated substantial obstacles for researchers worldwide.¹³³ Social distancing measures reduced researchers' ability to collect data from participants in person; thus, data collected during the pandemic were largely self-reported. Although some self-report measures are the best options available for assessing specific constructs (such as emotions), other self-report measures can be problematic in terms of accuracy, especially regarding nutrition.¹³⁴ Qualitative research during the pandemic faced challenges with interview processes while quantitative researchers, without standardized pandemic-relevant measures, turned to self-generated items leading to a reduced ability to compare findings across studies.¹³³ Many researchers encountered low response rates to studies even when utilizing more accessible platforms such as online surveys which creates further concerns about sampling bias.¹³³ Further, there has been a reduction in the timely and expedited approvals from ethics review boards.¹³⁵ In addition to logistical obstacles, researchers studying diet during the pandemic faced hurdles in acquiring the finances and technology needed to run more-involved studies in a timely manner. Lastly, illness or caretaking responsibilities for those who have become ill create extra constraints on researcher time and availability.

The barriers described above are prevalent in the research on eating behaviors, as a paucity of researchers used objective measures in assessing dietary patterns and behaviors. Moreover, truly capturing changes in eating behaviors in an objective way necessitates extant longitudinal designs with comparative data both before and during the pandemic. Only five studies included in this review utilized longitudinal designs.^{61,64,68,90,109} Further, conducting controlled experiments assessing the influences of the COVID-19 pandemic on dietary behaviors was implausible; thus, results from this time period are based in descriptive statistics and cross-sectional associations, and causality should not be inferred.

Implications and Recommendations for Future Research

Scientists have speculated that although it has been more than 100 years since the last major pandemic (ie, the 1918 influenza pandemic), the COVID-19 pandemic will likely not be the only pandemic of the 21st century.¹³⁶ Research from the COVID-19 pandemic not only benefits current understanding of the pandemic as it continues to wreak havoc around the globe, but also informs public health professionals about key changes in health behaviors that may be affecting the spread of the virus and the effectiveness of mitigation techniques. Similarly, many lessons can be learned to inform the empirical study of eating behaviors in future public health emergencies.

One of the pressing questions surrounding the COVID-19 pandemic is about the lasting changes it will make to day-to-day life around the globe. Strategically designed longitudinal studies benefit understanding of dietary changes over time. Given that many of the studies conducted in 2020 and reviewed here examined earlier time points in disease spread and lockdown orders, there exists a dearth of research addressing the long-term effects of the COVID-19 pandemic on eating behaviors around the globe. Whereas this review found that changes in eating behaviors during the pandemic were less prevalent than stable eating patterns, determining how eating changes over the course of the pandemic lends valuable insights regarding altered patterns of behavior during times of crisis, isolation, and daily routine change.

An important area for future research is developing resilience in healthy eating patterns during pandemic conditions. In addition to generalized health benefits, consumption of nutritious foods has been highlighted as an effective tool for personal risk management through bolstered immune system functioning.^{30,137} Moreover, further studies should focus on clinical and subclinical instances of disordered eating to increase access to care and counseling services because research shows that these populations might be particularly vulnerable to eating behavior disturbances.¹³⁸ Lastly, researchers should continue to address how weakness in the economic systems due to public health crises influence food insecurity and corresponding changes in eating behaviors.

CONCLUSIONS

Although the COVID-19 pandemic has been associated with some changes in what and how people eat, by and large, eating behaviors remained quite stable during the COVID-19 pandemic. When changes did occur, there tended to be

increases in the amount and frequency of food intake, consumption of food such as snacks and specified behaviors such as binge eating, uncontrolled eating, and overeating. Decreases were found for foods such as fast food and for meal skipping behaviors. Changes in eating behaviors were typically related to changes in mood, emotion, cravings, and/or the environment. Despite the comprehensive nature of this review, many related biopsychosocial variables are not fully explored. Further work is needed to address the influence of critical factors such as food insecurity. By understanding how health behaviors such as eating change under pandemic conditions, public health officials can develop more targeted campaigns to improve health on a local, national, or international scale.

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
Bakhsh and colleagues ²⁰²¹ ⁴⁶	M/I: How has your consumption of the following foods changed during the pandemic: fruits and vegetables ...sweets (cake, chocolate, and ice cream), savory snacks (chips and salty biscuits)? RO: I ^c , D ^d , or U ^e	I = 48% U = 43% D = 9%	N/A ^f	N/A	Frequency of snacking: I = 45% U = 36% D = 19% Savory snacks: I = 30% U = 40% D = 30%	Sweets: I = 44% U = 31% D = 25%	N/A	N/A
Bann and colleagues ²⁰²⁰ ⁴⁷	M/I: How many portions of fruit and vegetables do you eat a day? RO: "From 0 to ≥ 6 ; portion guidance was provided"	Portions of fruits and vegetables consumed pre-pandemic similar to during lockdown	N/A	N/A	N/A	N/A	N/A	N/A
Ben Hassen and colleagues ²⁰²⁰ ^{48g}	M/I: How has your consumption of the following foods changed during the pandemic: Fruits/vegetables... Candy/cakes/cookies/pastries, healthy snacks, unhealthy snacks...? RO: "Much more, Moderately more, About the same, Slightly less, Much less, First time [meaning that their first time consuming the food was during the pandemic], or Never"	I = 32.4% U = 60% D = 5.8%	N/A	N/A	Healthy snacks: I = 20.9% U = 57.7% D = 12.7% Unhealthy Snacks: I = 12.2% U = 41.4% D = 32.4%	Candy, cookies, cakes, and pastries: I = 24.6% U = 43.3% D = 28.7%	N/A	N/A
Bin Zarah and colleagues ²⁰²⁰ ⁴⁹	M/I: How has your consumption of the following foods changed during the pandemic: Sweets, Potato chips or other salty snacks... Starchy vegetables... Eggs/chicken/turkey... Non-starchy	N/A	I = 16.4% U = 50.2% D = 33.4%	Starchy vegetables I = 8.5% U = 70% D = 21.5% Non-starchy vegetables:	Salty snacks: I = 37.4% U = 49.6% D = 13%	Sweets such as candy, cookies, pies: I = 43.9% U = 43.5% D = 12.6%	Fish or shellfish: I = 14.9% U = 68.4% D = 16.7%	N/A

(continued on next page)

Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
	Vegetables/salad, fruit... Fish or shellfish? RO: I, D, or U			I = 14.3% U = 57.5% D = 28.2%				
Błaszczyc-Bębenek and colleagues ²⁰²⁰ ⁵⁰	M/I: How frequently have you consumed the following foods before the pandemic and during the pandemic: fish... fruits, vegetables, fast foods... sweets...? RO: "(1) never, (2) 1–3 times a month, (3) once a week, (4) few times a week, (5) once a day, (6) few times a day" M/I: How many portions of each food did you consume both before and during the pandemic? RO: "(1) zero, (2) half a portion, (3) one, (4) two, (5) three, (6) four or more"	N/A	Frequency: No significant change Portion size: No significant change	Frequency: No significant change Portion size: No significant change	N/A	Sweets frequency: Significant increase (<i>P</i> = 0.0241) Sweets portion Size: Significant increase (<i>P</i> = 0.0029)	Fish frequency: No significant change Fishes Portion size: No significant change	Frequency: Significant decrease (<i>P</i> = 0.0001) Portion size: Significant decrease, (<i>P</i> < 0.0001)
Buckland and colleagues ²⁰²¹ ⁵¹	M/I: How has your consumption of the following foods changed during the pandemic: sweet snacks, savory snacks... fruit intake, vegetable intake? RO: "I eat a lot less, I eat a lot more, or I eat the same amount"	N/A	I = 48% U = 36% D = 16%	I = 49% U = 40% D = 11%	Sweet snacks: I = 28% U = 46% D = 26% Savory snacks: I = 28% U = 49% D = 22%	N/A	N/A	N/A
Carroll and colleagues ²⁰²⁰ ^{53h}	M/I: How has your and your child's diets changed during the pandemic? RO: "...eating more/fewer fruit and vegetables, eating more/less snack foods, such as chips or cookies, eating more/fewer foods from fast food/take out restaurants"	Mothers: Eating fewer = 22% Eating more = 20% Fathers: Eating fewer = 12% Eating more = 32%	N/A	N/A	Mothers: Eating fewer = 4% Eating more = 66% Fathers: Eating fewer = 4% Eating more = 58%	N/A	N/A	Mothers Eating fewer = 42% Eating more = 10% Fathers: Eating fewer = 44% Eating more = 13%

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
		Children: Eating fewer = 20% Eating more = 24%			Children: Eating fewer = 6% Eating more = 54%			Children Eating fewer = 26% Eating more = 8%
Celik and Dane, 2020 ⁵⁴	M/I: Which foods did you have a preference to consume both before and during the pandemic? RO: Vegetables, fruits... bakery foods	N/A	Before = 18.5% During = 26.5%	Before = 14.4% During = 24.6%	N/A	Bakery foods: Before = 20% During = 10%	N/A	N/A
Cheikh Ismail and colleagues2020 ⁵⁵	M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? RO: "...fast food..."	N/A	N/A	N/A	N/A	N/A	N/A	Significant decreased consumption (P < 0.001)
Cheikh Ismail and colleagues2021 ⁵⁶	M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? RO: "... fast food..."	N/A	N/A	N/A	N/A	N/A	N/A	Significant decreased consumption (P < 0.001)
Chenarides and colleagues2021 ^{13f}	M/I: "How much more or less have you consumed these foods since COVID-19 started?" for 10 major food groups: fresh produce,...fast food..." RO: "A lot more (5), A bit more (4), About the same (3), A little less (2), A lot less (1) and Do not consume"	I = 27.53% U = 54.59% D = 16.84%	N/A	N/A	N/A	N/A	N/A	I = 16.84% U = 21.37% D = 47.97%
Di Renzo, Gualtieri, Pivari, and colleagues2020 ^{58h}	M/I: "During this [quarantine] period, which of these foods are you consuming MORE than before?" RO: "...fruits, fresh vegetables, frozen vegetables,...industrial bakery products/sweets, fish, frozen fish, canned fish..."	N/A	Fresh fruit Reduced intake = 18% Increased intake = 15.3%	Packaged vegetables Reduced intake = 6.0% Increased intake = 8.0% Fresh	Snacks: Reduced intake = 12.7% Increased intake = 9.3%	Packaged sweets: Reduced intake = 16.7% Increased intake = 11.3%	Preserved fish: Reduced intake = 4.7% Increased intake = 6.7% Frozen fish: Reduced intake	N/A

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
	snacks..." M/I: "During this [quarantine] period, which of these foods are you consuming LESS than before?" RO: "...fruits, fresh vegetables, frozen vegetables... industrial bakery products/sweets, fish, frozen fish, canned fish... snacks..."			vegetables Reduced intake = 17.3% Increased intake = 19.3%			= 8.0% Increased intake = 9.3% Fresh fish: Reduced intake = 24.7% Increased intake = 4.7%	
Flanagan and colleagues ²⁰²¹ ⁶²	M/I: In an average week, how frequently did you engage in each of the following behaviors both before and during the pandemic... consuming less than 2 fruits and vegetables per day,... eating fast food 2 or more times...eating sweets and desserts...? RO: Usually/often, Sometimes, or Rarely/never"	N/A	Significant decrease in frequency of eating <2 servings per day (<i>P</i> < 0.001)	No significant change in the frequency of eating <2 servings per day	N/A	Significant increase in the frequency of eating sweets or desserts (<i>P</i> < 0.001)	N/A	Significant decrease in the frequency of eating two or more meals from fast food (<i>P</i> < 0.001)
Gallo and colleagues ²⁰²⁰ ⁶⁴	M/I: Which foods did you consume in the last 24 hours? RO: "Foods and beverages were entered by typing in specific search terms and selecting items from a returned list" Results compared with 2018 and 2019 studies	N/A	N/A	N/A	Significant increase in 2 snack occasions with 1 and energy density attributed to snacks for women	N/A	N/A	N/A
Giacalone and colleagues ²⁰²⁰ ⁶⁵	M/I: How has your frequency of snaking changed during the pandemic? How has your consumption of the following foods changed during the pandemic: Vegetables, fruit ...Fish,	N/A	I = 11.1% U = 64.0% D = 24.9%	I = 11.3% U = 69.2% D = 19.5%	I = 41.7% U = 47.5% D = 10.8%	Pastries commercial: I = 21.1% U = 60.6% D = 18.4%	I = 15.8% U = 75.8% D = 8.4%	I = 15.1% U = 59.5% D = 25.4%

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
Górnick and colleagues2020 ⁶⁶	<p>pastries (commercial)... Fast food?</p> <p>RO: Higher, Lower, or As Before.</p> <p>M/I: Has your consumption of the following foods changed during the pandemic: vegetables, fruits... fish and seafood... fast foods, salty snacks, confectionary, sweetened spreads, commercial pastry, ice cream and puddings, sweetened cereals and/or cereal bars?</p> <p>RO: "I eat more/I eat the same/I eat less/I didn't eat before and during the pandemic"</p>	N/A	<p>I = 15.2%</p> <p>U = 64.7%</p> <p>D = 20.1%</p>	<p>I = 18.5%</p> <p>U = 62.1%</p> <p>D = 19.4%</p>	<p>Salty snacks:</p> <p>Increased = 18.1%</p> <p>U = 62.2%</p> <p>D = 19.7%</p>	<p>Confectionary:</p> <p>I = 32.5%</p> <p>U = 48.7%</p> <p>D = 18.8%</p> <p>Sweetened spreads:</p> <p>I = 3.7%</p> <p>U = 91.6%</p> <p>D = 4.7%</p> <p>Commercial pastry:</p> <p>I = 10.9%</p> <p>U = 59.6%</p> <p>D = 29.4%</p> <p>Ice cream and pudding:</p> <p>I = 10.0%</p> <p>U = 74.9%</p> <p>D = 15.0%</p> <p>Sweetened cereal and/or cereal bars:</p> <p>I = 5.4%</p> <p>U = 88.3%</p> <p>D = 6.3%</p>	<p>I = 6.8%</p> <p>U = 76.2%</p> <p>D = 17.0%</p>	<p>I = 8.1%</p> <p>U = 55.3%</p> <p>D = 36.6%</p>
Huber and colleagues2021 ⁶⁹	<p>M/I: How has your consumption of the following foods changed during the pandemic: Confectionaries... Fruits, vegetables?</p> <p>RO: Increased, Decreased, or Unchanged</p>	N/A	<p>I = 33%</p> <p>U=52%</p> <p>D = 14.5%</p>	<p>I = 31.5%</p> <p>U=53.5%</p> <p>D = 15%</p>	N/A	<p>Confectionaries:</p> <p>I = 44.5%</p> <p>U = 27.5%</p> <p>D = 27.5%</p>	N/A	N/A
Husain and Ashkanani, 2020 ⁷⁰	<p>M/I: How frequently do you eat each of the following foods: fruit... vegetables... fish and</p>	N/A	<p>Before:</p> <p>None = 8%</p> <p>Less than 1/</p>	<p>Before:</p> <p>None = 7%</p> <p>Less than 1/d =</p>	N/A	N/A	<p>Before:</p> <p>Never = 10.6%</p> <p>Less than 1/w=</p>	N/A

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
	seafood? RO: "Never, less than 1/wk, 1-2/ wk, 3-4/wk, 5-6/wk, 7 or more, I do not know, or none. The answer alternatives for fruits and vegetables were less than 1/d, 1/d, 2/d, 3/d, 4 or more, none, or I do not know"		d = 31.1% 1/d = 37.8% 2/d = 14.9% 3/d = 4.1% 4 or more = 2.2% I do not know = 1.9% During: None = 9.2% Less than 1/d = 29.2% 1/d = 35.4% 2/d = 18.3% 3/d = 4.3% 4 or more = 1.7% I do not know = 1.9%	22.4% 1/d = 36.4% 2/d = 20.5% 3/d = 7.7% 4 or more = 4.1% I do not know = 1.9% During: None = 8.2% Less than 1/d = 23.1% 1/d = 33.7% 2/d = 21.4% 3/d = 9.2% 4 or more = 2.2% I do not know = 2.2%			31.6% 1-2/wk = 47.0% 3-4/wk = 8.7% 5-6/wk = 0.2% 7 or more = 0.5% I don't know = 1.4% During: Never = 26.5% Less than 1/ wk = 33.0% 1-2/wk = 34.5% 3-4/wk = 4.3% 5-6/wk = 0.2% 7 or more = 0.2% I don't know = 1.2%	
Kansiime and colleagues2021 ^{73h}	M/I: How often did you consume the following foods both before the pandemic and during the pandemic: fruits, vegetables, fish and seafood...? RO: Rarely (once or twice a month), sometimes (3-10 times a month), and often (>10 times a month)" "Frequent consumption variables that are equal to 1 if a respondent selected 'often (>10 times a month)' and zero otherwise, were computed"	N/A	Percent of partic ipants who reported a frequent consump tion (>10 times per mo) Kenya: Before = 57.6% During = 22.4% Uganda: Before = 60.8% During = 28.8%	Percent of participants who reported a frequent consumption (>10 times per mo) Kenya: Before = 76.8% During = 67.2% Uganda: Before = 64% During = 35.2%	N/A	N/A	Percent of participants who reported a frequent consumption (>10 times per mo) Kenya: Before = 22.4% During = 6.4% Uganda: Before = 28.8% During = 12.8%	N/A
Kriaucioniene and colleagues2020 ⁷⁶	M/I: How has your consumption of the following foods changed during the pandemic: Vegetables, Fruits... Fish-Seafood...	N/A	I = 22.1% U = 63.2% D = 14.7%	I = 18.8% U = 66.2% D = 15.0%	I = 45.1% U = 45.1% D = 9.8%	Commercial pastries such as cookies, custards, sweets:	I = 7.5% U = 78.3% D = 14.3%	I = 6.7% U = 51.9% D = 41.3%

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
Lamarche and colleagues2021 ⁷⁷	Commercial pastries, Fast food...Snacking? RO: Higher, Lower or As usual M/I: Which of the following foods did you eat in the last 24 hours? RO: Total vegetables... seafoods and plant proteins, added sugars... whole fruits... total fruits	N/A	Whole fruits: Signi ficant reduced consum ption Total fruits: Significant reduced consum ption	Total vegetables: Significant increased consumption Greens and beans: Significant increased consumption	N/A	I = 18.9% U=55.2% D = 26.0% Added sugars: Significant reduced consum ption	Seafood and plant proteins: Significant increased consumption	N/A
López-Buena and colleagues2020 ⁷⁸	M/I: "How many fresh fruit and vegetables do you usually eat daily?" RO: 0, 1, 2, 3, 4, 5, or more than 5 Reporting a consumption of <3 fresh fruit or vegetables a day was considered a health risk behavior	Significant decrease in consuming fewer than three fresh fruits or vegetables a day (<i>P</i> = 0.011)	N/A	N/A	N/A	N/A	N/A	N/A
Malta and colleagues2020 ⁸⁰	M/I: "Before the pandemic how many days a week did you usually eat any of the following foods: greens and vegetables, fruit... savory snacks, chocolate/sweet biscuits/pieces of tart?" "During the pandemic, how frequently do you eat these foods now?" RO: 5 d or more (considered to be regular consumption); 2-4 d; ≤1 d	N/A	Regular consum ption of fruit: Before = 32.8% During = 31.9%	Regular consumption of greens and vegetables: Before = 37.3% During = 33.0%	Savory snacks more than 2 d: Before = 9.5% During = 13.2%	Chocolate/ sweet biscuits/ pieces of tart more than 2 d: Before = 41.3% After = 47.1%	N/A	N/A
Matsungo and Chopera, 2020 ^{82gh}	M/I: How has your consumption of the following foods changed during the	Other vitamin A rich fruits and	Other fruits: I = 12.5%	Dark green leafy vegetables I = 29.2%	N/A	N/A	N/A	N/A

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
	pandemic: Dark green leafy vegetables, Other vegetables, Other vitamin-a rich fruits, Other fruits...? RO: 1 = less/D, 2 = same/U, 3 = more/I, or 4 = N/A	vegetables: I = 12.5% U = 25% D = 58.4%	U = 20.9% D = 62.6%	U = 33.4% D = 29.2% Other vegetables I = 12.5% U = 37.5% D = 45.9%				
Murphy and colleagues2021 ^{B3}	M/I: How many portions of fruit and vegetables did you consume per day both before and during the pandemic?	N/A	Significant increase in the portions of fruit consumed per day	Significant increase in the portions of vegetables consumed per day	N/A	N/A	N/A	N/A
Pakravan-Charvadeh and colleagues2020 ^{B4}	M/I: Which of the following foods did you consume before the pandemic? Which of the following foods did you consume during the pandemic? Cereals, vitamin A-rich vegetables and tubers...Dark green leafy vegetables, Other vegetables, Vitamin A-rich fruits, Other fruits (ie, wild fruits and 100% fruit juices made from fruits), Fruits... Fish... Sweets RO: Yes or no	N/A	Vitamin A-rich fruits/"other" fruits/fruits: No significant change	Vegetables: Significant decreased consumption (P = 0.05) Dark green leafy vegetables: Significant decreased consumption (P = 0.001) Vitamin A rich vegetables and tubers/"other" vegetables: No significant change	N/A	Sweets: Significant decreased consumption (P = 0.001)	Fish: No significant change	N/A
Papandreou and colleagues2020 ^{B5}	M/I: Did you consume more pastries during the pandemic? RO: "No, less than 3 pieces per week, or more than 3 pieces per week" M/I: Did the number of snacks	N/A	N/A	N/A	Spain: Yes = 34.1% No = 65.9% Greece: Yes = 40.8% No = 59.2%	Pastries: Spain: No = 69.4% <3/wk = 19.7% >3/wk = 10.9% Greece: No = 62.2%	N/A	N/A

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
	you consumed between meals increase during the pandemic? RO: "Yes or no"					<3/wk = 12.6% >3/wk = 25.2%		
Pellegrini and colleagues ²⁰²⁰ ⁹⁶	M/I: Has your consumption changed: The number of snacks you consume a day... fruits and vegetables, sweets? RO: "I don't consume those foods usually, is less than before quarantine, is the same as before quarantine, is more than before quarantine"	I = 27.3% U = 54% D = 18%	N/A	N/A	Don't consume = 28% I = 32.7% U = 28% D = 11.3%	Sweets: Don't consume = 16% I = 50% U = 22% D = 12%	N/A	N/A
Radwan and colleagues ²⁰²⁰ ⁹¹	M/I: Which of the following foods did you consume more of during the pandemic? RO: "...salty snacks, sweet snacks..."	N/A	N/A	N/A	Salty snacks: 21% reported consuming more during COVID-19 Sweet snacks: 7.1% reported consuming more during COVID-19	N/A	N/A	N/A
Reyes-Olavarria and colleagues ²⁰²⁰ ⁹²	M/I: How has your consumption of vegetables and fruits changed during the pandemic? RO: "Less than before/same than before/more than before"	I = 30.9% U = 48.4% D = 20.7%	N/A	N/A	N/A	N/A	N/A	N/A
Rodríguez-Pérez and colleagues ²⁰²⁰ ⁹⁶	M/I: How has your fast-food frequency changed during the pandemic? How has your snacking frequency changed during the pandemic? How has your consumption of the following foods changed during the pandemic: Vegetables, fruits... Fish, Non-	N/A	I = 18.3% U = 67.6% D = 13.6%	I = 16.7% U = 71% D = 11.8%	I = 37.6% U = 46.7% D = 15.7%	Non-home made pastries I = 21% U = 59% D = 20%	I = 8% U = 72% D = 21%	I = 5.1% U = 60.0% D = 34.9%

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
Sánchez-Sánchez and colleagues ⁹⁹	homemade pastries...? RO: Higher, Lower, As before M/I: "How many portions of vegetables do you consume every day? (Garnishes and accompaniments would be 1/2 portion, 1 portion is equal to 200 g)" RO: "1 or less, 2 or more, none of them in salad or raw, or 2 or more, some of them in salad or raw." M/I: "How many pieces of fruit, including fruit juice, do you consume a day?" RO: "2 or less per day, 3 or more per day" M/I: "How many portions of fish/seafood do you consume per week? (1 dish, piece, or portion = 100-150 g fish or 4-5 pieces or 200 g seafood)" RO: "2 or less portions per week, 3 or more portions per week" M/I: "How many times per week do you consume industrial bakery (nonhomemade) foods, like biscuits, puddings, sweets, or cakes?" RO: "1 or less portions per week, 2 or more portions per week"	N/A	Significant increased consumption (P < 0.001)	Significant increased consumption (P = 0.032)	N/A	Industrial bakery foods: Significant increased consumption (P < 0.001)	Significant increased consumption (P < 0.001)	N/A
Scarmozzino and Visioli, 2020 ¹⁰⁰	M/I: "Have you changed your fresh fruit and vegetables consumption during the lockdown?" RO: "Yes, it increased, I increased only the consumption of canned fruits and vegetables, No, I have been eating more"	I = 21.2% I (canned) = 0.9% U = 69.2% D = 8.7%	N/A	N/A	Salty or sweet snacks: I = 23.5% U = 57.6% D = 18.9%	Sweet food (chocolate, spreads, cakes, ice creams) I = 42.5% U = 44.0% D = 13.5%	N/A	N/A

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
	or less the usual amount, or Yes, I decreased it" M/I: "Have you changed your consumption of other kinds of sweet food (chocolate, spreads, cakes, ice creams) during the lockdown?" RO: "Yes, it increased, I have been consuming more or less the usual amount, or Yes, I decreased it" M/I: "Have you changed your consumption of sweet or salty snacks during the lockdown?" RO: "Yes, it increased, I have been consuming more or less the usual amount, or Yes, I decreased it"							
Sharma and colleagues ²⁰²⁰ ¹⁰¹	M/I: How has your consumption of fruits and vegetables changed because of COVID-19? RO: I, D, Stayed the same	I = 30.2% U = 28.4% D = 41.4%	N/A	N/A	N/A	N/A	N/A	N/A
Werneck and colleagues ²⁰²⁰ ¹⁰⁶	M/I: How frequently did you consume fruit or vegetables both before the pandemic and during the pandemic quarantine? Reporting eating fruits or vegetables <5 d/wk was classified as low frequency	Participants without depression: Low frequency of fruit or vegetable Before = 77.5% During = 78.1% Participants with depression: Low frequency of fruit or vegetable Before =	N/A	N/A	N/A	N/A	N/A	N/A

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Table 3. Measures and findings for changes in the consumption of fruits and vegetables, snacks, sweets, seafood, and fast food during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Fruits/ vegetables	Fruits	Vegetables	Snacks	Sweets and/ or bakery products	Fish and/or seafood	Fast food
		81.6% During = 81.6%						
Yilmaz and colleagues2020 ¹⁰⁷	M/I: How has your consumption of the following foods changed during the pandemic: vegetables, fruits, snacks... RO: I, D, or U	N/A	I = 49.1% U = 49.4% D = 1.5%	I = 40.5% U = 58.4% D = 1.0%	I = 38% U = 57.5% D = 4.5%	N/A	N/A	N/A
Zhang and colleagues2020 ¹⁰⁹	M/I: How has your consumption of the following food types changed during the pandemic: seafood... snacks and beverages? RO: I, U, or D	N/A	N/A	N/A	Consuming Snacks and beverages: I = 25% U = 38% D = 38%	N/A	Seafood: I = 9.5% U = 37.5% D = 53%	N/A

^aM/I = measure/items.^bRO = response options.^cI = increased intake.^dD = decreased intake.^eU = no change in intake.^fN/A = not available.^gFindings are presented only for response options related to an increase, decrease, or no change, thus percentages reported will not add to equal 100%. Remaining percentages align with the alternative response options noted in the measures section including "never" and "first time" for Ben Hassen and colleagues,⁴⁸ "do not consume" for Chenarides and colleagues,¹³ and "not applicable" for Matsungo and Chopera.⁸²^hStudies where values were estimated from a figure.

Table 5. Measures and findings for changes in healthy eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

Reference	M/I ^a and RO ^b	Finding
Alhusseini and Alqahtani, 2020 ⁴¹	M/I: "How would you rate your overall habits of eating healthy foods?" (Before and during COVID-19) RO: Poor/fair/good/very good/excellent	Statistically significant increase in respondents rating of their eating healthy food as very good/excellent (22.3% to 29.5%; $P < 0.001$)
Almandoz and colleagues, 2020 ⁴³	M/I: "As a result of COVID-19, do you find it is easier or more difficult to stick to healthy diet menus and plans?"	61.2% reported greater challenge in following healthy diet plans. 25% reported no change
Ammar and colleagues, 2020 ⁴⁴	M/I: "How likely are you to have an unhealthy diet/food?" Referenced for before and after confinement Never/sometimes/most of the times/always	Significantly higher reports of unhealthy eating during confinement ($t = -3.46$; $P < 0.001$; $d = 0.14$). Consuming unhealthy food increased for responses to most of the time (23.3% vs 18.4%) and always (10.9% vs 6.2%)
Ben Hassen and colleagues, 2020 ^{48c}	M/I: Change of eating or drinking habits during the COVID-19 pandemic for the healthy foods, unhealthy foods (eg, fast food, healthy snacks, and unhealthy snacks) RO: Never/first time/much less/slightly less/about the same/moderately more/much more	54.1% about the same healthy foods 16.6% much more healthy foods 15.7% moderately more healthy foods 6.3% slightly less healthy foods 2.8% much less healthy foods 4.4% never 0.2% first time 22.5% about the same unhealthy foods 3.5% much more unhealthy foods 6.3% moderately more unhealthy foods 11% slightly less unhealthy foods 33.5% much less unhealthy foods 22.2% never 1.0% first time 57.7% about the same healthy snacks 6.8% much more healthy snacks 14.1% moderately more healthy snacks 8% slightly less healthy snacks 4.7% much less healthy snacks 8.5% never 0.2% first time 41.4% about the same unhealthy snacks 2.8% much more unhealthy snacks 9.4% moderately more unhealthy snacks 12.6% slightly less unhealthy snacks 19.8% much less unhealthy snacks 13.6% never 0.3% first time
Canello and colleagues, 2020 ⁵²	M/I: "How do you evaluate the quality of your nutrition compared with before isolation for COVID-19?"	47% reported diet quality was like before 34% reported improved diet quality 19% reported worsened diet quality
Di Renzo, Gualtieri, Pivari, and colleagues, 2020 ⁵⁸	M/I: "Did your lifestyle and eating habits change ^d during the COVID-19 pandemic period?"	46.1% no change in lifestyle/eating habits 37.2% COVID-19 made habits worse 16.7% COVID-19 made habits improve <i>(continued on next page)</i>

Table 5. Measures and findings for changes in healthy eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Finding
	M/I: "During this period, which of these foods are you consuming MORE than before?"	37.4% reported eating more healthy food; 35.8% ate less (defined as adherence to the Mediterranean diet)
	M/I: "During this period, which of these foods are you consuming LESS than before?"	29.8% reported a decrease in "junk food" consumption. Percent increase not reported
	Healthy food defined as fruit, vegetables, nuts and legumes	
	Junk food is defined as packaged sweets and baked products, sweet beverages, savory snacks and dressing sauces	
Do and colleagues, 2020 ⁵⁹	M/I and RO: "Reported their current... eating (less healthy vs unchanged or healthier) behaviors compared with that before the pandemic"	5042 (96.8%) ate at an "unchanged or healthier" level [no distinction made]
Duong and colleagues, 2020 ⁶⁰	M/I and RO: Participants rated their eating behavior as less healthy, unchanged, and healthier	42.8% reported healthier eating behavior compared with before the pandemic. (Less healthy and unchanged eating behaviors were assessed together)
Flanagan and colleagues, 2021 ⁶²	M/I: Perception of overall healthy eating habits and weight change M/I: Optional long form was a modification of the Rapid Eating Assessment ¹¹²	20.7% perceived they were eating healthier and 35.6% reported eating less healthy The Rapid Eating Assessment increased (0.81 ± 0.04 ; $P < 0.001$), indicating overall healthier eating
Górnick and colleagues, 2020 ⁶⁶	M/I: 3 patterns created: Prohealthy: Increased healthy foods and decreased nonrecommended foods. Constant: Relatively stable dietary patterns. Unhealthy: Increased consumption of nonrecommended foods and decreased consumption of healthy ones Healthy foods: Based on plant food (vegetables, legumes, and fruits), healthy fats, and high protein/low-fat food	53.0% constant eating pattern 27.6% prohealthy eating pattern 19.4% unhealthy eating pattern
Ingram and colleagues, 2020 ⁷¹	M/I and RO: Diet: 1 = A lot more unhealthy, 3 = About the same, 5 = A lot more healthy	34.1% diet remained the same. 28.1% diet was a little more unhealthy 12.8% diet was a lot unhealthy 18.8% diet was a little more healthy 6.3% diet was a lot healthier
Kansiime and colleagues, 2021 ⁷³	M/I: The Food Insecurity Experience Scale ¹¹⁰	Percent of people reporting unable to eat health/nutritious food before and during the pandemic. All are significant ($P < 0.01$) In total sample: 21% before, 55% during (<i>continued on next page</i>)

Table 5. Measures and findings for changes in healthy eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Finding
Khubchandani and colleagues, 2020 ⁷⁵	M/I and RO: "Overall perception of diet quality change" healthier than before the pandemic/same as before the pandemic/worse than before the pandemic.	Kenya sample: 23% before, 56% during Uganda sample: 16% before, 51% during 32% their diet is healthier than before 31% report their diet was worse than before 37% reporting no change in overall diet
Marty and colleagues, 2021 ⁸¹	M/I: Simplified Programme National Nutrition Santé guidelines score 2 (an index to reflect the 2017 French main dietary recommendations) ¹¹⁴ "Less healthy food groups which consumption should be limited, ie, red meat, processed meat, sugary foods, sweet-tasting beverages, alcoholic beverages, salt" "healthier food groups carrying a positive score, ie, fruits and vegetables, nuts, legumes, whole-grain food, milk and dairy products, fish and seafood"	Scores on the Simplified Programme National Nutrition Santé guidelines score 2 significantly decreased during lockdown compared with before (0.8 vs 1.2 respectively; $P < 0.001$)
Pellegrini and colleagues, 2020 ⁸⁶	M/I: "During the lockdown period, the healthy foods that you prepare/consume..."	56% reported "I have not changed habits with respect to the type of food" 28% reported "I don't pay attention to how healthy a food is. I consume/prepare foods that give me satisfaction" 16% reported "I consume/prepare more healthy foods, paying attention to the seasoning"
Pham and colleagues, 2020 ⁸⁷	M/I: Healthy intake: 5-item Healthy Eating Score ¹¹⁵	Being under the lockdown associated with lower healthy dietary intake scores ($P < 0.001$)
Poelman and colleagues, 2021 ⁸⁹	M/I & RO: Participants healthy eating before lockdown on a 5-point Likert scale (fully agree to full disagree) M/I & RO: If they "found it easier or more difficult than usual to make healthy food choices" and "if they ate healthier or less healthy than usual"	Before lockdown, most perceived their eating as healthy (81%) with 16.1% being neutral and 2.9% reporting eating unhealthily 82.7% no change in difficulty to eat healthy 10.8% more difficult to eat healthy 6.5% easier to eat healthy 83.3% reported no difference in healthiness of food 9.6% reported eating healthier 7.1% reported eating unhealthier
Robinson and colleagues, 2021 ⁹⁴	M/I: "Compared to before the COVID-19 lockdown in the United Kingdom, I	Below are the percent of people who agreed to the question: "Compared to (<i>continued on next page</i>)

Table 5. Measures and findings for changes in healthy eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	M/I ^a and RO ^b	Finding
	have" followed by several items on barriers/facilitators to healthy eating RO: 7-point response scale 1 = A lot less frequently, 4 = The same amount, 7 = A lot more frequently M/I: Short 13-item food frequency questionnaire ^{116e}	before the COVID-19 lockdown in the United Kingdom, I have..." 77% been able to access healthy food 79% been able to afford healthy food 77% been able to plan healthy meals 83% known how to eat healthily in the current circumstances 88% had time to eat healthily 83% had unhealthy food in the house 55% been motivated to eat healthily 49% fallen into unhealthy habits 43% been supported by others to eat healthily Nearly equal proportions said that their eating a healthy and balanced diet remained the same (31%), was less (17% a little less, 12% less, or 6% a lot less), and was more (17% a little more, 12% more, or 6% a lot more) Lower diet quality was related to higher body mass index, lower education, being White, younger, and a man
Rossinot and colleagues, 2020 ⁹⁸	M/I: Self-evaluation of the change during the lockdown of their diet RO: Less balanced/no change/more balanced	54.1% unchanged 28.7% more balanced 17.1% less balanced
Sánchez-Sánchez and colleagues, 2020 ⁹⁹	M/I: Prevention with Mediterranean diet questionnaire: Healthy defined as high adherence	Adherence to Mediterranean diet increased (8% vs 4.7%)
Wang and colleagues, 2020 ¹⁰⁵	M/I: Not listed	23% of adults reported changing their diets to be healthier

^aM/I = measure/items.^bRO = response options.^cFindings related to healthy foods and unhealthy snacks from reference 63 have percentages that do not add to be 100%. These results are presented in accordance with the original study.^dThe original item from reference 67 reads "Did your lifestyle and eating habits changed during the COVID-19 pandemic period?"^eMeasure source as cited in reference 70 "Participants completed a UK-based short 13-item food frequency questionnaire in which consumption frequencies of "healthy" and "unhealthy" key food groups (eg, fruit, vegetables, whole-grains, sugary drinks, and processed meat) during the last week are measured (Green and colleagues, 2016)."

Table 6. Measures and findings for changes in other eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

References	Behavior	M/I ^a and RO ^b	Findings
Adams and colleagues, 2020 ⁴⁰	Meal skipping	M/I: Whether/how often they cut meal sizes or skipped meals in the past 30 d because there was not enough money for food RO: Number of days per month ≥ 3 d considered food insecure	Parents reported cutting or skipping meals because of not enough money more often during the pandemic (11.0 ± 7.5 d/mo) compared with before COVID-19 (2.9 ± 2.2 d/mo)
Almandoz and colleagues, 2020 ⁴³	Meal skipping	M/I: Food security: The 6-item US Adult Food Security Survey Module ¹³⁹ M/I: Skipping meals? RO: Yes/no	12.1% of participants reported skipping meals (although 78.3% of the sample was not food insecure)
Ammar and colleagues, 2020 ⁴⁴	Uncontrolled eating	M/I: Asked as before and during the pandemic "How often have you found yourself eating out of control?" RO: Never/sometimes/most of the time/always	Eating out of control was significantly higher during home confinement ($P < 0.001$) 20.4% of participants indicated eating out of control most of the time during home confinement compared with 9.7% before confinement 9.6% of participants indicated they were always eating out of control during home confinement compared with 2.3% before confinement
Cheikh Ismail and colleagues, 2020 ⁵⁵	Meal skipping	M/I: Meal skipping? RO: Yes/no M/I: Main reasons for skipping meals? RO: To reduce food intake, lack of time, to lose weight, lack of appetite, fasting	46.2% of people reported skipping meals during the pandemic compared with 65.5% skipping meals before the pandemic People reported the main reason they skipped meals during and before the pandemic was: To reduce food intake (29.1% during, 21.7% before) Losing weight (23.6% during, 18.5% before) Lack of time (30.6% during, 62.3% before) Lack of appetite (36% during, 27.7% before) Fasting (25.7% during, 10.3% before)
Cheikh Ismail and colleagues, 2021 ⁵⁶	Meal skipping	M/I: Meal skipping? RO: Yes/no M/I: Main reasons for skipping meals?	45.1% of participants skipped meals during the pandemic compared to 64.4% of participants skipping meals from before the pandemic ($P < 0.001$)

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Table 6. Measures and findings for changes in other eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

References	Behavior	M/I ^a and RO ^b	Findings
		RO: To reduce food intake, lack of time, to lose weight, lack of appetite, fasting	People reported the main reason they skipped meals during and before the pandemic was: To reduce food intake (27.7% during, 18.6% before) Losing weight (23.8% during, 20.2% before) Lack of time (27% during, 60.8% before) Lack of appetite (37.9% during, 30.9% before) Fasting (26.4% during, 10% before)
Di Renzo, Gualtieri, Pivari, and colleagues, 2020 ⁵⁸	Meal skipping	M/I: "Did you change the number of daily meals, during this period?" RO: No, it didn't/Yes, I skip 1 or more of the main meals (breakfast, lunch, dinner)/Yes, I skip 1 or more of snacks between meals/Yes, I added 1 or more of the main meals/Yes, I added 1 or more of the snacks between meals/Yes, I eat out of the meals ^c	17.5% reported skipping more snacks or meals 23.5% reported introducing more meals/snacks
Elmacloğlu and colleagues, 2021 ⁶¹	Uncontrolled eating Restrictive eating	M/I: Uncontrolled eating, cognitive restriction, and emotional eating behavior: 18 items in total ^{140,141} RO: 1 = absolutely true; 2 = mostly true; 3 = mostly false; and 4 = absolutely false	Uncontrolled eating behavior significantly increased during the pandemic in "normal" and "overweight" individuals compared with before ($P < 0.001$). Compared with men, women's uncontrolled eating and cognitive restriction were higher during the pandemic compared with before 22.14% of participants reported increases in uncontrolled eating behavior 9.12% of participants reported increases in restrictive eating behaviors
Flaudias and colleagues, 2020 ⁶³	Binge eating Restrictive eating	M/I: Depression and anxiety: The Hospital Anxiety and Depression Scale ¹⁴² M/I: Perceived stress: The 10-item Perceived Stress Scale ¹⁴³ M/I: Eating behaviors: The body dissatisfaction and impulse regulation subscales of the Eating Disorder Inventory, 2nd edition ¹⁴⁴ an eating disorder screening tool (Sick, Control,	Binge eating (past 7 d) higher in women, those with higher body mass index, greater perceived stress, higher stress related to lockdown, more anxiety, more depression, and probable eating disorders Dietary restriction (past 7 d) higher in women, younger students, those who are classified as "underweight" or "obese." Having scholarship associated with less restriction

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Table 6. Measures and findings for changes in other eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

References	Behavior	M/I ^a and RO ^b	Findings
		One, Fat, Food) ¹⁴⁵ and the Ideal Body Stereotype Scale ^{146d}	Higher stress related to the lockdown and anxiety was associated with a higher likelihood of current dietary restriction (past 7 d; $P < 0.001$) and anticipated restriction (next 2 wk; $P < 0.01$). Higher eating disorder risk, body dissatisfaction, and endorsement of appearance ideals linked to report higher dietary restriction ($P < 0.001$) Anticipated bingeing (next 2 wk) associated with higher age, depression, stress related to lockdown, and COVID-19 media exposure, being “underweight,” risk for eating disorder, and lower impulse regulation and body dissatisfaction Anticipated dietary restriction (next 2 wk) was higher for those who were younger, women, at risk of eating disorders, had high levels of body dissatisfaction, endorsement of appearance ideals, low impulse control and body mass index classified as “underweight” and “obese”
Haddad and colleagues, 2020 ⁶⁷	Restrictive eating	M/I: The Eating Disorder Examination-Questionnaire ¹⁴⁷ M/I: 10 questions related to fear of COVID-19 (eg, “Thinking about COVID-19 makes me feel anxious”) RO: 5-point Likert scale ranging from 1 (not at all) to 5 (extremely) Higher scores indicate increased fear	Greater fear of COVID-19, higher body mass index, and physical activity predicted higher restraint scores ($P < 0.001$)
Husain and Ashkanani, 2020 ⁷⁰	Meal skipping	M/I & RO: “Skipping meal breakfast; skipping meal snack (breakfast and lunch); skipping meal lunch; skipping meal snack between lunch and dinner; skipping meal dinner; none skipping meal”	Changes in meal skipping were seen for: Breakfast: 41.7% during, 38.8% before Snack between breakfast and lunch: 25.8% during, 32.3% before Lunch: 13.7% during, 8.9% before Snack between lunch and dinner: 20.2% during, 28.7% before

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Table 6. Measures and findings for changes in other eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

References	Behavior	M/I ^a and RO ^b	Findings
Kansiime and colleagues, 2021 ⁷³	Meal skipping	M/I: Food security: The food insecurity experience scale ¹¹⁰ M/I: Skipped a meal RO: Yes/no	Meal skipping significantly increased in samples from Kenya (19% before, 42% during) and Uganda (12% before, 27% during). This was an indicator of food insecurity, which rose significantly in both samples
Kaya and colleagues, 2021 ⁷⁴	Meal skipping	M/I: Fear: The fear of COVID-19 Scale ¹⁴⁸ M/I: Anxiety: The Generalized Anxiety Disorder-7 test ¹⁴⁹ M/I: Eating: Questions about skipping meals (not specified)	There was a significant decrease in skipping breakfast (19.9% before to 16.7% during) and snacks (54.7% before to 35.6% during) and a significant increase in skipping lunch (35.6% before to 49.2% during)
Khubchandani and colleagues, 2020 ⁷⁵	Overeating Restrictive eating Meal skipping	M/I: Stress: 10-item Perceived Stress Scale ¹⁴³ M/I: Dietary behaviors: 4 questions about dietary behaviors (eg, overeating and fasting) RO: More than before the pandemic/same as before the pandemic/less than before the pandemic	39% reported overeating at the same level 39% reported overeating more 22% reported overeating less 52% reported no changes in restricted eating 20% reported an increase in their restricted eating 28% reported a decrease in their restricted eating 45% reported no changes in meal skipping 25% reported skipping meals more 30% reported skipping meals less 54% reported no changes in fasting 16% reported increased fasting 30% reported less fasting Changes in overeating, restricted eating, meal skipping, and fasting were related to higher stress scores
Phillipou and colleagues, 2020 ⁸⁸	Binge eating Restrictive eating	M/I: Current negative mood states (over the past week): The Depression Anxiety Stress Scale ¹⁵⁰ M/I: Restricted eating and binge eating questions adapted from the Eating Disorders Examination Questionnaire ¹⁵¹ RO: 5-point Likert scale ranging from 1 (a lot more) to 5 (a lot less)	60% reported no changes in binge eating behaviors 34.6% reported increased binge eating behaviors 5% reported decreased binge eating behaviors 59% reported no change in level of food restriction 27.6% reported a greater level of food restriction 13% reported less food restriction

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Table 6. Measures and findings for changes in other eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

References	Behavior	M/I ^a and RO ^b	Findings
Puhl and colleagues, 2020 ⁹⁰	Binge eating	M/I: Binge eating: 2 questions adapted from the Questionnaire on Eating and Weight Patterns-Revised ¹⁵² "In the past month, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge eating)?" and "During the times when you ate this way, did you feel you couldn't stop eating or control what or how much you were eating?" RO: Yes/no M/I: Weight stigma ¹⁵³ : asked how often they teased you about your weight (1 = Never, 2 = Less than once a year, 3 = A few times a year, 4 = A few times a month, and 5 = At least once a week)	Those who experienced prepandemic weight stigma had 2.88 times higher odds of binge eating during the pandemic
Robertson and colleagues, 2021 ⁹³	Uncontrolled eating	M/I: Perceived changes in eating: "I have found it more difficult to regulate or control my eating"; "I have become more preoccupied with food/eating" M/I: Psychological distress: The 4-item version of the Patient Health Questionnaire ¹⁵⁴	29.4% of participants agreed and 23.7% strongly agreed that it was more difficult to control or regulate eating during the pandemic compared to before 37.8% of participants agreed and 21.8% strongly agreed they were more preoccupied with food and eating during the pandemic compared with before Both difficulty with controlling eating and preoccupation with food were significantly related to psychological distress
Robinson and colleagues, 2021 ⁹⁴	Overeating Meal skipping	M/I: 10 questions on mental/physical health: "Compared with before the COVID-19 lockdown in the United Kingdom, I have (eg, 'Felt lonely' and 'Had conflict/arguments with others')" RO: 7-point scale ranging from 1 = A lot less frequently to 7 = A lot more frequently M/I: The 5 item World Health Organization well-being scale ¹⁵⁵	Overeating during COVID-19 was associated with lower age and education, being female, higher body mass index, having a previous psychiatric diagnosis, having had COVID-19, and experiencing negative mental health since lockdown 45% reported no change in meal skipping 23% reported increased meal skipping (12% a little more, 7% more, 4% a lot more).

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Table 6. Measures and findings for changes in other eating behaviors during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

References	Behavior	M/I ^a and RO ^b	Findings
		M/I: Overeating: The Appetitive Drive subscale of the Addiction-Like Eating Behavior Scale ¹⁵⁶	31% reported decreased meal skipping (9% a little less, 11% less, 11% a lot less) 48% reported no change in fasting 19% reported increased fasting (8% a little more, 6% more, 5% a lot more). 33% reported decreased fasting (9% a little less, 12% less, 12% a lot less)
Robinson and colleagues, 2020 ⁹⁵	Binge eating	M/I: Binge Eating: "Compared with before the COVID-19 virus crisis, I have binged on food." RO: 7-point scale from 1 (a lot less) to 7 (a lot more). 1-3 points was coded as reduced behavior, 4 points was no change, and 5-7 points were increased behavior	49% reported increased bingeing 33% of participants reported no changes in bingeing 19% reported decreased bingeing
Şimsek and Şen, 2020 ¹⁰³	Uncontrolled eating Restrictive eating	M/I: Eating behaviors: 20 questions from the 3-factor eating questionnaire ¹⁵⁷	There were significant increases in uncontrolled eating during the COVID-19 pandemic compared with before Participants with a lower income had greater uncontrolled eating compared to those with a higher income There was a significant decrease in cognitive restraint behavior during compared with before COVID-19 There was lower cognitive restraint and higher uncontrolled eating in participants aged 18-20 y compared with those older than age 35 y

^aM/I = measure/items.^bRO = response options.^cThe response options stated here are quoted directly from reference 67. There was no reporting on the "Yes, I eat out of the meals" response option.^dAs cited in reference 97.

Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic

Reference	Reason	M/I ^a and RO ^b	Finding
Adams and colleagues, 2020 ⁴⁰	Food insecurity	M/I: Whether/how often they cut meal sizes or skipped meals in the past 30 d because there was not enough money for food ¹³⁹ RO: Number of days per month ≥ 3 d considered food insecure	Food security lowered by 17% and there was a 20% increase in families with very low food security during the pandemic There were increases in meal skipping related to lack of money from an average of 2.9 ± 2.2 d/mo before the pandemic and 11.0 ± 7.5 d/mo during the pandemic.
Almandoz and colleagues, 2020 ⁴³	Stress Food insecurity	M/I: Do you stress eat more? RO: Yes/No M/I: 6-item US Adult Food Security Survey Module ¹³⁹	61.2% reported stress eating 78.3% of the sample was not food insecure
Buckland and colleagues, 2021 ⁵¹	Emotional eating Craving	M/I: Food responsiveness, emotional eating: The Adult Eating Behavior questionnaire ¹⁵⁸ M/I: Cravings: The Control of Eating Questionnaire ¹⁵⁹	Greater emotional overeating and lower emotional undereating were significantly associated with higher increased overall eating 46% of participants reported increased food cravings; 23% reporting less cravings 41% of participants reported no changes and 36% reported increases in craving intensity during COVID-19 compared with before Greater craving frequency and intensity and lower craving control were significantly associated with higher increased overall eating
Carroll and colleagues, 2020 ⁵³	Food insecurity	M/I: "During the past month, was there a time when you were worried you would not be able to pay the mortgage, rent, or other bills on time?" RO: Yes/no/I don't know M/I: "Are you worried about not being able to pay the mortgage, rent or other bills on time over the next 6 months?"	5% of fathers and 10% of mothers reported concerns about food security in the past month or over the next 6 mo
Cheikh Ismail and colleagues, 2020 ⁵⁵	Weight control Time	M/I: Meal skipping? RO: yes/no M/I: Main reasons for skipping meals?	People reported the main reason they skipped meals during and before the pandemic was: Losing weight (23.6% during, 18.5% before) Lack of time (30.6% during, 62.3% before)

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Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Reason	M/I ^a and RO ^b	Finding
Cheikh Ismail and colleagues, 2021 ⁵⁶	Weight control Time	RO: To reduce food intake, lack of time, to lose weight, lack of appetite, fasting M/I: Meal skipping? RO: yes/no M/I: Main reasons for skipping meals? RO: to reduce food intake, lack of time, to lose weight, lack of appetite, fasting	People reported the main reason they skipped meals during and before the pandemic was: Losing weight (23.8% during, 20.2% before) Lack of time (27.0% during, 60.8% before)
Di Renzo, Gualtieri, Cinelli, and colleagues, 2020 ⁵⁷	Emotional eating Anxiety	M/I: Anxiety: 14-item Hamilton Anxiety Rating Scale ¹⁶⁰ M/I: Depression: 17-item Hamilton Depression Scale ¹⁶¹ M/I: Emotional eating: 25-item Yale Food Addiction Scale ¹⁶²	57.8% of participants reported feeling anxious due to their eating habits 48.7% reported using food to respond to anxious feelings 55.1% reported increasing their food intake to feel better 20.3% reported exclusion of foods that led to anxious feelings
Elmacloğlu and colleagues, 2021 ⁶¹	Emotional eating	M/I: Uncontrolled eating, cognitive restriction, and emotional eating behavior: 18 items in total ^{140,141} RO: 1 = absolutely true; 2 = mostly true; 3 = mostly false; and 4 = absolutely false	In normal individuals, emotional eating behavior increased significantly during the pandemic compared with before Women's emotional eating scores were higher than men during the pandemic compared to before
Flaudias and colleagues, 2020 ⁶³	Depression Anxiety Stress Body image	M/I: Depression and Anxiety: The Hospital Anxiety and Depression Scale ¹⁴² M/I: Perceived stress: The 10-item Perceived Stress Scale ¹⁴³ M/I: Eating behaviors: The body dissatisfaction and impulse regulation subscales of the Eating Disorder Inventory, 2nd edition an eating disorder screening tool (Sick, Control, One, Fat, Food) ¹⁴⁵ and the Ideal Body Stereotype Scale ^{146c}	Binge eating in the past 7 d was higher in those with higher body mass index, perceived stress, stress related to lockdown, anxiety, and depression, those with probable eating disorders, and women Higher stress related to the lockdown and anxiety were associated with a higher likelihood of dietary restriction over the past 7 d Higher endorsement of appearance ideals and body dissatisfaction ($P < 0.001$) associated with a higher likelihood of dietary restriction (past 7 d) Lower body dissatisfaction was related to

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Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Reason	M/I ^a and RO ^b	Finding
Haddad and colleagues, 2020 ⁶⁷	Anxiety Fear and anger Boredom	M/I: The Eating Disorder Examination-Questionnaire ¹⁴⁷ M/I: 10 questions related to fear of COVID-19 (eg, "Thinking about COVID-19 makes me feel anxious") RO: 5-point Likert scale ranging from 1 (not at all) to 5 (extremely) Higher scores indicate increased fear M/I: Short boredom proneness scale ¹⁶³ M/I: Lebanese anxiety scale ¹⁶⁴ M/I: Anger subscale of the Buss-Perry scale ¹⁶⁵	increased intentions to binge eat in the coming 2 wk ($P < 0.001$) Greater anxiety, fear of COVID-19, anger, and boredom were significantly associated with higher eating concerns scores Greater fear of COVID-19 predicted higher restraint scores
Husain and Ashkanani, 2020 ⁷⁰	Stress Anger Boredom	M/I: "Do you eat when you feel stressed, unhappy, angry, or bored?" Reported in reference to before and during the pandemic RO: Never/rarely/occasionally/ usually	Participants reported eating when stressed, unhappy, angry, or bored (before and during the pandemic): Never: 24.1% before and 23.6% during Rarely: 24.8% before and 21% during Occasionally: 35.9% before 34.5% during Usually 15.2% before and 21% during
Jeżewska-Zychowicz and colleagues, 2020 ⁷²	Stress Fear Food access	M/I: "Have you noticed changes in the availability of food in stores over the last month?" RO: No, I did not notice any changes/yes M/I: Fear of limited access to food as the pandemic spreads RO: Definitely not/rather not/neither no nor yes/rather yes/ definitely yes M/I: Perceived Stress Scale 4 ¹⁴³	Higher levels of perceived stress were related greater fears of limited access to food and purchasing of larger quantities of food during the pandemic 87.4% of respondents reported perceiving changes in food availability at the onset of the pandemic 43.7% reported that they were "definitely" or "rather" not worried about limited food access as the pandemic spreads, whereas 39% reported fears to some degree Perceived changes in food availability were the strongest predictor of fear for limited food access
Kansiime and colleagues, 2021 ⁷³	Food security	M/I: Food security: The food insecurity experience scale ¹¹⁰	In the total sample, there were significant increases in food insecurity indicators including worrying about not having enough food, being unable to eat healthy/nutritious

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Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Reason	M/I ^a and RO ^b	Finding
Kaya and colleagues, 2021 ⁷⁴	Anxiety Fear	M/I: Fear: The fear of COVID-19 Scale ¹⁴⁸ M/I: Anxiety: The Generalized Anxiety Disorder-7 test ¹⁴⁹	foods, eating only a few kinds of foods, skipping meals, eating less food, running out of food, feeling hungry and not eating, and going the whole day without eating In the total sample here were significant increases in the amount of people who were food insecure (39% increase) and severely insecure (16% increase) Anxiety was positively related to consumption of milk, cheese, kefir, meat, poultry, fish, legumes, dried fruits, nuts-seeds, bread, rice-pasta, cake-cookies and general desserts Fear of COVID-19 was positively related to consumption of yogurt, cheese, kefir, cake-cookies, dried fruit, and nuts-seeds
Khubchandani and colleagues, 2020 ⁷⁵	Stress	M/I: Stress: 10-item Perceived Stress Scale ¹⁴³ M/I: Dietary behaviors: 4 questions about dietary behaviors (eg, overeating and fasting) RO: More than before the pandemic/same as before the pandemic/less than before the pandemic	High stress scores were related to worsening diet and changes in restricted eating, fasting, skipping meals, and overeating Stress scores were lowest among those that had no changes in these behaviors
Marty and colleagues, 2021 ⁸¹	Mood Weight control	M/I: Food choice motives: French version of the Food Choice Questionnaire developed in English ¹⁶⁶ and adapted ¹⁶⁷	48% of participants reported an increase in the importance of mood during COVID-19 compared with before and this was associated with worsened dietary nutritional quality 29% of participants reported an increase in importance of weight control and this was associated with lower dietary nutritional quality
Pakravan-Charvadeh and colleagues, 2021 ⁸⁴	Food security	M/I: Food security: modified version of the Household Food Insecurity Access Scale, ¹⁶⁸ validated in Iran RO: 9 scales rated over the past 4 wk with response options including never/rarely/sometimes/often with total scores ranging from 0 to 27. Higher scores indicate higher household food insecurity	There was a reduction in food insecurity overall $P < 0.001$ Food security was negatively related to factors such as higher family size, and number of educated family members. Food security was positively related to factors such as personal savings and nutrition knowledge

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Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Reason	M/I ^a and RO ^b	Finding
Pellegrini and colleagues, 2020 ⁸⁶	Depression Anxiety Boredom Family and friends Time Exposure	M/I: "Which of the following conditions mainly impact on your eating habits? (you can choose more than 1 option)"	Participants reported the following as mainly influencing their eating behaviors: 34.7% reported anxiety/depression 36% of participants reported boredom 21.3% reported family presence 32.7% reported increased time for cooking 19.3% reported continuous availability of food
Poelman and colleagues, 2021 ⁸⁹	Stress Boredom Friends and family Time Exposure	M/I: Eating behavior reasons: Participants were asked to indicate the 2 most important reasons for eating either healthier or less healthy from a list	Percent of participants that reported the following relevant factors related to eating healthier during lockdown: 30.3% reported more time/head space to prepare a healthy meal 26.3% reported more time/head space to be conscious about healthy nutrition 30.3% reported a need to improve resistance 17.2% Facing less unhealthy temptations at work 25.3% Facing less unhealthy temptations at social events 24.2% Facing less unhealthy temptations when going out for dinner Percent of participants that reported the following relevant factors related to eating unhealthier during lockdown: 19.2% reported more stress 21.9% reported being bored 5.5% reported less social control 17.8% reported fewer social contacts/feeling lonely 5.5% reported more time/head space to prepare an extensive meal 19.2% reported more time/head space and opportunities to bake 31.5% reported more leisure time

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Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Reason	M/I ^a and RO ^b	Finding
Puhl and colleagues, 2020 ⁹⁰	Depression Stress	M/I: General weight teasing and weight stigma: Assessed with a tool developed by the researchers to ask participants about the frequency they are teased about their weight M/I: Depressive symptoms: 6-item scale ¹⁶⁹ M/I and RO: Perceived stress ¹⁷⁰ Average level of stress was indicated in the past 30 d, with response options ranging from 1 (not at all stressed) to 10 (very stressed) M/I: Eating as a coping strategy: The 5-item coping subscale of the Motivations to Eat Scale ¹⁷¹	35.6% reported facing more unhealthy temptations at home Participants who experienced weight stigma and weight teasing before the COVID-19 pandemic reported greater depression, stress, and eating to cope during the pandemic
Robertson and colleagues, 2021 ⁹³	Psychological distress Cravings	M/I: Perceived changes in eating: "I have found it more difficult to regulate or control my eating" and, "I have become more preoccupied with food/eating" M/I: Psychological distress: The 4-item version of the Patient Health Questionnaire ¹⁵⁴	Psychological distress was significantly related to difficulty in eating control and regulation ($P < 0.001$) Psychological distress was significantly related to preoccupations with food/eating ($P < 0.001$) where 37.8% "agreed" and 21.8% "strongly agreed"
Robinson and colleagues, 2021 ⁹⁴	Emotional eating Time	M/I: 10 questions on mental/physical health: "Compared to before the COVID-19 lock-down in the UK, I have (eg, 'Felt lonely', 'Had conflict/arguments with others')" RO: 7-point scale ranging from 1 = "a lot less frequency" to 7 = "a lot more frequently" M/I: The 5-item World Health Organization well-being scale ¹⁵⁵ M/I: Overeating: The Appetitive Drive subscale of the Addiction-Like Eating Behavior Scale ¹⁵⁶	42% of participants reported eating more due to their feelings 26% of participants reported eating less due to their feelings COVID-19 mental health decline was significantly related to overeating 88% reported having time to eat healthily
Rolland and colleagues, 2020 ⁹⁷	Mental well-being General stress Family and friends	M/I: Warwick-Edinburgh Mental Well-being Scale ¹⁷² M/I: Stress visual numeric scale M/I: "How many people share your accommodation during the lockdown (including you)?"	Increased consumption of caloric/salty foods was related to lower mental well-being, higher general stress, and current/past psychiatric disorders.

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Table 7. Measures and findings for reasons for changes in eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic (*continued*)

Reference	Reason	M/I ^a and RO ^b	Finding
Rossinot and colleagues, 2020 ⁹⁸	Depression Stress	M/I “Since the beginning of the lockdown, are you feeling more . . . anxious? Depressed? Irritable?” RO 0 = “more depressed, stressed, irritable” to 3 = “no change” M/I and RO: “Self-evaluation of the change during the lockdown of their diet (less balanced, no change, more balanced)”	Increased consumption of caloric/salty foods was related to having a partner and being lockdown alone Negative changes in nutrition were related to negative changes in mental health (depression, stress, irritability)
Scarmozzino and Visioli, 2020 ¹⁰⁰	Anxiety	M/I: Measures are all in Italian and can be found through this link: https://clikka.net/0f1BP	42.7% of participants reporting an increase in “comfort food” consumption reported it was due to higher anxiety levels
Şimsek and Şen, 2020 ¹⁰³	Emotional eating	M/I: Eating behaviors: 20 questions from the 3-factor eating questionnaire ¹⁵⁷	Emotional eating significantly increased during compared with before the pandemic No significant differences in emotional eating by age
Zeigler and colleagues, 2020 ¹⁰⁸	Stress Boredom Cravings Family and friends Exposure	M/I: Eating: The Weight and Lifestyle Inventory ¹⁷³ M/I: Stress: The Perceived Stress Scale ¹⁷⁴	52% reported eating more in response to stress 73% reported eating more when bored 73% reported eating more due to craving certain foods 59% reported eating more often with friends and family 65% reported eating more in response to sight and smell of food

^aM/I = measure/item.^bRO = response item.^cAs cited in reference 97.

Reference	M/I ^a and RO ^b	Findings
Papandreou and colleagues 2020 ⁸⁵	M/I: The Dutch Eating Behavior Questionnaire ¹¹³ was utilized to assess eating behaviors	59.8% of the Spain sample and 51.7% of the Greece sample reported that they do follow same hours/number of meals during the pandemic
Poelman and colleagues 2021 ⁸⁹	M/I: Participants asked to indicate if they ate in a different way than usual during lockdown (with more awareness, taking more time, during different occasions, more often and snacking more frequently) RO: Fully disagree (1) to fully agree (5). Calculated the number of participants that (fully) agreed on each of the items (score 4 or 5).	16.9% ate at different times 19% took more time eating
Sutaria and colleagues 2020 ¹⁰⁴	M/I: "Has your eating schedule changed?" RO: Yes/No/Maybe	During the pandemic: 50.2% reported eating schedule changed during 38.6% reported no change in eating schedule 11.1% reported eating schedule "maybe" changed
^a M/I =measure/item. ^b RO = response options.		

Figure 4. Measures and findings for changes in the timing of eating during the initial months of the coronavirus disease 2019 (COVID-19) pandemic.